Seattle All-Hazards Mitigation Plan

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Introduction

What is Hazard Mitigation?

The Disaster Mitigation Act of 2000 and the Federal Emergency Management Agency (FEMA) Local Multi-Hazard Mitigation Planning Guidance, July 2008, define hazard mitigation as any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. The latter document further states that mitigation activities may be implemented prior to, during, or after an incident; but invariably it has been demonstrated that hazard mitigation is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs. Hence, the rationale for maintaining a city-wide mitigation program and plan that is consistent with 44 CFR Part 201.

For the City of Seattle, mitigation can include a range of actions, such as retrofitting buildings and bridges; adopting building codes aimed at current and planned development; clean environmental practices, hardening and dispersal of critical assets, business contingency planning; educating the public about preparedness and mitigation issues, etc.

What's the Plan's Focus?

This Seattle All-Hazards Mitigation Plan represents the City's second comprehensive effort to describe mitigation efforts across City departments and to develop an integrated mitigation strategy. The plan emphasizes mitigation of city-owned and operated facilities and infrastructure. It also includes reference to mitigation efforts undertaken by related public, quasi-public, and private entities.

This plan emphasizes natural hazards, but recognizes that mitigation can likewise be applied to human caused hazards. Efforts to determine effective strategies for managing the risks of terrorism, cyber attacks and pandemics, including work done under the Urban Area Security Initiative (UASI), have been ongoing for the past several years.

The plan is intentionally written so that all stakeholders can understand more about Seattle's hazard risks and the city's corresponding mitigation strategy. One of the key central themes that should become apparent to readers of the plan is that responsibility for mitigation rests with everyone – and not just with the public sector. We encourage people to do mitigation planning at every level – at home, in the workplace, and in their communities.

How this Revision of the Plan is Organized?

Chapter 1 describes the City's methodology and process for engaging a community-wide consensus in revising and adopting this update, recaps how the plan was

administered over the past 5 years to include efforts seeking FEMA grants, and acknowledges the many constituencies involved.

Chapter 2 focuses on Seattle's hazard risks. This chapter contains detailed information about the conditions that affect Seattle's vulnerability, both in terms of natural and human caused hazard exposures. Information in this chapter includes Seattle's Hazard Identification and Vulnerability Analysis (SHIVA) in its entirety (Refer to Appendix A). It further includes a comprehensive lead-in section that updates information in the SHIVA with new findings, as well as an examination of disaster events that have occurred and impacted the City since the SHIVA was published. As soon as the latest iteration of the SHIVA becomes available it will be inserted in this document.

Chapter 3 provides information about the City's current mitigation capacity. It includes summary information about each department, highlighting their respective and collective accomplishments over the past 5 years in furthering the City's unified strategy (as set forth in this plan) for advancing structural and non-structural mitigation for the spectrum of local hazards identified in the SHIVA. It further updates the inter-departmental planning groups involved in mitigation, and shows their interconnectivity to and collaboration with both inter-jurisdictional and public/private partnerships working on common mitigation issues.

Chapter 4 sets forth the Plan's updated mitigation goals and objectives. It contains summary information about mitigation-related projects currently underway or planned - and includes a method for prioritizing mitigation projects for FEMA and other outside funding. The chapter also offers recommendations for new policies and actions that would contribute to Seattle's disaster resiliency.

Chapter 5 describes the city's current plan for monitoring, evaluating and updating the All-Hazard Mitigation Plan over the next five-year period.

Supplemental materials that contain information on the City's engagement of the public in vetting this plan, as well as the formal adoption of this plan, are included as Appendices B-D. Additionally, there are Figures 2-1 through 2-8 that graphically portray important geographical, distributional and topographical features of the local environment, and complement the corresponding narrative descriptions in Chapter 2. All of these can be found at the end of the plan.

A copy of this plan, along with the Seattle Disaster Readiness and Response Plan, is available on the Seattle Office of Emergency Management website at www.seattle.gov/emergency.

Chapter 1
The Planning Process

1. 1 Background

The City of Seattle is a large, complex organization with a number of departments involved in planning for public safety, including the integrity of the city's structures and infrastructure. Many of these departments have been integrating mitigation into their planning efforts for a number of years, although not always describing projects as "mitigation" *per se*. This updated plan represents the city's second comprehensive inter-departmental mitigation document drafted to date.

The process used in maintaining this plan has continued to help educate department representatives about the depth and breadth of Seattle's mitigation efforts across city departments and has enabled the City to more efficiently integrate its community wide mitigation efforts. Those involved with plan maintenance have continued to expand and improve mitigation awareness within their own departments and among stakeholders in both the public and private sectors.

1.2 Plan Development

Planning originated in May 2002 when the Seattle Office of Emergency Management (OEM) solicited initial public comments about the development of a hazard mitigation plan. Attendees included representatives from the University of Washington, a geotechnical engineering firm, the Port of Seattle, private businesses and the community.

The city began its formal Hazard Mitigation Plan development in earnest in July 2003 by convening a mitigation planning work group that included representatives from key departments. Development continued for the remainder of the year and culminated with the plan's adoption by City Council Resolution 30653 on February 9, 2004; with the Mayor concurring on February 18, 2004.

Over the intervening 5 years, the Plan has been used after each disaster and annually to reevaluate, consider new initiatives, and to as necessary re-prioritize projects to propose for State and FEMA hazard mitigation grants. Between 2005 and 2009, the Mitigation Work Group used the process set forth in the plan (see Chapters 4, Mitigation Strategy, and 5, Plan Maintenance) to evaluate department proposals in a structured way towards agreed-upon goals. To date, six projects have been developed for competitive grant application since the plan's initial adoption: South Lake Union Armory Seismic Retrofit -completed, Queen Anne Community Center Seismic Retrofit - in progress, Facilities Gas Shut-Off Valves Project - in progress, Post-Alley Seismic Retrofit – in review, Fire Station 14 Seismic Retrofit – eligible but not funded, and King Street Station Seismic Retrofit – eligible but not funded.

The below chart recaps the estimated costs of the above projects, and the reimbursements received so far from FEMA.

Project Title	Funding Source	Award Date	Estimated Cost	Reimbursements Received To Date
S Lake Union Armory	*PDMC – 2005	Nov 2005	$713, 229.00	$534,922.00
Queen Anne CC	**HMGP – DR 1671	Aug 2008	$780,000.00	
Gas Shut-off Valves	HMGP – DR 1682	Sep 2008	$200,000.00	
Post-Alley	HMGP – DR 1682	TBD	$1,000,000.00	
Fire Station 14	PDMC – 2009	TBD	$3,034,342.00	
King St Station	PDMC - 2009	TBD	$6,960,238.00	
		TOTALS	$12,687,809.00	$534,922.00

*PDMC = Pre-Disaster Mitigation Competitive Grant Program
**HMGP = Hazard Mitigation Grant Program

Because of experiences gained during the previous 5 years, the City decided to take a different approach in the manner in which this update was prepared in addition to developing a new strategy for the plan's implementation for the next 5 years (See Chapter 5).

Mitigation Work Group

During the first quarter of 2008, a new Strategic Work Group was created. This group, which now serves as the Mitigation Work Group is primarily comprised of Emergency Managers from all key departments in the City government, and was formed to act as a permanent task force of the Disaster Management Committee (which is described in the Seattle Disaster Readiness and Response Plan). Their overall mission is to advance and coordinate emergency management initiatives within and across department lines, to include all phases of emergency management.

As such they are responsible for the development and stewardship of the overall goals and objectives of this update, which are:

- Identifying vulnerabilities to buildings and infrastructure
- Documenting recent mitigation accomplishments
- Collectively engaging in the city's mitigation planning processes
- Setting and revising the city's mitigation goals and policies
- Contributing to and accepting ownership for maintaining this plan

The new group, whose affiliation is identified on page 94, also discussed issues related to the substance and process of developing the plan and updating the SHIVA.

Other City Departments Consulted

We consulted other individuals in city departments on an as-needed basis, including key officials from the Law Department; Human Services Department; Office of Housing; Department of Neighborhoods; Department of Information Technology; Office of Economic Development; Seattle Center; and Risk Management.

In addition and to capitalize on the City's efforts to establish a prevention program as envisioned under pertinent Homeland Security Presidential Directives (HSPDs)[1], the Special Operations Bureau of the Seattle Police Department along with the Washington State Fusion Center and OEM are partnering with public and private property and facility managers throughout the City to inventory critical infrastructure and key resources (CIKR). The principal aim is to support the identification of vulnerabilities which form the nexus for the development of plans to cope with these vulnerabilities, to include discovering and countering potential and actual threats. The tool utilized by the City for this purpose is the Automated Critical Asset Management System (ACAMS), which facilitates the development and implementation of protective measures within critical infrastructure protection plans. It further, and as an integral part of the process, helps identify systemic and/or structural safety risks and single points of failure that can be remedied through mitigation. Through this cooperative effort, substantive improvements in building resiliency and the survivability of building occupants are being highlighted for resolution.

Discussions with non-City Agencies

Ongoing contact has been maintained with the public and private sectors through officials representing the following organizations: University of Washington Emergency Management; King County Emergency Management; USGS; Seattle Housing Authority (SHA); Port of Seattle; Office of Sustainability and Environment, and Seattle Public Schools.

1.3 Public Participation and Adoption Process

Public participation and official action in the plan's revised development occurred in the following ways:

- Placed a draft of the Plan on the City's Public Access Network website (www.seattle.gov) beginning on May 15, 2009, to include an email link to the Emergency Management Plans Coordinator to streamline the process for collecting public comments.

- On June 9, 2009, the plan was briefed to the Seattle City Council's Environment, Emergency Management and Utilities (EEMU) Committee. This televised

[1] HSPD – 5, Management of Domestic Incidents, HSPD – 7, Critical Infrastructure Identification, Prioritization and Protection, and HSPD – 8, National Preparedness

meeting was open to the public, and advertised in advance on the City Council website.

- Held a public meeting on June 24, 2009 at the Yesler Community Center. Invitations were sent to people involved with the City's 13 Neighborhood Councils, business and community partners, the University of Washington, and others who might be interested.

  To induce wider exposure notices of the meeting were placed in the Seattle Times newspaper (see Appendix B), bulletin boards at the City's 27 Community Centers, 27 Seattle Public Library branches and 13 Neighborhood Service Centers, and posted on the City's Public Access Network (PAN) website.

  Minutes of the meeting were recorded and will be used by the Mitigation Work Group to vet future mitigation initiatives. (See Appendix C)

- On July 23, 2009, the Disaster Management Committee, after a 4 month peer review period, voted to recommend the plan to the Mayor for approval.

- On July 24, 2009, the plan was submitted to the Mayor for approval.

- On August 4, 2009, the Mayor approved the plan and on August 4, 2009 he referred it to the President of the City Council for adoption.

- On August 11, 2009, the plan was briefed in detail to the EEMU Committee of the City Council. This session was open to the public and cable-casted on the Seattle Channel.

- On September 11, 2009, the EEMU Committee in open session voted to recommend the plan for approval by the full Council.

- On September 14, 2009 the City Council in open session voted 9-0 to approve the plan, which was formalized by Resolution 31158. (See Appendix D)

Chapter 2
Risk Assessment

This chapter contains the following summary information:

- Conditions affecting Seattle's vulnerability
- Summary of the city's most common natural and human-caused hazards according to Seattle's Hazard Identification and Vulnerability Analysis (SHIVA)
- Ranking of the hazards and description of the assessment methodology used

A copy of the SHIVA, included in this document as Appendix A, contains detailed information about each hazard, historical occurrences, impact on communities, probability of future hazard events, and a bibliography of associated data sources.

2.1 Conditions Affecting Seattle's Vulnerability

The Puget Sound Region is home to numerous islands, two dramatic mountain ranges, and many cities and towns of varying sizes. Seattle is the largest urban center and marine port in the Puget Sound Region. Its 193 miles of waterfront include 53 miles of tidal waters.

According to the State of Washington Office of Finance Management, the city's official estimated population as of April 1, 2008 was 592,800, including 258, 499 households. During workdays the influx of commuters causes the population to grow to over 723,000. These totals swell even higher when the 9.4 million tourists that visited Seattle/King County in 2006[2] are added. Both the higher daytime population with its greater concentration of workers in the Downtown area suggests that Seattle is more vulnerable to the impact of a major disaster occurring during the workday than it would be at any other time.

2.1.1 The Natural Environment

Geology and Topography

Western Washington is "young" and very active in geologic terms. In the last two million years alone, the area has been glaciated at least a half dozen times. The term glaciation refers to a protracted process in which large sheets of ice expand slowly southward from the Arctic Ice Cap during epochs in which the earth's climate cools and slowly reverses its path as the earth warms. The last recession affecting Puget Sound occurred about 17,000 years ago.

When glaciers advance, they scrub and grind the Earth's surface, leaving sand, gravel and silt in their wake. Polished rocks, visible grooves and ridges, and erratically placed

[2] Seattle Convention and Visitors Bureau

boulders are among the observable, present day, markers of our geologic history. The ground layers left by the glaciers are irregular, contributing to slope instability and landslide risk.

The area's topography was massively altered during the last ice age when glaciers moved south, scooping out long valleys and leaving a series of long north-south running hills with steep eastern and western sides - especially in the middle and southern parts of the City. Figure 2-1 indicates the elevations of various parts of the city. Today terrain varies sharply throughout the city, ranging from sea level to 530 feet above, and features mostly hills that descend toward the major water bodies. Seattle's natural physical structure has historically influenced the city's economic growth, patterns of land use, and placement of transportation routes, utility networks, and other important facilities. In addition, several landfills, regrades, and cuts have modified Seattle's natural landscape.

Acts of nature, like severe windstorms, earthquakes and volcanoes, can contribute to ground instability. But so does human activity. What we do can place undue stress on the ground and cause it to give way – or 'fail'. For instance, removing vegetation and changing water runoff patterns on hillsides are some of the human acts that increase the risk of slope failure.

Two waterways, the Lake Washington Ship Canal and the Duwamish Waterway, divide the city internally. The Ship Canal runs east-west, separating the northern third of the city from the south. The Duwamish runs from the southern edge of the city north into Elliott Bay, dividing the southern third of the city in half - with West Seattle, South Park, and White Center on the west bank and Beacon Hill, Rainier Valley, Rainier Beach, and Mt. Baker on the east bank. Elliott Bay pushes into the middle section of the city from the West, giving it a rough hourglass shape. The narrowness of this middle area, as well as its importance as the central business district, creates a vulnerable concentration of economic activity and infrastructure. The terrain makes access to this area almost entirely dependent on several bridges. (See figure 2-2 for a map of Seattle neighborhoods.)

The geographic concentration of Seattle's economy is in itself an indicator of the city's vulnerability. Areas of the city that rest on landfill include the Duwamish Valley, Interbay, the University Village area, and Pioneer Square, which have developed into sites for many of the city's major warehousing and industrial centers in addition to commercial and entertainment districts.

Unfortunately, much of the soil these centers are built on is loosely consolidated with large amounts of water suspended in it. Such soft soils can turn into mud with the consistency of quicksand during an earthquake, causing the ground under buildings to lose shear strength and give way. While newer buildings may be engineered to reduce the impacts of liquefaction in these vulnerable areas, damaged transportation routes may prevent access. Areas of potential landslides and liquefaction are shown in figure 2-3.

Since much of Seattle's industry resides in the Duwamish Valley, Interbay and Ballard liquefaction areas, an event such as an earthquake could be seriously disruptive. In addition, a large portion of Seattle's workforce is employed in the downtown area, which includes Pioneer Square. The service economy is equally vulnerable because it relies heavily on underground utilities, communications networks, and transportation modes to move people, commodities, and documents in and out of this center.

Climate

Seattle's climate is dominated by wind patterns that bring weather into the city generally from the Pacific Ocean. The marine air mass tends to keep weather relatively mild year round.

The city resides in the heart of the Puget Sound region between the Olympic Mountains to the west and the Cascade Range to the east. Weather in the region is terrain driven, meaning it can be different from one location to another. As a result, regional average annual precipitation maps reflect a range of near 30 inches to 40 inches within the city alone.

The complex topography offers a variety of weather patterns that can impact the city's weather. Much of the weather comes from the Pacific. Yet in winter, much colder air can invade the region from the interior of western Canada via the Fraser River canyon south through Puget Sound. East winds coming out of the Cascade mountain passes can help create quite warm and dry conditions in the summer.

Seattle can also be in what is called the Puget Sound Convergence Zone. When this happens, westerly Pacific winds in the lowest elevations of the atmosphere are often funneled around the Olympics into the central Puget Sound region from the south through the Chehalis Gap and from the north through the Strait of Juan de Fuca. The wind flow often collides just north of Seattle. In many cases, the convergence zone then drifts southward into the City. The Puget Sound Convergence Zone can produce a variety of weather depending on the time of year. In winter if the air mass is cold enough, it can produce snow. Year round, it can produce showers with copious amounts of rainfall, thunderstorms with lightning, and shifting winds.

Summers can be compared with Mediterranean weather – dry and warm yet mild. The dry conditions can leave vegetation withering and water running short.

Winters are considered the rainy season with the bulk of the annual precipitation falling in the months of November through February. Most of the 'severe' weather that impacts the City occurs during the winter season and can generate strong damaging wind storms, snowfall, and heavy rainfall that can produce, if conditions are ripe enough, urban and small stream flooding as well as landslides.

Though rare, the City does have a history of short-fused severe weather as well. Thunderstorms have produced downbursts with strong damaging winds, lightning, large

hail of at least ¾ inch diameter and even tornadoes. For instance in Sept 1962, a F1 tornado touched down in the Wedgwood district and tracked northeast for nearly 10 minutes before dissipating over Lake Washington.

Records maintained by the National Weather Service Western Region Climate Center for Sea-Tac Airport from 1945 to 2007 reveal that Seattle's annual temperatures range from an average high of 59.3° to an average low of 44.3°; with average annual precipitation amounting to 38.20 inches.

Snow, ice and hail have an average frequency of 3.9 days during the year that is most likely from November through April; totaling average annual accumulations of 11.8 inches. Even though snowfall and freezing temperatures are not as frequent in Seattle as in other northern U.S. cities, it does happen on occasion. Between 1990 and 2008, there were 22 days of snowfall totaling an inch or more recorded at the Sea-Tac Airport and NOAA Sandpoint weather stations. [3] Three of the most recent heavier falls dumping nearly a foot of snow, occurred during the mid-December 1990 Arctic Express episode, again in late-December 1996, and the latest from mid-December 2008 to very early January 2009. None of these events came close to approaching the record 33 inches that fell over a 4-day period from January 31-February 3, 1916, and paralyzed the city.[4]

High winds are another phenomenon commonly experienced. These episodes usually occur during the winter months and are most often associated with a major Pacific storm system. The Chanukah Eve Storm that struck on December 14 and 15, 2006, followed by the December 2-3, 2007 windstorm, were the most recent examples and caused major damage that to date has resulted in over 12 million dollars in FEMA Public Assistance reimbursements -- primarily to Seattle City Light.

Ironically, the climate's usual mildness leaves many city residents unprepared for many of the weather-related hazards that do strike, e.g., water shortages, wind storms, snow, and even heavy rain. Wind storms create power disruptions and debris clearance issues caused by falling trees and limbs. Snowfall is relatively infrequent, but it can paralyze the city because of the City's steep hills and limited snow removal equipment.

Weather can similarly hamper emergency response. If a major disaster strikes when snow is on the ground, emergency responders could experience delays in reaching people in need – and in transporting the injured to hospitals, many of which are located on steep hills. Even rain can be an unforeseen complication. After the Northridge (California) Earthquake in 1994, many people moved out of their damaged houses and into local parks thanks to fair weather. In Seattle, residents might not be so fortunate, encountering wet and perhaps cold weather conditions.

[3] Meteorologist Dana Felton, NWS Seattle
[4] Seattlepi.nwsource.com/archives

Vegetation

Vegetation's presence or absence can influence landslides, windstorms, snowstorms and floods. Especially in those areas of Seattle with thick tree cover major storms can cause trees to fall onto houses, power and telephone lines, and if uprooted can dislodge underground pipelines. North Seattle has the densest tree cover in the city, followed by areas in West Seattle. As a consequence it is likely that the greatest amount of debris, fallen trees and associated service disruptions may be expected in these areas. Vegetation additionally can increase the risk of urban flooding when fall leaves and other debris clog street drains or otherwise block the capacity of the drainage system to effectively channel storm water.

2.1.2 The Built Environment - Buildings

Seattle is a young city, but over half of its housing units were built prior to the adoption of building codes in 1949 that introduced seismic standards. Actual requirements for bolting homes to foundations were implemented in Seattle in the mid 1960's.

The majority of Seattle's housing units were constructed before the city upgraded its seismic codes in 1992 (Seattle Planning Dept., December 1992). Buildings constructed to earlier codes are generally not required to upgrade to the most recent code. Table 2-1 shows the age distribution of the housing stock. Most of the stock is wood frame construction, which generally performs well in earthquakes.

Table 2-1. Age of Housing Stock

Year Built	Number of Units	% of Total
Built 1990 to March 2000	24,488	9.47%
Built 1980 to 1989	23,266	9.00%
Built 1970 to 1979	25,762	9.97%
Built 1960 to 1969	31,644	12.24%
Built 1950 to 1959	36,297	14.04%
Built 1940 to 1949	32,507	12.57%
Built 1939 or earlier	84,546	32.75%
All Years	**258,510**	**100%**

Source: U.S. Census Bureau, Census 2000, Summary File 3 (SF 3) sample data. [Table HCT 6]

The Department of Planning and Development is in the process of performing a comprehensive survey of un-reinforced masonry (URM) buildings. This is a second effort aimed at refining an earlier study that indicated there are roughly 800-1,000 URM structures in the City, mostly in older sections such as Pioneer Square.

City Buildings

The city owns approximately 1,000 structures. Different departments have completed vulnerability assessments of their buildings and facilities in recent years. Chapter 3 describes many of the individual departments' recent mitigation accomplishments.

Buildings Serving Vulnerable Populations

The Seattle Housing Authority (SHA) is a public corporation that provides affordable housing to nearly 23,000 people in the City of Seattle. It owns and operates approximately 9,000 units of housing for low-income families, seniors and people with disabilities.

The majority of Seattle's public housing was built in the 1960's and 1970's, long before the city updated its seismic code in 1992. While the facilities are mapped, they have not been overlaid onto liquefaction zone or landslide susceptibility maps.

No SHA structures were impacted by the 1996/7 winter storms that caused landslides in many areas of the city. The Nisqually Earthquake of 2001 resulted in only minor damage to elevators in SHA high-rise buildings. These problems have now been remedied and elevators retrofitted to reflect current seismic standards.

In addition, a number of non-profits agencies provide housing and other essential services to vulnerable populations. Several shelters, food banks and community clinics that serve Seattle's homeless, low-income, mentally and physically disabled people are located in the Downtown and Pioneer Square areas.

As a result of the 2001 Nisqually Earthquake, one homeless shelter, the Compass Center, suffered significant damage. With a combination of City and federal funds, this facility was seismically upgraded beginning in 2004.

2.1.2 The Built Environment - Infrastructure

Infrastructure is the city's physical and organizational skeleton. It provides the communication and utility systems residents use to sustain their daily lives; and it provides the underlying structure the local economy needs to sustain growth. Indirectly, geology and the resulting topography impact vulnerability through their effect on land use and infrastructure.

Many of Seattle's transportation and utility networks are aligned North-South with many channeled through steep hills rather than crossing over them, particularly in the north-south direction. This layout could make east-west transportation and utility networks more vulnerable to damage and hamper emergency access. This problem occurred during the winter of 1996/7 when snow on some slopes made it difficult for police and fire vehicles to travel on them.

Bridges

Seattle's topography creates a critical dependence on over 150 bridges operated and maintained by the Seattle Department of Transportation. Within the city limits, there are six bridges connecting north Seattle with the rest of the city. Four of these bridges are "bascule" design and can be opened for marine traffic; the other two are "fixed-span" bridges that are owned by the Washington State Department of Transportation (WSDOT). Another four bridges lead in and out of West Seattle, two of which are the "bascule" type, one that is "fixed-span" and the last a "swing" type. Three WSDOT "floating" bridges cross Lake Washington, one leading to Evergreen Point that draws open to marine traffic and two parallel "fixed-spans" that connect to Mercer Island. These bridges link the City with communities on the Lake's eastside, and the two parallel "fixed-spans" are a part of the I-90 interstate. Each of these bridges can be a bottleneck during normal peak hours and could affect access to emergency services immediately following a disaster.

A large number of government services and employers are located in or near Downtown. Most of the hospitals are on First Hill east of I-5, and the Fire Department's hazardous materials team is housed in Pioneer Square. Normally, this centralization is the most efficient distribution of resources, but during an emergency some neighborhoods could be cut off from these downtown services. If the bridges were down for any reason, there would be limited capacity to get medical treatment or other emergency services to many neighborhoods.

Networks

Seattle has many networks that need to operate normally in order to maintain the health, safety and economic functioning of those who live and work here. These include transportation, power, water, sewer, telephone services including voice over internet protocol (VoIP), natural gas, fiber-optic network, and cable services. Figure 2-4 shows the location of the city's water, power and sewer mainlines.

Much of Seattle's flat land is in the Duwamish Valley and Interbay, both of which are major industrial areas built on landfills. Networked infrastructure (such as electric, water, sewer, and natural gas systems) where trunk lines must cross landslide prone hillsides and liquefaction zones increases the city's vulnerability during our highest risk hazard events.

Unfortunately, networks by their very nature are vulnerable to breaks and blockages. Most are broken down into trunk and distribution lines. Trunks carry large quantities of a substance into Seattle. They connect to distribution lines that feed into smaller lines that supply product to the end users. If a break or blockage in the network occurs, service beyond the problem will stop until the service can be re-routed or the problem is solved. Furthermore, the closer the problem is to the front-end of the network the wider the disruption will be. Creating redundant systems or re-routing these networks can mitigate these problems.

2.1.3 Land Use

Figure 2-5 is a zoning map indicating several land use categories including: single and multi-family residential dwellings, commercial, industrial, and major institutions. Each use generates a different pattern of vulnerability. Figure 2-6 shows the city's residential population density per census tract. The highest residential densities occur in older sections north of the I-90 freeway such as Capitol Hill. Other dense areas include portions of the Denny Regrade, the south slope of Queen Anne Hill, and parts of the University District. Damage in any of these areas would probably produce greater casualties than in other parts of the city.

In 1992, the State passed the Growth Management Act in an attempt to check urban sprawl. Seattle's response to the Act has been to promote greater density in clustered "urban villages" with its comprehensive plan, Towards a Sustainable Seattle. Utilizing this strategy will improve the city's infrastructure and encourage development in a way that reduces the area's vulnerability to hazards.

Figure 2-3 indicates the locations of urban centers and urban villages and their relationship to liquefaction and landslide prone areas. There is a slight overlap between landslide prone areas and the extreme eastern edge of the Eastlake and South Lake Union urban villages. Liquefaction prone areas overlap with centers and villages in parts of Downtown, the U-district, South Park, Eastlake and South Lake Union.

The city's two manufacturing/industrial centers (Duwamish and Interbay) are almost entirely underlain by liquefaction zones. While the city's goal is to increase employment in these areas, most of the new employment is expected to be fairly low density. No housing is permitted in these areas.

The Port of Seattle is a large property owner in both of the industrial centers. It is currently looking at the possibility of dense development that could include offices, housing and retail uses just west of the stadiums and at Pier 91. In both cases, such development would require changes to the Comprehensive Plan and existing zoning ordinances.

South Lake Union is an area slated for development. Plans include 12 acres designated for an innovative cultural, educational and recreational waterfront center and a large area slated for both biotech and mixed-use office space and housing. The city is planning for significant growth in this area - up to an additional 20,000 jobs and 5,000 more housing units over the next 10 to 20 years.

Codes and Regulations

Through local zoning and building codes responsive to mitigation concerns, Seattle government has been proactive in adopting laws and regulations aimed at improving Seattle's disaster resistance. The adoption of the 2006 International Building Code (IBC) in 2007 is the latest update.

Table 3-1 in Chapter 3 lists mitigation-related land use and building codes and policies enacted by the City's Department of Planning and Development in recent years.

2.1.4 Population Demographics – Vulnerable Populations

Seattle is home to many people who could be extremely vulnerable in the event of a serious disaster – the elderly, children, people with mental and physical disabilities, and those who are limited or non-English speakers.

The map in figure 2-7 reflects 2000 U.S. Census data on where people with special needs (vulnerable populations) live in Seattle. People included in this category are the elderly, non-English speakers, people living in poverty, persons with disabilities, and people living in group quarters (such as those receiving health care in institutional settings).

Figure 2-9 indicates where recent immigrants have settled in the city. This potentially vulnerable population often includes limited English-speakers and those with cultural practices that differ from mainstream American customs. These factors may result in communication challenges during an emergency. Providing useful preparedness and mitigation information to this population often requires additional resources of time and relevant cultural expertise to achieve.

2.2 Seattle's Hazards

The information about Seattle's hazards is summarized from the most recently updated SHIVA, available under separate cover. In that document, readers will find considerable detail about each hazard, including its historical occurrence, impact on communities, probability of future events, and data sources.

Following the summary of each type of hazard is a probability rating of *Low, Infrequent, Periodic,* or *High* that characterizes the likelihood of an event occurring. The rating is based on the frequency number assigned to each hazard in Table 2-5, summary of hazard risk, which is determined by historic occurrence: *1 and 2 = Low*; *3 and 4 = Infrequent or Periodic*; and *5 = High*. Note that this rating does not factor in the severity of impact.

Aircraft Accidents

Two major airports, Seattle-Tacoma (Sea-Tac) and King County International Airports service the city. Sea-Tac, which is operated by the Port of Seattle, is the principal commercial airline and air cargo facility with 43 carriers as of July 2009, while King County International, which is operated by the King County Department of Construction and Facility Management, handles mostly private fixed wing and helicopter aircraft. The latter shares a common runway with the Boeing Airfield.

For 2007, Sea-Tac airport handled a total of 31,296,628 passengers and 319,013 metric tons of cargo amounting to a total of 347,046 aircraft operations. From the air traveler side the latter numbers include both air carrier operations representing 80% of flights, and air taxi operations representing 20% of flights. For this same period

Sea-Tac airport ranked as the 18th busiest commercial flight terminal in the US, increasing its passenger totals by 4.3% over the previous year. Air cargo totals to the contrary decreased 6.7% from the previous year's stats, which placed Sea-Tac as the 19th busiest air cargo terminal in the US.[5]

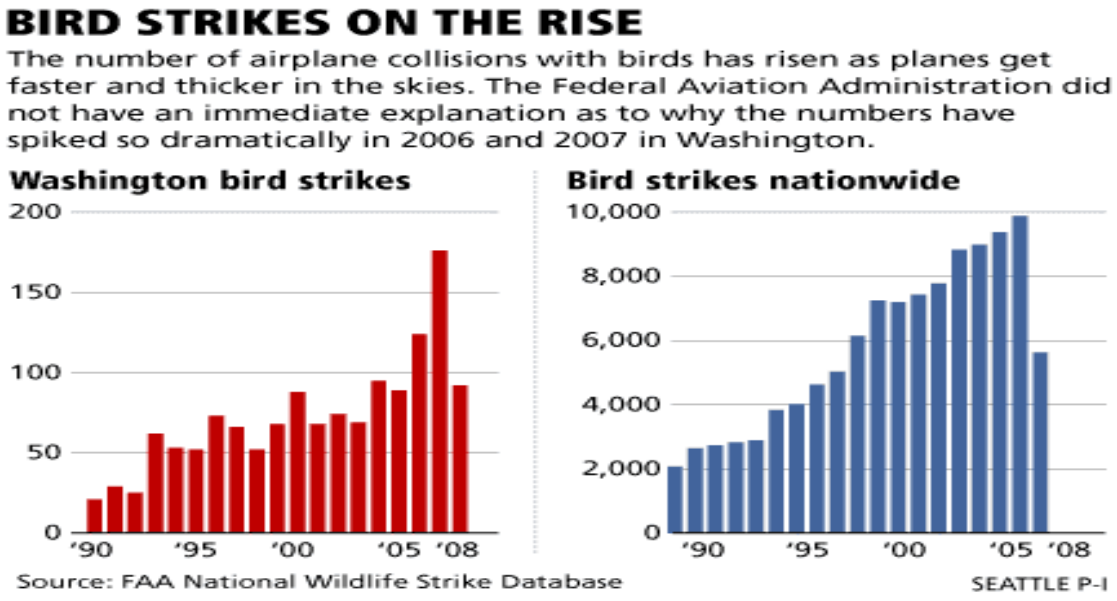
There have been three major aircraft accidents within the city involving ground casualties. The city's deadliest disaster was a plane crash that occurred in 1943, killing 32 people in the air and on the ground. Since the beginning of 2003, the National Transportation Safety Board (NTSB) has recorded 13 accidents or incidents in the Seattle area, none of them fatal. Areas in the Southern Duwamish Valley are the most vulnerable. A crash could cause fatalities, fires, power outages and other disruptions.

On September 29, 2005 a medical helicopter crashed into Puget Sound near Edmonds killing 3; the following month another non-fatal medical helicopter crash occurred just after take-off from Olympia, WA. Air ambulance mishaps in the US have risen dramatically in the past 15 years. From 2002-2004 the NTSB has tracked 55 such incidents resulting in 54 deaths.[6]

Kenmore Air operates a fleet of 20 seaplanes that fly in and out of bases in Lake Union and Lake Washington in Kenmore. These flights transport mostly vacationers to and from destinations throughout the Puget Sound. As with any aircraft their greatest risk exposure lies with take-offs and landings, which poses an even higher threat potential when they fly over heavily populated areas, particularly during bad weather.

Sea-Tac Airport and Boeing Field are not immune to bird strikes like the one that caused a US Airways Airbus A320 to lose power in both engines and crash land in the Hudson River on January 15, 2009. With such incidents in mind, the Port of Seattle has long been proactive in mitigating this threat as far back as 1970. Most recently, "the Port designed its replacement of wetlands that were dislocated by recent construction of a new third runway to drive birds away from the airfield. The 113 acres of wetlands near the airport are heavily forested with trees such as cedars and cottonwoods to keep large flocks of birds from feeding and nesting there, and the Port sowed 158,000 native plants known to be unattractive to birds, eschewing all varieties that produce fruits, nuts and berries. The Port also developed a grass seed mix containing a fungus that makes it less appetizing to some birds and insects.[7]"

[5] http://www.portseattle.org/seatac/statistics/
[6] KOMO news report that aired in February 2006
[7] Seattle PI, January 16, 2009



Probability of Recurrence: Infrequent (Roughly once every 10-30 years)

Civil Disorder

Like many other American cities Seattle has suffered from civil unrest. The most recent episodes were related to the November 29 to December 3, 1999 World Trade Organization (WTO) meeting at the Westin Hotel (primary venue) and the February 28, 2001 Mardi-Gras celebration in Pioneer Square. Previous Seattle disorders have centered on Downtown and Capitol Hill. Violence targeted against people has been rare and looting light, but fires were a significant threat. Response to large disorders such as the WTO can require an enormous expenditure of money, resources and time to reestablish control and recover from property damage, business losses and revenue collections. It can similarly damage the city's reputation, which in turn may dampen future economic growth and impart a negative psychological affect on prospective visitors and the community-at-large.

Looking to the immediate future there may be episodic demonstrations in cities across the country, including Seattle, if the current economic downturn worsens and peoples' livelihoods become more and more threatened.

Probability of Recurrence: Infrequent (Roughly once every 10 years)

Climate Change

The Earth's climate has changed many times during the planet's history, with cyclical events ranging from ice ages to long periods of warmth. Historically, natural factors such as volcanic eruptions, changes in the earth's orbit, and the amount of energy released from the Sun have affected the Earth's climate. Beginning in the 19th century, it is generally accepted that human activities associated with the Industrial Revolution and its development since have contributed to changes in the composition

of the Earth's atmosphere and thus have become an additional source influencing the Earth's climate.

For over the past 200 years, the burning of fossil fuels, such as coal and oil, and widespread deforestation have caused a significant build up of heat-trapping "greenhouse gases" in the atmosphere, which in earlier times would have dissipated into space. "Greenhouse gases" are necessary to life as we know it because they keep the planet's surface warmer than it would be otherwise. But, as excessive concentrations of these gases continue to build, the Earth's temperature has climbed abnormally beyond past levels. According the NOAA and NASA data, the Earth's surface temperature has increased by about 1.2 to 1.4°F in the last 100 years. Of some concern is that the 8 warmest years recorded from 1850 to the present have all occurred since 1998, with the warmest being 2005.

If "greenhouse gases" continue this current pattern, climate models predict that the average temperature at the Earth's surface could increase from 3.2 to 7.2°F above 1990 levels by the end of this century.[8] Moreover and without substantive mitigation that results in reduced emissions by the global community, this trend is generally believed by scientists to eventuate, in the not too distant future, in major portions of the Earth succumbing to drought, coastal inundation, and famine. Such catastrophes would likely create a disturbing destabilization of economies and social orders the world over.

Findings from a 190-page "Global Climate Change Impacts in the United States" report, confirm what scientists have long suspected: Climate change due to heat-trapping pollution is already occurring and is visible throughout the United States and choices we make now will determine the severity of its impacts in the future[9].

Key findings indicate:

- ✓ Global warming is due primarily to human-induced emissions of heat-trapping pollution, mainly from the burning of fossil fuels as well as from forest clearing and agricultural activities. Earlier reductions in emissions will have a greater effect in reducing climate change than comparable reductions made later.

- ✓ In the United States, climate change is causing increases in temperatures, more heavy downpours, sea-level rise, less snow and ice cover, and other impacts.

- ✓ Unless polluting emissions are reduced significantly, heat waves will become more frequent; heavy downpours will cause more severe flooding; and agriculture will be increasingly challenged by insects, diseases and drought.

[8] USEPA
[9] http://www.globalchange.gov/usimpacts

- ✓ Reduced summer water availability will create greater demand for water in some regions, especially in the West.

- ✓ Rising water temperatures and ocean acidification threaten coral reefs and diverse ecosystems with major implications for our fish supply, our fishing industry and our coastal communities.

- ✓ Local sea-level rise of 3 to 4 feet on top of storm surges will increasingly threaten homes and coastal infrastructure; more of our coastal lands will be lost to rising seas.

For Seattle, as a coastal city, any significant rise in sea levels may cause the inundation of some shorelines; threatening the adjacent built environment. It could also cause an increase in drought conditions, produce heavier downpours with possible localized flooding, and result in health problems if air quality deteriorates.

Probability of Recurrence: Effects continue to build and are thought to be having variable impacts throughout the world. Without adequate remediation it is believed that the effects will become more pronounced and dangerous in the 21st Century and beyond.

Conflagration

Conflagrations are rare in modern, developed cities, but could happen after a earthquake or during civil unrest. Ignitions could occur throughout the city simultaneously. A 1994 study by EQE estimated that 80-100 fires could occur in Seattle following a large quake. Such a large number of fires could overwhelm the capabilities of the Fire Department, and in combination with water main breaks could severely complicate the ability to control the spread of fires. Fires in the city's power distribution network can create large power outages, such as encountered with a vault fire in Belltown on October 4, 1993 that affected residents and businesses in a contiguous 35 square block area for 3 days.

Probability of Recurrence: Low (Roughly once every 20-40 years)

Earthquakes

Earthquakes can be the most destructive hazard Seattle faces. Three major Benioff Zone intra-plate quakes have struck Seattle since the beginning of the 20th century (in 1949, 1965 and 2001). Recently, geologists have found evidence of massive earthquakes off the Washington coast (referred to as the Cascadia Subduction Zone) and along the Seattle Fault.

The northernmost strand of the Seattle Fault Zone (SFZ) has long been thought to lie near Interstate 90 and the sports stadiums, about 1.5 km (0.9 miles) south of the downtown area. The SFZ zone consists of several thrust faults in a 7 km-wide area south of the fault tip. New research and a new compilation of existing geophysical and geologic data, however, suggest that the fault tip may lie directly beneath the downtown area. If the fault indeed lies directly beneath the downtown area, ground

motions there during a Seattle fault earthquake may be significantly larger than had been presumed in the past. Modeling and empirical data show that the area of strongest ground shaking above thrust faults occurs in a relatively narrow zone, 1 to 2 kilometers wide near the fault tip. Modeling of earthquakes associated with SFZ scarps on Bainbridge Island further imply that moderate (~M6.5) earthquakes could occur more frequently on the various strands of the Seattle fault than large (~M7.5) earthquakes, such as last happened around 900-930 A.D.[10]

The bulk of potential damage from a major earthquake may come from building collapse, landslides, fires, land subsidence, and even a tsunami or seiche (a large oscillation in an enclosed body of water). Casualties could exceed 1,000 people and economic damage could easily run into billions of dollars.

These findings are discussed in greater detail in the SHIVA section devoted to earthquakes and in the Earthquake Incident Annex in the Seattle Disaster Readiness and Response Plan.

Probability of Recurrence: Periodic (Roughly every 27-35 years)

Floods

Seattle does not have a significant river flood problem within its City limits. The Duwamish has been dredged and is regulated upstream at the Green River near the city of Pacific in King County by the Howard Hanson Dam. Nonetheless, there can be river-induced flooding along the Duwamish River when there is a combination of high tides and heavy precipitation. This area is mapped within the FEMA 100-yr floodplain.

"Urban Flooding" occurs along creeks and natural drainage courses throughout the City. Areas within Thornton, Longfellow, and Pipers Creek Basins have flooded during heavy rainfall in the past. Seattle Public Utilities has built control structures to reduce the frequency and extent of flooding; past flooding in these areas was usually not widespread and was limited to portions of blocks or neighborhoods. These areas are also mapped within the FEMA 100-yr floodplain.

"Urban Flooding" also occurs within the piped drainage network. Significant ponding in streets and adjacent low areas occur when the capacity of the existing storm drainage system is exceeded and/or inlets become severely clogged with debris. One recent example occurred in the Madison Valley neighborhood during the Chanukah Eve storm that struck the city on December 14, 2006. This short-duration, high-intensity event, overwhelmed the two separate parts of the Madison Valley storm drainage system – a mainline pipe and a detention pond. In this storm damage claims against the City within the Madison Valley neighborhood totaled ~$7M, with one fatality attributable to the flooding. Across the City, nearly 500 claims for private property damage were filed against the City.

[10] Briefing of DMC on 5/28/09 by Thomas Pratt and Kathy Troost of the UW

Another recent example occurred within the Aurora/Licton Springs neighborhood during a storm that struck on December 3, 2007. This long duration, moderate-intensity event overwhelmed a major pipe drainage system and resulted in major ponding that impacted commercial buildings, single-family residential homes, and multiple-family complexes. Along the Thornton Creek system 32 private property damage claims have been filed as of June 2009. Surveys conducted after the event estimated 45 homes were damaged along Thornton Creek. In the area of N 107th St & Midvale Ave N there were 24 property damage claims filed in less than 4 square block area. A number of these claims have gone into litigation and remain unresolved with more lawsuits expected to be filed. The ~400 private property damage claims against the City are estimated to be $10-12M.

A recent study that examined rainfall collected from SPU gauges between 1978 and 2007 indicates there is a small but statistically significant trend towards short-duration and high-intensity events that are spatially localized. Such a trend represents a challenge to the City's drainage system, which was designed for precipitation of much lower intensity over longer times, and as a result systems upgrades are being made at critical areas to increase overall and surge capacities. Recently completed and on-going improvements to the drainage system to improve conveyance and/or storage have included: Madison Valley, South Park, MLK/Norfolk, and Thornton Creek. The capital funding for these improvements have totaled more than $50-M.

Both Seattle City Light and Seattle Public Utilities own and operate facilities located outside of the City limits on the Cedar and Tolt Rivers, the Skagit River and the Pend Oreille River. River related flooding can be a concern in these areas during times of heavy rains and extraordinary snowpack melt.

According to the Washington State Mitigation Plan[11], King County has a history of 139 repetitive flood loss properties with 9 classified as severe repetitive losses. Records maintained by FEMA Region 10 and the Washington State Emergency Management Division as of March 2009 reflect there has been a history of 6 repetitive flood loss claims made by Seattle residents. A comparison of these later records with automated data compiled by the Seattle Department of Planning and Development since the mid 1980s, which oversees floodplain management for the City, disclosed 4 of the 6 addresses were mapped as flood prone in the National Flood Insurance Program (NFIP) Rate Maps with the sources identified as: the Duwamish River, Puget Sound, and Thornton Creek. All of the claims made to date have totaled $153,495.70.

While flooding is much more a vulnerability in riverine areas of King County outside city limits, the City has established and maintained eligibility in the Regular Phase of the NFIP since July 19, 1977. The most recent Community Assistance Visit (CAV) by the Washington State Department of Ecology (DOE) was conducted on August 6, 2008. Their determination is considered valid as of this time, and by letter dated August 12, 2008 from DOE, the City was certified as a participant in good standing in the NFIP. In the letter it stated "that the City is effectively regulating development in

[11] http://www.emd.wa.gov/plans/washington_state_hazard_mitigation_plan.shtml

the City's flood prone areas". Seattle's Community Identification Number is 530089. See Action Items A-4 and A-5 (page 90) that are aimed at addressing future compliance with the NFIP.

Chapter 25.06, as amended by Council Bill Number 114503 on April 7, 2003, is the floodplain management chapter in the Seattle Municipal Code (SMC); it was reviewed and found to be fully compliant with the NFIP and State floodplain management regulations on April 8, 2003. Other related City legislation includes: SMC 25.09 (Environmentally Critical Areas Ordinance), SMC 22.100 (Seattle Building Code), and SMC 22.150 (Seattle Residential Code).

Probability of Recurrence: Infrequent (Roughly once every 5 years for localized flooding only)

Hazardous Material Incidents

Hazardous materials are substances that are flammable or combustible, explosive, toxic, noxious, corrosive, oxidizable, an irritant or radioactive. A hazardous material spill or release can pose a risk to life, health or property. An incident can result in the evacuation of a few people, a section of a facility or an entire neighborhood.[12] Most hazmat incidents occur at fixed sites, but incidents involving transported hazardous materials are often more dangerous, since they occur in less controlled environments.

According to the Seattle Fire Department there are over 3,600 fixed facilities in the City with permits to store substantial quantities of hazardous materials, including a major petroleum and diesel storage facility on Harbor Island. The latter receives the majority of its deliveries through a pipeline that transects the southeastern and south of downtown (SODO) parts of the City.[13] Since its opening in 1966 there have been 4 significant spills in the Seattle and metro area totaling 152,140 gallons.[14]

Other potentially serious sources for a hazmat incident could present itself from transport mishaps along I-5 and the Burlington Northern Santa Fe rail line, cargo onboard container ships, cruise ships and fishing trawlers (Seattle is homeport for the largest fishing fleet in the US) that use ammonia for refrigerating their catches[15] and from 15 water treatment plants that store large quantities of chlorine and hypo-chlorite.

Probability of Recurrence: High (Roughly 6 significant releases annually)

Landslides

Landslides are a common problem in Seattle – and can be secondary to other hazards, such as earthquakes and storms. They usually develop slowly and tend to move as a unit, decreasing sudden and unpredictable safety risks. Most slides are small enough that they do not create city-scale emergencies, but occasionally weather and soil

[12] http://www.fema.gov/business/guide/section3b.shtm
[13] Refer to page 69 for more information on the pipeline
[14] Washington State Department of Ecology
[15] Shipboard incidents oftentimes present firefighter with an additional confined space hazard

conditions cause slides throughout the city within a short period of time. Slides can destroy buildings, block roads and sever lifelines. The main impacts are dislocation and economic.

The city recognizes that landslides are a complex problem. Following the major slides of 1996/97, it convened an Interdepartmental Landslide Team to address this problem. In addition, USGS monitoring of rainfall and soil conditions, along with new landslide susceptibility maps, add new accuracy to the city's predictive ability.

Probability of Recurrence: Periodic (Roughly once every 6-10 years)

Pandemic

Pandemic influenza is the most serious disease threat we face. Unlike Severe Acute Respiratory Syndrome (SARS), which struck between November 2002 and July 2003, and where transmission was primarily confined to hospitals and close household contacts, pan flu can spread quickly throughout a community and across the world. This acute viral illness has an incubation period of one to three days, with a period of communicability of up to 24 hours prior to the onset of symptoms to seven days after symptoms develop.

Highly Pathogenic Avian Influenza type A of subtype H5N1 (commonly known as bird flu) is the strain of influenza virus of greatest concern today. While not easily transmitted to humans at this time, the disease has demonstrated that it can be fatal to those who contact it with mortality at approximately 60%. Currently there is no vaccine available for this strain of influenza virus.

Because influenza pandemics are recurring events, it is not a question of whether there will be another pandemic; it is only a question of when the next one will occur and how severe it will be. The last three influenza pandemics (1957-58, 1968-69, and 2009-ongoing) were comparatively mild, but the pandemic of 1918 killed 20 to 50 million people worldwide, including more than 500,000 in the US.

In many respects, the global community is more vulnerable to influenza pandemic today than it was in 1918. With almost a century of advances in mass transit, people now have the means to travel more, both nationally and internationally, using conveyances that cause close contact. Moreover, the rapid growth of the global economy and the world-over rise in an expanding upper and middle class with a greater distribution of wealth, enables greater numbers of people to engage in more widespread contacts on a daily basis than people in 1918 did. Add to this the fact that the world's population has grown to over 6 billion, which includes far more elderly, immune compromised and malnourished people than it did in the past.

An influenza pandemic today could have far-reaching negative consequences for the health and well-being of Seattle residents and for the economic and social stability of the City and region. For example, pandemic influenza has the potential to infect 30% or more of the population, with an average of 20% of the general workforce unable to perform a wide spectrum of jobs for an extended period of time. In any affected community, a pandemic outbreak could last from six to eight weeks. Multiple waves of illness might occur, with each wave lasting two to three months. Historically, the largest waves have occurred in the fall and winter, but the seasonality of a pandemic

cannot be predicted with certainty. Increased absenteeism among all workers and a requirement to implement social distancing to help curb or at least delay the spread of a pandemic could place a severe strain on all City services, particularly public safety and health-based services.[16]

The chart below depicts the 4 officially classified pandemics that have occurred from 1918 to the present.[17]

YEAR	***STRAIN***	***SUMMARY***
1918	"Spanish flu" H1N1	The most devastating flu pandemic in recent history, killing more than 500,000 people in the United States, and 20 million to 50 million people worldwide.
1957-1958	"Asian flu" H2N2	First identified in China; this virus caused roughly 70,000 deaths in the United States during the 1957-58 season. Because this strain has not circulated in humans since 1968, no one under 30 years old has immunity to this strain.
1968-1969	"Hong Kong flu" H3N2	First detected in Hong Kong, this virus caused roughly 34,000 deaths in the United States during the 1968-69 season. H3N2 viruses still circulate today.
2009-ongoing	"Swine flu" A (H1N1)	First detected in Mexico in February 2009, and declared a pandemic by the World Health Organization on June 11, 2009. On April 26, 2009, the United States Government declared a public health emergency. This pandemic is expected to continue its global spread, with the potential for morphing into an even deadlier strain in the Fall.[18]

Since 1957 there have been an additional 18 episodes where new strains of influenza have presented themselves in humans, including the newest swine flu A (H1N1) pandemic that is believed to have started in Mexico in February 2009.[19] As of July 10, 2009 this newest strain is still running its course. So far, it has infected 94,512 people in 115 countries and 13 territorial possessions worldwide, with Mexico enduring the severest impact in infections (10,262) versus deaths (119).[20]

Concurrently and in the US, there are 37,246 lab confirmed and probable infections with novel influenza A (H1N1) in all 50 states, plus the District of Columbia, Puerto Rico, Guam and the Virgin Islands, with a total of 211 deaths.[21] Statewide in Washington there are 636 cases and 4 deaths. To offer some perspective for these figures, an average of 36,000 deaths occur in the US every year from flu associated causes.

[16] City of Seattle Pandemic Influenza Incident Annex, June 2007
[17] http://www3.niaid.nih.gov/topics/Flu/Research/Pandemic/TimelineHumanPandemics.htm
[18] http://seattletimes.nwsource.com/html/health/2009318301_apununswineflu.html
[19] MRC Centre for Outbreak Analysis and Modeling at Imperial College London
[20] http://www.who.int/en/
[21] http://www.cdc.gov/h1n1flu/

Probability of Recurrence: Periodic (Roughly once every 30-40 years)

Snowstorms

Once every four or five years a major storm like the December 2008 13-day event paralyzes the city. The immobility causes economic damage and inconveniences for many. As demonstrated during the December 1996 snowfall of over 11 inches it can also affect the ability to transport patients to hospitals and maintain police patrols. The snow can also cut power and phone lines, topple trees, and even collapse roofs. Seattle has a limited amount of snow removal equipment, but it must be placed on vehicles that are normally used for other purposes.

Probability of Recurrence: High (Roughly once every 4-10 years)

Terrorism

In recent years, Seattle has experienced a number of terrorist incidents perpetrated by right-wing hate groups, eco-terrorist groups and others. During the November 1999 World Trade Organization (WTO) and again in 2001, Earth Liberation Front (ELF) eco-terrorist attacks occurred at the University of Washington's Center for Urban Horticulture.

On December 14, 1999, Ahmed Ressam was caught smuggling bomb-making material into the country through a border entry at Port Angeles, WA. His arrest initially raised fears that Seattle had become a terrorist target, although it was later confirmed that the target-of-choice was Los Angeles International Airport. A subsequent FBI arrest and federal indictment of James Ujaama in 2002 revealed that a Seattle Mosque had been co-opted by a small group of militant Muslims, who were attempting to create their own "Seattle Taliban". The FBI's investigation further determined that Ujaama had links to al-Qaida and had pitched the idea of setting up a Jihad training camp at an isolated ranch site near Bly, Oregon.[22] Most recently, on July 28, 2006 a Muslim male attacked the Seattle Jewish Federation offices in Belltown and shot and killed a female employee while decrying epithets aimed at the state of Israel. Five others were wounded but survived the intrusion.

The September 11, 2001 attacks on the World Trade Center and the Pentagon brought heightened awareness of the possibility that any large city like Seattle could become a target. Photographs later retrieved from caves used by Osama Bin Laden and al-Qaida in Afghanistan revealed that symbolic edifices, such as the Space Needle and Columbia Tower (formerly the Bank of America Tower) in Seattle had been identified for possible targeting.

Post 911 Seattle has also taken the threat of bio-and-radiological terrorism seriously by using UASI grant funds to build a more robust response organization. A portion of this money enabled the City to establish a Chemical, Biological, Radiological, Nuclear, Explosive (CBRNE) component in the Seattle Police Department; a similar

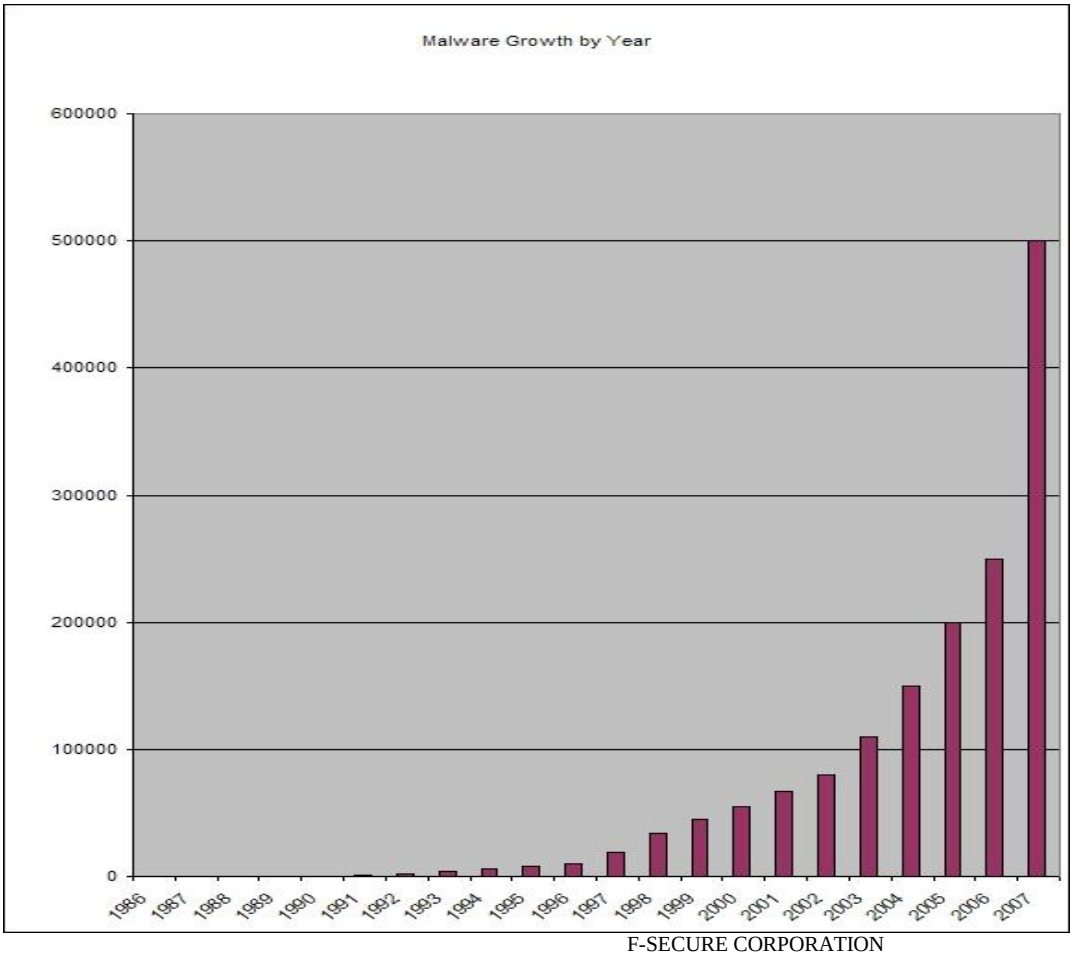
[22] http://seattletimes.nwsource.com/html/localnews/2009127495_ujaama27m.html

upgrade has also been funded and made in the Seattle Fire Department and neighboring UASI Region 6 mutual aid jurisdictions.
Probability of Recurrence: Infrequent (Roughly once every 3-5 years)

Cyber-Terrorism/ IT Infrastructure Attacks

Cyber terrorism is the use of existing computers and information, particularly over the internet, to cause physical or financial harm or a severe disruption of infrastructure service. Transportation, public safety, and utility services are all critical, and are highly dependent on information technology. The motive behind such disruptions can be driven by religious, political or other objectives.

Cyber-terrorism can impact the City's computer infrastructure, and the systems and services that are provided to the public. The City of Seattle's Department of Information Technology has established firewalls within the computer infrastructure to help protect the environment from cyber attack; however, attack techniques are adaptable and perimeter protection by itself is no longer adequate. The City logs thousands of these attacks daily, and many are suggestive of nation-wide incidents. Department of Homeland Security (DHS) statistics show that 37,000 attempted breaches of government and private computer systems were reported in fiscal year (FY) 2007, marking a dramatic increase from the 24,000 reported in 2006. The incidents of software designed to infiltrate or damage a computer system without the consent of the computer owner (malware) are increasing at alarming rates. The below table reflects malware incidents from 1986-2007. Additional controls are required to minimize the potential for attack delivery and attack success, enable trusted communications, and to quickly adapt to changing attack strategies.



F-SECURE CORPORATION

Probability of Recurrence: High (Multiple attacks monthly)

Tornadoes

One tornado touched down in Seattle in 1962 and another struck nearby in 1969. A tornado killed six people in Vancouver, Washington. While tornadoes rarely occur in our area, the National Weather Service notes an increase in tornado sightings – speculating that the increase may be attributed to a growth of the region (hence more reporting) rather than a change in weather patterns. If this is true, tornadoes were under-reported in the past and may be more common than previously thought.

Fortunately, because the Northwest doesn't experience the temperature extremes (i.e., very warm moist surface air clashing with much colder air aloft) that occur in other Gulf state and mid western parts of the country, severe thunderstorms are not as common a phenomena -- and those that do develop are not likely to produce more than a Enhanced Fajita (EF) Scale event higher than a 1 or 2.

Probability of Recurrence: Infrequent (Roughly once every 20-30 years)

Tsunamis and Seiches

Tsunamis, or 'tidal waves', are the product of earthquakes or large landslides. They contain a massive amount of wave energy and travel at high speeds. When they strike

the shallower shoreline, they push water with tremendous force inland. The generation of a tsunami is complex, but usually an earthquake must be large (magnitude 7.0 or over) and with a hypocenter near the surface to cause a dangerous tsunami. Some scientists think, and there is recently discovered geologic evidence to support this belief, that an earthquake along the Seattle Fault has produced a tsunami and could do so again. Because of these current discoveries, Seattle used money it received from the Washington State Emergency Management Division All-Hazard Alert Broadcast (AHAB) program in 2005 to build a partial public outdoor warning system at 3 locations along the downtown waterfront.

Seiches develop when an enclosed body of water is shaken. They are rare occurrences in our area. An 1891 earthquake produced an eight-foot seiche on Lake Washington, and the 1964 Alaskan quake generated seiche-caused damage around Lake Union.

Probability of Recurrence: Infrequent (Roughly once every 1,000-3,000 years)

Volcanic Eruptions

There are five active volcanoes in Washington State. All of them are too far away from the city to cause any blast or lahar effects. The most probable impact is ash. Mt. Rainier and Glacier Peak are the most likely sources. Ash falls from Rainier's most recent eruptions have been light, but Glacier Peak's have been some of the heaviest in the Pacific Northwest. Heavy ash fall could paralyze the city, damage infrastructure, and cost millions of dollars to clean up.

Probability of Recurrence: Infrequent (Roughly once every 100-200 years)

Water Shortages

Urban water shortages result when water demand exceeds supply over an extended period. Unlike the other hazards covered in this plan, droughts are slow-onset emergencies. Seattle has a history of water shortages. The main impacts are the inconveniences of usage restrictions and economic hardship for some businesses that use large amounts of water. In 1993, the Seattle Public Utilities adopted a plan to mitigate water supply problems. Water shortages are also associated with earthquake damage to water reservoirs, treatment plants, and water distribution systems.

Probability of Recurrence: Periodic (Roughly once every 6-10 years)

Windstorms

Sustained winds of 85 mph have been recorded in the Seattle area. Normally, the hilly terrain breaks up strong winds, but there are occasional strong storms that halt normal activity throughout the city. Such severe examples most recently occurred during the Inaugural Day Windstorm in January 1993 and the Chanukah Eve Windstorm in December 2006, both of which caused widespread power outages that lasted for days. These episodes often cause widespread line damage due to toppled trees and broken limbs. The City of Seattle has programs for vegetation management

to include tree trimming that serve to mitigate damage to electrical systems during windstorms.

Probability of Recurrence: Periodic (Roughly once or twice every 3-6 years)

Avalanche and Wildfire

The threat of avalanche is not relevant to Seattle since the Olympic and Cascade mountain ranges are too distant to impact the city. The threat of wildfire is included in the SHIVA section on conflagration and other large urban fires. In addition to wildfires, this section includes other types of fires that can impact an urban area; namely large, multi-structure fires or urban brushfires, structure fires and vault fires. Seattle has never had a large wildfire, such as occurred in Oakland and Berkeley, California in 1991, and it is considered unlikely to occur due to the damp climate, vegetation and Seattle's wind patterns.

However, both Seattle City Light and Seattle Public Utilities (SPU) have infrastructure in sparsely-inhabited wildland areas that could be threatened by an avalanche or wildfire and impact power generation and distribution, and water supplies and distribution. To counter a wildland fire in watershed areas, SPU maintains a special team of trained fire fighters to respond to such a contingency. They also have a mutual aid agreement with the Washington State Department of Natural Resources and are currently developing one with the National Forest Service.

Probability of Recurrence: Periodic (Roughly once or twice every 3-4 years in City watershed areas)

2.3 Presidential Disaster Declarations

Between 1990 and 2009, Seattle was included in 14 presidential disaster declarations. The majority occurred during the winter months and resulted from wind, rain and snow storms, with landslides and power outages sometimes occurring as a secondary impact.

The most recent declarations followed the Winter Storm in mid December 2008 and January 2009 Flood event. Table 2-2 includes response and repair costs to city-owned facilities and systems for each of these declared disasters. The figures do not include damage to arterial street structures.

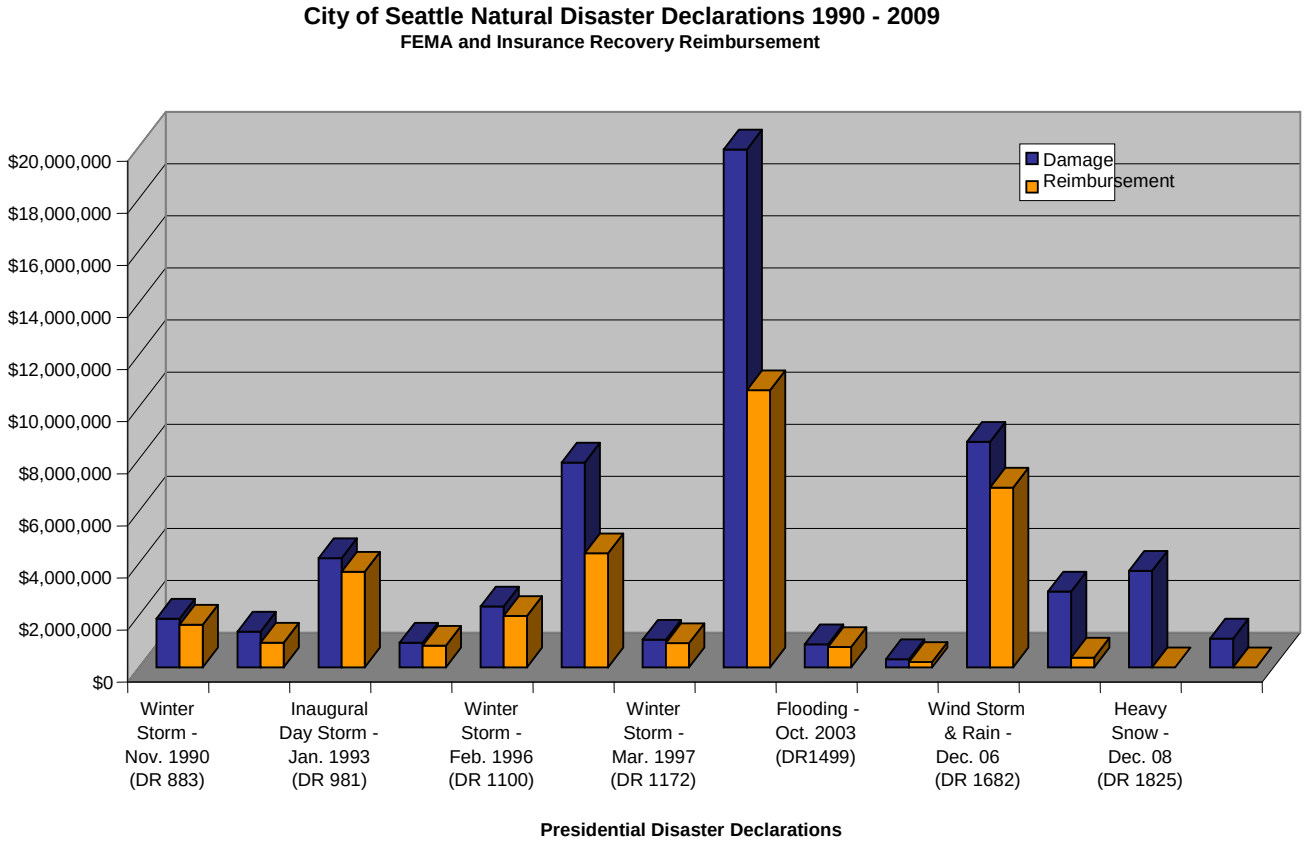

City of Seattle Natural Disaster Declarations 1990 - 2009
FEMA and Insurance Recovery Reimbursement
$20,000,000
$18,000,000
$16,000,000
$14,000,000
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$0
Damage
Reimbursement
Winter Storm - Nov. 1990 (DR 883)
Inaugural Day Storm - Jan. 1993 (DR 981)
Winter Storm - Feb. 1996 (DR 1100)
Winter Storm - Mar. 1997 (DR 1172)
Flooding - Oct. 2003 (DR1499)
Wind Storm & Rain - Dec. 06 (DR 1682)
Heavy Snow - Dec. 08 (DR 1825)
Presidential Disaster Declarations

Table 2-2

Comparison between Damage Estimates and Disaster Recovery Funds Recouped from Nov 1990 – Jan 2009

	Winter Storm Nov 1990 DR 883	Winter Storm Dec 1990 DR 896	Inaugural Day Storm Jan 1993 DR 981	Winter Storm Nov/Dec 1995 DR 1079	Winter Storm Feb 1996 DR 1100	Winter Storm Dec 1996 DR 1159	Winter Storm Mar 1997 DR 1172
Damage Estimate	**$1,863,867**	**$1,370,510**	**$4,190,281**	**$943,098**	**$2,333,180**	**$7,857,743**	**$1,056,408**
Reimbursement Totals	**$1,634,703**	**$938,974**	**$3,666,496**	**$825,212**	**$1,970,295**	**$4,378,273**	**$924,359**

	Nisqually Earthquake Feb 2001 DR 1361	Flooding Oct 2003 DR 1499	Flooding Nov 2006 DR 1671	Wind/Rain Storm Dec 2006 DR 1682	Winter Storm Dec 2007 DR 1734	Heavy Snow Dec 2008 DR 1825	Flooding Jan 2009 DR 1817
Damage Estimate	**$19,881,908**	**$884,024**	**$305,267**	**$8,657,046**	**$2,910,220**	**$3,700,000**	**$1,100,723**
Reimbursement Totals	**$10,640,607**	**$773,521**	**$198,724**	**$6,896,820**	**$369,481**	**$0**	**$0**

TOTALS	**Damage Estimate**	**$57,054,274**
	Reimbursement	**$33,217,464**

Hazard Ranking and Methodology

The tables contained in this section (tables 2-3, 2-4 and 2-5) are taken directly from the SHIVA, which is currently undergoing an update. Please note that Climate Change, Cyber Terrorism/IT Infrastructure attacks and Pandemics are not represented in the current SHIVA table 2-3.

Table 2-3. Hazard Relationships

	Aircraft Accidents	Civil Disorders	Conflagrations (Fires)	Droughts	Earthquakes	Floods	Haz-Mat Incidents	Landslides	Snowstorms	Terrorism	Tornadoes	Tsunamis and Seiches	Volcanoes	Windstorms
Aircraft Accidents	■		■				■							
Civil Disorders		■	■											
Conflagrations (Fires)			■				■							
Droughts				■										
Earthquakes			■		■		■	■				■		
Floods						■	■	■						
Haz-Mat Incidents							■							
Landslides						■	■	■						
Snowstorms						■		■	■					
Terrorism	■	■					■			■				
Tornados							■				■			
Tsunamis and Seiches							■	■				■		
Volcanoes						■	■	■					■	
Windstorms						■			■					■

Table 2-3 summarizes the relationships between hazards Seattle has historically experienced. Often the primary hazard event triggers other problems, called "cascading" hazards. For example, earthquakes may trigger fires, hazardous materials incidents, landslides, tsunamis and seiches. Also, winter storms can trigger landslides and power outages. Cyber-Terrorism/IT Infrastructure attacks and Pandemics could likewise cause a series of cascading effects that may hinder the delivery of critical public services along with interruptions to businesses and homes.

Table 2-4. Hazard Impacts

	Expected Impacts												***Potential Impacts***										
	Area Affected	*Safety*	*Economy*	*Utilities*	*Transportation*	*Structures*	*Social Services*	*Medical Services*	*Psychological*	*Secondary Impacts*	**Average Score**		*Area Affected*	*Safety*	*Economy*	*Utilities*	*Transportation*	*Structures*	*Social Services*	*Medical Services*	*Psychological*	*Secondary Impacts*	**Average Score**
Air Crashes	1	3	1	3	2	3	1	1	2	2	**1.9**		1	4	2	3	3	3	2	2	4	3	**2.7**
Civil Disorders	3	3	3	2	2	4	3	1	3	3	**2.7**		4	4	4	3	3	5	4	2	4	4	**3.7**
Conflagrations	2	3	2	3	2	4	2	2	2	2	**2.4**		4	4	4	3	3	5	3	3	3	3	**3.5**
Droughts/Water Shortages	5	1	3	1	1	1	1	1	1	1	**1.6**		5	2	4	2	2	2	1	2	2	1	**2.3**
Earthquakes	5	4	5	5	4	5	4	4	3	5	**4.4**		5	5	5	5	5	5	5	5	5	5	**5.0**
Floods	2	2	2	2	2	2	1	1	1	2	**1.7**		3	3	3	3	3	3	2	2	2	2	**2.6**
Hazardous Materials	1	2	2	1	2	1	1	2	2	3	**1.7**		3	4	2	2	3	2	3	3	3	3	**2.8**
Landslides	3	2	2	3	3	3	2	1	2	2	**2.3**		4	4	3	4	3	3	2	2	3	3	**3.1**
Snowstorms	5	1	3	4	4	2	2	2	1	2	**2.6**		5	2	3	4	4	2	3	3	2	2	**3.0**
Terrorism	4	3	4	3	2	4	3	2	5	4	**3.4**		4	5	5	4	4	5	4	3	5	5	**4.4**
Tornadoes	1	2	1	2	1	2	1	1	1	1	**1.3**		1	3	2	3	3	3	2	2	3	2	**2.4**
Tsunamis/Seiches	3	3	4	3	4	4	3	2	2	3	**3.1**		3	4	4	4	4	4	3	2	4	3	**3.5**
Volcanic Eruptions	5	2	3	5	4	3	3	3	2	2	**3.2**		5	4	4	5	4	3	4	4	4	3	**4.0**
Windstorms	5	2	4	4	4	3	3	2	2	2	**3.1**		5	3	4	4	4	3	3	3	3	2	**3.4**

Table 2-4 summarizes the most likely (expected) and maximum credible (potential) impacts for each hazard. These numbers are based on an assessment of the qualitative research presented in the SHIVA. By their nature, they are subjective. Individual readers may draw different conclusions from the same body of evidence.

Each impact is rated on a scale of one (low) to five (high) relative to one another. The scores reflect only the damage stemming directly from the primary event itself (i.e., no cascading hazards are included). To compensate, one category is set aside to express the likelihood for induced hazards. The two scores are averaged to obtain the most likely impact and the maximum credible impact.

Please note that Climate Change, Cyber Terrorism/IT Infrastructure attacks and Pandemics are currently not represented in the SHIVA table 2-4.

Table 2-5. Summary of Hazard Risk in Seattle

	Frequency	Expected Effects	Potential Effects	Risk
Earthquakes	3	4.4	5.0	**66.0**
Windstorms	4	3.1	3.4	**42.2**
Snowstorms	5	2.6	3.0	**39.0**
Landslides	5	2.3	3.1	**35.7**
Civil Disorders	3	2.7	3.7	**30.0**
Terrorism	2	3.4	4.4	**29.9**
Volcanic Eruptions	2	3.2	4.0	**25.6**
Conflagrations	3	2.4	3.5	**25.2**
Hazardous Material Incidents	5	1.7	2.8	**23.8**
Tsunamis/Seiches	2	3.1	3.5	**21.7**
Floods	4	1.7	2.6	**17.7**
Droughts/Water Shortages	4	1.6	2.3	**14.7**
Air Crashes	2	1.9	2.7	**10.3**
Tornadoes	1	1.3	2.4	**3.1**

Table 2-5 summarizes Seattle's hazard risks. The "risk score" is a final assessment of the danger Seattle faces from each hazard. It was obtained by multiplying the event frequency by the scores for expected and potential impacts. The latter two numbers were taken from the preceding table. The same caveat from that table applies to this one: the numbers in this table are a subjective assessment of qualitative data.

Please note that further analysis of the terrorist threat and vulnerability is currently on-going, which may result in a change in the assessment of its risk relative to other hazards.

The conclusion drawn from this hazard and vulnerability analysis is that Seattle's highest risk is for earthquakes, followed by winter storms (windstorms and snowstorms) and landslides. This analysis is consistent with the city's history of Presidential disaster declarations (for both earthquake and winter storms).

The mitigation strategy described in Chapter 4 focuses on the potentially most damaging hazards identified in this analysis.

Note that Climate Change, Cyber Terrorism/IT Infrastructure attacks and Pandemics are currently not represented in the SHIVA table 2-5. They will be covered in the updated SHIVA and are discussed in some detail in the Cyber Incident and Pandemic Incident Annexes of the Seattle Disaster Readiness and Response Plan.

Chapter 3
Seattle's Mitigation Capacity

The City of Seattle has a long history of commitment to city-centric and regional hazard mitigation planning that is aimed at reducing vulnerability to disaster-induced damage. For the purpose of this plan, we distinguish two primary types of mitigation: 1) structural (e.g., physical modifications to buildings, bridges, and other infrastructure), and 2) non-structural (e.g. codes, regulations). As related components, the City's emergency management efforts also include training and public information, as well as target hardening and resiliency, as important and complementary mitigation strategies.

Mitigation success depends on a partnership between government, the private sector and individuals. A central component of the Emergency Management Director's contract with the Mayor focuses on a commitment to systematically educate all who live and work in the City about our hazard risks, and steps they can take to reduce their vulnerability. Members in all sectors of the community are encouraged to check the Seattle Emergency Management website www.seattle.gov/emergency for more information.

This chapter contains details about city departments charged with maintaining the integrity of Seattle's built environment, as well as other departments that address the housing and service needs of the city's general and vulnerable populations. Departments are listed alphabetically. Depending upon information available from each department, the chapter covers:

- Department purpose
- Planning mechanisms, priority-setting processes and hazard impact
- Recent mitigation-related accomplishments

In addition, the chapter includes information about interdepartmental planning, inter-jurisdictional public/private partnerships, and related mitigation planning efforts in other organizations.

We have attempted to capture the main policies, programs and projects that make up the city's mitigation capacity. Subsequent updates of the plan will incorporate new and innovative activities identified as having mitigation benefits.

3.1 City Department Mitigation Planning

This section includes detailed information about departments within city government involved in mitigation-related activities. It reflects each department's unique structure and priorities.

Emergency Management

The Seattle Office of Emergency Management (OEM) is an office of the Seattle Police Department, whose Director is a direct report to the Chief of Police. Its basic mission is

devoted to citywide disaster preparedness, response, recovery and mitigation. It places a strong emphasis on individual and community preparedness, and provides a key liaison function between the city and its state and federal emergency management counterparts.

Emergency Management has the following responsibilities:

- Maintains the city's Emergency Operations Center
- Updates the city's Disaster Readiness and Response Plan
- Educates the public
- Acts as the overall city coordinator for mitigation grants, to include their submission and contract administration when approved and authorized by FEMA
- Manages citywide disaster recovery process
- Plans and administers emergency exercises
- Directs the Seattle Project Impact and Seattle Neighborhoods Actively Prepare (SNAP) programs
- Trains city staff on mitigation, preparedness, response and recovery best practices
- Develops partnerships with businesses, non-profit organizations, schools and others to further the missions of mitigation, preparedness, response and recovery

Special Mitigation Highlights

Mitigation of City Facilities.

The Recovery and Mitigation function oversees the application for and management of State/FEMA funds for mitigation projects. It also encourages city departments to integrate mitigation into post-disaster recovery projects.

Seattle Project Impact.

Seattle Project Impact was a successful public-private partnership with the goal of making the community more disaster resistant. Started in 1998 with the help of a FEMA pilot project grant, this mitigation program had several components: home retrofit, schools non-structural retrofit, improved earthquake and landslide hazard mapping and business continuity planning. Although no longer a funded program per se, all the initiatives had measurable mitigation benefits, and the Regional Home Retrofit Program has been effectively institutionalized within many jurisdictions, including Seattle.

Public Education and Community Preparedness.

OEM has a long-standing history of providing all-hazard preparedness information and programs to a diverse community of individuals, families, neighborhoods, businesses, schools, and community based organizations. Information is available in a variety of mediums and languages. Such outreach involves:

- Safety and earthquake hazard mitigation at home and at work are part of the overall preparedness messaging within Seattle's Public Education Program. A

primary delivery source is the neighborhood preparedness program called SNAP (Seattle Neighborhoods Actively Prepare), which concentrates on general preparedness classes that are taught throughout the City. These offerings are supplemented by more advanced skills training classes, which are further augmented by online training via the OEM web site -- www.seattle.gov/emergency .

- The OEM web site also provides more specific mitigation information to help citizens reduce earthquake hazards in the home and at work (example: earthquake non-structural hazard mitigation for water heaters, pictures/wall hangings, kitchen cabinets, tall furnishings, computers and other electronics). The latter information provides the foundation and introduction for skills training classes that focus on how and when to control utilities following an earthquake, and how to retrofit older homes so they are adequately attached to their foundations.

Community Level Planning.

There are various levels of preparedness planning that are being undertaken to prepare for potential disasters. With the SNAP program focusing on preparing by individuals, families and neighbors, planning is now underway to prepare at the larger geographic community level. This planning is focusing on the following: 1) understanding the vulnerabilities a community may face in a natural disaster; 2) identifying potential resources within the community which could provide assistance following the disaster; and 3) developing a plan for communications, including the identification of communications hubs where the community can gather following the disaster. The intent of the communication hubs is for the sharing of information within the community and between the communities and the City.

The ultimate objective is to more readily and more precisely capture a common operating picture of the scale and nature of serious conditions and human needs that exist in the City's communities in the immediate and possibly extended aftermath of a serious event. With such information that can be reported in real time it will enable the city to more proactively identify and target the most pressing concerns, so that limited resources can be directed to those most in need -- while at the same time allowing the City's EOC to give communities the necessary feedback to enable them to remain safe and facilitate the City's public response.

Currently three geographic communities are working on this level of planning: Magnolia/Queen Anne/Interbay, West Seattle and Wallingford. West Seattle and the Magnolia/Queen Anne/Interbay have both identified eight locations for Communications Hubs. Wallingford is currently in the process of identifying the locations for their community.

Many of these Hubs are located in Parks within each community based on the presumption that these would become natural gathering locations for community members following a major disaster. In addition to the identification of the Hubs within

each community, supplemental planning is underway to develop Ham Radio capabilities in each community to support the communication efforts.

Recent Mitigation Accomplishments

Between 1995 and 2005, Seattle OEM successfully applied for and received $5,168,922 in State/FEMA mitigation reimbursement funds.

In 2008 two other grants for the Queen Anne Community Center Seismic Retrofit and Gas Shut-off Valves for 40 City-owned facilities have been approved at a projected cost of $980,000.00.

Three more projects with a projected cost of $11,000,000.00 are either under review or were determined to be eligible but not funded. Specifically they involve seismic retrofits for Fire Station 14, King Street Station, and Post Alley.

Funding from previous grants have helped pay for projects such as the Alki Landslide Mitigation Project, three former Emergency Operations Center retrofits (this structure is being converted for use by the Seattle Fire Department under the Fire Levy), and numerous bridge retrofits.

Because of current discoveries that showed that Puget Sound had experienced tsunamis in the past, and which were subsequently reported in a Department of Planning and Development Best Available Science Report for Geological Hazards in January 2007, Seattle used money from the Washington State Emergency Management Division All-Hazard Alert Broadcast (AHAB) program in 2005 to build a partial public outdoor warning system at 3 locations along the downtown waterfront. The system was also equipped with cameras, a weather station, a strong motion instrument, and gamma detectors.

In January 2008 OEM moved into a new state-of-the-art EOC that was built to match the International Building Code essential facility structural standard. In addition to giving the City a more resilient central emergency coordination center, its design included a green roof that reclaims rain water for use in the building which is shared with the Seattle Fire Department Fire Alarm Center and Station 10. It further maximizes energy efficiency in lighting and HVAC systems, and is equipped with security enhancements to protect occupants and the facility against an intrusion or attack.

Finance

The Department of Finance is responsible for city budgeting, debt management, financial policies and overall financial controls.

Planning

Through the Capital Improvement Program (CIP), the department allocates existing funds and anticipated revenues to rehabilitate, restore, improve and add to the city's capital facilities. The six-year CIP, updated annually, covers a range of capital improvement projects.

This document, prepared by the Department of Finance and based on submissions from city departments, is approved by the Mayor and then submitted to the City Council for adoption, along with the city's annual budget. The CIP does not appropriate funds, but rather functions as a budgeting tool, and supports the actual appropriations that are made through adoption of the budget. The CIP is consistent with the city's Comprehensive Plan and includes information required by the state's Growth Management Act.

Criteria used in selecting capital priorities and projects include preservation of existing facilities, investment in facilities that support the Comprehensive Plan, implementation of neighborhood plans, support for economic development, leveraging of external funding sources, and consistency with the City's debt policies.

In making investments in city facilities or infrastructure, Seattle departments try to balance three goals:

- Rehabilitation or restoration of existing facilities to avoid the higher costs of deferred maintenance and to meet regulatory requirements,
- Improvement of existing facilities to meet growing demand or to improve efficiency,
- Development of new facilities to provide additional services (i.e., new requirements imposed by regulations).

Many, but not all, hazard mitigation projects undertaken by individual departments are integrated into the city's CIP (see Chapter 4.2).

Most recently the Proposed Capital Improvement Plan for 2009-2014 identifies investments for the following future projects that will mitigate various types of exposures that currently exist, and that can be remediated by upgrading, restoring and rebuilding of the City's capital assets:

- Constructing lids for the West Seattle and Maple Leaf reservoirs, to shield environmental contaminants and protect the water supply from tampering.
- Construction of a new Seattle City Light substation in the North downtown area, which is intended to be the hub for a new underground network. The combined substation and network will provide power for the expected growth in the North downtown area by distributing an additional 200 MVAs and continuing to support City Lights efforts to rehabilitate aging infrastructure.
- Design a second tunnel at the Gorge Dam, which will enable City Light to increase capacity by 45,000 MW per year with no increase in water release. This

project when fully constructed in 2013 will help City Light realize the 15% goal of power from renewable resources as mandated by Initiative 937.
- Continue to projects under the 2003 Fire Facilities and Emergency Response Levy to retrofit 32 fire stations and install backup generators.
- As part of the Alaska Way Viaduct replacement project, the city together with King County will fund the replacement of the adjacent seawall with Elliott Bay.
- Lastly, there are environmental projects designated for climate protection, clean water, replanting tree cover, and conservation through reusable resources.

An Asset Preservation Study was prepared in 2003 to catalogue all of the city's capital facilities and calculate their replacement value. The four departments involved in the study (Fleets & Facilities, Library, Parks and Recreation, and Seattle Center) are responsible for a total of 6.9 million square feet of building space, 2.6 million square feet of parking space, and 240 million square feet of grounds (primarily green space) and work yards. At the time of the study, these assets were judged to have an aggregated replacement value of approximately $5 billion.

Study recommendations were implemented over past six years; however, the amount of money suggested as necessary to fully fund asset preservation was more than the City thought it could dedicate to that purpose.

Today the Fleets and Facilities Department (FFD) is responsible for management and ongoing review of the City's property inventory and coordinating decision-making processes for reuse and disposition of property. The Real Property Asset Management System (RPAMIS) was created in the mid 1990's and is managed by FFD.

RPAMIS is an integrated, City-wide database containing information about all City real property and related data. As such, RPAMIS stores information about parcels, property management areas, purchases, sales, permits, leases, information requests, facilities, buildings and property values. This system not only provides a comprehensive inventory, but is also used as an analytical tool to assist decision-makers in weighing alternative uses of real properties based on planned management of the portfolio for optimum public benefit, including operational requirements, policy goals and economic benefits.[23]

Replacement values for City buildings are maintained by the Department of Executive Administration Risk Management Division in their INCERT database for the purpose of insuring City property.

Fire Department

The Seattle Fire Department provides fire suppression, rescue and emergency medical services to Seattle's culturally diverse population. The Fire Department also manages and supports the City's Local Emergency Planning Committee (LEPC) to address hazardous materials issues, the requirements of which are mandated under the Superfund

[23] http://rpamis/getreal/

Amendments and Reauthorization Act (SARA) Title III of 1986. (See Section 3.3 Inter-jurisdictional Partnerships for more details.)

The Fire Prevention Division of the Seattle Fire Department, commonly referred to as the Fire Marshal's Office**,** provides the leadership and inspection services to help prevent fires, explosions and release of hazardous materials and to assure fire and life safety for Seattle's residents, workers and visitors.

The Hazardous Materials Section of the Fire Marshal's Office provides inspection services for the storage and use of flammable and combustible liquids and other hazardous materials and processes as required by the Seattle Fire Code and Administrative Rules.

The Fleets and Facilities Department manages the construction, maintenance and mitigation of all Fire Department facilities.

The Fire Facilities and Emergency Response Levy was approved by voters in November 2003, and provided $167 million to enable the Seattle Fire Department to be more resilient in dealing with crisis situations, especially those that could damage critical department assets and disrupt emergency operations. The majority of projects included in the levy are being administered by the Fleets and Facilities Department (See below).

Fleets and Facilities

The Fleets and Facilities Department (FFD) is responsible for managing real estate, buildings and vehicles for the City of Seattle. The FFD has four major operating divisions, including Capital Program, Facilities Operations, Fleet Services, and Real Estate. Each of these divisions provides services to city policy makers, departments, and employees. In more specific terms the four divisions engage in the following lines of business:

- Fleet Services centrally manages the city's vehicle and equipment in order to achieve timely, cost effective, and high quality replacement of vehicles, maintenance, fueling, and short-term transportation.
- Facility Operations maintains approximately 3 million square feet of city-owned facilities, to include maintenance and repair of buildings and building systems occupied by city departments and other users who lease space from the city.
- Real Estate Services provides strategic planning and management of the city's real estate assets and assures a safe work place environment for city workers and citizens who visit city offices to conduct business and seek city services.
- Capital Program Division provides for new construction, remodeling, tenant improvements, asset preservation, hazardous materials abatement, and renovation services for the FFD Capital Improvement Program.

The department manages and maintains 108 separate buildings. These include 3 office buildings and 2 parking garages in the downtown Civic Center, a network of 33 Fire

Stations and 2 fire support facilities, 5 police precincts and police support facilities, and 5 major complexes of shops and yards. The 108 buildings also include a number of special-purpose facilities, such as senior centers, neighborhood service centers, and the Animal Shelter. In addition to owned facilities, FFD also leases and manages space in about 20 buildings, primarily small office spaces and large warehouses.

As of the end of calendar year 2008, the Fire Facilities and Emergency Response Levy program managed by FFD has completed seven projects:

- The construction and occupancy of a new Fire Station 10, a new Fire Alarm Center and a new Emergency Operations Center. The new joint facility housing all of these functions became operational in the first part of 2008, and provides both the Fire Department and the City's Emergency Management Office with state-of-the-art facilities that are built to essential function standards.

- The construction and occupancy of a Joint Training Facility for the city, that allows first responders from all departments to conduct class room and field training to become more proficient in the emergency response missions.

- The purchase of emergency generators to power life support systems at six city community centers, that include centers in Bitter Lake, Meadowbrook, Queen Anne, Garfield, Delridge, and Rainier Beach.

- The purchase of emergency supply caches to assist 3,500 people that may seek shelter in an earthquake or widespread disaster that displaces individuals and families from their homes. These caches, which are discreetly located in Magnolia, North Seattle, Central/Southeast Seattle, and West Seattle contain: cots, blankets, shelter kits, nurse kits, and emergency radios.

- Two new fire boats were added to the fleet to boost the Fire Departments capacity to attack and/or contain vessel fires or that could threaten mooring facilities or other fires along shorelines.

Ultimately, when all of the levy money is spent as set out in the City's CIP, 32 neighborhood fire stations will be made more disaster resistant, and the fire department will gain the ability to draw water from Puget Sound or other close by water reservoirs should hydrants or water distribution lines become inoperable.

Planning

The department's Capital Improvement Program includes structural mitigation projects performed following Seismic Evaluation Studies completed in the early to mid 1990's. These studies evaluated various types of structures, including libraries, parks facilities, and municipal buildings, and fire and police stations. The studies evaluated non-structural components as well. They include:

- Facilities Screening Studies by EQE, 1993: selected branch libraries, Seattle Central Facilities, Dept. of Parks & Recreation facilities, and DAS (since divided into Fleets and Facilities, the Department of Finance, and the Department of Information Technology).

- Studies of Non-Structural Components at City Light, Seattle Public Libraries, Seattle Parks and Recreation and the Seattle Center by EQE in 1992 and 1993.

- Detailed Seismic Evaluations of numerous city buildings, substations, service shops, community centers, libraries, police and fire stations, the Seattle Aquarium, and Sunny Jim warehouse by EQE, completed between 1992 and 1995.

- Detailed seismic evaluations, recommendations and cost estimates by Schreiber & Lane of Fire Stations 8-10, 16, 18, 20, 24 and 41, completed in 1996.

- Detailed seismic evaluations, recommendations and cost estimates by Coughlin Porter Lundeen of Fire Stations 2, 11, 13, 26-30, 32, 36-37 completed in 1996.

- Passage of a $167.2 million Levy that provides for seismic retrofitting of 20 fire stations and rebuilds 12 others to current seismic standards.

  Progress made as of September 2008 in completing work or acquiring assets designated in the Fire Levy, include:

  - ✓ Construction of a new Fire Station 10 and Fire Alarm Center. This facility also included a new 14,290 square foot state-of-the-art city Emergency Operations Center. The building housing these co-located facilities was built to an "essential facility" standard, capable of withstanding an earthquake load 50% higher than required by current building code.
  - ✓ Construction of a new Joint Training Facility.
  - ✓ Purchasing of emergency generators to provide auxiliary power to 6 community centers that are designated as mass care shelters.
  - ✓ Emergency supply caches to support 3,500 people in a major earthquake or other widespread disaster or catastrophe.
  - ✓ Two new fire boats.
  - ✓ Hardening of fire hydrants installed at the City's 9 reservoirs.
  - ✓ Equipping fire engines with light-weight hard suction hoses and flooding strainers so they can draw water from lakes and Puget Sound.
  - ✓ Equipping fire engines with a new large diameter hose to increase the distance firefighters can draw water from reservoirs, lakes, or Puget Sound.

Recent Mitigation Accomplishments

Many of the structures identified and evaluated have since been mitigated; others are either in process or are planned – and are listed in Chapter 4.2.

- The two most visible examples of recently mitigated buildings that provide critical city services are the Municipal Building and the Public Safety Building. Both buildings were seismically unsound and have since been rebuilt to comply with current seismic code.
- New Police Precinct facilities (West and Southwest Police Precincts) have been built to meet current seismic standards and have been fully operational for the past several years.
- In 2002 Mayor Nickels released his Environmental Agenda, which included the following initiatives that have been acted on by the Fleets and Facilities Department:

    - To promote fuel savings and to lower carbon emissions the City, as part of its annual vehicle replacement program, is converting to a Green Fleet (refer to 2003 Green Fleet Plan) by buying alternative and hybrid vehicles.
    - Seattle City Hall Case Study – Designed to last 100 years, with the ability to adapt to changing services and technology, the new City Hall building exemplifies Seattleites' values. Its healthy, open and transparent design achieves great resource savings, features livability, and received a Gold Leadership in Energy and Environmental Design (LEED) rating by the US Green Building Council.
    - Seattle Justice Center Case Study – Also designed for a 100-year life span, the new Justice Center features interior spaces illuminated with daylight space design that provides views, a thermal buffer wall to save energy, and a multi-functional living roof. This building was awarded a Silver LEED rating by the US Green Building Council.
    - Seattle Municipal Tower (SMT) Remodel Case Study – The TI projects recommended in the case study that were part of the SMT remodel were not submitted individually or collectively for LEED certification; however, they included many green/sustainable elements recommended by the US Green Building Council.
    - The SMT for the second year in a row has qualified for an Energy Star certification, which acknowledges that it has achieved superior energy performance as one of the most energy efficient buildings in the country.
    - Southwest Police Precinct Case Study – Savings of approximately $83,000 a year in maintenance and operating costs were achieved through sustainable building strategies such canted wall and overhang design to provide sun protection.
    - Awarded $200,000.00 FEMA mitigation grant to install gas valve shut off mechanisms on 40 city-owned facilities. These valves automatically cut off the flow of gas in the event of an earthquake to prevent the ignition of fires.

Housing

The Seattle Office of Housing (OH) invests in and promotes the development and preservation of affordable and energy conserving housing for lower-income individuals and families.

Impact of Nisqually Earthquake

A survey conducted by the Office of Housing following the Nisqually Earthquake revealed that a number of downtown buildings owned by non-profits that house vulnerable populations sustained damage. The event impacted 3299 units and caused an estimated nearly $8 million in damage.

Human Services

The Human Services Department's (HSD) mission is to find and fund solutions for human needs so that low-income and vulnerable residents in greater Seattle can live and thrive. The Department contracts with more than 230 community-based organizations to provide services to these populations.

Actions Resulting from Nisqually Earthquake

Following the February 2001 Nisqually Earthquake, HSD met with an ad hoc planning group to discuss issues related to disaster response for vulnerable King County residents with special medical issues, including the homebound frail elderly. Subsequently, HSD provided disaster response training for Aging & Disability Services' case managers.

Information Technology

The Department of Information Technology (DoIT) is charged with management, operations, and maintenance for the majority of the City government's telecommunication and information technology infrastructure. A number of telecommunications and infrastructure responsibilities are distributed among IT units located in many of the larger departments. DoIT is responsible for the coordination with the distributed units to help ensure operational service for the telecommunications and information technology infrastructure services. These services include the 800 megahertz public safety radio network, the City's telephone network including call centers and voice mail, the City's data communications (computer) network, fiber-optic cabling, messaging (email) and collaboration, the City's internet connections, the 24/7 data center, the city's website (seattle.gov) and the Seattle Channel -- a public television channel.

Planning

- DoIT's Department Director has the additional responsibility as the Chief Technology Officer (CTO) for the City. The CTO oversees the preparation of citywide strategic

technology plans to support the City's business needs. The CTO leads and works closely with the City Technology Board to produce a City of Seattle Enterprise Information Technology Strategic Plan. This plan is a strategic plan keyed to the Mayor's stated priorities and vision. The plan is developed with the IT management in all of the major city departments and identifies key investments and expected budget timing within a five-year planning horizon (2008-2012).

- The DoIT capital improvement program includes a number of information technology infrastructure improvement projects financed in a variety of ways, including bond funding and collection of funds from the city's other departments.
- DoIT participates in several regional groups to jointly plan enhancements to the IT infrastructure. These include the Regional Communications Board (RCB), which governs the King-County-wide public safety radio network. The entire network has 25 radio sites and about 15,000 radios used by every police and fire agency in King County. Seattle operates a portion of this network – 9 radio sites and about 5,000 radios. In addition to the RCB, the City's CTO chairs the Puget Sound Regional Interoperability Committee (PSR-IEC). The PSR-IEC plans infrastructure initiatives across the region, including three counties (King, Pierce and Snohomish). Another group is the fiber-partners, a consortium of public agencies such as the city, county, state, and federal governments, Seattle Schools, Community Colleges, the University of Washington and others. This group plans enhancements to the existing fiber optic cable network in Seattle. DoIT is the lead agency for construction and extensions of this network.

Mitigation Accomplishments

DoIT has made a number of improvements to information technology systems and infrastructure that mitigate the city's vulnerability to disasters. Such improvements include:

- Construction of about 330 miles of fiber-optic cable linking various government facilities in the City of Seattle and nearby suburbs. This infrastructure is owned and operated by the DoIT on behalf of the fiber partners (see *Planning* above). It is the central fiber optic cable used for operation of other networks, e.g. the city's private telephone network, the radio network and the data communications (computer) network. The network infrastructure is used by other government agencies including King County, public schools, and the University of Washington for their infrastructure networks. High speed electronic communications are vital to service delivery and effective communications rely on voice, video, and other types of data that need more bandwidth capacity. Key projects include those that have improved remote access technologies. The Broadband Initiative is a key program that can support City requirements as well as community development and regional growth.
- Implementation and continuous improvement of a public safety 800 megahertz (MHz) trunked radio system n King County. This network was authorized by King County voters in a special levy in 1992 and was implemented in 1995. It links every police and fire agency in the County, plus other related agencies such as Seattle Public Utilities. The present network is composed of 25 radio sites that enable and

support hundreds of talk groups and over 15,000 radios (Seattle's portion is 9 transmission sites and 5,000 mobile and portable radios). The radio network is the primary method used by the police, fire and public utilities departments to dispatch their field units to citizens requesting services, as well as for emergencies and disasters. The Seattle network is part of a linked and jointly owned and operated King County region wide network. Replacement of the 800 MHz radio systems as it becomes obsolete is imperative in order to support communications for the public safety agencies of the region. There are various initiatives that will enhance interoperable communications between public safety agencies in the three-county region (King, Pierce and Snohomish) in 2009/2010 and in future years.

- Upgraded the microwave system located in the North King County loop. The upgrade increased communications capacity and enabled the City to participate in future communications initiatives across the three-county region.
- Replacement of two radio site generators to run off diesel rather than propane in order to address fuel availability issues during disaster events.
- Implementation and continuous improvement of a private telephone network for city government, linking about 350 city business sites, composed of about 13,000 telephone lines, with related services such as 8,000 voicemail boxes and interactive voice response systems. The telephone network is the one method citizens use to contact their government and the main communications method used by city departments to coordinate their internal responses to both day-to-day work and disasters. This system is used internally to City government and is designed to operate even when the public telephone network and cellular networks are inoperative. The network operates largely on the City's own fiber-optic cable network; but there are also leased circuits. This system supports related services such as automatic call distribution system (ACD), interactive voice response systems (IVR) and voicemail. DoIT has completed a $1.5 million upgrade of telephone switches in this network.
- Construction of a $2.3 million data center and consolidated server room with state-of-the-art HVAC, electrical power, fire suppression and security. DoIT operates this facility on a 24 hour-a-day, 7 day-a-week basis.
- Initial work has started on the implementation of an alternate data center located in the City of Bellevue, which provides critical infrastructure and critical application redundancy for IT systems supporting critical government services in the event of an emergency. The DoIT Continuity of Operations Plan (COOP) is leading the way in defining disaster recovery requirements for critical IT systems. Investments are required to support the Alternate Data Center (ADC) in Bellevue and a second tier facility outside of the region.
- Implementation of a private data communications network which links all desktop, server, mid-range and enterprise computers in city government as well as many other special purpose services including printers and video. The network operations depend largely on the City's fiber optic network between buildings and intra-building risers and copper for distribution within buildings. This data network is the basis for a wide variety of computer applications and used for emergency management.
- Implementation of network equipment to provide firewalls within the city's infrastructure to prevent cyber attacks.

- Installed emergency generator in City's data center which provides power when required during emergency situations for critical computer systems located within Seattle Municipal Tower.
- Enhancement of the "Seattle Channel". The Seattle Channel is the city government's television station, broadcast to Comcast cable television viewers and streamed live over the Internet. DoIT has re-branded the Seattle Channel, built an enhanced website to supplement it, and does live broadcasting of City Council meetings and other programming. The Seattle Channel is a one of the methods used by city government to help prepare citizens to confront disasters and terrorism. The Seattle Channel provides live link services to the city's Emergency Operating Center and from other city locations to carry information to the public during emergencies.
- DoIT supports the public facing city government website www.seattle.gov. This award-winning website is used by every city department to provide information to citizens regarding normal government business and disaster preparedness. During emergencies this website is utilized for communications to the public and becomes an integral part of the city's emergency operations center. It is important that the website is operational during all types of hazards.

Neighborhoods

Department of Neighborhoods (DON) currently has three programs directly relevant to mitigation: Historic Preservation, Neighborhood Plan Implementation and Neighborhood Matching Fund grants to help neighbors get more prepared.

- Seattle's Historic Preservation Program is responsible for the designation and protection of more than 350 historic structures, sites, objects, and vessels, as well as seven historic districts scattered throughout Seattle.

- In 1999, the City Council finished the approval process for 38 neighborhood plans created by nearly 20,000 citizens. The plans identify actions needed to enhance that each neighborhood will continue to thrive and improve as Seattle grows over the next 20 years in ways that meet our commitments under the State's Growth Management Act. Seven of these plans currently include hazard mitigation-related proposals and are reflected in Chapter 4 of this Plan.

- Funding was added in a 2009-2010 City Council Budget Action to assist Disaster Response Plans for three districts: Wallingford, West Seattle, and Queen Anne-Interbay-Magnolia. Funds will be granted to community groups in these areas and will provide for the development and implementation of the plans and communication networks. The Department of Neighborhoods will administer the funds. Neighborhood Matching Funds are also available for eligible neighborhood groups who propose community-building projects including projects focused on emergency preparedness.

Impact of Nisqually Earthquake

Several historic business buildings were affected in Pioneer Square and the International District; however, chimneys on a number of residential historical properties were damaged as well. Many privately owned historic buildings had been retrofitted prior to the earthquake. As a result, those buildings suffered little or no damage. A number of historic buildings have or are in the process of undergoing renovation that includes seismic upgrades.

Parks & Recreation (DOPAR)

Seattle Parks and Recreation will work with all citizens to be good stewards of our environment, and to provide safe and hospitable opportunities to play, learn, contemplate, and build community.

During a major event Parks' primary responsibility is to provide Tier 1 sheltering sites through its network of community centers. The system has 26 primary sheltering sites.

Depending on the scale of the event and the locale of the incident, shelters may be activated in the following community centers: Bitter Lake, Delridge, Garfield, Meadowbrook, Queen Anne and Rainier Beach. These facilities are electrically wired with transfer switches to accept a portable generator to serve lighting in key areas, kitchen refrigerators, and other critical circuits.

Planning

Parks maintains a 6-year Major Maintenance Plan (MMP) that compiles major known maintenance needs required to keep the Parks Department's assets in safe and operable condition. Its current operating document covers 2004-2010. Part 1 of the MMP describes the Plan and includes lists of projects; Part 2 contains project descriptions.

The following process was used to prioritize projects in the current MMP:

- In-house review by Parks staff of the earlier MMP to eliminate projects that were completed and to add new projects.

- Each of the seven Parks geographic and citywide divisions prioritize the remaining projects and selected the top 30 most needed projects in their districts.

- Roughly 200 projects are selected across divisional lines and are ranked according to a priority ranking system. Criteria include: division priorities; facility integrity; identification of a need in an existing plan; safety; and urgency.

- Points are totaled and projects re-ranked.

- The final list is presented to the Parks Project Steering Committee (Directors and Parks Superintendent) for review and buy-in.

- Parks attempts to fund the top 50 projects per biennium.

Recent Mitigation Accomplishments

- Slide Mitigation Projects at Kinnear Park, Lake Washington Blvd., Magnolia Blvd., and Aurora Ave.

- Received a FEMA hazard mitigation grant for $780,000.00 to seismically retrofit the Queen Anne Community Center. Construction is scheduled to be completed by the end of 2009.

- Receipt of a seventh emergency generator. These seven generators are located in the following Community Centers: Rainier Beach, Queen Anne, Meadowbrook, Bitterlake, Garfield, Delridge, and Southwest. All of the generators, except the one at Southwest CC, were paid for out of the Fire Levy.

- Conducted training for community center coordinators in emergency shelter operations.

- Revamping the Parks Emergency Management Manual (2009) and Sheltering Operations Handbook (2009).

- Received a FEMA grant for $534,922.00 to seismically retrofit the South Lake Union Armory Building. The project was completed in 2007.

Planning and Development

The Department of Planning and Development (DPD) develops, administers, and enforces standards for land use, design, construction, and housing within the city limits.

Planning

The department is responsible for several plans and planning processes relevant to hazard mitigation:

- Seattle's Comprehensive Plan**,** *Toward a Sustainable Seattle*, is a 20-year policy plan designed to articulate a vision of how Seattle will grow in ways that sustain its citizens' values. The City first adopted the Plan in 1994 in response to the state Growth Management Act of 1990. The plan addresses neighborhood planning issues, coordinating regional policy, and analyzing Census data. This plan involves considerable opportunity for public participation through community meetings and posting on the City's website.

- Area Planning & Urban Design. This effort coordinates community priorities with major development projects. It includes Seattle's City Design Office, the "Central Waterfront Plan" and other waterfront connection programs.

- Seattle Planning Commission is a 15-member citizen group that includes an engineer or architect, an urban planner, ethnic minority members, and citizens active in neighborhood and community affairs. The group advises the Mayor, City Council and city departments on broad planning goals, policies and plans for the physical development of the city.

  The Comprehensive Plan and its vision frame the Commission's work for Seattle into the 21st Century. The Commission engages citizens in planning and working to reach the Plan's goals. The role of the Commission is:

  - To foster community participation in support of quality urban planning and design.
  - Advise city decision-makers on broad planning policies and goals, and on major planning projects and issues.
  - Educate leaders and citizens to promote excellence in planning, particularly at the intersection of urban design, preservation, art and architecture.
  - Advocate for planning decisions that support the health and vitality of the community.

Development

DPD develops, adopts, and enforces codes, ordinances, and policies that regulate construction activities, both for new and existing buildings. These regulations have the effect of mitigating damage caused by natural disasters.

- Seattle Building Code – based on the International Building Code promulgated by the International Codes Council. This 2006 edition adopted by the City in November 2007 is the primary tool for mitigating damage from earthquakes, snowstorms, and windstorms. New buildings constructed in compliance with this code are expected to be serviceable after most events and remain standing after a major event. For existing buildings, the code requires an owner who is substantially renovating a building to commission a seismic investigation, which may lead to a requirement to upgrade the earthquake resistance of the building.

- Seattle Project Impact – DPD helped develop Seattle Project Impact's standards for encouraging seismic retrofits of single-family homes. The Department also provides expedited permitting services for these retrofit projects.

- Seismic Repair Policies – the Nisqually Earthquake in February 2001 prompted DPD to adopt policies for repairing damage caused by the earthquake. The policies in effect require upgrades of the most damage-prone building elements (parapets and

chimneys), with the expectation that damage to these elements in the next earthquake should be greatly reduced. Other policies trigger upgrades to structures that were more heavily damaged in the earthquake.

- As a consequence and outcome of the 1996/97 landslides, DPD and SPU have sponsored annual Landslide Awareness public meetings, with the intent of providing an all-encompassing range of expert advice for owners that manage landslide-prone properties in Seattle. At these meetings city staff representing DPD, SPU, DOPAR and SDOT are augmented by private sector experts that include civil and geotechnical engineers, landscape architects, arbor culturists, and contractors.

Disaster Management

DPD participated in the Interdepartmental Landslide Team described in Chapter 3.2.

Recent Mitigation and Mapping Projects

As a result of the interdepartmental landside effort referred to in section 3.2 of this chapter, DPD developed maps of 1400 reported slides, planning level descriptions and cost estimates at 50 sites where the city could undertake stabilization measures to protect utilities and public safety. DPD uses the updated maps to regulate steep slopes under the Environmental Critical Areas (ECA) Ordinance. More recent updates made in 2006 for environmentally critical area polices of the Comprehensive Plan addressed riparian corridors, wetland buffers, and reduced development along steep slopes.

In addition, DPD and SPU jointly funded development of a soils layer with the University of Washington and USGS. Now completed, this layer enhances the city's ability to plan infrastructure, as well as improve the way the city regulates private property.

DPD further produced a Best Available Science Report for Geologic Hazard Areas that was made available on January 31, 2007. This report stated that Seattle may be subject to tsunamis generated by the following sources: 1) Shallow crustal earthquakes that rupture the submarine floor of Puget Sound. 2) Shallow crustal earthquakes that rupture the floor of Lake Washington. 3) Landslides within or into Puget Sound. 4) Landslides within or into Lake Washington. 5) Lateral spreading due to liquefaction causing landslides into or in the Duwamish River and/or Puget Sound.

DPD commissioned an Unreinforced Masonry (URM) Study by Reid and Middleton that was published in December 2007. The study estimated there are 800-1,000 URM structures in the city. Given the public safety concerns raised in the study, DPD has undertaken the lead for developing policy recommendations, including the possibility of required seismic retrofits. To help with this work, two public-private advisory committees have been convened – Technical and Policy.

- The Technical Committee is considering thresholds for compliance, engineering standards and the value of earlier upgrades.
- The Policy Committee is considering timeline for compliance, incentives, penalty for non-compliance and financing options.

The resulting programmatic recommendations will be presented to City Council for consideration. If adopted, Seattle would be the first city outside California to enact such a retrofit requirement.

New updated liquefaction and potential slide area and new tsunami/seiche and lahar maps were incorporated into the late 2006 update to the Comprehensive Plan. Similarly, and based US Geological Survey (USGS) seismic maps released in the Fall of 2008, much of the new information will be used to update seismic codes. This latter action is scheduled for adoption in the summer of 2013.

Risk Management

The Risk Management Division of the Department of Executive Administration manages the insurance program for all city property, including purchasing coverage and making policy revisions.

The City has insured its property through an outside carrier since 1998; prior to that it was self-insured. The insurance program covers all city-owned structures within and outside the city limits, and includes more than 1000 structures. Seattle's current policy covers all-risk (including acts of terrorism), earthquake and flood. Deductible levels can change with each policy revision, but the trend is towards higher deductibles. The 2009-2010 minimum deductible for all types of hazards is $500,000 per structure.

Seattle Center

Seattle Center is the fourth largest visitor destination in the United States, attracting more than ten million visitors per year to its 74-acre campus and hosting over 5,000 arts, sporting, educational, and cultural events. It is the home of the Seattle Opera, Pacific Northwest Ballet, three major theater companies, the Storm women's professional basketball team, the Children's Museum, the Fun Forest Amusement Park, and The Center School, a small public high school. The grounds and buildings host festivals, concerts, conferences, and exhibitions throughout the year. Seattle Center is also a major urban park with lawns, gardens, fountains, and a variety of open spaces throughout the campus.

There are 24 buildings, two parking garages and five surface parking lots, a skateboard park, and an outdoor public basketball court on the Seattle Center grounds. Also part of the campus, but privately owned and operated, are the Space Needle, the Pacific Science Center, and the Experience Music Project (EMP). The nation's only publicly owned monorail carries more than two million riders each year between Seattle Center and

Westlake Center. The Monorail is owned by the city and operated by a private contractor.

Planning

Seattle Center has conducted a number of seismic studies over the last 5-10 years. In addition, the Center developed a new Emergency Response Plan following the 2001 Nisqually Earthquake.

Recent Mitigation Accomplishments

- Seismic retrofit of Opera House
- Removal of retaining wall on Kreielsheimer Site
- Phase I seismic improvements in Center House as part of construction of Center School (small public high school in Center House)
- Replacement of seismically unsound Flag Pavilion
- Replacement of Central Utility Plant and elimination of hazardous materials in old chillers
- Storm water management – construction of detention systems as part of construction projects at McCaw Hall, Fisher Pavilion, Central Utility Plant, 5th Ave. Parking Lot, and Key Arena

Seattle City Light

Seattle City Light (SCL) is in business to provide excellent energy services to its customers. It serves a population of almost 700,000 people living in a 130 square mile area, including the City of Seattle and several adjoining jurisdictions.

Planning

SCL considers system reliability, safety, cost effectiveness, regulatory compliance, environmental impacts, and customer service when prioritizing and evaluating annual capital and maintenance projects. Projects are proposed and approved as part of the Department's annual budget and capital improvement planning processes. Tools used for evaluating projects include, but are not limited to, studies, load forecasts, rate forecasting estimates, economic models, etc.

Recent Mitigation Accomplishments

System Reliability. Reliability is a key factor considered in evaluating and approving capital and maintenance projects and activities. SCL has ongoing projects and programs

that are focused on preserving the integrity of its electrical system. Many of these projects result in the installation and/or construction of protective equipment and systems that mitigate potential damage to our electrical system from natural and manmade hazards. Examples are: protection devices, fire protection systems, and looped communication systems.

There are also systems and practices that allow remote control of key facilities and equipment during emergencies and back up generation and power resources, both owned and contracted, that can be activated to minimize operational interruptions and failures or damage. Mitigation accomplishments are included throughout this section.

Structural Mitigation

- Boundary Rehabilitation Program. Comprehensive, programmatic rehabilitation of major equipment and auxiliary systems to improve plant reliability, operating life, best practices in the industry, new technology and licensing requirements.

- Turbine Runner Overhauls. These projects refurbish existing generators by replacing or refurbishing worn components and installing new turbine runners to increase efficiency, operational flexibility and reliability.

- Ross and Diablo Fire Protection Systems Modifications. Installation of a refrigerated carbon dioxide storage tank to protect generators, oil rooms, and the station service rooms and advanced smoke detection system for early warning of fire at the control, relay and communication rooms.

- Substation and Network Improvements. Improvements are made to substation buildings, ancillary facilities (e.g., vaults and conduits, cables and feeders, etc.) and other electrical structures to enhance system reliability, to comply with regulatory requirements, and to maintain safe work environments.

- Relay Improvements. Improvements are made to metering, control and relay systems that serve substations and transmission systems to enhance reliability.

- Communication. The construction of fiber rings to City Light facilities to create a secure digital communications network and upgrading communication systems infrastructure consisting of fiber optic cable, digital microwave, or conventional radio systems. These systems are critical for operation, command and control of the electrical system and to dispatch crews that support these systems.

- Transmission Reliability. This project includes engineering and construction to improve or maintain reliability of transmission systems through rebuilds, replacement and/or relocation of infrastructure.

- Network Maintenance Hold and Vault Rebuild. Field surveys are performed to assess conditions and record condition of Network vaults and maintenance holes in the downtown and First Hill areas (underground electrical network). Current data facilitates service restoration during emergencies or system failures.

- King County Metro Direct Current (DC) Cables. Relocation of Metro DC cables from City Light maintenance holes and vaults to separate and isolate two electric systems that have uncoordinated protection schemes. Separation minimizes the potential for the loss of one system due to a catastrophic failure of the second system.

- North 26 Kilovolt (kV) Conversions. This project replaces all 4 kV electrical equipment in the distribution system with more efficient and reliable 26 kV electrical components.

- North Capacity Additions. This project replaces old line segments, rotten and damaged poles and adds or renovates underground facilities from the substations to the customer property lines to enhance sufficient capacity to maintain system reliability.

Non-structural Mitigation

- Network Control Systems. Design for a networked based control system at Boundary Dam, including interface with security systems.

- SCL 230 kV Reliability Loop. Preliminary engineering and system analysis are underway to determine the optimal transmission improvements for increased capacity and reliability of regional and local City Light transmission systems.

Dam Safety Program

The overall goal of SCL's Dam Safety Program is to protect the public from risks from dam failure due to natural and manmade hazards. SCL's Dam Safety Program involves the coordination, monitoring and oversight of activities for six major dams to enhance compliance with Federal and State license requirements related to power, water supply, recreation, environmental and flood control functions.

Structural Mitigation

- Skagit spillway gate seismic strengthening at Ross and Diablo
- Rock Fall Mitigation and Stabilization Projects - Both Skagit and Boundary projects have experienced recent rock falls causing damage to infrastructure and jeopardizing the safety of workers and visitors. Projects at Boundary, Diablo and Ross Dams were completed to stabilize hillsides and slopes. Stabilization included the installation of shields and high impact fencing to mitigate the potential for rock falls resulting from natural hazards.

Non-structural Mitigation

- Oversee the design, installation and monitoring of equipment that can detect dam movement, instruments that detect and measure high flows, alarms for dam failure, and other such hazards. Recent projects include the following:
    - Cedar Falls Dam Failure Detection System
    - Cedar Falls Dam Remote Closing System for Intake System
    - Dam movement monitoring system at Boundary

- Annual dam safety inspections by Federal Energy Regulatory Commission (FERC) or periodic inspections by the State Department of Ecology.

- Inspections following disasters such as earthquakes, rock falls, major flooding, or terrorist activities that result in potential harm to infrastructure.

- Emergency Action Plans for all generation facilities that outline call out procedures for key emergency responders that should be followed in the event of a dam failure.

- Annual update/tests of emergency procedures for all projects.

Emergency Back up Systems

Structural Mitigation

- Recent installation of a fail-over redundancy system with backup at an off-site location for data systems designed so that servers with critical systems and users would automatically be pointed to this backup system if primary systems failed.

Security

In the past several years, security improvements have been made at generation plants to reduce the potential for terrorism, other criminal acts or trespass.

- Skagit and Boundary Security System Improvements. Automated gates, fences, jersey barriers, security systems for surveillance and detection have been installed at key locations.

Non-structural Mitigation

- Vulnerability and Threat Assessments

    - Seattle City Light conducted vulnerability and threat assessments for the Skagit and Boundary Hydroelectric Projects in conjunction with state, local and federal law enforcement agencies. These assessments helped identify security issues and formed the basis for shaping plans for improved security at

these locations to enhance the safety of the public, downstream communities, SCL's workforce, and SCL's infrastructure.

- A joint assessment project was completed in conjunction with Seattle Public Utilities for the Cedar Falls/Tolt Dams.

Seismic Mitigation

Structural Mitigation.

- Seismic upgrades to facilities aimed at correcting structural deficiencies are accomplished as facility upgrades are made.

Current and Future Activities

- Automated Meter Reading (AMR). This project installs AMR reading in the South Lake Union and Denny Triangle areas. A pilot project in 2006 purchased, installed, integrated, and tested a 2-way radio frequency (RF) network collection system in these two areas. This project installs AMR-equipped metering in all new buildings developed in these areas from 2007 onward and retrofits existing buildings beginning in 2008 until done. An AMR-equipped meter has an internal 2-way radio that sends/receives high-frequency signals via other meters' radios within the area's network until they reach a point in City Light's fiber network where they connect to a data collection server at the Seattle Municipal Tower. The current RF Network infrastructure is limited to the South Lake Union/Denny Triangle areas, although the host servers have capacity to read up to 250,000 meters. The AMR Pilot will install up to 1,000 electric meters and 30 water meters, integrate with the billing system(s), and evaluate the system. If the City finds the system acceptable and elects to proceed, then the existing meters (about 6,000 currently) will be exchanged for AMR meters and all new meters in that area will be AMR. The construction of new buildings will drive the pace of deployment and the ultimate number of AMR meters. The AMR Business Plan, developed during 2006, guides future deployments of the AMR technology in this area and elsewhere.

- Disaster Recovery/Business Continuity. SCL's Information Technology Division (ITD) is studying disaster recovery needs for all IT systems. ITD has developed a proposal to hire an outside firm to prepare a business resumption plan for IT systems. The contract should be issued later this year.

- Environmental Safeguarding and Remediation of Facilities. This project prevents air and water pollution at City Light facilities. The project implements cost-appropriate solutions for identified environmental programs and provides facilities' solutions to meet environmental and remediation concerns. Typical projects include ventilation for painting operations, storage equipment for toxic material, containment provisions to provide protection in the event of a spill or leak, and handling equipment to enable safe movement of hazardous items.

- Underground Residential Distribution Rebuild. This project rebuilds the underground distribution system in several neighborhoods served by SCL. It replaces aging and increasingly failure-prone 4 kV equipment and direct buried cables with a buried conduit system that improves service reliability, customer satisfaction, economic operating efficiencies, and safety. Service reliability improvements should be fully realized in 2014 when construction is complete. Service life for the new system is estimated at 40 years.

- Utility Relocation due to Alaskan Way Tunnel and Seawall Project. This project relocates, replaces, and protects City Light facilities affected by the replacement of the Alaskan Way Viaduct and Seawall with a new seawall and transportation facility. The Alaskan Way Viaduct is part of State Route 99, which carries 25% of the north-south traffic through downtown Seattle and is a major truck route serving the city's industrial areas. The seawall supports the soils under Alaskan Way and the Viaduct. Both facilities were damaged in the February 2001 Nisqually Earthquake. SCL has substantial critical transmission and distribution infrastructure along the approximately four-mile project corridor, all of which must be relocated one or more times during the project. This project designs and constructs these relocations according to the transportation project scope and schedule. Note that the project will likely extend to about 2016.

Police Department

The Seattle Police Department's (SPD) primary mission is to prevent crime, enforce the law and support quality public safety by delivering respectful, professional, and dependable police services. The Department is specifically charged with the enforcement of Title 11 (City of Seattle Traffic Code), Title 12 (City of Seattle Criminal Code), Revised Code of Washington Title 9A (Criminal Code), and statutes in Washington Code 9 (specified sections dealing with Criminal Law). Consistent with its mission, the Seattle Police Department has lead agency responsibility for all Criminal Investigations, to include Civil Disorder, Bomb Threats, and Terrorism Incidents as codified in Article VI of the Seattle City Charter.

It is assumed that the Police Department will play a lead or major role in any response to a large-scale incident or disaster. In preparing for this role, the Police Department conducts regular training and participates in exercises to maintain familiarity with the National Incident Management System, Incident Command System (Unified Command), and National Response Framework.

As part of its mitigation strategy, the Department supports and participates in the regional multi-discipline, Type 3, Incident Management Team, which ensures that the Department maintains a cadre of personnel to effectively manage major incidents and disasters. Additionally, the Department strives to identify CIKR (both public and private) and support all-hazard mitigation efforts throughout the City and region that are necessary to sustain vital city operations during disaster response and recovery. Most recently, the Department has staged representatives within the Washington State Fusion Center that

work directly with CIKR representatives to ensure interagency communication and collaboration in preparedness, prevention, and response efforts.

Seattle Public Utilities

Seattle Public Utilities (SPU) provides more than 1.3 million customers in King County with a reliable water supply, as well as essential sewer, drainage, and solid waste services for the City of Seattle. To deliver these basic services, SPU relies on a system of pipes, reservoirs, and disposal and recycling stations. SPU's Capital Improvement Projects focus on natural drainage systems, water, drainage in public spaces, sewer systems, and garbage and recycling services.

Planning

SPU has its own Hazard Identification and Vulnerability Plan, which it has incorporated into its Disaster Response & Recovery Plan. Along with SDOT, DPD and Parks, SPU is part of the Interdepartmental Landslide Team. Its landslide mitigation priorities are reflected in the Landslide Team's projects.

SPU has a Comprehensive Drainage Plan that guides the department's management of storm water, drainage and run off. The plan addresses flood protection, habitat enhancement and water quality, among other issues. The 2004 Comprehensive Drainage Plan update will chart a 20-year course for drainage projects and program direction. SPU has a seismic mitigation program**.** In 1990, Cygna Energy Services completed a study on the seismic vulnerability of SPU's water system tanks, pump stations, treatment facilities, gatehouses, the Control Works and a few important transmission pipeline locations. These facilities were prioritized and upgrades were planned and designed for those facilities found to be vulnerable.

SPU also recognized its large inventory of highly vulnerable cast iron pipe and extensive regions of liquefiable soils. The Loma Prieta, Northridge and Kobe earthquakes demonstrated how quickly and extensively pipeline breaks could reduce water pressure and result in substantial economic losses. Despite this finding SPU determined that wholesale pipe replacement was not a practical seismic mitigation solution.

Because water facilities act together as a system, their interaction must be considered to address each facility's contribution to system performance. The backbone pipeline program was initiated in 2002 to take a systemic approach to address the seismic vulnerability of SPU's water pipelines, develop a seismically rugged backbone pipeline system that could deliver water between the in-town reservoirs, and determine cost effective measures to mitigate earthquake effects on water system operation. The backbone pipeline program is currently (Fall 2003) in the analysis phase. Some of the mitigation options that will be considered are:

- Seismic upgrade of those facilities found to be vulnerable in the 1990 Cygna study that have not already been upgraded

- Using valves to isolate one reservoir of dual reservoirs that serve the same area so that water is prevented from draining through broken pipelines
- Installing hardware and/or developing procedures (to enhance alternate source of fire suppression water is available) to isolate areas of significant pipeline damage so these areas do not drain the system
- Using flex hose to bridge broken mains and/or extend into areas without sufficient water pressure to fight fires
- Including seismic vulnerability as a consideration of resource management decisions on pipeline and facility replacement
- Using more stringent pipeline design standards through the normal pipeline replacement program so the system will become much more seismically rugged over time
- Developing/modifying existing system emergency operating strategies and emergency planning and preparedness

Recent Mitigation Accomplishments

- By fall 2003, critical facilities such as the Control Works, Operations and Control Center Warehouse, and several elevated tanks, standpipes and pump stations have been seismically upgraded. Separate studies were conducted and upgrades implemented for the in-town reservoirs, the Tolt, Lake Youngs and Landsburg dams.

- Hired the geotechnical engineering firm of Shannon & Wilson, Inc. to conduct a Seattle Landslide Study in November 1997; they completed the study in March 2000. One product of the study was a prioritized list of engineering projects in identified Stability Improvement Areas where landslides have historically occurred that share somewhat similar geologic and groundwater conditions. (see Section 3.2 on the Interdepartmental Landslide Team.)

- Located and mapped all ditches and culverts in GIS, so there is a record of these informal systems in order to regulate and design in steep slope areas.

- Hired a contractor to inspect all drainage pipes in landslide prone areas and are making necessary repairs.

- Hired staff to coordinate public reports of landslides with staff who can respond, including customer service representatives who staff the Emergency Response Information Center.

- Holds annual landslide response workshops each fall with seven departments to better coordinate emergency response and review specific departmental capabilities.

- Increased the Drainage Fee in 1999 to better control storm water runoff.

- Capitalized hazard mitigation fund to protect public facilities in 1999-2000. Some of these funds were used to implement the following mitigation projects: Hillcrest/58th SW, Marine View Drive North, Marine View Drive/47th Ave SW, 47th Ave SW Gabion Wall, Garfield Landslide, Aurora Emergency Repair, 3000 block of W. Galer St, SW Admiral Way/SW Hinds St., California Way SW/Ferry Ave. SW, Lake Washington Blvd. /46th Ave S., and numerous small spot slope and drainage repairs in landslide prone areas.

- Worked with SPU and Parks to establish a citywide landslide prioritization criteria matrix for prioritized landslide mitigation projects. Using this matrix, the team identified four high priority landslide sites: Burke Gilman (e.g. 41st NE), Lakeside Pl NE, SW Admiral Way, Golden Gardens NW. SDOT will complete soil studies and begin preliminary design work for two of the sites this year (41st Ave NE and Lakeside PL NE), if SPU and Parks support the proposal.

- Under the landslide program SPU has completed or is working on 13 projects beginning in 2001. These include:

    - Alki Landslide Mitigation project in 2001.
    - Marine View Drive N basin in 2003.
    - Hillcrest LPA/Spot improvements in 2003.
    - Marine View Drive/47 Ave SW Landslide Mitigation project in 2004.
    - SW Jacobsen Rd Landslide Mitigation project in 2004.
    - Atlas Place SW Landslide Mitigation project in 2004.
    - East Boston Terrance Landslide Mitigation project in 2004.
    - Prescott/Admiral Landslide Mitigation project in 2004 and 2006.
    - Perkins Lane W/W Ruffner Landslide Mitigation project in 2005.
    - Burke Gilman/144th Landslide Mitigation project in 2005 and 2007.
    - Golden Gardens Landslide Mitigation project in 2008.
    - SW Thistle St/Northrup Place Erosion work in 2008.
    - 1100 9th Ave W Erosion work is ongoing.

- As noted in the CIP, SPU is constructing lids for five reservoirs. Specifically the following projects, which have either been completed or soon will be, are identified below:

    - Lincoln Reservoir with a capacity of 12.5 million gallons was completed in 2004.
    - Myrtle Reservoir with a capacity of 5 million gallons was completed in 2008.
    - Beacon Reservoir with a capacity of 50 million gallons will be completed in 2009.
    - West Seattle Reservoir with a capacity of 30 million gallons is under construction.
    - Maple Leaf Reservoir with a capacity 60 million gallons is in the final design phase with construction scheduled to begin in 2009.

An additional CIP initiative involves seismic upgrades of water distribution pipelines. This ongoing program provides seismic retrofitting to strengthen existing and/or install new elements and structures for improved performance and sustainability of the water distribution system throughout Seattle in the event of a damaging earthquake.

- 4th and Trenton Drainage Improvement: In 2008 SPU installed 6 blocks of storm drains and 3 bioswales to mitigate the impact of flooding and non-point source pollution in the South Park area.

- NE 104th St Sewer: In 2008 SPU stabilized a sewer line crossing Thornton Creek that had been exposed by heavy storm flows in 2007. Protecting this sewer prevented raw sewage from infiltrating the creek.

- Pipers Creek Fish Passage: In 2006 SPU built weirs in Pipers Creek to help migrating salmon cross over sewer lines that were blocking their spawning run.

- Creekside Vegetation: Since 2005 SPU has embarked on a citywide program to plant conifer trees on public land near streams. These trees provide many environmental benefits including storm water migration, carbon sequestration, cooling and habitat for native species.

- Jackson Park Detention Ponds: In 2003 SPU completed construction of three storm water detention ponds on the Jackson Park Golf Course. These ponds temporarily capture storm water during heavy or prolonged rainfall events to protect downstream property owners from flooding and reduce the environmental impact of high flows.

- In-stream Habitat Projects: Since 2005 SPU has undertaken several small scale projects to enhance in-stream habitat along creeks in public parks. The improvements enhance habitat fish and other aquatic creatures.

- Northgate Day-lighting: Starting in late 2007 SPU began construction of a $14.8 million creek channel that surfaced buried sections of Thornton Creek in Northgate. This project is part of the Thornton Creek watershed, which weaves nearly 12 miles through heavily populated and trafficked areas of Shoreline and North Seattle before emptying into Lake Washington at Matthews Beach Park. The newly completed channel spans almost 3 acres and is designed to provide a natural filter for storm-water pollutants that drain as residue in run-off from adjacent streets and parking lots. It was also engineered to provide for downstream flood control through the use of a detention pond that stores and slowly releases rising waters from heavy rains.

- SPU Dam Safety Program: SPU maintains and monitors 14 SPU owned dams to ensure safe operation of reservoirs and storm water detention systems. This further includes the regulatory requirement for working with downstream communities and their emergency agencies to develop plans and procedures to safeguard those that may be at risk from potential flooding.

- Lake Youngs Outlet Dam Failure Warning System: Completed in 2006, it combines instrumentation, video cameras, IT telecommunications, etc. to give automatic notification of a dam failure to residents in vulnerable areas along Little Soos Creek through the NOAA Weather Radio and the City's reverse 911 system.

- Tolt Dam Failure Warning System Upgrade: Due for completion in the first half of 2009, it uses state of the art technology to provide early warning of a dam failure to citizens of Carnation and other downstream communities along the Tolt River.

- Critical Infrastructure Protection: Based on the results of vulnerability assessments, security enhancements have been installed in most SPU facilities. Such countermeasures include fences, gate card readers, CCTV, motion detectors, upgrading locks, etc.

Transportation

Seattle Department of Transportation (SDOT) is charged with creating and maintaining a safe, reliable transportation system that enhances Seattle's neighborhoods, environment and economy. SDOT has a number of on-going mitigation-related programs:

- Identification and upgrade and/or replacement strategies for aging structures, such as the Spokane Street Viaduct, Alaskan Way Viaduct, and Seawall.

- The Bridge Seismic Retrofit Phase 2 Program is part of the City's Bridging the Gap (BTG) voter approved program. The nine year BTG program has provided funding to seismically retrofit up to nine bridges.

- Homeland Security Program has secured federal funding through USASI grants to assess threat and vulnerabilities to critical transportation infrastructure, such as bridges. Additional funding was provided to implement deterrent and hardening strategies.

- The Retaining Wall Replacement Program identifies retaining walls throughout the city that require repair or reconstruction, and makes the necessary repairs to reduce interference with adjoining sidewalks or roadways.

- The Landslide Mitigation Program funds the ongoing analysis of areas throughout the city that are landslide prone and pose a risk of damage to or from public property. The project also contributes to funding the construction of landslide prevention improvements.

- The Areaways Program constructs appropriate mitigation projects for areaways that reduce risks to city facilities and the general public. Areaways are usable space, generally in the street right-of-way, constructed under sidewalks between the building foundation and the street wall. Many areaways in the Pioneer Square District are old and in poor condition, and may present hazards to the traveling public, public and

private utilities, and adjacent building owners and occupants. Improving these areaways is an action included in the South Downtown Strategic Plan. SDOT identifies the areaways that require repair and, based on feasibility and cost assessment, either repairs them or fills them with lightweight concrete in order to reduce risks to pedestrians and property.

- Olympic Pipeline - SDOT, the Fire Department, SCL, the Mayor's office and other interested parties are holding in abeyance prior efforts to negotiate a new franchise agreement with Olympic Pipeline that would permit the company to continue transporting liquid fuel through Seattle. The original agreement, which was adopted by Ordinance Number 116331 on September 8, 1992, was to remain in effect for 10 years, and be renewable for two successive 10 year terms.

  So far efforts to renew the agreement, particularly as it relates to more frequent safety inspections, haven't been successful. The City Attorney's Office believes the terms of the original agreement are probably more favorable to the City than could be renegotiated in a new agreement because of precedents set elsewhere. The original agreement, however, remains in-force and the City is protected by an Indemnity Agreement. The pipeline spur, called the Seattle lateral, runs primarily through the Seattle City Light transmission right-of-way for 12.5 miles from Renton to Harbor Island. The lateral is used to transport approximately 9 million gallons of petroleum fuel per week.

  Remembering the tragic pipeline explosion that occurred in Bellingham in June of 1999, public safety remains a paramount concern for the City. The City continues through its Local Emergency Planning Committee (LEPC) to study the potential for safety issues as well as track the adequacy of emergency planning -- as the lateral runs through heavily populated areas with neighborhoods, businesses, and schools.

Planning

SDOT has a Transportation Strategic Plan that addressees the operation and maintenance of the city's $12 billion transportation infrastructure – a system that includes 142 bridges, 586 retaining walls and 5 seawalls.

In 1999, SDOT Landslide Management began working with SPU, Parks and DPD to develop a citywide landslide mitigation program. This interdepartmental team's efforts are described more fully in Chapter 3.2. SDOT hired a full-time senior civil/geotechnical engineer to manage its Landslide Mitigation Program.

Recent Mitigation Accomplishments - Landslides

Since the landslides of 1996/7, SDOT has done the following:

- Hired a consultant in 1999 to conduct several studies: a) Retaining Wall Drainage Inventory Study; b) Retaining Wall Inspection Services; and c) Landslide Risk

Assessment on Arterial Streets. Based on the results of the Landslide Risk Assessment study, the consultant identified 24 arterial streets as high priority sites. In the summer of 2000, the consultant conducted in-depth site reconnaissance along those 24 arterial streets and identified various street segments as High, Moderate and Low hazard segments.

- In an attempt to look for opportunities to have joint landslide mitigation projects with multi-departmental interests, SDOT compared priority locations for various departments. SDOT prioritized sites in 2 phases: first along arterial streets where the risks were greatest; and more recently along non-arterial streets based on internally developed criteria. The known landslide sites along non-arterial streets were taken from SDOT's Landslide Event List during the last four years in which slope movements and public concerns were reported. SPU and Parks identified priority locations on both arterial and non-arterial streets.

- Developed a system to track ongoing clean-up and maintenance costs associated with slide areas. Costs will be tracked on a block-by-block basis. These costs will then be used to conduct a "benefit/cost" analysis for individual sites, which will help in selecting the most cost-effective improvement projects.

- Developed draft standards for tailored street and drainage for residential streets.

Recent Mitigation Accomplishments – Earthquakes

As a result of increased public and governmental concern resulting from the 1989 Loma Prieta Earthquake in Northern California, the Seattle City Council appropriated funding to analyze and prioritize the City's bridges for increased seismic resiliency. The last project in this particular seismic retrofit program was completed in 2000. Bridges in the following areas were seismically retrofitted:

- Haller Lake/Greenwood/Blue Ridge
- Ballard
- University District
- Fremont
- Eastlake
- Magnolia/Queen Anne
- Downtown Seattle
- Beacon Hill
- Greater Duwamish
- West Seattle
- Southeast Seattle

Following the 2001 Nisqually earthquake, FEMA provided mitigation funds to seismically retrofit the North Queen Anne Drive Bridge. The project was completed in 2005. The 2007 BTG initiative provided funding for seismically retrofitting seven other bridges; all

are in the process of design with construction scheduled to begin in 2009 and be completed in 2015. The bridges to be retrofitted are:

- Albro over Airport Way
- Fauntleroy Express Way
- Ballard Bridge
- 4th Ave, Jackson to Airport Way
- 2nd Ave Extension
- Airport, 4th Ave to 5th Ave
- South Jackson Street, 4th Ave to 5th Ave

Recent Mitigation Accomplishments – Areaways

Monitoring Program – An extensive monitoring system has been installed in the most critical areaways in the Pioneer Square District. The monitoring devices will allow SDOT to determine which areaways are deteriorating at the greatest rate, which will help prioritize future areaways repairs.

Inspection – Condition inspection was performed on areaways in the International District. This inspection provides an important benchmark for determining deterioration and identifying those critical areaways in need of repair.
Over the past several years the following areaways have either been repaired or filled:

• A212b – 4th Ave South @ Main Street	Filled	2005
• A5000 – 2nd Ave South @ Main Street	Restored	2005
• A903 – 1st Ave South @ Yesler Street	Restored	2007
• A1806A – South Jackson Street @ Occidental Street	Filled	2007

3.2 Interdepartmental Mitigation Planning

In recent years, a number of interdepartmental groups led by SPU have met to focus on mitigation for both natural and human-caused disasters. SDOT has been a key participant in the following initiatives:

Interdepartmental Landslide Program

During the winter of 1996/97, heavy snow and rains caused more than 300 landslides citywide, resulting in over $30 million in damages. In an effort to be proactive in mitigating the effects of future landslides, the City Council adopted the City Landslide Policies directing city departments to develop a program to address landslide risks.

An Interdepartmental Landslide Team was formed to continue the work of protecting public infrastructure in landslide-prone areas. The team, consisting of representatives from Seattle Public Utilities (SPU), Seattle Department of Transportation (SDOT), Seattle Department of Parks and Recreation and the Department of Design, Department of Planning and Development (DPD), first met in 1997.

Recent Mitigation Accomplishments

Under the landslide program, a number of initiatives have been undertaken, including the following:

- Mapped 1400 reported slides (Seattle Landslide Study of 2001), wrote planning level descriptions, and developed cost estimates for stabilizing slopes needed to protect utilities and public safety at 50 sites.

- Contributed funding for the University of Washington and USGS to develop GIS soils layers.

- Sponsored 12 public educational workshops on landslide hazards and mitigation, attended by 950 members of the public. Fewer than 10% were repeat attendees. Technical experts representing the city and geotechnical, landscaping and contractor professional organizations provided information and answered questions at these meetings.

- Hired outside engineers to investigate drainage complaints and code violations in landslide prone areas.

- Developed policies for hillsides to enhance uniform administration of the Environmental Critical Areas, building codes and utility standards to promote slope stability.

- Developed and distributed educational brochures.

- Developed goals, objectives and a criticality matrix for prioritizing future projects. These criteria include mobility, criticality and vulnerability of city facilities, natural features and human influence.

- Completed a study that maps all recorded landslides since the late 1800's, updated the landslide prone areas critical areas maps, and describes the causes of landslides in Seattle.

- Identified 63 projects with construction estimates of $37 million that would protect city facilities or reduce the city's landslide risks. SPU, SDOT and Parks agreed in principle to move forward with four joint landslide projects.

- Established a citywide landslide prioritization criteria matrix for prioritized landslide mitigation projects. Using this matrix, the team identified four high priority landslide sites: Burke Gilman (e.g. 41st NE), Lakeside Pl. NE, SW Admiral Way, Golden Gardens NW.

- Using CIP funds, SDOT completed the following projects from 2004 through 2008:

- **Lakeside PL NE:** In late 2003, SDOT took the lead and started geotechnical study by a consultant. Based on recommendations from geotechnical study, a three-tiered reinforced Keystone wall was designed by SDOT in-house design force. The wall is approximately 40 feet in length and 20 feet in height. A 150-ft 6-inch diameter drainage pipe was installed to discharge groundwater collected behind the wall down to an existing ditch next to the Burke Gilman Trail. After final inspection, SDOT's Landscape crew planted vegetation in the project area and a street maintenance crew resurfaced the affected roadway. The project was completed in 2004.

- **41st Ave NE:** The Street had been settling for many years due to slope movement. In late 2003, SDOT took the lead and started preliminary geotechnical study. In 2005, two water service lines were broken on the slope which resulted in partially closing the street for one lane. In early 2006, SDOT formed a design team. Based on the geotechnical investigation, a Soldier Pile wall was selected as a cost-effective solution to stabilize the street. The wall is about 150 feet in length and up to 15 feet in height. After wall construction, SDOT Street Maintenance crew reconstructed a section of damaged road and SDOT Landscape crew planted vegetation in front of the wall on the slope. The project was completed in 2007.

- **Golden Garden Dr. NW:** Golden Garden Dr. NW project was initially scoped based on a limited fund the City had, however, a big landslide in December 2007 totally destroyed the road. SDOT took the lead and is managing a larger-scale landslide capital improvement project funded by both FHWA and City as an emergency project. Based on consultant study in early 2008, a tie-back Soldier pile wall was recommended along with a section of reinforced slope to the north. The wall is about 160 feet in length and up to 25 feet in height. After wall construction, the contractor will reconstruct an approximately 200 feet long roadway. The project started in September 2008 and is scheduled to be completed by the end of 2008.

SDOT Landslide Project Status

Besides citywide high priority landslide mitigation projects above, SDOT also allocated some of the landslide mitigation program funds to some landslide locations that might be important to safeguard the Right-of-Way but may not be citywide priorities. These projects protect transportation infrastructure which has a real benefit to the general public.

- **Gilman Dr. W near 14th Ave W:** In 2004, SDOT completed a 50 feet long Soldier Pile wall constructed by SDOT city forces on Gilman Dr. W near 14th Ave W where one lane of the street has been closed since early 2002 after a landslide

occurred in December of 2001. After wall construction, SDOT Street Maintenance crew reconstructed a section of damaged roadway.

- **10100 Rainier Ave S:** A steep slope/embankment eroded in October 2003 due to heavy rains. A 30 to 40 feet long segment of sidewalk was undermined. The sidewalk has been closed to protect public safety. A rock buttress was recommended by a geotechnical study for the slope repair along with rebuild damaged sidewalk. The project was completed in March, 2005.

- **Newport Way & 38th Ave**: A landslide occurred at the bottom of the hill side and covered the sidewalk on Newport Way. Additional movement has required continual maintenance and closure of the sidewalk. A rock buttress was designed by SDOT in-house design force to improve the slope stability. The construction project was completed in the fall of 2005.

- **10200 Block 47th Ave SW**: Heavy rains in January 2006 collapsed 100 feet of roadway shoulder in the 10200 block of 47 Ave. SW. One lane had been closed on the only access road serving about 30 houses. Based on a geotechnical investigation, SDOT developed repair options, and designed the proposed roadway repair. The repair included a rock buttress, a soldier pile wall (60 feet long and up to 10 feet high), and reconstruction of the concrete roadway. The project was completed in the summer of 2008.

- **1600 Block 20th Ave E:** During the December 2006 storm, a landslide undermined edge of the roadway along the 1600 block of 20th Ave East. Portion of the street had been closed to a one lane street. Based on a geotechnical investigation, SDOT developed repair options, and designed the proposed roadway repair. The repair included a soldier pile wall (40 feet long and up to 10 feet high), and reconstruction of the roadway. The project was funded by both FEMA and SDOT. It was completed in the fall of 2008.

Landslide Projects in 2009

Ferry Ave SW and California Way SW/Harbor Ave SW: Due to budget constraints affecting the SDOT Landslide Mitigation program, only one landslide project will be constructed in 2009 to repair disaster-related damage. During a December 2007 storm, heavy rainfall caused the slope below Ferry Avenue SW to erode, compromising the roadway and similarly impacting the downhill roadways of California Way SW and Harbor Ave SW. Based on a geotechnical study by a consultant, it was recommended to build a soldier pile wall to restore support to the Ferry Ave SW roadway. This repair project is FEMA-funded. A separate body of work to control the effects of future downhill erosion on California Way SW is planned with FHWA support. Construction of these parallel projects is scheduled to begin in spring of 2009.

6300-6500 Block Beach Drive SW: The sidewalk in this street segment of Beach Drive SW has been settling more than 2.5 feet over the years, resulting in numerous citizen

complaints. SDOT closed the sidewalk in 2007 for public safety. In 2000, SDOT hired AMEC geotechnical firm to conduct a site reconnaissance which classified this street segment as high hazard segment. However the cost estimate for building the walls were estimated more than 6 million dollars. The community brought this issue to Mayor's Office in early 2009. It was agreed that a geotechnical study with long term instrument monitoring of the ground would be a cost effective way to in the near term address the community's concern. The first phase of study should be completed in the summer of 2009 with initial recommendations based on soil investigation. A final recommendation will be provided based on findings of longer term instrumental monitoring.

Office of Sustainability and Environment (OSE)

OSE's mission is to accelerate environmentally sustainable practices by the City government and in the community at-large. OSE collaborates with City departments, business partners, non-profit and community-based organizations, and learning institutions to develop and implement the Mayor's priority sustainability initiatives: climate protection and urban forest restoration and management. Sustainability initiatives are implemented in departments throughout the City

How the Office of Sustainability and Environment addresses the Mayor's priorities:

Build Strong Families and Healthy Communities
OSE leads the development and implementation of the Mayor's Environmental Action Agenda. The Agenda protects and improves our urban environment, enhances neighborhood health and livability, and promotes environmental justice. Healthy natural and built environments support people, families and communities.

Get Seattle Moving
Motor vehicles are the number one source of air pollution and climate-warming greenhouse gas emissions in our region, and a major source of water pollution as well. OSE works closely with other City departments and agencies like King County and the Puget Sound Clean Air Agency to promote healthy and environment-friendly transportation choices, such as public transit, walking and biking, as well as cleaner vehicles and fuels.

Keep Our Neighborhoods Safe
Research suggests greener neighborhoods are safer neighborhoods. OSE coordinates the Mayor's Green Seattle Initiative, a program to protect and restore our urban forest, and to "increase the green" in our neighborhoods by promoting green buildings and streets.

Create Jobs and Opportunity For All
A healthy environment is a key to Seattle's past, present and future economic vitality. OSE leads the Seattle Climate Partnership, a voluntary commitment by Seattle-area employers to take action to reduce their carbon footprints, and to work together to help meet the community-wide goal. In addition, we promote business development and job creation in emerging "green" industry sectors, such as clean energy and green building.

Seattle Climate Action Plan[24]

The climate crisis presents Seattle with an extraordinary challenge. The local impacts – winter flooding, summer drought, rising sea levels, heightened wildfire risk, receding glaciers and declining snow pack – can now or in the future pose serious risk to the local economy and quality of life.

In February 2005, Mayor Greg Nickels challenged fellow mayors across the country to join Seattle in pledging to meet or exceed the Kyoto Protocol's emission-reduction goals. So far, more than 300 mayors, representing 51 million Americans in 46 states have signed the US Mayors Climate Protection Agreement.

The plan details substantial new investments to encourage businesses and residents to take action and to expand the City's emission-cutting programs, which are summarized as follows:[25]

Goals of the Climate Protection Initiative

The City will reduce its climate pollution through broad-ranging strategies including investing in transportation choices, encouraging compact communities, promoting clean energy and conservation, leading by example, and inspiring others to take action.

In addition to reducing the City's contribution to global warming, the City will also prepare for climate change by ensuring that Seattle's infrastructure, facilities, and services are ready to adapt to the projected impacts of climate change.

The goal of the Seattle Climate Protection Initiative is to reduce greenhouse gases in Seattle by:

- 7% below 1990 levels by 2012
- 30% below 1990 levels by 2024
- 80% below 1990 levels by 2050

Strategies to Meet Our Goals

Transportation Choices, Compact Communities

To reduce vehicle miles traveled, the City is currently working to expand transportation options, center growth in urban centers, and improve bike and pedestrian infrastructure to help bicyclists and walkers reach their destination safely.

Current Accomplishments

[24] OSE home page at www.seattle.gov
[25] Refer to www.seattle.gov/climate

- The City, in combination with King County Metro, purchased 20,000 hours of new bus service.
- Seattle Department of Transportation added 50 miles of new bike lanes and sharrows since the Bicycle Master Plan was finalized.

Clean Vehicles, Clean Fuels

To reduce climate pollution from cars on the road, the City has developed a citywide fuel-reduction plan, individual departments are taking steps to incorporate hybrid and electric vehicles into their fleets, and the City is currently testing Plug-in Hybrid Electric Vehicles and researching alternative fuels.

Current Accomplishments

- The City passed Green Taxi regulations that increase the number of taxis by 30 percent but decrease green house gas emissions by at least ten percent over the next four years.
- The City reduced citywide fuel consumption by 41,000 gallons, saving 410 tons of greenhouse gases emissions.
- Seattle Center reduced fuel consumption by 40 percent by using electric vehicles.

Clean Energy, Efficient Buildings

To increase the number of buildings and infrastructure that use clean energy efficiently in Seattle, in addition to saving energy through Seattle City Light's conservation programs, the City is working to promote solar and other alternative energy sources and will provide homeowners and businesses with the tools to improve building efficiency, with the goal of increasing the efficiency of Seattle buildings by at least 20 percent by 2020.

Current Accomplishments

- The City launched a Green Building Task Force to develop policies that will increase energy efficiency of Seattle buildings by 20 percent, with policy recommendations due this year.
- City Light distributed 1.4 million CFLs through the Twist & Save program, avoiding 23,000 tons of GHGs.
- City Light exceeded conservation goals by 20%, saving enough energy to power 9,800 homes in Seattle for a year.

Community Engagement

To help Seattle residents lower their carbon footprint, the City is engaging businesses and residents through two innovative programs- Seattle Climate Action Now and the Seattle Climate Partnership.

Current Accomplishments

- Climate Action Now distributed 10,000 home energy kits to help residents increase the energy efficiency of their homes.
- Seattle Climate Partnership membership increased by approximately 110% in 2008--from 53 to 122 members.

Leadership, Leverage

To help create federal and state policies that advance local climate solutions, the City is currently active at the federal and state level and is encouraging cities throughout the United States to follow Seattle's lead by sharing resources and best practices, and by asking mayors to join the Mayors' Climate Protection Agreement.

Current Accomplishments

- 910 mayors have signed the US Mayors Climate Protection Agreement.

Measuring Progress

Progress toward the Climate Protection Initiative is measured in three ways. First, the Climate Protection Initiative Progress Report outlines some significant accomplishments made in the City's climate protection strategy areas. Second, specific progress toward meeting the Climate Protection Initiative goals is measured through the community-wide carbon footprint, which is released every three years. Third, to track progress on a yearly basis, the City has identified a collection of measures that give us early indications of progress. These measures are shown in the sidebar to the right. The City will use these measures as part of an ongoing evaluation of strategy areas and innovation.

Urban Areas Security Initiative

The City of Seattle is the core city of the Seattle Urban Area. Since the inception of the Urban Area Security Initiative (UASI), the City has played a leading role. In 2003, Seattle was one of eight cities across the country to directly receive UASI funds. Subsequent funding cycles have been administered through the Washington State Military Department, but the City has by far been the biggest beneficiary of these funds.

Within the City, the Police and Fire Department along with the Department of Information Technology have received a majority of the funds. Efforts have focused on preventing, protecting, responding, and recovering from terrorism related events.

Beginning during the FFY06 cycle, an "All-Hazards" approach allowed the focus of the funding to expand the capabilities of more emergency response activities. For the time being however the major concentration for law enforcement and fire response continues to be directed at Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) events. Similarly the Department of Information Technology continues to focus in areas aimed at expanding and improving the resiliency of interoperable communications, as well as other technology capability upgrades.

Following the recently approved "All Hazards" approach, regional Emergency Management departments have been awarded funding to enhance training and exercise activities related to naturally occurring events, which are likely to occur within the Seattle Urban Area.

Going forward, the CBRNE threat will continue to be the City's main area of concentration. In particular, Improvised Explosive Devices (IEDs) are becoming a major area of concern. Likewise, interoperable communications will continue to be an important goal. As the City advances its capabilities it is beginning to transition to its newest goal, preparedness planning. The latter is being stressed to insure the Seattle Urban Area is current in its strategic planning and analysis of enhancement efforts, to include gap analysis.

For Fiscal Years 2003-2008 the City together with the University of Washington has received a total of $41,154,126.80 in the form of UASI grant monies. These monies have been shared among the following 9 departments and have been used to advance the City's overall capabilities to interdict, counter and/or respond to a potential terrorist attack: Department of Information Technology, Department of Planning and Development, Fleets and Facilities Department, Seattle Center, Seattle City Light, Seattle Department of Transportation, Seattle Fire Department, Seattle Police Department, and Seattle Public Utilities.

3.3 Inter-jurisdictional and Public/Private Mitigation Partnerships

Local Emergency Planning Committee

The Seattle Local Emergency Planning Committee (LEPC) was set up in 2002 to foster a working relationship between private industry and public agencies in addressing hazardous materials issues. In addition to promoting public awareness and industry reporting, the LEPC takes a cooperative approach toward the prevention and preparation for hazardous materials releases. Seattle's LEPC is managed by the Fire Department using guidelines mandated in the Superfund Amendments and Reauthorization Act (SARA) Title III and the Seattle LEPC Plan.

Partnering with city personnel, LEPC membership includes representatives from the Washington State DOT, Washington State Department of Ecology, Seattle/King County Public Health, Harborview Hospital, and Port of Seattle, Boeing, Burlington Northern Santa Fe Railway, Bank of America and a member of the public.

Home Retrofit

Originally an initiative developed under Project Impact, the Home Retrofit program continues to be a joint OEM effort with DPD -- for both Retrofit Plan development and permitting. OEM continues to support trained volunteers who teach Home Retrofit classes on a monthly basis. On a yearly basis OEM works with other jurisdictions in the region to conduct a class specific to contractors.

Since the program's inception:

- 700+ permits to perform seismic home retrofit work approved by DPD.
- More than 3,600 homeowners have attended Home Retrofit classes.
- Several thousand copies of the Home Retrofit Series distributed to homeowners and available online.
- More than 500 builders, contractors, engineers and architects completed Professional Home Retrofit training at the University of Washington.
- The city's Office of Housing approved grants for 25 low-to-moderate income homeowner retrofits, all of which were completed by 2005.

Business Mitigation

- The Disaster Resistant Business (DRB) Toolkit has been designed and is currently in beta testing. The state of Washington Emergency Management Division is planning to host the Toolkit on its web site so that it can be made available to businesses statewide, including those in the City of Seattle.

Ad hoc Human Services Planning Group

Following the Nisqually Earthquake, an ad hoc planning group met in July 2001 to discuss issues related to disaster response for vulnerable King County residents with special medical issues. City of Seattle and Seattle-King County Public Health staff convened the meeting at the request of an inter-jurisdictional earthquake debriefing group. Participants included representatives of Seattle's Human Services Department, the American Red Cross, a Pioneer Square neighborhood clinic, and several people from the Public Health Department.

The populations discussed were the homebound frail elderly, homeless people living in shelters and transitional housing programs, and people who are "marginally" housed, for example, in low-income housing for formerly homeless people, many of whom have chronic health and/or psychiatric conditions.

The group briefly reviewed the current protocols for mass sheltering in the event of a disaster and acknowledged the need to better address the medical issues of vulnerable populations who might become displaced. They also recommended a number of longer-term planning and policy actions which are ongoing and identified in Table 4-1.

<u>Port-to-Port Transportation Corridor Earthquake Vulnerability Study</u>

This study, reflecting a King-Pierce Project Impact partnership, involved numerous jurisdictions in an investigation of the seismic vulnerabilities of the Central Puget Sound

Region's transportation network. The study area included the main transportation routes of I-5, Highways 99 running north-south through Seattle. Due to insufficient resources, the study did not include assessment of any major bridge structures. The economic impact studied only one earthquake scenario – a deep earthquake centered under the City of SeaTac. This effort marked a "first" in bringing together transportation planners from many jurisdictions to engage in joint contingency planning.

The study, completed in 2003, together with the FEMA Hazards US (HAZUS) software program provided the basis for many of the damage assumptions used to develop the Seattle Fault Scenario in June 2005.[26] The latter, in turn, was used as core background material for developing the City's Sound Shake Exercise in March 2008.

3.3.1 Mitigation Planning in Other Organizations

The following entities are not part of City of Seattle government.

Seattle Public Schools

Seattle Public Schools (SPS), a public entity governed by a board of directors, has 93 sites and 45,500 students. Starting in the Fall of 2009 five schools will be closed because of budget cuts, reducing the number to 88.[27] All facilities have had some form of structural upgrading. Since 1988, 33 structures either have been rebuilt or substantially remodeled up to the current seismic building code. Many of these campuses have multiple buildings; therefore, any one campus would be in compliance with code at the time buildings were remodeled or, in the case of portables, when last relocated. SPS incorporates new technological developments in structural strengthening or new code requirements whenever it designs new buildings or substantial remodeling.

SPS' structural retrofits or rebuilds to current seismic code levels that have been completed in the past 5 years, or that are currently scheduled are bulleted below:

- Roosevelt High School – Completely renovated to include structural upgrades
- Madison High School – Completely renovated to include structural upgrades
- Cleveland High School – Completely renovated to include structural upgrades and new additions
- Brighton High School – Rebuilt
- Garfield High School – Completely renovated to include structural upgrades and a new addition
- Chief Sealth – Limited modernization and structural upgrades
- South Lake High School – Rebuilt
- West Seattle High School – Scheduled for a complete renovation in the next 5 years

[26] http://www.eeri.org/site/projects/eq-scenarios/seattle-fault
[27] http://seattletimes.nwsource.com/html/localnews/2009112434_webbudget23.html

Seattle Housing Authority

The Seattle Housing Authority (SHA) is a public corporation governed by a seven-member citizen commission. SHA provides affordable housing to nearly 23,000 people in the City of Seattle. It houses low-income residents, primarily the elderly and mentally-disabled people, in both high-rise and low-rise structures.

The 1996/7 winter storms that caused landslides in many parts of the city did not impact any SHA-managed buildings. SHA high-rise buildings did not fare as well during the 2001 Nisqually Earthquake; however, the damage suffered was not structural. Numerous building elevators broke down because at the time the structures were built, no code requiring seismic protection for elevators with the use of counter weights existed. All of the elevators were quickly repaired and retrofitted following the earthquake. One building in Pioneer Square, the Morrison Hotel, was damaged during the earthquake. SHA no longer manages that building.

University of Washington

The University of Washington (UW) is the oldest and largest public institution of higher education in the Pacific Northwest. The Seattle campus, covering 693 acres, is the largest of the UW's three campuses. It encompasses fifteen schools and colleges and serves in excess of 37,000 students, has 20,000 faculty and staff, and hosts approximately 5,000 visitors.

The UW Emergency Management Office prepared a Hazard Identification and Vulnerability Analysis study and a Comprehensive Hazard Mitigation Plan in 2003 (updates are planned for 2010), recently updated the University's Emergency Response Management Plan and is developing a pilot business continuity/resumption plan. Altogether these plans are intended to serve as the linchpins for enabling the UW to resume normal education, research and public service operations as quickly as possible following a major disaster.

The UW started seismic strengthening of its older facilities more than 15 years ago with a study by the Earthquake Readiness Advisory Committee (ERAC) that established an orderly protocol for structural and nonstructural retrofitting of campus buildings. The Department of Environmental, Health & Safety at the University maintains a comprehensive fire safety program for the campus. Since 2003, more than $4 million in federal UASI, FEMA Pre-Disaster Mitigation and Hazard Mitigation Grant Program funds have been allocated to the UW.

In the event of a major regional disaster, a Pre-Entry Assessment Team has been established as an on-campus resource to assess building safety with respect to chemical hazards prior to search and rescue efforts. On a bi-monthly schedule a campus-wide Emergency Management Planning Committee (EMPC) meets to review the progress of overall UW disaster management on a system-wide basis. The City of Seattle has a permanent seat on this important advisory committee.

The UW expanded its emergency communications systems in 2003 after a number of local and national campus public safety incidents. Twelve new outdoor alert emergency call pedestals were installed in 2007-2008 for approximately $200,000.00 using UW funds. These new "BLUE PHONE" pedestals included an outdoor public address system that can disseminate external alarms and announcements.

Most recently and to add another layer of coverage, the UW rolled out a new UW alert system. Currently, over 14,000 student, faculty and staff have voluntarily signed up to receive emergency and crisis alert messages on their mobile devices and emails. This system too was funded by the UW.

In addition to internal activities, the University manages the following:

- UW Medical Center, Harborview Medical Center and neighborhood clinics, providing medical care in the states of Washington, Alaska, Idaho, Montana and Wyoming.

- Pacific Northwest Seismograph Network (PNSN), collecting and analyzing data in order to provide rapid and accurate information on earthquakes and volcanic activity in Washington and Oregon.

- The Northwest Atmospheric Modeling System (MM5), one of the highest resolution operational weather prediction systems in the U.S. It provides 72-hour forecasts on the World Wide Web for Pacific Northwest (Washington, Oregon, Idaho) weather, and is produced twice daily at the University of Washington.

- Institute for Hazard Mitigation Planning and Research, an interdisciplinary academic institute dedicated to exploring ways to integrate hazard mitigation principles into a wide range of crisis, disaster, and risk management opportunities.

Cascadia Region Earthquake Workgroup

Cascadia Region Earthquake Workgroup (CREW) is a coalition of private and public representatives working together to improve the ability of Cascadia Region communities to reduce the effects of earthquake events.

CREW's goals are to:

- Promote efforts to reduce the loss of life and property.
- Conduct education efforts to motivate key decision makers to reduce risks associated with earthquakes.
- Foster productive linkages between scientists, critical infrastructure providers, businesses and governmental agencies in order to improve the viability of communities after an earthquake event.

Table 3-1

Disaster Mitigation Land Use Codes, Regulations and Rules Adopted by Seattle Department of Planning and Development

Codes, Regulations, Rules, Memos	Purpose	Date Adopted
DR 33-2006, General Duties and Responsibilities of Geotechnical Engineers	Defines requirements for geotechnical engineers, with special emphasis on construction in landslide-prone areas.	2007
Floodplain Development Ordinance Seattle Municipal Code Chapter 25.06	This chapter regulates development in areas of special flood hazard in accordance with standards established by the National Flood Insurance Program and the Washington State Department of Ecology.	1989
Seattle Municipal Code Chapter 25.09	Regulations for environmentally critical areas.	1992
Seattle Amendments to Chapter 18 of the IBC	Requires evaluation and mitigation of slope instability due to earthquakes.	2007
Directors Rule 32-96 Seismic Survey and Report Requirements (Note: In the process of publishing a revised rule to supersede DR 32-96)	Allows FEMA 178 or Uniform Code for Building Conservation (UCBC) evaluations of existing buildings. New rule will require use of American Society of Civil Engineers (ASCE) 31 to evaluate existing buildings; ASCE 41 to rehabilitate.	1996 New rule to be adopted in 2009
Seattle Amendments to Chapter 34 of the International Building Code	Requires all substantially altered buildings to be seismically retrofitted. Requires repair and strengthening of buildings damaged by earthquakes and other means.	2007
Directors Rule 32-2006, Requirements for a Letter of Certification in Environmentally Critical Areas	Requires a letter of certification from geotechnical engineers stating that site conditions have not changed since the issuance of the original geotechnical report.	2007
Adoption of Chapter 16 of 2006 International Building Code	Regulations for the seismic design of new buildings.	2007
Voluntary Home Retrofit program developed as part of Seattle Project Impact	Pre-designed plans for bracing homes against earthquake damage available for qualified residential structures. Expedited permitting process.	1999

Codes, Regulations, Rules, Memos	Purpose	Date Adopted
Directors Rule 15-2001 Update of Environmentally Critical Areas Mapping	Updates mapping where enhanced data is now available.	2002
Directors Rule 5-2004 Alteration and Repair of Unreinforced Masonry Chimneys	Requires strengthening of altered and repaired chimneys, originally in response to Nisqually Earthquake of 2/01.	2004
Client Assistance Memo 324	Identifies actual and potential signs of landslide and erosion damage and provides solutions for property owners.	2002
Client Assistance Memo (CAM) 314 Seattle Building Code Requirements for Existing Buildings that Undergo Substantial Alterations	Provides clarifying criteria used in defining substantial alterations.	2002
Revised Voluntary Home Retrofit program developed as part of Seattle Project Impact	Pre-designed plans for bracing homes against earthquake damage available for qualified residential structures. Expedited permitting process.	2003
2006 International Building Code	Adopts the most current regulations for seismic design of new buildings.	2007
Policy to approve code alternate requests for use of more current ASCE documents	Encourages use of newer ASCE documents 31 and 41 for evaluation and retrofit of existing buildings.	Ongoing

Chapter 4
Mitigation Strategy

This chapter sets forth the Plan's mitigation goals, objectives, strategy for prioritizing projects, and current and proposed mitigation actions. These actions place particular emphasis on new and existing buildings and infrastructure; however, the chapter includes reference to other mitigation efforts as well.

4.1 Goals and Objectives

The city's Hazard Mitigation Work Group developed and recommended the following vision statement, goals and objectives. The goals and objectives reflect concerns identified in Washington State's Hazard Mitigation Strategy (published in January 2000) and in many of the planning and policy documents already adopted by individual departments.

Vision: **To reduce the vulnerability of Seattle's people, businesses, communities, and built and natural environment to the effects of a natural or human-caused disaster.**

Goal 1. Protect public health and safety

Objectives:

A. Partner with agencies serving vulnerable populations to minimize harm in the event of an emergency
B. Promote disaster contingency planning and facility safety among institutions that provide essential services such as food, clothing, shelter and health care to vulnerable populations
C. Educate individuals and communities about disaster preparedness and mitigation
D. Improve disaster warning systems

Goal 2. Safeguard critical public facilities and infrastructure

Objectives:

A. Implement mitigation programs that protect critical city facilities and services and promote reliability of lifeline systems to minimize impacts from hazards, to maintain operations, and to expedite recovery in an emergency
B. Consider known hazards when siting new facilities and systems
C. Create redundancies for critical networks such as water, sewer, digital data, power and communications
D. Formalize best practices for protecting systems and networks

Goal 3. Protect public and private property

Objectives:

A. Adopt and enforce public policies to minimize impacts of development and enhance safe construction in high hazard areas
B. Integrate new hazard and risk information into building codes and land use planning mechanisms
C. Educate public officials, developers, realtors, contractors, building owners and the general public about hazard risks and building requirements
D. Promote appropriate mitigation of all public and privately-owned property within the city's jurisdiction, including but not limited to, residential units, commercial structures, educational institutions, health care facilities, stadiums, and infrastructure systems
E. Incorporate effective mitigation strategies into the city's Capital Improvement Projects
F. Promote mitigation of historic buildings
G. Promote post-disaster mitigation as part of repair and recovery

Goal 4. Maintain Seattle's economic vitality

Objectives:

A. Partner with private sector, including small businesses, to promote structural and non-structural hazard mitigation as part of standard business practice
B. Educate businesses about contingency planning citywide, targeting small businesses and those located in high risk areas
C. Partner with private sector to promote employee education about disaster preparedness while on the job and at home and conservation

4.2 Mitigation Strategy Components

The City's Mitigation Strategy consists of four parts:

- **Part 1: Long-term directions**
- **Part 2: Proposed planning and policy actions**
- **Part 3: Proposed capital project actions**
- **Part 4: Current and planned capital projects**

All of the strategies included in this section relate directly to the identified goals and objectives listed above. They also reflect the city's top-ranked hazard risks: earthquakes and landslides. A number of strategies reflect an all hazards approach.

Part 1: Long-term Directions

Table 4-1 includes possible directions for future consideration that could ultimately result in greater visibility and heightened priority for mitigation projects across city

departments. Action on some of these items may not be possible due to budgetary or other constraints.

Table 4-1. Long-term Directions

	Proposal	Rationale
1	**Integrate Hazard Mitigation into the City's Comprehensive Plan**	**The Comprehensive Plan provides the basis for all current and future development. As such, it is an ideal place to include mitigation goals and objectives.**
2	**City departments should include hazard mitigation as a criterion for internally evaluating projects as part of their annual capital planning process**	**Departments are currently working on mitigation projects, although the projects may be characterized as maintenance, repair or capital improvements rather than as "mitigation." This proposal would help raise awareness about mitigation within city departments. This, in turn, could help match projects with appropriate mitigation funding sources in the future.**
3	**Promote inter-departmental hazard planning efforts, such as those initiated around seismic and landslide issues**	**It is important to harness expertise across departments to ensure that complex projects are well conceived and wisely implemented.**
4	**Departments should integrate mitigation into repair and recovery planning and projects**	**Disasters provide an opportunity for departments to think about mitigation. However, mitigation actions should be considered proactively as well. When buildings and infrastructure are being substantially rehabilitated or repaired is an excellent time to consider strengthening or retrofitting structures or networks. Doing these projects before a serious event occurs can avoid costly re-work in the future.**

Part 2: Proposed Planning & Policy Actions

Parts 2 & 3 of this chapter include proposed planning, policy and capital project actions that in many cases have no funding sources identified. For obvious reasons, timelines are dependent upon securing of funding. If and when funds become available, more concrete timelines will be determined.

The items listed below suggest actions that could help integrate mitigation into existing city policy and planning mechanisms and assessments to improve our understanding of vulnerabilities. This list is in the beginning stages of development and will be regularly updated.

Action Item No**:** **A-1**
Action: **Conduct vulnerability analysis of shelters and traditional housing serving vulnerable populations.**
Mitigation Goal: **Protect public and private property and public health and safety**
Mitigation Purpose: **Promote appropriate mitigation of all property**
Relevant Hazard: **All Hazards**

How Identified:	**Ad hoc committee initiated post-Nisqually**
Status/Timeline:	**Staff resources currently unavailable and will not be able to implement until funding is found**
Responsible Dept:	**HSD/Public Health**
Funding Source:	**No funding identified. Seek grant funding from FEMA mitigation grant programs or other outside source.**

Action Item No**:**	**A-2**
Action:	**Provide contingency planning technical assistance for agencies serving the general pubic and vulnerable populations.**
Mitigation Goal:	**Protect public health and safety**
Mitigation Purpose:	**Promote disaster preparedness outreach and education programs serving the general public and vulnerable populations**
Relevant Hazard:	**All hazards**
How Identified:	**Ad hoc committee initiated post-Nisqually**
Status/Timeline:	**Disaster preparedness training and planning for agencies serving vulnerable populations started in 2006 and will continue to be offered through 2009. As of November 2008, 54 agencies providing 100 programs that aggregately assist approximately 1,224,884 underserved clients in the Puget Sound Region participated in the training developed by HSD and Public Health.**
Responsible Dept:	**HSD/Public Health**
Funding Source:	**Funding was initially provided by United Way for some United Way agencies. In 2008 the City added $500,000.00 to HSD's budget for development of Emergency Preparedness Continuity of Business Plans to increase the preparedness of City-funded human services programs and agencies. HSD also contracted with the Vulnerable Population Action Team (VPAT) of Public Health to enable them to partner with agencies funded by HSD to develop emergency preparedness and response plans.**

Action Item #**:**	**A-3**
Action:	**Complete study cataloging Seattle's unreinforced masonry buildings**
Mitigation Goal:	**Protect public and private property**
Mitigation Purpose:	**Promote appropriate mitigation of all property**
Relevant Hazard:	**Earthquake**
How Identified:	**SHIVA/Planning & Development**
Status/Timeline:	**Completed the Reid Middleton Study. As a second phase are in the process of supplementing with the study's findings with more definitive field counts of URMs.**
Responsible Dept:	**Planning & Development**
Funding Source:	**No funding identified. Seek grant funding from FEMA mitigation grant programs, USGS or other outside source.**

Action Item #**:**	**A-4**
Action:	**Update city hazard maps with new liquefaction, earthquake-triggered landslide, seismic ground motion and tsunami/seiche inundation data from USGS, and NFIP flood mapping – particularly as it relates to urban flooding**
Mitigation Goal:	**Protect public and private property**
Mitigation Purpose:	**Ensure the City is integrating the most recent scientific data into its maps**
Relevant Hazard:	**Earthquake, Landslide, Flooding, Tsunami/Seiche**
How Identified:	**SHIVA consultant**
Status/Timeline:	**Long term and ongoing – Because of the manner in which the City administers its code adoption process, which is periodic and involves field testing, there can be a delay in using the latest USGS maps. The City is currently using maps derived from a 2003 USGS report.**
Responsible Dept:	**SPU/DPD**
Funding Source:	**N/A**

Action Item #:	**A-5**
Action:	**Use SPU records, technical data and GIS to create maps that capture the boundaries of recent localized flooding along the Thornton, Pipers and Longfellow Creek basins, to include other problems areas such Densmore, Aurora/Licton Springs, Midvale, Southpark, etc.**
Mitigation Goal:	**Better determine and document high priority flood prone areas that have not been previously mapped and that are outside existing flood plain maps**
Mitigation Purpose:	**Better manage drainage system and improvements, and to educate residents and businesses**
Relevant Hazard:	**Localized Flooding**
How Identified:	**SPU**
Status/Timeline:	**Need to find funding source**
Funding Source:	**Seek grant funding from FEMA mitigation grant programs or other outside source as needed.**

Action Item #:	**A-6**
Action:	**Update Seattle Hazard Identification & Vulnerability Analysis (SHIVA)**
Mitigation Goal:	**All**
Mitigation Purpose:	**Ensure the city continues to have an up-to-date comprehensive risk assessment document upon which to base its mitigation planning**
Relevant Hazard:	**All hazards**
How Identified:	**OEM**
Status/Timeline:	**Scheduled for completion in 2009**
Responsible Dept:	**OEM**
Funding Source:	**No funding identified**

Part 3: Proposed Capital Project Actions

The action items listed below reflect capital mitigation projects already identified by departments for which there is no current funding. This list is in the beginning stages of development and will be regularly updated.

Action Item #**:**	**B-1**
Action:	**Complete the four landslide mitigation projects identified and prioritized by the city's interdepartmental landslide team.**
Mitigation Goal:	**Protect public and private property**
Mitigation Purpose:	**Mitigate sites vulnerable to landslide damage**
Relevant Hazard:	**Landslides**
How Identified:	**Interdepartmental landslide team**
Status/Timeline:	**Three of the four projects identified have been completed. The fourth has been delayed because of budget reductions.**
Responsible Dept:	**SDOT, SPU, Parks**
Funding Source:	**General Fund, Rate Payer funds, FHWA funding.**

Action Item #**:**	**B-2**
Action:	**Complete seismic upgrade of Queen Anne Community Center. This is a Tier 1 Congregate Shelter Site.**
Mitigation Goal:	**Safeguard critical public facilities and infrastructure**
Mitigation Purpose:	**Enhance seismic safety of all structures serving as congregate shelter sites**
Relevant Hazard:	**Earthquakes, All Hazards**
How Identified:	**Parks Department**
Status/Timeline:	**Project is underway with anticipated completion in 2009**
Responsible Dept:	**Parks Department**
Funding Source:	**FEMA mitigation grant**

Action Item #:	**B-3**
Action:	**Seismically upgrade 6 community centers that have been designated as Tier 1 Congregate Care Facilities**
Mitigation Goal:	**Safeguard critical public facilities and infrastructure**
Mitigation Purpose:	**Enhance seismic safety of all structures serving as congregate care shelters**
Relevant Hazard:	**Earthquakes, All Hazards**
How Identified:	**2009 Parks Department shelter vulnerability analysis**
Status/Timeline:	**Awaiting the availability of funding**
Responsible Dept:	**Parks Department**
Funding Source:	**To be determined**

Action Item #**:**	**B-4**
Action:	**Seismically retrofit or rebuild to current seismic standards 32 fire stations and emergency facilities and support other fire mitigation projects**
Mitigation Goal:	**Safeguard critical public facilities and infrastructure**
Mitigation Purpose:	**Enhance safety of fire and police stations**
Relevant Hazard:	**Earthquakes**

How Identified:	**Fleets & Facilities Dept. (FFD)**
Status/Timeline:	**This action has received voter approval for a $167.2 million Bond Issue in 2003 – construction began in 2004 and be completed by 2014**
Responsible Dept:	**FFD**
Funding Source:	**Funding available through Bond Issue and other sources, including possible mitigation grants.**

Action Item #**:**	**B-5**
Action:	**Implement Phase II Bridge Seismic Retrofits.**
Mitigation Goal:	**Safeguard critical public facilities and infrastructure**
Mitigation Purpose:	**Enhance bridge safety**
Relevant Hazard:	**Earthquakes**
How Identified:	**SDOT**
Status/Timeline:	**Funding identified for seven additional structures; work is scheduled to begin in 2009 and be completed by 2015.**
Responsible Dept:	**SDOT**
Funding Source:	**2007 "Bridging the Gap" program**
Action Item #**:**	**B-6**
Action:	**Areaways Restoration**
Mitigation Goal:	**Protect public and private property**
Mitigation Purpose:	**Enhance areaways safety. Areaways are usable space constructed under sidewalks between the building foundation and the street wall.**
Relevant Hazard:	**Earthquake**
How Identified:	**SDOT**
Status/Timeline:	**Two areaways have been rehabilitated and two have been filled. Dependent upon ongoing funding, appropriate mitigation techniques will be pursued on a case-by-case analysis through 2012.**
Responsible Dept:	**SDOT**
Funding Source:	**Some funding available through CIP process. Seek grant funding from FEMA mitigation grant programs or other outside source as needed.**

Action Item #**:**	**B-7**
Action:	**Rebuild Emma Schmitz and Viaduct Seawalls to halt deterioration and improve resistance to erosion and earthquakes**
Mitigation Goal:	**Safeguard critical public facilities and infrastructure**
Mitigation Purpose:	**Enhance building & infrastructure safety**
Relevant Hazard:	**Earthquake, Erosion, Flooding, Tsunami**
How Identified:	**Parks**
Status/Timeline:	**Projects in design; working with state of Washington DOT on date to begin construction and date of anticipated completion. USACE currently does not have funding for the Emma Schmitz seawall.**
Responsible Dept:	**USACE working with SDOT, Parks, and KC Metro Wastewater**
Funding Source:	**USACE budget when it becomes available**

Action Item #:	**B-8**
Action:	**Build out alternate data center site to support City of Seattle Continuity Plans for critical city IT systems**

Mitigation Goal:	**Safeguard critical city IT systems that support critical city services**
Mitigation Purpose:	**To back up multiple single points of failures**
Relevant Hazard:	**Earthquake, Cyber Attack, Windstorm**
How Identified:	**DoIT**
Status/Timeline:	**Initial 2 phases completed; funding needed to finish project.**
Funding Source:	**Some funding available through CIP process. Seek grant funding from FEMA mitigation grant programs or other outside source as needed.**

Action Item #:	**B-9**
Action:	**Implement technology to routinely inventory installed non-microsoft applications to determine counter measures to cyber attacks**
Mitigation Goal:	**Safeguard city IT systems against intrusions/interruptions**
Mitigation Purpose:	**Reduce existing vulnerability and eliminate interruption of city services**
Relevant Hazard:	**Cyber Terrorism, IT Infrastructure Attacks**
How Identified:	**DoIT**
Status/Timeline:	**Need to find funding source**
Funding Source:	**Seek grant funding from FEMA mitigation grant programs or other outside source as needed.**

Part 4: Current/Planned Capital Projects

For the past 10-20 years, many city departments have been doing mitigation planning, although not always referring to their projects formally as "mitigation." Most often, project descriptions refer to increasing building and infrastructure safety and/or reliability. In many cases, these actions also reduce the city's vulnerability to the impact of natural hazards.

The projects identified in Table 4-2 (located at end of chapter) were derived primarily from the city's Capital Improvement Program (CIP) and are either partially or fully funded. Some projects appear because grant proposals for implementation have already been submitted.

Information about each project includes:

- Mitigation goals
- Mitigation purpose
- Timeframe for completion
- How the project is funded
- Department responsible
- Hazards the action will help mitigate

The actions identified have been through an internal planning, prioritizing and decision-making process. Most departments use some type of benefit/cost analysis in determining their project priorities.

4.3 Prioritizing Mitigation Measures

The Mitigation Work Group faced the challenge of designing a system that reflected the plan's goals and objectives in a way that could be simple and practical to use. The process by which the group eventually adopted the priority ranking system shown in Table 4-3 began with looking at two tools: one used by the Interdepartmental Landslide Team developed with the help of outside consultants (referred to in Chapter 3.1), and the other used by the Seattle Office of Emergency Management for its own informal priority-setting. After the initial draft was completed, the work group made additional changes. Departments have not yet begun to use this tool.

Seattle Office of Emergency Management, as the unit charged with citywide disaster preparedness, response, recovery and mitigation, will use the mitigation priority-setting tool adopted as part of this plan in conjunction with the city's Mitigation Work Group. This tool will help guide decision-making for outside funding. See Section 4.4 for further information about how this tool may be used by individual departments.

Benefit-cost Considerations

This Mitigation Priority Ranking Tool includes a criterion requiring benefit-cost consideration. Most departments currently use some type of cost-benefit or cost-effectiveness analysis in determining their internal capital project priorities; however methods are tailored to the type of service or facilities they manage. Where possible, Seattle Emergency Management will use FEMA's benefit-cost analysis when considering projects for outside funding.

4.4 Strategy Implementation

Hazard mitigation grant funding from FEMA and the State has historically followed natural disasters as part of the recovery phase. However, a recent change that makes some mitigation funding available outside of the recovery process encourages a more proactive strategy. Part of our mitigation strategy is to establish a mitigation work group that will meet on a regularly scheduled basis. The group's initial activities are defined below. Chapter 5 indicates how this group will be involvement in maintaining the plan.

Work Group Representatives

Departments will identify representatives for inclusion in the interdepartmental Mitigation Work Group to be convened by Seattle Emergency Management. This Mitigation Work Group will consist of representatives from the following city departments:

- Finance
- Fleets & Facilities
- Department of Information Technology
- Parks & Recreation
- Planning & Development

- Seattle City Light
- Seattle Fire Department
- Seattle Police Department
- Seattle Public Utilities
- Transportation
- Office of Sustainability and Environment

***Representatives' responsibilities*:**

- Act as liaison between department and OEM for the purpose of implementing the Plan's mitigation strategy
- Serve as department's liaison to OEM for the purpose of updating and maintaining the Hazard Mitigation Plan (see Chapter 5 on Plan Maintenance)
- Other activities as specified by each department

Step 1. Identify Work Group Representatives

Reconfirm or replace former members.

Timeframe: April 2009

Step 2. Identify High Priority Mitigation Projects

OEM will ask departments to identify and prioritize their top mitigation projects. These will be integrated into the action lists contained in this chapter.

The project lists will provide an excellent starting point for OEM and departments to use when seeking mitigation funding from FEMA and other outside sources.

Timeframe: May 2009

Step 3. Convene Meeting

Responsibilities: See activities specified in Chapter 5

Timeframe: May 2009

Table 4-2. CURRENT AND PLANNED MITIGATION PROJECTS

Mitigation Goals	Mitigation Purpose	Mitigation Actions	Status	Funding/Other support	Responsible Department	Relevant Hazards
Protect critical public facilities and infrastructure	**Protect Ferry Ave SW and California Way SW from further landslide**	1). Build a retaining wall along Ferry Ave SW, remove slide debris, and place quarry spouts on slope	**Ready for bids**	**FEMA/FHWA/ SDOT Operating funds**	SDOT	**Landslide**
	Protect Beach Dr SW, Sidewalk and public utility	2). Geotechnical study and long term landslide monitoring for 6300-6500 Blocks of Beach Dr SW	**Geotechnical consultant is ready to start the work**	**SDOT Operating funds**	SDOT	**Landslide**
	Retrofit or fill areaways	3). Hazard Mitigation Program – Areaways	**In progress***	**SDOT CIP and FEMA Mitigation Grant**	SDOT	**Earthquake**
	Seismically retrofit bridges	**4). Prevent catastrophic collapse from ground shaking**	**In progress***	**SDOT CIP**	SDOT	**Earthquake**
	Replace downtown Elliott Bay seawall	**5). Prevent erosion and subsidence**	**To be done as part of Viaduct replacement**	**Shared funding between King County and city**	SDOT	**Earthquake**
	Strengthen critical infrastructure/ Networks	6). Seismic Upgrade – Pipeline backbone system	**In progress***	**SPU CIP**	SPU- Water	**Earthquake**
	Protect water supply	7). Seismic Upgrade – Volunteer Park Standpipe	**Decision pending on whether to go ahead with project**		SPU- Water	**Earthquake**
	Protect water supply	8). Seismic Upgrade – Pump Station Buildings 6-B & 6-C	**In progress***	**SPU CIP**	SPU- Water	**Earthquake**
	Protect infrastructure from earthquake damage	9). Comprehensive Retrofit/BMP Program	**In progress***	**SPU CIP**	SPU – Drainage & Waste-Water	**Earthquake**
	Protect water	10). Seismic Upgrade –	**In progress***	**SPU CIP**	SPU –	**Earthquake**

	supply	Building Package 6E			Water	
	Protect water supply	11). Seismic Upgrade – Lake Youngs Upgrade Package 6D	**In progress***	**SPU CIP**	SPU – Water	**Earthquake**
	Protect water supply	12). Construct lids to cover W Seattle and Maple Leaf reservoirs	**Work to begin in 2009**	**Funding identified in 2009-2014 CIP**	SPU - Water	**Contamina-tion, Tampering**
	Create redundancies for critical networks	13). Emergency Generators	**Tied to Fire Levy, which has been extended because of budgetary constraints**	**Funding identified in 2009-2014 CIP**	Fleets and Facilities	**Earthquake, Windstorm**
	Prevent fires in the event of serious building damage	14). Gas Valve Retrofit	**To be completed in 2010**	**FY 06 HMGP; Awarded in 2009**	Fleets and Facilities	**Earthquake**
	Seismic strengthening of Fire Stations	15). Continue retrofitting Fire Stations	**Ongoing****	**Fire Levy**	Fleets and Facilities	**Earthquake**
	Seismic strengthening	16). Ross Dam – Abutment Rock Stabilization	**In progress***	**SCL CIP**	SCL	**Landslide, Flood, Earthquake**
	Safety of field personnel from hazard exposures	17). Automated Meter Reading	**In progress***	**Unfunded – some meters are being installed as funds become available**	SCL	**All Hazards**
	Seismic strengthening	18). Underground Residential Distribution Rebuild	**In progress***	**Unfunded – some neighborhoods being rebuilt as funds become available**	SCL	**Earthquake, Windstorm**
		19). Utility Relocation due to Alaskan Way Viaduct and Seawall replacement	**In progress***	**2009-2014 CIP**	SCL	**Earthquake**
Add resiliency to critical power distribution source		20). Construct a new substation in the N downtown	**To begin in 2009**	**2009-2014 CIP**	SCL	**Earthquake, Windstorm**
Add resiliency		21). Design and construct a	**To begin in 2009**	**2009-2014 CIP**	SCL	**Power**

to critical power generation source		second tunnel at Gorge Dam	**and scheduled for completion in 2013**			**Failures, Climate Change**
	Ensure survivability, capacity, and coverage for voice, data, and video network which provides communication for public safety.	22). Add next generation switches to support progress for standards toward P25 compliance three county system	**In progress, but needs additional funding***	**Radio network reserve (DoIT operating fund)**	DoIT	**All hazards, emphasis on homeland security and earthquake**
	Improve computer network communications	23). Upgrade essential network routers, firewalls, and switches	**Continuous*****	**DoIT CIP**	DoIT	**All hazards**
	Improve telephone, radio and data Transport infrastructure	24). Add upgrades to SONET necessary to improve capacity of existing fiber optic network	**Continuous*****	**DoIT CIP**	DoIT	**All hazards**
	Improve telephone network	25). Upgrade moving Time Division Multiplexing (TDM) network to VoIP/Multimedia Communications in City's systems	**Continuous*****	**DoIT CIP**	DoIT	**All hazards**
	Ensure critical applications which support critical City services have systems disaster recovery	26). Creation of City-wide alternate site locations to be used during times of emergencies or disasters	**In progress; however continuous*****	**UASI grant/DoIT CIP**	DoIT	**All hazards**
Minimize potential for IT infrastructure attack success	**Implement end-point security for desktop systems**	27). Implement controls on desktop systems that enforce policy and prohibit the installation of non-approved applications	**Initialized planning—needs additional funding********	DoIT General Fund	DoIT	**All hazards, emphasis on cyber-terrorism**
	Improve	28). Implement technology	**Initialized**	DoIT General Fund	DoIT	

	computer vulnerability management	to routinely inventory installed, non-Microsoft applications to determine the extent to which upgrade or patching is required. Transition the information to operations for patch/upgrade	**planning—needs additional funding******			
Recover from successful IT infrastructure attack quickly to minimize impacts	**Improve ability to detect compromised desktop systems**	29). Implement technology for the detection of command and control computer traffic for compromised desktop systems	Initialized planning—needs additional funding****	DoIT General Fund	DoIT	**All hazards, emphasis on cyber-terrorism**
Reevaluate and update current threat to determine relative risks and vulnerabil-ities	**Assess potential risk**	30). Complete Hazard Mitigation Risk Assessment	**In progress***	**Parks General Fund**	Parks	**All Hazards**
Maintain Seattle's Economic Vitality	**Promote businesses awareness about disaster contingency planning**	31). Development of a Contingency Planning Toolkit for small businesses	**Currently in beta testing. Will be hosted on WA EMD web site in 2009**	**EMPG, OEM General Fund, and UASI grant**	OEM & EMD	**All Hazards**
Protect Public Health & Safety	**Educate public about preparedness and disaster response**	32). The Seattle Neighborhoods Actively Prepare (SNAP) program is the successor to Seattle Disaster Aid and Response Teams (SDART)	**Ongoing - There are 77 SNAP groups located throughout the City****	**EMPG, OEM General Fund, and SHSP and UASI grants**	OEM	**All Hazards**
Environmental protection	**Projects to advance climate protection, clean water, restoring tree cover, and conservation by using reusable**	33). Advancing the City's green initiatives to protect the environment and the health of the community	**Ongoing****	**2009-2014 CIP**	SPU, Fleets & Facilities, Parks, OSE	**Climate Change**

	resources					

Key for Interpreting Status

*In progress = Project started in 2009, but additional work remains
**Ongoing = Project started prior to 2009, but additional work remains
***Continuous = Project expected to become a long-term (multi-year) initiative
****Initialized = Project in start-up phase

Table 4-3. Mitigation Priority Ranking

	Project Criteria	**Weight-ing**	**Score** (1–3 points possible) **Low**	(4-6 points possible) **Medium**	(7-9 points possible) **High**	Total Points (Weight X score)
1.	**Public health and safety (potential for causing injury or death)**	**4**	**No people harmed**	**Fewer than 25 people affected**	**More than 25 people affected**	
2.	**Cost-benefit – comparison of the mitigation project's costs and benefits (whenever possible, attempt to use FEMA's criteria for FEMA funding requests)**	**3**	**No cost-benefit analysis completed or weak case presented of benefits outweighing costs**	**Moderately strong case demonstrated (i.e. greater than 1:1)**	**Excellent case (i.e. greater than 2:1)**	
3.	**Criticality of infrastructure, building or network**	**3**	**Facility or system not deemed critical**	**Facility or system moderately important to lifeline services**	**Critical to provision of lifeline services**	
4.	**Vulnerability of facility/system/function**	**3**	**Not located in vulnerable area or system not likely to be impacted**	**Moderate vulnerability**	**High vulnerability**	
5.	**Level of Target Hazard Risk (frequency and impact)**	**3**	**Hazard Risk score below 20 in SHIVA**	**Hazard Risk score in SHIVA of 20-35**	**Hazard Risk score in SHIVA above 35 or multiple hazards addressed**	
6.	**Economic impact (if project not completed)**	**2**	**Minimal impact on business or city services or related jurisdiction**	**Moderate impact on business or city services or related jurisdiction**	**High impact on business or city services or related jurisdiction**	
7.	**Public involvement**	**2**	**No public hearings held**	**Prioritized by department with public involvement**	**Included in neighborhood plan**	
V.	**TOTAL POINTS**					

Additional factors to consider (please note other compelling reasons why you think this project should be funded (e.g. legal liability, social or environmental impact, high visibility):_____

_____

Chapter 5
Plan Maintenance

This plan is intended to be a "living" document that will help inform all interested parties about the city's natural hazard mitigation policies and projects. It will be reviewed and updated on a regular basis. As mentioned earlier Chapter 4, the mitigation strategy identified will act as a guide for City of Seattle departments in determining projects for which to seek FEMA and other mitigation funds from outside sources.

5.1 Annual Review

Seattle Office of Emergency Management (OEM) will oversee an annual Plan review to make sure that all information is current. The review and update process follows:

1. The Mitigation Work Group will meet to consider:
    - Progress made on plan recommendations during the previous 12 months
    - Mitigation accomplishments in projects, programs and policies
    - Status of mitigation projects included on the city's Capital Improvement Program (CIP) list
    - New mitigation needs identified
    - Cancellation of planned initiatives, and the justification for doing so
    - Changes in membership to the Work Group

2. OEM will request input from other departments and outside entities not represented on the Work Group on issues listed above. A special effort will be made to gather information on non-capital projects and programs important to mitigation. These departments include the city's Human Services Department, Office of Housing and the Department of Neighborhoods.

3. OEM will make "minor" changes to the Plan – such as updates to the CIP - without seeking outside approval.

4. "Major" changes – those related to new policies or recommended projects - will go through a more formal review process that will be submitted by the Emergency Management Director to the DMC, Mayor and City Council for final peer review, approval, and adoption.

5. To allow for on-going public input, OEM will post the plan permanently on the Emergency Management website along with contact information that will encourage people to submit questions or comments.

Given the findings of the Work Group in their analysis and review of this Plan, all 5 Chapters were updated to reflect the most current information and to formulate the City's mitigation approach and strategy for the next several years.

5.2 Following a Major Disaster

Within 2 months of a major disaster warranting a Presidential Disaster Declaration, and as determined necessary for a smaller event, OEM will convene the Work Group. Because recovery is a long process and the full impact of a disaster may not be known for many months, this initial meeting may be followed by additional meetings over time.

The annual update process described above will also be used following a major disaster. However, post-disaster deliberations will also consider the following:

- "Lessons Learned" from the disaster, and what new initiatives should be added to the plan to help reduce the likelihood of similar damage in the future
- Follow-up needed on items relevant to mitigation from any After Action reports produced by the City
- Integration of mitigation into the recovery process

5.3 5-Year Update

Every five years, the plan will be re-submitted for adoption to the City Council. Prior to this, Seattle Emergency Management will use the following process to make sure that all relevant parties are involved:

1. Follow steps 1 and 2 above.
2. Incorporate all relevant issues raised via the forums identified.
3. Hold public meeting and initiate meetings with identified groups of interested parties and outside organizations to gain input and feedback.
4. Integrate relevant feedback and circulate revised plan to Mitigation Work Group for approval.
5. Seek Disaster Management Committee (DMC) Plan review and comment.
6. Integrate recommendations into the plan.
7. Submit Plan to the Mayor for approval and the City Council for adoption by resolution.
8. Submit revised Plan to FEMA via the Washington State Hazard Mitigation Officer.

Seattle Office of Emergency Management Mitigation Coordinator will oversee the following Hazard Mitigation Plan Monitoring and Update Schedule:

Plan Monitoring and Update Schedule for 2009-2014	
Date	**Action**
Annually	Confirm and, as necessary, identify replacement Mitigation Work Group Representatives. Review the status of all mitigation efforts undertaken by City departments and update Table 4-2.
As necessary after a Major Disaster, or no later than January 2012	**Convene Mitigation Work Group**
	Seek input of ancillary departments
	Integrate "minor" changes
December 2012	Submit "major" changes to DMC for review.
January 2014	Convene Mitigation Work Group
	Seek input of ancillary departments
	Integrate all changes

	Public Meeting
	Recommend and obtain Mayoral Approval
	Submit to City Council for adoption by Resolution
April 2014	**Submit 5-year Plan Update to state/FEMA**