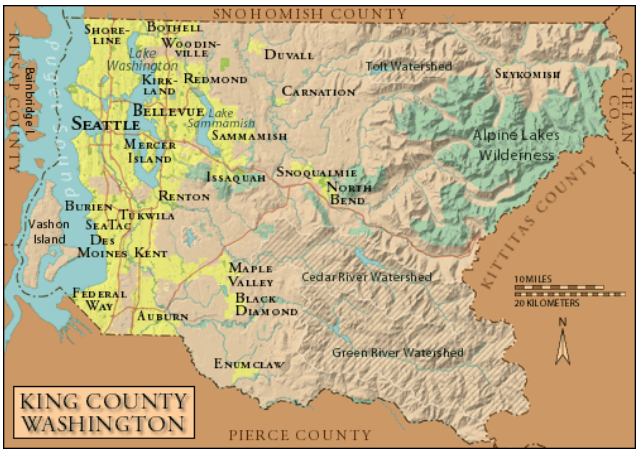
King County
Regional Hazard Mitigation Plan



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December 15th, 2005

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Acknowledgements

King County Office of Emergency Management wishes to acknowledge the contribution of many individuals for their hard work and dedication that made this plan possible. We extend our grateful appreciation to the following individuals and their support staff:

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Ken Thomas – RH2 Engineering Inc.

Jerry Thorson - Federal Way Fire Department

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Funding Acknowledgement:

Washington State Emergency Management Division
Federal Emergency Management Agency

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Section 1: Introduction

Executive Summary

The Federal government passed legislation in 2000 requiring states, local communities and tribal governments to have mitigation plans in place by November 2004 to be eligible for mitigation funding. King County and the Office of Emergency Management have committed to providing coordination in an effort to identify possible alternatives and secure funding for the benefit of the region.

This document is the culmination of a cooperative partnership between local governments, special purpose districts, King County internal agencies, King County Office of Emergency Management (OEM), State of Washington Emergency Management Division and the Federal Emergency Management Agency (FEMA). This plan meets the requirement for a Hazard Mitigation Plan under the Stafford Act. It is a living document and will be refined and updated on a five-year basis. Many local communities and governmental agencies, and the public were involved in the plan development and critical review process.

It is vital for the region to have a proactive, coordinated approach to mitigation. Mitigation measures save lives, reduce injuries and prevent or decrease financial losses from the many hazards our region faces. The Regional Hazard Mitigation Plan examines efforts that can be applied to reduce the loss of life and property, human suffering, economic disruption, and disaster assistance costs through prevention.

Some projects are being implemented with existing funding sources. As additional funding sources become available, the regional plan will guide the selection of eligible projects from the criteria set forth in the Hazard Mitigation Grant Program (HMGP) process.

Development of a regional hazard mitigation plan is unique. The process for the plan's development was invented during the process with new ideas continuing to be incorporated at each step. A Regional Hazard Mitigation Plan Taskforce was formed to guide the planners and workgroups through the plan development and review. The group was tasked with establishing the Regional Plan's Strategy from the common elements of the individual agency strategies.

The Regional Hazard Mitigation Plan will continue to be developed over five years. The first year submission will include information related to the most pressing natural and technological hazards King County may experience. It

includes strategies and initiatives provided by the individual agencies that are signatories to the plan as well as a Regional Strategy. The first year document was submitted to Washington State Emergency Management on December 8, 2003 and to FEMA on January 8, 2004. Conditional approval from FEMA was received on June 9th, 2004 for 22 signatory agencies. Another group of agency annexes were submitted and approved on October 29th, 2004 followed by several individual agencies gaining approval and adoption during 2005. Six hazards were added to the HIVA in 2005 with four more anticipated in 2006. The total number of participants in the region planning process has reached 36 with four more agencies working on submissions for early 2006.

The planning process resulted in many accomplishments and defined new short- and long-term goals:

- Hazard mapping projects – hazard prone areas were identified.
- Direct the incorporation of hazard mitigation in land use planning and building construction– to reduce vulnerability to hazards.
- Educate King County elected officials and citizens about hazards and mitigation alternatives.
- Improve assistance and provide incentives to local and tribal communities – to support local efforts in their attempts to make their communities safer.
- Pursue additional mitigation funding.

The development of this document represents a coordinated effort of many elements in the region. We are indebted to the staff of Washington State Emergency Management, our technical writer, researchers and contributing members of the workgroups. Each local mitigation strategy can stand alone but the combined efforts provide greater return for the region as a whole. The underlying regional mitigation plan goal is to implement the regional strategy through mutually beneficial and cost-effective regional projects.

Planning Context and Limitations

King County is comprised of over 150 agencies including cities, fire districts, school districts, utility districts, hospital districts and miscellaneous other small jurisdictions. Of these, 36 jurisdictions participated in the creation of this submission of the King County Regional Hazard Mitigation Plan (RHMP). Some agencies chose to produce their own mitigation plan. For this reason, the current planning document may lack details regarding particular portions of geographic King County. Subsequent revisions will include additional jurisdictions and an increasingly complete coverage of geographic King County as we gain more participation from regional partners.

Preface and Overview

Why Develop a Mitigation Plan?

The rising cost from the impacts of natural disasters has led to renewed interest in identifying effective ways to reduce our vulnerability to disasters. Natural hazard mitigation plans help communities to reduce their risk from natural and manmade hazards by identifying vulnerabilities and developing strategies to lessen and sometimes even eliminate hazards.

Many communities resist adopting mitigation measures as they can be seen to be restrictive, costly, without immediate tangible benefits, or are incompatible with community development. However, effective mitigation measures are designed with the future in mind. Consequently, our region is committed to convincing its constituents to view mitigation as an opportunity to provide sustainable development that improves the economic value and quality of life for the region, its communities, businesses and residents.

Here are some benefits of mitigation planning for agencies within King County:

- *Leads to a judicious selection of risk reduction actions* by setting clear goals and identifying and implementing policies and cost-effective programs and actions that reduce the effects of losses from future disasters.

- *Builds partnerships* to enhance collaboration and gain support among the parties whose interests may be affected by hazard losses.

- *Encourages a broad range of stakeholders to forge partnerships* that pool skills, expertise, and experience to achieve a common vision to ensure that the most appropriate and equitable mitigation projects are undertaken.

- *Contributes to sustainable communities*, ensuring future generations will continue to enjoy the same or improved quality of life that we do.

- *Links sustainability and loss reduction efforts to other goals,* like promoting open space planning that also prevents development in hazard locations such as floodplains or landslide areas.

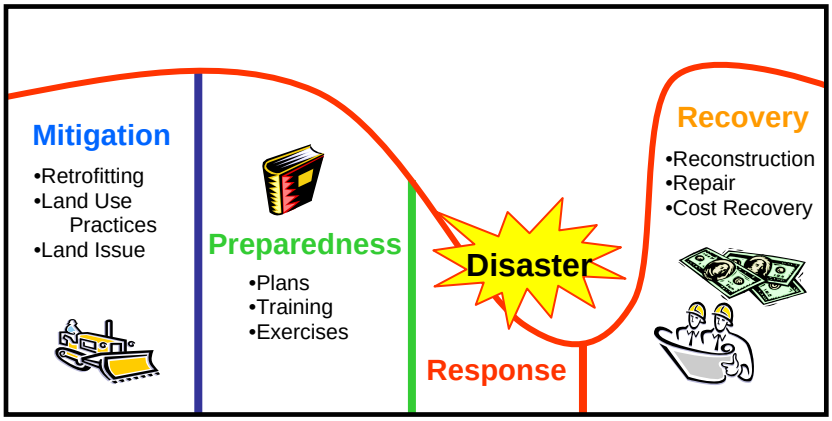
- *Establishes funding priorities* so agencies can better articulate their needs to state and federal officials when funding becomes available, particularly following a disaster. Such communities can present projects as an integral part of an overall, agreed-upon strategy, rather than as projects that exist in isolation.

Most importantly, hazard mitigation **"saves lives and property"** from natural and manmade hazards through mitigation actions. If we can identify potential hazards in our community and assess potential impacts and vulnerability assets and populations, then we have the opportunity to develop strategies to help mitigate the impacts before, during and after a hazard event.

In addition, future federal and state funding of mitigation projects depend on the successful completion of a mitigation plan. Only those states and communities with approved plans that meet the Disaster Mitigation Act of 2000 criteria will be eligible to receive Hazard Mitigation Grant Program (HMGP) funds in the future. Through a "regional" hazard mitigation planning approach, participating agencies within King County will optimize the benefits of working together and ensuring the best opportunity for gaining future competitive grant funding for mitigation projects.

Mitigation Planning Process

Mitigation planning is the first of the four "phases of emergency management" followed by preparedness, response and recovery. This "prevention-related" aspect of emergency management often gets the least attention, yet is one of the most important steps in creating a disaster-resistant community.



Four Phases of Emergency Management

Mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event. Mitigation encourages long-term reduction of hazard vulnerability. The goal of mitigation is to save lives and reduce property damage. Mitigation can accomplish this, and should be cost-effective and environmentally sound. This, in turn, can reduce the enormous cost of disasters to property owners and all levels of government. In addition, mitigation can protect critical community facilities, reduce exposure to liability, and minimize community disruption. Examples include land use planning,

adoption of building codes, elevation of homes, acquisition and relocation of homes away from floodplains, and public education.

There are also four steps in mitigation planning:

1. Organizing Resources

2. Assessing Risks

3. Developing the Plan

4. Implementing, Monitoring and Updating the Plan

From the start, communities need to focus on the resources needed to develop a successful mitigation planning process. An essential step includes identifying and organizing interested members of the community as well as those with technical expertise. A wide cross-section of planning participants is a necessary ingredient in identifying and addressing regional hazard mitigation concerns, as well as building overall consensus.

Next, communities must identify the characteristics and potential consequences of hazards that can occur locally and regionally. It is important to understand how much of the community can be affected by specific hazard events and what the impacts could be on important community assets. Some assets may be more at risk than others simply because of where they are located and the function they serve. Examples can include emergency operations centers, hospitals, telecommunications, etc. Certain populations may be more at risk because of where they live – densely-populated urban areas in a liquefaction zone are more likely at risk during an earthquake than smaller populations living in more stable areas of rural parts of the County. Other sectors of the population may get limited emergency information because of communication obstacles.

By understanding the risks posed by hazards, communities can then determine their priorities and look for possible ways to avoid or mitigate the impacts. The result is a well thought-out plan and strategy, along with effective activities to mitigate such potential hazards.

To ensure the success of an ongoing program, it is critical that the plan remains relevant. In order to do this the regional hazard mitigation planning group must continually update the plan, monitor its progress, and conduct periodic evaluations. In King County's case, this can include incorporation of new regional partners; improved collection and evaluation of hazard data, and making sure mitigation activities are being accomplished.

How the Plan is Organized

The King County Regional Hazard Mitigation plan is organized into seven basic sections. Sections 1 and 2 provide an administrative overview of the planning process. Section 3 provides a comprehensive profile of the region; this information is key in understanding the various aspects of the community that are involved or can be impacted during hazard events. Section 4 profiles individual participating agencies. Section 5 includes hazard identification and vulnerability information based on the six most common hazard types that occur within our region; other hazard topics will be addressed in priority order in subsequent years. Section 6 summarizes the major hazard events and repetitive losses reported by participating agencies. Section 7 outlines the County's regional hazard mitigation strategy. Section 8 includes annexes that support the main document. The sections are arranged in a sequence that reflects the mitigation planning process itself.

Mission and Vision

The RHMP Taskforce developed the mission and vision statements with input from the Partner's group. It was the intent of both groups to keep these statements simple and broad in scope.

Mission

"Reduce the impact of natural, technological and human-caused disasters upon the communities within King County."

Vision

"King County is a region where disasters have minimal impact on people, infrastructure and the environment."

Goals and Objectives

The goals and objectives are based on the mission and vision statements and are listed in order of planning priority. Mitigation strategies and activities are based on these goals:

1) Protect Life and Property
2) Support Emergency Services
3) Increase Public Awareness
4) Preserve Natural Systems and Resources
5) Encourage Partnerships
6) Enhance Planning Activities

Protect Life and Property

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

- Maintain essential services, facilities and infrastructures during disasters.

- Identify populations with special needs or those who may be more vulnerable to the impacts of disasters or hazard events.

- Reduce losses and repetitive damages from chronic hazard events.

- Provide and/or improve emergency warning systems.

Support Emergency Services

- Strengthen and support countywide disaster and emergency response efforts.

- Protect and maintain critical facilities, infrastructures and services essential to emergency service and disaster response activities.

Increase Public Awareness

- Enhance the public's knowledge about hazards that occur in the region and how they can be impacted.

- Support education and outreach programs to increase the public's awareness about disaster preparedness, mitigation, emergency response, and recovery activities.

- Develop education strategies, programs and materials to reach populations with special needs.

- Provide and support comprehensive education activities that address all sectors of the community.

Preserve Natural Systems and Resources

- Insure protection of agriculture, fish, wildlife, and natural resources.

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

Encourage Partnerships

- Strengthen communication and participation among public agencies, citizens, non-profit organizations, businesses and industry.

- Coordinate hazard mitigation planning efforts with other local and regional organizations involved in disaster preparedness, response, and recovery activities.

Enhance Planning Activities

- Improve data collection and evaluation processes for identifying critical facilities, infrastructures, essential services, and populations at risk.

- Improve hazard assessment information and resources.

- Enhance and increase participation and representation on the Regional Hazard Mitigation Plan Taskforce and Partners Committee.

- Facilitate ongoing review and implementation of the plan.

- Actively monitor and evaluate the status, implementation and completion of mitigation action items.

- Routinely review, update and enhance all aspects of the plan.

Section 2: Plan Development

Agency Participation

Thirty six agencies agreed to commit to the development of King County's first multi-jurisdictional hazard mitigation planning effort. These agencies actively participated in weekly work group sessions and monthly participant meetings. Their specific involvement included many activities such as collection and development of data, providing input, reviewing the plan document, and submitting formal documentation identifying their intent to adopt the final approved plan. Of these 36 have been approved and adopted.

Participating agencies include:
Cities (10)

City of Auburn
City of Burien
City of Duvall
City of Federal Way
City of Issaquah
City of Kirkland
City of Normandy Park
City of North Bend
City of SeaTac
City of Woodinville

Utility Districts (14)

Cedar River Water and Sewer District
Coal Creek Utility District – Newcastle
Covington Water District, Covington
King County Water District #20 – Seattle
King County Water District #90 – Renton
King County Water District 111
Midway Sewer District, Kent/Des Moines
Northshore Utility District
Ronald Waste Water District
Shoreline Water District, Shoreline
Soos Creek Utility District – Renton
Southwest Suburban Sewer District – Seattle
Val Vue Sewer District
Woodinville Water District

Fire Districts (8)

Federal Way Fire Department
King County Fire District #2 - Burien
King County Fire District #40 – Renton
King County Fire District #45 – Duvall
Woodinville Fire & Life Safety
North Highline Fire District 11
King County Fire District 43, Maple Valley
King County Fire District 44

School Districts (3)

Lake Washington School District
Federal Way School District
Vashon Island School District

King County Government (1)

King County Facilities Maintenance
King County Information and Telecommunications
King County Natural Resources and Parks, Solid Waste
King County Natural Resources and Parks, Parks
King County Natural Resources and Parks, Flood Control
King County Natural Resources and Parks, Wastewater
King County Public Health
King County Sheriff's Office
King County Transportation

Planning Process

Background

The King County Government and King County Office of Emergency Management have been leaders in regional response planning since 1998. In an extension of regional planning efforts already underway, we encouraged local partners to take advantage of common background elements required in the Hazard Mitigation Plan Act of 2000.

In June 2002, King County Executive Sims formally invited 154 agencies to participate in a multi-jurisdiction regional hazard mitigation planning process. In December 2003, the County received a $100,000 grant from Washington State Emergency Management Division to help support this effort. In March 2003, the

Emergency Management Advisory Committee (EMAC) sent a second invitation to the same regional partners. As a result of both efforts, 78 agencies expressed interest and submitted signatory forms to become a regional partner.

While many cities and special purpose districts took advantage of this synergy, some opted to write mitigation plans independently. Some of the latter also chose to contribute to the Regional Hazard Mitigation Plan content, or indicated intent to do so in the future. Many jurisdictions were unable to commit to planning efforts because of the regional plan timeline and are presently working toward development of a hazard mitigation plan for submission to FEMA on or before the November 1, 2004 deadline. Additionally, some agencies expressed their intention to participate in the next phase of the regional planning process which starts the beginning of 2004, with the updated plan (annexes) to be completed by April of that year.

Planning Deadlines

Initial planning timelines were largely established based on the planning grant received by Washington State Emergency Management Division. The plan deadline for submittal to the Federal Emergency Management Administration (FEMA) was January 8, 2004; therefore the submittal deadline to the State of Washington was one month prior, December 8, 2003. The State reviewed the plan, and upon their approval forwarded it on to FEMA in accordance with the January due date.

Participation Requirements

In addition to providing a signatory form, each participating agency was expected to attend work group meetings, submit required data, write their own mitigation strategy and initiatives, participate in a public review process, and submit an approved “intention to adopt” resolution.

Planning Process

The planning process consisted of multiple phases and teams, including the Taskforce, work groups, and partners group.

The RHMP “Taskforce” included representatives from participating agencies who acted as a guiding body for the direction of the regional plan and work group activities. The Taskforce met monthly to review work progress, adoption process and public participation efforts.

Originally, participating agencies met monthly as a group. When a review of the RHMP progress and information submitted by jurisdictions was conducted late in the spring of 2003, it became evident that some agencies had made substantial

progress in the planning progress while other agencies had not. For this reason, participants were divided into two groups – one with a submission deadline of December 8, 2003 and a second group to convene for the 2004 planning phase. Only those with December 8th deadline targets participated in work group sessions. Work groups were segregated into operational areas: schools, cities, utilities, fire districts, and King County government agencies. They met every week to discuss selected topics, submit data and review draft plan document drafts. Eventually the schools joined the cities work group to consolidate meeting schedules. New work groups for the next planning phase will be formed in early 2004.

In an effort to pull together the entire process, all participants and interested parties met once a month at the "RHMP Partners Meeting." This forum provided an opportunity to brief everyone on the plan status, distribute draft documents, share information and provide for agency comments and feedback.

RHMP Work Plan

An aggressive work plan for Group 1 was developed and implemented in August of 2003 toward the December 8th submission date. Each week involved collection of background information from participants toward construction of the regional profile and hazard identification and vulnerability assessment (HIVA). In addition, the work plan developed information in support of each jurisdiction's individual mitigation strategy and initiatives. Group 2 completed similar work on August 23rd, 2004.

Week 1: Signatory agreements, critical facilities and dependent populations.

Week 2: History of events and losses and repetitive losses.

Week 3: Probability of events and estimate of catastrophic losses.

Week 4: Identify existing mitigation funding sources.

Week 5: Benefit cost analysis, priority issues for mitigation, and schedule public presentations in interested jurisdictions.

Week 6: Review sample strategies and review plan drafts.

Week 7: Jurisdictions strategy drafts and review draft plan.

Week 8: Create regional mitigation strategy from composite of jurisdiction strategies and plan maintenance.

Week 9: Existing jurisdiction mitigation policies and regulations.

Week 10: Jurisdiction initiatives.

Week 11: Distribution of composite RHMP draft.

Week 12: Review and intention to adopt documents due.

King County Emergency Management Staff Support

King County's personnel contribution to the development of the regional hazard mitigation plan consisted of two full-time Project Management III staff members, one contract temporary technical writer, one part-time work-study student, and several volunteers. These staff resources were dedicated to the facilitation of regional participation, coordination of the planning process, research, data collection, plan writing, and administration of public presentations. Office of Emergency Management staff also provided support and guidance to partner agencies as requested and developed and maintained the RHMP website for the benefit of partner agencies and the general public.

Data Collection and Mitigation 20/20 Software

The County received a copy of "Mitigation 20/20" software as part of the State grant. This "Microsoft Access" database program provided a step-by-step method to help agencies collect and evaluate hazard mitigation data. We provided a limited version of the County's master copy to interested signatories, per the licensing agreement. While the software was somewhat useful for single jurisdictions, it did not lend itself to the political jurisdictional environment in King County or to a true regional hazard mitigation planning effort. In addition, some agencies did not have the computer hardware or software capability to run the program. Forms and data generated and collected in the Mitigation 20/20 software format was limited but somewhat useful as a standard for collecting data in hardcopy form. Some agencies opted to use their own methods for collecting, documenting and evaluating data for their plan. This information was manually integrated with other data submitted via the Mitigation 20/20 format. Due to program limitations, the County chose to manually develop the plan instead of utilizing the pre-written format provided in the Mitigation 20/20 program. Mitigation 20/20 will not be utilized for future revisions and additions to the RHMP.

Plan Adoption

The December 8, 2003 submission date and the RHMP work plan left very little time for the regional partners to review and adopt the final composite of the draft plan. For this reason, the plan sections were released to the partners as they were drafted for comment and reviewed at the weekly work group meetings. Draft documents were also made available on-line at the King County Office of Emergency Management website at www.metrokc.gov/prepare/KCRHMP as they were completed. Partners and citizens alike were given access to the documents in this fashion. Group 1 was conditionally approved by FEMA on June 9th, 2004. Group 2 signatories were approved October 29th, 2004. Additional approval and adoption by individual agencies during 2005 brings the total to 36 participants.

Intention to Adopt – Individual Agencies

Each jurisdiction chose to pass resolutions expressing their intention to adopt the King County Regional Hazard Mitigation Plan upon acceptance of the plan by Washington State Emergency Management and FEMA. This was done at different points in the process per the desires of each jurisdiction. Documentation of the adoption resolution was a requirement for acknowledgement of the jurisdiction's successful participation in the hazard mitigation planning process. All participating agencies in this planning session met this requirement as identified in the **Annex D: Plan Adoption**. Original resolutions are kept on file at the King County Office of Emergency Management.

Public Involvement

The planning process attempted to provide opportunity for public involvement in a variety of ways at every step. While we recognized this topic was typically of interest to specific individuals and groups, we tried to provide appropriate opportunity to gain public interest and feedback. We felt it was important to educate the public on the hazard mitigation planning process as well as the specific work being done by the various agencies contributing to the plan.

We also acknowledged the need to reach individuals and groups at all levels in a way that met their needs. To accomplish this we approached the task using several different methods:

CTV- King County Civic Television

In March 2003, the County produced and aired a "Project Impact" segment featuring the Director of Emergency Management, Taskforce members and RHMP project staff. The production, televised on County Television (CTV), focused on the types of hazards that occur in our region and the benefits to developing a multi-jurisdictional regional hazard mitigation plan. This segment was available to a potential viewing population of approximately 445,000 households throughout King County. VHS and DVD copies were also made available to RHMP partner agencies.

Internet/Website

A portion of the King County's Emergency Management website was specifically dedicated to regional hazard mitigation planning. This site was developed and still remains as a tool for participating agencies as well as the general public. It contains information on hazard mitigation planning, help for participating

agencies, resources, draft and final plan components, and a method for providing plan comments and feedback. The address is www.metrokc.gov/prepare/kcrhmp.

Public Meetings

As the RHMP was being developed, Office of Emergency Management staff conducted presentations to a variety of political and community groups, including commissioners, city councils, emergency managers and the general public. Many of these meetings and/or presentations were provided as a direct result from public requests. To insure a formal opportunity for the public to provide input, staff and members of the RHMP Partners group hosted two public meetings, one in Woodinville and one in Federal Way. Meeting content included an overview of the hazard mitigation process and the plan. The second planning group held a meeting for public comment on August 23rd, 2004 in Auburn. A separate public meeting for the City of Kirkland was scheduled and conducted in February 2005.

The public presentations completed prior to the submission of the plan to Washington State Emergency Management are listed in **Annex E: Public Participation.**

Citizen Involvement

The RHMP group benefited greatly from the interest and involvement of a private citizen who was willing to dedicate time and disaster-related expertise to the project. He contributed a considerable amount of personal time doing research, developing sections of the plan, reviewing the draft document, and helping to facilitate meetings.

Participating Agency Input

For participating agencies, the review process was incorporated into the weekly work group meetings and monthly RHMP partner meetings. Partners were provided with draft documents in hard copy and/or via electronic format for their review. There were able to provide input, additions and corrections throughout the entire process.

Public Review Comment Period/Process

Throughout the planning process the RHMP was made available via the World Wide Web for public review; no comments were received from the general public by the November 8, 2003 deadline. Any written comments received after November 8, 2003 and prior to March 1, 2004 were to be addressed in the next planning phase starting in 2004. The additions to the plan from Group 2 were posted to the King County OEM website in August, 2004. The plan was also distributed during public meetings with utility commissioners, city councils and

fire commissioners. A comment period for 2005 began on December 1st ending on December 14th, 2005.

Documentation

King County Office of Emergency Management, the coordinating agency, documented and tracked meeting attendance, participation activities, and public review and comment throughout the entire planning process.

RHMP partners were required to sign in at all meetings. Later in the process, OEM designed an electronic tracking record in order to monitor week-to-week agency participation.

OEM project staff developed a "functional group work plan" that outlined the weekly activities for each discipline group. Each agency was required to submit data in hardcopy and electronic formats. All data was filed in electronic as well as hard copy filing systems. In order to track whether data was submitted and if it was complete, OEM staff also developed a quick-reference tracking form. Meeting reminders and meeting summaries were provided to partners via e-mail.

Agendas and draft plan documents were provided at public meetings. Public input and comments were documented. Comments and input received through other avenues, such as participant meetings, agency review, or the web site were documented and maintained in hard copy files. Electronic media was also maintained in the electronic filing system. All plan comments were addressed and documented. For comments that were not included in the December 8th plan submission, written justification was provided.

All documents are maintained at the King County Office of Emergency Management. Work plan, data summaries and other tracking documents are in **Annex C: Agency Participation**.

Benefit-Cost Review

A measure of benefit-cost review for initiatives is a requirement of this mitigation plan. The Office of Management and Budget Circular A-94 describes the economic principles and methods by which most federal programs must determine the cost-effectiveness of funded projects. OMB A-94 states: "Analysis should include comprehensive estimates of the expected benefits and costs to society based on the established definitions and practices for program and policy evaluation. Social benefits, and not the benefits and costs to the Federal Government, should be the basis for evaluating government programs or policies that have effects on private citizens or other levels of Government."

Benefit-Cost Review (BCR) is an effort to objectively prioritize projects that will best serve the community in a cost-effective way. This key element in the planning process is derived from the use of relative cost-to-benefit ratios. Many of the regional partners participating in the development of the regional hazard mitigation plan used Mitigation 20/20 software methodology to generate this ratio by using a formula. The formula requires an estimated cost to implement the project, the estimated replacement cost of the infrastructure protected by the project and the population served by the services provided by agencies using the infrastructure.

The method worked well for projects associated with tangible property but did not work as well for public education projects and code changes. Dollar figures could not be estimated for the benefit to these initiative measures.

All initiatives listed by the participant jurisdictions have cost-benefit figures where the number can be generated.

Plan Administration and Maintenance

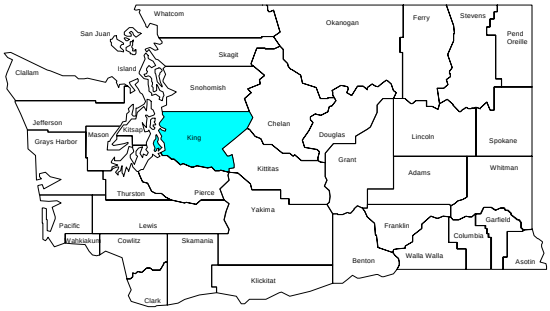
The King County Office of Emergency Management Director/ Program Manager will hold the Regional Hazard Mitigation Plan (RHMP). The King County Office of Emergency Management will be responsible for administering changes to the plan, facilitating the planning process for new partners, and forwarding annual revisions to Washington State Emergency Management for review.

Signatory jurisdictions, businesses and agencies to the RHMP are responsible for the maintenance of their individual strategies, revision of incomplete mitigation initiative efforts, and submission of those changes to the King County Office of Emergency Management for review by the Regional Hazard Mitigation Plan Taskforce. RHMP amendments, revisions and additions will be provided to the Regional Hazard Mitigation Plan Taskforce by the end of September each year for review. Changes to RHMP sections one through six will be affirmed by the impacted department managers.

The RHMP will be revised annually for resubmission to FEMA and the State of Washington. Submission will be on the second Monday of December. Changes to the RHMP will be posted on the King County Office of Emergency Management website. A public meeting to present the plan changes or additions was conducted one month after review by Washington State Emergency Management but prior to acceptance by FEMA. Public comment will continue to be solicited. A two week public comment period on the 2005 amendment has been posted to two local newspapers and noted on the King County website.

Section 3: Regional Profile

Geography[1,2,3]



Located on Puget Sound in Washington State and covering 2,134 square miles, King County is nearly twice as large as the average County in the United States.

King County is geographically diverse, extending from Puget Sound in the west to 8,000-foot Mount Daniel at the Cascade crest to the east. Except for the northern boundary shared with Snohomish County, each of the County's borders reflects unique geographic contours. The eastern boundary closely follows the Pacific Crest National Scenic Trail, the crest of the Cascade Range. The White River delineates the County's southern boundary, while the western part of the County faces Puget Sound.

King County contains a wide variety of landforms including saltwater, coastline, river floodplains, plateaus, slopes and mountains, punctuated with lakes and salmon streams. Lake Washington, covering 35 square miles, and Lake Sammamish with eight square miles are the two largest bodies of fresh water. Vashon and Maury Islands in Puget Sound and Mercer Island in Lake Washington provide different island environments. Major rivers include the Snoqualmie, White, Green and Cedar Rivers, which all flow out of the Cascade Mountains through the County.

The western part of the County, where the vast majority of the population has settled, is an alluvial plain near sea level. In the east are the Cascade Mountains. The County only has three vehicular exits to the east: Stevens Pass, Stampede Pass and Snoqualmie Pass. A substantial portion of the eastern King County is in the Mount Baker-Snoqualmie National Forest.

Climate[4,5]

King County's climate is mild and moderately moist; winters are comparatively warm with mild, temperate summers. The average summer temperature is 64 degrees, and temperatures climb over 90 degrees only a few days per year. During the winter, temperatures rarely drop below freezing (only 15 days per year). The area's wet season extends from October through April, during which

82 percent of annual rainfall occurs (about 35 inches a year). Heavy rainfall is rather rare; instead the area experiences a stable level of light rain throughout the winter. Snow accumulations below the 2,000-foot level are uncommon and rarely remain two days after such storms. The average monthly snowfall is .98 inches over a five-month period in the winter, with the heaviest accumulations occurring in December and January.

Population and Demographics[1,2,6,7]

With a population of 1,737,034 and 29 percent of the state's population, King County is the largest county in Washington State, and the 12th largest in the nation. It is also the most densely populated area in the state, with 814 people per square mile. As a populous large county with a major central city, King County comprises the majority of the "Seattle-Bellevue-Everett-Tacoma" metropolitan area.

Population Distribution

Given the total land area of King County of 2,134 square miles, the majority of the population resides on only 381 square miles of incorporated land or 18 percent of the entire County.

About 78 percent of King County residents, 1,387,261 people, live in incorporated cities and towns; 32 percent live in Seattle alone, the largest City in the Pacific Northwest. The next three largest cities are Bellevue, Federal Way and Kent. During the 1990s there was a strong increase in incorporations and annexations. Among the new cities in the 1990s are Burien, Covington, Kenmore, Maple Valley, Newcastle, Sammamish, Shoreline, and Woodinville.

Unincorporated King County, the territory outside any city, has about 349,773 people or 20 percent of the County's population on 82 percent of its land area. Most of the population resides on the Seattle-sized portion within the Urban Growth Area designated by Growth Management. Unincorporated areas of King County range from urban communities such as White Center, Kingsgate and Fairwood to tiny rural communities, farmland, commercial forest, national forest and wilderness area with almost no residents.

More than 96 percent of the overall population in the County lives in densely settled urbanized areas, with the remaining living in rural settings. **See Map 3-1: Population Density**.

Population by Age and Sex

King County has an aging population with a median age near 36. People ages 20-64 account for the majority of the population, about 67 percent. Young people age 19 and under account for 25 percent of the population. Approximately one in ten people living in King County is older than 65.

Table 3-1: Population by Age

Age Group	Population	%
0-4	105,321	6.1%
5-19	329,415	18.9%
20-54	978,999	56.4%
55-64	141,527	8.1%
65-84	157,232	9.1%
85+	24,540	1.4%
Total	**1,737,034**	**100%**

Source: U.S. Census Bureau – 2000 Census

The median age for both male and female are very close, age 35.92 for male and 35.08 for female. The number of males and females are proportionally the same, until age of 65 and older where the percentage of females increases significantly over that of males.

Table 3-2: Population by Sex

Age Group	Male Population	%	Female Population	%
0-19	222,752	25.8%	211,984	24.3%
20-54	496,004	57.4%	482,995	55.4%
55-64	70,432	8.1%	71,095	8.1%
65-84	67,962	7.9%	89,270	10.2%
85+	7,307	.8%	17,233	2.0%
Total	**864,457**	**100%**	**872,577**	**100%**

Source: U.S. Census Bureau – 2000 Census

Households

King County has 710,900 households, an increase of 95,000 since 1990. The average household size is 2.39, and while household size in some Eastside communities continue to decline, it remains stable in Seattle and is actually increasing in some South County communities. The majority of households, 584,974 (82.3%) are located within cities and 125,942 (17.7%) households are located in unincorporated areas.

The County has more single-person households than family households consisting of a married couple with children. The number of married couples without children exceeds the number of married couples with children. Single parent households represent a smaller percentage of the population in King County than nationally – and smaller in Seattle than in the suburbs.

Table 3-3: Household Types

Household Types	Number of Households	%
Married with children	150,574	21.2%
Married, no children	179,194	25.2%
Single Parents, other family	90,191	12.7%
Single-person households	290,957	40.9%
Total	**710,916**	**100%**

Source: U.S. Census Bureau – 2000 Census

Cultural Diversity

King County exhibits growing diversity; its racial and ethnic characteristics shifting significantly in the last ten years. Over 25 percent of the County's population is now comprised of people of color or different ethnic groups. The County is also more ethnically diverse than the state as a whole.

According to the 2000 Census, ethnic diversity has increased from 16.7 to 27 percent in the last ten years. During this period the Hispanic or Latino population more than doubled to 95,000 persons making up 5.5 percent of the population. The Asian population has increased about 70 percent to187,000 persons, accounting for 10.7 percent of the population. The Non-Hispanic White population is the slowest growing racial group. The African-American population has been growing less rapidly, about 23 percent over the last ten years, and the Native American population has remained about the same.

Table 3-4: Cultural Diversity

Ethnic Category	Population	%
Non-Hispanic White	1,275,127	73.4%
Asian	186,615	10.7%
Hispanic	95,242	5.5%
Black or African American	91,798	5.3%
Pacific Islander	8,737	0.5%
Native American	14,278	0.8%
Other	4,577	0.3%
Two or more races	60,660	3.5%
Total	**1,737,034**	**100%**

Source: 2003 King County Annual Growth Report

While Seattle is somewhat diverse, the dispersion of persons of color outside Seattle presents some interesting trends. Bellevue has the highest percentage of Asian population. South King County is experiencing the most dramatic increase in diversity, with minority populations doubling and tripling in several communities. Tukwila has the largest percentage of minorities, 46 percent. Burien, Sea Tac and Federal Way have large Pacific Island communities as well as black, Latino and Asian populations. Countywide, the foreign-born population has nearly doubled to 268,000 people or 15 percent of the population. Immigrants to King County have come from literally all over the world, with Mexico, China, Vietnam, and the Philippines sending the most people in the last ten years. King County also has 7,200 residents from the Ukraine and 5,500 from Russia – both significant increases in the last decade.

Approximately 63,000 persons over the age of five (3.9 percent of the population) do not speak English well or at all. Almost half of this linguistically isolated population speaks Asian or Pacific Island languages, including Chinese, Vietnamese, Tagalog and Korean. The diversity of European languages has also increased greatly, especially Russian and Spanish.

Nearly one in five King County residents does not speak English as their primary language at home, and about eight percent speak English less than well. Asian-Pacific Islanders may have language barriers more than other minority people groups.

People with Disabilities

About 16.1 percent of the King County population over the age of five has a disability. The breakdown between males and females is relatively close, with males experiencing a slightly higher disability rate. People over the age of 65 account for 10.8 percent of the entire population, yet this age group represent the largest percentage of people having disabilities, almost 40 percent. About 15 percent of working-age adults have a disability that does not require them to be institutionalized, and about two in three are employed.

Table 3-5: Non-Institutionalized Disabled Population
(people age 5 years and over)

Age	Total Population	Population with a Disability	%
5-15	242,496	12,689	5.0%
16-64	1,199,800	177,507	14.8%
Over 65	175,083	69,647	39.8%
Total	**1,617,379**	**259,843**	**16.1%**

Source: U.S. Census Bureau – 2000 Census

Specific types and breakdowns of disabilities can be difficult to ascertain from Census reports since data is based on self-identification. Participants may not perceive and identify certain impairments or physical/mental challenges as a "disability." The statistics in the table below reflect general disability categories and reflect the possibility that more than one type of disability may apply to a single individual.

Table 3-6: Disability by Type
(people 5 years and over)

Type	Population	%
Sensory	52,388	3.2%
Physical	105,173	6.5%
Mental	72,457	4.5%
Self-Care	33,488	2.1%

Source: U.S. Census Bureau – 2000 Census

Population Growth and Future Trends

The County has been growing less in comparison to the state as a whole. The County is a large and mature county that saw rapid growth during earlier periods. In the last decade, King County's population has grown by 15 percent, a modest rate compared to other areas and nearby Puget Sound counties. However, given the large population already here, the growth numbers are significant. The increase in population since 1990 – 230,000 people – is equivalent to the total current population of the cities of Bellevue, Federal Way and Sammamish together. Just over one-third of this growth is due to people moving into the County.

South King County has experienced the biggest share of the County's growth, more than half, and the south remains the largest of three sub-areas with more than 630,000 residents. Rural areas of the County have grown at relatively slow rates.

Net population migration is a major contributor to population change, and typically varies as a result of changing economic conditions. King County is forecasted to grow by an additional 140,000 persons, eight percent, to about 1,875,000 in 2012. The bulk of this growth is expected to occur within designated Urban Growth Areas as identified in the Countywide Planning Policies (CPPs).

Housing[1,2,6]

The vast majority of the King County population, 98 percent, lives in single-family, multi-family and other types of residential housing. About two percent live in group quarters.

There are approximately 742,200 housing units in King County, an increase of more than 15 percent from 1990. About 60 percent of the housing stock consists of single-family housing, including detached houses and attached town-homes. The number of multifamily units, apartments and condominiums is 275,000 units or 37 percent of the housing stock. Home ownership accounts for 59.8 percent. Fully 425,000 households in the County own their own home. The median value of single family home is $236,900. Median rent ranges from $758 in the County to $721 in the City of Seattle.

Growth and Household Size

The number of housing units in King County is growing as fast as the population. The increase in housing since 1990 is almost evenly divided between single family including mobile homes and multi-family. Household size has stabilized after declining in the 1970s and 1980s and slight declines are anticipated in coming years, to about 2.30 by 2020.

Table 3-7: Housing Development

Single-Family	Multi-Family	Mobile Homes	Other
60.2%	37.0%	2.5%	0.2%

Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000

Age of Construction

The age of King County's housing stock generally mirrors the state average, but is slightly older with a greater percentage of units built before 1960. About two-thirds of all homes were built prior to 1980.

TABLE 3-8: HOUSING – YEAR BUILT

	Pre-1939 – 1959	1960 – 1979	1980 – 2000
King	33.5%	32.5%	33.9%
Washington State	*29.4%*	*32.7%*	*37.9%*

Source: U.S. Census Bureau, Profile of Housing Characteristics 2000

Group Housing

Group housing consists of school dormitories, nursing homes, military quarters, and institutional-type facilities. In 2000, there were 37,619 people living in a group living arrangement.

Table 3-9: Group Housing Types

Type of Quarters	Group Housing Population	% Group Housing Population
Correctional Facilities	4,402	11.7
Nursing Homes	6,849	18.2
Hospitals/wards, hospices and schools for chronically ill and disabled	714	1.9
Juvenile Institutions	560	1.5
College Dormitories	11,136	29.6
Military Quarters	232	.6
Group Homes/Quarters	5,570	14.8
Crews-Maritime Vessels	310	.8
Other	7,846	20.9
Total	**37,619**	**100.0%**

Source: U.S. Census Bureau – 2000 Group Quarters Population by Group Quarters Type

According to Washington State Department of Social and Health Services, there are currently 1,418 licensed family homes in King County with a capacity of 12,610 people. This equals 20 percent of the state's total. Based on 2002 data, vacancy rates are in the 13-15 percent range.

Homelessness[8]

City of Seattle Human Services Department estimates there are 6,000 homeless people in Seattle and King County on any given night. Of the 6,000 it is estimated that 1,000 are not sheltered. The number of estimated homeless youth (ages 12-24) range from up 1,000 in Seattle and up to 2,000 or more in King County. King County and Seattle have an extensive network of emergency shelter facilities with total year-round capacity of over 2,700 slots. Additional emergency shelter is made available as a response to winter weather, October through March. Homeless individuals and families who are not housed in shelter facilities typically utilize benches, parking garages, vehicles, areas under roads and bridges, doorways, parks, greenbelts, bus stops, alleys and other locations.

Geopolitical Jurisdiction[9]

Governmentally, King County is divided into 40 jurisdictions including County and 39 municipal agencies. In addition to county government and cities, there are other equally-vital public agencies and taxing districts that contribute the overall governmental infrastructure serving citizens within the region. They include the Port of Seattle, Native American Tribes, school districts, fire protection districts, public hospital districts, water districts, sewer districts, flood zone control districts, drainage districts, parks and recreation districts, and other miscellaneous districts. This section identifies all public agencies defined as a "taxing authority."

King County Government[10]

King County operates under a Home Rule Charter adopted by a vote of the citizens of King County in 1968 and is organized under the Council-Executive form of county government. The Metropolitan King County Council is the policy-making legislative body of the County. The Council's thirteen members are elected by district and serve on a full-time basis. The County Council sets tax levies, makes appropriations, and adopts and approves the annual operating and capital budgets for the County. The County Executive serves as the chief executive officer for the County. Other elected County officials include the Prosecuting Attorney, Sheriff, Judges and Assessor. Every County citizen, including city residents, has an opportunity to vote for County-elected officials.

King County provides regional services to all residents of the County, including people who live in cities. These include public transportation, courts and related legal services, property tax appraisals and collections, criminal detention, rehabilitative services, public health care, records and elections, emergency management, water quality, flood control, sewage treatment and disposal, regional parks and facilities, and the King County International Airport (Boeing Field). In unincorporated communities, the County provides additional local services such as building and land use development, fire code enforcement, police protection, road construction and maintenance, fire investigation, local parks and animal control. In addition, the County has contracts with some cities to provide local services to incorporated areas of the County. Other local services in unincorporated communities are provided by fire, utility, library and hospital districts which operate independently of County government.

The majority of King County's funding is derived from taxes and charges for services. Other revenues include licenses and permits, intergovernmental revenue, federal grants (direct and indirect), federal shared revenues, state grants, state shared revenues, state entitlements, grants from local units, intergovernmental payment, fines and forfeits and miscellaneous revenue[11]. See **Map 3-2: Unincorporated King County, Cities and Towns.**

Cities and Towns

There are 39 cities and towns in King County, the largest number of any county within Washington State. The largest city is Seattle with a population of 563,374 people. The next largest cities include Bellevue with 109,827 people, followed by Federal Way, Kent, Shoreline and Renton all with populations over 50,000. In contrast, some of the smallest cities or towns like Skykomish, Beaux Arts and Hunts Point all have populations less than 500. The Cities of Auburn and Algona are partially located in Pierce County to the south and a portion of Bothell is located in Snohomish County to the north. Cities and towns located in King County are identified on **Table 3-10.**

Cities and towns are governed either by a council/mayor or a council/city manager form of government.

Municipal government generally provides the same types of services as county government. Depending on the size and needs of the jurisdiction, such services typically include: fire, police, building and land use development, public works (roads, transportation, and utilities), human services, parks and recreation, economic development, waste management, and municipal court services. Some cities and towns may contract with other agencies, such as fire districts or the King County Sheriff's Office, for services.

The majority of funding for municipalities comes from property and other taxes including sales, business and occupation, motor fuel, admission, leasehold excise, utility, gambling and lodging taxes. Additional funding is provided from special licensing fees, permit fees, grants, state-shared per capita distributions, fines and penalties, grants, EMS levies, franchise fees, charges for service, investment interest, mitigation fees (fire, parks, transportation), parks fees, and investment interest. See **Map 3.2: Unincorporated King County, Cities and Towns.**

Port of Seattle[12]

The Port of Seattle is a municipal corporation created in 1911 by the voters of King County. They are charged with construction, maintenance and operation of harbor and airport facilities, including seaport cargo and vessel-handling terminals, Seattle-Tacoma International Airport, Fishermen's Terminal, and Bell Street Pier Cruise Terminal at Pier 66. Their services and facilities accommodate transportation of cargo and passengers by air, water and land; provide a home for the fishing industry; and fosters regional economic vitality and quality of life for King County citizens. The Port operates its own police and fire departments. The port is governed by port commissioners elected by the citizens of King County. Their funding is obtained through property taxes, interest recipes, bond

issues, grants, passenger facility charges, and other miscellaneous revenue. See **Map 3-3: Port of Seattle Properties**.

Table 3-10: King County Cities

City	2000 Population	2002 Land Area (sq. miles)	2002 Assessed Value (in thousands)
Algona	2,460	1.31	265,203
Auburn	42,901	21.45	2,928,335
Beaux Arts	307	0.08	68,899
Bellevue	109,827	31.70	19,705,692
Black Diamond	3,970	6.19	358,660
Bothell	16,185	5.67	1,823,459
Burien	31,881	7.44	2,382,652
Carnation	1,893	1.16	137,293
Clyde Hill	2,890	1.06	854,274
Covington	13,783	5.55	948,855
Des Moines	29,267	6.56	1,828,326
Duvall	4,616	2.21	476,016
Enumclaw	11,116	3.82	672,049
Federal Way	83,259	21.53	5,620,635
Hunts Point	443	0.29	531,196
Issaquah	11,212	9.93	2,362,753
Kenmore	18,678	6.18	1,768,808
Kent	79,524	29.04	7,579,363
Kirkland	45,054	10.51	6,726,540
Lake Forest Park	13,142	3.58	1,392,039
Maple Valley	14,209	5.62	1,138,794
Medina	3,011	1.42	1,715,391
Mercer Island	22,036	6.34	5,705,115
Milton (KC portion)	814	0.55	51,125
Newcastle	7,737	4.48	1,007,185
Normandy Park	6,392	2.55	796,605
North Bend	4,746	2.96	489,204
Pacific	5,373	1.94	253,644
Redmond	45,256	15.92	8,213,241
Renton	50,052	17.06	5,565,475
Sammamish	34,104	21.58	5,082,720
Sea Tac	25,496	10.27	3,041,736
Seattle	563,374	83.93	74,953,452
Shoreline	53,025	11.70	4,545,786
Skykomish	214	0.33	17,473
Snoqualmie	1,631	5.26	583,629
Tukwila	17,181	9.06	3,340,379
Woodinville	9,194	5.66	1,563,376
Yarrow Point	1,008	0.36	463,604
Total	**1,387,261**	**382.27**	**$ 177,959,283**

Source: 2003 King County Annual Grown Report

Native American Tribes

There are two Native American Tribes located within King County, the Muckleshoot and Snoqualmie Tribes.

The Muckleshoot Indian Tribe (MIT) was established in 1874 and is comprised of the descendants of the area's original Coast Salish peoples. The Tribe has lived in this area for thousands of years. As time passed, a number of people from other local Tribes, such as the Duwamish and Snoqualmie, were absorbed into the Muckleshoot Tribe, as well as other neighboring federally recognized Tribes including the Tulalip and Suquamish. The six square-mile Muckleshoot Reservation located near Auburn is laid out diagonally and has 20 miles of boundaries. Most of the reservation is surrounded by the farms and rural area, with urbanization encroaching on the western portion. The Muckleshoot Tribe is one of Washington State's larger tribes, with a population of about 3,300. Through the Indian Reorganization Act, the Tribe adopted its constitution in 1936. It provides for a nine-member council. With advice and input of the General Council comprised of all community members, the Muckleshoot Tribal Council provides a full range of governance services to the reservation[13,14]. See **Map 3-4: Muckleshoot Tribal Lands**.

The Snoqualmie people have lived in the Snoqualmie River Valley at least from 1844 to present. After 67 years of petitioning, the Snoqualmie Tribe was re-recognized by the Federal Government in 1999. This provided the Tribe with the right to acquire its initial reservation land. The Snoqualmie Tribe currently has approximately 1,000 members. Historically, the tribal members lived in the area of east King and Snohomish Counties that now contain the communities of Monroe, Carnation, Fall City, Snoqualmie, North Bend, Mercer Island and Issaquah. Tribal members continue to live in each of these communities. The Tribe is governed by a tribal constitution and elected council. The Tribe's governing structure includes building codes, health codes and other standard governmental functions[15].

School Districts

There are 20 school districts within King County that provide an opportunity for education to all children. They include:

Table 3-11: School Districts		
School District	**2000 District Population**	**2002-03 Enrollment**
Auburn #408	67,700	13,621
Bellevue #405	114,600	15,656
Enumclaw #216	25,500	5,112
Federal Way #210	123,000	22,449
Highline #401	122,500	17,735
Issaquah #411	73,200	14,759
Kent #415	137,600	26,694
Lake Washington #414	153,500	24,098
Mercer Island	22,000	4,133
Northshore #417	72,000	20,181
Renton #403	95,500	13,100
Riverview #407	15,800	2,912
Seattle	564,200	47,853
Shoreline #412	66,000	10,099
Skykomish #404	600	76
Snoqualmie #410	25,900	4,719
Tukwila #406	16,000	2,742
Tahoma #409	28,800	6,272
Vashon Island #402	10,100	1,606
Fife 800 (KC portion)	2,500	N/A
Total	**1,737,000**	**253,817**
Source: 2003 King County Annual Growth Report *WA State Public School Building Count 2002-2003*		

Under the constitutional framework and laws of the State of Washington, the governance structure for the state's public common school system is comprised of the following bodies: legislature, governor, superintendent of public instruction, state board of education, educational service district boards of directors, and local school district boards of directors (elected by the citizens). The respective policy and administrative roles of each body are determined by the State Constitution and statues. Local school districts are political subdivisions of the state[16]. The primary source of funding for grades K-12 comes from the State funding. In fact, about one-quarter of the State's distribution of operating expenditures goes to K-12 education. School districts obtain additional revenues from the federal government, local levies, Washington State Initiative 728 (education reform and improved student learning funding), capital improvement bonds, fees for service, local taxes, grants, school districts and other sources[17]. See **Map 3-5: School Districts**.

Fire Protection Districts

There are 28 fire protection districts (in addition to municipal fire departments) whose role it is to eliminate fire hazards, protect life and property, and provide suppression and emergency medical services. **Table 3-12** reflects district data only; municipal fire department data (i.e. population, service area) is located in **Table 3-10.** A few municipalities contract with fire districts to provide fire service.

Table 3-12: Fire Districts

Fire District	Service Population	Service Area (sq. miles)
Burien/Normandy Park (KCFD #2)	32,000	8.5
Eastside Fire and Rescue (KCFD #10, #38) *(merged with Issaquah Fire–district figures only)*	91,900	189.0
Federal Way Fire Department	125,000	34.0
KCFD #14 – Bellevue*	?	4.0
KCFD #17 – Black Diamond*	3,375	19.0
KCFD #20 – Skyway/Bryn Mawr/Lakeridge	14,000	4.5
KCFD #24 – SeaTac*	30	1.0
KCFD #25 – East Renton*	10,000	4.5
KCFD #26 – Des Moines	30,000	5.5
KCFD #27 – Fall City	6,300	24.5
KCFD #28 – Enumclaw	40,000	80.0
KCFD #31 – Auburn*	350	4.0
KCFD #34 – Redmond	10,000	26.0
KCFD #37 – Kent*	58,280	23.5
KCFD #40 – Spring Glen/Cascade/Fairwood	43,000	12.0
KCFD #41 – Kirkland*	30,000	20.0
KCFD #45 – Duvall	13,000	55.0
KCFD #47 – Kangley/Palmer	1,500	26.0
KCFD #50 – Skykomish/Stevens Pass	1,000	140.0
KCFD #51 – Snoqualmie Pass	200	14.0
Maple Valley Fire and Life Safety (KCFD #43)	40,000	55.0
Mountain View Fire and Rescue (KCFD #44)	25,000	50.0
North Highline Fire District (KCFD #11)	40,000	9.0
Northshore Fire Department (KCFD #16)	31,000	11.0
Shoreline Fire Department (KCFD #4)	56,000	13.5
Vashon Island Fire and Rescue (KCFD #13)	10,500	48.0
Woodinville Fire and Life Safety (KCFD #36)	42,000	36.0

**Services provided by the city*
Source: RHMP Participating agencies; 2002 WA Fire Service Directory

Each fire district is governed by a board of fire commissioners elected by the citizens living within the district. Fire Districts are primarily funded through property taxes. Additional revenues are obtained through benefit charges,

capital improvement bonds, and grants. See **Map 3-6: Fire Districts and City Departments**.

Public Hospital Districts[18,19]

There are three public hospital districts that own and operate hospitals and other health care facilities in King County. Hospital districts are community supported governmental entities charged with delivering health care to their communities. They fulfill a vital role in King County because without them many people would be unable to receive healthcare. The Washington State legislature granted local communities the ability to create their own hospital districts in 1945. Nearly half of all Washington's 90 hospitals are part of a public hospital district. Districts are authorized not only to operate a hospital, but to deliver any service to help people stay healthy – physically, socially and mentally. Hospital districts are located in areas considered to be "rural" in character. Public hospital districts within King County include:

District #1 - Valley Medical Center
(Kent, Renton and two-thirds of Tukwila)

District #2 - Evergreen Healthcare
(Bothell, Redmond and Woodinville)

District #4 - Snoqualmie Valley
(Snoqualmie. North Bend, Carnation, Fall City, Preston and Snoqualmie Pass)

Public hospitals are governed by hospital commissioners elected by the citizens living within their district. Levy funds typically provide a small portion of the hospital revenues. The majority of funding is obtained through inpatient and outpatient services, and other services. See **Map 3-7: Public Hospital Districts**.

Utility Districts

There are 22 water districts in King County that are responsible for acquiring and distributing water, construction and maintaining water storage and distribution facilities and infrastructures, and managing water resources.

Covington Water District
Fall City Water District
Highline Water District
King County Water District #1 – Yarrow Point
King County Water District #19 – Vashon Island
King County Water District #20 – Burien/Riverton/McMicken Heights
King County Water District #42
King County Water District #45 – Seattle
King County Water District #49 – Burien
King County Water District #54 – Des Moines/Normandy Park/ Burien
King County Water District #83
King County Water District #86
King County Water District #87
King County Water District #90 – Renton
King County Water District #94
King County Water District #105
King County Water District #111 – Kent
King County Water District #117 – Bellevue
King County Water District #119 – Carnation/Duvall
King County Water District #123 – Present
King County Water District #125 – Riverton Heights
Shoreline Water District

Water Districts are typically funded from water sales and base charges, fees such as water availability certificates, hydrant permits and street light fees. Restricted funds include general facilities and local facilities charges paid when customers hook-up to a system and G.O. bonds or revenue bonds. See **Map 3-8 Water Service Utilities**.

There are seven sewer districts that are responsible for managing wastewater needs of the community. This includes construction, maintenance and operation of sewer system facilities and infrastructures. Sewer districts obtain their funding through fees and charges. See **Map 3-9: Wastewater Service Utilities**.

Highlands Sewer District
Midway Sewer District
Ronald Wastewater
Snoqualmie Pass Sewer District
Southwest Suburban Sewer District
Stevens Pass Sewer District
Val Vue Sewer District

There are eleven combination water/sewer utility districts in the County. They include:

Bryn Mawr-Lakeridge Water and Sewer District
Cedar River Water and Sewer District
Coal Creek Utility District
Lakehaven Utility District
Northeast Sammamish Sewer and Water District
Northshore Utility District
Sammamish Plateau Water and Sewer District
Skyway Water and Sewer District
Snoqualmie Pass Utility District
Soos Creek Water and Sewer District
Woodinville Water District (KCWD #111)

Utility districts are governed by elected commissioners.

Flood Zone Control Districts[9,20]

There are ten flood zone control districts in the County that operate and maintain flood control projects. They include: #082 Cumberland, #135 Enumclaw, #143 Evans Creek, #199 Green River, #200 Green Water, #309 Kimball Creek, #400 Patterson Creek, #549 Sikes, #555 SW Lake Sammamish, and #665 West Lake Sammamish. Flood zone control districts are governed by commissioners elected by citizens within their district.

Drainage Districts[9,20]

There are six drainage and diking districts in King County. They Include: #1 – Green River Valley, #2 – Military Road/Green River, #5, #6 – Enumclaw South, #7 – Farmland joining Cherry Creek-Duvall, and #13 – Farm area north of Enumclaw. Their funding comes from assessments for service (not a property tax).

Parks and Recreation Districts[9,20]

There are five parks and recreation districts that provide for leisure activities and recreational facilities. They include: #076 Coalfield Park and Recreation, #555 Enumclaw Park and Recreation, #550 Northshore Park and Recreation, #548 Shoreline Park and Recreation, and #002 Vashon Park and Recreation. Park and recreation districts are governed by commissioners elected by citizens in the district. Their funding is obtained through special levies.

King County Library System (Rural Library District)[21]

King County Library System (KCLS) is the third largest circulating library in the United States. The system includes 42 libraries and a traveling library center that serve over one million residents. The governance of the District is a Board of Trustees appointed by the King County Executive and confirmed by the County Council. Additional oversight is provided by boards in cities and library groups throughout the district. Their primary funding is obtained through levy taxes.

Puget Sound Clean Air Agency (King County Air Pollution Control)[22]

Puget Sound Clean Air Agency Control enforces federal, state and local air quality laws and regulations in King, Kitsap, Pierce and Snohomish counties. Their policies and programs are designed to meet and maintain air quality standards, protect human health, prevent injury to plant and animal life and protect Puget Sound's panoramic views. They are governed by a board of directors. Their funding is obtained from fees and federal, state, county and city funding.

Cemetery District #1

Cemetery District #1 is located on Vashon Island. It is governed by elected district commissioners. They receive their funding from tax levies.

Economy[1,2,4,6,7]

Employment

King County is a nationally important market, with the ninth largest number of jobs among the nation's 3,100 counties, and a year 2000 payroll of $54 billion, ranking eighth in the nation.

Employment growth is a driver of King County's population and housing growth. More than 1.1 million workers are employed within the borders of King County, at nearly 65,000 business establishments. With more than 40 percent of Washington State's jobs and payroll, the County is truly the economic engine of Washington and the Pacific Northwest. The County's economy is larger than that of several U.S. states.

In 2000, King County had 43 percent of Washington jobs, but only 29 percent of the population and 30 percent of the housing units. During the 1990s, the number of jobs grew faster than population and housing. Most of these workers live in King County, but an increasing number commute in from Snohomish, Pierce and other counties.

Although King County contains only three percent of the State's land area, it is large and diverse with many different job centers. Manufacturing and warehousing dominate in South Seattle and South King County. High-tech industries are located mostly in Seattle and the Eastside (Bellevue/Redmond/ Kirkland area) and services and retail are located throughout the County.

The economy of King County is diverse, though more heavily dependent on the services and trade sectors than the state as a whole. The table below provides a profile of employment in various economic segments in King County.

Table 3-13: Employment by Industry – 2001

Industry	Number of Workers	%
Wholesale and Retail Trade	185,200	15.8%
Professional and Business Services	174,700	15.0%
Government and Education	158,000	13.5%
Manufacturing	131,900	11.3%
Leisure and Hospitality	102,300	8.7%
Financial Activities	78,600	6.7%
Health Services	75,700	6.5%
Information	72,600	6.2%
Construction	63,700	5.4%
Transportation, Warehousing , Utilities	51,400	4.4%
Other Services	39,300	3.4%
Social Assistance and Educational Services (private)	35,600	3.0%
Natural Resource and Mining	1,300	.1%
Total	**1,170,300**	**100%**

Source: 2003 King County Annual Growth Report – Washington State Security Department 2003

The services producing sector is the largest in the County's economy, with 83 percent of employment. It has been the fastest growing sector since 1970; almost half of all new jobs in King County from 1994 to 1999 (91,100 jobs) were in services. Some of the highest paid workers in the County are in the services sector, as well as some of the lowest paid workers. However, the bulk of job growth in recent years has been in the higher paying jobs, primarily in the software industry. In fact, our region is ranked fifth in the nation for concentration of high-tech businesses.

About eleven percent of the County's employment base is in manufacturing. Transportation equipment is the largest industry in this sector, with the bulk of manufacturing employment (about 41%) in the aerospace products and parts.

However, manufacturing is diversifying with advanced technology. Computer and electronic products account for about ten percent of manufacturing trade, most of which has occurred in the Interstate 5/Interstate 405 corridor. Non-durable goods, which include the production of food products, account for 23 percent of all manufacturing.

About 7.6 percent of the County's jobs are in the transportation and public utilities sector. More than half of the State's jobs in this sector are in the County, primarily due to activities at the Port of Seattle and SeaTac International Airport. The County is also home to the television media that serves most of western Washington.

As a regional finance and insurance hub, King County's employment in the finance, insurance, and real estate sector is larger than the rest of the State. In 1999 the County had 54 percent of all statewide employees in this sector. The state's banking and insurance industries are primarily headquartered in Seattle as are most security and commodity brokers, holding companies and investment firms.

Approximately 13.5 percent of the jobs in King County are in the public sector. There are about 80,000 employees at the local government level and primary employers are K-12 school districts. King County Government employs approximately 12,000 people. Cities, including Seattle, are the largest municipal employers. Seattle employs over 12,700 people. State Government provides another 41,000 jobs, with employment driven primarily by the University of Washington and eleven community colleges. The federal government employs over 21,000 people; almost one-third of its employment is in the postal service.

Major businesses and employers in King County include:

- Bank of America
- Boeing Company
- Bon-Macy's
- City of Seattle
- Evergreen Healthcare
- Fred Meyer
- Group Health Co-operative
- King County Government
- Providence Health System
- QFC
- Qwest Communications
- Safeway Stores Inc.
- Seattle School District #1
- Swedish Hospital
- United States Postal Service
- University of Washington

Top companies with headquarters located in King County:

- Airborne Express*
- Alaska Air Group, Inc.
- Amazon.com
- AT & T Wireless
- Attachmate
- Costco*
- Microsoft*
- Nintendo
- Nordstrom*
- Paccar*
- Phillips Medical Systems
- REI
- Safeco*
- Starbucks
- Washington Mutual Bank
- Western Wireless
- Weyerhaeuser*

*Fortune 500 Companies

International Trade

Washington State exceeded $46 billion in foreign exports in 2001. Nearly three-quarters of Washington exports are coming from the central Puget Sound region. Two-way trade through Seattle involves more than 100 countries and amounted to over $106 billion in 1999. As a result, the economy is extremely dependent upon foreign trade. International trade (directly and indirectly) supports 740,000 jobs annually. One in three jobs in Washington State is involved in foreign exports. While the State represents about two percent of the nation's population, its ports handle seven percent of all U.S. exports and receive a six percent share of the nation's imports.

King County has evolved from a resource-based economy centered principally in forest products manufacturing, into an increasing diversified export base with significant orientation in high-tech industry, services, and trade serving broad national and worldwide markets. An increasing number of finished goods and services originating in King County, such as commercial aircraft and computer software, are exported overseas, particularly to Europe and the Far East. In addition to the major producers, Boeing Aerospace and Microsoft, new industry is developing in special market niches with high-growth market potential such as computer software and biotechnology. Other top exports include industrial machinery, electric machinery, cereals, medical or surgical equipment, grains/seeds/fruits, wood and wood products, paper products, fish and mineral fuel.

The top imports into Washington include high technology products, forest products, motor vehicles, motor vehicle parts, airplane engines, games, aircraft parts, petroleum gases, toys and office machine parts.

Our top ten trading partners include Japan, Korea, Singapore, Germany, China, Taiwan, UK, France, Canada and Saudi Arabia.

Income and Wages

King County is the strongest driver of the statewide average income due to its large population and highly paid high-tech and aerospace industries. Seattle is the regional industrial and commercial hub; headquarter offices of a large number of firms are located here and workers tend to have higher wages than others do around the state. Some of that difference also reflects high-tech jobs on the Eastside as well as high-wage manufacturing jobs in South King County. All of King County's economic sectors have higher salaries than that for the state, on average 14 percent higher.

In 2002, the median household income was $65,400, the largest in the state and well above national medians. This figure represents the point where half of all households have a higher income, and half have a lower income. The median, however, does not portray the breadth of income distribution. More than one-third of King County households report an income of more than $75,000, and almost one-third report an income under $35,000. Every community and every ethnic group has households with high and low incomes. However, there is still some income disparity by race.

Unemployment

Unemployment was at historic lows near three percent for several years, but the King County economy remains quite cyclical. Although unemployment has increased to about 6.6 percent as of August 2003, many businesses continue to suffer from a labor shortage. This current level is slightly higher than the national unemployment rate of six percent and somewhat lower than the State rate of 7.2 percent.

Poverty

About 8.4 percent or 142,500 of the people in King County live in poverty, considerably less than the 12.4 percent national rate, and slightly lower than the 10.6 percent rate in Washington State. An additional 192,000 people reported incomes below 200 percent of the official poverty thresholds, still a very low income. Approximately 9.4 percent of this group are children under the age of 18, and 7.4 percent are adults over age 65. These numbers likely increased during the recent recession; a recent U.S. Census survey estimated 9.5 percent now live below the poverty level.

Table 3-14: Poverty Rates		
% of Total Population	**Children under 18**	**Over age 65**
8.4%	9.4%	7.4%
Source: 2003 Washington State Hazard Mitigation Plan - U.S. Census Bureau of Selected Economic Characteristics: 2000		

Future Trends

King County's economy remains strong despite severe shocks resulting from recent key events. In February 2001, a 6.8 magnitude earthquake hit the Puget Sound region, causing significant damage and related costs that are still mounting. The following month, Boeing announced they would be moving their headquarters. As of mid-2002 Boeing, our major aerospace employer, laid off a significant number of employees, many in the Puget Sound region.

Manufacturing remains strong despite the ups and downs of the aerospace industry. Although the aerospace industry is well below its record employment levels, they continue to provide high wages to local workers. The computer services industry now employs almost as many as aerospace, although it too has lost ground. The composition of the economy is shifting from the traditional manufacturing and resource bases to high-tech, services and trade, both local and international.

Long range prospects are mixed. The move of the Boeing headquarters provides some uncertainty in the aerospace industry. Sales tax and other government revenues are declining at a time when public investment is needed.

Tourism[4]

King County is a domestic and international tourism destination, featuring scenic beauty, temperate climate, both metropolitan and rural activities, and easily accessible by air, land and water. Tourism is the state's fourth largest industry and the Western Washington region accounts for over half of statewide tourism.

Over the years King County has gained a reputation for providing excellent venues for conferences and conventions with several large convention centers and approximately 80 hotels with conference or convention meeting space and about 28,000 hotel rooms.

Throughout the County there is a multitude of cultural, recreational and entertainment venues, including museums, theater, historical landmarks, fine dining, tours by air, land and sea, shopping, major cruise lines, professional

sports, community and regional festivals, pleasure boating, camping, and many other indoor and outdoor recreation activities.

Transportation[4]

The King County region is a national hub for transportation on land, on water, and in the air. The extensive highway and railroad infrastructure supports the transport of people, commodities, and valuable resources. The water hosts a major international seaport, cruise ship facilities, and the largest ferry system in the world. Two major international airports, supported by aviation facilities unique to our geographical needs, play a key role in facilitating the economic vitality, tourism, and domestic and international trade. Our unique geographic diversity inspires a wide range of transportation alternatives for the everyday commuter, visitors and those involved in the movement of products and goods.

Air Service

King County has two major international airports as well as several other mid-size and small airports and airparks that accommodate different modes of air travel and business, pleasure and personal needs.

Sea-Tac International Airport [4,12,23]

Seattle-Tacoma International Airport (Sea-Tac) serves as the regional air hub for the Pacific Northwest, providing direct and regular service for passengers and cargo to major U.S. and international destinations. The airport is ranked among the five best U.S. airports by the International Airline Passengers Association and is consistently one of the top 20 busiest cargo airports in the United States.

Sea-Tac airport operates 24 hours a day, 365 days a year and is run by the Aviation Division of the Port of Seattle. Thirty airlines and six cargo-only carriers fly out of Sea-Tac. There are scheduled direct flights to more than 25 international and 66 domestic destinations. There are 40 non-stop flights to Asia and ten non-stop flights to London each day.

Sea-Tac is the 15th busiest U.S. airport in total annual passengers and the 25th busiest airport for aircraft operations. An average of 73,126 passengers passes through the airport each day.

Sea-Tac Airport has a strong and steady air travel market base. Approximately 76 percent of the travelers using the airport are origin and destination passengers, meaning they begin or end their trip at Sea-Tac Airport; the remainder is on connecting flights. Airline service is diversified among many carriers and the airport is not dominated by a single hub carrier.

The total number of passengers in 2002 was 26,690,843. The majority, 24,440,713 or 91.5 percent, were domestic passengers and 2,250,130 were international passengers. A little over one-third of passenger travel is done for business-related purposes; about ten percent of this group are local residents and the rest come from other destinations. About two-thirds of all passenger air travel is non-business related, with a fairly equal mix of resident and non-resident passengers. Annual air passenger levels have steadily increased over the last 30 years from 4.7 million in 1972 to an all time high of 28.4 million in 2000. Since 2000 there has been a 6.4 percent decrease in air passenger travel.

About 374,853 total metric tons of cargo is transported at Sea-Tac Airport. Over half, 57.5 percent, is domestic freight, 19 percent is international freight, and 23.5 percent is air mail. Air cargo levels have also increased in the last 30 years from 137,270 tons in 1972 to the all time high of 456,920 tons in 2000. There's been a dramatic 21.9 percent decrease in cargo levels in the two years since.

Sea-Tac is a significant employer. There are approximately 18,000 airport employees and 42,000 airport-related jobs off-site. About $6.9 billion in business revenue is generated by the airport, airlines and related businesses. Sea-Tac and related businesses generate $209 million in state and local taxes.

The airport is currently in the process of developing a third runway and making substantial improvements to the airport facility, including south terminal expansion, new central terminal, underground satellite transit system upgrade, improved parking garage lighting, and seismic reinforcements.

King County International Airport[24]

King County International Airport (KCIA), commonly known as Boeing Field, is owned and operated by King County. It is one of the busiest general aviation airports in the country – used by aircraft of all sizes and types, and filling a wide range of commercial and recreational needs. KCIA receives no general tax dollars and is financed by rents, fees and some Federal Aviation Administration (FAA) resources.

KCIA is located five miles south of downtown Seattle in the Duwamish corridor. It serves multiple functions: a municipal airport, testing and delivery facility for the Boeing Company, and as a major air freight center for the region's industries. KCIA averages 290,000 operations annually. The airport is a base for about 150 businesses, including air cargo companies, flight

schools, charter operations, and helicopter services. Other tenants include hundreds of small aircraft owners who use planes for recreational and business purposes. There are approximately 480 aircraft based at the airport. KCIA is a United States airport of entry, with U.S. Customs, Immigration, and Public Health and Agricultural Inspection facilities.

Renton Airport[25,26]

The Renton Municipal Airport, owned by the City of Renton, is a general aviation airport that serves Renton and other nearby communities. The airport provides regional aviation services for air charter, air taxi, corporate, business and recreational flyers. It is also an FAA-designated "Reliever" airport, diverting general aviation aircraft traffic from Sea-Tac International Airport.

The Airport is used predominately by single-engine piston aircraft, and ranks among the top six airports in the State of Washington in terms of aircraft landings and takeoffs. The Boeing Commercial Airplane Company, located adjacent to the airport, manufactures Boeing 737 and 757 aircraft and uses the airport for their initial flights.

Seaplane (or floatplane) operations from the Will Rogers-Wiley Post Memorial Seaplane Base, located at the north end of the airport along the shore of Lake Washington, also comprise a significant level of activity (see “Seaplane Bases” section).

There are approximately 286 aircraft based at Renton Municipal Airport; most are single-engine airplanes. Aircraft operations average 301 a day. About 60 percent of the activity is local general aviation, 38 percent is transient general aviation, two percent is air taxi services, and less than one percent is attributed to military and commercial activity.

The Renton Municipal Airport is a Landing Rights Airport, with US Customs services available for both floatplane and wheeled aircraft arriving by water or by land.

Auburn Municipal Airport[26,27]

Auburn Municipal Airport is owned by the City of Auburn and is also one of the busiest general aviation airports in the state of Washington. There are approximately 275 aircraft based at Auburn and about 143,000 operations (takeoffs & landings) occur annually. The majority of aircraft located at the airport are single-engine planes. About 60 percent of airport activity is attributed to general transient aviation, 36 percent is local general aviation, four percent is air traffic services, and less than one percent is military

activity. The airport provides hanger and tie-down rental, aircraft charter, aircraft rental, repair stations, and pilot training.

Vashon Municipal Airport[26]

Vashon Municipal Airport located on Vashon Island is owned by King County Airport District #1. There are 32 aircraft based on the field and aircraft operations average 115 per week. The majority of traffic, about 83 percent, is transient and 17 percent is local general aviation.

Crest Airpark[28]

Crest Airpark is a small airport located near the City of Kent. It is private with 330 base aircraft, mostly single engine with some multi-engine and two helicopters. Latest available data indicates the airpark has a total of over 95,000 annual operations. The airport provides flight instruction, rentals and fuel services.

Skykomish State Airport[26,29]

Skykomish State Airport services Skykomish and King County and is owned by Washington State Department of Transportation. Skykomish has a turf runway and the airport caters to transient general aviation. Fly-ins and glider operations are also common, and is frequently used by the Forest Service. Aircraft operations average 25 per month.

Kenmore Air Harbor Seaplane Base[26,30,31]

Privately-owned Kenmore Air Harbor Seaplane Base serves Seattle and King County. Today Kenmore Air is the largest purveyor and flyer of floatplanes in the Unites States and for 57 years has been flying, building and selling a variety of seaplanes from its headquarters in Kenmore and its terminal on Lake Union near downtown Seattle. Last year, the airline division of the company flew 70,000 people north to the San Juan Islands, Vancouver Island and various points beyond. They have two terminals, one at Lake Union and the other in Kenmore on the north end of Lake Washington. At the Lake Union location, they average 84 aircraft operations per day, 67 percent in air taxi services, 25 percent in general local aviation, and eight percent in general transient aviation. In Kenmore they average 110 aircraft operations a day, with 60 percent in commercial activities, 20 percent in air taxi services, 18 percent in local general aviation and two percent in general transient aviation. Both seaplane terminals are open to the public.

Seattle Seaplanes Seaplane Base[26]

Seattle Seaplanes is located on Lake Union. They average 30 aircraft operations a week; 94 percent in air taxi services, three percent in general transient aviation and 3 percent in local general aviation. They have three aircraft based there. The seaplane base is open to the general public.

Will Rogers Wiley Post Memorial Seaplane Base[25,26]

Seaplane (or floatplane) operations from the Will Rogers-Wiley Post Memorial Seaplane Base, located at the north end of the Renton Municipal Airport along the shore of Lake Washington, also comprise a significant level of activity at the airport. The seaplane facilities include a floating dock and launching ramp, which make the Renton Municipal Airport one of the few airports in the Pacific Northwest where aircraft can land on wheels, be equipped with floats and depart from the water, or vice versa. Seaplane aircraft operations average 46 per week. About 73 percent of seaplane activity is local general aviation and the remainder is transient.

Heliports[26]

There are at least 45 heliports located throughout the King County region. Heliports can be situated in an array of environments and utilized by many different entities including hospitals, major corporations, businesses, governmental agencies, emergency services, and the news media. There are also several private individuals who have their own heliport for personal use.

Railroads and Rail Service[4]

The Burlington Northern Santa Fe (BNSF) and Union Pacific Southern Pacific (UPSP) railroads serve the King County area. Both railroads have spur lines that span King County, making it possible to deliver almost any type of load. International cargo and cargo originating in Seattle travels quickly over these two rail networks to inland U.S. markets, including the Midwest, South and East. These lines are also used by other rail service providers, including Amtrak and Sound Transit.

Burlington Northern Santa Fe Railroad[32]

The Burlington Northern Santa Fe Railway Company operates one of the largest railroad networks in North America, with 33,000 route miles covering 28 states and two Canadian provinces. This network covers the western two-thirds of the United States, stretching from major Pacific Northwest and Southern California ports to the Midwest, Southeast and Southwest, and from the Gulf of Mexico to Canada.

The railway moves more intermodal traffic than any other rail system in the world. It is America's largest grain-hauling railroad and transports the mineral components of many of the products we depend on daily, including enough coal to generate more than 10 percent of the electricity produced in the United States. Revenues are generated primarily from the transportation of coal, grain, intermodal containers and trailers, chemicals, metals and minerals, forest products, automobiles and consumer goods.

BNSF NW Division

The King County portion of the BNSF is located in their Northwest Division. Rail lines extend north-south paralleling Puget Sound and traverses the major cities of Auburn, Kent, Tukwila, Seattle and Edmonds. Another line extends off the main line and goes through Renton and north to Woodinville and Snohomish. A main east-west line extends from Auburn to Stampede Pass heading towards Ellensburg.

Union Pacific Railroad[33]

The Union Pacific Railroad (UPS) serves Washington State with two north-south main lines. In western Washington, the Union Pacific connects Portland with important ports of Seattle, Tacoma and Kalama. Major commodities handled by the Union Pacific Railroad include lumber, fruit, automobiles and trucks, manufactured products, grain, chemicals and import-export consumer products on double-stack trains from Seattle and Tacoma. The railroad also handles municipal trash from Seattle to a landfill in Oregon. Terminal facilities within King County are located in Seattle.

Amtrak[34]

Amtrak passengers utilize service in more than 500 communities in 46 states throughout a 22,000-mile route system. Amtrak's "Pacific Northwest Rail Corridor" extends from Eugene, Oregon through King County and extending as far north as Vancouver, British Columbia. Around 658,000 passengers rode Amtrak within the corridor in 2001. Three daily round trips are provided between Seattle and Portland with two of these trips extending south to

Eugene. Amtrak also offers two daily round trips between Seattle and Bellingham with one of these trains extending north to Vancouver, B.C.

There are currently two Amtrak long-distance trains that serve Washington State, both originating in Seattle – one offers daily round-trip service between Seattle and Chicago and one offers daily round-trip between Seattle and Los Angeles.[37]

Sounder Commuter Rail[35]

Sounder currently offers commuter rail service between downtown Seattle and Tacoma. There are seven rail stations, with four stops in King County (Auburn, Kent, Tukwila and Seattle). The commuter rail currently serves about 14,000 passengers per week with three round-trips each weekday. Sounder also provides service for special events such as Seahawks Football and Mariner Baseball games.

The trains run on freight tracks owned by the Burlington Northern Santa Fe Railways (BNSF). While Sound Transit owns the stations and provides security and ambassadors, Sounder trains are operated by BNSF and maintained by Amtrak.

Commuter rail service started in 2000. Over 672,000 commuters were taking advantage of this new mass transit option by the end of 2002, with a projected goal of two million passengers by the end of 2003. When track and signal work is completed in 2005, commuter rail service between Tacoma and Seattle will be expanded to nine round trips. There are also plans to extend the rail line to the Everett area. Once in full operation, 18 trains (nine in the morning and nine in the evening) will serve the Lakewood-Tacoma-Seattle segment, and 12 trains (six in the morning and six in the evening) will serve the Everett-Seattle segment. Sounder will eventually serve at least a dozen stations.

Ballard Terminal Railroad (BT)[36]

The Ballard Terminal (BT) railroad is a three-mile stretch of short line rail in the Ballard area. The rail line transports consumer commodities and minerals.

See **Map 3-10: Railway Network**.

Highway Infrastructure

The highway system in the region is a major national asset, comprised of interstate highways, state highways and local arterials. The intersections of Interstate-90, Interstate-5 and Interstate-405 provide critical links north-south and east-west, as well as access between the Seattle metropolitan area and the eastside of Lake Washington, including the communities of Renton, Bellevue, Kirkland and Redmond. Major state highways terminating or providing critical linkages in the region include state highways 99, 18, 509 and 520. Washington State Department of Transportation, King County Department of Transportation and local municipalities construct and maintain the highways, roads and bridges that are very important to the county's transportation system. See **Map 3-11: Road Network**.

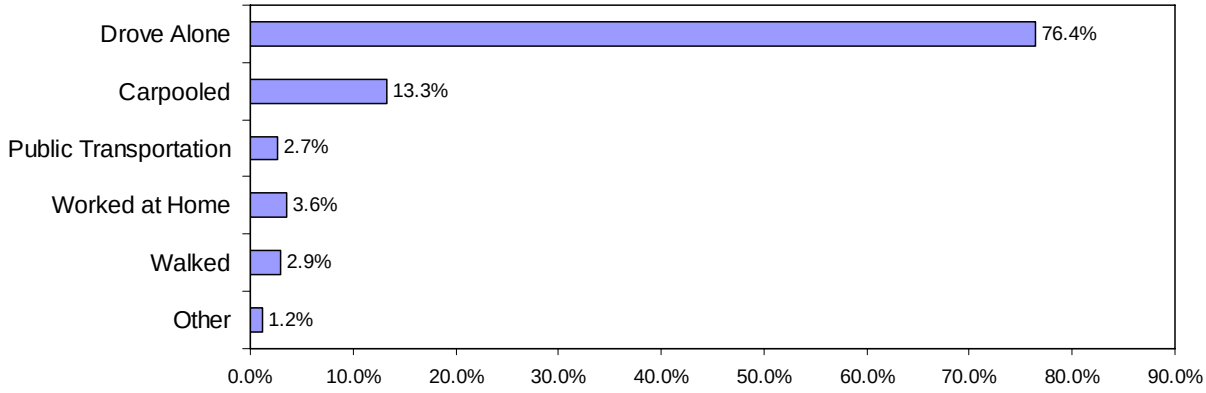
Commuting Trends[1,37,38,39]

More than 900,000 King County residents commute to work. Two-thirds of these commuters drive to work alone. Almost ten percent take public transportation. Bus ridership has increased nearly 25 percent over the last decade. Nevertheless, the majority of commuters opt to drive their own vehicles. The majority of King County households have two or more vehicles, but 66,000 households (almost one-tenth) have no vehicle available.

A substantial number of people – more than 210,000, according to the 2000 Census – commute into King County for work. The largest number comes from Snohomish County, about 103,000, followed by Pierce County, 80,783, and Kitsap County, 14,960.

Figure 3.1, below, shows transportation used by commuters. Primary mode of transportation is driving alone. Metro Transit, the public bus system in King County carried 97 million riders in 2001. Vanpools carried another 1.9 million passengers in 2001. Sound Transit's Sounder commuter rail line carried 610,218 passengers in 2002 between Tacoma and Seattle. The state ferry system carried 12.9 million passengers and 4.6 million vehicles between Seattle and Vashon Island, Bainbridge Island, and Bremerton in 2002.

Figure 3.1: Commuting Patterns



Source: U.S. Census Bureau, Profile of Selected Economic Characteristics: 2000

Public Transit[40,41]

King County Metro Transit operates a fleet of about 1,300 vehicles, including standard and articulated coaches, electric trolleys, dual-powered buses, and streetcars that serve an annual ridership of 100 million within a 2,134 square mile area. Metro also serves riders who are disabled with accessible fixed route service (all Metro buses have wheelchair lifts and all routes and trips are accessible), as well as paratransit van service and a taxi scrip program.

Metro operates the largest publicly-owned vanpool program in the country with more than 700 vans making more than 2.9 million trips per year. More than 5,000 people use those vans every day, eliminating a least 4,500 vehicles from area roads.

To help meet future needs and ease severe downtown traffic congestion, Metro operates a 1.3-mile electric bus tunnel underneath downtown Seattle, making stops at several locations within the downtown Seattle area.

King County's Six-Year Plan for Public Transportation 2002-2007 intends to continue the successful efforts of the past by making transit more relevant to changing travel needs at all levels – regionally, locally, and among the numerous cities and neighborhoods of King County. The plan sets forth objectives and strategies for transit, paratransit, rideshare services, transportation demand management and supporting facilities. The plan proposes that transit services and facilities be focused in the urban areas of King County. The plan also establishes a strong link between land use and transit actions in order to make development, as well as transit services and facilities, more efficient. The continued development and support of King County's Designated Urban Growth

Area with higher levels of transit service are central components of the region's growth strategy. See **Map 3-12: Metro Transit Routes**.

Trucking Services[42]

Truck transportation is a major commercial function of the region, being the nexus of the northwest highway system, as well as the location of the Port of Seattle. Approximately 3,700 interstate truck companies operate in Washington, most of which operate in the King County region.

Water Transportation and Shipping[43,44]

Washington State Ferries

Washington State Ferries (WSF) is owned and operated by the Washington State Department of Transportation. WSF is the largest ferry system in the United States, serving eight counties within Washington and the Province of British Columbia in Canada. In fiscal year 2001, Washington State Ferries carried over 11 million vehicles and 26 million people, making it the second largest transit system in the state.

The ferry system is an essential part of western Washington's and King County's highway network, providing a critical link between the urban areas on the east side of Puget Sound the growing communities to the West. For the King County community of Vashon Island, Washington State Ferries provides the only link for automobile travel with the mainland. The State ferry system has 29 vessels, predominantly passenger/vehicle types and several walk-on only ferries. In total there are 20 ports of call (terminals) and 10 routes; four of these routes and three terminals, including Seattle, are located within King County. Routes in the County provide service between Seattle-Bainbridge Island, Seattle-Bremerton, and Fauntleroy (West Seattle)-Vashon Island-Southworth.

Commercial Freight Transportation[45]

Commercial freight transportation in and out of Puget Sound is dominated by the Port of Seattle and Port of Tacoma. The Port of Seattle, the fifth largest container port in the United States, is served by 25 regularly scheduled shipping lines and provides services such as on-dock intermodal rail yard, five container terminals, four breakbulk terminals, 25 cranes, on-dock freezer

facilities and a 4.2 million bushel capacity grain terminal. Total tonnages handled average about 14,000,000 metric tons annually, comprised of about 68 percent containers, 31 percent petroleum, grain and breakbulk, and 50-80,000 autos.[46] Numerous shipping and barge companies operate out of Seattle.

Emergency Services

King County is the home to numerous local, regional and state professional emergency service organizations. These services include fire service, law enforcement, emergency medical services (EMS), emergency communications, emergency management, search and rescue, public health, emergency health care, and other critical resources. The operations and standards to which these agencies perform are dictated by State and Federal Laws, national standards and local agreements.

Fire Service

There are 43 public fire agencies in King County. These fire services are organized into three zones. In general, fire zone one consists of the area north of I-90 to the Snohomish County line; zone three includes Vashon Island and the area south of I-90; and zone five is the City of Seattle. See **Map 3-13: Emergency Response Zones**.

Operationally, there are two different types of fire organizations - departments that provide services as part of municipal government and districts governed by their own elected commissioners. There are 15 city fire departments and 28 fire districts in King County. Fire agencies are responsible for providing essential services such as emergency medical aid (basic life support), fire suppression and disaster response. Many fire departments also specialize in prevention-related activities including hazardous materials mitigation, fire prevention, code enforcement, public education, fire inspection and fire investigation. In the case of fire districts, the King County Fire Marshal's Office is responsible for some of the activities relating to code enforcement and fire investigation in unincorporated areas of the County.

Many fire agencies within King County provide specialty services and have firefighters who are trained technicians that serve their jurisdiction and some also participate on regional teams. Specialties can include hazardous materials, trench rescue, confined space rescue, technical rope – low and high angle, swift water rescue, surface water rescue, dive, and wildland firefighting. Many jurisdictions have joined forces to also develop regional teams. Seattle, Zone 1 and Zone 3 all have "regional response teams" for hazardous materials. Other specialty groups are in the process of developing regional response teams.

The County has approximately 1,500 full-time firefighters and 700 volunteers (excluding Seattle). There are over 1,000 firefighters in Seattle, making it the largest fire department in King County. Additional staff include administrative support, civilian employees, community volunteer specialists and fire explorers.

Washington State fire statistics indicate the majority of all fire department response, almost 70 percent, is related to emergency medical service and rescue; significantly smaller numbers of calls are due to fire-related incidents. These percentages similarly reflect the activity occurring within the County. However, not all fire departments report their incident data to the Office of the State Fire Marshal, so a truly accurate measure is not available.

Table 3-15: 2002 Washington Fire Response

Response Type	% of Calls
Rescue and Emergency Medical Aid	68%
Good Intent Calls	8%
Fire	7%
Service Calls	6%
Unintentional Fire System Activation	4%
Hazardous Conditions (no fire)	3%
False Alarm/False Call (including malicious)	2%
Fire Protection System Malfunction	2%
Other – overpressure, ruptures, explosion, overheating; Sever weather and natural disasters; and undetermined. *Total number of calls were less than 1%	0%*
Total	**100%**

Source: 2002 Washington State NFIRS 5.0 Data – Washington State Patrol, Office of the State Fire Marshal

The fire services in Washington State and King County have long operated under mutual aid agreements between agencies. These agreements provide for rapid assistance from neighboring fire jurisdictions to meet the immediate need requirements of an emergency situation. Rapid intervention by mutual aid resources can secure control over an emergency incident that may otherwise continue to escalate.

Washington State Fire Services Resources Mobilization Plan[47]

In response to major events, the Washington State Fire Services Resource Mobilization Plan provides a process to quickly notify, assemble, and deploy fire service personnel and equipment to any local fire jurisdiction in the state that has depleted all local and mutual aid resources in attempting to manage, mitigate and control an emergency incident or situation. This plan is typically utilized to

respond to major wildland fires, however it is also designed to address all hazards and provide resources to any emergency situation required to protect life and property. The main criterion for initiating fire mobilization is exhaustion of local resources. Activation of the State Mobilization plan is coordinated through the Washington State Patrol – Office of the Fire Marshal.

Other fire agencies include:

Fire Protection Bureau – Office of the State Fire Marshal[48]*:* The Bureau is an integral agency supporting fire agencies in King County. The Bureau, located within the Washington State Patrol, provides assistance to fire districts, government agencies, and the general public. These services include fire investigation, fire incident reporting and data collection, fire code review and adoption, construction plan review for fire protection systems, and fire inspections of high risk occupancies housing elderly and vulnerable populations. In addition, the bureau regulates the fireworks and sprinkler industry through a licensing program. They operate the State Fire Training Academy which provides firefighter training certification program through a standards and accreditation process, and on-going specialized training on terrorism, hazardous materials and fire-related issues. The Bureau also coordinates Washington State fire service resources for mobilization during natural or human-caused disasters.

The Department of Natural Resources (DNR)[49]*:* DNR protects and manages valuable assets within the State of Washington, including more than five million acres of land – forests, farms, commercial properties and underwater lands. Two of their largest and most important responsibilities in resource protection are fire prevention and suppression and regulating forest practices (or timber harvest). They are responsible for wildfire protection on 12 million acres of private and state forest land. They have the state's largest on-call fire department with 1,200 temporary and permanent employees who fight fires on private and state-owned forest lands. DNR offers local fire districts support with fire protection and safety equipment requirements.

Boeing Fire Department (private)[50]*:* Boeing Fire provides vital emergency service resources within the region. Company-wide, they provide fire service to more than 59,000 employees and protect approximately 45 million square feet of floor space that is a combination of manufacturing, hazardous operations, design, flight test and aviation support. In King County, they operate three fire stations, two located adjacent to airfields (Renton Municipal Airport and King County Airport) and a structural/hazmat fire station in Auburn. Boeing Fire employs 135 personnel in Puget Sound, with 91 located in King County. Their fire department structure is essentially the same as for public fire agencies with fire suppression/EMS personnel and staff specializing in hazardous materials, code enforcement, training and safety, fire protection, and firefighting operations specific to aviation. Boeing also provides mutual aid to surrounding public

agencies and participates in regional hazardous materials response. Their marine rescue unit in Renton is utilized by the Renton Fire Department. They provide a "special" resource with their ability to mobilize large quantities of foam for flammable liquid fires and their 5,000 gallon tenders are requested each summer to assist with freeway brush fires. Boeing Fire Department's training division is utilized throughout the region and the world for their expertise in aircraft firefighting, hazardous materials training (including drug labs and explosives) and disaster preparedness.

Fire service trends[51]

For economic and operational reasons, the fire departments, fire districts and fire zones in King County have continued to consolidate. Fire zones one and two consolidated in 1997 and fire zones three and four consolidated in 2003. There are increasingly common examples of fire departments and fire districts consolidating administrative and operational functions. It's likely, with future funding issues, we will see additional fire district mergers in an effort to become more cost effective.

Regional hazardous materials and special operations teams will be more common in the future. The fire service is evaluating partnerships in emergency medical services and will likely expand those roles as well. This may include an increase in transporting patients from the emergency scene to the hospital and perhaps more paramedics in the fire service. There has been increased cooperation between fire districts with funding issues at recent elections.

The future will likely bring an increase in joint training, purchasing and a sharing of other resources. The zone three training officers are a good example of what the future holds for the fire service. The training officers have joined together to offer regional training classes, reducing the cost of providing quality simulations for individual fire departments and districts. There will also experience more coalitions for public education and prevention in the future. Teaching our senior citizens how to prevent falls and working with hospitals to provide low cost and properly fitting bicycle helmets are examples of the partnerships we'll see in the future.

Emergency Medical Services (EMS)[52]

The Medic One system is a critical part of our regional emergency medical service system. This concept of advanced medical care operates in a coordinated partnership between King County, cities, fire districts, private ambulance companies, hospitals and others involved to provide pre-hospital emergency medical care. The tiered response system assures that patients receive effective medical care by the most appropriate health care provider. Basic Life Support (BLS) services are provided by first response firefighters

trained as Emergency Medical Technicians (EMTs). Advanced Life Support (ALS) or paramedic services are provided by six paramedic agencies that respond to patients with more serious life-threatening illnesses or injuries.

Paramedic providers in the Seattle-King County region include Seattle Medic One, Shoreline Medic One, Evergreen Medic One, Bellevue Medic One, King County Medic One, and Vashon-Maury Medic One. These agencies operate a total of 23 paramedic units, with several variations in paramedic service. BLS services are provided by 34 fire departments and fire districts.

The regional Medic One program employs over 200 paramedics, about 3,500 EMTs, in providing emergency response to patients in the Seattle-King County area. In 2002, the Medic One program served over 147,000 patients, of which over 47,000 required a paramedic level response.

Law Enforcement

There are 25 law enforcement agencies in King County, 23 departments associated with cities, one with the University of Washington and the King County Sheriff's Office. There are approximately 1,954 full-time law enforcement officers in King County, and 1,352 volunteer personnel (600-700 of which are search and rescue). Seattle has an additional 1,100 law enforcement officers. Basic services provided by police departments include patrol services, crime investigation, narcotics enforcement, public education, crime prevention, school resource officers, animal control and parking enforcement. Most departments have their own jail or holding facility. Many departments also have their own specialty teams. Special Weapons and Tactics (SWAT) teams are available through the King County Sheriff's Office, Seattle Police, Valley SWAT (multi-agency cooperative), and Bellevue/Eastside Police. Bomb disposal units are provided by King County Sheriff's Office, Port of Seattle, Federal Way, Bellevue and the City of Seattle. Seattle Police, Mercer Island Police Services, and King County Sheriff's Office maintain Marine Units. Several agencies use K-9 units and the King County Sheriff's Office has the only helicopter unit in service. Both Seattle Police and the King County Sheriff's Office Special Operations Units provide dignitary protection for significant government officials.

The following table identifies the *overall* crime statistics for all of the County as reported by the Washington Association of Sheriffs and Police to the Washington Office of Financial Management. This data is based on information collected only from reporting agencies.

Table 3-16: Reported Index Crimes – 2001		
Crime	**2001**	**%**
Theft	61,135	59.7%
Motor Vehicle Theft	18,293	17.9%
Burglary	14,897	14.5%
Aggravated Assault	4,013	3.9%
Robbery	2,624	2.6%
Arson	771	.8%
Forcible Rape	594	.6%
Murder	60	.0%
Total	**102,387**	**100.0%**
Source: Washington State Office of Financial Management – Washington Association of Sheriffs and Police Chiefs		

Until recently, police agencies did not have an operational mechanism similar to the mutual aid concept used by the fire service. Efforts to draft a law enforcement mobilization plan at the state level being developed. Typically, police mutual aid has been informally conducted by small units in what is called automatic aid.

King County Sheriff's Office[53,54]

The King County Sheriff's Office (KCSO) directly serves about 570,000 people in unincorporated areas and thirteen cities for which they provide contract police services including Beaux Arts Village, Burien, Carnation, Covington, Kenmore, Maple Valley, Newcastle, North Bend, Sammamish, SeaTac, Shoreline, Skykomish and Woodinville. They also serve as the Metro Transit Police and the King County International Airport Police.

There are four police precincts, five stations or substations, and eighteen storefront locations spread throughout the County. Over 640 commissioned deputies and 350 civilian employees serve the community in various capacities. In addition to the general services they provide such as traffic enforcement, accident investigation, criminal investigation, emergency communications (911), and community and crime prevention they also offer an array of specialty services including major accident response and reconstruction (M.A.R.R.), air support (Guardian One), automated fingerprint identification (A.F.I.S), fraud and computer forensics, bomb disposal, hostage negotiations, K-9, search and rescue (SAR), Tactical Team 30 (SWAT), marine unit, Metro Transit Police, Child Find Unit, community service officers, vice control, drug enforcement, and court security.

According to state law, the Sheriff's Office has jurisdiction throughout the County; this obliges them to be ready to provide service to other cities in the County if

they request it. Sometimes the cities that use the service are asked to pay a fee. Other services are provided regionally, so there is no fee involved.

Table 3-17: King County Crime Summary – 2001

Part 1 Offenses	2001	Crime Rate
Larceny	11,081	19.45
Vehicle Theft	3,427	6.01
Burglary, Residential	2,569	4.51
Burglary, Commercial	1,058	1.86
Aggravated Assault	760	1.33
Arson	338	0.59
Robbery	374	0.66
Forcible Rape (incl. Attempts)	233	0.41
Criminal Homicide	22	0.04
Part 1 Offenses – Total	**19,862**	**34.85**
Part 2 Offenses – Total*	**20,613**	**36.17**

Source: King County Sheriff's Office – 2001 Annual Report. Includes data for unincorporated King County and contracted cities. The crime rate is calculated on the basis of 1,000 people (i.e., number of crimes per 1,000 people), based on a population of 569,944.

**Summary total of all Part II offenses - crimes committed to a lesser degree than Part 1 Offenses.*

Table 3-18 indicates the majority of activity in 2001 was calls for service, followed by traffic enforcement. Data indicates there is an increase in activity in all areas; the most obvious change is in gang-related incidents with a 136.9 percent increase from the year 2000.

Table 3-18: King County Police Activity Summary – 2001

Category	Number of Incidents	% Change from 2000
Dispatched calls for service	126,730	1.5%
Adult charges/arrests	10,990	11.0%
Juvenile charges/arrests	2,289	1.9%
Traffic enforcement	50,284	9.9%
Officers assaulted	49	2.1%
Gang related incidents	424	136.9%
Domestic violence*	5,031	0.6%
Hate crimes/malicious harassment	55	5.8%

Source: King County Sheriff's Office – 2001 Annual Report. Includes data for unincorporated King County and contracted cities.

Washington State Patrol[55]

The Washington State Patrol is divided into seven Bureaus that administer the activities of nearly 1,000 commissioned officers and more than 1,000 non-commissioned personnel. They include: Field Operations, Fire Protection, Forensic Laboratory Services, Investigative Services, Management Services, Technical Services, and Office of the Chief.

The Fields Operations bureau is primarily responsible for enforcing traffic laws, investigating collisions, and assisting motorists on 17,524 miles of the State's highways. The state is divided into eight districts. District #2, serving King County and northern Pierce County, operates six detachments, with offices located Bellevue (headquarters), North Bend, North Seattle, South Seattle and Enumclaw. The Special Operations Division within the bureau also operates an Aviation Section and Vessel and Terminal Security (VATS). The Aviation Section provides aerial traffic enforcement, traffic congestion management, aerial surveillance, assistance to other agencies, transport of donor organs and blood supplies in medical emergencies, and other governmental services. The Vessel and Terminal Security provides traffic control and law enforcement services on Washington State ferry routes. The Explosives Unit (or bomb squad) provides assistance to agencies and individuals in the rendering safe of identified explosives or suspected explosive devices and materials.

The Investigative Services Bureau (ISB) consists of five divisions that provide various public services, including weighing and inspection of commercial vehicles and school buses; narcotics investigation and dismantling of clandestine labs; fatality, criminal and missing children investigations; computer forensics; organized crime intelligence; and public records and records retention.

The Technical Services Bureau provides many diverse services to the entire department, other law enforcement and government agencies, and members of the general public. These services include information technology, employee training and development, emergency communications, and criminal history.

The Office of the State Fire Marshal – Fire Protection Bureau, is highlighted in the "Fire Service" section of the Emergency Services profile.

Emergency Communications

9-1-1[56]

There are 14 Public Safety Answer Points (PSAPs) or emergency dispatch centers in King County. The largest of these include Bellevue Eastside Communications, King County Sheriff's Office Communications, Seattle Police

Department Communications, Valley Communications, and Washington State Patrol Communications.

The King County Sheriff's Office, Seattle Police Department and Washington State Patrol dispatch centers answer 911 calls and dispatch for police service only. Bellevue Eastside Communications and Valley Communications answer 911 calls for multiple jurisdictions and provide police, fire and emergency medical services dispatch. Many smaller 911 centers answer calls and dispatch for single jurisdictions. The PSAPs offer 24-hour coverage for emergencies and dissemination of Emergency Alert System (EAS) messages.

The County-wide enhanced 911 system consists of the dedicated 911 network, redundant selective routers, and public safety answering points. The 911 trunks between each telephone company central office and the selective routers is maintained at double the number of trunks (lines) needed to ensure that no more than one caller out of 100 will get a busy signal. The 911 trunks between the selective routers and the five largest dispatch centers are on a self-healing network service to minimize the chance of a service outage. Redundant selective routers ensure that if one router is disabled and unable to provide service, the E-911 system would continue to function at half capacity.

Each dispatch center has a back-up system established where 911 calls can be answered if they are unable to provide service. Most back-up systems are located at other communication centers within the King County Enhanced 911 system. Each PSAP is required to have an emergency power source that is capable of supplying power to meet their basic operational needs. Additionally, each PSAP has implemented security procedures to limit access to their facilities.

Funding for the Enhanced 911 system is provided through dedicated 911 excise taxes on wireline and wireless phones. A portion of these funds are distributed to the PSAPs to assist in funding and operational costs of answering 911 calls. The majority of funding for the PSAPs is provided by local jurisdiction general funds or user agency fees.

Only once was the King County 911 center directly impacted by an event; as a result of the Nisqually earthquake there was a temporary relocation of the Sheriff's dispatch operations to Precinct Based Emergency Communications (PBECs). During the World Trade Organization meetings held in Seattle there was some impairment of operations for staff coming and going to their work locations.

There is the potential that economics will continue to motivate the consolidation of PSAPs into fewer operations.

Emergency Management

State Law requires every political jurisdiction in Washington State to have a designated emergency manager and a plan on file with the Washington State Emergency Management Division. In many cases, the fire chief has the added duties of emergency manager. In some cases, the emergency manager is the public works director (Tukwila and Federal Way). Larger cities (Seattle, Bellevue, Redmond, Mercer Island, and Kent) have full-time emergency management professionals. Very few cities have dedicated locations for the coordination and management of emergency operations. Most convert existing space and existing resources for emergency uses.

King County Office of Emergency Management

The King County Office of Emergency Management has its roots in civil defenses as an office in the King County Sheriff's Department. In 1991, the office became a civilian organization with a broader, all-hazards mission. The initial staff consisted of a manger, two professional staff and administrative staff with offices co-located with the Sheriff's Communications Center in the King County Courthouse.

Organizationally, the office is now part of the Department of Executive Services. The current staff includes a director, assistant director, five full-time professional staff and two administrative staff. Program assignments include operations of the King County Emergency Coordination Center, regional planning, logistics, exercises, training, public education and homeland security. Since 1991, the office has provided support to first responders and citizens of King County during ten presidentially-declared disasters and numerous other local emergencies.

All municipalities in Washington State are required to have an emergency management program as defined in the Revised Code of Washington 38.52. King County Emergency Management has an obligation to the citizens and responders of unincorporated King County. The office also supports the cities of King County and coordinates resources between jurisdictions during emergencies. Increasingly, the office works toward regional solutions to disaster, pre-disaster mitigation, preparedness, and response and recovery issues.

The vision for the Office of Emergency Management is to produce "disaster resistant communities."

Local Emergency Planning Committee

WAC 118-40 requires every county to have a Local Emergency Planning Committee for hazardous materials release planning. Some small cities have formed cooperative arrangements for Emergency Services Coordinating Agency

(ESCA) – cooperative employment of emergency management support for seven cities on both sides of the King County/Snohomish County borders.

Washington State Emergency Management Division[57]

Washington State Emergency Management Division (EMD) coordinates emergency management programs and activities with local governments, public agencies, private organizations, businesses and communities. EMD is a division of the Washington State Military Department that includes the Washington Army and Air National Guard. In addition to the Emergency Management Division's Director's Office, there are four units within the division: Enhanced 911; Mitigation, Analysis and Planning; Response and Recovery; and Policy, Programs and Training.

Emergency Management Trends

Emergency Management has experience radical shifts in priorities over the last decade. Following the end of the Cold War in the early 1990s the Federal Emergency Management Agency (FEMA) began an era of emphasis on natural disasters. This was followed by a period of particular emphasis on disaster mitigation. Both King County and neighboring Pierce County joined forces to do regional mitigation projects under the Project Impact umbrella that was the focus of FEMA's efforts at pre-disaster mitigation program.

Following the attacks of September 11, 2001 we have now experience a radical shift in priorities, especially funding, to that of Homeland Security. FEMA is no longer the lead for counter terrorism efforts and has been replaced by the Office of Domestic Programs which controls the Homeland Security funding for state and local jurisdictions. Tens of millions of dollars in Homeland Security funding are now being allocated to programs right here in King County. Given the limited number of personnel in emergency management organizations, this significant distribution of funding is driving emergency management programs to focus almost entirely on Homeland Security issues. The forecast is for this trend to continue as long as funding remains plentiful and natural disaster events do not eclipse the perceived hazard of terrorism.

Search and Rescue

King County Search and Rescue (SAR)

Under state law, the King County Sheriff's Office is the agency designated with Search and Rescue (SAR) responsibilities. In King County, the SAR unit is managed by one full-time uniformed deputy and 18 deputies as ancillary duties, but largely is supported by 10 volunteer units. Over 760 volunteers participate in search and rescue activities. Groups include 4 x 4, trackers, search dogs, and the Ski Patrol and Rescue Team (SPART). Members of several SAR units have participated in numerous evidence searches, including the Green River killer investigation. In 2002, they conducted 132 searches for missing skiers, aircraft, persons, and injured or lost hikers. Volunteers operating on SAR missions are registered emergency workers (per WAC 118-04).

King County provides search and rescue services throughout the entire County, including incorporated areas. They also provide mutual aid to adjacent counties in the State. While the County funds a full-time sheriff deputy to oversee SAR volunteer units and operations, much of the funding for this programs comes from private donations.

Washington State Urban Search and Rescue (USAR)

The Washington State Urban Search and Rescue Taskforce #1 is comprised of fire, police, emergency medical services (EMS) and hospital professionals from the City of Seattle, King County and Pierce County. The taskforce has three 'platoons' that are available for deployment at anytime. They respond to major incidents that require extensive search and rescue operations. The Washington State Task Force has been deployed to the Atlanta bombing, Salt Lake City Olympics, Northridge Earthquake, World Trade Center, Oklahoma City Bombing and hurricanes impacting the Gulf States. The group maintains a supply of materials and equipment to support self-sufficient operations anywhere in the world. Its able to organize its members and load and depart within 72 hours of notification. The local USAR Task Force gets it funding from FEMA and local contributions.

Public Health

The Seattle-King County Department of Public Health (SKDPH) is a jointly operated agency covering cities and unincorporated areas of King County. A wide range of services are provided to citizens of King County, from food service inspections and health clinics, to epidemiological and medical examiner's office responsibilities. Medic One (Advanced Life Support – ALS) and the Medical Examiner's Office are both operated under the health department.

The top official in the SKDPH is empowered by state law as the lead authority for health-related emergencies that extend from water supply issues and outbreaks of the flu to immunization and biological terrorist agents.

The Department of Public Health recently increased its commitment to emergency operations relating to public health emergencies with the hiring of emergency management and planning personnel. Grants and priorities are commonly being directed at planning for response to health emergencies and protecting the public's confidence in the health care system. A continuation of this trend is expected for the near future.

Hospitals – Emergency Care[4]

As a healthcare center for Alaska, Idaho, Montana and Washington, King County offers a comprehensive selection of outstanding healthcare facilities, services and personnel. The region's medical and nursing services are internationally acclaimed and feature sixteen special centers for Children's diseases, drug abuse and alcoholism, burns, cancer, pain and other traumas, kidney ailments and transplants, psychiatry and disability rehabilitation.

The Puget Sound region has 45 general acute hospitals with 9,400 beds, staffed by over 38,000 employees. Sixteen special purpose centers serve the area. Over 15,000 medical personnel staff these facilities. The University of Washington's medical facilities together handle more than 450,000 patient visits each year.

There are 22 licensed hospitals in King County. Of these, three are public hospitals and the others are private or nonprofit institutions. Of the 22 hospitals, Harborview is listed as a Level 1 Trauma Care facility, three are listed as Level 3 Trauma Care Facilities and four are listed as Level 4 Trauma Care Facilities.

Local hospitals have their own system for managing hospital resources during emergencies. For local emergencies, Harborview, operated by the University of Washington, acts as central "hospital control" for the distribution of patients during a mass casualty incident or health emergency. Hospital Control monitors unusual numbers of symptomatic patients, bed counts (occupancy), and the distribution of patients transported by aid units. The region has a mass casualty plan (MCI). Evergreen Hospital, Overlake Hospital and Harborview Hospital have advanced life support (ALS) programs.

Other Emergency Services-Related Organizations

Private Ambulance

Private ambulance companies provide transport services of non-critical care patients to hospitals and other health care providers. This essential service allows emergency service workers to get back into service more quickly. Private ambulance companies are also a critical resource during major incidents. They provide many other services including hospital-to-hospital transport and transport of private non-emergency related patients. There are two major ambulance companies serving the King County area – American Med Tech and Tri-med.

Airlift Northwest[58]

Seattle-based Airlift Northwest provides rapid emergency air-transport service to critically ill or injured patients throughout Washington, Alaska, Montana, Idaho and Western Canada. When responding to emergencies in the Western Washington area, Airlift Northwest uses one of four fully-dedicated Agusta A109/Mark II helicopters based in Seattle, Bellingham, Arlington and Puyallup. Flight teams consist of two registered nurses with extensive critical care trauma experience. The Seattle, Arlington and Puyallup flight teams include one neonatal/pediatric critical care specialist.

Civil Air Patrol[59]

Civil Air Patrol (CAP) is a nonprofit organization that has long been associated with search and rescue missions. They have over 64,000 members nationally and cover eight geographic regions, including all 50 states. Its work also includes disaster relief and communications, as well as counter-drug and homeland security missions. CAP members fly 95 percent of all federal inland search and rescue missions, as directed by the Air Force Rescue Coordination Center at Langley Air Force Base, Virginia. On the average they help save 100 lives a year. CAP also provides air and ground support for disaster relief, flying officials to remote locations, transporting blood or live tissue to critical care sites and performing aerial damage assessment. King County is in the CAP "Pacific Region" and is served by the "Washington Wing."

Education[1,4,2,6,60,61,62,63]

Education in King County is a major factor in our economic success. The educated labor force capability spans traditional skills from basic manufacturing to new technologies, including software and biotechnology. The ability of the workforce in the region to develop and adapt to changing business, public and commercial needs is supported in large part by the educational infrastructure and systems that are based in our region.

King County is a highly educated community in which more than 90 percent of the adult population has graduated from high school and 40 percent, or 475,000 people, have a college education with a Bachelor's degree or higher. In the United States as a whole, just 80 percent have high school diplomas, and 24 percent of adults have college degrees. In the County, of those adults who do not have a college degree, at least 280,000 have some level of college experience.

Child Care and Early Learning

There are 643 licensed child care centers in King County, or 30 percent of the state's total. Total capacity for child care centers equals 39,874 children, or 33 percent of the State's total capacity. These facilities have an average of 62 children per licensed facility.

Public preschool programs provided by school districts enroll approximately 2,503 students, about 25 percent of the State's public preschool total. Preschool enrollment in private schools is much larger; 3,883 students are enrolled, representing nearly half (48 percent) of the state's private pre-school enrollment.

Public Primary and Secondary Education

About 26 percent of all children attending school in Washington State live in King County. King County has 20 school districts serving over 250,000 students in grades K through 12. The County's largest school districts include Seattle, Kent, and Lake Washington. The Seattle school district enrolls 47,174 students; Kent has 26,103 and Lake Washington has 24,143 students.

The majority, about 56 percent, of public school students in the County are in elementary grades. Younger students, pre-school and kindergarten age, make up approximately 17 percent of the total public school student population.

Table 3-19: School Enrollment – Pre-school through High School

Pre-school	Kindergarten	Elementary	High School	Total
31,153	21,552	178,889	87,382	318,976

Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000

According to the Office of Superintendent of Public Instruction, as of 2001-2002 the graduation rate for King County was 84 percent.

Across the region there are nearly 500 buildings that comprise physical educational facilities. The majority of structures house elementary grade students.

Table 3-20: Types of Educational Buildings	
School Level	**Number of Buildings**
Alternative School	68
Complete School	2
Elementary School	271
High School	56
Institutional	6
Junior High School	28
Middle School	41
Special Education	24
Vocational School	1
Total	**497**
Source: WA State Office of Superintendent of Public Instruction – WA State Public School Building Count by County and District, 2002-2003	

Private Education

Private schools in the region are numerous, accounting for approximately 38,500 students or 46 percent of the state's private school population. Data is currently not available for the types and age of structures.

Home Schooling

There are 3,697 registered home-school students in King County, representing 19 percent of the state's total. These students are typically home-schooled in a family education setting. There are 2,178 such home schools, which averages 1.7 students per school environment.

Post - Secondary Education

The King County region represents a major factor in education at this level, offering an extensive network of schools for post-secondary education, including the University of Washington, eight private colleges and universities, eight community colleges and two technical colleges.

Table 3-21: Post-Secondary School Enrollment		
Type of School	**Enrollment**	**%**
University of Washington	37,641	25.5
Private Colleges and Universities	17,799	12.1
Community Colleges	62,030	42.0
Technical Colleges	30,066	20.4
Total	**147,536**	**100.0%**
Source: Economic Development Council of Seattle & King County web-site		

The University of Washington (UW) is a recognized leader in aerospace engineering, fisheries, oceanography, forestry, nuclear engineering, medical technology and bioengineering. The UW Medical School is a world-class facility serving the western states of Alaska, Idaho, Montana and Washington. There are over 37,000 students enrolled at the UW; the majority is located at the main Seattle campus and about 1,500 are located at the campus in Bothell. The university owns and/or leases a significant amount of property, numbering over 400 buildings.

Private colleges and universities account for about 12 percent of the total post-secondary school enrollment in King County. The four major private universities, along with other private institutes that enroll 17,799 students. Major private colleges and universities include:

Antioch University – Seattle
City University – Renton
Seattle Pacific University – Seattle
Seattle University – Seattle

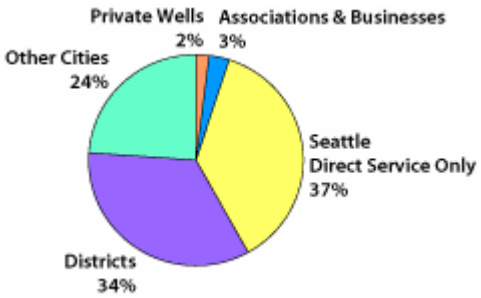
Nearly one-third of the state's community and technical colleges are based in the King County region. They account for the majority of post-secondary school enrollment. These schools play a pivotal role in providing alternative post-secondary education opportunities to individuals who wish to either transition to a university via community college, or pursue specialized training or trades based on industry needs and conditions. These types of colleges have become increasingly important due to the influx of people involved in retraining or changing career paths. Technical colleges in King County account for 35 percent of the state's total enrollment in this type of post-secondary school. Community and technical colleges in King County include:

Bellevue Community College - Bellevue
Cascadia Community College – Bothell
Green River Community College – Auburn
Highline Community College – Des Moines
Lake Washington Technical College – Kirkland
North Seattle Community College – Seattle
Renton Technical College – Renton
Seattle Central Community College – Seattle
Seattle Vocational Institute – Seattle
Shoreline Community College – Seattle
South Seattle Community College – Seattle

Resources

Water[64]

County citizens receive potable water from a variety of sources. These sources are classified as either private or public water systems. Private water systems serve only a single connection and usually consist of a well used for a single home. There are approximately 12,000 private water systems in King County.



Public water systems contain more than one connection. The majority of public systems are managed by municipalities and utility districts; homeowners, private nonprofit organizations, and private for-profit companies manage the rest, about five percent of the systems.

Public water systems are further classified by size. A public water system is classified as a Group B system if, in general, it serves from two to 214 connections. About 1,700 Group B public water systems currently operate in King County. In general, Group A systems serve 15 or more connections. There are 217 Group A public water systems in the County.

Seattle Public Utilities (City of Seattle) provides the majority (about 90 percent) of potable water for County residents, about 1,300,000 people, either through direct service or the sale of water to 25 other water utilities.[65] The remaining King County population, about 400,000, obtains their water from approximately 14,000 other public and private systems.

Water and combination utility districts provide about one-third of water service to the county residents. They own and operate the infrastructures that store and distribute water supplies for both consumption and firefighting suppression activities. Similar to the emergency services sector, utility departments also operate under mutual aid agreements.

Municipalities other than Seattle, provide water service for their communities. They also own and operate utility infrastructures. Some municipalities contract for water services through other agencies.

About 60-70 percent of the County's water comes from the Tolt Reservoir and 20-30 percent comes from the Cedar River Drainage Basin. Pierce County/Tacoma receives 90 percent of its water from the Palmer facility located in South King County[65].

Our supply of potable water is dependent on the area's watersheds. The watersheds located within King County are: Central Puget Sound Watershed, Sammamish Watershed, Snoqualmie – Skykomish River Watershed, Cedar River – Lake Washington Watershed, Green River Watershed and White River Watershed.

The rain, rivers, lakes, wetlands and even our drinking water are all parts of an intricate cycle. Everything that washes into a storm drain ends up in a stream, lake or wetland. Conversely, activities occurring within our watersheds can impact this valuable natural resource. Watershed boundaries are determined by the land and not city limits, so watersheds in one community can extend into neighboring jurisdictions, making this a regional priority.

A watershed in King County is the land area draining to a nearby river or lake, or directly into Puget Sound.

In general, most of the time the region has plenty of water available. During the summer, however, water use increases from 50 to 250 percent because of irrigation of lawns, golf courses, and parks. Accommodating this peak demand can impact human water needs and migrating salmon in the fall. Managing summer peak demand and in-stream flows during the early fall period are issues driving current multi-county discussions.

Waste Water Treatment[66]

King County Department of Natural Resources and Parks – Wastewater Treatment Division provides wholesale wastewater treatment to 18 cities and 15 sewer districts (including Vashon Island Sewer District) in the central Puget Sound region. There are six other wastewater utilities in King County that do not participate in the regional system. The King County system serves approximately 1.4 million people, including most urban areas of King County and parts of south Snohomish County and North Pierce County. The service area is 420 square miles (including 250 acres on Vashon Island). The County has three treatment plants located in Seattle, Renton and on Vashon Island. This system is connected by 335 miles of conveyance lines with 42 pump stations and 19 regulator stations.

Solid Waste[67]

Rabanco and Waste Management are the two major providers of solid waste disposal and recycling services for King County residents and businesses outside of Seattle. Rabanco has a recycling facility in Seattle and Waste Management has a recycling facility in Woodinville. Seattle Public Utilities provides waste disposal services for more than 1.3 million customers in its City. Enumclaw and Skykomish also provide its own services. Smaller waste disposal companies provide service to the Town of Milton and Vashon Island.

There are nine King County Solid Waste Disposal stations, where hauling companies, businesses and King County residents can dispose of solid waste, yard waste and recyclable materials. The transfer stations serve as conduits to gather solid waste and separate recyclable materials from general waste before the material is transported to the Cedar Hills Landfill. Cedar Hills occupies 920 acres with approximately 406 acres available for landfill and support functions.

The County will be looking at closing the Cedar Hills landfill when it reaches capacity in 2012. At that time the County will export waste outside of King County. The current proposed plan to deal with this inevitability is to export waste from an intermodal facility by rail to an out-of-county landfill facility[68]. Seattle ships their solid waste, via rail, to eastern Washington and Oregon.

There are two private Toxic Substance Disposal Facilities (TSDF) in King County where hazardous materials and chemicals are taken in

Electricity

Two major electric utilities serve King County customers – Puget Sound Energy and Seattle City Light.

Puget Sound Energy (PSE) is the largest combination natural gas and electric utility in the Pacific Northwest. Serving 1.3 million customers in 11 Washington State counties, its 6,000 square mile service territory covers the largest metropolitan region north of San Francisco and west of Chicago. PSE purchases 65 percent of its electricity primarily from plants on the mid-Columbia River; Bonneville Power is one of its major power providers. The remainder is produced at their own generating facilities located in Washington and Montana, including the Baker River Hydro Project, White River Hydro Project, and Snoqualmie Falls Hydro Plant. Almost half, about 47 percent, of electrical energy consumption is residential; 37 percent is commercial; and 17 percent is used by the industrial and transportation sectors[69].

Seattle City Light is the seventh largest public power system in the United States. It transmits and distributes electricity to more than 330,000 residential, commercial, industrial, and government customers. At 82 percent of its generation, City Light has the highest percentage of hydropower in the region. It obtains most of the remaining power from the Bonneville Power Administration[70].

Natural Gas[4,71]

Puget Sound Energy (PSE) is the sole distributor of natural gas to consumers in King County. PSE purchases gas from Canada and the Western United States. About 61 percent of its gas supply comes from Alberta and British Columbia. Washington State is served by major transmission pipelines from Wyoming, Colorado and Utah. About 39 percent of our natural gas comes from the western United States. About half the natural gas consumed is for residential purposes; 27 percent is for commercial uses; and 25 percent is used by the industrial and transportation sectors.

Fuel Transmission Systems

Williams produces and delivers about 12 percent of the natural gas consumed in the United States. It has three interstate pipelines that serve major markets around the country, including the Seattle and Portland areas. The Williams' Northwest Pipeline system transmission system is a primary artery for the transmission of natural gas to the Pacific Northwest and Intermountain region. The 4,000-mile bi-directional transmission system crosses the states of Washington, Oregon, Idaho, Wyoming, Utah and Colorado. It also provides access to British Columbia, Alberta, Rock Mountain, and San Juan Basin gas supplies. Within King County, the pipeline parallels the I-5 corridor[71].

The Olympic Pipe Line Company, operated by BP Pipelines, North America, is a 400-mile interstate pipeline system that runs along a 299-mile corridor from Blaine, Washington to Portland, Oregon. The system transports gasoline, diesel, and jet fuel. This fuel originates at four Puget Sound refineries, two in Whatcom County and two in Skagit County, and is delivered to Seattle's Harbor Island, Seattle-Tacoma International Airport, Olympia and Vancouver, Washington, and Portland, Oregon. BP Pipelines (North America) is the second largest liquids pipeline company in the U.S., transporting over 450 million barrel-miles of oil, refined products, natural gas liquids, carbon dioxide, and chemicals daily - about nine percent of the U.S. liquids pipeline market[73]. See **Map 3-14: Underground Fuel Lines**.

Telecommunications[4]

King County's telecommunications sector is one of the fastest-growing service industries. In addition to regular telephone or cable copper, telecommunications encompasses fiber optics, wireless (cellular and satellite) technology, and now laser/microwave transmission in urban parts of the region. High-tech companies, such as data centers, “e-tailers,” Internet service providers, and even industrial/distribution companies are in a rush to gain access to fiber optic nodes (or “pipes”) to transmit necessary data at quick and uninterrupted speed. Virtually all metropolitan, suburban and many rural areas in King County are served by digital switching technology to ensure unencumbered access to quick data transmission.

The backbone of this advanced telecommunications system is fiber optic cable, which allows improved data transmission. More than 1,000 route miles of fiber optic cable allow lightwave transmission throughout King County's busiest exchanges. Virtually all metropolitan areas in the Northwest are served by digital switching technology ensuring faster data transmission, increased capacity and maximum clarity.

In King County, consumers have access to modern cellular/wireless networks that are ahead of many parts of the country. The major carriers have widespread coverage throughout the state of Washington and are connected to national networks, providing seamless call delivery.

Land Use, Development and Growth[1,74,75,76,77]

In 1990 the Washington State Legislature passed the Growth Management Act (GMA). For the first time in the State’s history, all urban counties and its cities were required to develop and adopt comprehensive plans designed for a 20-year growth period, and regulations to implement the plans. To achieve an interjurisdictional coordinated countywide plan, GMA further required that King

County and its 35 cities first develop framework policies – the King County Countywide Planning Policies (CPPS).

Designated Urban Growth Areas

Designated Urban Growth Areas (UGAs) originated as a result of the Washington State Growth Management Act which encourages a greater share of growth in urban areas and limits growth in rural resource areas. King County's Urban Growth Area covers 460 square miles of the County's total area of 2,134 square miles; the unincorporated portion of the UGA is now about 84 square miles. The UGA is broken down into three contiguous sub-areas: Seattle-Shoreline, Eastside, and South King County. A fourth sub-area consists of six rural cities and their immediate surroundings. By the Growth Management Act's definition, rural and resource areas are only unincorporated, although there are six urban-designated cities within the rural sub-area: Duvall, Carnation, Snoqualmie, North Bend, Enumclaw and Skykomish.

Urban centers in King County are areas with concentrated housing and employment, supported by high capacity transportation systems and retail, recreational, public facilities, parks and open space. Much of the growth in employment, and a significant share of new housing, is occurring in urban centers. The Centers are linked by the high-capacity transit system, with transit stations located within walking distance to all parts of the center. Each center has its own unique character, and they are all noted for their livability, pedestrian orientation and superior design. Smaller concentrations of businesses are distributed throughout the urban area and focus on providing goods and services to surrounding residential areas. They are linked to Urban Centers by an effective local transit system.

The King County Urban Growth Area contains almost 27,000 acres of vacant or potential redevelopable residential land. The largest acreages of land supply are in South King County (11,500 acres) and the Eastside (7,300 acres).

Vacant land accounts for 43 percent of the land supply in urban King County while 57 percent of the land supply is potential redevelopable land. More than 84 percent of the land supply is in single family zones, but more than two-thirds of the capacity on residential land is in mixed-use and multi-family zones.

Rural and Natural Resource Lands

The rural areas first formally identified in 1985 and expanded in 1992 remain permanently preserved with a clear boundary between rural and urban areas.

King County's rural area, including communities such as Hobart Plateau, Vashon Island, Snoqualmie Valley and Enumclaw Plateau, contains predominantly low-

density residential development with a wide variety of homes found in rural cities, small historic towns, and scattered on lots in a broad range of sizes. Rural resource areas are characterized by extensive forests, small-scale farms, free-flowing rivers and streams that provide high-quality habitat for fish and wildlife, and watersheds crucial for both fisheries and flood control. Large-scale commercial forestry and mining have been traditional land uses in the eastern half of the County where soils are thick and rocky, while farming continues in primate soils found in river valleys. Many rural residential communities are focused on scene resources such as lakes, rivers and territorial views, or lifestyle activities such as keeping horses. There are numerous historical sites, archaeological sites and regionally important recreation areas

The glacial soils and terrain in the rural resource areas also create significant environmentally sensitive areas such as steep, erodable slopes, wetlands and ground water recharge areas. Maintenance of tree cover, natural vegetation and wetlands are critical to prevention of erosion, flooding, property and habitat damage, the continued function of the ecosystem and preservation of rural character.

See **Map 3-15: Urban Growth Boundary** and **Map 3-16: Land Use**.

Land Use Trends and Growth Targets

An additional 325,000 people will live here by the year 2010 bringing the total population to 1.8 million[7]. King County is continuing to develop land primarily in urban areas. The County is nearing its goal of 25 percent growth occurring in urban centers and the percent of rural development is declining. There is adequate land supply and capacity to meet both housing and job targets through 2012 and beyond. The County has nearly 27,000 acres or urban parks, but the number of acres per person is declining.

The “Rural Areas” first formally identified in 1985 and expanded in 1992 remain permanently preserved with a clear boundary between rural and urban Areas. Development has emphasized the use and reuse of the existing urbanized areas. Much of the new growth after 1992 first occurred in the areas where there was existing capacity. Growth then occurred where existing infrastructure could be easily extended or enhanced.

Lastly, areas that require significant new investment in infrastructure accommodated growth. Today, there is still ample room for new development within the Urban Area.

Policies, Regulations, and Codes

There are numerous policies, regulations and codes that govern our environment and way of life in King County. Some are federal requirements and others are directed by the state, regional and local agencies. Components of these documents can relate to or impact hazard mitigation activities. Examples include building and construction codes, fire codes, growth management plans, land use plans, flood management, shoreline regulations, environmental regulations, endangered species legislation, waste and land management, and disaster response plans. A complete listing of policies, regulations and codes, along with specific references applicable to hazard mitigation, are identified in **Annex F: Policy and Program Analysis**.

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Section 4: Participating Agency Profiles

Cities

City of Auburn

The City of Auburn is located in King County in the southern Puget Sound area of western Washington between Seattle and Tacoma. It lies at the south end of Highway 18, in the Green River Valley. Settled in 1855, the town was plotted in 1886. The community was incorporated in 1891. Auburn has a total land area of 21.82 square miles. The City's population numbers 45,355. This is a significant growth over the 2000 US Census population of 40,314, and the trent is expected to continue for the foreseeable future.

The community economy includes The Boeing Company's Auburn plant, a Super Mall, Emerald Downs Race track, the Muckleshoot Casino, a U.S. Government Agency warehouse, and light industrial companies.

The City maintains its own fire and police departments, and coordinates with the King County Office of Emergency Management for emergency management services.

A Mayor and seven council members serve the City of Auburn, and this body is responsible for setting City policies as well as reviewing and approving Auburn's Mitigation Plan.

City of Bothell

The City of Bothell was incorporated in 1909 and consists of 12.09 square miles with a population of 30,910 according to the 2000 US Census. Bothell's economy consists of small and moderate size retail and services businesses as well as multiple business parks which consist of many large businesses and corporations.

Bothell is located on I405, 12 miles north of Seattle, Washington. A residential community that has been able to expand its business park areas to offer great incentives to outside businesses. Although it is limited in space, the downtown area is home of the Bothell City Hall, Bothell Police Department, and Bothell Downtown Fire Station.

The Bothell City Council, a seven-member elected board, is responsible for adopting the Hazard Mitigation Plan. The Emergency Preparedness Coordinator

will assist the City departments in the development and implementation of the Hazard Mitigation Plan Annex.

City of Burien

The City of Burien was incorporated in 1993. It consists of 6.4 square miles and has a population of 31,881 according to the 2000 US Census. Largely a residential community, the City of Burien economy consists of small and moderate sized retail and service businesses.

City of Duvall

The City of Duvall is located in King County at the foothills of the Cascade Mountains. With a population of 5,460 the City of Duvall was homesteaded in 1871 and incorporated in 1913. The largely residential city is served by King County Fire District #45 and has its own police department.

City of Federal Way

Situated 25 miles south of Seattle and eight miles north of Tacoma, the City of Federal Way occupies 22 square miles on a plateau between the Puget Sound and the Green River. The name “Federal Way” was first used in 1929 to identify a school district and was officially adopted in the early 1950s by the Chamber of Commerce. Incorporated in 1990, Federal Way is a rapidly growing community of 83,259 people (2000 US Census) which includes a diverse population. The economy of Federal Way includes major employers like the Weyerhaeuser Company, World Vision, and other companies with headquarters in Federal Way. The largest US Mail bulk sorting facility in Washington State and the King County Aquatic Center are also located in Federal Way.

The Federal Way Fire Department and the Federal Way Public School District serve Federal Way. Federal Way has its own police department.

City of Issaquah

The City of Issaquah is located at the Southern end of Lake Sammamish fifteen miles East of Seattle. Occupying 11.5 square miles and bisect by Interstate 90; Issaquah covers portions of three mountains, two valleys and a plateau, and includes four major stream systems. Incorporated in 1892 with a coal mining history, Issaquah has become a diverse, rapidly growing community of 15,253 people. A significant amount of Issaquah’s residential community resides on Squak Mountain and Cougar Mountain, which is subject to coalmine subsidence and slide hazards. The streamside residential and commercial areas in Issaquah and Tibbetts Creek Valleys are subject to flooding, and the areas adjacent to I-90 and SR-900 are vulnerable to hazardous materials spills. Issaquah’s mountainous terrain and heavy tree cover make it particularly susceptible to

winter storms. The economy of Issaquah includes a mix of retail, office, commercial and some light industry with a number of major employers like Microsoft and Costco. The City of Issaquah is a full service city with a seven-member council and elected mayor. Issaquah has its own police department and water, sewer and storm water utilities. Eastside Fire and Rescue provide fire and medical services.

City of Kirkland

The City of Kirkland was established in 1888 on the banks of Lake Washington. Incorporated in 1905, the 5.75 square mile community is the home to 45,054 residents. Kirkland is largely a residential community of professionals. The City of Kirkland has its own fire, building, police, and public works departments. The City of Kirkland is served by Lake Washington School District.

City of Medina

The City of Medina was incorporated in 1955. This 1.4 square mile residential community is located approximately two miles west of Interstate 405 along State Route 520 and north of Interstate 90, on the east side of and bordering Lake Washington. The 2,990 (2001) resident population consists of professionals, many of whom are high profile. The city has its own police department who also serves the Town of Hunts Point and contracts with the City of Bellevue for water, sewer and fire protection services. Puget Sound Energy is the provider of gas and electric services. The seven-member, elected Medina City Council is responsible for adopting the Hazard Mitigation Plan.

City of Normandy Park

The City of Normandy Park was established in 1953 and consists of 1681 acres with a population of approximately 6395 according to the 2002 estimates projected from the 2000 Census. The City is governed by a seven member Council that are elected by the registered voters of the City for 4 year terms. The Council sets policy and hires a City Manager to run the City Government. The City is primarily single-family residences, with an economy of a few small to moderate retail sales and service oriented businesses. Geographically, the City is located in the south west of King County, Washington. State route 509 runs along the eastern border of the City. The City is served by Burien/Normandy park Fire Department, two independent sewer districts, 3 independent water districts, Seattle City Light and Puget Sound Energy. The City lies entirely within the Highline School District.

City of North Bend

Named for the bend in the Snoqualmie River, the City of North Bend was established in 1889 and incorporated in 1909. North Bend is a small rural, mostly residential town, located in a plateau of the Upper Snoqualmie River Valley that includes wooded landscapes, the Snoqualmie River system, Interstate-90, and the slopes of the nearby Cascade Mountains. North Bend is the closest city to the Snoqualmie Pass area and the first community as I-90 travelers head west to the metropolitan Puget Sound areas. With a 2000 US Census population of 4,746, the city covers an area of 2.9 square miles.

City of Redmond

The City of Redmond was established in 1881 on the fertile plains between Lake Washington and the Snoqualmie River. Incorporated in 1912, Redmond covers 16.6 square miles and has a 2000 US Census population of 45,256. There is a sizable population of non-English speaking residents that calls Redmond home. The Redmond economy includes world and North American Corporate Headquarters for the Microsoft Corporation, Ninetendo, AT&T Wireless, and Medtronic/Physio Control.

Redmond is served by its own police and fire departments. Lake Washington School District provides public education for the children in the city.

City of SeaTac

The City of SeaTac was incorporated in 1990. The city covers 13 square miles and is home to 25,320 people. The City is located on a plateau overlooking the Green River valley, South of the City of Seattle. The major employers in the city include airlines, Sea-Tac International Airport/Port of Seattle and services that serve travelers to the Pacific Northwest such as hotels, restaurants and car rental agencies. The City of SeaTac has a very diverse population base. Water is provided by Highline Water District and Water District 125. Sewer service is provided by Midway and Val Vue Sewer districts. Puget Sound Energy and Seattle City Light provide electric service. Gas service is provided by Puget Sound Energy and phone service is provided by Qwest. Schools are provided by Highline School District 401. Police is contracted with King County Sheriff's Office and the City provides its own fire, public works, and parks.

City of Woodinville

The City of Woodinville was incorporated in 1993 and has a 2000 US Census population of 9,194 covering 5.6 square miles. Woodinville is home to the St. Michelle Winery and several plant nurseries. The city residents are served by the

Northshore School District, Woodinville Fire and Life Safety, Woodinville Water District, and contracts for police services with the King County Sheriff's Office.

Fire Districts

King County Fire District #2 - Burien

King County Fire Protection District #2 is located in Southwest King County and was established in 1920. The District is governed by a board of 3 Commissioners that are elected for 6 year overlapping terms. As portions of District #2 became cities, the City of Normandy Park and the City of Burien eventually annexed into District #2. Currently District #2 consists of the City of Normandy Park and the City of Burien in their entirety with a population of approximately 36,000. The north 1/3 of the City of Burien is covered by an emergency services contract with North Highline Fire District as they have stations located closer to this area. District #2 is essentially a bedroom community to the City of Seattle, and has a fairly large commercial area in the downtown Burien and more commercial in the area of 1st Avenue S. that runs North-South through the District for 3 miles. The west border of the District is Puget Sound where there is a large amount of urban interface between high bank wooded areas and homes. The east border of the District is Sea-Tac Airport, protected by the Port of Seattle Fire Department. The northern border of the district is a portion of King County that has yet to be annexed by a municipal entity but is currently being looked at for annexation by the City of Seattle and the City of Burien. If the City of Seattle annexes this portion of the County, this would leave the northern portion of the District with no station to provide coverage and Seattle does not contract for services or provide automatic mutual aid. The southern border of the district is the City of Des Moines. Over the years District #2 has gradually increased staffing to a current level of operating 2 Stations (Station 28 & Station 29) with 2 engines staffed with three personnel each and one aid car staffed with 2. These apparatus are also cross-staffed with a 105' aerial ladder truck and a zodiac style water rescue craft. District #2 is primarily funded by property taxes with a current rate of $1.41 per thousand of assessed valuation.

Federal Way Fire Department

Federal Way Fire Department is a fire district serving the greater Federal Way area within Fire Zone 3. Formed in 1949, the district covers 34 square miles and serves 125,000 people. A board of commissioners governs it as a junior taxing district. The district is proud of its fire prevention, public education, and mitigation efforts. Other services provided include fire suppression, hazardous materials response, and basic life support – medical services.

King County Fire District #40 - Renton

King County Fire District #40 is a fire district in the Fairwood area of King County, east of Renton. The district covers 12 square miles and serves 43,000 people. Formed in 1949 it is governed by commissioners as a junior taxing district. Services provided include fire suppression and basic life support – medical services.

North Highline Fire District – White Center

North Highline Fire District, originally known as King County Fire District 11, was legally authorized in 1942. The District is governed by an elected, three member, Board of Commissioners. The District currently serves approximately 43,000 citizens in a densely poulatred nine square mile area. IN 2003, the Ditrict answered 5,002 requests for services. The population is traditional blue collar and diverse in the extreme. A recent award winning documentary film profiles a District elementary school where not feweert han 27 lanaguages are spoken by students. The district also serves approximately one-third of the city of Burien on a long term contract for emergency services. The Board of Commissioners will make plan approval for both the protected area. North Highline District boundaries abut the southern boundary of the City of Seattle with Seatac Airport on the Northeast. The District is bisected by SR-509.

Maple Valley Fire and Life Safety District #43

Maple Valley Fire and Life safety (King County Fire District 43) was established as a fire district in 1953 and consists of 55 square miles and a population of 45,000 according to 2002 District projections. Maple Valley Fire and Life Safety has a three member Board of Commissioners that are elected by registered voters of the district for 6 year terms. The economy for the district is primarily small to moderate retail sales and service businesses. Geographically, the district is located in southeast King County where SR 516 and SR 169 intersect. State Route 18 also travels through portion of the district. Highway 18 is considered a major transportation route for commercial traffic. The City of Maple Valley is located within the boundaries for the Fire District. The Board of Commissioners for the Fire District are responsible for adoption of the Hazard Mitigation Plan, when completed.

King County Fire District #44 – Mountainview

King County Fire Protection District 44 was established as a junior taxing district in 1954, provides fire, rescue and basic emergency medical services, staffing seven fire stations protecting 45 square miles of unincorporated south central King County. The District provides service for the majority of the Muckleshoot Indian Reservation. The district protects several schools and a large community

college. A five-member elected board represents the 23,000 District residents. The privately sponsored White River Amphitheatre and Pacific Raceways draw 20,000 spectators each during events from the beginning of spring to the end of summer.

King County Fire District #45 – Duvall

King County Fire District #45, Duvall Fire Department serves 53 Square miles in eastern King County. The district was formed in 1959 and serves 14,000 people. A board of commissioners governs it. Services provided include fire suppression and basic life support – medical services.

Woodinville Fire and Life Safety

Woodinville Fire and Life Safety is a fire district in northeastern King County serving 36 square miles and the citizens of greater Woodinville in King County, since 1948. Over 50,000 citizens depend on Woodinville Fire and Life Safety for fire suppression, basic life safety – medical services, and they contribute to the Eastside Hazardous Materials Response Consortium.

Utility Districts

Cedar River Water and Sewer District

Cedar River Water and Sewer District was formed in June of 1960 and is located in southeast King County. The District serves 10,364 water and sewer connections in a 37 square mile area of Fairwood and Maple Valley. A board of 3 elected commissioners governs the District.

Coal Creek Utilities

Coal Creek Utilities is a district formed in 1959. It serves 13,938 households and businesses in and around the City of Newcastle with water and sewer service in a 5 square mile area. A board of commissioners governs the district.

Covington Water District

The Covington Water District was formed in southeast King County in 1960 with less than 100 customers. Over the years, a number of small districts merged into the Covington Water District and more customers were added as development occurred. Currently the Covington Water District serves a population of approximately 33,000 with 13,000 connections in a 53 square mile area that borders the city of Kent to the west and the Green River to the south. The District encompasses portions of the cities of Covington, Maple Valley and Black

Diamond as well as unincorporated King County. The District's service area contains residential, commercial and institutional/educational development. The Covington Water District is governed by a five member Board of Commissioners who will adopt the plan by resolution.

King County Water District #20

King County Water District #20 is a district formed in 1925. It serves 10,624 households and businesses covering 6.98 square miles in and around the greater City of Burien with their water needs. The district is governed by a board of commissioners.

King County Water District #90

King County Water District #90 is a district formed in 1952. It serves 5,569 households and businesses near Renton with their water needs. The district is governed by a board of commissioners.

King County Water District 111

King County Water District #111 (KCWD111) originally formed in 1962 to bring water service to the Lake Meridian area. KCWD111 provides water service to a population of approximately 19,000, covering approximately 7 square miles. KCWD111 serves primarily residential customers within the City of Kent, a portion of the City of Covington and unincorporated King County. Other water purveyors bound KCWD111's service area including, the City of Kent, Covington Water District, Soos Creek Water & Sewer District, and the City of Auburn. A three-member Board of Commissioners responsible for adopting the Hazard Mitigation Plan governs the District.

Midway Sewer District

Midway Sewer District is located near the border between Kent and Des Moines and was formed in 1946. It serves 7,500 households and businesses within a 13 square mile area. and is governed by a board of commissioners.

Northshore Utility District

Northshore Utility District (District) is a special purpose water and sewer district near Seattle, Washington that receives its authority to operate under Title 57 of the Revised Code of Washington. The District is governed by a five-member board of commissioners who are elected by the ratepayers. The District was originally formed in 1947 as King County Water District No. 79. The District operated only as a water purveyor until 1979 when it merged with Northeast Lake Washington Sewer District at which time it became known as the Northeast Lake

Washington Water and Sewer District. In 1992, the name was changed to Northshore Utility District.

The District lies mainly within King County. It is bordered by Lake Washington on the southwest, the Snohomish-King County border to the north, and the western foothills of the Sammamish River to the east. The elevation of the District ranges from about 14' above sea level along the shores of Lake Washington to approximately 550' in the northwest portion.

The District encompasses more than 11,000 acres in the municipalities of Kenmore, Bothell, Lake Forest Park and Kirkland, as well as parts of unincorporated King County, and serves more than 70,000 people through approximately 22,000 service connections. While the majority of the District's service area is single family residential, it also serves multi-family residential, commercial, public facilities and parks. The District also serves Evergreen Hospital, several health care centers and twenty public and private schools.

Ronald Wastewater District

Ronald Wastewater is a sewer utility serving 10.5 square miles of the greater Shoreline area. The district was formed in 1951 and serves 15,038 households and businesses. It is governed by a board of commissioners.

Shoreline Water District

Shoreline Water District is a special purpose district that has been providing municipal water service since its inception in 1931. The District serves approximately 7,824 households and businesses within portions of the City of Shoreline and Lake Forest Park, throughout an area of approx. 5 square miles. Shoreline Water District is governed by a board of commissioners.

Soos Creek Water and Sewer District

Soos Creek Water & Sewer District was formed in 1939 and serves 35 square miles with an approximate population of 80,000. The District provides both water and sewer services generally in South King County. Specifically, the District's corporate boundary generally lies directly east of and adjacent to the City of Kent and south of, and adjacent to, the City of Renton. The District extends east to Maple Valley and south to Black Diamond and Auburn. In addition to serving these areas in whole or in part, the District serves the entire area of the City of Covington and portions of unincorporated King County. The District is governed by a Board of Commissioners.

Southwest Suburban Sewer District

The Southwestern Suburban Sewer District provides wastewater services to 23,198 customers from unincorporated King County, the Cities of Burien, Normandy Park, SeaTac Seattle and Des Moines. The coverage area includes 13.15 square miles. The district was formed in 1945 and is governed by a board of commissioners.

Val Vue Sewer District

The Val-Vue Sewer District is a wastewater district serving 14,000 customers in the area of 8 square miles covering parts of Burien, SeaTac, Tukwila and unincorporated King County. The district was formed in 1946 and is governed by a board of commissioners.

Woodinville Water District

Woodinville Water is a utility district serving 24,223 customers in the 34 square mile area around greater Woodinville with its water needs. It also provides sanitary sewer service. The district was formed in 1969 and is governed by a board of directors.

School Districts

Lake Washington School District

The Lake Washington School District serves the cities of Redmond, Kirkland, and Sammamish as well as areas of unincorporated King County. 23,476 children in grades K-12 attend LWSD schools. The school district was formed in 1944 and serves 76 square miles. It is governed by a board and a superintendent of schools.

Federal Way School District

The 36 Federal Way Public Schools are home to 22,462 students, including 2,780 disabled students; a 74% minority population speaking 78 different languages; 220 pre-school special needs students and 3,983 full or part time staff. With heavy dependence on roadways, 9,680 students are transported daily to and from school on 145 radio-equipped busses traveling 1,371,021 miles annually. The School District encompasses 35 square miles, is bordered by 8 miles of Puget Sound and is intersected by 9 miles of Interstate 5. The District's northern boundary is 3 ½ miles south of SeaTac International Airport and approximately one third of the District's buildings are in the flight path. The District's Central Kitchen prepares about 13,000 lunches daily. The District's

boundaries include all or part of 4 municipal and 4 public utility jurisdictions, with all energy services supplied by Puget Sound Energy. Founded in 1929, a five member elected Board of Directors governs the District. The District is a participant in the Greater Federal Way Emergency Operations Center.

Vashon Island School District

The Vashon Island School District is a district comprised of three schools – one elementary, one middle school and one high school – with a districtwide enrollment of about 1,600 students and employment of 200 staff members, including 105 full-time certificated teachers. The student population is approximately 12% disabled and 9.24% minority, with five different languages spoken. A large percentage of the students, about 25%, are gifted and talented. The school board consists of five local elected individuals of varying backgrounds, careers, and interests.

Our centralized campus, of about 122 acres, is bordered on the North by a church, businesses, residential housing, and wooded areas; on the South by wooded areas, residential housing, a King County Forward Thrust Pool, the Transportation Department/Bus Lot, and the district's Administrative Offices, including stand-alone portables for Technology and Facilities; on the East by wooded areas, residential housing and a church; and on the West by businesses, including retail and restaurant establishments, the telephone company main office, the Blue Heron Arts Center, residential lots, and a Park and Ride lot.

Vashon Island is part of non-incorporated King County, and is served by Puget Sound Energy (electrical and natural gas), CenturyTel (communications), Vashon Island Fire & Rescue, King County Roads, and several independent water companies, with the School District receiving its water from Water District 19.

Unincorporated King County

Unincorporated King County includes 1,750 square miles and a population of 352,360[1]. King County Government's primary responsibility is to the citizens of these rural areas and the urban areas of White Center and Skyway. King County government provides a variety of regional services such as transit, waste water and solid waste management, court and public health services. Contract cities receive some services from the Sheriff's Office and King County Roads Division of the Department of Natural Resources and Parks. There is a continuing trend toward the delivery of regional services and toward annexation of unincorporated King County by cities. Formation of new cities has slowed dramatically from the pace of the 1990's.

The Wastewater Treatment Division of the Department of Natural Resources and Parks provides regional treatment of wastewater to 1.4 million customers in King County. The system consists of two large and one small secondary treatment

plants, and 2 combined sewer overflow/storm water treatment plants. Over 270 miles of large diameter conveyance pipelines include 96 pumps, regulators, and combined sewer overflow facilities. The system is vulnerable to severe land movement and concerted terrorist attack. It is also dependant on electricity to operate.

Section 5: Hazard Identification and Vulnerability Assessment (HIVA)

The first step toward a mitigation program is the identification of the hazards a community may face. Firsthand information can be obtained from interviews of businesses, local employees, first responders, and residents; or gathered from newspaper archives, FEMA documents, state and local government records, and the Internet. Largely, local hazards can be categorized as either natural or technological/manmade events. While the local climate changes rather slowly, our manmade environment can change rapidly, especially in terms of the local economic base.

Some hazard events occur on an almost annual basis while others may not happen once within our lifetime. Additionally, not every hazardous event occurs with notable damage or loss of life. For this reason, hazards are assessed by comparing the experienced frequency of the event versus the potential impact that may result.

High Probability Low Impact	**High Probability Moderate Impact**	**High Probability High Impact**
Moderate Probability Low Impact	**Moderate Probability Moderate Impact**	**Moderate Probability High Impact**
Low Probability Low Impact	**Low Probability Moderate Impact**	**Low Probability High Impact**

Probability vs. Impact

Planning begins with events that are expected to occur often and have potentially high impacts on life and property followed by those with more moderate probabilities or moderate impacts. Jurisdictional strategies are dependant on the philosophy and experiences of local officials. Largely, the priorities addressed in HIVA years one through five are a reflection of this assessment and local philosophical priorities.

For the purpose of this document, the criteria for high, moderate, and low probability are:

High Probability: once a year
Moderate Probability: once every two to ten years
Low Probability: once every ten to fifty years

Events occurring once every 50 to 1,000 years will are treated as “low probability” for the purpose of this document.

Criteria for evaluating impacts are somewhat more subjective. While some figures are available for dollar damages, productivity and economic losses are difficult to gauge. Injuries and fatalities are similarly difficult to assess. There is no known method for evaluating and quantifying the impacts of personal injury or loss of life, and whether the potential exists to affect one life or many. However, without establishing a value to human casualty, calculation of benefit-cost analysis for proposed mitigation projects could not be conducted.

Benefit / cost = ratio

Benefit-Cost analysis is required to prioritize mitigation projects. High ratios would receive a higher priority than lower ratios. We will use $2.3 million as the minimum benefit of one life saved by these projects. The figure was one used by some in the 9-11 World Trade Tower settlement discussions.

Cause and Effect

Disaster events can be categorized as the cause of an impact or the effect/impact itself. Winter storms bring heavy rains, high winds, snow, and cold temperatures (causes) that may result in property damage, local flooding, power outages, injuries and deaths (effects). Despite flooding being an effect of severe weather conditions, it can also be considered to be an event with its own unique effects to roadways, structures, building sites, and bridges. Power outages can be associated with a variety of natural or manmade events. Power interruptions are addressed as effects of natural or technological events in the King County Regional Hazard Mitigation Plan. Washington State Emergency Management has included a flooding element of its hazard identification and vulnerability assessment as well. The RHMP follows that model.

Five-year Planning Cycle

Research and planning for all the hazards a community may be vulnerable to is a very time-consuming process. For this reason, HIVA is being updated over a five-year period. The expectation of the “year one” planning effort is to provide a detailed update of the community’s most pressing vulnerabilities, with other possibilities and year one revisions distributed over the subsequent four years.

Year One Hazard Focus

The Pacific Northwest has experienced specific notable natural hazards listed below for thousands of years. These are included in the first year HIVA. The following hazards are addressed as part of the year one (2003) planning phase:

Severe Weather
Avalanche
Flooding
Landslide
Earthquake
Civil Unrest
Terrorism

These topics were identified as a higher priority based on past hazard history, frequency and likelihood of occurrences, and potential catastrophic losses. On the strength of recent national and local events and other concurrent planning processes, it seemed logical to add terrorism and civil unrest to the year one HIVA focus.

Years Two through Five

Years two through five will include updates, expansion and development of other hazard topics including drought, wildfire, tsunami-seiche, cyber terrorism, hazardous materials, industrial, transportation, erosion, volcanic activity, urban economy, agricultural economy, air and water quality, food contamination and epidemics. This time period also includes a process to continually review HIVA documents in order to maintain current hazard information and to accurately evaluate vulnerabilities and planning priorities.

Some topics to be updated and expanded upon are contained in the 1997 King County Hazard Identification Vulnerability Assessment included in the "annex" section of this document; new hazard topics will be developed over the next four years based on priority of hazard impact.

Sources of Data

Information supporting the hazard identification vulnerability assessment update for the 2003 regional hazard mitigation plan was obtained from a variety sources:

- King County Office of Emergency Management-Duty Officer Log 1996 to present
- National Weather Service
- Presidential Disaster Declarations 1990 to present
- Media searches (newspapers) & Websites
- Jurisdiction and agency experience
- King County Geographic Information System (GIS)
- University of Washington Seismology Department

(Note: Washington State damage data was not made available for this document.)

Introduction

With a substantial marine influence, the climate of King County is well known for its moderation. Despite this, severe weather in King County can happen at any time of year but usually occurs between October and April. Severe weather can include unseasonable rain, snow, ice, extreme cold, and high winds. (Wind speed itself does not predict damage due to different tempering effects of variable landscapes; 45 mph tends to be the threshold at which damages occur.)

The effects of severe weather in the County can include flooding, power outages, land and mudslides, and road, rail and airport closures. There is little snow removal equipment or budget associated for such service in King County. Vehicles and drivers are often poorly equipped to travel roadways under such conditions. For this reason, impacts from unusually heavy snowfalls and severe winter tend to be dramatic though short-lived.

High Probability Low Impact	**High Probability Moderate Impact**	**High Probability High Impact**
Moderate Probability Low Impact	**Moderate Probability Moderate Impact**	**Moderate Probability High Impact**
Low Probability Low Impact	**Low Probability Moderate Impact**	**Low Probability High Impact**

Severe Weather Probability vs. Severe Weather Impacts

Hazard Identification

Precipitation

The geographical location of northwestern Washington subjects it to several climatic controls: the effects of terrain, the Pacific Ocean, and semi-permanent high and low pressure regions located over the North Pacific Ocean combine to produce significantly different weather conditions within short distances.[1] Accordingly, rainfall in King County varies widely from city to city and area to area. The City of Seattle has an average of 37 inches annually;[2,3] while Enumclaw has an annual average of 55 inches[4,5] and Snoqualmie/North Bend has 61 inches[6,7] of precipitation. The majority of this precipitation occurs as rain in the lowlands between October and early May with substantial snow packs in the Cascades during the same time frames.

Snow accumulations in King County at elevations below 2,000 feet are uncommon. On average, Seattle will have one or two snow storms during a winter season with appreciable accumulations. Snow accumulation rarely remains two days after such a storm. Heavy local snows and associated cold conditions have resulted in power outages, transportation restrictions, and adverse impacts to the regional economy.

Table 5-1: Precipitation in Inches by Month[8]
(Snow and Rain for Seattle)

Month	Average Snowfall	Average Snow Pack	Average Rainfall	Average Precipitation Winter 96/97[9]
July	0	0	.95	.77
August	0	0	1.30	1.32
September	0	0	1.61	1.85
October	0	0	3.35	5.54
November	0.7	0	5.63	5.23
December	1.8	0	6.03	11.20
January	1.4	0	5.01	7.02
February	0.7	0	3.92	1.99
March	0.3	0	3.80	8.20
April	0	0	2.81	4.32
May	0	0	1.99	2.88
June	0	0	1.52	1.91

Wind

High wind events in King County are fairly common and are usually experienced as part of a winter weather pattern.

Ice and Extreme Cold

King County's marine climate results in very few extreme cold/ice events. Typically, the area experiences below freezing temperatures for 10-14 consecutive days in January or February.

Flooding

Severe weather is often accompanied by heavy rains and flooding conditions, See Flooding section.

Power Outages

Power outages are commonly experienced in association with high winds, rain and flooding conditions.

History of Events

The table below represents damages to public property from severe weather events since 1972. Damages occurred to roadway, school roofs, reservoirs, vehicles (from falling trees), and public buildings were caused directly or indirectly by wind, rain, snow load, or flying debris.

Table 5-2: Severe Weather History

FEMA No.	Dates	KC Public Damages (FEMA Approved)
328	1972 – Flooding	Prior to FEMA
492	1975 - Flooding	Prior to FEMA
545	1977 – Flooding, landslide	Prior to FEMA
612	1979 – Flooding	Figures not available
757	1986 – Flooding, landslide	Figures not available
784	1986 – Flooding	Figures not available
852	1990, Jan – Flooding	$5,246,411
883	1990, Nov – Flooding	$3,694,824
896	1990, Dec – Flooding	$ 477,737
981	1993, Jan – Wind Storm	$1,927,837
1079	1996, Jan – Winter Storm	$3,031,519
1100	1996, Feb - Flooding	$4,226,719
1159	1997, Jan – Winter Storm	$3,576,309
1172	1997, April – Flooding	$1,266,446
Total		**$23,447,802**

Hazard Impacts

Precipitation

Heavy local snows and associated cold conditions have resulted in power outages, transportation restrictions, and adverse impacts to the regional economy.

Wind

Winds in excess of 45 miles per hour can cause road closures, significant damages to public and private property, and injuries to public safety, utility workers and private citizens. The most recent and best known of these was the Inaugural Day Windstorm on January 19, 1993.[10] Winds began mid-morning, lasted five hours and reached over 90 miles per hour in downtown Seattle. Widespread power outages resulted from downed trees and many suburban and rural roads were made impassible. Usually, these winds are from the south.

Ice and Extreme Cold

Extended temperatures of less than 20 degrees can burst residential water pipes. The population is vulnerable to the effects of extreme cold and associated power outages. In some cases, shelters are opened for the homeless, senior citizens and people without heat/power.

Power Outages

Downed trees caused by high winds and rain saturated soils damaged transmission lines and cause power outages in local areas for hours to days when multiple occurrences are experienced. Utility crews from Puget Sound Energy, Bonneville Power and Seattle City Light work around the clock to restore services. Outages of 80,000 customers have been experienced. Downed power lines pose an electrocution hazard to motorist, pedestrians and any unsuspecting by-standers.

Transportation Impacts

High winds sometimes result in the closure of the floating bridges (Highway 520 and Interstate 90) over Lake Washington. Wind-driven waves often break over the roadway under those conditions.

Trees uprooted by wind regularly sever power lines and/or block vehicular access. Together, these conditions make roadways impassable.

Past Mitigation Efforts

One of the most common impacts from severe weather is the loss of commercial power. Since many other services rely on power for critical functions, providing backup power capabilities has long been a favored strategy for mitigating damages from winter storms. Many police precincts, fire stations, emergency operations centers, hospitals, service providers and major employers have already introduced this capability.

Severe Weather Endnotes:

[1] *Climate of Washington*. Western Regional Climate Center. 12 Oct. 2003 www.wrcc.dri.edu/narratives/WASHINGTON.htm
[2] *In Town, Out-of-Doors facts*. Seattle's Convention and Visitors Bureau. 30 Sept. 2003 www.seeseattle.org/visitors/overview/intownmore.asp
[3] *Seattle Visitor Information – Weather*. 26 Jul. 2003. GoNorthwest Travel Guide. 30 Sept. 2003 www.gonorthwest.com/Washington/seattle/weather.htm
[4] *Enumclaw – Climate & Weather*. Key to the City. 30 Sept. 2003 www.pe.net/~rksnow/wacountyenumclaw.htm#climate

[5] *Enumclaw Area Chamber of Commerce.* 30 Sept. 2003 chamber.enumclaw.wa.us/area_info-demographics.htm
[6] *Snoqualmie Falls, Washington – Period of Record Monthly Climate Summary*. Western Regional Climate Center. 30 Sept. 2003 www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wasnoq
[7] *Weather*. Snoqualmie Valley Chamber of Commerce. 30 Sept. 2003 www.snovalley.org/vn_weather.html
[8] Western Regional Climate Center - *Seattle Urban Site, Washington – Period of Record Monthly Climate Summary*. Western Regional Climate Center. 12 Oct. 2003 www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wasurb
[9] *Seattle Climate Data Monthly Summary*. Beautiful Seattle. 12 Oct. 2003 www.beautifulseattle.com/clisumm.htm
[10] *"400,000 Lose Power – But Storm Not as Bad as Had Been Feared*." Seattle Times 13 Dec. 1995: A.1.

Introduction

Avalanche hazards in the Northwest are associated with winter storms in the Cascade and Olympic Mountain ranges. Avalanches occur when a snow pack loses its grip on a slope and slides downhill. Typically, slopes of between 20 to 30 degrees and snow packs of 34 inches or more may produce avalanches.[1]

There are two kinds of avalanches, loose and slab. Loose avalanches occur when light-grained snow exceeds its angle of repose, collapses a snow drift or bank and fans out as it slides downhill. A slab avalanche occurs when heavy or melting snow resting on top of looser snow breaks away from the slope and moves in a mass. The latter often occurs when rains soak the top layer of snow on moderately sloped terrain.

The factors that cause avalanches are numerous and complex. Scott Kruse lists twelve common factors: old snow depth, old snow surface, new snow depth, new snow type, snow density, snow fall intensity, precipitation intensity, settlement, wind direction and wind speed, temperature, subsurface snow crystal structure, and tidal effect.[2] Research done at Snoqualmie Pass indicates that most natural avalanches occur within one hour after the onset of rain over a weakened snow pack.[3]

High Probability Low Impact	**High Probability Moderate Impact**	**High Probability High Impact**
Moderate Probability Low Impact	**Moderate Probability Moderate Impact**	**Moderate Probability High Impact**
Low Probability Low Impact	**Low Probability Moderate Impact**	**Low Probability High Impact**

Avalanche Probability vs. Avalanche Impact

A variety of mitigation efforts have significantly reduced the potential impact on humans and property. See “History of Mitigation Efforts.”

Hazard Identification

Avalanche danger is highest during severe winter weather. It is also true that most natural avalanches occur in back country little used by humans during such weather conditions. This tends to minimize exposure to avalanche impacts. Most at risk are travelers and winter recreation enthusiasts using Steven’s Pass in northern King County, Snoqualmie Pass in central King County, and Crystal Mountain Ski Area near Chinook Pass in southern King

County. Recreational areas that support snowshoeing, alpine and cross-country skiing, snowmobile areas, and winter hikers and campers are most at risk from avalanche events. Typically, injuries to recreational hikers, skiers, snow boarders, and climbers occur outside managed areas.

Several stretches of Interstate 90 and Highway 2 in King County are vulnerable to avalanches between November and May each year, depending on snow packs and weather conditions.

Both Snoqualmie and Steven's Pass are significant commercial routes. Cargos are carried between the Ports of Tacoma and Seattle, and eastern Washington. When Stevens and Snoqualmie Passes are closed, air travel is the only practical way to travel between Spokane and Seattle.

History of Events

The most significant avalanche event in Washington State occurred in 1910 near Steven's Pass. A train carrying passengers was hit by an avalanche killing 96 people.[4] The table below represents recent and significant avalanche events in King County.

Table 5-3: Avalanche History

Year	Location	Impact
1910	Steven's Pass[5]	96 killed
1962	Steven's Pass	2 buried
1966	Snoqualmie Pass	1 buried
1971	Snoqualmie Pass	1 killed
1993	Snoqualmie Pass	5 injured
1994	Steven's Pass	11 injured
1996	Snoqualmie Pass	2 buried
1996	Alpental (Snoqualmie Pass)	2 dead
1996-97	Snoqualmie Pass, I-90	Repeated closure of Pass, stranding travelers several days
2002	Snoqualmie	I-90 road closures lasting multiple days

Source: Washington State Emergency Management Division, Hazard Identification and Vulnerability Analysis, June 1996.

Periodically each winter season, Snoqualmie and Stevens Passes both close for several hours for avalanche control measures. During the 2002-03 winter season, there were 30 deaths from avalanches in Washington State. Un-inhabited alpine areas in the Cascades north and south of I-90 experience hundreds of avalanches annually.[6]

Hazard Impacts

Impacts on King County from avalanche closures of Snoqualmie Pass include economic impacts to the Port of Seattle, ski areas, and the cities of Snoqualmie, North Bend, Skykomish, and Issaquah. Motorists and truckers are often re-routed through Interstate 84 in Portland.[7] Stranded motorists occupied shelters and hotel space in Snoqualmie, North Bend, Issaquah and Bellevue. During the winter of 1996-97, I-90 was closed for 276 hours. The later closures cost the State of Washington an estimated 144 million dollars (2002).[8]

Past Mitigation Efforts

Avalanche research began in the mid-1940s. By 1952 Stevens Pass was one of three research stations in the United States. The use of artillery for avalanche control was one of the developments of that research. Washington State Department of Transportation (WSDOT) is responsible for avalanche control. The WS DOT snow and ice removal budget was $20,000,000 in 1996, the most recent available data provided.[8] This money has been used to control avalanche hazards along major roadways. The roadway covering along I-90 near Snoqualmie and the 7.8 mile tunnel at Stevens Pass was constructed to protect rail lines from avalanches in 1929.[3] The National Weather Service Avalanche Center provides reports on avalanche conditions and issues advisories.

Avalanche Endnotes

[1] Washington State Department of Transportation, Prediction of Snow and Avalanches in Maritime Climates: Final Report, WA-RD 203.1, December 1989, p.3.
[2] Avalanche Evaluation Check List by Scott M. Kruse in the Avalanche Review vol. 8, No 4, February 1990
[3] Washington State Department of Transportation, Prediction of Snow and Avalanches in Maritime Climates: Final Report, WA-RD 203.1, December 1989, p.1.
[4] Description of the Wellington (Stevens Pass) avalanche, www.Northwestrailfan.com/scenic
[5] "In mountains, experience sometimes isn't enough" by Joe Nabbefeld, Seattle Times, December 27, 1996, p. B1
[6] "Cold Snap May Help Situation in Passes" by Richard Seven, Seattle Times, February 11, 1990, p. A1
[7] Washington State Emergency Management Division, Hazard Identification and Vulnerability Analysis, draft, May 2003
[8] Washington State Emergency Management Division, Hazard Identification and Vulnerability Analysis, June 1996, P. A2

Introduction

Flooding in King County occurs primarily when large wet and warm weather systems occur in the Cascade Mountains and after snow packs have accumulated. The combination of melting snow runoff and added precipitation can fill rivers within hours but usually build over one to three days. For this reason most flooding occurs in the winter months.

Rainfall in geographic King County varies widely from city to city and area to area. The City of Seattle has an average of 37 inches annually,[1,2] while Enumclaw has an annual average of 55 inches[3,4] and Snoqualmie/North Bend has 62 inches[5,6] of precipitation. The majority of this precipitation occurs as rain in the lowlands between October and early May with substantial snow packs in the Cascades during the same time frames.

High Probability Low Impact	**High Probability Moderate Impact**	**High Probability High Impact**
Moderate Probability Low Impact	**Moderate Probability Moderate Impact**	**Moderate Probability High Impact**
Low Probability Low Impact	**Low Probability Moderate Impact**	**Low Probability High Impact**

Flooding Probability vs. Flooding Impacts

Hazard Identification

King County has several low-lying areas that are susceptible to flooding on an annual basis to varying degrees. Neal Road, Southeast Reinig Road and Northeast Walker Road may flood at Phase II on the Snoqualmie River while at Flood Phase III water covers the lower Mill Creek basin roadways. Cities that have experienced significant river flood impacts include Auburn, Kent, Issaquah, Carnation, Duvall, Renton, Bothell, Snoqualmie and North Bend.

Table 5-4 shows there is a buildup of snow pack in December through March with a rapid melt-off of that snow pack while spring rains continue. Heavy rains in November and December, when accompanied by fluctuating temperatures, can trigger events similar to spring melts. Thanksgiving weekend has often been noted as the beginning of flood season in King County.

Flooding events in King County are described in Flood Phases for individual river systems.[8]

Flood Phase I: Rivers running bank full

Flood Phase II: Some minor flooding and water over roadways

Flood Phase III: Some homes inaccessible, roadways overtopped, water velocities may be dangerous with some debris

Flood Phase IV: Homes in low-lying areas flooding with significant damage and threat to life and safety

Table 5-4: Precipitation in Inches

Month	Average Snowfall[7]	Average Snow Pack[7]	Average Rainfall[5,6]
January	107	70	8.4
February	81	91	6.3
March	78	96	6.0
April	27	76	4.4
May	5	32	3.4
June	Nil	2	3.0
July	Nil	0	1.4
August	Nil	0	1.5
September	Nil	0	3.0
October	6.7	0	5.6
November	44	10	8.9
December	92	37	9.1

Note: Measurements for snow was taken at Snoqualmie Pass and rain taken at the City of Snoqualmie.

Major Rivers that are susceptible to flooding inhabited communities and roadways are (in cubic feet per second – cfs).[8]

Table 5-5: Flood Phase Levels

River System	Phase I	Phase II	Phase III	Phase IV
Snoqualmie River – Sum of the Forks	6,000 cfs	12,000 cfs	20,000 cfs	38,000 cfs
Cedar River	1,000 cfs	2,800 cfs	3,500 cfs	4,200 cfs
Tolt River	1,500 cfs	2,500 cfs	4,500 cfs	7,000 cfs
Green River	5,000 cfs	7,000 cfs	9,000 cfs	12,000 cfs
White River	2,500 cfs	6,000 cfs	8,000 cfs	12,000 cfs
Issaquah Creek	200 cfs	500 cfs	800 cfs	1,000 cfs

Some systems have reported historic flood peaks: Raging River flood peak - 6,220 cfs in November 1990 and Skykomish River flood peak -102,000 cfs November 1990.

History of Events

King County Duty Officer reports since 1996 document the following flooding events occurring within King County:

1996, October - Snoqualmie Phase III
1997, January – Tolt and Snoqualmie Phase II
1997, March/April – Tolt and Snoqualmie Phase II
1997, October – Tolt Phase III, Snoqualmie Phase II
1997, November – Snoqualmie Phase III
1997, December – Snoqualmie and Tolt Phase II
1998, Flood watches January – March
1998, November – Snoqualmie, Tolt and Skykomish Phase II
1998, December – White River Phase III
1999, June – Phase II
1999, November – Tolt Phase III
1999, November – Snoqualmie & White River Phase II
1999, November – Snoqualmie Phase III, Tolt Phase IV
2000, October – Green River Phase III
2000, December – Snoqualmie Phase III
2002, January – Tolt and Snoqualmie Phase II-IV
2002, April – Tolt Phase II
2003, January – Snoqualmie and Tolt Phase III
2003, March – Tolt and Snoqualmie Phase III
2003, October – Snoqualmie Phase IV, Tolt Phase IV

Not all flooding incidents are eligible to receive federal assistance for public agencies. For this reason alone, mitigation efforts to minimize the impacts of flooding in King County can save a considerable amount of public moneys needed to repair damages from modest-sized events. The following list of presidential disaster declarations were associated with listed King County flooding events listed above.

Often, Small Business Administration (SBA) loans are available to individuals and businesses that qualify without a presidential declaration of disaster.

Table 5-6: FEMA Flooding Disasters in King County		
No.	Dates	KC Public Damages (FEMA Approved)
185	December 1964	Figures not available
328	February 1972	Figures not available
492	December 1975	Figures not available
545	December 1977	Figures not available
612	December 1979	Figures not available
757	January 1986	Figures not available
784	November 1986	Figures not available
852	January 1990	$4.9 Million
883	November 1990	$5.6 Million
896	December 1990	$1.4 Million
1079	Nov-Dec 1995	$5.2 Million
1100	Jan-Feb 1996	$7.4 Million
1172	Spring 1997	$647,005

Hazard Impacts

Flooding impacts to the community include injuries to citizens and public safety officials, damage to property, lost revenue and economic damages, an increased demand on public safety and infrastructure related services. The King County Emergency Operations Center (EOC) activates for flooding events of Phase III level or greater to coordinate resources, information, and response activities.

Response activities include unanticipated overtime for EOC activations, evacuations, sheltering of displaced people, rerouting traffic destined for impassible roads, bridge and road damage repairs, and rescue or medical missions related to motorists and isolated families. The Cities of Duvall and Carnation have been isolated as an entire community. Private property damages to homes and vehicles as well as land erosion, river channel changes, agricultural damages and livestock losses result in significant rural economic impacts to local residents.

Past Mitigation Efforts

King County Department of Natural Resources and Parks (KCDNR&P), King County Water and Land Resources Division (KCW&LRD) is nationally known for its work on flooding mitigation. In 1978 unincorporated King County entered the National Flood Insurance Program (NFIP).[9] The NFIP, administered by FEMA, enables residents in participant communities to purchase discounted flood insurance. The amount of discount each community receives is contingent upon its Community Rating System (CRS) rating corresponding to the extent of

its floodplain management efforts.[10] For its extensive services in this respect – the implementation of programs such as buyouts for properties experiencing repeated flooding, maintenance of levees along pertinent rivers, and annual public meetings with affected communities, the County has earned a Class 4 rating, making it the highest rated community of any county in the nation. The result of this has been a 30 percent annual savings to flood insurance policy holders in unincorporated King County.[11]

Flooding Endnotes:

[1] GoNorthwest Travel Guide, www.gonorthwest.co
[2] Seattle's Convention and Visitors Bureau, www.seeseattle.org
[3] Key to the City, www.pe.net
[4] Enumclaw Area Chamber of Commerce, http://chamber.enumclaw.wa.us
[5] Western Region Climate Center, www.wrcc.dri.edu
[6] Sno valley Chamber of Commerce, www.snovalleyorg
[7] Climate Summary, http://www.wrcc.dri.edu/summary/climsmwa.html
[8] King County Dept of Natural Resources and Parks, brochure - Flood Warning Information, http://dnr.metrokc.gov/flood
[9] FEMA Federal Insurance Administration, http://www.fema.gov/cis/wa.pdf
[10] FEMA – Flood Insurance, http://www.fema.gov/nfip/intnfip.shtm
[11] KC Department of Development and Environmental Services - News Release, http://www.metrokc.gov/ddes/press/press_floodrecog.htm

Introduction

Landslide events in King County are most often associated with either unusually heavy seasonal rains or local earthquake activity. Urban areas of western King County have been developed for residential structures in many places. The vistas provided by the Olympic Mountains and Puget Sound are breathtaking backdrops to the Seattle skyline. Despite the possibility of landslide events, property values continue to rise disproportionately and development of available properties continues.

View homes and property values can reach and even exceed $500,000 in some landslide areas, making even the loss of only a few homes significantly costly.

High Probability Low Impact	**High Probability Moderate Impact**	**High Probability High Impact**
Moderate Probability Low Impact	**Moderate Probability Moderate Impact**	**Moderate Probability High Impact**
Low Probability Low Impact	**Low Probability Moderate Impact**	**Low Probability High Impact**

Landslide Probability vs. Landslide Impacts

Hazard Identification

The slopes of Magnolia, West Seattle, Burien, Des Moines, Vashon Island, Newcastle, Federal Way and many areas of Bellevue have long been developed for their magnificent views of Mount Rainier, the Cascade and Olympic Mountains, and Puget Sound. Three major factors that contribute to landslide activity and possible impacts to structures include soil type, slope angle, and precipitation levels.

Soil conditions vary widely in King County. In geological terms, King County's landscape is very young. As recently as 14,000 years ago, the region was covered by up to 3,000 feet of ice. The Vashon Glacier, which extended from Canada to south of Olympia carved valleys as it expanded and left soil deposits and rock as it retreated. Evidence of this activity is still observed in the "U" shaped valleys and stony soils common to Puget Sound. Seas rose 300 feet worldwide from the global melting following that ice age, creating Puget Sound as we know it today.[1]

The top layer of soil in King County is referred to as Vashon till, a stable mixture of rocks, dirt, clay, and sand that reaches depths of up to 30 feet. The next

layer, Esperance sand, is a permeable mixture of sand and gravel. This layer sits upon an impermeable layer of Lawton clay, made up of fine sediments and large boulders. Often, slides occur at this boundary interface when water runs laterally on top of this boundary.[2]

In some ways, landslide areas are similar to avalanche terrain. Characteristics of landslide hazard areas include:[3]

1. A slope greater than 15 percent
2. Landslide activity or movement in the last 10,000 years
3. Steam or wave action with erosion or bank undercutting
4. The presence or potential for snow avalanches
5. The presence of an alluvial fan that indicates vulnerability to the flow of debris or sediments
6. The presence of impermeable soils, such as silt or clay, which are mixed with granular soils such as sand and gravel

History of Events

The most recent widespread landslide activity was secondary to the severe winter storm events that hit the Puget Sound region during December 1996 through March 1997. Unusually heavy snow and rain in King County resulted in slides that damaged or destroyed 8,000 homes. Over 100 slides were recorded in King County over a two-month period. Particularly hard hit areas were slopes on Magnolia Hill (Seattle), areas along Interstate-5, and Vashon Island.[2,4]

A January 15, 1997 slide at Woodward in southern Snohomish County derailed five cars of a freight train. Passenger and cargo rail traffic was interrupted for nine days. Cargo traffic resumed first. Amtrak remained concerned for passenger safety and did not travel on this section of track for several weeks.[5]

Very heavy rains in King County resulted in significant slides and associated damages in 1972.[6] Seventy percent of the slides occurred during the two following days.[7]

Two weather events in November and December of 1998 caused a number of small slides in King County. Landslides along Interstate-5 near SeaTac Airport briefly closed portions of that northbound roadway.[8]

Landslides have been a significant problem in the Puget lowland areas for many years, and several landslides occur every year during the rainy season. Storms have triggered significant numbers of landslides in 1972, 1986, 1990, 1996, and 1997. Comparison of the locations of (more) recent landslides with those mapped by “Tubbs” reveals that many of the 1997 landslides are in the same general areas as the 1972 landslides.[9]

Heavy rains are not the only cause of landslides. The Nisqually earthquake in February 2001 caused a portion of hillside near Jones Road to slide into the riverbed of the Cedar River. The flow of the river was partially blocked resulting in several homes along the river being damaged by the dammed waters.

Evidence of slide activity can still be seen along the eastern side of Interstate-5 from King County Airport all the way to the Interstate-90 interchange where portions of hillside collapsed carrying trees and debris downhill, but just short of impacting Interestate-5.

Hazard Impacts

Slides have resulted in direct damages to structures, roadways, rail lines, bridges and the blockage of the Cedar River (see "History of Landslide Events"). Indirect impacts included the isolation of small communities on Vashon Island and Magnolia Hill, cost of debris clearance, personal injuries, and economic loses from rail and roadway closures.

Table 5-7: Landslide History

Event Date(s) & FEMA Event	Area	KC Public Damages
1972 Severe Weather	King County	$1.8 million
1996-97 Severe Weather (#1100, #1159, #1172)	King County	$9.0 million
2001 Nisqually Earthquake	Renton/Cedar River	

Source:

Past Mitigation Efforts

Efforts to reduce landslide-related losses have been ongoing for at least 20 years. Relative-slope-stability maps at several scales were developed in the 1970s for many of the urbanized areas surrounding Puget Sound (Miller, 1973; Artim, 1976; Smith, 1976; and Laprade, 1989). Most cities and many counties in the area regulate development of steep hillsides (Laprade, 1989). Despite these efforts, losses continue to mount because (1) economic growth continues to exert pressure to develop in or near landslide-prone areas; (2) increased erosion and consequent downcutting caused by urban runoff has locally reduced slope stability (Booth, 1989); and (3) new or previously unidentified landslides damage structures that were built in unstable areas before regulations existed.[10]

King County Surface Water Management maintains a response program related to landslides. The Emergency and Rapid Response Program funds efforts to prevent and recover from such events.[11]

In addition to the efforts at zoning and land use regulations initiated by the government, local citizen groups sometimes work to set aside environmentally sensitive or unstable areas as urban buffers. Such an action is being undertaken by the Denny Creek Neighborhood Alliance toward the purchase of property in the Juanita area near northern Lake Washington.[12] The area is well timbered and is being considered as an environmental buffer to prevent landslides.

An extensive list of codes related to land use and building restrictions for King County has been developed over many decades. For a complete list of codes governing building in King County, go to http://www.builtgreen.net/assets/KC_Resources.oc.

Land Slide Endnotes:

[1]Crozier, Michael J., Landslides: Causes, Consequences, and Environment, Croom Helm, Australia, 1986, p 195.
[2]Carter, Don and Scott Maier, "Slide-Wise, Danger Remains Real as Soggy Slopes are still unstable", Seattle Times, January 17, 1997, p A8.
[3]King County Planning and Community Development Division, "Landslide Hazard Areas", Sensitive Areas: Map Polio, Seattle Washington, 1990, p1.
[4] "It's Been a Winter of Mudslides on Area's Slopes', Seattle Times, January 20, 1997, p A2
[5]Washington State HIVA Draft May 2003
[6]McDoanld, Terrance J., "Landslides", Seattle: A Hazard Vulnerability Analysis, Master's Thesis, Cornell University, 1995, p 147
[7]Tubbs, Donald W., "Landslides in Seattle", Washington State Department of Natural Resources, Information Circular No 52, 1974, p4
[8]REex L. Baum and Aln F. Chleborad, Landslides triggered by Pacific Northwest Storms, November and December 1998, http://landslides.usgs.gov/Wash-Or/PNW98.html, January 14, 1999
[9]Rex L. Baum and Alan F. Chleborad, Geosettings and Landslides, Landslides triggered by the Winter 1997-1998 Storms in Puget Lowland, Washington, http://geohazards.cr.usgs.gov/pubs/ofr/ofr98-239.html, Jul 13, 1998
[10]ibid
[11]Donald Althaueser, Emergency and Rapid Response, King County Department of Natural Resources and Parks, Surface Water Management Division, http://directory.metrokc.gov/ServiceDetail.asp?ServiceID=6659, July 2002
[12]Tony Dondero, Group Seeks to Buy Woodlands, Eastside Journal, July

Introduction

Earthquakes are described as the sudden release of energy occurring from the collision of crustal plates on the earth's surface or from the fracture of stressed rock formations in that crust. Though it can be said that there are many technical differences in the rocking, rolling, jarring and jolting felt during an earthquake, they can be devastatingly damaging and seriously unnerving.

King County is geographically located in an area known as the Pacific Ring of Fire. The same geological events that result in volcanic activity also generate notable earthquakes. Washington State is framed by the Pacific, North American, and Juan de Fuca plates, segments of the earth's crust. A significant number of active fault lines or cracks in that crust have been identified in the central Puget Sound area including Seattle and King County. On an annual basis, thousands of minor earthquake events occur in the greater Puget Sound Region.[1]

King County has a long history of documented earthquake activity. The most recent significant activity was the Nisqually Earthquake of February 28, 2001. This earthquake, 10 miles northeast of Olympia in Thurston County (over 40 miles from Seattle), resulted in statewide losses exceeding $1 billion and injured 700 people, many in King County.[2]

High Probability Low Impact	**High Probability Moderate Impact**	**High Probability High Impact**
Moderate Probability Low Impact	**Moderate Probability Moderate Impact**	**Moderate Probability High Impact**
Low Probability Low Impact	**Low Probability Moderate Impact**	**Low Probability High Impact**

Earthquake Probability vs. Earthquake Impacts

Hazard Identification

Most earthquakes go unnoticed by the residents of King County; significant numbers of 'dish rattlers' occur on a regular basis to remind people of their vulnerability. Some people and animals are more sensitive to these minor events than others. Usually, it requires a magnitude of 2.5-3.0 for a local shaker to be noticed. These happen on a fairly frequent basis (see "History of Events"). Direct impacts from earthquakes may include damages to structures like buildings, pipelines, roadways, and bridges. Secondary impacts from earthquakes are common. These can include tsunamis, seiches, and

landslides. A slide in King County generated from the Nisqually Earthquake partially blocked the Cedar River – flooding several homes. Evidence of tsunami/seiche activity and major landslides has been identified from a 7.0 earthquake in Puget Sound around 900 A.D.

There are at least five active fault lines (crustal cracks) in the Puget Sound lowlands, any of which may impact King County. These are the Tacoma fault, Seattle fault, Darrington-Devil's Mountain fault, Utsalady Point fault, and southern Whidbey Island fault.[3] Many of these faults run east-west and extend for over 20 miles in length.

There are three technically distinct types of earthquakes: interplate or benioff zone earthquakes, subduction or interplate zone, and shallow crustal earthquakes. Each can generate powerful damaging motion in the greater Puget Sound area.[4]

Interplate or Benioff Zone Events[2]

These earthquakes occur at depths of 15 to 60 miles from the subducting Juan de Fuca plate. Examples of this type of damaging event include the Olympia earthquake in 1949, 1965 Seattle/Tacoma earthquake, 1999 Satsop earthquake and 2001 Nisqually earthquake. Depending on your location shaking could be felt for 15-40 seconds.

Subduction Zone Events[2]

Subduction zone events occur along the interface between tectonic plates. The energy generated from the collision of the Juan de Fuca, Pacific, and North American plates is considerable. These great magnitude events can reach 8.0 to 9.0 on the Richter scale.

Shallow Crustal Earthquakes[2]

Shallow earthquake events occur within 20 miles of the earth's surface. These are fairly common events with typical magnitudes of up to 5.5, though there is some evidence that a number of shallow events have exceeded this figure.

History of Events

The State of Washington has experienced 20 damaging earthquake events in the last 125 years. Most of these have been in western Washington[5]. The Seattle-Tacoma earthquake and the recent Nisqually earthquake type of events seem to reoccur about every 30 to 35 years, while a 1949 Olympia type event occurs about once every 110 years.

Subduction earthquakes do not recur based on anticipated time frames; events can be spaced anywhere from 100 to 1,100 years apart. The latest recorded subduction earthquake event in Washington State occurred in 1700.[6]

Table 5-8: Earthquake Events Felt or Impacting King County[7]

Date	Magnitude	Location
April 1945	5.7	12.5 km SSE of North Bend
February 1949	7.1	12.3 km ENE of Olympia
April 1965	6.5	18.3 km N of Tacoma
January 1995	5.0	17.5 km NNE Tacoma
July 1996	5.4	8.5 km ENE of Duvall
November 1996	2.9	Puget Sound
February 1997	3.0	SE of Seattle
April 1997	4.9	Puget Sound off Vashon Island
June 1997	2.7	Puget Sound
July 1997	3.1	Duvall
February 1998	2.9	NE of Seattle
March 1998	3.1	Pierce County
March 1998	2.9	Skykomish
July 1999	3.9	Tacoma
February 2001	7.2	Nisqually – Olympia
May 2002	4.2	Friday Harbor, San Juan Islands
May 2003	3.7	Bremerton, Kitsap County

Olympia Earthquake – April 1949[8]

The 7.1 magnitude earthquake was centered along the southern edge of Puget Sound. Eight people were killed and property damage in Olympia-Tacoma-Seattle amounted to about $25 Million in 1949 dollars. In Seattle, a sixty-inch water main ruptured, a radio tower collapsed, power lines and gas lines were broken in over 100 places. Three damaged schools needed to be demolished and one rebuilt.

Seattle-Tacoma Earthquake – April 1965[2]

At magnitude 6.5, the earthquake killed seven people and caused $12.5 Million in damage (1965 dollars). Severe shaking was felt in Seattle and as far east as Issaquah. Most damage was in the Pioneer Square area and waterfront. Older masonry buildings were most impacted. Damage patterns experienced in 1949 were repeated. Eight schools were closed for inspections and repairs; two were severely damaged. Areas along the Duwamish River experienced severe settling. Three water mains failed in Seattle.

Nisqually Earthquake – February 2001[9,10]

The 6.8 magnitude earthquake was centered under Anderson Island in south Puget Sound. Soil geology resulted in the most extensive damage occurring along the I-5 corridor, not around the epicenter. This pattern was the result of soft river bottom sediments (heavier damage) and improvements in building standards (lesser damage). Some damage was experienced in 300,000 households, many from settling foundations. Buildings built prior to 1950 located in the south downtown area and Pioneer Square in Seattle were the most impacted; structural damage to chimneys, walls, foundations and non-structural elements accounted for two-thirds of all damage reported.

Damages to airport runways and towers were significant and there were temporary closures of the SeaTac International and King County Airports as a result. The Alaskan Way viaduct and Magnolia bridges were both closed until repairs were done. Of the 290 dams inspected by state engineers, only five had earthquake-related damage. A hillside collapse blocked the flow of the Cedar River; this resulted in flooding that impacted several homes along the river that were otherwise untouched by the earthquake shaking.

Hazard Impacts

The impacts to a community from earthquake events include injuries to citizens and public safety officials, damage to property, lost revenue and economic damages, increased demand on public safety and infrastructure related services. Damage projections for a 6.7 magnitude earthquake centered in King County might damage more than 58,000 structures, displace 55,000 households, and result in up to 2,400 deaths and 800 injuries. These damages and impacts to the economy could reach $36 Billion.[11] Washington State ranks second only to California among states susceptible to earthquake damages.[12] Nationally, Seattle might incur the seventh largest potential dollar damages/losses.[2]

Populations and Economy at Risk

According to the 2000 US Census, King, Snohomish, Pierce, and Kitsap Counties are home to more than 60 percent of the state's population and much of its economic base.[13] Most vulnerable of these are non-English speaking individuals, people with disabilities, senior citizens, and people living in poverty, and school-age children. Older homes are also at greater risk of incurring damage from an earthquake.

Table 5-9: Vulnerable Population Groups						
Jurisdiction	**Non-English Speaking**	**Disabled**	**Over Age 65**	**Poverty**	**K-12 Students**	**Homes Over 40 Years Old**
King County	18.4%	15.1%	10.5%	6.4%	16.6%	33.5%
Washington State	14.0%	17.7%	11.2%	10.6%	19.1%	29.4%
Source: U.S. Census Bureau, Profile of Selected Social Characteristics: 2000, and Profile of Housing Characteristics: 2000.						

The King County Emergency Operations Center (EOC) becomes activated for earthquake events to coordinate damage assessment, information, response activities, and to insure continuity of government operations. Response activities include unanticipated overtime for EOC activations, evacuations, sheltering of displaced people, rerouting traffic destined for impassible roads, bridge and road damage repairs, and rescue or medical missions.

Not all earthquake events are eligible for federal assistance to public agencies. For this reason alone, mitigation efforts to minimize the impacts of earthquakes in King County can save a considerable amount of public moneys needed to repair damage from modest-sized events. The following list of presidential disaster declarations were associated with listed King County earthquake events above.

Table 5-10: FEMA Earthquake Disasters in King County		
No.	**Dates**	**King County Public Damage (FEMA or Congress Approved)**
*	April 1949	$25 Million (1949 dollars)
*	April 1965	$12.5 Million (1965 dollars)
1361	February 2001	$155.9 Million FEMA $84.3 Million SBA $93.8 Million US DOT
**FEMA was established in 1978*		

Often, Small Business Administration (SBA) loans are available to individuals and businesses that qualify without a presidential declaration of disaster.

Past Mitigation Efforts

The United States has been a world front-runner in mitigation efforts related to natural disasters. The advent of United States building codes, zoning codes, research on liquefaction areas and ground shaking, building retrofitting, non-structural mitigation/tie-downs, public education, drop-cover-and-hold exercises,

and public television specials have dramatically reduced the impact to property, injuries and economic damage. When the United States is compared to countries that do not have these codes and standards (e.g., Turkey, Iran, and Pakistan) the earthquake disaster results are dramatically different.

Earthquake Endnotes:

[1] *Washington State 2001 Hazard Identification and Vulnerability Assessment*, Washington State Military Department, Emergency Management Division, April 2001.
[2] Ibid.
[3] *Late Holocene displacement on the Southern Whidbey Island fault zone, northern Puget lowland, Washington*. 2001. U.S. Department of the Interior, U.S. Geological Survey. 2 Oct. 2003 http://erp-web.er.usgs.gov/reports/abstract/2000/pn/00HQGR0067.pdf.
[4] *Earthquake Hazards in Washington and Oregon – Three Source Zones*. U.S. Department of the Interior, U.S. Geological Survey. 2 Oct. 2003 http://www.ess.washington.edu/SEIS/PNSN/CascadiaEQs.pdf. http://www.psrc.org/datapubs/census2000/pl94-171/pl_report.pdf.
[5] *Earthquakes in Washington*. 13 Jul. 2001. Washington State Department of Natural Resources Division of Geology and Earth Resources. 5 Oct. 2003 http://www.dnr.wa.gov/geology/hazards/equakes.htm.
[6] *Earthquake Hazards in Washington and Oregon – Three Source Zones.* U.S. Department of the Interior, U.S. Geological Survey. 2 Oct. 2003 http://www.ess.washington.edu/SEIS/PNSN/CascadiaEQs.pdf.
[7] *Map and List of selected significant quakes in WA and OR*. 27 Mar. 2003. The Pacific Northwest Seismograph Network, University of Washington Department of Earth and Space Sciences. 5 Oct. 2003 http://www.ess.washington.edu/SEIS/PNSN/INFO_GENERAL/hist.html.
[8] *Earthquake History of Washington*. 5 Aug. 2003. U.S. Department of the Interior, U.S. Geological Survey. 5 Oct. 2003 http://neic.usgs.gov/neis/states/washington/washington_history.html.
[9] *Hazard Mitigation Survey Team Report, Nisqually Earthquake, February 28, 2001, DR-1361-WA*, Federal Emergency Management Agency and Washington Military Department, Emergency Management Division
[10] *The Nisqually Earthquake of 28 February 2001, Preliminary Reconnaissance Report*, Nisqually Earthquake Clearinghouse Group, University of Washington, March 2001.
[11] Preliminary Estimates of Damages and Loss from a run of HAZUS 99-SR2 by Kircher Associates Consulting Engineers for the Seattle Fault Scenario project funded in part by the EERI Foundation, May 2003. The figures developed from a Level 1 analysis of HAZUS default data adjusted for the year 2005 for a five county region – King, Kitsap, Pierce, Snohomish, and Thurston Counties.
[12] *HAZUS 99 Estimated Annualized Earthquake Losses for the United States*. Feb. 2001. Federal Emergency Management Agency. 5 Oct. 2003 http://www.fema.gov/hazus/pdf/eq_ael.pdf.
[13] *2000 Census P.L. 94-171 Restricting Data*. Aug. 2001. Puget Sound Regional Council. 5 Oct. 2003

Introduction

Our country's history has many examples of civil unrest associated with demands for political reform. The modern civil disturbance has become increasingly associated with sports events and issues unrelated to political positions. Civil disorders have become a part of the urban environment in Washington State. "Riots" can now generally be classified as either being politically motivated or spontaneously erupting around another event. The most important characteristic of civil disorders is an association with property damage and clashes with law enforcement and authorities.

High Probability Low Impact	**High Probability Moderate Impact**	**High Probability High Impact**
Moderate Probability Low Impact	**Moderate Probability Moderate Impact**	**Moderate Probability High Impact**
Low Probability Low Impact	**Low Probability Moderate Impact**	**Low Probability High Impact**

Civil Disorder Probability vs. Civil Disorder Impacts

Hazard Identification

In the 1960's civil unrest was focused on civil rights. The Watts riots in Los Angeles left 34 people dead. Similar events occurred in Newark New Jersey with similar results.

In recent years, civil disorder typically begins as nonviolent gatherings. Injuries are usually restricted to police and individuals observed to be breaking the law. Crowds throwing bottles, rocks, and other projectiles are usually responsible for the majority of law enforcement injuries. Injuries to protestors, demonstrators, or law breakers are often the result of efforts to resist arrest, exposure to tear gas or mace, attempts to strike a police officer or from other civilians and law breakers.

Political demonstrations that become civil disorders or riots have specific targets for their attention. Examples would be protests outside a national embassy, city hall, or federal building. These incidents are typically marked by efforts by organizers to obtain permits to demonstrate and are nonviolent in nature. Occasionally, these demonstrations become violent when triggered by some other event. Often, out-of-town agitators are the catalyst for these violent outbreaks. In the Pacific Northwest, groups with such notoriety are the Skinheads, White Supremacists, and Anarchists.

Celebrations resulting from outcomes of sporting events and annual holiday celebrations occasionally evolve into violence. The central characteristic of these “riots” have been related to substance abuse and consumption of alcohol. Incidents of this type are common in other parts of the world following soccer matches. In the United States, civil disturbances have come to be anticipated following basketball championships (Chicago Bulls, 1991 and 1992; Detroit Pistons, 1990; and recently the LA Lakers, 2001).

Police continue to use variations of riot tactics common for over a hundred years: horse-mounted police and officers on foot with riot shields and batons. Arrests are made of key violent individuals. The 1960s saw the advent of the use of tear gas, also known as CS. There has been an evolution of tactics used by demonstrators and agitators that has resulted in an increasingly complex confrontation/interface between local officials and civilians.

Sophisticated communications capabilities are now available for retail purchase. Radios and “police scanners” have made it possible for demonstrators to organize their efforts and counter law enforcement tactics. This was seen during the World Trade Organization (WTO) disturbances in Seattle, 1999. Members of one group intercepted police tactical communications and broadcast the information over the Internet. One group transmitted over an illegal FM station. The result has been an increase in the integration of efforts between federal agency officials from the Federal Communications Commission and the Federal Bureau of Investigation with local law enforcement.

History of Events

Rodney King Verdict

Following the 1992 Rodney King verdict in California, some local disturbances occurred in Seattle. The night of the verdict, small groups of people roamed the downtown streets smashing windows, lighting dumpsters on fire, and overturning cars. The next day, there was a rally at the Jackson Federal Building in Seattle. Many people feared violence and avoided the downtown area. After the rally broke up, small groups moved around downtown, eventually attacking the Seattle West Precinct on Capitol Hill. Another protest occurred in the University District of Seattle. This event, though peaceful, shut down Interstate-5 to traffic for some time.

WTO and N30

The best known civil disturbance in King County occurred in conjunction with the World Trade Organization’s (WTO) meeting in Seattle during November of 1999. The week-long event found Seattle as the meeting place for world

economic leaders and political figures. The world stage event provided an opportunity for activists to gain media attention for their multiple causes ranging from labor reform to environmental exploitation concerns. Similar WTO meetings have occurred in other places around the world with demonstrations that sometimes became violent. Preparations made by local officials proved inadequate to contend with the civil unrest that followed. This event was marked by the presence of many Oregon-based antagonist groups, most notably the "Anarchists."

"N30" was the first anniversary of the WTO riots. Some protestors did appear, but improvements in intelligence, police staffing and staging, use of secure radio frequencies, and briefing of elected officials resulted in a considerably more subdued event.

Mardi Gras Melee[1,2]

In 2001, Mardi Gras celebrations became violent with one man being beaten to death during a violent confrontation involving intoxicated young people in the Pioneer Square area of Seattle. There was some indication the beating may have been racially motivated and gang-related. There were 43 arrest, seven officers injured, and thousands of dollars of damage done to six businesses. There was considerable news coverage of the event and subsequent legal proceedings.

Additional Interstate-5 Closures

The closure of Interstate-5 to traffic by illegal protest marchers has become somewhat of a traditional expression by individuals opposing social or political events. In April 2002, a King County Deputy shot a suspect. That month protestors caused temporary closure of Interstate-5.[3] Again on September 30, 2002, street marchers mingled peacefully with sports enthusiasts in downtown Seattle. At the outbreak of hostilities regarding the war in Iraq in February 2003, this same disruption of I-5 transportation and commerce was repeated.

University of Washington Violence

In 2003, a recent outburst by drunken youths in the University of Washington fraternity district resulted in overturned burning vehicles and injured people. While only one person was arrested, non-college outside agitators were suspected of instigating the incident.

Hazard Impacts

The economic impact to urban areas during civil unrest and following such events can be profound. Direct impacts include looting and smashed windows as well as endangering shop owners and customers. Indirect economic impacts result from the loss of business when potential customers do not approach businesses for extended periods of time. Customer impressions and habits can change from the experience of a single threatening event. In Seattle, WTO resulted in the closure of several small businesses in the downtown core, resulting in a cry from shop owners to visibly increase protection of their properties. Largely, Mayor Paul Schell lost his re-election bid because of the City's handling of the event.

Thousands of political demonstrations occur each year nationally without major incidents, injuries, property damage or arrests. The right to protest peacefully is a hallmark of our nation's liberties handed down to us from the 18th century.

Table 5-11: Civil Disorder Costs

Event Date(s)	Area	King County Damage Dollars
Rodney King Verdict[3]	Seattle/King County	150 arrests 5 major fires Looting, property damage
WTO-N30 Nov 1999, 2000[4]	Downtown Seattle & Capital Hill	$1.5 M police costs, $7 M in lost retail sales 250+ arrests 120+ injuries
Mardi Gras- February 28, 2002[1]	Pioneer Square – Seattle	1 person killed 6 police injured 43 arrests
A20 Event – April 2002[5]	Capitol Hill, Westlake Mall, Seattle Central Community College	19 arrests Nominal property damage
I-5 closures – protest marches[6]	University of Washington to Downtown – Seattle	Nominal damage
University of Washington Compass 10/03	University of Washington Campus Fraternities	Police cruisers and civilian vehicles damaged and burned

Past Mitigation Efforts

Law enforcement surveillance and counter intelligence units are becoming common place in major cities around the United States. Intelligence sharing efforts between national agencies and local officials is improving. The controversial Patriot Act and civil rights issues have become part of the landscape of police efforts to minimize exposure to violent civil disturbances.

Police in urban areas continue to explore training opportunities and consider tactical changes in their planning for such expected and unscheduled events.

Local merchants have installed monitoring cameras in the Pioneer Square area to reduce the attraction to anonymous violence and illegal activity.

Civil Unrest Endnotes:

[1] Tracey Johnson, "Police charges won't be filed against teen arrested in melee", Seattle Post Intelligencer, May 26th, 2001, www.Seattle PI.NWsource.com/specials/mardigras
[2] Candy Hatcher, "Thousand of dollars claimed by 6 Businesses", Seattle Post Intelligencer, February 28th, 2001, www.SeattlePI.nwsource.com/specials/mardigras
[3] Vanessa Ho and Hector Castro, "10 years after Rodney King, the issues very much with us", Seattle Post Intelligencer, April 29th, 2002
[4] Murakami, Kerry. "Seattle Saddled with Millions in WTO Bills." Seattle PI, NW Source (200) October 14, 2003
[5] Mike Roarke & Lewis Kamb, "Police Arrests as hundreds march on downtown streets", Seattle Post Intelligencer, April 20th, 2002
[6] Jeffrey Barker, "Thomas Rally intrigues some, puzzles others", Seattle Post Intelligencer, September 30, 2002

Introduction

Terrorism has been defined by the Federal Bureau of Investigation as "the unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment of it in furtherance of political or social objectives." More importantly, it is necessary to understand that the objective of terrorism is not destruction or death – it is the psychological impact to the targeted population and world opinion. Disruption to public services, economies, and social patterns or a feeling of insecurity is the desired goal.

High Probability Low Impact	**High Probability Moderate Impact**	**High Probability High Impact**
Moderate Probability Low Impact	**Moderate Probability Moderate Impact**	**Moderate Probability High Impact**
Low Probability Low Impact	**Low Probability Moderate Impact**	**Low Probability High Impact**

Terrorism Probability vs. Terrorism Impacts

Hazard Identification

Terrorism can be categorized as either domestic or international. Domestic terrorism incidents are acts conceived of and carried out by U.S. citizens within the U.S. borders. Examples of domestic terrorism include environmental groups like the Animal Liberation Front (ALF), groups opposing abortion, animal rights groups opposing the fur trade, or the Oklahoma City bombing of the Murrah Building.[1] Each year King County Police receives calls related to hundreds of bomb threats. International terrorism originates from groups based outside the U.S.A. and may be perpetrated against U.S. interests abroad or within the territorial boundaries of the U.S.A. Examples would be Al Quada and sympathizer groups.

Terrorist targets tend to be located in urban areas. Seats of government, stadiums and public meeting places are high-value targets that produce substantial news coverage. Contrary to this, there is some evidence that terrorist organizations prefer rural safe houses from which to operate. The rural environment offers an environment that is more difficult to observe.

On a worldwide basis, explosive and small arms remain the primary method of aggression. Domestically, this theme was evident in the shoe bomber incident (Richard Reid),[2] Washington, D.C. shootings,[3] Twin Trade Towers, University of

Washington School of Horticulture bombing, Atlanta Olympics bombing,[4] and Atlanta abortion clinic bombing. Officials are increasingly concerned about the use of weapons of mass destruction on U.S. soil. Concern for this possibility began to grow with the disintegration of the Soviet Union. At that time the Soviet military acknowledged it could not account for many "suitcase" or portable nuclear devices.

Weapons of Mass Destruction (WMD) can be categorized as belonging to one or more of the following groups: chemical, biological, radiological, nuclear or explosive. Incendiary devices and cyber terrorism can also be added to this list. Title 18, U.S.C. 2332a, includes the accepted definition for weapons of mass destruction in the United States:

> "(1) any destructive device as defined in section 921 of this title [which reads] any explosive, incendiary, or bomb, grenade, rocket having a propellant charge of more than one quarter ounce, mine or device similar to the above; (2) poison gas; (3) any weapon involving a disease organism; or (4) any weapon that is designed to release radiation or radioactivity at a level dangerous to human life."

The concept of using chemical weapons is based on the field of toxicology. As such, chemical weapons are comprised of a fairly large, growing and creative list of materials that can kill humans or pollute the environment. While listed as a weapon of mass destruction, typical chemical weapons do not destroy property – rather, they deny the use of the area of distribution or scatter through persistence of a difficult to clean up chemical. In this way, chemical, radiological and biological terrorist weapons are similar. Military chemical weapons are designed to be used in battlefield conditions against combatants. Their persistence or impact is of short duration (hours or days) to allow occupation of some strategic area by friendly forces.

In many ways the common components used to make chemical weapons are similar to those used for industrial, commercial and agricultural purposes, although with a destructive intent and outcome involved. Chemical weapons began as industrial materials with military applications. They have been used in organized military programs since the Germans used chlorine and arsine in World War I. The list expanded to the use of nerve agents like sarin and tabin when it was realized that insecticides could effectively be used against human targets.

Radiological materials are very similar to chemical materials. They usually do not kill humans outright. Exposure to such a dose would require very large amounts of radioactive material at fairly close range. While the time required for a material to decay and render itself inert varies widely, many materials can

persist in the environment for years to centuries at levels that can impact humans and the environment.

The usefulness of radioactive materials to the terrorist is derived from long-term exposures to moderate amounts of radiation and the difficulty in cleanup of the impacted area. Like chemical and biological agents, radioactive materials can not be observed by a civilian. For this reason they instill a significant psychological impact to the public.

The Federal Bureau of Investigation defines biological agents as micro organisms or their toxins. The U.S. Code Title 18, Section 178 also provides a broad definition to biological agents. This definition would include viruses, bacteria, spores, and toxic materials given off by these organisms. Commonly, these include the plague, anthrax, smallpox, and other disease organisms.

Natural materials with toxicity to humans are also being used for terrorist activities. Ricin, a toxin derived from Castor beans, has been used as a direct contact poison for assassinations. Another known natural poison is curare. Used for hundreds of years by South American tribes, this material (in smaller doses) has taken a beneficial roll in medicine. The medical profession has a fairly substantial list of these natural occurring materials.

Explosives have been defined by a variety of sources ranging from the fire service to the United States Code. Commonly, these definitions focus on chemical reactions that produce a shock wave and heat. This definition allows the inclusion of nuclear fission devices. These and incendiary devices are truly weapons of mass destruction, their purpose being to cause damage to property as well as injury to people. Definitions of explosives include black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord, and igniters. Incendiary devices include chemicals that may accelerate or initiate fire.

Any individual or combination of the WMD classes listed can be used as booby traps, mines and bombs and can be directly or remotely detonated or initiated.

Increasingly, experts are putting efforts into countermeasures related to cyber terrorism. The global economy's reliance on transactions and communications presents an inviting target to terrorists that can operate in almost any corner of the globe. Terrorists are also likely to use cyber attacks as a force multiplier in a physical incident to impede first responders, spread misinformation, and promote panic in the general populations.

Presidential Decision Directive #39 designates the Federal Bureau of Investigation as the lead agency responsible for terrorism investigations within the borders of the United States and its territories. This lead designation has

required a new partnership and increased cooperation between local law enforcement, federal officials and hazardous materials teams in Washington State.

History of Events and Hazard Impacts

The U.S. population has largely been spared the impacts of international terrorism until recently. The devastation which occurred at the World Trade Center in New York and the Alfred Murray building in Oklahoma City illustrates the need to plan for potential threats within our own communities. Domestically, the distribution of anthrax spores using the United States Postal System as a delivery mechanism caused concern nationwide for several weeks. The bomb detonated at the Atlanta Olympics in (1996) resulted in an investigation/manhunt that lasted years. The Richard Reid (a.k.a. the Shoe Bomber) disrupted air travel and changed security measures in airports; he was sentenced to life in prison.

Washington State and King County locations have witnessed multiple examples of terrorist activity over the last decade. One East Coast incident involved a Tacoma gun shop connection. See the table below for a list of events over the past decade:

Table 5-12: Recent Washington Terrorism-related Events

Type Event	Date	Group	City/ Location	No. of Incidents	Damage or Injuries
Explosive	1993	Skinheads[6]	Tacoma	2	Figures not available
Chemical-Explosive	1995	Unknown[7]	Burien District Court	1	No damage reported
Explosive	Dec 14, 1999	Ahmed Ressam[8]	Port Angeles	1	none
Incendiary	May 2001	ALF	University of Washington	2	$5 M
Biological White Powder	Jan 2000 to Dec 2002	Miscellaneous individuals[9]	Seattle, Federal Way, Tukwila, Port of Seattle, other cities	208	Overtime and service disruption
Fire Arms	Oct 2002	John Allen Muhammad & John Lee Malvo[3]	Washington, DC & Tacoma	13	10 killed, 3 wounded

Past Mitigation Efforts

While some legislation and operational countermeasures have existed for some time, the events of September 11, 2001 have accelerated terrorism mitigation efforts. Broadly, grants have been awarded to local first responders since 1998

for the purchase of important response equipment; national and local exercises of plans a procedures conducted; powers given or broadened for law enforcement regarding surveillance; and the consolidation of several agencies into the U.S. Department of Homeland Security have been completed. Capabilities related to bioterrrorism have received increasing attention.

Equipment grants for decontamination, detection, and protective gear for first responders have been available to local first responders since 1998. These grants and supplemental grants have provided millions of dollars in increased capabilities. As these capabilities have improved, the definition of first responder has been broadened from fire and police to now include hospital personnel and facilities, public works and emergency medical responders.

In 2000, the U.S. Department of Justice and Office of Domestic Preparedness began a national exercise program to integrate federal, state, and local terrorism response capabilities and elected official preparedness for such events. The TOPOFF (top officials) series began with an exercise involving Portsmouth, New Hampshire and Denver, Colorado. In 2002, this exercise opportunity presented itself to Seattle, King County, and Washington State as well as Chicago, Illinois. Cities and counties in Washington State continue to pursue opportunities to improve response capabilities by conducting additional local exercises and training. It is worth noting that TOPOFF 2 included a multi-jurisdiction cyber exercise involving King County, the City of Seattle, and Washington state business leaders and senior technologists. This forum provided an excellent learning opportunity and helped underscore how dependent business operations are on technology and some of the key vulnerabilities jurisdictions typically face with their technology infrastructure and cyber incident response capabilities.

Beginning in 2002, grants became available from several federal agencies for local jurisdictions to initiate and continue planning, training, equipment purchase, and exercise efforts. Federal funding agencies include Department of Justice, Office of Domestic Preparedness, Centers for Disease Control and Prevention, Transportation Security Administration, Federal Transit Administration and others.

An important step in the efforts to counter terrorism in the U.S. was made with the issue of Presidential Decision Directive #39[10] on June 21, 1995. This directive identified the FBI as the lead agency for terrorism investigation. Subsequent to the events of September 11th, 2001 the U.S. Congress consolidated elements of the U.S. Department of Justice, U.S. Coast Guard, U.S. Immigration, and other agencies into the Department of Homeland Security. The Aviation and Transportation Security Act was passed by Congress on November 19, 2001 giving responsibility for items like airport security to the Transportation Safety Administration.

The USA PATRIOT Act [11,12] contains provisions appreciably expanding government investigative authority, especially with respect to the Internet. The USA PATRIOT Act introduced sweeping changes to U.S. law, including amendments to:

- Wiretap Statute
- Electronic Communications Privacy Act
- Computer Fraud and Abuse Act
- Family Education Rights and Privacy Act
- Pen Register and Trap and Trace Statute
- Money Laundering Control Act
- Bank Secrecy Act
- Right to Financial Privacy Act
- Fair Credit Reporting Act

Other important federal acts and directives include:

- Homeland Security Presidential Directives 1-5

    1. Organization and Operation of the Homeland Security Council
    2. Combating Terrorism Through Immigration Policies
    3. Homeland Security Advisory System
    4. National Strategy to Combat Weapons of Mass Destruction
    5. Management of Domestic Incidents (NIMS-National Incident Management System)

- Presidential Directive #62, Protection against Unconventional Threats to Homeland and Americans Overseas.
- Title 18, USC Section 2332a Weapons of Mass Destruction
- Title 18, USC, Sections 175-178, Biological Weapons Anti-terrorism Act
- H.R. 5005, the Homeland Security Act of 2002

Federal, State, and local cooperation continues to improve relationships, capabilities and innovative methods to mitigate terrorism in the U.S. and impacts to its interests.

Some details of grants, exercises, plans and procedures are not subject to Freedom of Information Act release due to their sensitive or national/domestic security protection.

Terrorism Endnotes:

[1] CNN News, "Oklahoma City Bombing" April 19th, 1995, www.cnn.com/us/okc/bombing.html
[2] BBC News, "Shoebomber Jailed for Life", January 30th, 2003
[3] CNN.com, "Ballistics match rifle to sniper attacks", http://www.cnn.com/2002/US/South/10/24/sniper.shootings/
[4] CNN.com, "Atlanta Olympic Bombing Suspect Arrested", May 31st, 2003
[5] Presidential Decision Directive #39, June 21, 1995, http://www.fas.org/irp/offdocs/pdd39.htm
[6] Washington State Emergency Management Hazard Vulnerability Analysis, 1996
[7] King County Emergency Management, Duty Officer Log, May 1995
[8] Sam Skolink & Paul Shukovsky, "Ressam- Seattle no Target", Seattle PI, May 31st, 2001
[9] Washington State Joint Committee on Terrorism figures, 2003
[10] Presidential Decision Directive #39, http://www.fas.org/irp/offdocs/pdd39.htm
[11] "Uniting and strengthening America by providing appropriate tools to intercept and Obstruct Terrorism Act of 2001", aka the Patriot Act (HR 3162), http://www.epic.org/privacy/terrorism/hr3162.html
[12] Electronic Privacy Information Center, the US Patriot Act (Summary/Brief & Commentary), http://www.epic.org/privacy/terrorism/usapatriot/

Introduction

Western Washington is typically associated with rain, green trees, and healthy environments, making the idea of drought in King County a far-fetched notion. There is a possibility for drought conditions in our area, as exemplified most recently in 2001. As a result, King County residents and employers need to be aware of the hazards presented by drought to our area.

Drought can be a result of multiple causes including "global weather patterns that produce persistent, upper-level high-pressure systems along the West Coast with warm, dry air resulting in less precipitation."[1] Drought may be defined as a prolonged period of dryness severe enough to reduce soil moisture, water and snow levels below the minimum necessary for sustaining plant, animal, and economic systems.[2] While drought isn't typically thought of as a King County hazard, the historical record demonstrates that it is important to consider drought conditions as a potential impact to the region.

High Probability Low Impact	**High Probability Moderate Impact**	**High Probability High Impact**
Moderate Probability Low Impact	**Moderate Probability Moderate Impact**	**Moderate Probability High Impact**
Low Probability Low Impact	**Low Probability Moderate Impact**	**Low Probability High Impact**

Hazard Identification

The National Oceanic and Atmospheric Administration (NOAA) defines drought as less than 60% normal precipitation over a prolonged period of time.[3] However, in Washington State, the statutory criteria for drought is a water supply below 75% of normal and a shortage expected to create undue hardship for some water users.[4]

[1] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf
[2] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf
[3] Pierce County Hazard Identification and Vulnerability Assessment, http://www.co.pierce.wa.us/xml/abtus/ourorg/dem/EMDiv/HIVA/DROUGHT.pdf
[4] Washington State Comprehensive Emergency Management Plan Annex Z2, Drought Contingency Plan, http://www.drought.unl.edu/plan/state%20plans/WAplan.pdf

Assessing the probability of drought conditions in King County can be challenging, due to the temperate weather nature of our region. As a result, current long-range forecasts of drought have limited reliability. Meteorologists do not believe that reliable forecasts are attainable any more than a season in advance.[5] If historic patterns repeat themselves, dry conditions occur approximately every decade. Probability of Drought conditions is Moderate – the potential Impact from Drought conditions is Moderate. See table
Drought conditions can be described in the following four ways:

Meteorological: a measure of departure of precipitation from normal. Due to climate differences what is considered a drought in one location may not be a drought in another.
Agricultural: refers to a situation when the amount of moisture in the soil no longer meets the needs of a particular crop.
Hydrological: occurs when surface and subsurface water supplies are below normal.
Socioeconomic: refers to the situation that occurs when physical water shortage begins to impact people's jobs, incomes, recreational capabilities and other such factors.

The severity of drought is measured by the Palmer Drought Severity Index in a range of 4 (extremely wet) to –4 (extremely dry), and incorporates temperature, precipitation, evaporation and transpiration, runoff and soil moisture when designating the degree of drought.[6]

Table 5-13: Palmer Drought Severity Index Classifications

3.0 to 3.99	Very Wet
2.0 to 2.99	Moderately Wet
1.0 to1.99	Slightly Wet
0.5 to 0.99	Incipient Wet Spell
0.49 to -0.49	Near Normal
-0.5 to 0.99	Incipient Dry Spell
-1.0 to –1.99	Mild Drought
-2.0 to –2.99	Moderate Drought
-3.0 to –3.99	Severe Drought
-4.0 or less	Extreme Drought

[5] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf
[6] Governor's Ad Hoc Executive Water Emergency Committee Staff, "History of Drought in Washington State", State of Washington, December 1977, p 7.

Source: Pierce County Emergency Management Hazard Identification and Vulnerability

Assessment, September 2002

In 1989, the Washington State Legislature gave permanent drought relief authority to the Department of Ecology and enabled them to issue orders declaring drought emergencies. (RCW 43.83B.400-430 and Chapter 173-166 WAC).[7]

In comparison to other natural disasters that may occur in Western Washington, drought doesn't usually result in property damage or loss of life, although it can have substantial negative impact on the environment and economy.

History of Events

Every few years in Washington State, drought conditions are present with an inherent impact of moderate on the Palmer Drought Severity Index. In the last century in Washington State, there have been a number of drought episodes, including several that have lasted for more that a single season, including dry periods occurring between 1928-1932 and 1992-1994.

However, King County experiences drought conditions of at least moderate severity in classification from 5 to 10 percent of the time, evidenced most prominently during our most recent severe drought periods in 1977 and 2001. The 1977 event set records for low precipitation, snow-pack, and stream flow totals that still stand today, while the 2001 event was the second-worst drought year in state recorded history.[8]

1977 Drought: King County experienced severe or extreme drought conditions between 10-20 percent of the time.

2001 Drought: At the height of this event in March 2001, King County experienced moderate to severe drought conditions.[9]

Rainfall for Western Washington during the 2001 water year was approximately 30% below normal. On March 14, 2001, after several months of record low precipitation, Governor Gary Locke authorized the Department of Ecology to

[7] Skagit County Natural Hazards Identification Plan, http://www.skagitcounty.net/EmergencyManagement/Documents/2003HazMitFinal/Section%20II%20Final%20Documents/3%20HIVA%20Skagit%20Drought.pdf

[8] Skagit County Natural Hazards Identification Plan, http://www.skagitcounty.net/EmergencyManagement/Documents/2003HazMitFinal/Section%20II%20Final%20Documents/3%20HIVA%20Skagit%20Drought.pdf

[9] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf

declare a statewide drought emergency. Washington was the first Northwest state to make a drought declaration. Due to above-average precipitation during the final two months of the year, the drought emergency formally expired on December 31, 2001. The National Weather Service reported that the winter of 2000-01 was the driest since 1976-1977, and was one of the top five driest in the past 100 years.[10]

Table 5-14: Drought History

Year	Conditions	Causes
2001	Moderate to Severe Drought	Low precipitation
1988	Water Shortage; Water Shortage	Level of Chester Morse Lake fell below outlet; Tolt Pipeline broke during peak usage
1987	Water Shortage; Water Shortage	Tolt Pipeline broke Hot, dry summer weather increased water demands beyond limits
1977	Severe to Extreme Drought	Low precipitation
1967	Water Shortage	Dry summer
1965-66	Water Shortage	Dry throughout state
1952-53	Water Shortage	Lack of winter precipitation
1928-30	Statewide Drought	Rainfall was 20% of normal
1919	Water Shortage	Dry summer

Source: City of Seattle Emergency Management Disaster History, http://www.cityofseattle.net/emergency_mgt/hazards/disasterHistory.htm.

Hazard Impacts

Drought conditions occurring in King County can have an impact on the economic viability of agriculture- and power-related industries as well as water- and snow-related recreational activities. Drought conditions would impact the amount of water available for crops grown for commercial and domestic use, and could also reduce the snow pack available in our local mountain passes, which could have a negative result on area winter sports tourism.

Additionally, due to the prevalence of hydroelectric dams in King County, drought conditions could also have a negative impact on the availability and cost of electric power for local businesses and industries. When water levels drop, electric

[10] Skagit County Natural Hazards Identification Plan, http://www.skagitcounty.net/EmergencyManagement/Documents/2003HazMitFinal/Section%20II%20Final%20Documents/3%20HIVA%20Skagit%20Drought.pdf

companies cannot produce enough power to meet demand and are forced to buy electricity from other sources.[11]

Additional impacts to King County industry may include a negative impact on the capabilities of firefighters in the area, as water shortages may result in reduced water flow and pressure available to combat wild land and structural fires that may take place in our region.

Past Mitigation Efforts

Efforts to mitigate the effects of drought conditions in our area include consistent vigilance of forecasted conditions like the prevalence of rainfall, or the amount of snow pack present in the mountain passes.

Additonal efforts include King County's Regional Wastewater Services Plan, a 30-year operating plan for our wastewater system that calls for expanding the production and use of reclaimed water as a valuable resource. Reclaimed water is wastewater that gets treated to such a high level that it can be used safely and effectively for non-drinking water purposes such as landscape and agricultural irrigation, heating and cooling, and industrial processing. Reclaimed water has been used successfully and safely in other areas of the country and world for decades, and is a viable tool to utilize when combating drought in King County.[12]

Other mitigation efforts include sustainable landscaping, a low maintenance method of outdoor design featuring native plants that promotes healthy soil, minimizes water use, and doesn't need excessive fertilizer or pesticides.[13]

[11] King County Office of Emergency Management Drought Resource Section, http://www.metrokc.gov/prepare/preparerespond/hazardsdisasters/droughts.aspx
[12] King County Water Reuse Program, http://dnr.metrokc.gov/wtd/reuse/
[13] King County Solid Waste Division, Sustainable Landscaping, http://www.metrokc.gov/dnrp/swd/sustainable-landscaping/index.asp

Fire Hazards

Introduction
Fires don't generally call for region wide attention unless the fire migrates to adjoining buildings, homes, or property or is determined to have the potential to do so. Fast-spreading structure fires can quickly threaten a large amount of people, as well as tax the resources of local fire-fighting jurisdictions

King County is at risk for three types of fire threats: structure, wildland, and wildland-urban interface fires. These threats are typically defined as:

Structure Fire**:** a fire of natural or human-caused origin that results in the uncontrolled destruction of homes, businesses, and other structures in populated, urban or suburban areas.

Wildland Fire**:** a fire of natural or human-caused origin that results in the uncontrolled destruction of forests, field crops and grasslands.[14]

Wildland-Urban Interface**:** a fire of natural or human-caused origin that occurs in or near forest or grassland areas where isolated homes, subdivisions, and small communities are also located. [15]

High Probability Low Impact	**High Probability Moderate Impact**	**High Probability High Impact**
Moderate Probability Low Impact	**Moderate Probability Moderate Impact**	**Moderate Probability High Impact**
Low Probability Low Impact	**Low Probability Moderate Impact**	**Low Probability High Impact**

The Washington Department of Natural Resources and its federal and local partners found that 181 communities were at high risk for fire threats, including some communities housed within the jurisdiction of King County. Communities

[14] Sinnett, George M, Meteorologist, Fire Weather Summary, 1983-1991, Department of Natural Resources, Division of Fire Control, Washington State, 1992.
[15] Skagit County Natural Hazards Mitigation Plan
http://www.skagitcounty.net/EmergencyManagement/Documents/2003HazMitFinal/Section%20II%20Final%20Documents/5%20HIVA%20Skagit%20Fire.pdf

were evaluated based on fire behavior potential, fire protection capability, and risk to social, cultural and community resources. Assigned risk factors included area fire history, type and density of vegetative fuels, extreme weather conditions, topography, number and density of structures and their distance from fuels, location of municipal watershed, and likely loss of housing or business. The evaluation used the criteria in the wildfire hazard severity analysis of the National Fire Protection Association's NFPA 299 Standard for Protection of Life and Property from Wildfire, 1997 Edition.[16]

As a result, fire hazards are a very real risk for King County residents and businesses and must be vigilantly prepared for and mitigated against in efforts to keep our region and surrounding counties and communities safer.

Hazard Identification

A fire needs three elements in the right combination to ignite and grow – a heat source, fuel, and oxygen. How a fire behaves primarily depends on the characteristics of available fuel, weather conditions, and terrain. Fuels can include ignition sources like poor wiring or unattended candles, lighter fuels like grasses and leaves, heavier fuels like tree branches and logs, and hazard trees that may be diseased or dying.[17]

Weather also plays a role in the forms of wind, low precipitation, and lightening. As a result, strong, dry east winds in late summer and early fall can produce extreme fire conditions west of the Cascades. Drought, snow pack, and local weather conditions can also expand the length of the fire season.[18] Additionally, according to data from 1992-2001, lightening ignited 135 wildland fires annually and burned more state-protected acreage than any other cause, an average of about 10,866 acres annually.[19]

Terrain is an additional factor, as the topography of a region or local area influences the amount and moisture of available fuel. Other elements like barriers and land elevation also need to be taken into account as highways and lakes can affect

[16] Washington State Hazard Mitigation Plan, Hazard Identification and Vulnerability Assessment on Wildland Fire, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/Tab%207.1.9%20Wildland%20Fire%20final.pdf
[17] Washington State Hazard Mitigation Plan, Hazard Identification and Vulnerability Assessment on Wildland Fire, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/Tab%207.1.9%20Wildland%20Fire%20final.pdf
[18] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf
[19] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf

spread of fire, as can an uphill/downhill orientation, as fire spreads more easily as it moves uphill. [20]

In addition to natural conditions for fire viability, humans also play a role. From 1992 to 2001, people, on average, caused more than 500 wildland fires each year on state protected lands. Human caused fires burn an average of 4,404 state-protected acres each year.[21]

Hazard Impacts

Most wildland fires are usually extinguished in their initial stages being less than one acre in area.[22] In fact, Western Washington is less prone to the danger of large or catastrophic wildland fires than the Eastern half of the state. The Western slopes have a shorter fire season, receive more rainfall, have wetter and cooler spring seasons, and are more urbanized.[23] However, these conditions don't make wildland fires any less dangerous, as statistics show that on an annual basis, an average of 905 wildland fires burn 6,488 acres resulting in a resource loss of $2,103,884 in Washington State. [24]

Depending upon temperature, wind, topography, and other factors, wildland fires can spread rapidly and may require thousands of firefighters working several weeks to extinguish.[25] Wildland fires can create their own winds and weather, and generating hurricane force winds of up to 120 miles per hour. Fires can also heat fuels in their path, drying them out, and making them easier to ignite and burn.[26]

With the increasing urbanization of King County, the threat of wildland/urban interface fire grows, due to a rise in the building of vacation homes and the prevalence of more comprehensive transportation systems. King County residents can live outside of crowded city centers while commuting or telecommuting to work.

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[20] Washington State Hazard Mitigation Plan, Hazard Identification and Vulnerability Assessment on Wildland Fire, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/Tab%207.1.9%20Wildland%20Fire%20final.pdf

[21] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf

[22] Skagit County Natural Hazards Mitigation Plan http://www.skagitcounty.net/EmergencyManagement/Documents/2003HazMitFinal/Section%20II%20Final%20Documents/5%20HIVA%20Skagit%20Fire.pdf

[23] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf

[24] Skagit County Natural Hazards Mitigation Plan http://www.skagitcounty.net/EmergencyManagement/Documents/2003HazMitFinal/Section%20II%20Final%20Documents/5%20HIVA%20Skagit%20Fire.pdf

[25] Skagit County Natural Hazards Mitigation Plan http://www.skagitcounty.net/EmergencyManagement/Documents/2003HazMitFinal/Section%20II%20Final%20Documents/5%20HIVA%20Skagit%20Fire.pdf

[26] Washington State Hazard Mitigation Plan, Hazard Identification and Vulnerability Assessment on Wildland Fire, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/Tab%207.1.9%20Wildland%20Fire%20final.pdf

As a result, wildfires can encroach onto residential properties and structure fires can invade wooded areas. These fires are also quite difficult to fight, as the remote locations of residential properties in wooded areas make fire-fighting response times to those areas take longer than normal residential responses. In addition, most fire fighters are trained to fight either wildfires or structure fires and interface fires require both skills, making it difficult to balance the two. [27]

Structure Fires**:** In addition to typical methods of occurrence, structure fires are a potential secondary hazard of earthquakes and riots. One study estimated that 80-100 fires would occur from a large earthquake in the Seattle area.[28] Building codes requiring fire detectors and sprinkler systems are in effect for most large structures, therefore reducing some vulnerability. However, injuries and causalities to structure occupants are the primary concern. These events can also cause the release of hazardous materials as well as disconnect utility lines.

Wildland/Urban Interface Fires: King County is becoming more vulnerable to the effects of wildland/urban interface fires due to increased building, living and recreating in forested areas. The effects of interface fires can be the combined affects of both structure and wildland fires.

History of Events

The largest fire in King County history remains the 1889 Seattle fire, which was estimated to have consumed 60 acres of the downtown area.[29] Also notable was the Blackstock lumberyard fire in 1989 which took the life of one fire fighter and the Mary Pang warehouse fire in 1995 which killed four fire fighters.

In contrast, wildland fires historically, were not considered a hazard, as fire is a normal part of most forest and range ecosystems in the temperate regions of the world, including King County. Fires historically burn on a fairly regular cycle, recycling carbon and nutrients stored in the ecosystem, and strongly affecting the species within the ecosystem. The burning cycle in western Washington is every 100 – 150 years.[30] Controlled burns have also been conducted because the fire cycle is an important aspect of management for many ecosystems. These are not considered hazards unless they were to get out of control. [31]

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[27] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf
[28] McDonald, Terrence J, "Conflagration and Other Large Urban Fires", Seattle: A Hazard Identification and Vulnerability Analysis, Masters Thesis, Cornell University, 1995, p 82.
[29] McDonald, Terrence J, "Conflagration and Other Large Urban Fires", Seattle: A Hazard Identification and Vulnerability Analysis, Masters Thesis, Cornell University, 1995, p 82.
[30] Pierce County Department of Emergency Management Hazard Identification and Vulnerability Assessment Urban/Wildland Interface Fires Section, http://www.co.pierce.wa.us/pc/abtus/ourorg/dem/EMDiv/NaturalHaz.htm
[31] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf

None of Washington State's most significant wildland fires have occurred in King County, although smaller wildland fires have occurred in the region. All but the Snoqualmie Pass area of King County is part of the South Puget Sound fire protection region of the Washington Department of Natural Resources. During 1992-2001, the South Puget Sound region averaged 182 fires a year that burned an average of 81 acres of state-protected lands.[32]

Past Mitigation Efforts

The Blackstock lumberyard fire fatality resulted in the development of an accountability system called the passport system. This system works with the Incident Command System for tracking the assignments and locations of fire fighters during a response. The system worked so well, that it has been adopted on a national basis for safety improvement on the fire ground. Similarly, the fatalities at the Mary Pang fire have reinforced the continuing need for accountability and safety at a fire scene.

Public education programs are key elements of educating King County residents on indoor and outdoor fire safety, including the importance of fire alarms, extinguishers, fire insurance, and knowledge and understanding of building codes. In efforts to avoid injury or death, residents must plan how to safely exit their home and workplace in the event of a structure fire.

Additionally, effective early fire detection programs and emergency communications systems are essential. Wildland fire prevention education and enforcement programs can reduce the number of wildland fires Washington State faces each year. As a result, the importance of immediately reporting any wildland fire must be impressed upon local residents and visitors utilizing wooded areas. An effective warning system is crucial when needing to notify local residents and visitors in the fire risk area, as well as an evacuation plan detailing primary and alternate escape routes. [33]

The prevention of wildland/urban interface fires, fire-safe development planning requires coordination between county building and transportation planners, to ensure adequate fire escape routes for new sections of development in forested areas. Road closures may also be increased during peak fire periods to reduce access to fire-prone areas. [34] Land use, building codes, mandated sprinkler system

[32] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf
[33] King County Office of Emergency Management Fire Resource Section, http://www.metrokc.gov/prepare/preparerespond/hazardsdisasters/firehazards.aspx
[34] King County Office of Emergency Management Fire Resource Section, http://www.metrokc.gov/prepare/preparerespond/hazardsdisasters/firehazards.aspx

installation, vegetation management, survivable materials used in construction of homes, highly trained and equipped fire services and accessibility are all methods used to assist in mitigating urban/wildland fire risk.[35]

[35] Pierce County Department of Emergency Management Hazard Identification and Vulnerability Assessment Urban/Wildland Interface Fires Section, http://www.co.pierce.wa.us/pc/abtus/ourorg/dem/EMDiv/NaturalHaz.htm

Introduction

Hazardous chemicals are prevalent throughout our society. While industry is the primary user and maintainer of hazardous chemicals, we also have them in our homes, in our cars, at our places of work and recreation. Hazardous materials move through our region on highways, rail lines, pipelines, and by ship and barge through Puget Sound. These major transportation routes are utilized by our trucking industry to transport chemicals not only to local manufacturing plants, but also to businesses and retail outlets. [36]

The geographic and economic characteristics of King County make it likely that hazardous materials releases will occur. Our diverse industrial facilities and transportation routes share space with numerous bodies of waters, wetlands, environmentally sensitive areas, and a multitude of densely populated centers, creating areas of great potential risk for a hazardous materials release.

High Probability Low Impact	**High Probability Moderate Impact**	**High Probability High Impact**
Moderate Probability Low Impact	**Moderate Probability Moderate Impact**	**Moderate Probability High Impact**
Low Probability Low Impact	**Low Probability Moderate Impact**	**Low Probability High Impact**

Hazard Identification

King County hosts a variety of unique transportation and geographic conditions, including one of the largest deepwater seaports on the west coast, an International Airport in SeaTac that handles cargo from all over the world, as well as fuel pipelines running south from Whatcom County through King County and down into Portland carrying jet fuels, diesel, gasoline, etc. Additionally, local highways like I-5, I-90, US Highway 2, State Route (SR) 18, SR 516, SR 167, US Highway 99 and others transport hazardous materials throughout the region.

In the City of Seattle, there are over 3000 facilities with hazardous materials regulated under the fire code. Other areas with high concentrations of hazardous materials usage include Harbor Island, the Duwamish Corridor, Redmond and the Kent Valley. Business types that commonly use hazardous materials locally include: hospitals, schools, metal plating and finishing, the aircraft industry, public

[36] Pierce County Department of Emergency Management Hazard Identification and Vulnerability Assessment, Technological Hazards Section: Hazardous Materials, http://www.co.pierce.wa.us/xml/abtus/ourorg/dem/EMDiv/HIVA/hazmat.pdf

utilities, cold storage companies, the fuel industries, the communication industry, chemical distributors, research, and high technology firms. Each of these facilities is required to maintain plans for warning, notification, evacuation and site security under various regulations. The majority of releases that occur during the course of regular commerce happen at fixed facilities.

While the majority of incidents tend to involve petroleum products, a significant number involve extremely hazardous materials. Approximately 200 local facilities with extremely hazardous materials report their inventories to the county under SARA Title III provisions. Efforts continue to increase the compliance rate and education level of local facilities. In excess of 300 hazardous materials events require response in King County annually; however, many events are not reported or go undetected.

Hazardous materials may also be released as a secondary result of a natural disaster like earthquakes or floods. In either case, buildings or vehicles can release their hazardous materials inventories when structurally compromised or involved in traffic accidents. Pipelines can be exposed or ruptured from collapsed embankments, road washouts, bridge collapses, and fractures in roadways, and as nearly every neighborhood in urban King county includes a natural gas pipeline, this is a very possible risk. Examples of areas at risk for a secondary incident are Harbor Island, a western Washington facility with a large fuel storage area. Earthquake damage to Harbor Island could result in subsequent fuel spills that may impact the Duwamish River and Elliot Bay. These potential spills may occur from above ground storage, pipelines or fuel transfers from tankers. Events resulting from a spill would produce severe fire hazards and enormous environmental damages to fish, wildlife and commerce.

Additional potential causes of hazardous materials releases may include terrorist incidents and illegal drug labs or dumping. Illegal drug labs present a special concern due to the fact that each must be treated as a chemical hazard site and decontaminated before the property can be used again. Illegal drug labs can be set up in homes, apartments, vacant buildings, shacks in the forest or even in a van parked on the street.[37] Exposure of King County's sizable population to a hazardous materials release presents a complex problem to responders, since it is difficult to find a home, school, hospital or place of business in our modern society that isn't vulnerable to the possibility.

The chemical, physical and biological properties of hazardous materials pose a potential risk to life, health, the environment, and property when not properly contained. Hazardous materials may be explosive, flammable, combustible, corrosive, reactive, poisonous, biological or radioactive, as well as solid, liquid or

[37] Pierce County Department of Emergency Management Hazard Identification and Vulnerability Assessment, Technological Hazards Section: Hazardous Materials, http://www.co.pierce.wa.us/xml/abtus/ourorg/dem/EMDiv/HIVA/hazmat.pdf

gaseous. Hazardous materials incidents may be either generated from a fixed site or the result of a transportation-related accident or release.[38] Hazardous substances are subject to regulation by a variety of state and federal agencies through an assortment of labor, environmental and transportation laws.[39]

The types of materials that can cause a hazardous materials release are wide ranging in nature and may include chlorine, sodium hydroxide, sulfuric acid, radioactive isotopes, anhydrous ammonia, gasoline and other hydrocarbons, as well as medical/biological waste from hospitals or clinics. Hazardous materials subject to reporting under the Emergency Planning and Community Right-to-Know Act (EPCRA) or Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) include these four groups:

Extremely Hazardous Substances: These are materials with acutely toxic properties that may do irreversible damage or cause death to people or harm the environment when released or used outside their intended use. Examples include: ammonia, chlorine, and sulfuric acid. Includes 366 US EPA listed chemicals.

Hazardous Substances: These are any materials posing a threat to human health and/or the environment, or any substance designated by the Environmental Protection Agency (EPA) to be reported if a designated quantity of the substance is spilled into the waters of the United States or is otherwise released into the environment.[40] Includes 720 chemicals listed by the US EPA.

Hazardous Chemicals: If present at a chemical facility in certain amounts, these substances require a Material Safety Data Sheet (MSDS) under the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard. Such substances are capable of producing fires and explosions or adverse health effects such as cancer, burns, or dermatitis.[41]

Toxic Chemicals: Chemicals or chemical categories that appear on the list because of their chronic or long-term toxicity. Includes 325 chemicals. [42]

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[38] Pierce County Department of Emergency Management Hazard Identification and Vulnerability Assessment, Technological Hazards Section: Hazardous Materials, http://www.co.pierce.wa.us/xml/abtus/ourorg/dem/EMDiv/HIVA/hazmat.pdf
[39] Snohomish County Department of Emergency Management Hazard Identification and Vulnerability Assessment: Hazardous Materials Section, http://www.snodem.org/HIVA.pdf
[40] Snohomish County Department of Emergency Management Hazard Identification and Vulnerability Assessment: Hazardous Materials Section, http://www.snodem.org/HIVA.pdf
[41] Snohomish County Department of Emergency Management Hazard Identification and Vulnerability Assessment: Hazardous Materials Section, http://www.snodem.org/HIVA.pdf
[42] Pierce County Department of Emergency Management Hazard Identification and Vulnerability Assessment, Technological Hazards Section: Hazardous Materials, http://www.co.pierce.wa.us/xml/abtus/ourorg/dem/EMDiv/HIVA/hazmat.pdf

Other hazardous materials include hazardous wastes, by-products of society that can pose a substantial or potential hazard to human health or the environment when improperly managed, and possess at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity), or appear on special EPA lists.[43]

Hazardous Materials Impacts

The industrial and geographic characteristics of our region continue to place King County at risk for probably hazardous materials releases. Many factors determine the impact of a potential incident including quick and solid decision-making by emergency officials, location and type of release, evacuation and shelter-in-place needs, public health concerns, and relevant economic considerations. Additionally, while most incidents are generally brief, the resulting recovery and cleanup may take time to exact.

If evacuation is necessary due to a chemical emergency road closures and traffic jams may result. If a large-scale evacuation is deemed necessary, it can pose serious long term economic consequences to the involved population area.[44] A delay in the resumption of industry commerce may cause economic losses for both business owners and employees. In addition, an evacuation ordered on short-notice could cause serious problems for businesses requiring time to shut down specialized equipment.[45] There is also the monetary impact borne by responding public or private emergency response organizations. These agencies may be challenged by the expenses dictated by a hazardous materials release, and may need to wait an uncomfortable length of time for the responsible party to reimburse any outstanding costs, further straining the economic resources of the region.

A major incident involving significant injuries may severely tax regional medical services, as medical facilities aren't generally designed to handle mass amounts of victims on short notice. Consequently, in the event of a major incident, hospitals and other medical facilities must still be able to provide their customary level of service to all patients, regardless of whether they were incident victims or not.

History of Events

Hazardous materials emergencies have emerged as a public concern only within the past 30 years, as older records mixed hazardous materials emergencies with fire emergencies. As a result constructing a detailed history is difficult. This section highlights major incidents.[46]

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[43] Snohomish County Department of Emergency Management Hazard Identification and Vulnerability Assessment: Hazardous Materials Section, http://www.snodem.org/HIVA.pdf
[44] Snohomish County Department of Emergency Management Hazard Identification and Vulnerability Assessment: Hazardous Materials Section, http://www.snodem.org/HIVA.pdf
[45] Snohomish County Department of Emergency Management Hazard Identification and Vulnerability Assessment: Hazardous Materials Section, http://www.snodem.org/HIVA.pdf
[46] City of Seattle Emergency Management, Human-Caused Disasters: Hazardous Materials Resource Section, http://www.seattle.gov/emergency_mgt/hazards/hazardousMaterials.htm

A Washington State Department of Health study examined incidents occurring in 1992. According to the report there were 118 events in King County, about 10.2% involving transportation and 89.8% occurring at fixed facilities. Twenty-six incidents caused a total of 66 injuries, most commonly involving acids and volatile organic compounds. Additionally, 29 incidents resulted in the evacuation of nearly 1400 people. The report indicates that 44 incidents in King County occurred within one-quarter mile of residential areas, indicating some risk to people not directly involved with the released chemicals.[47]

A recent Washington State Hazard Identification and Vulnerability Analysis cited an average of 960 emergency spills occurring annually in King County. Significant events in King County detailed by the study include: the release of 2500 gallons of fuel from Olympic Pipeline at their Renton pumping station, the release of hydrofluoric and nitric acids from Boeing's Auburn plant, numerous drug lab events, metal finishing company fires at Boeing and Universal Manufacturing, a spill at UPS in Redmond, numerous releases of ammonia from cold storage facilities and the release of a small amount of chorine from a public water company. Response teams have narrowly averted some potentially large releases.

Hazardous materials may also be released during transport. For example, a 1994 King County study shows that the most common material transported along I-5 is gasoline. In addition, the most commonly released chemicals in transportation accidents included volatile organic compounds, acids, herbicides, and insecticides. Consequently, the Washington State Department of Transportation reported that almost 60,000 transportation incidents resulting in the accidental release of hazardous materials occurred between 1987 and 1989. Case in point of a typical problem posed by chemical transport involves a crash in 1975 where a gasoline tanker traveling north on the Alaska Way Viaduct lost control, bounced sideways, and crashed against the guardrail, where the tank ruptured. Gasoline flowed down the side of the Viaduct where it was ignited by flares set coincidentally by a railroad crew. The resulting fire damaged several buildings, but there were no casualties. [48] As for railroad incidents however, King County has not had any significant events in recent years, although rail lines do run throughout downtown Seattle and populous areas of King County.

King County also has numerous abandoned hazardous waste sites that are being cleaned up under the Superfund program. There are at lease five sites in Kent and one very large site in South Seattle.

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[47] City of Seattle Emergency Management, Human-Caused Disasters: Hazardous Materials Resource Section, http://www.seattle.gov/emergency_mgt/hazards/hazardousMaterials.htm

[48] City of Seattle Emergency Management, Human-Caused Disasters: Hazardous Materials Resource Section, http://www.seattle.gov/emergency_mgt/hazards/hazardousMaterials.htm

Past Mitigation Efforts[49]

There are currently sixteen hazardous materials response teams in King County. These are split evenly between public fire jurisdictions and the Boeing Company. Private response contractors working with the Environmental Protection Agency (EPA) and a unit of the Washington State Department of Ecology supplement the hazardous materials teams in King County.

An Area Contingency Plan was developed by the State Department of Ecology in cooperation with Federal, State and Local agencies. The purpose of the plan is "to provide orderly implementation of response actions to protect the people and natural resources of the states of Washington, Oregon, and Idaho from the impacts of oil or hazardous substances spills." The plan accounts for potential problems from vessels, offshore facilities, onshore facilities or other sources. The EPA has responsibility for all spills in inland waters. The United States Coast Guard has responsibility for all spills in coastal waters.

Other mitigation efforts include the Local Hazardous Waste Management Program, a regional consortium of local governments working together to protect public health and environmental quality by helping citizens, businesses and government reduce the threat posed by the use, storage, and disposal of hazardous materials. Prompted by citizen demand, this program was developed when Washington State directed local governments to create plans to ensure proper management of hazardous wastes produced by households, businesses, and other organizations. In 1991 local governments and agencies within King County established a partnership to manage these wastes regionally by developing the Local Hazardous Waste Management Program.[50] This program offers information and services to help King County residents, businesses, and other groups reduce toxic and hazardous materials, safely use and store hazardous materials, and properly dispose of hazardous wastes.[51]

With 1.7 million people living in King County and more than 60,000 businesses and other institutions operating therein, the amount of hazardous waste generated adds up. When improperly used, stored or disposed of, these chemicals threaten human health and the environment. Moreover, exposure to some household products and business materials presents a risk to health and environmental quality even when used and disposed of properly. Program efforts focus on helping local residents, business owners and operators, and other institutions (such as schools, hospitals and government agencies): use fewer and/or less toxic materials (and generate less

[49] Vulnerability Analysis prepared for the Local Emergency Planning Committee by Rich Tokarzewski, King County Office of Emergency Management
[50] Local Hazardous Waste Management Program in King County: Working Together to Reduce Hazardous Waste, http://www.govlink.org/hazwaste/about/
[51] Local Hazardous Waste Management Program in King County, http://www.govlink.org/hazwaste/

hazardous waste), properly use and store hazardous materials, and properly dispose of hazardous wastes. [52]

As demonstrated by the Local Hazardous Waste Management Program's efforts, public education is a key component to reducing the risks associated with a hazardous materials release. Educating the public on the fundamentals of shelter-in-place is also a key component. Citizens must know when, where, and how to shelter-in-place effectively, as this response mechanism is key to saving lives in a chemical emergency. Being aware and attentive of emergency officials and their public safety directives during a hazardous materials release will help ensure the protection of vulnerable populations and may lessen the economic impact of a release to the business and industrial community.

[52] Local Hazardous Waste Management Program in King County: Working Together to Reduce Hazardous Waste, http://www.govlink.org/hazwaste/about/

Introduction

Transportation systems available in King County include air, rail, water and road. All of these systems and supporting transportation resources provide services on a national, regional and local basis and are critical to local, regional, national and international commerce. While highway traffic accidents are a daily occurrence, transportation accidents with impacts to local commerce or resulting in transportation diversions are fairly rare.

High Probability Low Impact	**High Probability Moderate Impact**	**High Probability High Impact**
Moderate Probability Low Impact	**Moderate Probability Moderate Impact**	**Moderate Probability High Impact**
Low Probability Low Impact	**Low Probability Moderate Impact**	**Low Probability High Impact**

Hazard Identification

King County is a transportation hub in the northwest. Major highways, air transportation, railroad operations and a deep water marine port all exist in King county.

Highways: Privately owned vehicles and local bus services traveling on area freeways, highways and roads provide the primary means of transportation for individuals in King County. The principal north-south arterials are Interstate 5 and Interstate 405. Interstate 90, which connects Seattle with Spokane and points east, is the most heavily traveled east-west corridor. US Highway 2 crosses the Cascade Mountains in northeast King County at Steven's Pass. The two Floating Bridges over Lake Washington link Seattle to the eastern portion of the county as well as eastern Washington, Idaho, Montana and other states.

Air Transportation: The largest airport in King County, for both passenger and cargo traffic, is the Seattle-Tacoma International Airport, where domestic and international service is provided by several major airlines. Sea-Tac is the largest airport in Washington and was ranked 18th in the United States for passenger carriage in 1998.[53]

[53] Washington State Department of Transportation Aviation Division Report on the Economic Impacts of Seattle-Tacoma International Airport, http://www.wsdot.wa.gov/aviation/EconImpacts/NWR/SeaTac.pdf

Sea-Tac generates substantial economic impacts to the region, as shown by the total combined direct output of on-airport tenants and general aviation and air carrier visitors, which was approximately $11.6 billion. Additionally, these expenditures were responsible for approximately 94,952 jobs, generating $1.8 billion in wages. Sea-Tac also provides numerous secondary impacts to the King County area through visiting passengers and airport-dependant firms, accounting for 22,486 jobs and posting wages of $1 billion. The total employment impact of Sea-Tac stands at approximately 146,245 jobs earning $3.6 billion, while the sum total impact of economic activity was $16.9 billion.[54]

Rail Transportation: Rail Carriers in this area include Burlington Northern and the Union Pacific for freight traffic, and Amtrak for passenger travel. North-South railways travel along the coastline though much of King County. East-West rail traffic primarily uses Steven's Pass, traveling a 7-mile tunnel through the Cascade Mountains. Sounder commuter rail service is initially providing one-way service during peak hours between Tacoma and Seattle on weekdays, while service will eventually be expanded to operate along the entire 82-mile track between Everett and Lakewood.[55]

Marine Transportation: As with other modes of transportation, there are both passengers and cargo transported in King County. The Washington State Ferry System provides the primary means of marine passenger transport in our region with four ferry terminals located in the County jurisdiction. In 1995, 1256 different ships made 3,619 calls to Puget Sound ports either through the Straits of Juan de Fuca or the Straits of Georgia.[56]

Washington State Ferries is the largest ferry transit system in the United States and one of the busiest, carrying over 25 million riders in 2003, and is the largest transit system in Washington State, second only to King County Metro. Commuters make up about 50% of the annual ridership, as exemplified by the busiest commuter route, Bainbridge to Seattle, where 20,000 people are carried in an average day.[57] Additional water transport systems exist with the Port of Seattle and numerous private marine facilities located on Puget Sound, Lake Union and Lake Washington, which provide services and docking facilities for marine cargo and tanker traffic.

[54] Washington State Department of Transportation Aviation Division Report on the Economic Impacts of Seattle-Tacoma International Airport, http://www.wsdot.wa.gov/aviation/EconImpacts/NWR/SeaTac.pdf

[55] Pierce County Department of Emergency Management, Hazard Identification and Vulnerability Assessment, Technological Hazards: Transportation Accidents, http://www.co.pierce.wa.us/pc/abtus/ourorg/dem/techaz.htm

[56] Washington State Office of Marine Safety, Vessel Entries and Transits for Washington Waters, 1995, p B2.

[57] Washington State Ferries: An Introduction to the Largest Ferry System in the Nation, http://www.wsdot.wa.gov/ferries/pdf/WSFLargest.pdf

Transportation Impacts

The Puget Sound region is vulnerable to all types of transportation emergencies. Growth in this region will continue to increase the risk of transportation accidents.

Highways: King County is likely to experience an increase of accidents along our highways as congestion increases. Many accidents involve rain, high speeds, and heavy traffic. These conditions are certainly not unique, as rain and fog are common, especially during the winter months, while heavy traffic and high speeds are common throughout the year. The bridges in King County play an important role in commerce and in the daily commute. Thanksgiving Day weekend in 1990, a span of the I-90 floating bridge over Lake Washington sank. While the span was replaced and a second bridge built, traffic patterns were disrupted for two years.

Air Transportation: The Puget Sound region is vulnerable to two types of major air transportation accidents. One is a crash involving a large passenger aircraft, while the other is an airplane crash causing casualties on the ground. Despite the large number of planes flying over heavily populated areas, the number of crashes killing or injuring non-passengers is quite small. In general, crashes are most likely to occur within five miles of an airport, typically along flight paths. The area within a five mile radius of airports in the Puget Sound region are heavily populated and therefore could result in a mass casualty event if a plane crashed in these areas, even if the plane itself was not a passenger aircraft. Weather is a significant factor in these air transportation accidents. Down bursts, thunderstorms, and ice are the primary weather-related events that increase risk.

Sea-Tac Airport is becoming as congested as some of the nation's major airports including Chicago's O'Hare and New York City's Kennedy airports. Currently, King County International Airport averages 400,000 flights per year while Sea-Tac is reaching its design capacity with 350,000 flights per year.[58] The proximity of King County International Airport's flight path also increases the risk. The flight paths for these two airports overlap, increasing the risk of mid-air collisions. With the completion of a third runway, congestion will be reduced, but the total volume of flights over Seattle will probably increase, offsetting some of the benefits of the reduced congestion.

Rail Transportation: An accident involving an Amtrak train traveling through Washington State could result in a mass casualty incident. However, the greatest risk associated with freight trains is a spill of hazardous materials.[59] Nevertheless, with the development of Sound Transit, King County's railway vulnerability will

[58] City of Seattle Emergency Management, Human Caused Disasters: Aircraft Accidents Resource Section, http://www.cityofseattle.net/emergency_mgt/hazards/aircraftAccidents.htm

[59] Transportation accidents involving hazardous materials releases and spills are discussed in a separate HIVA section.

increase, as new hazards may present themselves with the continued growth of this light rail service.

Marine Transportation: In addition to the Puget Sound itself, the region contains many smaller bodies of water. These areas are vulnerable to shipping and boating accidents, as well as those involving ferries. Ferry accidents could result in a mass casualty incident that may be difficult to address, though the United States Coast Guard has the primary responsibility for safety and rescue on the open waterways. Major emergencies associated with freight vessels though, are more likely to result from spills or collisions with passenger vessels.

History of Events

Highway Accidents: King County has averaged around 117 traffic fatalities during the past nine years.[60] Past history also shows the potential for major incidents, like a 42 car pileup that occurred in 1996, closing southbound Interstate 5 for four hours, and was responsible for 23 injuries and one death.

Marine Accidents: It is fortunate that the Puget Sound region has not experienced a major incident involving a Washington State Ferry, but with an examination of the history of near misses, one can see that potential for a fatal accident does exist. For example, two incidents in 1994 involved a ferry running aground off Orcas Island, as well as a ferry colliding with a pleasure craft while attempting to dock.[61] Additionally, in the case of freight vessels, a Canadian Study that examined past collisions, accidents, and groundings in the Straits of Juan de Fuca, found that 56% involved bulk carriers, 12% involved container vessels, 12% involved passenger vessels and 18% involved tankers. Tankers are currently the most heavily regulated, as the Exxon Valdez oil spill in Alaska caused Washington State to pass strict regulations on their usage.

Air Accidents: There has not been a major air accident in the Puget Sound region in recent history. However, accidents in other parts of the country allow us to examine the potential vulnerabilities we face in this area. In 1995 there were 175 deaths associated with large scheduled airline traffic and 732 deaths associated with general aviation flights. King County is at risk for these threats, as the region experiences extensive air traffic of both these types. SeaTac airport handles most of the scheduled airline traffic while King County International Airport/Boeing Field handles most of the general aviation traffic. A relatively minor commercial air traffic accident occurred when a Dash 8 commuter plane lost control after landing at SeaTac International Airport. It crashed into the terminal building causing some damage but no deaths or service disruptions.

[60] Washington Traffic Safety Commission, 1993-2001: Fatalities by County, http://www.wtsc.wa.gov/stats/Table3.pdf

[61] Taken from 1997 King County Hazard Identification and Vulnerability Assessment.

Rail Accidents: The Puget Sound region has not experienced a major rail accident in recent history, however recent examples point to the potential for this hazard to occur in King County. For example, a massive landslide in nearby Snohomish County pushed five freight cars into Puget Sound, knocking out 100 yards of track. Railroad-related fatalities, on the other hand, are generally the result of people walking on or near railroad tracks. A 1994 statistic gathered that almost 75% of railroad-related deaths were attributed to such a situation.[62]

Past Mitigation Efforts

The source and location of transportation accidents can vary widely but the response is typically the same. Response is focused on determining the presence or absence of hazardous materials and then assisting the injured. Local emergency managers should work with transportation planners to mitigate current risks associated with major transportation corridors. Additionally these agencies should work together when planning new infrastructure such as the Regional Transit Authority or a third runway at SeaTac Airport to minimize associated risks.

For any type of transportation accident, mitigation involves first and foremost, the following of safety guidelines as well as using caution in unusual conditions or situations. Inspections required on a regular basis on carriers, as well as infrastructure like highways, airports, railroad, or marine systems must be carried through as required by the regulations in place in order to prevent transportation incidents. In addition, as new technology comes into being or new information is gathered as to the cause of transportation accidents, regulations on safety and maintenance need to be updated. [63]

Additionally, local media outlets, as well as King County Department of Transportation take care to keep the public updated of transportation-related emergencies and resulting highway, airport, rail, or ferry delays and closures. The Regional Public Information Network (RPIN) also provides the public with a central source for breaking news by providing links to information being released by a variety of agencies and organizations in central Puget Sound, including those incidents involving transportation accidents.[64] Citizens can subscribe to RPIN to stay abreast of breaking transportation news and other regional alerts.

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[62] Taken from 1997 King County Hazard Identification and Vulnerability Assessment.
[63] Pierce County Department of Emergency Management, Hazard Identification and Vulnerability Assessment, Technological Hazards: Transportation Accidents, http://www.co.pierce.wa.us/pc/abtus/ourorg/dem/techaz.htm
[64] Regional Public Information Network (RPIN), http://www.govlink.org/rpin/

Tsunami and Seiches

Introduction

Tsunami (soo-NAH-mee): a Japanese word that means harbor wave; a sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides, or exploding volcanic islands. [65]

Tsunamis, often incorrectly described as tidal waves, are sea waves usually caused by displacement of the ocean floor. Typically generated by seismic or volcanic activity or by underwater landslides, a tsunami consists of a series of high-energy waves that radiate outward like pond ripples from the area in which the generating event occurred. The arrival of tsunami waves is usually typified by a sudden and unexpected recession of water; the first wave will be followed by additional waves a few minutes or even a few hours later. Wave size typically increases over time, and coastal flooding may often precede the largest waves.

Seiche (saysh): a series of standing waves (sloshing action) of an enclosed body or partially enclosed body of water caused by earthquake shaking. Seiche action can affect harbors, bays, lakes, rivers, and canals. [66]

Tsunami and Seiche events occur only very infrequently in Puget Sound.

High Probability Low Impact	**High Probability Moderate Impact**	**High Probability High Impact**
Moderate Probability Low Impact	**Moderate Probability Moderate Impact**	**Moderate Probability High Impact**
Low Probability Low Impact	**Low Probability Moderate Impact**	**Low Probability High Impact**

Hazard Identification

Normally caused by earthquake activity, tsunamis and seiches can affect harbors, bays, lakes, rivers, and canals. In the majority of instances, earthquake-induced events do not occur close to the epicenter of an earthquake, but hundreds of miles away. Earthquake shock waves close to the epicenter consist of high frequency vibrations, while those at much greater distances are of lower frequency. It is the

[65] Skagit County Natural Hazards Identification Plan, http://www.skagitcounty.net/EmergencyManagement/Documents/2003HazMitFinal/Section%20II%20Final%20Documents/3%20HIVA%20Skagit%20Drought.pdf
[66] Skagit County Natural Hazards Identification Plan, http://www.skagitcounty.net/EmergencyManagement/Documents/2003HazMitFinal/Section%20II%20Final%20Documents/3%20HIVA%20Skagit%20Drought.pdf

low frequency vibrations that move bodies of water. The biggest tsunamis and seiches develop when the period of ground movement matches the frequency of oscillation in the body of water.[67]

Not all earthquakes produce tsunamis. To generate a tsunami, an earthquake must occur underneath or near the ocean, be very large (approximately Richter magnitude 7 or greater), and create vertical movement of the sea floor. All oceanic regions of the world can experience tsunamis, but in the Pacific Ocean there is a much more frequent occurrence of large, destructive tsunamis because of the many large earthquakes along the boundaries of the Pacific Ocean's "Ring of Fire." [68]

Tsunamis can be intensely powerful, as large Pacific Ocean tsunamis typically have wave crest to wave crest distances of 60 miles and can travel about 600 miles per hour in the open ocean, navigating the entire 12,000 to 14,000 miles of the Pacific Ocean in just 24 hours. In deep ocean waters, the length from wave crest to wave crest may be a hundred miles or more but only reaches a wave height of less than a few feet. As a result, tsunamis cannot be felt aboard ships nor can they be seen from the air in the open ocean. [69]

Tsunamis and seiches can be generated by a number of sources:

1. Distant earthquakes along the Pacific Rim.

2. Local earthquakes, such as those generated by local surface faults, those originating in the Benioff zone, or those that occur in the Cascadia Subduction Zone off the coast.

3. Large landslides into bodies of water, such as Puget Sound or area lakes.

4. Submarine landslides in bodies of water like Puget Sound.[70]

Either a large subduction zone quake off the coast or along the Seattle fault could produce a tsunami, however, while a tsunami generated by a distant or Cascadia subduction earthquake could result in much damage to the coast, it wouldn't create as great of an impact in King County. For in the case of a subduction zone quake, a tsunami would travel from the coast through the Straight of Juan de Fuca into Puget Sound, and then south to Seattle. Because of the shielding effects of the Olympic

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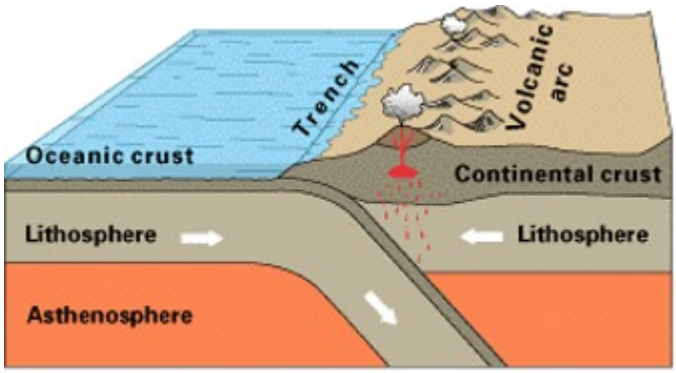
[67] Snohomish County Department of Emergency Management Hazard Identification and Vulnerability Assessment, http://www.snodem.org/HIVA.pdf
[68] Snohomish County Department of Emergency Management Hazard Identification and Vulnerability Assessment, http://www.snodem.org/HIVA.pdf
[69] Skagit County Natural Hazards Identification Plan, http://www.skagitcounty.net/EmergencyManagement/Documents/2003HazMitFinal/Section%20II%20Final%20Documents/3%20HIVA%20Skagit%20Drought.pdf
[70] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf

Peninsula and the islands in Puget Sound, the tsunami expected from a magnitude 8.5 quake would be less then 2 feet high when it arrived at Seattle's shores, having lost much of its' velocity.[71] As a result, primary concerns lie with a tsunami or seiche generated by a land movement originating on the Seattle fault, which runs off the northern end of West Seattle through Elliott Bay towards the Kingdome and across toward Bellevue. [72]

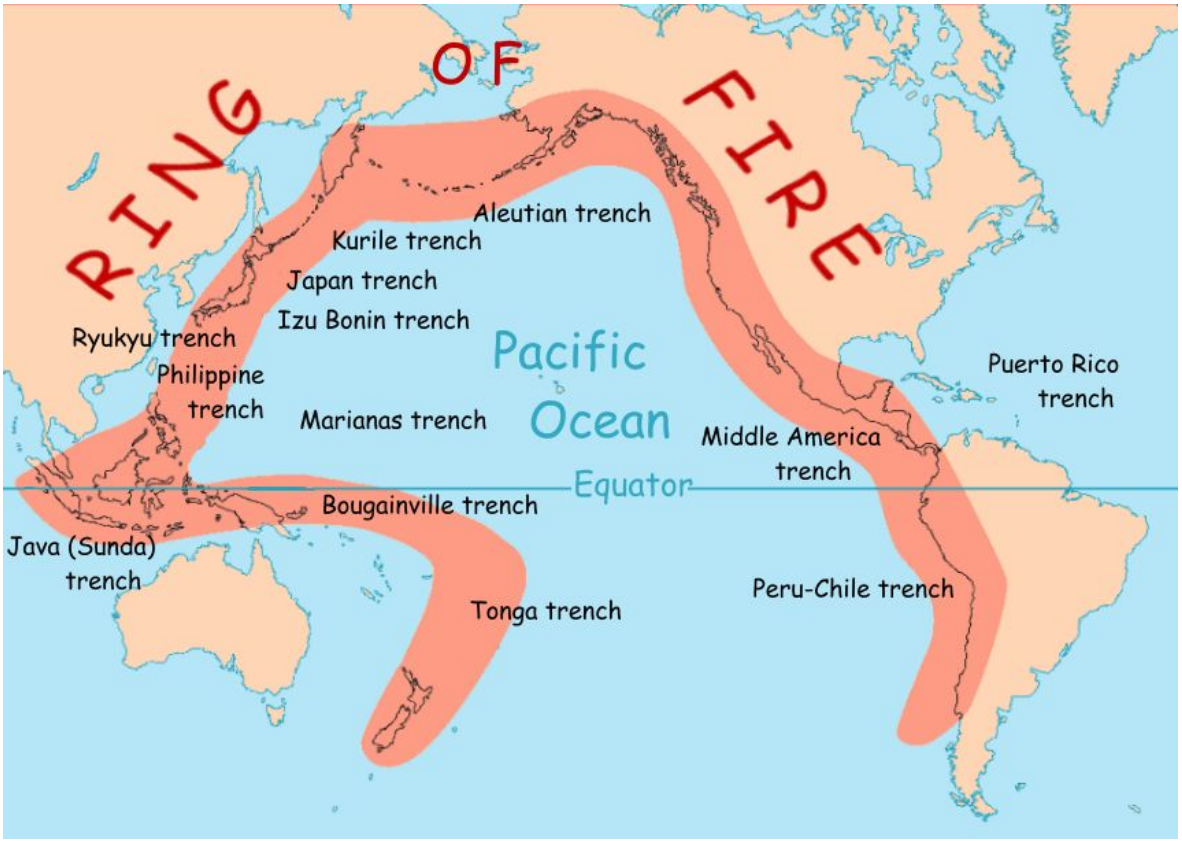
The National Oceanic and Atmospheric Administration (NOAA)'s Center for Tsunami Inundation Mapping Efforts developed a tsunami inundation model for Seattle's Elliott Bay using a magnitude 7.3 Seattle Fault earthquake as an initiating event (this model simulates the earthquake event 1,000 years ago, considered by NOAA to be the credible worst-case scenario.) The area modeled includes communities within one kilometer of the Puget Sound coast, such as portions of Seattle, Riverton-Boulevard Park and White Center, and projects a potential at-risk population of 11,056.[73]

For example, in addition to Lake Washington, Lakes Sammamish and Union have many watercrafts, houseboats, docks, piers, houses and buildings located on or close to their waterfronts. Our area floating bridges may also be at risk for seiche damage. Additional vulnerabilities to seiche in King County include water storage tanks and containers of liquid hazardous materials, which could be affected by the rhythmic motion of a "sloshing" seiche.



Source: Peninsula Emergency Preparedness Committee, Pacific Northwest Tsunamis Resource Section, http://www.pep-c.org/pacificnorthwesttsunamis/

[71] City of Seattle Emergency Management Natural Hazards, Tsunami and Seiche Section, http://www.cityofseattle.net/emergency_mgt/hazards/tsunamiSeiches.htm
[72] City of Seattle Emergency Management Natural Hazards, Tsunami and Seiche Section, http://www.cityofseattle.net/emergency_mgt/hazards/tsunamiSeiches.htm
[73] City of Seattle Emergency Management Natural Hazards, Tsunami and Seiche Section, http://www.cityofseattle.net/emergency_mgt/hazards/tsunamiSeiches.htm



Source: NOAA National Geophysical Data Center, http://www.ngdc.noaa.gov/seg/hazard/stratoguide/glossary.html

Hazard Impact

Several factors could influence the size, shape, volume, and potential destructiveness of a tsunami generated by the Seattle Fault. First, since Elliott Bay and Puget Sound are shallow, there is less water to displace; therefore, a resulting tsunami would be slower and have less volume than those generated in the deep ocean. Second, Puget Sound's steeply sloping seabed tends to increase the chance that a tsunami will break on the shore, thus potentially enhancing a tsunami's destructiveness. Finally, the shape of Elliott Bay could increase damage by funneling waves together, increasing wave height. The net result is unclear, as the depth versus shape relationship of Elliot Bay is relatively unknown.[74]

Estimated recurrence rate of an earthquake on the Seattle fault of the size necessary to generate a tsunami or seiche is estimated at once every 1,100 years.

[74] City of Seattle Emergency Management Natural Hazards, Tsunami and Seiche Section, http://www.cityofseattle.net/emergency_mgt/hazards/tsunamiSeiches.htm

Great earthquakes in the North Pacific or along the Pacific coast of South America that generate tsunamis that sweep through the entire Pacific basin occur at a rate of about six every 100 years.[75]

With regards to seiche threats, both Puget Sound and Lake Washington could experience a seiche as they did in 1891, 1949 and 1964. In those years, there was not as much development near the waterfront as there is now. As a result, since the tsunami and seiche threats were not recognized until recently, most of the structures located near the water were probably not engineered to withstand them.[76]

The potential impact to bridges is expected to be minimal, since the Washington State Department of Transportation anticipates that storm-generated wave forces would exceed the force created by a small to moderate-sized tsunami. As to the possibility of earthquake-induced liquefaction impacting bridge support, bridge design assumes seismic effects to govern.[77]

Additional impacts from a tsunami include floating debris with the potential to batter and damage inland structures. The sheer impact of the waves could even cause breakwaters and piers to collapse. Ships moored in harbors would also be at risk, as they could be swamped, sunk or left battered and stranded high on the shore. In addition, railroad yards and oil tanks situated near the waterfront would also be particularly vulnerable, as resulting oil fires are often spread by waves.

Moreover, port facilities, fishing fleets, and public utilities are frequently the backbone of the economy of the affected areas, and these are the very resources that generally receive the most severe damage. Until debris can be cleared, wharves and piers rebuilt, utilities restored, and the fishing fleets reconstituted, communities may find themselves without fuel, food, and employment. Wherever water transport is a vital means of supply, disruption of coastal systems caused by tsunamis can have far reaching economic effects. For example, Port of Seattle facilities and the Burlington Northern Railway tracks are likely to suffer damage because of their proximity to the shore.[78]

A seiche could affect a larger area because of King County's extensive shoreline, and could also affect the floating bridges across Lake Washington. While, the bridges have withstood waves up to eight feet, waves from a seiche could be much larger. A seiche's rapid onset could also hamper the ability of motorists to exit the

[75] Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf
[76] City of Seattle Emergency Management Natural Hazards, Tsunami and Seiche Section, http://www.cityofseattle.net/emergency_mgt/hazards/tsunamiSeiches.htm
[77] City of Seattle Emergency Management Natural Hazards, Tsunami and Seiche Section, http://www.cityofseattle.net/emergency_mgt/hazards/tsunamiSeiches.htm
[78] City of Seattle Emergency Management Natural Hazards, Tsunami and Seiche Section, http://www.cityofseattle.net/emergency_mgt/hazards/tsunamiSeiches.htm

bridge before it began.[79] Additionally, the "sloshing" effect of a seiche could cause damage to moored boats, piers and facilities close to the water. Secondary problems, including landslides and floods, are related to accelerated water movements and elevated water levels. Many landslide prone bluff areas are in residential settings, so risk could be quite high in the event of a secondary seiche threat.

History of Events

On average, the west coast of the United States experiences a damaging tsunami every 18 years. Geologic evidence shows that the Cascadia Subduction Zone has generated great earthquakes in the past, the most recent about 300 years ago. Any large earthquake has the capability to generate a tsunami or severe seiche action. Recent studies regarding the potential for a great Subduction zone earthquake off the Washington, Oregon, and Northern California coastlines indicate that local tsunami waves may reach nearby coastal communities within minutes of the earthquake thereby giving little or no time to issue warnings.[80]

Local studies of the Seattle Fault indicate a potential for tsunamis. Scientists interpret the evidence of irregular sand sheets in the Northern Puget Sound area found at the West Point Sewer Treatment Plant, Alki, and Restoration Point on Bainbridge as the result of a tsunami generated by an earthquake on the Seattle fault about 1,000 years ago.[81]

Similar evidence in Lake Washington sediments suggests a recurrence interval of 300 to 400 years. Several areas of the Seattle Fault show evidence of episodic fault rupture of about 6 feet that could produce a tsunami. Continued studies of Seattle Fault traces suggest that the fault may have ruptured in different segments and at different times.[82]

[79] City of Seattle Emergency Management Natural Hazards, Tsunami and Seiche Section, http://www.cityofseattle.net/emergency_mgt/hazards/tsunamiSeiches.htm
[80] Skagit County Natural Hazards Identification Plan, http://www.skagitcounty.net/EmergencyManagement/Documents/2003HazMitFinal/Section%20II%20Final%20Documents/3%20HIVA%20Skagit%20Drought.pdf
[81] City of Seattle Emergency Management Natural Hazards, Tsunami and Seiche Section, http://www.cityofseattle.net/emergency_mgt/hazards/tsunamiSeiches.htm
[82] City of Seattle Emergency Management Natural Hazards, Tsunami and Seiche Section, http://www.cityofseattle.net/emergency_mgt/hazards/tsunamiSeiches.htm

Table 5-15: History of Tsunami and Seiche in King County	
Year	**Conditions**
A.D. 900-930	A magnitude 7 or greater earthquake on the Seattle fault created uplift on the floor of Puget Sound. The uplift generated a tsunami that deposited a sand sheet at West Point and the Duwamish Delta in Seattle. Computer simulations showed the tsunami reached heights of 10 feet or more on the Seattle waterfront.
1891	Water in Lake Washington and Puget Sound surged onto beaches two feet above the high water mark from two earthquake shocks and submarine landslides. This earthquake near Port Angeles also caused an eight-foot seiche in Lake Washington.
1949	Both Lake Union and Lake Washington experienced seiches during the 1949 earthquake (M7.1), but they did no damage.
1964	The tsunami generated by the magnitude 9.2 Alaska earthquake raised the water level 0.1 feet in Elliott Bay, Seattle. Seiches damaged houseboats, buckled moorings, and broke water and sewer lines in Lake Union. However, the tsunami's effect was negligible in Seattle because the complicated shoreline in Puget Sound acted as a baffle for incoming ocean waves.
1965	Due to a local earthquake event (M6.5), sloshing action was observed in area lakes.
2002	Seiches damaged houseboats, buckled moorings, and broke water and sewer lines in Lake Union following an Alaskan earthquake (Denali, M7.9).
Sources: Washington State Hazard Mitigation Plan, Region 6, http://emd.wa.gov/3-map/mit/mit-pubs-forms/hazmit-plan/reg-6-profile.pdf; City of Seattle Emergency Management Natural Hazards, Tsunami and Seiche Section, http://www.cityofseattle.net/emergency_mgt/hazards/tsunamiSeiches.htm	

Past Mitigation Efforts

Since it is known that the speed of tsunamis varies with water depth, the prediction of tsunami arrival times at coastal locations is possible once the epicenter has been determined. But it is not yet possible to predict the wave height at a specific coastal location. Another indeterminable feature of a tsunami is how many successive waves there will be in the series, although there is rarely only one. However, efforts and programs exist to help mitigate the damage wrought by tsunamis and seiches, especially by providing warnings to vulnerable areas.

The Tsunami Warning System (TWS) in the Pacific, comprised of 26 participating international member states, monitors seismological and tidal stations throughout the Pacific Basin. The System evaluates potentially tsunami-generating earthquakes and disseminates tsunami warning information. The Pacific Tsunami Warning Center (PTWC) is the operational center of the Pacific TWS. [83]

The PTWC was instituted in 1948 following the extensive damage and loss of life in Hawaii caused by a tsunami generated by the great Aleutian Islands earthquake of 1946. [84] The PTWC is comprised of member nations and states that seek to coordinate tsunami detection and warning efforts within the area. The PTWC is responsible for providing warnings to international authorities, Hawaii, and U.S. territories within the Pacific basin.

Another mitigation program is the West Coast/Alaska Tsunami Warning Center (WC/ATWC), responsible for tsunami warnings for California, Oregon, Washington, British Columbia, and Alaska. [85] The devastation associated with the 1964 Alaskan earthquake and tsunami, led to the institution of the WC/ATWC in 1967. It serves as the regional warning center for Alaska, British Columbia, Washington, Oregon and California. This system is intended to detect, locate and calculate the magnitude of earthquakes in the region as quickly as possible and issue warnings to communities close to the epicenter.

The PTWC and WC/ATWC may issue the following bulletins:

WARNING: A tsunami was or may have been generated, which could cause damage; therefore, people in the warned area are strongly advised to evacuate. This notification also gives time of arrival estimations to the vulnerable areas in question.

WATCH: A tsunami was or may have been generated, but is at least two hours travel time to the area in watch status. Local officials should prepare for possible evacuation if their area is upgraded to a warning.

ADVISORY: An earthquake has occurred in the Pacific basin, which might generate a tsunami. WC/ATWC and PTWC will issue hourly bulletins advising of the situation.

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[83] Snohomish County Department of Emergency Management Hazard Identification and Vulnerability Assessment, http://www.snodem.org/HIVA.pdf
[84] Snohomish County Department of Emergency Management Hazard Identification and Vulnerability Assessment, http://www.snodem.org/HIVA.pdf
[85] Peninsula Emergency Preparedness Committee, Tsunami Warning Resource Section, http://www.pep-c.org/pacificnorthwesttsunamis/

INFORMATION: A message with information about an earthquake that is not expected to generate a tsunami. Usually only one bulletin is issued.[86]

Recent revelations about the potential for a great subduction zone earthquake off the Washington, Oregon, and Northern California coastlines have led to several studies about the effect of a local tsunami generated in this source area. FEMA estimates that a Cascadia Subduction Zone earthquake-generated tsunami could cost $25-125 billion in damages to the region. If one assumes that the tsunami would cause 5% of these losses, then the tsunami losses would total between $1.25 and 6.25 billion. More significantly, the population directly at risk from a Cascadia tsunami is significant. About 300,000 people live or work in coastal regions that could be affected and at least as many tourists travel through these areas each year. Some tourism and financial corporations already plan for and educate employees about tsunamis. Others are interested but do not know where to begin and are unaware of the potential losses in terms of lives, operations, and clients.[87]

Early warning, coupled with education of the affected populations, proper zoning, and suitable structural design can aid in reducing the disastrous effect of this natural hazard. If warning is received early enough (2 to 5 hours), which is possible for tsunamis generated at a distance, hasty preventive action can be taken: people can be evacuated, ships can clear harbors or seek safer anchorage, planes and rolling stock can be moved, buildings can be closed, shuttered, and sandbagged. For tsunamis generated by local events, however, the time from initiation of a tsunami to its arrival at shore can be as little as a couple of minutes. Residents in areas susceptible to tsunamis should be made aware of the need to seek high ground if they feel strong ground shaking. Coastal communities should identify evacuation routes even if they do not have good information about potential inundation areas.

Seiches that occur in King County also have the potential to cause property damage and casualties. Although much work has been done on disaster preparedness for the public, local governments, emergency planners and the citizenry need to recognize the dangers and effects of seiches as an important component of the earthquake/tsunami hazard.

Because King County is most vulnerable to tsunamis and seiches produced by a local quake, comprehensive educational programs that keep the public informed of the dangers and steps to be taken for personal protection are especially important. In these instances, there may not be enough time between the triggering event and the arrival of the first wave for effective warning.

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[86] American Red Cross Tsunami Resource Section, http://www.redcross.org/services/disaster/0,1082,0_592_,00.html#cause

[87] Snohomish County Department of Emergency Management Hazard Identification and Vulnerability Assessment, http://www.snodem.org/HIVA.pdf

Introduction

Cyberterrorism presents a hazardous threat to our increasingly digital world. The possibility of a major cyberterrorism attack in the United States would threaten infrastructure, financial systems, and everyday computing across the nation and here in Western Washington. Even more limited cyber infringement actions can disrupt the lifestyle of Central Puget Region residents and the daily activities of public, private, and nonprofit sector business and organizations, leading to potentially costly outcomes.

Far from the generally understood Internet irritations like "spam" (unwanted email) or "phishing" (email attempts to get the user to divulge private information like account numbers), cyberterrorism is much more sinister enterprise – a convergence of terrorism and cyberspace. By definition, it is generally understood to mean unlawful attacks and threats of attack against computers, networks, and the information stored therein when done to intimidate or coerce a government or its people in furtherance of political or social objectives. [1] Examples include attacks that lead to death or bodily injury, explosions, plane crashes, water contamination, or severe economic loss.[2]

Cyberterror can take a variety of different forms including:

Internet worms or viruses: these internet "viruses" or "worms" can be used to shut down programs, or even entire systems by hijacking email lists and address books. Worms or viruses may also be used to target communication devices like cellular phones or personal data assistants.

Phlooding: this new exploit targets businesses' central authentication servers with the goal of overloading them and causing a denial−of−service attack. These simultaneous but geographically distributed attacks have targeted but are not restricted to wireless access points with login requests using multiple password combinations in what are known as dictionary attacks. The multiple requests create a flood of authentication requests to the company's authentication server, which could slow down logins and potentially interfere with broader network operations, since many different users and applications often validate themselves against the same identity management system. Phlooding could effectively block broadband VPN or firewall connections making it temporarily impossible for employees to access their corporate network.[3]

System Threats: threats to various systems, new and antiquated, that power our everyday operations. An example of a new threat would be one to the security of Voice-Over Internet Protocol (VoIP) processes, whose similarity to traditional data

systems may become attractive to attackers, impacting the public's ability to utilize emergency services, or limit the ability of public safety organizations to act quickly in an emergency.[4]

Force Multiplier effects: Acts of cyberterror may also be used to multiply the impact of a physical attack when executed in concert. For example, terrorists might try to block emergency communications or cut off electricity or water in the wake of a conventional bombing or a biological, chemical, or radiation attack would impact the potential response capability for the initial attack. Many experts say that this kind of coordinated attack might be the most effective use of cyberterrorism.[5] Also, with much of the world becoming more web-savvy, terrorists are doing the same – experts are warning against terrorists researching hacker tactics in efforts to use the technology for their aims.[6]

High Probability Low Impact	**High Probability Moderate Impact**	**High Probability High Impact**
Moderate Probability Low Impact	**Moderate Probability Moderate Impact**	**Moderate Probability High Impact**
Low Probability Low Impact	**Low Probability Moderate Impact**	**Low Probability High Impact**

Cyberterrorism Probability vs. Cyberterrorism Impact

To understand the potential threat of cyberterrorism, two factors must be considered: first, whether there are targets that are vulnerable to attack that could lead to violence or severe harm, and second, whether there are actors with the capability and motivation to carry them out.[7]

Although many of the weaknesses in computerized systems can be corrected, it is effectively impossible to eliminate all of them. Even if the technology itself offers good security, it is frequently configured or used in ways that make it open to attack. In addition, there is always the possibility of insiders, acting alone or in concert with other terrorists, misusing their access capabilities.[8] With American society increasingly interconnected and ever more dependent on information technology, terrorism experts worry that cyberterrorist attacks could cause as much devastation as more familiar forms of terrorism.[9]

Cyberterrorism could involve destroying the actual machinery of the information infrastructure; remotely disrupting the information technology underlying the Internet, government computer networks, or critical civilian systems such as financial networks or mass media. Cyberterror could also include using computer networks to take over machines that control traffic lights, power plants, or dams in order to wreak havoc on unsuspecting populations.[10]

Hazard Identification

While some people use the term “cyberterrorism” to refer to any major computer-based attack on the U.S. government or economy, many terrorism experts would not consider cyberattacks by glory-seeking individuals, organizations with criminal motives, or hostile governments engaging in information warfare to be cyberterrorism. Like other terrorist acts, cyberterror attacks are typically premeditated, politically motivated, perpetrated by small groups rather than governments, and designed to call attention to a cause, spread fear, or otherwise influence the public and decision-makers. Terrorists try to leverage limited resources to instill fear and shape public opinion, and dramatic attacks on computer networks could provide a means to do this with only small teams and minimal funds. “Virtual” attacks over the Internet or other networks allow attackers to be far away, making borders, X-ray machines, and other physical barriers irrelevant.[11]

Acts of cyberterror can be used to disrupt our society and exploit our increasing reliance on computers and telecommunication networks, threatening the electronic infrastructure that supports computer networks tasked to regulate the flow of power, water, financial services, medical care, telecommunication networks, and transportation systems. The public and private sectors' unprecedented dependence on information and communications systems, computers, and networks, must recognize that networks are vulnerable to attack from any source. Also, the ability to distinguish a singular hacker-type incident from a cyberterrorist attack may not be readily evident, as tools for conducting cyberterrorism are widely available, broadly advertised, and easily used. Potential attackers only require access to a computer and a telecommunications network. [12]

As assessed by the Center for the Study of Terrorism and Irregular Warfare at the Naval Postgraduate School in Monterey, California, cyberterror capability can be described as:

Simple-Unstructured: The capability to conduct basic hacks against individual systems using tools created by someone else. The organization possesses little target analysis, command and control, or learning capability.[13]

Advanced-Structured: The capability to conduct more sophisticated attacks against multiple systems or networks and possibly, to modify or create basic hacking tools. The organization possesses an elementary target analysis, command and control, and learning capability. [14]

Complex-Coordinated: The capability for coordinated attacks capable of causing mass-disruption against integrated, heterogeneous defenses (including cryptography). Ability to create sophisticated hacking tools. Highly capable target analysis, command and control, and organization learning capability. [15]

Hazard Impacts

Cyber-attacks against computer systems could potentially shut down radio, telephone, and computer networks used to control and manage city or regional services, potentially resulting in loss of those services or the inability to properly dispatch public safety and other personnel to the scenes of crimes or physical terrorist attacks.[16]

Attacks on physical components of our information infrastructure could resemble other conventional attacks: for example, a bomb could be used to destroy a government computer bank, key components of web-based infrastructure, or even telephone switching equipment. Attacks could also involve remotely hijacking control systems in efforts to breach dams, impact air traffic, or shut down the power grid.[17]

Attacks launched in cyberspace could involve diverse methods of exploiting vulnerabilities in computer security: viruses, stolen passwords, insider assistance, software with secret "back doors" that intruders can penetrate undetected, and organized electronic traffic used to overwhelm computers – known as "denial of service" attacks are known to have occured. Attacks could also involve stealing classified files, altering the content of Web pages, disseminating false information, sabotaging operations, erasing data, or threatening to divulge confidential information or system weaknesses unless a payment or political concession is made. If terrorists managed to disrupt financial markets or media broadcasts, an attack could undermine confidence or instill public panic. [18]

History of Events

Like other governments and businesses across the nation, the Central Puget Region relies heavily on computers and networks to conduct its normal business. Some local examples include an attack of the SQL Slammer worm on January 25, 2003, which rendered the police computer-aided dispatch system of a Seattle suburb inoperable for several hours and stopped some bank ATM networks nationwide. Also, in August 2003, the MSBlaster and Nachi worms compromised Windows computers worldwide, including many within the City of Seattle government. [19]

Some attacks are conducted to further political and social objectives, as the following events illustrate:

- In 1996, a computer hacker allegedly associated with the White Supremacist movement temporarily disabled a Massachusetts ISP and damaged part of the ISP's record keeping system. The ISP had attempted to stop the hacker from sending out worldwide racist messages under the ISP's name. The

hacker signed off with the threat, "you have yet to see true electronic terrorism. This is a promise." [20]

- In 1998, Spanish protestors bombarded the Institute for Global Communications (IGC) with thousands of bogus e-mail messages. E-mail was tied up and undeliverable to the ISP's users, and support lines were tied up with people who couldn't get their mail. Protestors spammed IGC staff and member accounts, clogged their Web page with bogus credit card orders, and threatened to employ the same tactics against organizations using IGC services. They demanded that IGC stop hosting the Web site for the Euskal Herria Journal, a New York-based publication supporting Basque independence. Protestors said IGC supported terrorism because a section on the Web pages contained materials on the terrorist group ETA, which claimed responsibility for assassinations of Spanish political and security officials, and attacks on military installations. IGC finally relented and pulled the site. [21]

- In 1998, ethnic Tamil guerrillas swamped Sri Lankan embassies with 800 e-mails a day over a two-week period. The messages read "We are the Internet Black Tigers and we're doing this to disrupt your communications." Intelligence authorities characterized it as the first known attack by terrorists against a country's computer systems. [22]

- During the Kosovo conflict in 1999, NATO computers were blasted with e-mail bombs and hit with denial-of-service attacks by hacktivists protesting the NATO bombings. In addition, according to reports, businesses, public organizations, and academic institutes received highly politicized virus-laden e-mails from a range of Eastern European countries. Web defacements were also common. Also, after the Chinese Embassy was accidentally bombed in Belgrade, Chinese hacktivists posted messages such as "We won't stop attacking until the war stops!" on U.S. government Web sites. [23]

- Since December 1997, the Electronic Disturbance Theater (EDT) has been conducting Web sit-ins against various sites in support of the Mexican Zapatistas. At a designated time, thousands of protestors point their browsers to a target site using software that floods the target with rapid and repeated download requests. EDT's software has also been used by animal rights groups against organizations said to abuse animals. Electrohippies, another group of hacktivists, conducted Web sit-ins against the WTO when they met in Seattle in late 1999. These sit-ins all require mass participation to have much effect, and thus are more suited to use by activists than by terrorists. [24]

While the above incidents were motivated by political and social reasons, whether they were sufficiently harmful or frightening to be classified as cyberterrorism is

unknown as no attack thus far has led to violence or injury to persons, although some may have wreaked intimidation or inconvenience.[25]

Past Mitigation Efforts

Mitigation efforts against the threat of cyberterrorism are being addressed in trainings, workshops, and exercises taking place in the Central Puget Region and in national and global forums. Locally, the Pacific NorthWest Economic Region (PNWR) is convening scenario training on cyberterror for public and private entities. Exercises like "Blue Cascades" strive to harden infrastructure against potential attacks by examining vulnerabilities to our electrical, water, financial, and other computerized systems.[26] Per the recommendations of this exercise, a Cyber Security Council was formed to help lend advice on the direction of cyber security efforts in the region.[27]

Further efforts against cyberterror include the dedication and collaboration of public and private organizations in achieving cohesive and updated internet and network security applications. Like any mitigation effort against terrorism, organizations guarding against cyber attacks must remain vigilant and informed.

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[1] "Cyberterrorism" by Dorothy Denning, Georgetown University; Testimony before the Special Oversight Panel on Terrorism Committee on Armed Services U.S. House of Representatives, May 23, 2000, http://www.cs.georgetown.edu/~denning/infosec/cyberterror.html
[2] "Cyberterrorism" by Dorothy Denning, Georgetown University; Testimony before the Special Oversight Panel on Terrorism Committee on Armed Services U.S. House of Representatives, May 23, 2000, http://www.cs.georgetown.edu/~denning/infosec/cyberterror.html
[3] "New Wireless "Zero-Day" Attack Discovered" by IT Observer Staff, IT Observer, http://www.ebcvg.com/articles.php?id=802
[4] VoIP security chief warns of increased security threats, Networking Pipeline, http://www.networkingpipeline.com/showArticle.jhtml?articleI D=160700231
[5] Terrorism Questions and Answers, Council on Foreign Relations, http://www.terrorismanswers.org/terrorism/cyberterrorism.html
[6] "Terrorists copying hacker tactics", TechWeb, http://www.techweb.com/wire/security/167100173#
[7] "Cyberterrorism" by Dorothy Denning, Georgetown University; Testimony before the Special Oversight Panel on Terrorism Committee on Armed Services U.S. House of Representatives, May 23, 2000, http://www.cs.georgetown.edu/~denning/infosec/cyberterror.html
[8] "Cyberterrorism" by Dorothy Denning, Georgetown University; Testimony before the Special Oversight Panel on Terrorism Committee on Armed Services U.S. House of Representatives, May 23, 2000, http://www.cs.georgetown.edu/~denning/infosec/cyberterror.html
[9] Terrorism Questions and Answers, Council on Foreign Relations, http://www.terrorismanswers.org/terrorism/cyberterrorism.html
[10] Terrorism Questions and Answers, Council on Foreign Relations, http://www.terrorismanswers.org/terrorism/cyberterrorism.html
[11] Terrorism Questions and Answers, Council on Foreign Relations, http://www.terrorismanswers.org/terrorism/cyberterrorism.html
[12] http://emd.wa.gov/3-map/a-p/hiva/25-hiva-th-terrorism.htm
[13] "Cyberterrorism" by Dorothy Denning, Georgetown University; Testimony before the Special Oversight Panel on Terrorism Committee on Armed Services U.S. House of Representatives, May 23, 2000, http://www.cs.georgetown.edu/~denning/infosec/cyberterror.html

[14] "Cyberterrorism" by Dorothy Denning, Georgetown University; Testimony before the Special Oversight Panel on Terrorism Committee on Armed Services U.S. House of Representatives, May 23, 2000, http://www.cs.georgetown.edu/~denning/infosec/cyberterror.html
[15] "Cyberterrorism" by Dorothy Denning, Georgetown University; Testimony before the Special Oversight Panel on Terrorism Committee on Armed Services U.S. House of Representatives, May 23, 2000, http://www.cs.georgetown.edu/~denning/infosec/cyberterror.html
[16] http://www.cityofseattle.net/emergency_mgt/hazards/terrorism.htm

[17] Terrorism Questions and Answers, Council on Foreign Relations, http://www.terrorismanswers.org/terrorism/cyberterrorism.html
[18] http://www.cityofseattle.net/emergency_mgt/hazards/terrorism.htm
[19]"Cyberterrorism" by Dorothy Denning, Georgetown University; Testimony before the Special Oversight Panel on Terrorism Committee on Armed Services U.S. House of Representatives, May 23, 2000, http://www.cs.georgetown.edu/~denning/infosec/cyberterror.html
[20] "Cyberterrorism" by Dorothy Denning, Georgetown University; Testimony before the Special Oversight Panel on Terrorism Committee on Armed Services U.S. House of Representatives, May 23, 2000, http://www.cs.georgetown.edu/~denning/infosec/cyberterror.html
[21] "Cyberterrorism" by Dorothy Denning, Georgetown University; Testimony before the Special Oversight Panel on Terrorism Committee on Armed Services U.S. House of Representatives, May 23, 2000, http://www.cs.georgetown.edu/~denning/infosec/cyberterror.html
[22] "Cyberterrorism" by Dorothy Denning, Georgetown University; Testimony before the Special Oversight Panel on Terrorism Committee on Armed Services U.S. House of Representatives, May 23, 2000, http://www.cs.georgetown.edu/~denning/infosec/cyberterror.html
[23]"Cyberterrorism" by Dorothy Denning, Georgetown University; Testimony before the Special Oversight Panel on Terrorism Committee on Armed Services U.S. House of Representatives, May 23, 2000, http://www.cs.georgetown.edu/~denning/infosec/cyberterror.html
[24] "Cyberterrorism" by Dorothy Denning, Georgetown University; Testimony before the Special Oversight Panel on Terrorism Committee on Armed Services U.S. House of Representatives, May 23, 2000, http://www.cs.georgetown.edu/~denning/infosec/cyberterror.html
[25] "Dozens of Experts Take on Cyberterror", Seattle Post-Intelligencer, http://seattlepi.nwsource.com/local/190473_cyberterror13.html
[26] Puget Sound Partnership Update, http://www.pnwer.org/pris/Partnership%20Update%20Issues2.pdf

Section 6: Vulnerability Assessment and Risk Analysis

Critical Facilities

Public Disclosure

This section of the RHMP seeks to describe facilities critical to the continued function and service delivery of cities, utilities, school districts, fire agencies, and King County Government. Many of the critical facilities referenced in this section may be considered as potential terrorist targets. For this reason, the List of specific critical facilities described in "**Annex G - Critical Facilities**" is not subject to public disclosure under the Freedom of Information Act.

Planning Methodology

All public and private facilities are vulnerable to the natural hazards common to the Northwest - high winds, earthquakes, power outages, and to a limited extent, flooding. Additionally, there are many critical facilities and infrastructures that can also be vulnerable to civil disturbances and terrorism.

For this planning period, the RHMP participants focused their priority on identifying those facilities and infrastructures necessary for their organization to provide critical community services during and after hazard events. They also identified facilities they depend on outside of their organization, as well as those they need to support. It became immediately apparent that there was significant crossover among the disciplines in identifying common critical facilities they operate and/or rely on. Agencies utilized the "goals and objectives" in Section 1 of this plan as a method to help to identify and prioritize critical facilities.

Because the focus is limited to a small number of participating agencies, there is significant amount of work to be done in the future to build upon this foundation. In order to develop a comprehensive assessment of all regional critical facilities, infrastructures, and interrelationships it will be necessary to gain more widespread involvement in the planning process. This is one of the objectives tied to Goals Five and Six of the plan.

Critical Facilities Inventory – Cities in King County

The publicly-owned infrastructure identified as critical to the functioning of a community are described as those with the potential for human casualties or substantial monetary impact from catastrophic loss.

Cities are the most complex of the jurisdiction types participating in this regional hazard mitigation planning effort. Each city is different; some contract for police services, fire services, and public works functions. In some cases, cities own their own water treatment and distribution or sewer treatment facilities.

Whether owned or leased, all cities identified their city hall locations as critical facilities. Of near equal importance, jurisdictions included police, fire and medical facilities in their essential/critical facilities inventory. Community centers and senior centers were also included.

Certain cities chose to identify facilities critical to the community but outside their direct control. In the later category were schools, hospitals, important transportation intersections or bridges, and both water and sewer utilities. A few cities recognized the importance of communications facilities within their boundaries.

Critical Facilities Inventory – Fire Districts in King County

Fire jurisdictions have a fairly focused mission - fire suppression and basic life-support response. Fire personnel may be called upon to direct evacuations, perform rescue operations as well, and provide hazardous materials response.

All fire jurisdictions acknowledge the importance of their fire stations and major apparatus as critical to their ability to maintain their life safety missions. A few fire agencies recognized the importance of particular transportation intersections and bridges to evacuation routes. Medical facilities, public education facilities, and major hazardous materials facilities or pipelines in a jurisdiction were also identified as critical. Most fire jurisdictions included public education as an integral part of their agency services.

Critical Facilities – Utilities in King County

Utilities in the King County region identified the infrastructure owned by their own various utility districts based on the criticality of those facilities on their own direct operations. The impact of a disaster to safety and utility property could have an impact to other public safety agencies.

These special-purpose districts provide the essential service of water and sewer to the communities served throughout the region. There is a strong association and mandate that the water districts provide the essential fire protection service to the fire districts. This is evermore a challenge during a major hazardous event.

Both water and sewer districts identified their service lines, and pump and lift stations in their critical facilities inventory. For water districts in particular, the interlink to the larger Seattle Public Utilities (SPU) as their main water resource is important. The interlinking of the water system through districts has proven to be

essential in providing uninterrupted services throughout the region. A few of the districts noted the essential nature of the office and maintenance buildings. Far more critical were the telemetry and data relays providing operational status for the whole of each system. With power failure it becomes quite a challenge to determine the operational working of the system.

Critical Facilities – King County Government

King County Government has a wide range of facility types that are critical to public health and safety. These include facilities that directly or indirectly support police services, health care, road maintenance, and adult and juvenile detention. The County includes district and superior court service locations as well as a wide range of administrative and licensing service facilities in its list of critical facilities.

Repetitive Loss Properties

Documentation of damages, expenses and losses to public property was available for public sector losses. Detailed private sector damage figures were not available from FEMA or Washington State Emergency Management.

There have been 14 flooding events in the last 30 years with King County public damages of more than $23.5 million. This presents a fairly high likelihood of damaging flood events in any year. Damaging local earthquakes occur less frequently, every thirty to thirty-five years but result in significantly greater damages to public property. State-wide damages from the 2001 Nisqually Earthquake topped $300 million with $9 million to King County Government properties and infrastructure.

Agencies reporting repetitive losses in **Table 6-1**, note losses from winter storms and flooding events.

Estimating Potential Losses

The Vulnerability Assessment and Risk Analysis for the King County Regional Hazard Mitigation Plan provide a factual basis for mitigation goals and activities proposed by the plan. This section evaluates the areas in the county where populations, property and infrastructures are most vulnerable to the hazards identified in the first planning phase of the program. It also estimates the potential loss of facilities for those agencies participating in the plan at this time.

The risk analysis consists of three parts – the first part profiles the impacts on populations; the second section emphases the impacts on property and infrastructures; and the third section identifies the potential impacts to various natural resources located throughout the region.

Along with the Hazard Identification Vulnerability Analysis (HIVA) briefs, the regional profile sets the foundation for this evaluation. The HIVA topics focused on during this initial planning phase tries to address hazards with more likelihood of occurring or presents a significant impact if it does. The Regional Profile describes the setting of the region, its cities, economy and resources, and examines potential at-risk populations. In this section, we will evaluate *vulnerability* in more detail.

People at Risk[1]

Densely Populated Areas

More than 96 percent of King County's population lives in densely settled urbanized areas. The current growth pattern, both urban and rural, affects how agencies prepare for emergencies as changes in the population and development can increase risks associated with hazards. Growth is being directed into Urban Growth Areas (UGAs) of the County which can be more vulnerable to certain hazards, such as earthquakes. Comparing the hazard maps located in **Section 4: HIVA** and **Map 3-1: Population Density** provides an idea of where populations (and facilities) can be impacted.

Populations with Special Needs

The ability to prepare for and recover from a disaster varies among population groups. Research on various population groups and disasters found that it took some populations longer to recover from a disaster for a variety of reasons. These population groups include minorities, people with language barriers, the disabled, the elderly, those with low income, and young children.

- *Minorities:* People from non-white population groups generally experience longer recoveries due to lower incomes, savings and insurance; their difficulty accessing insurance; and their using aid and relief organizations differently than was anticipated. Language and cultural differences can pose difficulties in some populations understanding and implementing preparedness and mitigation actions as well as accessing and using available disaster relief resources.

- *People with Language Barriers*: Since nearly one in five residents in King County do not speak English as their primary language, there is a significant segment of the population may have a language barrier that prevents them from preparing for a disaster, responding to an event, or applying for assistance after a disaster.

- *Disabled:* People with disabilities often are left out of community preparedness activities for a disaster. They have complex challenges because of hearing, sight, mobility, or mental impairments. Additionally, a significant percentage of working-age people with disabilities do not work.

These factors make it difficult for the disabled to prepare in advance of a disaster.

- *Elderly:* The elderly may be overlooked in preparedness and recovery activities; their age could lead them to have trouble after a disaster, perhaps not qualify for loans, or become disabled because of the disaster.

- *Low Income:* The amount of money people have influences what type of housing they live in, whether they can engage in mitigation actions, and how long it takes to recover. Income is based on a number of factors, including the individual, the economy, availability of jobs, and educational opportunity among others. Expenses can vary by location – rural places are cheaper to live but have fewer jobs, while urban areas can be costly, especially for renters.

- *Young Children:* The number of children attending school is a concern because many of the school buildings they spend considerable time in each day are older and potentially more vulnerable to the effects of disaster.

Table 6-2 provides an overview of the vulnerable populations that are located in the RHMP participation agencies' individual jurisdictions.

Property at Risk

Housing

The year housing was built is important for mitigation. The older a home is, the greater the risk of damage from natural disasters. Homes built after 1980 are more likely to have been constructed to current standards for hazards such as floods, high winds, snow loads, and earthquake. About two-thirds of the homes in King County were built before 1960 when codes were less restrictive. **Table 6-2** identifies the number of housing units located in the RHMP participating agencies' individual jurisdictions.

Natural Resources at Risk

Conserving King County's rural and natural resource lands is integral to providing diversity in lifestyle choices, continuing farming and forestry economies, protecting environmental quality and wildlife habitat and maintaining a link to King County's resource-based heritage.

Vulnerability Assessment and Risk Analysis Endnotes

[1] Washington State Hazard Mitigation Plan – Regional 6 Profile, Sept 2003 Draft

Table 6-1: RHMP Repetitive Losses by Jurisdiction

Agency	Repetitive Loss	$ Loss	Vulnerable Populations	Comments
Cities				
Auburn	Floods/storm search			
Burien	None reported			
Duvall	Reported none			
Federal Way	Winter, wind and spring storms	$404,000		'92, '94, '96, '97
Kirkland	Reported none			
Newcastle	Reported none			
North Bend	Flood '90, '95, '96	$142,000 ('90)		
Sea Tac	Reported none			
Fire Districts				
Federal Way	None reported			
KCFD #2	None reported			
KCFD #26	Flood; SR509 and SR516			Both low benefit to cost
	Flood; Des Moines beach park			
KCFD #40	None reported			
KCFD #45	Wildland fires '94, '01, '03	$7,500 to $20,000		
	Flood '90, '95, '96	Minimal		
School Districts				
Lake Washington	Reported none	Superficial <$1,000 per incident		
Utility Districts				
Cedar River Utility District	No report			
Coal Creek Utility District	Reported none			
KCWD #20	Reported none			
KCWD #90	No Report			
Midway Sewer District	Flood '97	$99,930		
	Flood and wind '96	$14,600		
	Wind '93	$29,970		
	Flood '90	$111,500		
	Flood '86	$4,000		
	Flood '86	$4,300		
	Flood '86	$8,900		
	Flood '86	$3,300		
Ronald Wastewater	Winter storms, stormwater backup and	$330,000 utility $1,700,000 city		

Table 6-1: RHMP Repetitive Losses by Jurisdiction

Agency	Repetitive Loss	$ Loss	Vulnerable Populations	Comments
District	washouts '93, '96, '97			
Shoreline Water District	Winter storm/landslide	$23,000		
	Winter storm/lightning, loss of water service			
	Winter storm/wind, loss of water service			
Skyway	No report			
Soos Creek Water and Sewer District	No report			
SW Suburban Sewer District	No reported losses			
Val Vue Sewer District	No Report			
King County - Internal				
Assessor's Office	Computer virus			
Corrections	No report			
DDES	No report			
Emergency Management	Flooding Levels II, III, IV			Snoqualmie, Tolt, Skykomish, White Rivers
Facilities	Civil disorder (WTO)	$35,000 per year		
Health	No report			
Housing Authority	No report			
Information and Telecom		$400,000 to $1,000,000		Historic 8/27/02 worm virus
Natural Resources and Parks	No report			
Property Services	No report			
Radio Communications	No report			
Sheriff's Office	No report			
Solid Waste	No report			
Transit	Snow storms		Elderly, disabled and students in the business districts of Seattle, Bellevue and University District	

Table 6-1: RHMP Repetitive Losses by Jurisdiction

Agency	Repetitive Loss	$ Loss	Vulnerable Populations	Comments
Transportation/ Road Services	No report			
Wastewater Management	No report			
Water and Land Resources	No report			

Source: RHMP Partner Agencies

***None Reported** or **No Report** means the jurisdiction information did not address repetitive Loss. **Reported None** means the jurisdiction indicated there were no repetitive loss types to report.

Table 6-2 below is based on 2000 Census data. City information was obtained for the 2003 King County Annual Growth Report (2002 census data). Data for districts was extracted from 2002 Census data by block group; it provides a general representation for the purposes of identifying vulnerable populations in service areas and communities. Figures may somewhat vary (slightly) from data collected by individual agencies.

Table 6-2: Vulnerability Profile for RHMP Participating Agencies

City	2000 Population	2002 Land Area (sq. miles)	2000 Housing Units	1999 Persons below Poverty Level		2000 Speaks Other Language*		2000 Population Under Age 5		2000 Population Over Age 65	
King County											
Unincorporated	352,360	1,750.99	130,356	18,720	5.4%			23,439	6.7%	27,880	8.0%
Incorporated	1,384,674	383.01	611,881	123,826	9.1%			81,882	6.0%	153,892	11.1%
Total	**1,737,034**	**2,134.00**	**742,237**	**142,546**	8.4%			**105,321**	**6.0%**	**181,772**	**10.5%**
Cities											
Burien	31,881	7.44	14,024	2,961	9.4%	5,851	18.4%	1,932	6.0%	4,385	13.8%
Federal Way	83,259	21.53	32,589	7,696	9.3%	16,406	19.7%	6,508	7.8%	6,366	7.6%
Kirkland	45,054	10.51	21,939	2,337	5.3%	6,327	14.0%	2,474	5.5%	4,612	10.2%
Newcastle	7,737	4.48	3,169	162	2.1%	1,772	22.9%	605	7.8%	511	6.6%
North Bend	4,746	2.96	1,954	226	4.9%	374	7.9%	474	10.0%	504	10.6%
Sea Tac	25,496	10.27	10,032	2,839	11.5%	6,859	26.9%	1,831	7.2%	2,474	9.7%
Woodinville	9,194	5.66	3,494	413	4.5%	1,483	16.1%	599	6.5%	796	8.7%
Utility Districts											
Cedar River Utility	26,169		9,653	951	3.6%	2,500	9.6%	1,762	6.7%	204	0.8%
Coal Creek Utility	19,762		8,011	456	2.3%	3,653	18.5%	1,289	6.5%	2,242	11.3%
KCWD #20	30,355		12,034	3,298	10.9%	7,879	26.0%	2,248	7.4%	3,344	11.0%
KCWD #90	17,524		6,610	1,089	6.2%	1,739	9.9%	1,124	6.4%	1,239	7.1%
Midway Sewer	42,424		17,016	4,624	10.9%	8,829	20.8%	3,065	7.2%	507	1.2%
Ronald Wastewater	29,287		12,186	1,988	6.8%	4,918	16.8%	1,446	4.9%	452	1.5%
Shoreline Water	23,730		9,511	1,645	6.9%	3,771	15.9%	1,329	5.6%	2,784	11.7%
Soos Creek Utility	55,727		20,446	2,831	5.1%	9,373	16.8%	3,944	7.1%	405	0.7%
SW Suburban Sewer	50,842		20,989	5,013	9.9%	11,189	22.0%	3,254	6.4%	648	1.3%
Val Vue Sewer	31,662		12,393	3,585	11.3%	8,969	28.3%	2,380	7.5%	294	0.9%
Woodinville Water	42,301		15,121	1,812	4.3%	5,062	12.0%	2,740	6.5%	2,367	5.6%

Table 6-2: Vulnerability Profile for RHMP Participating Agencies

City	2000 Population	2002 Land Area (sq. miles)	2000 Housing Units	1999 Persons below Poverty Level		2000 Speaks Other Language*		2000 Population Under Age 5		2000 Population Over Age 65	
Fire Districts											
Federal Way Fire	108,158		41,732	913	0.8%	19,347	17.9%	8,233	7.6%	8,347	7.7%
KCFD #2	35,181		15,211	278	0.8%	6,129	17.4%	2,038	5.8%	5,109	14.5%
KCFD #26	27,179		10,641	217	0.8%	4,273	15.7%	1,869	6.9%	3,876	14.3%
KCFD #40	33,132		12,826	199	0.6%	5,156	15.6%	2,273	6.9%	2,533	7.6%
KCFD #45	10,915		3,847	28	0.3%	762	7.0%	894	8.2%	451	4.1%
Woodinville Fire	43,927		15,561	178	0.4%	5,339	12.2%	2,860	6.5%	2,638	6.0%
School Districts											
Lake Washington	153,500		61,794	1,481	5.5%**	23,216	15.1%	9,975	6.5%	11,184	7.3%

*****Speaks other language than English at home – people age five and over
******Number reflects number of school children ages 5-17 that are below poverty level.

Source: 2002 and 2003 King County Annual Growth Reports (for county and city data, and some school district data); and U.S. Census Bureau – 2000 Census

Section 7: Regional Mitigation Strategy

Regional Mitigation Strategy

The regional hazard mitigation strategy for the partners signing on to the December 8, 2003 submission of the Regional Hazard Mitigation Plan is based on a composite of the strategies provided by those partners. The Regional Hazard Mitigation Plan Taskforce discussed and determined the strategy to be a prioritization of the six (6) regional goals and objectives:

1) Protect Life and Property
2) Support Emergency Services
3) Increase Public Awareness
4) Preserve Natural Systems and Resources
5) Encourage Partnerships
6) Enhance Planning Activities

First Priority: Protect Life and Property and Support of Emergency Services

Most organizations and agencies identified initiatives that supported protection of critical infrastructure necessary to providing and supporting emergency services, public safety and essential services during a hazard event. Mitigating the potential loss of these facilities and systems has a direct and immediate impact on the ability to reduce injuries, save lives and minimize property damage. (Critical infrastructure and response capabilities are broadly identified in **Section 6: Vulnerability Analysis**; detailed critical facility data is located in "**Annex D**" which is not subject to public disclosure.)

The RHMP partners also identified the need to promote mitigation activities that prevent losses by making homes, businesses, other properties and infrastructures more resistant to the impacts of hazards. The first step in accomplishing this is to implement activities specific to repetitive loss properties and chronic hazard event damages. Viable activities include better coordination among other agencies governing land use and building regulations to ensure hazard mitigation concerns and strategies are incorporated into development activities.

Protection of life and property often relies on the ability of citizens to take the appropriate action before, during and after a hazard event. Critical to minimizing the loss of life and preventing injuries is ensuring the population understands the potential hazards in our region, how to prepare or mitigate the impacts, and what

to do if a disaster should happen. This leads to the next priority, increasing public awareness.

Second Priority: Increase Public Awareness and Preserve Natural Systems

Most agencies felt public education was one of the most important ingredients in the regional mitigation strategy equation, with emphasis on making additional efforts to reach populations who may be more vulnerable. Broadening the spectrum to include businesses and private agencies, in addition to private citizens, would also enhance the region's ability to sustain itself during a disaster or hazard event.

There are numerous natural systems within King County and the Puget Sound region that could be seriously impacted during a manmade or natural hazard event. Working closely with other agencies to understand potential impacts on our natural environment and resources, and to coordinate mitigation goals and objectives will help to support the preservation of natural systems.

Third Priority: Encourage Partnerships and Enhance Planning Activities

Encouraging additional partnerships and enhancing planning activities will build upon the existing planning effort. While the RHMP process is off to a good start, the overall success of a long-term planning effort relies on gaining support and involvement from the region as a whole. Inclusion of other regional partners and contributions from private entities is essential in promoting a comprehensive planning approach. Potential partners and private agencies must see the benefit in participating in such an effort.

Agency Mitigation Strategies

Participating agencies developed their own strategy based on the regional goals and objectives. Individual agency mitigation strategies are identified in their individual agency plan located in **Annex B**.

All regional partners recognize a desire to work cooperatively on mitigation projects and initiatives and will work collectively where funding and priorities permit.

Table 7-1: Regional Initiatives by Work Group						
Workgroup	**Protect Life & Property**	**Support Emergency Services**	**Increase Public Awareness**	**Preserve Natural Systems**	**Encourage Partnerships**	**Enhance Planning**
Utilities	39	8	2			
Fire Agencies	10	3	2			
Schools	1					
Cities	29	6	5	2	5	6
King County Government	34	1	8		1	7
Businesses	N/A	N/A	N/A	N/A	N/A	N/A
Totals*	113	18	17	2	5	13

*Figures indicate the number of initiatives from planning group one supporting the six regional goals.