City of Whittier, Alaska
Local Hazards Mitigation Plan

Whittier storm of October 2006

Prepared by:
City of Whittier
February 2008

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Acronyms

AEIS	Alaska Earthquake Information System
ARRC	Alaska Railroad Corporation
AWCG	Alaska Wildfire Coordinating Group
BCA	Benefit Cost Analysis
BCR	Benefit Cost Review
BFE	Base Flood Elevation (100 year flood)
BP&D	Bechtol Planning & Development
BTI	Begich Towers Inc.
CDBG	Community Development Block Grant
CFR	Code of Federal Regulations
CMP	Coastal Management Plan
CRS	Community Rating System
CRSA	Coastal Resource Service Area
DCRA	(Alaska) Division of Community and Regional Affairs Development
DHS&EM	(Alaska) Division of Homeland Security and Emergency Management
DMA	Disaster Mitigation Act
DNR	(Alaska) Department of Natural Resources
DOT&PF	(Alaska) Department of Transportation & Public Facilities
EMS	Emergency Medical Services
FBFM	Flood Boundary and Floodway Maps
FDIC	Federal Deposit Insurance Corporation
FEMA	Federal Emergency Management Agency

FHBM	Flood Hazard Boundary Maps
FHLBB	Federal Home Loan Bank Board
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Act
FMP	Flood Mitigation Plan
HMPG	Hazard Mitigation Planning Grant
GIS	Geographic Information System
LEPC	Local Emergency Planning Committee
LHMP	Local Hazards Mitigation Plan
MLLW	Mean Lower Low Water
NFIP	National Flood Insurance Program
NOAA	National Oceanographic and Atmospheric Administration
PDMG	Pre Disaster Mitigation Grant
USARC	U.S. Arctic Research Commission
USCOE	United States Army Corps of Engineers
USGS	United States Geological Survey
UTM	Universal Transverse Mercator

Planning Commission Resolution

To be adopted after FEMA and DHS&EM pre-approval.

Whittier Planning Commission
Local Hazards Mitigation Plan Adoption Resolution
Resolution # _____

Recommending Adoption
of the City of Whittier
Local Hazards Mitigation Plan

Whereas, the City of Whittier recognizes the threat that local natural hazards pose to people and property; and

Whereas, undertaking hazard mitigation projects before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

Whereas, an adopted Local Hazards Mitigation Plan is required as a condition of future grant funding for mitigation projects; and

Whereas, the Whittier Local Hazards Mitigation Plan has been sent to the Alaska Division of Homeland Security and Emergency Management and the Federal Emergency Management Agency for their approval.

Now, therefore, be it resolved, that the Whittier Planning Commission**,** hereby recommends adoption of the City of Whittier Local Hazards Mitigation Plan as an official plan; and

Be it further resolved, that the City of Whittier will submit the adopted Local Hazards Mitigation Plan to the Alaska Division of Homeland Security and Emergency Management and the Federal Emergency Management Agency officials for final review and approval.

Passed: _____
Date

_____
Planning Commission Chair

City Council Resolution

To be adopted after FEMA and DHS&EM pre-approval.

City of Whittier, Alaska
Local Hazards Mitigation Plan Adoption Resolution
Resolution # _____

Adoption of the City of Whittier Local Hazards Mitigation Plan

Whereas, the City of Whittier recognizes the threat that local natural hazards pose to people and property; and

Whereas, undertaking hazard mitigation projects before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

Whereas, an adopted Local Hazards Mitigation Plan is required as a condition of future grant funding for mitigation projects; and

Whereas, the Whittier Local Hazards Mitigation Plan has been sent to the Alaska Division of Homeland Security and Emergency Management and the Federal Emergency Management Agency for their approval.

Now, therefore, be it resolved, that the Whittier City Council**,** hereby adopts the City of Whittier Local Hazards Mitigation Plan as an official plan; and

Be it further resolved, that the City of Whittier will submit the adopted Local Hazards Mitigation Plan to the Alaska Division of Homeland Security and Emergency Management and the Federal Emergency Management Agency officials for final review and approval.

Passed: _____
Date

_____
Mayor

Chapter 1. Planning Process and Methodology

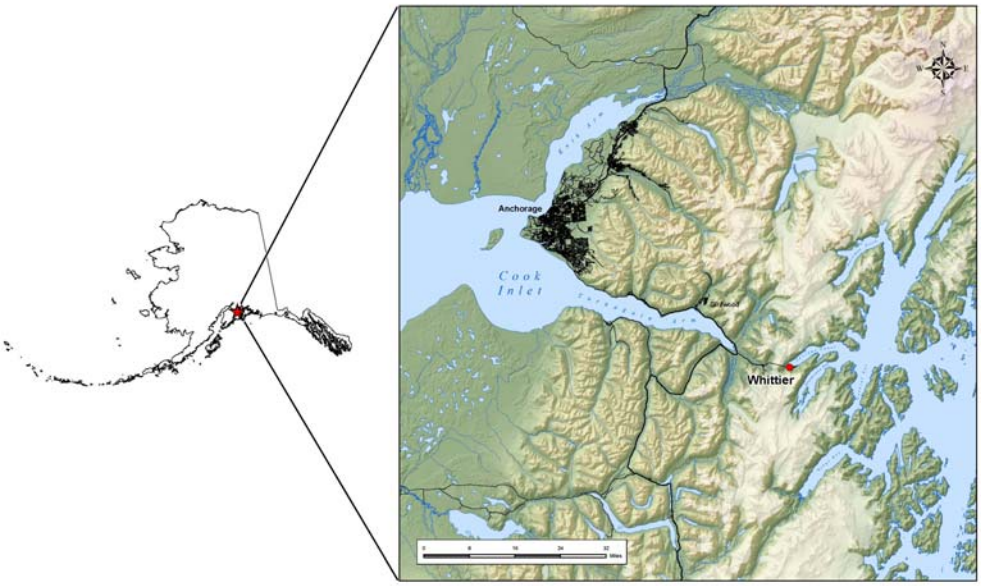
Introduction

The scope of this plan is natural hazards: flooding, erosion, severe weather, wildland fire, earthquake, avalanche and landslides and tsunami hazards. However, some of the mitigation projects for the natural hazards would also mitigate impacts from other hazards.

The City of Whittier Local Hazards Mitigation Plan (LHMP) includes information to assist the city government and residents with planning to avoid potential future disaster losses. The plan provides information on natural hazards that affect Whittier, descriptions of past disasters, and lists projects that may help the community prevent disaster losses. The plan was developed to help the City make decisions regarding natural hazards that affect Whittier.

Plan Development

As Alaskan communities go, Whittier is not exactly typical. Nearly all of its residents live in the Begich Towers (BTI) or the Whittier Manor; single-family housing is virtually non-existent. There are a large number of absentee landlords. Actions by the state and federal government, through the Alaska Railroad, the State Ferry System, and the Whittier Fuel Storage Depot, can have a major influence on the community yet are outside local control. The Municipality of Anchorage and the Kenai Peninsula Borough border Whittier; annexation by one of these local governments has always been a historic concern. Although Whittier is a major transportation hub, overland access to Whittier has been stymied by access restrictions. This limits potential community growth. Economic development activities, such as fish processing and recreation/tourism, are of



Source: Whittier CMP 2007

interest to Whittier residents, but are assets that have not reached their full potential Other community assets include a scenic setting, one of the most popular small boat harbors in Alaska, and land at Shotgun Cove that can be developed for residential, commercial, and recreation uses.

Whittier is dominated in many ways by the mountains and sea that surround it. It is a place of contradictions where natural beauty and wilderness exist alongside of industrial development. Much of the land within the city is undeveloped coastal area with mountains, glaciers and the sea, yet intense activity and high-density residential living within a small area are the norm.

The U.S. Army selected Passage Canal as the site of a year-round access to the Pacific Ocean. This was needed to keep an open supply line to Interior Alaska in the event of a blockade or the loss of Seward or a land war in the interior. Many wartime supplies were shipped through Whittier. The port and rail spur connection were built in 1942-43. These facilities proved to be the shortest route from the lower 48 to south central and interior Alaska and Whittier provided an ice-free port. The height of the military activity occurred in the late 1950's when about 1000 personnel were stationed in Whittier. The Army deactivated the military port in 1960 and continued to deactivate the buildings until 1968 when the property was turned over to the General Services Administration. The City of Whittier was incorporated in 1969. By incorporating, the City became eligible for the purchase of the ex-army lands and buildings and for funds to construct a small boat harbor.

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Plan Research

The plan was developed utilizing existing Whittier plans and studies as well as outside information and research. The following list contains the most significant of the plans and studies that were used in preparing this document. Please see the bibliography for additional sources.

1. *Alaska State Hazard Plan*. Prepared by and for DHS&EM. September 2004, October 2007.

2. *DCRA Community Information*: http://www.dced.state.ak.us/dca/commdb/CF_COMDB.htm.

3. *Disaster Cost Index,* (2005) excerpts for Whittier, Alaska Division of Homeland Security and Emergency Management.

4. FEMA How to Guides

   - Getting Started: Building Support For Mitigation Planning (FEMA 386-1)
   - Understanding Your Risks: Identifying Hazards And Estimating Losses (FEMA 386-2)
   - Developing The Mitigation Plan: Identifying Mitigation Actions And Implementing Strategies (FEMA 386-3)
   - Bringing the Plan to Life: Implementing the Hazard Mitigation Plan (FEMA 386-4)
   - Using Benefit-Cost Review in Mitigation Planning (FEMA 386-5)

4. *Whittier Comprehensive Plan*. Prepared by and for City of Whittier. 2005.

5. *Whittier Coastal Management Plan 2007 Amendment*. Prepared by BP&D for the Whittier Coastal District, 2007.

Web Sites

American Planning Association: http://www.planning.org

Association of State Floodplain Managers:	http://www.floods.org
Developing the Implementation Strategy:	www.pro.gov.uk
Federal Emergency Management Agency: Mitigation Planning	http://www.fema.gov/fima/planning.shtm
Community Rating System:	http://www.fema.gov/nfip/crs.htm
Flood Mitigation Assistance Program:	http://www.fema.gov/fima/planfma.shtm
Hazard Mitigation Grant Program:	http://www.fema.gov/fima/hmgp
Individual Assistance Programs:	http://www.fema.gov/rrr/inassist.shtm
Interim Final Rule:	http://www.access.gpo.govl
National Flood Insurance Program:	http://www.fema.gov/nfip
Public Assistance Program:	http://www.fema.gov/rrr/pa

Public Involvement

Site visits were conducted on October 9, 2006 and April 10, 2007. The Whittier Planning Commission held public meetings on April 10, 2007 and January 14, 2008 to provide a forum for public input and to review the draft document and provide revisions at those meetings.

A copy of the draft LHMP has been available for public review and comment since June 2007. There is not a local newspaper in Whittier, however, all Planning Commission meetings are noticed via flyers and are conducted in the BTI, which is where most everyone in Whittier lives. The Whittier Planning Commission is comprised of public volunteer members.

The public involvement strategy of LHMP included the following methods:

1. Hard copies of the Whittier LHMP Update were available at the City offices.
2. Flyers were posted at the City offices and around BTI.
3. Notices that the LHMP was out for public review were emailed to interested parties.

Using the strategies outlined above the LHMP will be put through another round of public involvement process after pre-approval from DHS&EM and FEMA.

The Whittier City Council will review and approve the plan after pre-approval by the State of Alaska and FEMA.

To summarize, the meetings were advertised using usual city meeting notices, the attendees at these meetings were the City Council, Planning Commission, City Staff, and members of the public. A copy of the draft LHMP is available for public perusal at the City Offices, Police Station, and the Harbor Office.

Plan Implementation

The City Council of Whittier will be responsible for adopting the Whittier LHMP and all future updates or changes. This governing body has the authority to promote sound public policy regarding hazards. The Hazards Mitigation Plan will be assimilated into other Whittier plans and documents as they come up for review according to each plans' review schedule.

Please see the following table for plan review schedules.

Table 1. Whittier Plans

Document	Completed	Next Review
Alaska State Hazard Plan	2007	2012
Whittier Comprehensive Plan	2005	2010
Capital Improvement Projects	Annually	2009
Emergency Operations Plan	Final Draft in Progress, 2008	As needed
Coastal Management Plan	2007	2012
Transportation Plan	2001	As needed
Prince William Sound Economic Development District Plan	2006	As needed
Whittier Master Sewer Plan	Draft 2004	Pending Finalization

Continuing Review Process

The Whittier Project Manager (Director of Public Safety) will evaluate the Whittier LHMP on an annual basis to determine the effectiveness of programs and to reflect changes in land development, status, or other situations that make changes to the plan necessary. The Project Manager, along with the City Manager and his staff will review the mitigation project items to determine their relevance to changing situations in the city, as well as changes in state or federal policy and to ensure that mitigation continues to address current and expected conditions. The Project Manager will review the hazard analysis information to determine if this information should be updated and/or modified, give any new available data or changes in status.

Continued Plan Development

The plan will continue to be developed as resources become available. Additional hazards not currently covered in the plan, including technological and manmade hazards, will be added, if funding becomes available during the next five-year update cycle.

The plan will be updated every 5 years, or as required by DHS&EM or FEMA. The Project Manager will be responsible for updating and maintaining the plan by adding additional hazards and completing vulnerability assessments for existing hazard chapters.

The following table lists the schedule for completion of these tasks, provided that funds are available to do so:

Table 2. Continued Plan Development

Hazard	Status	Hazard Identification Completion Date	Vulnerability Assessment Completion Date
Floods	Completed	2008	2008
Erosion	Completed	2008	2008
Severe Weather	Completed	2008	2008
Wildland Fire	Completed	2008	2008
Earthquake	Completed	2008	2008
Tsunami/Seiche	Completed	2008	2008
Avalanche	Completed	2008	2008
Economic	Future Addition	As Funding Become Available	To be Determined
Technological	Future Addition	As Funding Become Available	To be Determined
Public Health Crisis	Future Addition	As Funding Become Available	To be Determined

Continued Public Involvement

The following methods will be used for continued public involvement.

City website: http://www.ci.whittier.ak.us.

Places where the hazard plan will be kept:

City Offices
City Police Department
City Public Works Department

The LHMP will be reviewed at a public meeting on an annual basis and will be updated as needed. The plan will be available on the city website and at the City Offices, Fire Department, Public Works Department and the Harbormaster's Office. All meetings will be noticed to the public using public involvement strategies outlined under public involvement.

Risk Assessment Methodology

The goal of mitigation is to reduce the future impacts of a hazard including loss of life, property damage, and disruption to local and regional economies, environmental damage and disruption, and the amount of public and private funds spent to assist with recovery.

Mitigation efforts begin with a comprehensive risk assessment. A risk assessment measures the potential loss from a disaster event caused by an existing hazard by evaluating the vulnerability of buildings, infrastructure, and people. It identifies the characteristics and potential consequences of hazards and their impact on community assets.

A risk assessment typically consists of three components; hazards identification, vulnerability assessment and risk analysis.

1. *Hazards Identification* - The first step in conducting a risk assessment is to identify and profile hazards and their possible effects on the jurisdiction. This information can be found in Chapter 3: Hazards.

2. *Vulnerability Assessment* – Step two is to identify the jurisdiction's vulnerability; the people and property that are likely to be affected. It includes everyone who enters the jurisdiction including employees, commuters, shoppers, tourists, and others.

Populations with special needs such as children, the elderly, and the disabled should be considered; as should facilities such as the health clinic because of their additional vulnerability to hazards.

Inventorying the jurisdiction's assets to determine the number of buildings, their value, and population in hazard areas can also help determine vulnerability. A jurisdiction with many high-value buildings in a high-hazard zone will be extremely vulnerable to financial devastation brought on by a disaster event.

Identifying hazard prone critical facilities is vital because they are necessary during response and recovery phases. Critical facilities include:

- Essential facilities, which are necessary for the health and welfare of an area and are essential during response to a disaster, including hospitals, fire stations, police stations, and other emergency facilities;

- Transportation systems such as highways, airways and waterways;
- Utilities; water treatment plants, communications systems, power facilities;
- High potential loss facilities such as the levee and bulk fuel storage facilities; and
- Hazardous materials sites.

Other items to identify include economic elements, areas that require special considerations, historic, cultural and natural resource areas and other jurisdiction-determined important facilities.

3. *Risk Analysis* – The next step is to calculate the potential losses to determine which hazard will have the greatest impact on the jurisdiction. Hazards should be considered in terms of their frequency of occurrence and potential impact on the jurisdiction. For instance, a possible hazard may pose a devastating impact on a community but have an extremely low likelihood of occurrence; such a hazard must take lower priority than a hazard with only moderate impact but a very high likelihood of occurrence.

Additionally, the risk analysis must utilize a multi-hazard approach to mitigation. One such approach might be through a composite loss map showing areas that are vulnerable to multiple hazards.

For example, there might be several schools exposed to one hazard but one school may be exposed to four different hazards. A multi-hazard approach will identify such high-risk areas and indicate where mitigation efforts should be concentrated.

Currently there are insufficient funds and data with which to conduct an accurate risk analysis for all the hazards affecting Whittier. However, risk analysis information will be added as it is completed.

Vulnerability Assessment Methodology

The purpose of a vulnerability assessment is to identify the assets of a community that are susceptible to damage should a hazard incident occur.

Critical facilities as described in the Community Profiles Section of this hazard plan. A vulnerability matrix table of critical facilities as affected by each hazard is provided in Chapter 3 of this document.

Facilities were designated as critical if they are: (1) vulnerable due to the type of occupant (children or elderly for example); (2) critical to the community's ability to function (roads, power generation facilities, water treatment facilities, etc.); (3) have a historic value to the community (cemetery); or (4) critical to the community in the event of a hazard occurring (emergency shelter, etc.).

Based on a pilot program FEMA and the Alaska Division of Homeland Security and Emergency Management (DHS&EM) has initiated to inventory critical facilities in Alaska, it should be taken into consideration that Alaska critical facilities vary fundamentally from other states. A local post office in a rural community in Alaska may also be the location of the police station, emergency operations center, hospital, and only store within 100 miles.

This hazard plan includes an inventory of critical facilities, if applicable, from City records, there are no land use maps illustrating critical facilities available for Whittier.

Federal Requirement for Risk Assessment

Recent federal regulations for hazard mitigation plans outlined in 44 CFR Part 201.6 (c)(2) include a requirement for a risk assessment. This risk assessment requirement is intended to provide information that will help the community identify and prioritize mitigation activities that will prevent or reduce losses from the identified hazards. The federal criteria for risk assessments and information on how the Whittier LHMP meets those criteria are outlined below:

Table 3. Federal Requirements

Section 322 Requirement	How is this addressed?
Identifying Hazards	Whittier community members identified natural hazards at community meetings, which were used in developing the Plan.
Profiling Hazard Events	The hazard-specific sections of the Whittier LHMP provide documentation for all of the large-scale natural hazards that may affect the City. Where information was available, the Plan lists relevant historical hazard events.
Assessing Vulnerability: Identifying Assets and Estimating Potential Losses	Vulnerability assessments for floods, erosion, severe weather, wildland fire and earthquakes have been completed and are contained within the hazard chapter. Additional vulnerability assessments will be added as they are funded and completed.

Chapter 2: Community Profile

Community Overview

Current Population:	188 (State Demographer estimate)
Incorporation Type:	2nd Class City
Borough Located In:	Unorganized Borough
Regional Native Health Corporation:	Chugachmiut
Census Area:	City of Whittier
Taxes:	Sales: 3% April – September Property: 5.0 mills

General Location and Information

The City of Whittier is at the head of Passage Canal, a fjord of Western Prince William Sound. Whittier is approximately 47 air miles (62 miles by road) southeast of Anchorage. The nearest major communities to Whittier are Anchorage, Cordova (110 miles to the east), Valdez (97 miles to the northeast), and Seward (70 miles to the southwest). Whittier is a year round ice-free port and is a focal point for marine activity and freight transfer from seatrain barge serving South Central Alaska.

The city town site lies on a fan-shaped delta on the south shore of Passage Canal. The delta, approximately a mile square, is bordered by Whittier Creek on the west and by a mountain ridge on the east. At the west end of Passage Canal is a delta, commonly known as “West Camp” or the “Head of the Bay”, about one and one-half square miles in area. Creeks flowing from Portage Pass, Shakespeare Glacier and Learnard Glacier form this delta. These two deltas comprise the land area upon which the Whittier community infrastructure is presently located.

History, Culture and Demographics

Passage Canal was once the quickest route from Prince William Sound to Cook Inlet. Chugach Indians would portage to Turnagain Arm in search of fish. Nearby Whittier Glacier was named for the American poet John Greenleaf Whittier, and was first published in 1915 by the U.S. Coast & Geodetic Survey. A port and railroad terminus was constructed by the U.S. Army for transport of fuel and other supplies into Alaska during World War II. The railroad spur and two tunnels were completed in 1943, and the Whittier Port became the entrance for troops and dependents of the Alaska Command.

The huge buildings that dominate Whittier began construction in 1948. The 14-story Hodge Building (now Begich Towers) was built for Army bachelor’s quarters and family housing, with 198 apartments. Whittier Manor was built in the early 1950s by private developers as rental units for civilian employees. The Port remained an active Army

facility until 1960; at that time, the population was 1,200. Whittier Manor was converted to condominiums in 1964; Begich Towers now houses the majority of residents as well as City offices. The City was incorporated in 1969.

The population of the community consists of 12.6% Alaska Native or part Native. Residents enjoy sport-fishing, commercial fishing and subsistence activities. During the 2000 U.S. Census, total-housing units numbered 213, and vacant housing units numbered 127. Vacant housing units used only seasonally numbered 79. U.S. Census data for Year 2000 showed 90 residents as employed. The unemployment rate at that time was 15.89 percent, although 37.06 percent of all adults were not in the work force. The median household income was $47,500, per capita income was $25,700, and 7.1 percent of residents were living below the poverty level.

Begich Towers

Facilities, Utilities, Schools and Health Care

Water is derived from wells and a reservoir. Water storage capacity is 1.2 million gallons. The entire community is served by a piped water and sewer system, and over 95% of homes are fully plumbed. The older portions of the City sewer system need replacement. Refuse is hauled out by a private contractor to Anchorage - the landfill has been closed. An oil and hazardous waste recycling center was completed in 1998. Chugach Electric Association provides electricity.

There is one school located in the community, attended by 40 students. There is not a hospital in Whittier. Whittier Health Clinic is a qualified Emergency Care Center. Whittier is within EMS Region 2F in the Prince William Sound Region. Emergency services have limited highway, marine and air access and are provided by 911 Telephone Service and volunteers. Whittier Volunteer Ambulance provides auxiliary health care.

Coastal Development

Developable Areas. Only a few areas within the City of Whittier are suitable for development, and these sites are located within a short distance of the shoreline. In the city core area, the waterfront is extensively utilized by industrial, commercial, and recreational uses. West Camp Delta, at the head of Passage Canal, is the site of a major military petroleum tank farm, but has room for additional industrial and commercial expansion.

Shotgun Cove and Emerald Cove, have the only other potential shoreline development areas. The rest of Passage Canal within the City limits is steep and rocky, which makes for difficult development. In 2004, engineers completed the design for an approximately two mile road extending from Blackstone Road to the Emerald Bay Trailhead. This road will open up another area for coastal development. Shotgun Cove Road provides access to existing public recreational areas; plans are underway to improve this road to provide for year round access to this area.

Whittier is likely to see increased growth and expansion of industrial transportation and commercial uses in its city boundary. The core area of Whittier is already an intensely used area. Land for further expansion is currently available in this location.

The best site for expansion of industrial uses is at the West Camp Delta. The West Camp Delta is the site of the old Army fuel storage and pipeline terminal. It has several acres of usable uplands, which are available. This area has the potential for development, which could relieve some of the congestion from downtown.

The City of Whittier is situated at the head of Passage Canal on the fan-shaped gravel delta of Whittier Creek, emanating from Whittier Glacier one-mile south of the city. Streams draining Shakespeare Glacier from the south and Learnard Glacier from the north traverse the West Camp Delta at the western extreme of Passage Canal. Both the Whittier and West Camp Delta are comprised of unconsolidated deposits of out wash and stream gravel.

The Whittier Delta is primarily coarse, sub-angular to sub-rounded gravel in a matrix of coarse sand with a depth in excess of 44 feet in the vicinity of the Begich Towers. Alluvial deposits of the West Camp Delta are overlain by a moraine from Learnard Glacier comprised of coarse, angular blocks of slate and gray water of unknown depth interspersed with patches of sand and gravel ((Coastal Management Plan (CMP), 1986)).

The steep topography surrounding Passage Canal rises abruptly to approximately 2,000 feet elevation within one mile of the shoreline on the south side of the canal and approximately 3,000 feet in elevation within one mile of the north shoreline. Areas of more level topography are generally limited to stream valleys associated with Billings

Creek, the watercourse which terminates in Poe Bay, the head and south shoreline of Shotgun Cove, and Logging Camp Bay creek.

Climate

Whittier is on the northeast shore of the Kenai Peninsula, at the head of Passage Canal. It is on the west side of Prince William Sound, 62 miles southeast of Anchorage. The community lies at approximately 60.773060° North Latitude and -148.683890° (West) Longitude. (Sec. 24, T008N, R004E, Seward Meridian.) Whittier is located in the Anchorage Recording District. The area encompasses 12.5 sq. miles of land and 7.2 sq. miles of water. Winter temperatures range from 17 to 28; summer temperatures average 49 to 63. Average annual precipitation includes 80 inches of rain and 250 inches of snowfall.

Economy and Transportation

The City, school, local services and summer tourism support Whittier. Tours, charters and sport fishing in Prince William Sound attract seasonal visitors. Eight residents hold commercial fishing permits.

Whittier has an ice-free port and two city docks (70 ft cargo dock & 60 ft floating passenger dock). A small boat harbor has slips for 360 fishing, recreation and charter vessels. Road, rail, the state ferry, boat and aircraft serve it. A $70 million road connection was completed in the summer of 2000. The Anton Anderson Memorial Tunnel was reconstructed to accommodate both rail and road vehicles. The railway carries passengers, vehicles and cargo 12 miles from the Portage Station, east of Girdwood. The State-owned 1,480' long by 58' wide gravel airstrip accommodates charter aircraft, and a City-owned seaplane dock is available for passenger transfer

Organizations

Chamber of Commerce - Greater Whittier Chamber of Commerce
P.O. Box 607
Whittier, AK 99693
Web http://www.whittieralaska.com/

City - City of Whittier
P.O. Box 608
Whittier, AK 99693
Phone 907-472-2327
Web: www.ci.whittier.ak.us

Regional Native Health Corporation - Chugachmiut
1840 Bragaw Street, STE 110
Anchorage, AK 99508-3463
Phone 907-562-4155

Fax 907-563-2891
E-mail info@chugachmiut.org
Web http://www.chugachmiut.org

Community Assets

This section outlines the resources, facilities and infrastructure that, if damaged, could significantly impact public safety, economic conditions, and environmental integrity of Whittier.

Critical Facilities: Those facilities and infrastructure necessary for emergency response efforts.

- Whittier Tunnel
- Alaska Railroad and Barge Dock
- Begich Towers
- P12 Building

Essential Facilities: Those facilities and infrastructure that supplement response efforts.

- Designated Shelters
- City Office
- Whittier School and Gym
- Marine Highway Dock
- Second Cruise Ship Terminal

Critical Infrastructure: Infrastructure that provides services to Whittier.

- Telephone lines
- Power lines
- Transportation networks
- Wastewater collection
- Enstar Gas Line
- Water Reservoir
- Highway Bridge to Whittier Tunnel
- Whittier Creek Levee
- Airstrip

Vulnerable Populations: Locations serving population that have special needs or require special consideration.

- School
- Begich Towers elderly population

Cultural and Historical Assets: Those facilities that augment or help define community character, and, if lost, would represent a significant loss for the community.

- Begich Towers

Community Resources

Federal Resources

This section outlines the resources available to Whittier for mitigation and mitigation related funding and training.

The federal government requires local governments to have a hazard mitigation plan in place to be eligible for funding opportunities through FEMA, such as through the Pre-Disaster Mitigation Assistance Program and the Hazard Mitigation Grant Program. The Mitigation Technical Assistance Programs available to local governments are also a valuable resource. FEMA may also provide temporary housing assistance through rental assistance, mobile homes, furniture rental, mortgage assistance, and emergency home repairs. The Disaster Preparedness Improvement Grant also promotes educational opportunities with respect to hazard awareness and mitigation.
FEMA, through its Emergency Management Institute, offers training in many aspects of emergency management, including hazard mitigation. FEMA has also developed a large number of documents that address implementing hazard mitigation at the local level. Five key resource documents are available from the FEMA Publication Warehouse (1-800-480-2520) and are briefly described below:

- **How-to Guides.** FEMA has developed a series of how-to guides to assist states, communities, and tribes in enhancing their hazard mitigation planning capabilities. The first four guides mirror the four major phases of hazard mitigation planning used in the development of the Newtok Hazard Mitigation Plan. The last five how-to guides address special topics that arise in hazard mitigation planning such as conducting cost-benefit analysis and preparing multi-jurisdictional plans. The use of worksheets, checklists, and tables make these guides a practical source of guidance to address all stages of the hazard mitigation planning process. They also include special tips on meeting Disaster Mitigation Act (DMA) 2000 requirements (http://www.fema.gov/fima/planhowto.shtm).

- **Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments.** FEMA DAP-12, September 1990. This handbook explains the basic concepts of hazard mitigation and shows state and local governments how they can develop and achieve mitigation goals within the context of FEMA's post-disaster hazard mitigation planning requirements. The handbook focuses on approaches to mitigation, with an emphasis on multi-objective planning.

- **Mitigation Resources for Success CD.** FEMA 372, September 2001. This CD contains a wealth of information about mitigation and is useful for state and local

government planners and other stakeholders in the mitigation process. It provides mitigation case studies, success stories, information about Federal mitigation programs, suggestions for mitigation measures to homes and businesses, appropriate relevant mitigation publications, and contact information.

- **A Guide to Federal Aid in Disasters.** FEMA 262, April 1995. When disasters exceed the capabilities of state and local governments, the President's disaster assistance program (administered by FEMA) is the primary source of federal assistance. This handbook discusses the procedures and processes for obtaining this assistance, and provides a brief overview of each program.

- **The Emergency Management Guide for Business and Industry.** FEMA 141, October 1993. This guide provides a step-by-step approach to emergency management planning, response, and recovery. It also details a planning process that businesses can follow to better prepare for a wide range of hazards and emergency events. This effort can enhance a business's ability to recover from financial losses, loss of market share, damages to equipment, and product or business interruptions. This guide could be of great assistance to Newtok businesses.

- **Department of Agriculture.** Assistance provided includes: Emergency Conservation Program, Non-Insured Assistance, Emergency Watershed Protection, Rural Housing Service, Rural Utilities Service, and Rural Business and Cooperative Service.

- **Department of Energy, Office of Energy Efficiency and Renewable Energy, Weatherization Assistance Program.** This program minimizes the adverse effects of high energy costs on low-income, elderly, and handicapped citizens through client education activities and weatherization services such as an all-around safety check of major energy systems, including heating system modifications and insulation checks.

- **Department of Housing and Urban Development, Office of Homes and Communities, Section 108 Loan Guarantee Programs.** This program provides loan guarantees as security for federal loans for acquisition, rehabilitation, relocation, clearance, site preparation, special economic development activities, and construction of certain public facilities and housing.

- **Department of Housing and Urban Development, Community Development Block Grants.** Administered by the Alaska DCCED, Division of Community Advocacy. Provides grant assistance and technical assistance to aid communities in planning activities that address issues detrimental to the health and safety of local residents, such as housing rehabilitation, public services, community facilities, and infrastructure improvements that would primarily benefit low-and moderate-income persons.

- **Department of Labor, Employment and Training Administration, Disaster Unemployment Assistance.** Provides weekly unemployment subsistence grants for those who become unemployed because of a major disaster or emergency. Applicants must have exhausted all benefits for which they would normally be eligible.

- **Federal Financial Institutions.** Member banks of the Federal Deposit Insurance Corporation (FDIC) or Federal Home Loan Bank Board (FHLBB) may be permitted to waive early withdrawal penalties for Certificates of Deposit and Individual Retirement Accounts.

- **Internal Revenue Service, Tax Relief.** Provides extensions to current year's tax return, allows deductions for disaster losses, and allows amendment of previous tax returns to reflect loss back to three years.

- **United States Small Business Administration (SBA).** May provide low-interest disaster loans to individuals and businesses that have suffered a loss due to a disaster. Requests for SBA loan assistance should be submitted to the Alaska DHS&EM.

The following are websites that provide focused access to valuable planning resources for communities interested in sustainable development activities.

- **Federal Emergency Management Agency,** http://www.fema.gov – includes links to information, resources, and grants that communities can use in planning and implementation of sustainable measures.
- **American Planning Association,** http://www.planning.org – is a non-profit professional association that serves as a resource for planners, elected officials, and citizens concerned with planning and growth initiatives.

- **Institute for Business and Home Safety,** http://ibhs.org – an initiative of the insurance industry to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters. Online resources provide information on natural hazards, community land use, and ways citizens can protect their property from damage.

State Resources

- **Alaska DHS&EM** is responsible for coordinating all aspects of emergency management for the State of Alaska. Public education is one of its identified main categories for mitigation efforts.

  Improving hazard mitigation technical assistance for local governments is high priority item for the State of Alaska. Providing hazard mitigation training, current hazard information, and the facilitation of communication with other agencies would

encourage local hazard mitigation efforts. DHS&EM provides resources for mitigation planning on their website at http://www.ak-prepared.com.

- **DCCED, Division of Community Advocacy:** Provides training and technical assistance on all aspects of the National Flood Insurance Program (NFIP) and flood mitigation.

- **Division of Senior Services:** Provides special outreach services for seniors, including food, shelter, and clothing.

- **Division of Insurance:** Provides assistance in obtaining copies of policies and provides information regarding filing claims.

- **Department of Military and Veteran's Affairs:** Provides damage appraisals and settlements for Veterans Administration (VA)-insured homes, and assists with filing for survivor benefits.

Other Funding Sources and Resources

- **Real Estate Business.** State law for properties within flood plains requires real estate disclosure.

- **American Red Cross.** Provides for the critical needs of individuals such as food, clothing, shelter, and supplemental medical needs. Provides recovery needs such as furniture, home repair, home purchasing, essential tools, and some bill payment may be provided.

- **Crisis Counseling Program.** Provides grants to State and Borough mental health departments, which in turn provide training for screening, diagnosing and counseling techniques. Also provides funds for counseling, outreach, and consultation for those affected by disaster.

Local Resources

Table 4. Legal and Technical Capability

Regulatory Tools (ordinances, codes, plans)	Local Authority (Y/N)	Comments (Year of most recent update; problems administering it, etc)
Building code	NO	
Zoning ordinance	YES	
Subdivision ordinance or regulations	YES	
Special purpose ordinances (floodplain management, stormwater management, hillside or steep slope ordinances, wildfire ordinances, hazard setback requirements)	NO	Does not participate in the NFIP.
Growth management ordinances (also called "smart growth" or anti-sprawl programs)	NO	
Site plan review requirements	YES	
Comprehensive plan	YES	
A capital improvements plan	YES	
An economic development plan	YES	
An emergency response plan	YES	Finalization of Draft Plan in Progress
A post-disaster recovery plan	NO	
A post-disaster recovery ordinance	NO	
Real estate disclosure requirements	NO	

Table 5. Administrative Capability

Staff/Personnel Resources	Y/N	Department/Agency and Position
City Manager	YES	Administration/City of Whittier
Assistant City Manager	YES	Administration/City of Whittier
City Clerk	YES	Administration/City of Whittier
Public Works Director	YES	Public Works/City of Whittier
Librarian	NO	
Volunteer Firefighters & Volunteer EMS Personnel	YES	Dept. of Public Safety/City of Whittier
Planner(s) or engineer(s) with knowledge of land development and land management practices	NO	
Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	NO	
Planners or Engineer(s) with an understanding of natural and/or human-caused hazards	NO	
Floodplain manager	NO	
Surveyors	NO	
Staff with education or expertise to assess the community's vulnerability to hazards	YES	Professional staff has received HAZMAT training.
Personnel skilled in GIS	NO	
Scientists familiar with the hazards of the community	YES	Citizens live in Whittier who have scientific background.
Emergency manager	YES	Director of Public Safety
Grant writers	YES	Administration/City of Whittier
Environmental Advisory Council	NO	

Table 6. Fiscal Capability

Financial Resources	Accessible or Eligible to Use (Yes or No)
Community Development Block Grants (CDBG)	NO
Capital improvements project funding	YES
Authority to levy taxes for specific purposes	YES
Fees for sewer	YES
Impact fees for homebuyers or developers for new developments/homes	YES
Incur debt through general obligation bonds	YES
Incur debt through special tax and revenue bonds	YES
Incur debt through private activity bonds	NO
Withhold spending in hazard-prone areas	NO

Chapter 3: Hazards

Hazard Matrices – City of Whittier

Table 7. Hazard Matrix

City of Whittier					
Flood	**Wildland Fire**	**Earthquake**	**Volcano**	**Snow Avalanche**	**Tsunami & Seiche**
Yes-H	Yes-M	Yes-H	U	Yes-H	Yes-M
T	L	T	L	T	T
Severe Weather	**Landslides**	**Erosion**	**Drought**	**Technological**	**Economic**
Yes-H	Yes-H	Yes-H	No	Yes-U	U
T	T	T	Z	T	T

Source: Alaska State All-Hazards Plan, 2007

Probability:
Y = Hazard is present in jurisdiction but probability unknown
Y – L = Hazard is present with a low probability of occurrence within the next ten years. Event has up to 1 in 10 year's chance of occurring.
Y – M = Hazard is present with a moderate probability of occurrence with the next three years. Event has up to 1 in 3 year's chance of occurring.
Y – H = Hazard is present with a high probability of occurrence within the calendar year. Event has up to 1 in 1 year chance of occurring.
N = Hazard is not present
U = Unknown if the hazard occurs in the jurisdiction

Extent:
Z = Zero
L = Limited
T = Total

Table 8. Previous Occurrences

City of Whittier					
Flood	**Wildland Fire**	**Earthquake**	**Volcano**	**Snow Avalanche**	**Tsunami & Seiche**
6 – L	0	2 - L	0	1 - L	1 – L
Severe Weather	**Ground Failure**	**Erosion**	**Drought**	**Technological**	**Economic**
2 – L	0	0	0	2 – L	2 – L

Source: Alaska State All-Hazards Plan, 2007

Extent

Z - Zero — Used for historical information. An event occurred but may not have caused damage or loss.

L - Limited — Minimal through maximum impact to part of community. *Falls short of the definition for total extent*.

T - Total — Impact encompasses the entire community.

Number: Number of occurrences

Hazard Vulnerability Assessment

Identification of Assets

Because Whittier is a small community of 188 year round residents, every structure is essential to the sustainability and survivability of Whittier residents. The Hazard Vulnerability Matrix below includes a list of facilities, utilities and businesses and their vulnerability to natural hazards. It is also important to keep in mind that essentially the entire infrastructure in Whittier is located within a mile of the shoreline.

Due to the low population and small area suitable for development all of the infrastructure in Whittier could be defined as essential. Therefore the entire infrastructure in Whittier is included on the following matrix titled, Table 9. Whittier Hazard Vulnerability Matrix.

Vulnerability Matrix

Table 9. Whittier Hazard Vulnerability Matrix

Facility	Flood/ Erosion	Severe Weather	Earth-quake	Snow/ Avalanche & Landslides	Tsunami & Seiche	Wild= Land Fire
1. Whittier Tunnel	X	X	X	X	X	X
2. Begich Towers	X	X	X	X	X	X
3. AK Railroad	X	X	X	X	X	X
4. AK Railroad Barge	X	X	X	X	X	X
5. Whittier School	X	X	X	X	X	X
6. Cruise Ship Terminal	X	X	X	X	X	X
7. Enstar Gas Line	X	X	X	X	X	X
8. P-12 Building	X	X	X	X	X	X
9. Marine Hwy Dock	X	X	X	X	X	X
10. Highway Bridge	X	X	X	X	X	X
11. Whittier Creek Levee	X	X	X	X	X	X
12. Whittier Airstrip	X	X	X	X	X	X
13. Sewage Lift Station	X	X	X	X	X	X
14. Anchor Inn/Motel	X	X	X	X	X	X
15. Whittier Manor	X	X	X	X	X	X
16. Inn at Whittier	X	X	X	X	X	X
17. Harbor Front Seasonal Businesses	X	X	X	X	X	X
18. City Harbor/Boat Launch Ramp	X	X	X	X	X	X

Facility	Flood/ Erosion	Severe Weather	Earth-quake	Snow/ Avalanche & Landslides	Tsunami & Seiche	Wild= Land Fire
19. Ocean Dock	X	X	X	X	X	X
20. Great Pacific Seafood Processing Plant	X	X	X	X	X	X
21. DeLong Dock	X	X	X	X	X	X
22. Cell Phone Towers	X	X	X	X	X	X
23. ALMR Towers	X	X	X	X	X	X
24. Yukon Telephone	X	X	X	X	X	X
25. Shoreside Petro	X	X	X	X	X	X

Whittier's Vulnerability to Identified Hazards:

The City of Whittier's insurance carrier, Alaska Municipal League, was only able to provide replacement cost figures for the following infrastructure. Please keep in mind the small size of Whittier both in population and developable land mass.

1. Line 8 – P 12 Building, $2,700,000
2. Line 18 – City Harbor, $25,000,000
3. Line 13 - Sewage lift station, $340,000.

Severe weather hazards are area wide. A severe weather event would create an area wide impact and could damage structures and potentially isolate Whittier from the rest of the state.

Whittier is vulnerable to wildland fire on an areawide basis. If a wildland fire occurred near the tunnel the community could be cut off from outside assistance. Because the community is surrounded by forested land a wildland fire could impact the entire community.

Earthquake damage would be area-wide with potential damage to critical infrastructure up to and including the complete abandonment of key facilities. Limited building damage assessors are available in Whittier to determine structures integrity following earthquake damage. Priority would have to be given critical infrastructure to include: public safety facilities, health care facilities, shelters and potential shelters, and finally public utilities. All of these facilities, except for the public utilities, are located in the Begich Towers where almost all of the residents live or at the attached Whittier School.

Direct impact from flooding and tsunami could occur within one mile of the shoreline due to the steep topography of Passage Canal. As noted in the community profile section the city town site lies on a fan-shaped delta on the south shore of Passage Canal. The delta, approximately a mile square, is bordered by Whittier Creek on the west and by a mountain ridge on the east. At the west end of Passage Canal is a delta, commonly known as “West Camp” or the “Head of the Bay”, about one and one-half square miles in area. Creeks flowing from Portage Pass, Shakespeare Glacier, and Learnard Glacier form this delta. These two deltas comprise the land area upon which the Whittier community infrastructure is presently located.

Flooding and tsunami events, even for those properties unaffected directly, will suffer due to road closures, impacts to public safety (access and response capabilities), limited availability of perishable commodities, and isolation.

Vulnerability of infrastructure from avalanche and landslide hazards is areawide in Whittier. The steep topography surrounding Passage Canal rises abruptly to approximately 2,000 feet elevation within one mile of the shoreline on the south side of the canal and approximately 3,000 feet in elevation within one mile of the north shoreline. Areas of more level topography are generally limited to stream valleys associated with Billings Creek, the watercourse which terminates in Poe Bay, the head and south shoreline of Shotgun Cove, and Logging Camp Bay creek.

There are no Flood Insurance Rate Maps (FIRM) or critical facilities maps available for Whittier. Nor are there avalanche, landslides, or tsunami maps. The picture to the right however clearly illustrates the steep topography and proximity to both the coastline and the mountains.

Aerial view of Whittier Delta (left) and Head of the Bay Delta (right)

Section 1. Floods and Erosion

Hazard Description and Characterization

<u>Types of Flooding in Whittier</u>

Flood hazards in Whittier include storm surges, voluminous rainfall, snow and glacier melt and release of glacier-dammed lakes.

Storm Surge Flooding

Storm surges are relatively long-term, local increases in water level resulting from offshore

storms. Maximum hazard results when such a surge coincides with a maximum tide.

Rainfall, Snowmelt, Glacier Melt Flooding

Floods occur in rivers as a result of a large input of water to the drainage basin in the form of rainfall, snowmelt, glacier melt, or a combination of these inputs. In the Whittier area, as well as most coastal areas of Southcentral and Southeast Alaska, the floods due to snowmelt are typically lower in magnitude than those due to rainstorms in late summer or fall. Glacier melt is typically largest in late summer; increasing the potential magnitude of late summer rainfall floods in glacial streams.

Levee Failure

The Whittier Creek Levee was constructed approximately 50 years ago. Over the course of time, the levee protection has eroded, and the stream channel has filled in, bringing into question the ability of the levee to provide protection to many key facilitates in downtown Whittier.

Flood and Erosion Hazards

Deposition

Deposition is the accumulation of soil, silt, and other particles on a river bottom or delta. Deposition leads to the destruction of fish habitat and presents a challenge for navigational purposes. Deposition also reduces channel capacity, resulting in increased flooding or bank erosion.

Erosion

Erosion is a process that involves the wearing away, transportation, and movement of land. Erosion rates can vary significantly as erosion can occur quite quickly as the result of a flash flood, coastal storm or other event. It can also occur slowly as the result of long-term environmental changes. Erosion is a natural process but its effects can be exacerbated by human activity.

Stream bank erosion involves the removal of material from the stream bank. When bank erosion is excessive, it becomes a concern because it results in loss of streamside vegetation, loss of fish habitat, and loss of land and property.

Contaminated water

Floodwaters pose a health hazard by picking up contaminants and disease as they travel. All of Whittier depends on three city wells, which can be, and have been, contaminated during flood events. The city wells are located outside of the storm surge area.

Local Flood and Erosion Hazard Identification

As noted in the vulnerability section of the LHMP all of the infrastructure in Whittier is subject to flood and erosion damage.

The City owns its present administrative office complex comprised of two single apartments on the first floor of Begich Towers. The City Council, Planning and Zoning Commission and the Ports and Harbor Commission meet in the City Council Chambers in Building P-12, which also houses the City Shop. Public Safety in Whittier is shared by several city organizations: police department, volunteer fire department, search and rescue/dive team and volunteer emergency medical services (EMS). The police department is located in the Begich Towers.

As noted in the community profile most of the citizens of Whittier live in Begich Towers.

Table 10. Number of Housing Units by Location in Whittier

Location	Total Number of Units
Begich Towers	198
Whittier Manor	80
Anchor Annex	6
Whittier Subdivision Phase II	5

Source: City of Whittier Comprehensive Plan, 2005

Community Participation in the NFIP

The City of Whittier does not participate in the NFIP.

The function of the National Flood Insurance Program (NFIP) is to provide flood insurance to homes and businesses located in floodplains at a reasonable cost. In trade, the City of Whittier would agree to regulate new development and substantial improvement to existing structures in the floodplain, or to build safely above flood heights to reduce future damage to new construction. The program is based upon mapping areas of flood risk, and requiring local implementation to reduce flood damage primarily through requiring the elevation of structures above the base (100-year) flood elevations.
The table below describes the FIRM zones.

Table 11. FIRM Zones

Firm Zone	***Explanation***
A	Areas of 100-year flood; base flood elevations and flood hazard not determined.
AO	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet, average depths of inundation are shown but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown but no flood hazard factors

	are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood.
C	Areas of minimal flooding.
D	Areas of undetermined, but possible, flood hazards.

Development permits for all new building construction, or substantial improvements, are required by the City in all A, AO, AH, A-numbered Zones. Flood insurance purchase may be required in flood zones A, AO, AH, A-numbered zones as a condition of loan or grant assistance. An Elevation Certificate is required as part of the development permit. The Elevation Certificate is a form published by the Federal Emergency Management Agency required to be maintained by communities participating in the NFIP. According to the NFIP, local governments maintain records of elevations for all new construction, or substantial improvements, in floodplains and to keep the certificates on file.

Flood Hazard Vulnerability

Please see Hazard Vulnerability Assessment Matrix and description at the beginning of this chapter.

Previous Occurrences

The following previous occurrences information was obtain from DHS&EM Disaster Cost Index, dated March 2006.

Whittier, August 8, 1989 Provided funding to DOT/PF to repair the breakwater to the small boat harbor in **Whittier**, which was at risk of imminent collapse, threatening damage to the harbor itself and large numbers of privately owned boats.

South-central Fall Floods declared September 21, 1995 by Governor Knowles then FEMA declared (DR-1072) on October 13, 1996: On September 21, 1995, the Governor declared a disaster as a result of heavy rainfall in South-central Alaska an as a result the Kenai Peninsula Borough, Matanuska-Susitna Borough, and the Municipality of Anchorage were initially affected. On September 29, 1995, the Governor amended the original declaration to include Chugach, and the Copper River Regional Education Attendance areas, including the communities of **Whittier** and Cordova, and the Richardson, Copper River and Edgerton Highway areas which suffered severe damage to numerous personal residences, flooding, eroding of public roadways, destruction & significant damage to bridges, flood control dikes and levees, water and sewer facilities, power and harbor facilities. On October 13, 1995, the President declared this event as a major disaster (AK-1072-DR) under the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Individual Assistance totaled $699K for 190 applicants. Public Assistance totaled $7.97 million for 21 applicants with 140

DSR's. Hazard Mitigation totaled $1.2 million. The total for this disaster is $10.5 million.

Central Gulf Coast Storm declared February 4, 2000 by Governor Murkowski then FEMA declared (DR-1316) on February 17, 2000: On Feb 4 2000, the Governor declared a disaster due to high impact weather events throughout an extensive area of the state. The State began responding to the incident since the beginning of December 21, 1999. The declaration was expanded on February 8 to include City of **Whittier**, City of Whittier, Kenai Peninsula Borough, Matanuska-Susitna Borough and the Municipality of Anchorage. On February 17, 2000, President Bill Clinton determined the event disaster warranted a major disaster declaration under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, P.L. 93-288 as amended ("the Stafford Act). On March 17, 2000, the Governor again expanded the disaster area and declared that a condition of disaster exists in Aleutians East, Bristol Bay, Denali, Fairbanks North Star, Kodiak Island, and Lake and Peninsula Boroughs and the census areas of Dillingham, Bethel, Wade Hampton, and Southeast Fairbanks, which is of sufficient severity and magnitude to warrant a disaster declaration. Effective on April 4, 2000, Amendment No. 2 to the Notice of a Major Disaster Declaration, the Director of FEMA included the expanded area in the presidential declaration. Public Assistance, for 64 applicants with 251 PW's, totaled $12.8 million. Hazard Mitigation totaled $2 million. The total for this disaster is $15.66 million.

October 10 –13, 2006

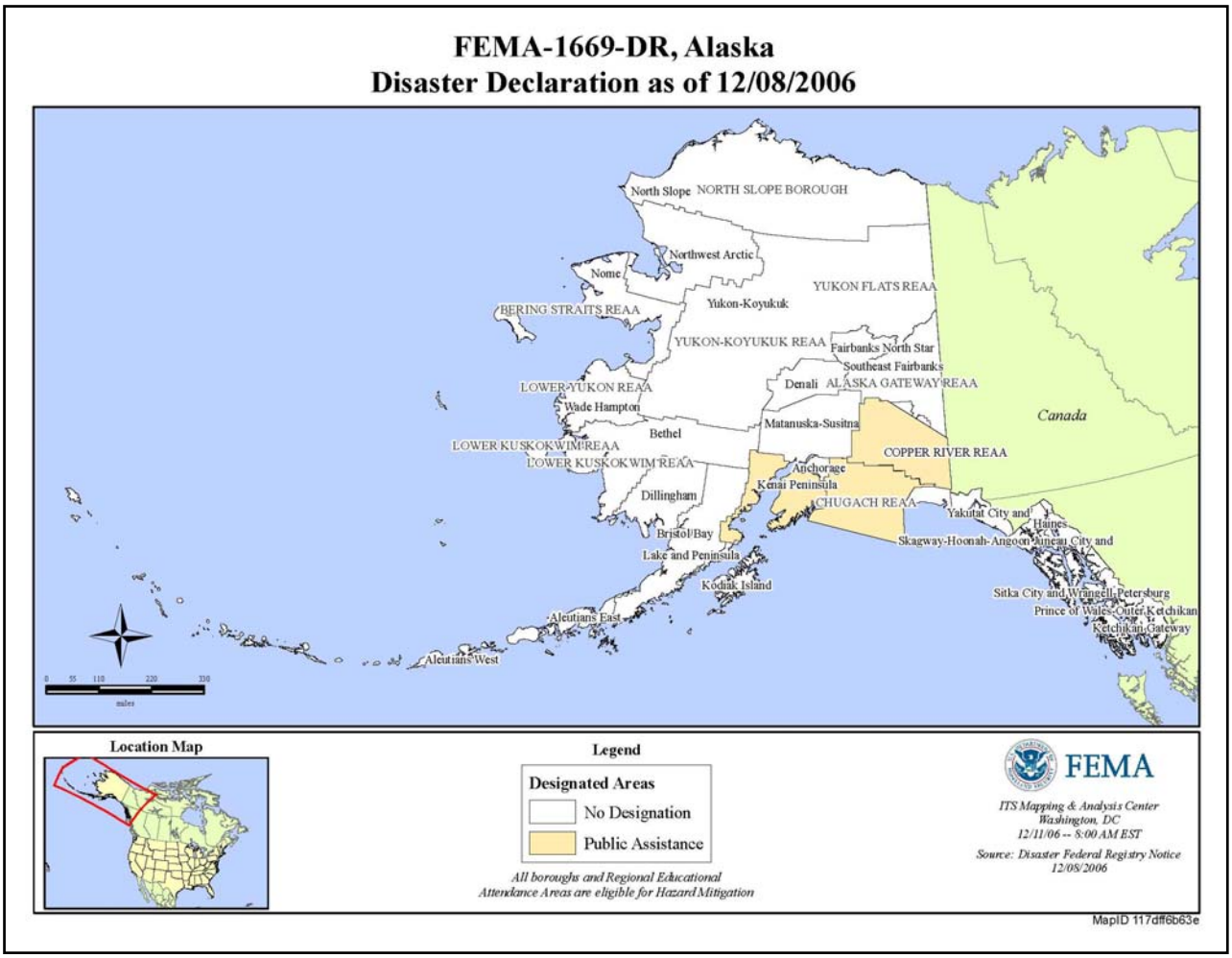
The City of Whittier suffered a major flooding event October 10 – 13, 2006. The storm resulted in heavy flooding in Whittier and was wide spread through out Southcentral Alaska. The City does not have records to document the dollar amount of damage, however the picture on the right illustrates that critical facilities were put at risk.

October 2006 Storm, Flooded Utilities

FEMA Press Release Date: December 12, 2006
New Disaster Declaration to Help Alaska Recover from October Storms

Release Number: 1669-010
ANCHORAGE, Alaska -- Federal disaster recovery assistance is now available to help communities recovering from the strong storm system that moved through south central Alaska Oct. 8-13. 2006.
President Bush signed a federal disaster declaration Dec. 8 that makes Federal Emergency Management Agency (FEMA) recovery assistance available to the Kenai Peninsula Borough and the Chugach and Copper River Regional Educational Attendance Areas (REAAs) following October's severe storms, flooding, landslides, and mudslides.
"The recent federal declaration is for Public Assistance which allows FEMA to help governmental entities restore or replace infrastructure and to help reimburse for debris removal and emergency protective measures," said Federal Coordinating Officer Bill Lokey.
FEMA's public assistance grants may be available for State agencies, local governments, Indian tribes, Alaska native villages and certain private non-profit organizations. The help comes in the form of grants that are based on a 75 percent federal reimbursement.
The Dec. 8 federal declaration brings the total to three that the State of Alaska and FEMA are now orchestrating from an Anchorage Joint Field Office. Earlier in October President Bush signed federal disaster declarations authorizing Public Assistance funds to assist the City of Hooper Bay with recovery from an August fire and to help the Chugach REAA, Mat-Su, and Denali Boroughs recover from an August flooding and mudslide event.
To date more than $1 million has been obligated through FEMA's Public Assistance grants to help recovery efforts following the Hooper Bay fire and August storm.
FEMA manages federal response and recovery efforts following any national incident, initiates mitigation activities and manages the National Flood Insurance Program. FEMA works closely with State and local emergency managers, law enforcement personnel, firefighters, and other first responders. FEMA became part of the U.S. Department of Homeland Security on March 1, 2003.

Whittier is located within the Public Assistance Area of the federal disaster declaration map published by FEMA in December 2006 map.



Flood and Erosion Mitigation Goals and Projects

<u>Goals and Objectives</u>

Goal 1. Reduce flood damage.

Objective 1.1: Support elevation, flood proofing, buyout or relocation of structures that are in danger of flooding or are located on eroding banks.

Goal 2. Prevent future flood damage.

Objective 2.1: Consider the benefits and costs of joining the National Flood Insurance Program.

Goal 3: Increase public awareness

Objective 3.1 Increase public knowledge about mitigation opportunities, floodplain functions, emergency service procedures, and potential hazards.

Flood/Erosion Projects

After receiving public input, it is the recommendation of this plan that the City of Whittier, along with other local, State and Federal entities look at the following project for flood and erosion control.

Structure Elevation and/or Relocation

A list of homes, commercial structures and critical facilities that are in danger of flooding and in erosion danger should be identified and mitigation projects for elevating and/or relocating the structures determined.

Whittier Maps

Flood maps should be prepared that delineate areas of flooding and upland areas, if any.

Public Education

Increase public knowledgeable about mitigation opportunities, floodplain functions, emergency service procedures, and potential hazards. This would include advising property owners, potential property owners, and visitors about the hazards. In addition, dissemination of a brochure or flyer on flood hazards in Whittier could be developed and distributed to all households.

Whittier Creek Levee Project

The levee is in need of repair and/or replacement to prevent levee failure and thus, protect areas downstream.

The Whittier Creek Levee was constructed approximately 50 years ago. Over the course of time, the levee protection has eroded, and the stream channel has filled in, bringing into question the ability of the levee to provide protection to many key facilitates in downtown Whittier. A flood damage reduction study will allow for the analysis of the levee and a determination of the potential threat to the Begich Towers, the Whittier school, and the Whittier water supply wells. Once the extent of the issue is known, a practicable solution can be developed.

The Whittier Creek levee project is needed to protect significant public infrastructure and private investments and redevelopment of formerly used defense property and facilities. At imminent risk are the following: Whittier Community School; a 14-story residential complex that also houses the Whittier City offices, Police Department, and health clinic; community drinking water supply, Alaska Railroad freight yard and

passenger facilities; fuel storage facilities; cruise ship terminal and boat harbor; numerous businesses; and the only road access to the National Highway System.

Pedestrian Tunnel

Larger pumps are needed to remove water build up in the tunnel.

Railroad/Highway Bridge

Bridge foundation improvements are needed.

Retaining Wall for Triangle Area

Current rubble mound should be replaced with amour rock to prevent erosion.

Seawall Improvements

Amour rock improvements are needed to prevent further erosion.

Section 2. Severe Weather

Hazard Description and Characterization

Weather is the result of four main features: the sun, the planet's atmosphere, moisture, and the structure of the planet. Certain combinations can result in severe weather events that have the potential to become a disaster.

In Alaska, there is great potential for weather disasters. High winds can combine with loose snow to produce a blinding blizzard and wind chill temperatures to 75°F below zero. Extreme cold (-40°F to -60°F) and ice fog may last a week at a time heavy snow can impact the interior and is common along the southern coast. A quick thaw means certain flooding.

Winter Storms

Winter storms originate as mid-latitude depressions or cyclonic weather systems. High winds, heavy snow, and cold temperatures usually accompany them. To develop, they require:

• Cold air - Subfreezing temperatures (below 32ºF, 0ºC) in the clouds and/or near the ground to make snow and/or ice.

• Moisture - The air must contain moisture in order to form clouds and precipitation.

• Lift - A mechanism to raise the moist air to form the clouds and cause precipitation. Any or all of the following may provide lift:

• the flow of air up a mountainside.

• Fronts, where warm air collides with cold air and rises over the dome of cold air.

• Upper-level low-pressure troughs.

Heavy Snow

Snow piles up around boats parked in Whittier in the winter.

Heavy snow, generally more than 12 inches of accumulation in less than 24 hours, can immobilize a community by bringing transportation to a halt.

Until the snow can be removed, airports and major roadways are impacted, even closed completely, stopping the flow of supplies and disrupting emergency and medical services. Accumulations of snow can cause roofs to collapse and knock down trees and power lines. Heavy snow can also damage light aircraft and sink small boats. A quick thaw after a heavy snow can cause substantial flooding. The cost of snow removal, repairing damages, and the loss of business can have severe economic impacts on cities and towns. Injuries and deaths related to heavy snow usually occur as a result of vehicle accidents. Casualties also occur due to overexertion while shoveling snow and hypothermia caused by overexposure to the cold weather.

Extreme cold

What is considered an excessively cold temperature varies according to the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold”. In Alaska, extreme cold usually involves temperatures below –40 degrees Fahrenheit. Excessive cold may accompany winter storms, be left in their wake, or can occur without storm activity.

Extreme cold, can bring transportation to a halt across interior Alaska for days or sometimes weeks at a time. Aircraft may be grounded due to extreme cold and ice fog conditions, cutting off access as well as the flow of supplies northern villages.

Extreme cold also interferes with a community's infrastructure. It causes fuel to congeal in storage tanks and supply lines, stopping electric generation. Without electricity, heaters do not work, causing water and sewer pipes to freeze or rupture. If extreme cold conditions are combined with low or no snow cover, the ground's frost depth can increase disturbing buried pipes.

The greatest danger from extreme cold is its effect on people. Prolonged exposure to the cold can cause frostbite or hypothermia and become life threatening. Infants and elderly people are most susceptible. The risk of hypothermia due to exposure greatly increases during episodes of extreme cold, and carbon monoxide poisoning is possible as people use supplemental heating devices.

Ice Storms

The term ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. They can be the most devastating of winter weather phenomena and are often the cause of automobile accidents, power outages, and personal injury. Ice storms result from the accumulation of freezing rain, which is rain that becomes super cooled and freezes upon impact with cold surfaces.

Freezing rain most commonly occurs in a narrow band within a winter storm that is also producing heavy amounts of snow and sleet in other locations.

Freezing rain develops as falling snow encounters a layer of warm air in the atmosphere deep enough for the snow to completely melt and become rain. As the rain continues to fall, it passes through a thin layer of cold air just above the earth's surface and cools to a temperature below freezing. The drops themselves do not freeze, but rather they become super cooled. When these super cooled drops strike the frozen ground, power lines, tree branches, etc., they instantly freeze.

Local Severe Weather Hazard Identification

Annual precipitation for Whittier can approach 175 inches with up to 440 inches of snowfall. Snowfall is greatest from December through February, and peak rainfall occurs from September through December. Winter snow accumulation can approach twelve feet in depth with rapid changes from snow to rain, and back again. .

Winds in Passage Canal and Whittier are strong and variable with a mean hourly wind speed of 10-15 mph. The strongest winds blow east and west along the axis of Passage Canal. Winds of 40 to 60 miles per hour are not uncommon and may generate waves from 4 to 6 feet in height in the center of Passage Canal. Within Whittier proper a south wind from the Whittier Glacier can attain a speed of 30-50 miles per hour and persist for long periods of time.

Ice formation does not occur in the marine waters of Passage Canal. However, the during the Corps of Engineers project at Shotgun Cove it was noted that winter

temperatures are cold enough in the vicinity of Shotgun Cove to form ice at freshwater inflow points and calm areas.

Table 12. Whittier Weather Summary

WHITTIER, ALASKA
Period of Record General Climate Summary - Temperature

	Monthly Averages			Daily Extremes				Monthly Extremes			
	Max.	Min.	Mean	High	Date	Low	Date	Highest Mean	Year	Lowest Mean	Year
	F	F	F	F	dd/yyyy or yyyymmdd	F	dd/yyyy or yyyymmdd	F	-	F	-
January	31.2	22.9	27.2	54	31/1963	-18	28/1989	36.3	1985	16.3	1989
February	32.7	24.3	28.5	52	21/1957	-9	03/1999	35.9	1997	19.8	1990
March	35.6	25.9	30.8	54	30/1954	-5	17/1959	37.7	1983	21.3	1961
April	43.3	32.5	37.9	66	27/2005	5	03/1960	43.0	1990	31.3	1963
May	51.3	39.4	45.3	75	25/1970	20	05/1958	50.9	1996	40.4	1955
June	59.8	46.6	53.2	82	25/1953	32	03/1965	58.3	1997	46.5	1955
July	62.6	50.8	56.7	88	23/1966	34	27/1959	61.4	1993	51.9	1961
August	60.9	49.6	55.3	87	09/1957	34	25/1955	59.7	1997	50.5	1961
September	53.3	43.9	48.6	73	03/1957	23	30/1957	51.8	1997	42.3	1960
October	42.7	34.3	38.5	71	07/1957	0	20/1970	44.0	2002	32.3	1961
November	35.3	27.1	31.3	56	02/1957	-17	12/1969	39.5	2002	22.8	1963
December	32.7	24.5	28.7	48	23/1983	-19	17/1957	35.3	1985	14.2	1961
Annual	**45.1**	**35.1**	**40.2**	**88**	**19660723**	**-19**	**19571217**	**43.2**	**1993**	**35.3**	**1961**
Winter	32.2	23.9	28.1	54	19630131	-19	19571217	33.9	1987	20.6	1965
Spring	43.4	32.6	38.0	75	19700525	-5	19590317	42.5	1996	33.1	1963
Summer	61.1	49.0	55.0	88	19660723	32	19650603	59.2	1997	51.2	1961
Fall	43.8	35.1	39.5	73	19570903	-17	19691112	44.0	2002	34.5	1961

Table updated on Feb 6, 2007
For monthly and annual means, thresholds, and sums:
Months with 5 or more missing days are not considered
Years with 1 or more missing months are not considered
Seasons are climatological not calendar seasons
Western Regional Climate Center, wrcc@dri.edu

Previous Occurrences

The topography of Whittier and surrounding areas such as Portage Pass, coupled with weather patterns in southcentral Alaska, create periods of extremely high winds. As the low point between weather patterns in the Prince William Sound/Gulf of Alaska and Cook Inlet/ Interior Alaska, high winds frequently come through Portage Pass, particularly during storms or pressure differentials. Winds of 40 to 60 miles an hour are not uncommon and may generate waves of four to six feet in Passage Canal. On occasion the wind has been strong enough to topple a railroad boxcar (City of Whittier 1986).

As indicated by the table above, Whittier is at most danger from extreme cold. The following severe weather events for the entire state were declared in 1989 and 1990.

Omega Block Disaster, January 28, 1989 & FEMA declared (DR-00826) on May 10, 1989. The Governor declared a statewide disaster to provide emergency relief to communities suffering adverse effects of a record-breaking cold spell, with temperatures as low as -85 degrees. The State conducted a wide variety of emergency actions, which included emergency repairs to maintain and prevent damage to water, sewer and electrical systems, emergency resupply of essential fuels and food, and Alaska Department of Transportation and Public Facilities (DOT&PF) support in maintaining access to isolated communities.

Hazard Mitigation Cold Weather, 1990 The Presidential Declaration of Major Disaster for the Omega Block cold spell of January and February 1989 authorized federal funds for mitigation of cold weather damage in future events. The Governor's declaration of disaster provided the State matching funds required for obtaining and using this federal money.

Severe Weather Hazard Vulnerability

Please see Hazard Vulnerability Assessment Matrix and description at the beginning of this chapter.

Severe Weather Mitigation Goals and Projects

Severe Weather Goals and Projects

Goal 1: Mitigate the effects of extreme weather by instituting programs that provide early warning and preparation.

Goal 2: Educate people about the dangers of extreme weather and how to prepare.

Goal 3: Develop practical measures to warn in the event of a severe weather event.

Research and consider instituting the National Weather Service program of *"Storm Ready"*.

Storm Ready is a nationwide community preparedness program that uses a grassroots approach to help communities develop plans to handle all types of severe weather—from tornadoes to tsunamis. The program encourages communities to take a new, proactive approach to improving local hazardous weather operations by providing emergency managers with clear-cut guidelines on how to improve their hazardous weather operations.

To be officially Storm Ready, a community must:

1. Establish a 24-hour warning point and emergency operations center.
2. Have more than one way to receive severe weather forecasts and warnings and to alert the public.
3. Create a system that monitors local weather conditions.
4. Promote the importance of public readiness through community seminars.
5. Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises.
6. Demonstrate a capability to disseminate warnings.

Specific Storm Ready guidelines, examples, and applications also may be found on the Internet at: www.nws.noaa.gov/stormready

Other Severe Weather Projects:

Conduct special awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.

Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability.

Encourage weather resistant building construction materials and practices.

Install a siren to warn people of a severe weather event or disaster event.

Installation of automated weather sensors. Automated weather sensors are the chief method by which the National Weather Service detects the occurrence of incoming severe weather.

Relocation of Wellhouses - $850,000.

Stores of emergency supplies.

Section 3. Wildland Fire

Hazard Description and Characterization

Wildland fires occur in every state in the country and Alaska is no exception. Each year between 600 and 800 wildland fires, mostly between March and October, burn across Alaska causing extensive damage.

Fire is recognized as a critical feature of the natural history of many ecosystems. It is essential to maintain the biodiversity and long-term ecological health of the land. In Alaska, the natural fire regime is characterized by a return interval of 50 to 200 years, depending on the vegetation type, topography, and location. The role of wildland fire as an essential ecological process and natural change agent has been incorporated into the fire management planning process and the full range of fire management activities is exercised in Alaska to help achieve ecosystem sustainability, including its interrelated ecological, economic, and social consequences on firefighter and public safety and welfare, natural and cultural resources threatened, and the other values to be protected dictate the appropriate management response to the fire. Firefighter and public safety is always the first and overriding priority for all fire management activities.

Fires can be divided into the following categories:

Structure fires – originate in and burn a building, shelter or other structure.

Prescribed fires - ignited under predetermined conditions to meet specific objectives, to mitigate risks to people and their communities, and/or to restore and maintain healthy, diverse ecological systems.

Wildland fire - any non-structure fire, other than prescribed fire, that occurs in the wildland.

Wildland Fire Use - a wildland fire functioning in its natural ecological role and fulfilling land management objectives.

Wildland-Urban Interface Fires - fires that burn within the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. The potential exists in areas of wildland-urban interface for extremely dangerous and complex fire burning conditions, which pose a tremendous threat to public and firefighter safety.

Fuel, weather, and topography influence wildland fire behavior. Wildland fire behavior can be erratic and extreme causing firewhirls and firestorms that can endanger the lives of the firefighters trying to suppress the blaze. Fuel determines how much energy the fire releases, how quickly the fire spreads and how much effort is needed to contain the fire. Weather is the most variable factor. Temperature and humidity also affect fire

behavior. High temperatures and low humidity encourage fire activity while low temperatures and high humidity help retard fire behavior. Wind affects the speed and direction of a fire. Topography directs the movement of air, which can also affect fire behavior. When the terrain funnels air, like what happens in a canyon, it can lead to faster spreading. Fire can also travel up slope quicker than it goes down.

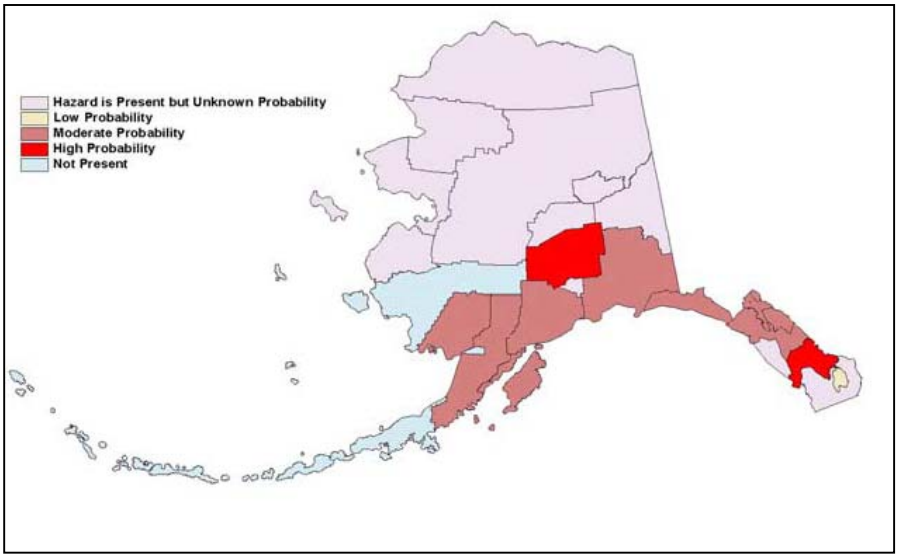
Wildland fire risk is increasing in Alaska due to the spruce bark beetle infestation. The beetles lay eggs under the bark of a tree. When the larvae emerge, they eat the trees phloem, which is what the tree uses to transport nutrients from its roots to its needles. If enough phloem is lost, the tree will die. The dead trees dry out and become highly flammable.

Local Wildland Fire Hazard Identification

Though Whittier has a moderate probability of occurrence, the Alaska Interagency Fire Management Plan lists it as a critical protection area. Please see map and explanation on the following pages.

The following map from the Alaska State Hazard Plan depicts Whittier as being in a moderate probability area of the state.

Figure 1. Alaska Hazard Plan - Fire Risk Map



Whittier is located in a full protection area of the state protection option areas. Full protection is suppression action provided on a wildland fire that threatens uninhabited private property, high-valued natural resource areas, and other high-valued areas such as identified cultural and historical sites. The suppression objective is to control the fire at the smallest acreage reasonably possible. The allocation of suppression resources to fires receiving the full protection option is second in priority only to fires threatening a critical protection area.

Wildland Fire Hazard Vulnerability

Please see Hazard Vulnerability Assessment Matrix and description at the beginning of this chapter.

Previous Occurrences

No history of catastrophic wildland fires in Whittier.

Wildland Fire Mitigation Goals and Projects

Wildland Fire Goals and Projects

Goal 1: Establish building regulations to mitigate against fire damage.

Goal 2: Conduct outreach activities to encourage the use of Fire Wise development techniques.

Goal 3: Encourage the evaluation of emergency plans with respect to wildland fire assessment.

Goal 4: Acquire information on the danger of wildland fires and how best to prepare.

Projects

Purchase a rescue boat with firefighting capabilities - $200,000.

Promote Fire Wise building design, siting, and materials for construction.

The Alaska Fire Wise Program is designed to educate people about wildland fire risks and mitigation opportunities. It is part of a national program that is operated in the State by the Alaska Wildfire Coordinating Group (AWCG).

Establish construction fire regulation and requirements.

Encourage development of building codes and requirements.

Enhance public awareness of potential risk to life and personal property. Encourage mitigation measures in the immediate vicinity of their property.

Section 4. Earthquake

Hazard Description and Characterization

Approximately 11% of the world's earthquakes occur in Alaska, making it one of the most seismically active regions in the world. Three of the ten largest quakes in the world since 1900 have occurred here. Earthquakes of magnitude 7 or greater occur in Alaska on average of about once a year; magnitude 8 earthquakes average about 14 years between events.

Most large earthquakes are caused by a sudden release of accumulated stresses between crustal plates that move against each other on the earth's surface. Some earthquakes occur along faults that lie within these plates. The dangers associated with earthquakes include ground shaking, surface faulting, ground failures, snow avalanches, seiches and tsunamis. The extent of damage is dependent on the magnitude of the quake, the geology of the area, distance from the epicenter and structure design and construction. A main goal of an earthquake hazard reduction program is to preserve lives through economical rehabilitation of existing structures and constructing safe new structures.

Ground shaking is due to the three main classes of seismic waves generated by an earthquake. Primary waves are the first ones felt, often as a sharp jolt. Shear or secondary waves are slower and usually have a side-to-side movement. They can be very damaging because structures are more vulnerable to horizontal than vertical motion.

Surface waves are the slowest, although they can carry the bulk of the energy in a large earthquake. The damage to buildings depends on how the specific characteristics of each incoming wave interact with the buildings' height, shape, and construction materials.

Earthquakes are usually measured in terms of their magnitude and intensity. Magnitude is related to the amount of energy released during an event while intensity refers to the effects on people and structures at a particular place. Earthquake magnitude is usually reported according to the standard Richter scale for small to moderate earthquakes.

Large earthquakes, like those that commonly occur in Alaska are reported according to the moment-magnitude scale because the standard Richter scale does not adequately represent the energy released by these large events.

Intensity is usually reported using the Modified Mercalli Intensity Scale. This scale has 12 categories ranging from not felt to total destruction. Different values can be recorded at different locations for the same event depending on local circumstances such as distance from the epicenter or building construction practices. Soil conditions are a major factor in determining an earthquake's intensity, as unconsolidated fill areas will

have more damage than an area with shallow bedrock. Surface faulting is the differential movement of the two sides of a fault. There are three general types of faulting.

Strike-slip faults are where each side of the fault moves horizontally. Normal faults have one side dropping down relative to the other side. Thrust (reverse) faults have one side moving up and over the fault relative to the other side.

Earthquake-induced ground failure is often the result of liquefaction, which occurs when soil (usually sand and course silt with high water content) loses strength as a result of the shaking and acts like a viscous fluid.

Liquefaction causes three types of ground failures: lateral spreads, flow failures, and loss of bearing strength. In the 1964 earthquake, over 200 bridges were destroyed or damaged due to lateral spreads. Flow failures damaged the port facilities in Seward, Whittier and Whittier.

Similar ground failures can result from loss of strength in saturated clay soils, as occurred in several major landslides that were responsible for most of the earthquake damage in Anchorage in 1964. Other types of earthquake-induced ground failures include slumps and debris slides on steep slopes.

Local Earthquake Hazard Identification

The following tables were obtained from the University of Alaska, Fairbanks, and Alaska Earthquake Information Center website at: http://www.giseis.alaska.edu/Seis/

Figure 2. AEIS Earthquake Active Faults

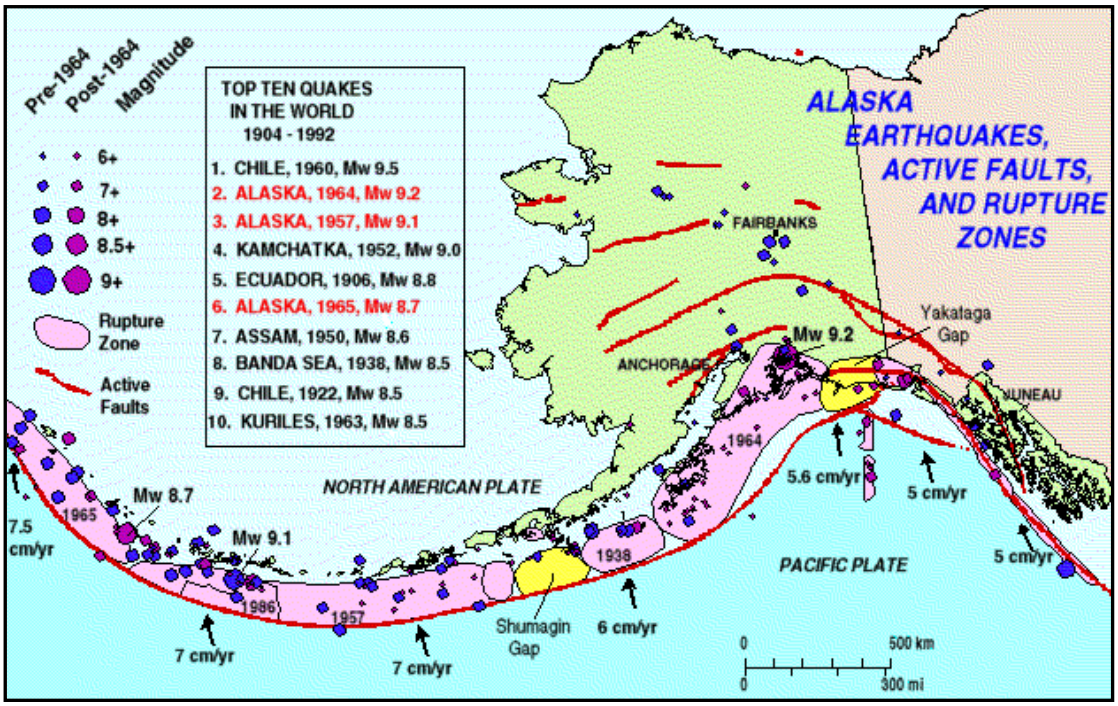
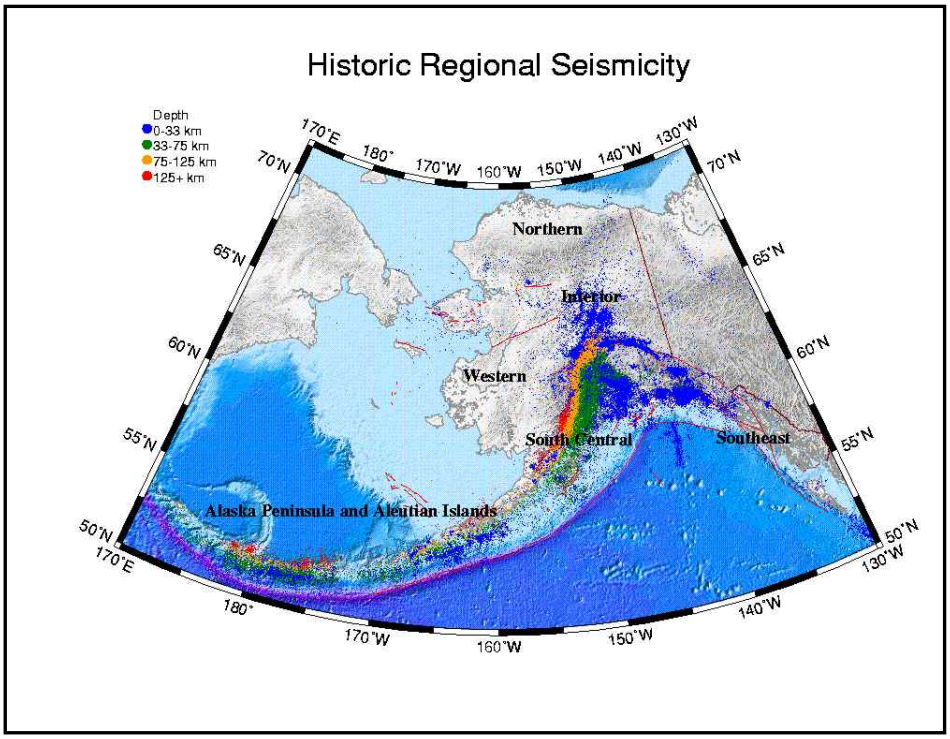


Figure 3. AEIS Historic Regional Seismicity



Faults. The nearest fault to the west of Whittier is the Border Range Fault system, which parallels the north edge of the Kenai Mountains and crosses Turnagain Arm northwest of Hope. To the east of Whittier, the Port Wells Fault crosses Passage Canal in a southwest-northeast trend traversing the area of Shotgun Cove.

Whittier is located within a seismically active zone of Alaska as evidenced by the March 27, 1964 earthquake; natural hazards associated with seismic activity are of particular concern.

Whittier has been recognized as an "area of particular concern". There are areas in Whittier, which include submarine sliding, areas subject to damage from submarine-slide generated waves, and potential damage from wave run-up, all of which resulted from the 1964 earthquake. Because the submarine slopes in Passage Canal were not significantly decreased by the land sliding which occurred during the earthquake, more slides and corresponding destructive waves may be expected in the wake of another earthquake of comparable magnitude (Whittier Coastal Management Plan Update, 2007).

Previous Occurrences

The 1964 earthquake triggered submarine landslides and produced at least two and probably three waves, which severely damaged the waterfront.

During the 1964 earthquake, violent seismic ground motion shook Whittier for nearly three minutes, the land subsided over eight feet, and three massive sea waves (largest exceeding 40 feet in height) struck the community. Injuries and property damage included: 13 persons killed; loss of most of the port facilities; destruction of waterfront buildings, the small boat harbor, the railcar barge slip, and several homes; and uncontrolled fire at the fuel storage facilities (CMP, 2007).

Seven factors related to the earthquake were responsible for the extensive damage in the Whittier area:

1. change in land level;
2. seismic shock;
3. fracturing of fill and unconsolidated deposits;
4. differential subsidence due to compaction;
5. landslides
6. waves generated by submarine landslides; and
7. fire. (Coastal Management Plan, 1986)

Earthquake Hazard Vulnerability

Please see Hazard Vulnerability Assessment Matrix and description at the beginning of this chapter.

Earthquake Mitigation Goals and Projects

Earthquake Goals and Projects

Goal 1: Obtain funding to protect existing critical infrastructure from earthquake damage.

Projects

If funding is available, perform an engineering assessment of the earthquake vulnerability of each identified critical infrastructure owned by the City of Whittier.

Identify buildings and facilities that must be able to remain operable during and following an earthquake event.

Contract a structural engineering firm to assess the identified buildings and facilities to determine their structural integrity and strategy to improve their earthquake resistance.

Section 5. Tsunami and Seiche Hazard

Hazard Description and Characterization

A ***tsunami*** is a series of ocean waves generated by any rapid large-scale disturbance of the seawater. These waves can travel at speeds of up to 600 miles per hour in the open ocean. Earthquakes generate most tsunamis, but they may also be caused by volcanic eruptions, landslides (above or under sea in origin), undersea slumps, or meteor impacts.

Tsunami damage is a direct result of three factors:

1. *Inundation* (the extent to which the water covers the land)
2. *Wave action* that will impact structures and moving objects that become projectiles.
3. *Coastal erosion*

A ***seiche*** is a wave that oscillates in partially or totally enclosed bodies of water. They can last from a few minutes to a few hours as a result of an earthquake, underwater landslide, atmospheric disturbance, or avalanche. The resulting effect is similar to bathtub water sloshing repeatedly from side to side. The reverberating water continually causes damage until the activity subsides. The factors for effective warning are similar to a local tsunami, in that the onset of the first wave can be a few minutes, giving virtually no time for warning.

Types of Tsunamis

Tsunamis are categorized in one of two ways:

- Distant-source tsunamis
- Locally generated tsunamis

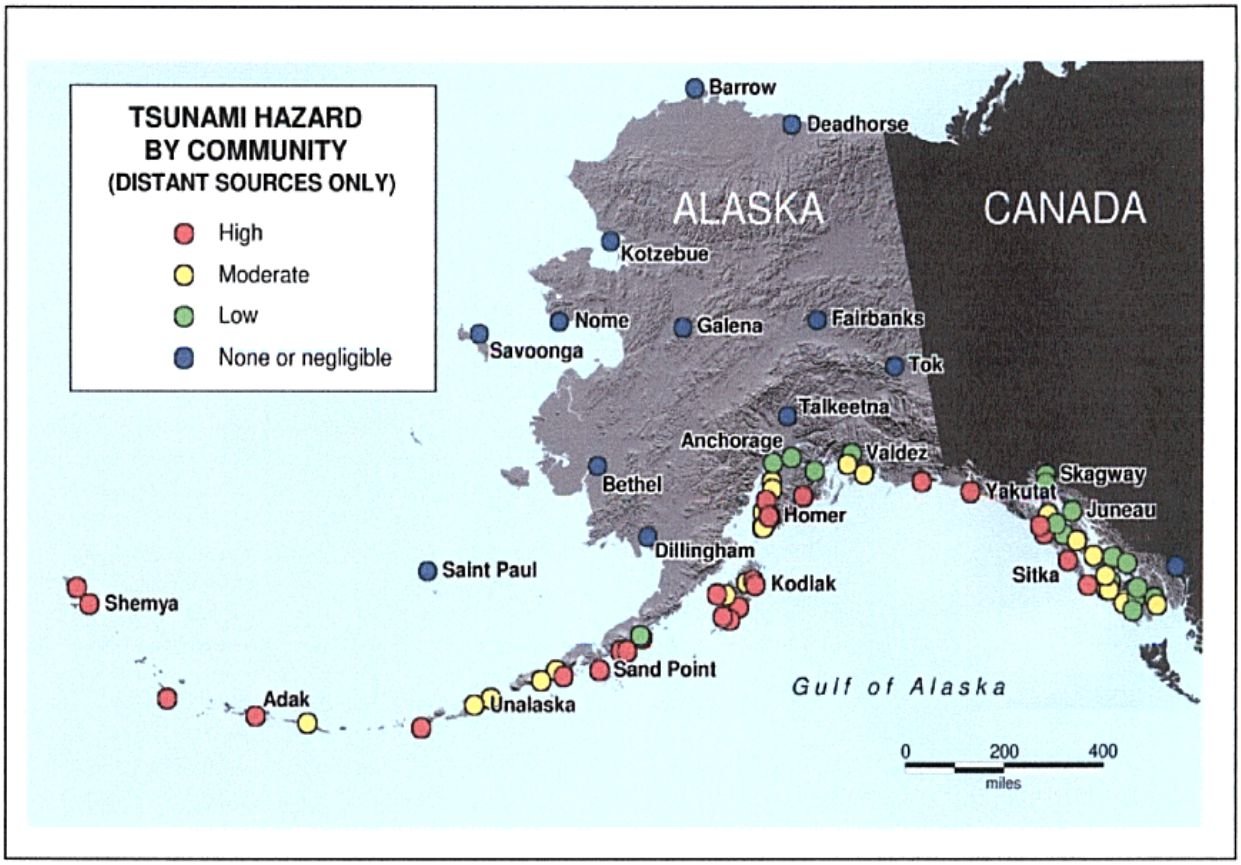
This distinction is made based on the time it takes the tsunami to leave the source disturbance and reach land.

A ***distant-source tsunami*** (Tele-tsunami) is the term for a tsunami observed at places 600 miles or more from their source of origin. Distant tsunamis are more likely to occur in the Pacific Ocean and are capable of traveling across the entire ocean in less than one day. Since distant-source tsunami make such long trips with a relatively constant speed, experts can predict their arrival with a fair degree of accuracy. This allows time for warnings and evacuation.

A ***locally generated tsunami*** is a term for a tsunami that is generated near the coast, thus the first waves may reach the shore within minutes of the event. This gives little or no time for warning or evacuation.

Local Tsunami/Seiche Hazard Identification

Figure 4. Tsunami Hazard by Community



Source: Alaska State Hazard Mitigation Plan, 2004

The Alaska Tsunami Warning Center (Palmer, Alaska) has rated the tsunami hazard to Whittier for waves generated "from some distance" (outside the Passage Canal area) as low. For tsunami waves generated within Passage Canal, a potential for wave ride-up to the 100-foot elevation is recognized (personal communication, G. Cartee, Alaska Tsunami Warning Center).

The Alaska Department of Natural Resources, Division of Geological and Geophysical Survey, has identified "areas of particular concern"(APC) in the Alaska coastal zone based, in part, on records of tsunamis which have caused significant damage. It should be understood that this recognition is not intended to be predictive of areas, which will suffer similar damage in the event of another major earthquake such as the 1964 event. In a like manner, the mechanics of submarine failure are not always well understood and thus uncertainties in degree of effect, place of occurrence, and impact of local waves generated by subaqueous slides are great (CMP, 2007).

Vulnerability Assessment

Please see Hazard Vulnerability Assessment Matrix and description at the beginning of this chapter.

Previous Occurrences

The Great Alaska Earthquake generated one of the largest seismic sea-wave trains of modern times. The 1964 earthquake involved vertical tectonic displacements beneath the sea that was followed by a seismic sea wave, which is also referred to as regional tsunami.

During the 1964 earthquake, violent seismic ground motion shook Whittier for nearly three minutes, the land subsided over eight feet, and three massive sea waves (largest exceeding 40 feet in height) struck the community. Injuries and property damage included: 13 persons killed; loss of most of the port facilities; destruction of waterfront buildings, the small boat harbor, the railcar barge slip, and several homes; and uncontrolled fire at the fuel storage facilities (Coastal Management Plan, 1986).

Tsunami/Seiche Mitigation Goals and Projects:

Tsunami Warning System

The West Coast/Alaska Tsunami Warning Center (WC/ATWC) in Palmer, Alaska issues tsunami warnings to Whittier and other areas in Alaska, British Colombia, Washington, Oregon, and California. The Palmer ATWC uses satellite telemetry, seismic and sea level data, and other information to track seismic activity and potential tsunamis in the Pacific basin. When a large earthquake occurs, geophysicist at the ATWC determine its epicenter and magnitude, and if this data meets certain known criteria for the possible generation of a tsunami, the ATWC will issue a TSUNAMI WARNING for a limited area near the epicenter.

A tsunami warning message (issued through the City of Whittier Police Dispatch) includes predicted tsunami arrival times at selected coastal areas and requires that those areas prepare for the possibility of immediate flooding from the tsunami. A TSUNAMI WATCH is issued to areas adjacent to the warning area alerting them to the possibility of a tsunami threat. Upon issuing the watch and warning threats, the ATWC geophysicist will confirm whether or not a tsunami has been generated by examining additional data, and based on this information will issue regular updates to the affected areas. In the event of a tsunami watch or warning in Whittier, City of Whittier Police Dispatch will follow the call-out procedures outlined in the Warning Annex of the Emergency Operations Plan.

A tsunami warning signal system has been installed throughout the populated areas to alert the public of a tsunami warning or watch for Whittier. These warning signals are

tested every Friday at 5:00 p.m. The tsunami-warning signal for the City of Whittier is a wavering tone for a 3 minute repeating period. This signal indicates that according to the best available information a tsunami wave is coming. Whenever this signal is sounded (except Friday at 5:00 p.m.) local residents should follow the evacuation procedures outlined in the Warning Annex of the Emergency Operations Plan.

Goal 1. Increased Public Education about Tsunamis and Seiches.

Goal 2. Tsunami Ready Community Designation.

Goal 3. Develop accurate inundation maps for the Port of Whittier.

Goal 4. Update Whittier Emergency Operations Plan.

Projects:

Continued Participation in the Tsunami Awareness Program.

Residents and visitors will be educated about the threat of tsunamis to the City of Whittier, as well as being informed about tsunami evacuation areas, routes, and safe areas. Community members will be encouraged to develop a Family Disaster Plan and an Emergency Survival Kit for their home and vehicles.

Tsunami Ready Community Designation

Participate in the NWS/WC&ATWC Tsunami Ready Program. The City of Whittier is actively pursuing "Tsunami Ready Certification". The Tsunami Ready Community program promotes tsunami hazard preparedness as an active collaboration among Federal, State, and local emergency management agencies, the public, and the NWS tsunami warning system. This collaboration supports better and more consistent tsunami awareness and mitigation efforts among communities at risk. The main goal is improvement of public safety during tsunami emergencies.

Inundation Mapping

Obtain tsunami inundation maps for the Port of Whittier. As stated earlier the National Hazard Mitigation Program (NTHMP) has identified Whittier as a participant in the tsunami inundation-mapping project, which will help refine evacuation areas. Without these maps, communities must rely on historical or estimated information for land use and evacuation route planning. Inundation maps will provide more accurate and precise information. Our goal is to ensure that emergency management has the most up to date and accurate information needed for planning and zoning.

Update Whittier Emergency Operations Plan

Update Emergency Operations Plan as mapping and other geological information becomes available. Though this is an ongoing project our next update is due to be completed in the summer of 2006.

Section 6. Avalanche and Landslides

Hazard Description and Characterization

Alaska experiences many snow avalanches every year. The exact number is undeterminable as most occur in isolated areas and go unreported. Avalanches tend to occur repeatedly in localized areas and can sheer trees, cover communities and transportation routes, destroy buildings, and cause death. Alaska leads the nation in avalanche accidents per capita.

A snow avalanche is a swift, downhill moving snow mass. The amount of damage is related to the type of avalanche, the composition and consistency of the material in the avalanche, the force, and velocity of the flow, and the avalanche path.

Avalanche Types

There are two main types of snow avalanches; loose snow and slab. Other types that occur in Alaska include: cornice collapse, ice, and slush avalanches.

Loose Snow Avalanches

Loose snow avalanches, sometimes called point releases, generally occur when a small amount of uncohesive snow slips and causes more uncohesive snow to go downhill. They occur frequently as small local cold dry 'sluffs', which remove excess snow (involving just the upper layers of snow) keeping the slopes relatively safe.

They can be large and destructive, though. For example, wet loose snow avalanches occur in the spring are very damaging. Loose snow avalanches can also trigger slab avalanches. Loose snow avalanches typically occur on slopes above 35 degrees, leaving behind an inverted V-shaped scar. They are often caused by snow overloading (common during or just after a snowstorm), vibration, or warming (triggered by rain, rising temperatures or solar radiation).

Slab Avalanches

Slab avalanches are the most dangerous types of avalanches. They happen when a mass of cohesive snow breaks away and travels down the mountainside. As it moves, the slab breaks up into smaller cohesive blocks. Slab avalanches usually require the presence of structural weaknesses within interfacing layers of the snow pack. The weakness exists when a relatively strong, cohesive snow layer overlies weaker snow or is not well bonded to the underlying layer. The weaknesses are caused by changes in the thickness and type of snow covers due to changes in temperature or multiple

snowfalls. The interface fails for several reasons. It can fail naturally by earthquakes, blizzards, temperature changes, or other seismic and climatic causes, or artificially by human activity.

When a slab is released, it accelerates, gaining speed and mass as it travels downhill. The slab is defined by fractures. The uppermost fracture delineating the top line of the slab is termed the “crown surface”, the area above that is called the crown. The slab sides are called the flanks. The lower fracture indicating the base of the slab is called the “stauchwall”. The surface the slab slides over is called the “bed surface”. Slabs can range in thickness from less than an inch to 35 feet or greater.

Cornice Collapse

A cornice is an overhanging snow mass formed when by wind blowing snow over a ridge crest or the sides of a gulley. The cornice can break off and trigger bigger snow avalanches when it hits the wind-loaded snow pillow.

Ice Fall Avalanche

Icefall avalanches result from the sudden fall of broken glacier ice down a steep slope. They can be unpredictable as it is hard to know when icefalls are imminent. Despite what some people think, they are unrelated to temperature, time of day, or other typical avalanche factors.

Slush Avalanches

Slush avalanches occur mostly in high latitudes such as in the Brooks Range. They have also occurred in the mountain areas of Alaska's Seward Peninsula and occasionally in the Talkeetna Mountains near Anchorage. Part of the reason they are more common in high-latitudes is because of the rapid onset of snowmelt in the spring. Slush avalanches can start on slopes from 5 to 40 degrees but usually not above 25 to 30. The snow pack is totally or partially water saturated. The release is associated with a bed surface that is nearly impermeable to water. It is also commonly associated with heavy rainfall or sudden intense snowmelt. Additionally, depth hoar is usually present a the base of the snow cover.

Slush avalanches can travel slowly or reach speeds over 40 miles per hour. Their depth is variable as well, ranging from 1 foot to over 50 feet deep.

Avalanche Terrain Factors

There are several factors that influence avalanche conditions, with the main ones being slope angle, slope aspect and terrain roughness. Other factors include slope shape, vegetation cover, elevation, and path history. Avalanches usually occur on slopes above 25 degrees. Below 25º, there usually is not enough stress on the snow pack to get it to slide. Above 60º, the snow tends to ‘sluff’ off and does not have the opportunity

to accumulate. Avalanches can occur outside this slope angle range, but are not as common. Slope aspect, also termed orientation, describes the direction a slope faces with respect to the wind and sun. Leeward slopes loaded by wind-transported snow are problematic because the wind-deposited snow increases the stress and enhances slab formation.

Intense direct sunlight, primarily during the spring months, can weaken and lubricate the bonds between the snow grains, weakening the snow pack. Shaded slopes are potentially more unstable because the weak layers are held for a longer time in an unstable state.

Terrain influences snow avalanches because trees, rocks, and general roughness act as anchors, holding snow in place. However, once an anchor is buried by snow, it loses its effectiveness. Anchors make avalanches less likely but do not prevent them unless the anchors are so close together that a person could not travel between them.

Avalanche Path

The local terrain features determine an avalanche's path. The path has three parts: the starting zone, the track, and the run-out zone.

The starting zone is where the snow breaks loose and starts sliding. It's generally near the top of a canyon, bowl, ridge, etc., with steep slopes between 25 and 50 degrees. Snowfall is usually significant in this area.

The track is the actual path followed by an avalanche. The track has milder slopes, between 15 and 30 degrees, but this is where the snow avalanche will reach maximum velocity and mass. Tracks can branch, creating successive runs that increase the threat, especially when multiple releases share a run-out zone.

The run-out zone is a flatter area (around 5 to 15 degrees) at the path base where the avalanche slows down, resulting in snow and debris deposition.

The impact pressure determines the amount of damage caused by a snow avalanche. The impact pressure is related to the density, volume (mass) and velocity of the avalanche. (*2004 State Hazard Plan*)

Local Hazard Identification

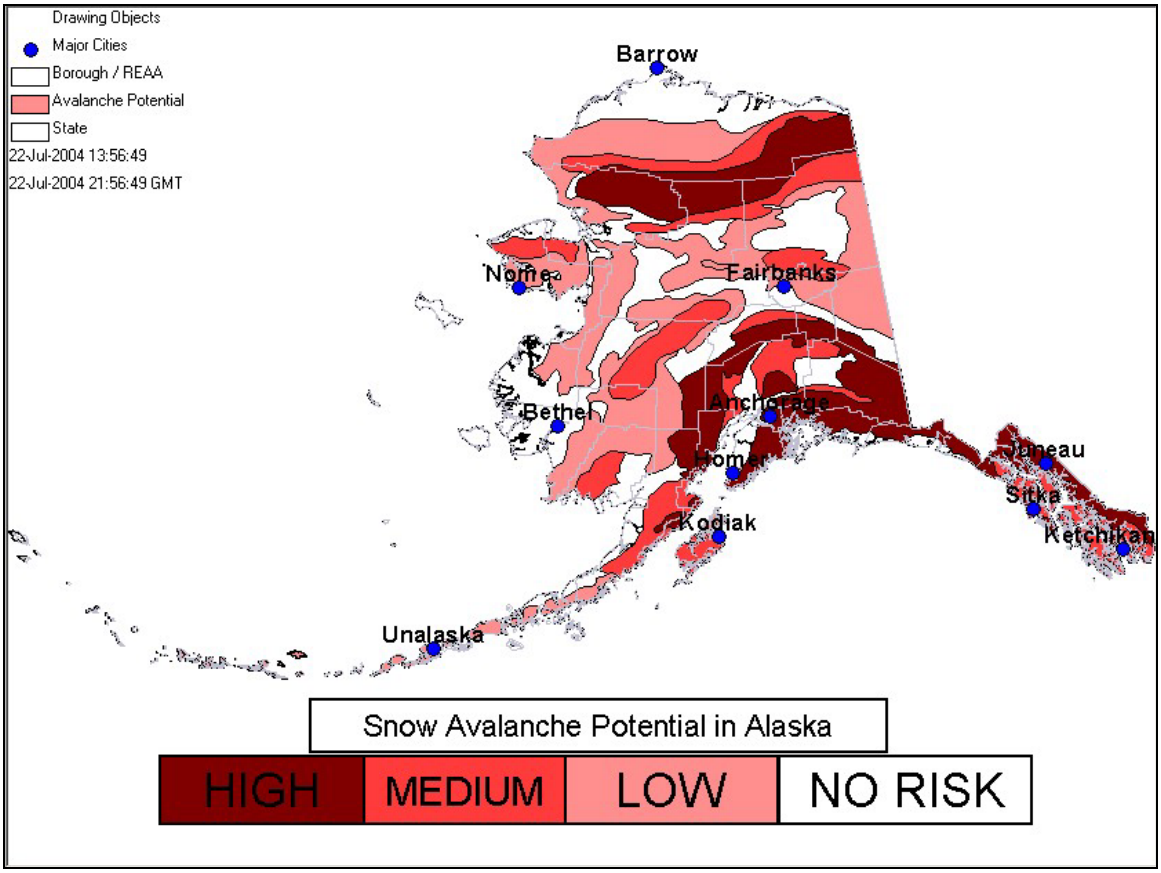
The steep topography surrounding Whittier and Passage Canal, high levels of precipitation as both rain and snow, and the thin mantle of soil overlying bedrock are cumulatively conducive to the formation of landslide areas and avalanche chutes.

Areas in which these hazards occur are generally conspicuous, due to the absence of vegetation and the accumulation of rocks and debris at the toe of the slopes or at tidewater: Areas less prone to frequent avalanches often support a dense growth of

alder which rapidly colonizes these disturbed areas. Avalanche chutes are commonly associated with the course of steep gradient drainages, which transport surface runoff during the summer and are pathways for snow slides during the winter. Areas of avalanche hazards include the steep terrain behind the West Delta and steep slopes partway out to Shotgun Cove.

The following figure depicts that Whittier faces a high avalanche threat.

Figure 5. Snow Avalanche Potential in Alaska



Source: 2004 Alaska State Hazard Plan

Vulnerability Assessment

Please see Hazard Vulnerability Assessment Matrix and description at the beginning of this chapter.

Previous Occurrences

Alaska has a long history of snow avalanches. It has been estimated that there have been over 4,500 avalanche disaster events in the past 200 years. The Palm Sunday avalanche, April 3, 1898 is considered to be the deadliest event of the Klondike gold rush. The Chilkoot Trail, near Skagway, experienced multiple slides that day, including

three with fatalities. The first fatal slide killed three people. The second one killed the entire Chilkoot Railroad and Transportation Company crew who were trying to evacuate an avalanche prone area further up the trail. The third slide occurred in about the same location as the second killing approximately 70 people who were following the trail left by the construction crew. The exact death toll is unknown because of the transient nature of those involved and inefficiencies in the identification process.

During the 1964 earthquake a large avalanche initiated by the quake fell on the moraine at the head of Passage Canal; however, it consisted largely of snow debris and did no real harm.

Late 1999 and early 2000 saw avalanches in Cordova, Valdez, Anchorage, Whittier, Cooper Landing, Moose Pass, Summit, Matanuska Susitna Valley, and Eklutna from the Central Gulf Coast Storm. The most damaging avalanche occurred in Cordova, near milepost 5.5 of the Copper River Highway and was approximately ½ mile wide. It resulted in one death, at least 10 damaged structures, and about 1 million dollars in damage.

Avalanches had struck in that spot before, including one in 1971. (*2004 State Hazards Plan*)

Avalanche/Landslides Mitigation Goals and Projects

Goal 1. Reduce Whittier's vulnerability to avalanche and landslide hazards in terms of threat to life and property.

Goal 2. Have comprehensive information regarding avalanche and landslide hazards and unstable soils throughout Whittier's developed area, including areas that will be developed in the future.

Goal 3. Increase public awareness of avalanche and landslide dangers and hazard zones.

Projects:

Prohibit new construction in avalanche zones. Construction in avalanche zones means bigger losses in the future should an avalanche occur. New construction in hazard zones should be discouraged or prohibited, even if structures are not intended for habitation.

Utilize appropriate methods of structural avalanche control. Containment structures, depending on their design, can prevent snow loads from releasing and forming an avalanche, and/or protect structures by diverting or containing avalanche debris. Such structures include snow fences, diversion/containment structures, snow nets, and reforestation.

Enact buyout of homes in avalanche paths. A buyout could be implemented to reduce the number of people living in avalanche zones. Update existing structures within avalanche zone to avalanche impact standards. Structures that already exist can be made safer with structural reinforcements.

Prohibit removal of vegetation in areas prone to landslides. Removal of vegetation from slopes can compromise the integrity of the soil and lead to landslides. Requests to remove vegetation should be handled through a permit process that involves an assessment of the area for landslide hazard.

Conduct additional study of unstable soils and avalanche or landslide prone areas, specifically those areas that have not yet been studied and might present additional dangers in the form of underwater landslides, or landslides that may cause tsunamis.

Public disclosure of risk linked to deed or title of property and require owners to notify renters of hazard prior to occupancy. Many residents, especially renters, are not aware of the locations of landslide zones or the potential dangers inherent in living within them.

Install warning signage in mapped landslide zones.

Continue to educate public about avalanche and landslide hazards. Information can be disseminated to the public through the City web site, press releases, media ads, and other methods.

Chapter 4: Mitigation Strategy

Benefit - Cost Review

This chapter of the plan outlines Whittier's overall strategy to reduce its vulnerability to the effects of the hazards studied. Currently the planning effort is limited to the hazards determined to be of the most concern; flooding, erosion, severe weather and earthquake; however the mitigation strategy will be regularly updated as additional hazard information is added and new information becomes available.

The projects listed on Table 12, Benefit and Costs Listing, were prioritized using a listing of benefits and costs review method as described in the FEMA *How-To-Guide Benefit-Cost Review in Mitigation Planning* (FEMA 386-5).

Due to monetary as well as other limitations, it is often impossible to implement all mitigation actions. Therefore, the most cost-effective actions for implementation will be pursued for funding first, not only to use resources efficiently, but also to make a realistic start toward mitigating risks.

The City of Whittier considered the following factors in prioritizing the mitigation projects. Due to the dollar value associated with both life-safety and critical facilities, the prioritization strategy represents a special emphasis on benefit-cost review because the factors of life-safety and critical facilities steered the prioritization towards projects with likely good benefit-cost ratios.

1. Extent to which benefits are maximized when compared to the costs of the projects, the Benefit Cost Ratio must be 1.0 or greater.

2. Extent the project reduces risk to life-safety.

3. Project protects critical facilities or critical city functionality.

    A. Hazard probability.

    B. Hazard severity.

Other criteria that was used to developing the benefits – costs listing depicted in Table 12:

1. Vulnerability before and after Mitigation

Number of people affected by the hazard, areawide, or specific properties.
Areas affected (acreage) by the hazard
Number of properties affected by the hazard
Loss of use
Loss of life (number of people)

Injury (number of people)

1. List of Benefits

Risk reduction (immediate or medium time frame)
Other community goals or objectives achieved
Easy to implement
Funding available
Politically or socially acceptable

2. Costs

Construction cost
Programming cost
Long time frame to implement
Public or political opposition
Adverse environmental effects

This method supports the principle of benefit-cost review by using a process that demonstrates a special emphasis on maximization of benefits over costs. Projects that demonstrate benefits over costs and that can start immediately were given the highest priority. Projects that the costs somewhat exceed immediate benefit and that can start within five years (or before the next update) were given a description of medium priority, with a timeframe of one to five years. Projects that are very costly without known benefits, probably cannot be pursued during this plan cycle, but are important to keep as an action were given the lowest priority and designated as long term.

The Whittier Planning Commission will hold another round of public meetings on the LHMP Update. The plan is subject to final Whittier City Council approval after pre-approval is obtained by DHS&EM.

After the LHMP Update has been approved, the projects must be evaluated using a Benefit-Cost Analysis (BCA) during the funding cycle for disaster mitigation funds from DHS&EM and FEMA.

A description of the BCA process follows, briefly, BCA is the method by which the future benefits of a mitigation project are determined and compared to its cost. The result is a Benefit-Cost Ratio, which is derived from a project's total net benefits divided by its total cost. The BCR is a numerical expression of the cost-effectiveness of a project. Composite BCRs of 1.0 or greater have more benefits than costs, and are therefore cost-effective.

Benefit-Cost Review vs. Benefit-Cost Analysis (FEMA 386-5) states in part:
Benefit-Cost Review for mitigation planning differs from the benefit cost analysis (BCA) used for specific projects. BCA is a method for determining the potential positive effects of a mitigation action and comparing them to the cost of the action. To assess and demonstrate the cost-effectiveness of mitigation actions, FEMA has developed a suite of BCA software, including hazard-specific modules. The analysis determines whether a mitigation project is technically cost-effective. The principle behind the BCA is that the benefit of an action is a reduction in future damages.

DMA 2000 does not require hazard mitigation plans to include BCA's for specific projects, but does require that a BCR be conducted in prioritizing projects.

Benefit-Cost Analysis

The following section is reproduced from a document prepared by FEMA, which demonstrates on how to perform a Benefit –Cost Analysis. The complete guidelines document, a benefit-cost analysis document and benefit-cost analysis technical assistance is available online http://www.fema.gov/government/grant/bca.

Facilitating BCA

Although the preparation of a BCA is a technical process, FEMA has developed software, written materials, and training that simplifies the process of preparing BCAs. FEMA has a suite of BCA software for a range of major natural hazards: earthquake, fire (wildland/urban interface fires), flood (riverine, coastal A-Zone, Coastal V-Zone), Hurricane Wind (and Typhoon), and Tornado.

Sometimes there is not enough technical data available to use the BCA software mentioned above. When this happens, or for other common, smaller-scale hazards or more localized hazards, BCAs can be done with the Frequency Damage Method (i.e., the Riverine Limited Data module), which is applicable to any natural hazard as long as a relationship can be established between how often natural hazard events occur and how much damage and losses occur as a result of the event. This approach can be used for coastal storms, windstorms, freezing, mud/landslides, severe ice storms, snow, tsunami, and volcano hazards.

Applicants and Sub-Applicants must use FEMA-approved methodologies and software to demonstrate the cost-effectiveness of their projects. This will ensure that the calculations and methods are standardized, facilitating the evaluation process. Alternative BCA software may also be used, but only if the FEMA Regional Office and FEMA Headquarters approve the software.

To assist Applicants and Sub-applicants, FEMA has prepared the *FEMA Mitigation BCA Toolkit* CD. This CD includes all of the FEMA BCA software, technical manuals, BC training courses, Data-Documentation Templates, and other supporting documentation and guidance.

The *Mitigation BCA Toolkit* CD is available free from FEMA Regional Offices or via the BC Helpline (at bchelpline@dhs.gov or toll free number at (866) 222-3580.

HAZARD EVENT (Frequency & Severity)	X	PROPERTY EXPOSED TO THE HAZARD	=	HAZARD RISK Dollars ($$)
Probability of Damaging Hazard Events		Value & Vulnerability of Property Exposed to the Hazard		Severity of the Hazard Threat to the Built Environment

The BC Helpline is also available to provide BCA software, technical manuals, and other BCA reference materials as well as to provide technical support for BCA.

For further technical assistance, Applicants or Sub-Applicants may contact their State Mitigation Office, the FEMA Regional Office, or the BC Helpline. FEMA and the BC Helpline provide technical assistance regarding the preparation of a BCA.

Benefit – Costs Review Listing Table

Table 13. Benefit-Cost Review Listing

* Priorities: High = Clearly a life/safety project, or benefits clearly exceed the cost or can be implemented 0 – 1 year.
Medium = More study required to designate as a life/safety project, or benefits may exceed the cost, or can be implemented in 1 – 5 years.
Low = More study required to designate as a life/safety project, or not known if benefits exceed the costs, or long-term project, implementation will not occur for over 5 years.

** PDMG Pre-Disaster Mitigation Grant
*** HMGP Hazard Mitigation Grant Program
****FMA Flood Mitigation Assistance (Program)

Mitigation Projects	Benefits (pros)	Costs (Cons)	Priority*
Flood/Erosion (FLD)			
FLD-1. Structure Elevation and/or Relocation	Life/Safety project Benefit to government facilities and private properties. Potential PDMG**, HMGP***, FMA****	Dollar cost unknown, >$50k 1 – 5 year implementation	Medium
FLD-2. Whittier Flood Maps	FEMA, PDMG**, HMGP*** and State DCRA funding available. USCOE facilitated project. Can be started immediately.	Expensive, at least $100,000	High
FLD-3. Public Education regarding flooding	DCRA funding may be available. Could be done yearly. Inexpensive <$1,000City	Not clear if there would be community interest or participation.	Medium
FLD-4. Pursue joining the NFIP.	Assistance available from DCRA Benefit to entire community No direct cost to City.	Not clear if there would be political support. Would entail added work for Administration.	Medium

Mitigation Projects	Benefits (pros)	Costs (Cons)	Priority*
FLD-5. Whittier Creek Levee Project	Life/Safety project Benefit to government facilities and private properties Potential PDMG	Dollar cost unknown, >$100k Engineering and feasibility study needed. Funding source not identified 1 – 5 year implementation	Medium
FLD-6. Pedestrian Tunnel - pumps are needed to remove water build up in the tunnel	Benefit to community pedestrians and visitors to Whittier. Could be implemented immediately. Inexpensive.	Cost approximately <$5,000	High
FLD-7. Railroad/Highway Bridge Improvements.	Damage reduction mitigation project Benefit to state and local governments and ARRC. Risk reduction from loss of use.	No funding source identified. Dollar cost unknown, $100k 1 – 5 year implementation	Medium
FLD-8. Retaining Wall Improvements for Triangle Area	Life/Safety issue Potential PDMG	Dollar cost unknown, >$250k Engineering study needed. Funding source not identified 5 + years implementation	Low
Severe Weather (SW)			
SW-1. Research and consider instituting the National Weather Service program of *"Storm Ready"*.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be implemented annually	Staff time	High
SW-2. Conduct special awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High

Mitigation Projects	Benefits (pros)	Costs (Cons)	Priority*
SW-3. Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High
SW-4. Encourage weather resistant building construction materials and practices.	Risk and damage reduction. Benefit to entire community.	Would require ordinance change. Potential for increased staff time. Research into feasibility necessary. Political and public support not determined. 1 – 5 year implementation	Medium
Wildland Fire (WF)			
WF-1. Continue to support the local fire department with adequate firefighting equipment and training.	Life/Safety issue Risk reduction Benefit to entire community State assistance available Annual project.	Dollar cost not determined. Staff time to research grants	High
WF-2. Promote Fire Wise building design, siting, and materials for construction.	Life/Safety issue Risk reduction Benefit to entire community, Annual project. State assistance available	Dollar cost not determined. Staff time to research grants	High
WF-3. Continue to enforce development of building codes and requirements for new construction.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be implemented annually	Staff time	High

Mitigation Projects	Benefits (pros)	Costs (Cons)	Priority*
WF-4. Enhance public awareness of potential risk to life and personal property. Encourage mitigation measures in the immediate vicinity of their property.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be implemented annually	Staff time	High
Earthquake (E)			
E-1. If funding is available, perform an engineering assessment of the earthquake vulnerability of each identified critical infrastructure owned by the City of Whittier.	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High
E-2. Identify buildings and facilities that must be able to remain operable during and following an earthquake event.	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High
E-3. Contract a structural engineering firm to assess the identified bldgs and facilities.	Benefit to entire community Risk reduction	Feasibility and need analysis needed. 1 – 5 years	Medium
Tsunami/Seiche (T/S)			
T/S-1. Participation in the Tsunami Awareness Program.	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High
T/S-2. Tsunami Ready Community Designation	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High

Mitigation Projects	Benefits (pros)	Costs (Cons)	Priority*
T/S-3. Inundation Mapping	FEMA, PDMG, HMGP and State DCRA funding available. USCOE facilitated project. 1 – 5 year project.	Expensive, at least $100,000	Medium
T/4. Update Whittier Emergency Operations Plan	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available 1 – 5 years, or as needed.	Staff time	Medium
Avalanche/Landslide (A/L)			
A/L-1. Prohibit new construction in avalanche zones.	Life/Safety issue/Risk reduction Benefit to entire community No direct cost to implement State assistance available 1 – 5 years to adopt ordinance.	Political Support not determined. Private property issues. Staff time.	Medium
A/L-2. Utilize appropriate methods of structural avalanche control.	Life/Safety issue/Risk reduction Benefit to entire community Federal or State assistance available	Engineering and structural design needed. Dollar cost not determined. Long timeframe to implement,5+ years.	Low
A/L-3. Enact buyout of homes in avalanche paths.	Life/Safety issue/Risk reduction Benefit to entire community PDMG or HMPG projects.	Political Support not determined. Private property issues. Staff time. Expensive, >$100k. Long timeframe 5+ years.	Low
A/L-4. Prohibit removal of vegetation in areas prone to landslides.	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available Could be an ongoing project	Staff time	High

Mitigation Projects	Benefits (pros)	Costs (Cons)	Priority*
A/L-5. Public disclosure of risk linked to deed or title of property and require owners to notify renters of hazard prior to occupancy.	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available Could be an ongoing project.	Political Support not determined. Private property issues. Staff time.	High
A/L-6. Install warning signage in mapped landslide zones.	Life/Safety issue/Risk reduction Benefit to entire community Federal and State assistance available	Mapped landslide zones do not exist at this time. 5+ years to implement	Low
A/L-7. Continue to educate public about avalanche and landslide hazards.	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High

Mitigation Project Plan Table

Table 14. Mitigation Project Plan

* Priorities: High = Clearly a life/safety project, or benefits clearly exceed the cost or can be implemented 0 – 1 year.
Medium = More study required to designate as a life/safety project, or benefits may exceed the cost, or can be implemented in 1 – 5 years.
Low = More study required to designate as a life/safety project, or not known if benefits exceed the costs, or long-term project, implementation will not occur for over 5 years.

** PDMG Pre-Disaster Mitigation Grant
*** HMGP Hazard Mitigation Grant Program
****FMA Flood Mitigation Assistance (Program/Grant)

Mitigation Project	Responsible Agency	Cost	Potential Funding Sources	Estimated Timeframe	Priority*
Flood/Erosion (FLD)					
Project FLD-1. Structure Elevation and/or Relocation	FEMA, USCOE DHS&EM	>$50,000	PDMG**, HMGP***	1 – 5 years	Medium
Project FLD-2. Whittier Maps	FEMA, USCOE, DCRA, DHS&EM	>$100,000	PDMG, FMA****	0 – 1 year	High
Project FLD-3. Public Education regarding flooding	City, DCRA DHS&EM	Staff Time	City, DCRA, FMA	Ongoing	Medium
Project FLD 4. Pursue joining the NFIP.	City, DCRA, FEMA	Staff Time	City, DCRA, FMA	1 – 5 years	Medium
FLD-5. Whittier Creek Levee Project	USCOE, FEMA, DHS&EM, DCRA	TBD	PDMG, HMGP, FMA	1 – 5 years	Medium
FLD-6. Pedestrian Tunnel - pumps are needed to remove water build up in the tunnel	City, DHS&EM	<$5,000	PDMG, FMA	0 – 1 year	High

Mitigation Project	Responsible Agency	Cost	Potential Funding Sources	Estimated Timeframe	Priority*
FLD-7. Railroad/Highway Bridge Improvements.	ARRC/State	TBD	State budget	1 – 5 years	Medium
FLD-8. Retaining Wall Improvements for Triangle Area	FEMA, USCOE	TBD	PDMG, HMGP, FMA	5+ years	Low
Severe Weather (SW)					
SW-1. Research and consider instituting the National Weather Service program of *"Storm Ready"*.	Local Emergency Planning Com (LEPC)	Staff time	City	0 – 1 year	High
SW-2. Conduct special awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.	LEPC	Staff time	City	Annually	High
SW-3. Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability	City	Staff time	City	Annually	High
SW-4. Encourage weather resistant building construction materials and practices.	City	Staff Time	City	<1 year	
Wildland Fire (WF)					
WF-1. Continue to support the local fire department with adequate firefighting equipment and training.	City, DHS&EM	TBD	City, PDMG	Ongoing	High
WF-2. Promote Fire Wise building design, siting, and materials for construction.	City, DHS&EM	Staff Time	City, DHS&EM	Ongoing	High

Mitigation Project	Responsible Agency	Cost	Potential Funding Sources	Estimated Timeframe	Priority*
WF-3: Continue to enforce development of building codes and requirements for new construction.	City	Staff Time	City	Ongoing	High
WF-4: Enhance public awareness of potential risk to life and personal property. Encourage mitigation measures in the immediate vicinity of their property.	City	Staff Time	City	Ongoing	High
Earthquake (E)					
E-1. If funding is available, perform an engineering assessment of the earthquake vulnerability of each identified critical infrastructure owned by the City of Whittier.	City, DHS&EM	TBD, >$50k	PDMG	0 – 1 years	High
E-2. Identify buildings and facilities that must be able to remain operable during and following an earthquake event.	City, DHS&EM	TBD, >$50k	PDMG	0 – 1 years	High
E-3. Contract a structural engineering firm to assess the identified bldgs and facilities.	City, DHS&EM	>$10,000	PDMG	1 – 5 years	Medium
Tsunami/Seiche (T/S)					
Project T/S-1: Participation in the Tsunami Awareness Program.	FEMA, City, DHS&EM	<$5k, Staff Time	PDMG	0 – 1 year	High
Project T/S-2. Tsunami Ready Community Designation	FEMA, City, DHS&EM	<$5,000 Staff Time	PDMG	0 – 1 year	High

Mitigation Project	Responsible Agency	Cost	Potential Funding Sources	Estimated Timeframe	Priority*
Project T/S-3. Inundation Mapping	FEMA, City, DHS&EM	>$100,000	PDMG, HMGP	1 – 5 years	Medium
Project T/S-4. Update Whittier Emergency Operations Plan	City, DHS&EM	Staff Time	PDMG	1 – 5 years	Medium
Avalanche/Landslide (A/L)					
Project A/L-1. Prohibit new construction in avalanche zones.	City	Staff Time	City Budget	1 – 5 years	Medium
A/L-2. Utilize appropriate methods of structural avalanche control	City, DHS&EM	>$25,000	PDMG	5+ years	Low
A/L-3. Enact buyout of homes in avalanche paths.	FEMA, City	>$100,000	PDMG, HMGP	5+ years	Low
A/L-4. Prohibit removal of vegetation in areas prone to landslides.	City	Staff Time	City	0 – 1 year	High
Project A/L-5. Public disclosure of risk linked to deed or title of property and requires owners to notify renters of hazard prior to occupancy.	City	Staff Time	City	0 – 1 year	High
Project A/L-6. Install warning signage in mapped landslide zones.	City, DHS&EM	>$25,000	PDMG	5+ years	Low
Project A/L-7. Continue to educate public about avalanche and landslide hazards.	City	Staff Time	City	0 – 1 year	High

Glossary of Terms

A-Zones

Type of zone found on all Flood Hazard Boundary Maps (FHBMs), Flood Insurance Rate Maps (FIRMs), and Flood Boundary and Floodway Maps (FBFMs).

Acquisition

Local governments can acquire lands in high hazard areas through conservation easements, purchase of development rights, or outright purchase of property.

Asset

Any manmade or natural feature that has value, including, but not limited to people; buildings; infrastructure like bridges, roads, and sewer and water systems; lifelines like electricity and communication resources; or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks.

Base Flood

A term used in the National Flood Insurance Program to indicate the minimum size of a flood. This information is used by a community as a basis for its floodplain management regulations. It is the level of a flood, which has a one-percent chance of occurring in any given year. Also known as a 100-year flood elevation or one-percent chance flood.

Base Flood Elevation (BFE)

The elevation for which there is a one-percent chance in any given year that flood water levels will equal or exceed it. The BFE is determined by statistical analysis for each local area and designated on the Flood Insurance Rate Maps. It is also known as 100-year flood elevation.

Base Floodplain

The area that has a one percent chance of flooding (being inundated by flood waters) in any given year.

Building

A structure that is walled and roofed, principally above ground and permanently affixed to a site. The term includes a manufactured home on a permanent foundation on which the wheels and axles carry no weight.

Building Code

The regulations adopted by a local governing body setting forth standards for the construction, addition, modification, and repair of buildings and

other structures for the purpose of protecting the health, safety, and general welfare of the public.

Community

Any state, area or political subdivision thereof, or any Indian tribe or tribal entity that has the authority to adopt and enforce statutes for areas within its jurisdiction.

Community Rating System (CRS)

The Community Rating System is a voluntary program that each municipality or county government can choose to participate in. The activities that are undertaken through CRS are awarded points. A community's points can earn people in their community a discount on their flood insurance premiums.

Critical Facility

Facilities that are critical to the health and welfare of the population and that are especially important during and after a hazard event. Critical facilities include, but are not limited to, shelters, hospitals, and fire stations.

Designated Floodway

The channel of a stream and that portion of the adjoining floodplain designated by a regulatory agency to be kept free of further development to provide for unobstructed passage of flood flows.

Development

Any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or of equipment or materials.

Digitize

To convert electronically points, lines, and area boundaries shown on maps into x, y coordinates (e.g., latitude and longitude, universal transverse mercator (UTM), or table coordinates) for use in computer

Disaster Mitigation Act (DMA)

DMA 2000 (public Law 106-390) is the latest legislation of 2000 (DMA 2000) to improve the planning process. It was signed into law on October 10, 2000. This new legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur.

Earthquake

A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of the earth's tectonic plates.

Elevation

The raising of a structure to place it above flood waters on an extended support structure.

Emergency Operations Plan

A document that: describes how people and property will be protected in disaster and disaster threat situations; details who is responsible for carrying out specific actions; identifies the personnel, equipment, facilities, supplies, and other resources available for use in the disaster; and outlines how all actions will be coordinated.

Erosion

The wearing away of the land surface by running water, wind, ice, or other geological agents.

Federal Disaster Declaration

The formal action by the President to make a State eligible for major disaster or emergency assistance under the Robert T. Stafford Relief and Emergency Assistance Act, Public Law 93-288, as amended. Same meaning as a Presidential Disaster Declaration

Federal Emergency Management Agency (FEMA)

A federal agency created in 1979 to provide a single point of accountability for all federal activities related to hazard mitigation, preparedness, response, and recovery.

Flood

A general and temporary condition of partial or complete inundation of water over normally dry land areas from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation or runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.

Flood Disaster Assistance

Flood disaster assistance includes development of comprehensive preparedness and recovery plans, program capabilities, and organization of Federal agencies and of State and local governments to mitigate the adverse effects of disastrous floods. It may include maximum hazard reduction, avoidance, and mitigation measures, as well policies, procedures, and eligibility criteria for Federal grant or loan assistance to State and local governments, private organizations, or individuals as the result of the major disaster.

Flood Elevation

Elevation of the water surface above an establish datum (reference mark), e.g. National Geodetic Vertical Datum of 1929, North American Datum of 1988, or Mean Sea Level.

Flood Hazard

Flood Hazard is the potential for inundation and involves the risk of life, health, property, and natural value. Two reference base are commonly used: (1) For most situations, the Base Flood is that flood which has a one-percent chance of being exceeded in any given year (also known as the 100-year flood); (2) for critical actions, an activity for which a one-percent chance of flooding would be too great, at a minimum the base flood is that flood which has a 0.2 percent chance of being exceeded in any given year (also known as the 500-year flood).

Flood Insurance Rate Map

Flood Insurance Rate Map (FIRM) means an official map of a community, on which the Administrator has delineated both the special hazard areas and the risk premium zones applicable to the community.

Flood Insurance Study

Flood Insurance Study or Flood Elevation Study means an examination, evaluation and determination of flood hazards and, if appropriate, corresponding water surface elevations, or an examination, evaluations and determination of mudslide (i.e., mudflow) and/or flood-related' erosion hazards.

Floodplain

A "floodplain" is the lowland adjacent to a river, lake, or ocean. Floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will be covered by the 10-year flood. The 100-year floodplain by the 100-year flood.

Floodplain Management

The operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to emergency preparedness plans, flood control works and floodplain management regulations.

Floodplain Management Regulations

Floodplain Management Regulations means zoning ordinances, subdivision regulations, building codes, health regulations, special purpose ordinances (such as floodplain ordinance, grading ordinance and erosion control ordinance) and other applications of police power. The term describes such state or local regulations, in any combination thereof,

which provide standards for the purpose of flood damage prevention and reduction.

Flood Zones

Zones on the Flood Insurance Rate Map (FIRM) in which a Flood Insurance Study has established the risk premium insurance rates.

Flood Zone Symbols

A - Area of special flood hazard without water surface elevations determined.
A1-30 - AE Area of special flood hazard with water surface elevations determined.
AO - Area of special flood hazard having shallow water depths and/or unpredictable flow paths between one and three feet.
A-99 - Area of special flood hazard where enough progress has been made on a protective system, such as dikes, dams, and levees, to consider it complete for insurance rating purposes.
AH - Area of special flood hazard having shallow water depths and/or unpredictable flow paths between one and three feet and with water surface elevations determined.
B - X Area of moderate flood hazard.
C - X Area of minimal hazard.
D - Area of undetermined but possible flood hazard.

Geographic Information System

A computer software application that relates physical features of the earth to a database that can be used for mapping and analysis.

Governing Body

The legislative body of a municipality that is the assembly of a borough or the council of a city.

Hazard

A source of potential danger or adverse condition. Hazards in the context of this plan will include naturally occurring events such as floods, earthquakes, tsunami, coastal storms, landslides, and wildfires that strike populated areas. A natural event is a hazard when it has the potential to harm people or property.

Hazard Event

A specific occurrence of a particular type of hazard.

Hazard Identification

The process of identifying hazards that threaten an area.

Hazard Mitigation

Any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards. (44 CFR Subpart M 206.401)

Hazard Mitigation Grant Program

The program authorized under section 404 of the Stafford Act, which may provide funding for mitigation measures identified through the evaluation of natural hazards conducted under §322 of the Disaster Mitigation Act 2000.

Hazard Profile

A description of the physical characteristics of hazards and a determination of various descriptors including magnitude, duration, frequency, probability, and extent. In most cases, a community can most easily use these descriptors when they are recorded and displayed as maps.

Hazard and Vulnerability Analysis

The identification and evaluation of all the hazards that potentially threaten a jurisdiction and analyzing them in the context of the jurisdiction to determine the degree of threat that is posed by each.

Mitigate

To cause something to become less harsh or hostile, to make less severe or painful.

Mitigation Plan

A systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in the State and includes a description of actions to minimize future vulnerability to hazards.

National Flood Insurance

The Federal program, created by an act of Congress in Program (NFIP) 1968 that makes flood insurance available in communities that enact satisfactory floodplain management regulations.

One Hundred (100)-Year

The flood elevation that has a one-percent chance of occurring in any given year. It is also known as the Base Flood.

Planning

The act or process of making or carrying out plans; the establishment of goals, policies, and procedures for a social or economic unit.

Repetitive Loss Property

A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least $1000 each have been paid within any 10-year period since 1978.

Risk

The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to a specific type of hazard event. It can also be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Riverine

Relating to, formed by, or resembling rivers (including tributaries), streams, creeks, brooks, etc.

Riverine Flooding

Flooding related to or caused by a river, stream, or tributary overflowing its banks due to excessive rainfall, snowmelt or ice.

Runoff

That portion of precipitation that is not intercepted by vegetation, absorbed by land surface, or evaporated, and thus flows overland into a depression, stream, lake, or ocean (runoff, called immediate subsurface runoff, also takes place in the upper layers of soil).

Seiche

An oscillating wave (also referred to as a seismic sea wave) in a partially or fully enclosed body of water. May be initiated by landslides, undersea landslides, long period seismic waves, wind and water waves, or a tsunami.

Seismicity

Describes the likelihood of an area being subject to earthquakes.

State Disaster Declaration

A disaster emergency shall be declared by executive order or proclamation of the Governor upon finding that a disaster has occurred or that the occurrence or the threat of a disaster is imminent. The state of disaster emergency shall continue until the governor finds that the threat or danger has passed or that the disaster has been dealt with to the extent that emergency conditions no longer exist and terminates the state of disaster emergency by executive order or proclamation.

Along with other provisions, this declaration allows the governor to utilize all available resources of the State as reasonably necessary, direct and

compel the evacuation of all or part of the population from any stricken or threatened area if necessary, prescribe routes, modes of transportation and destinations in connection with evacuation and control ingress and egress to and from disaster areas. It is required before a Presidential Disaster Declaration can be requested.

Topography

The contour of the land surface. The technique of graphically representing the exact physical features of a place or region on a map.

Tribal Government

A Federally recognized governing body of an Indian or Alaska native Tribe, band, nation, pueblo, village or community that the Secretary of the Interior acknowledges to exist as an Indian tribe under the Federally Recognized Tribe List Act of 1994, 25 U.S.C. 479a. This does not include Alaska Native corporations, the ownership of which is vested in private individuals.

Tsunami

A sea wave produced by submarine earth movement or volcanic eruption with a sudden rise or fall of a section of the earth's crust under or near the ocean. A seismic disturbance or landslide can displace the water column, creating a rise or fall in the level of the ocean above. This rise or fall in sea level is the initial formation of a tsunami wave.

Vulnerability

Describes how exposed or susceptible to damage an asset it. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. The vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power – if an electrical substation is flooded, it will affect not only the substation itself, but a number of businesses as well. Other, indirect effects can be much more widespread and damaging than direct ones.

Vulnerability Assessment

The extent of injury and damage that may result from hazard event of a given intensity in a given area. The vulnerability assessment should address impacts of hazard events on the existing and future built environment.

Watercourse

A natural or artificial channel in which a flow of water occurs either continually or intermittently.

Watershed

An area that drains to a single point. In a natural basin, this is the area contributing flow to a given place or stream.

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2. *DCRA Community Information*: http://www.dced.state.ak.us/dca/commdb/CF_COMDB.htm.

3. *Disaster Cost Index,* (2005) excerpts for Whittier, Alaska Division of Homeland Security and Emergency Management.

4. FEMA How to Guides

   - Getting Started: Building Support For Mitigation Planning (FEMA 386-1)
   - Understanding Your Risks: Identifying Hazards And Estimating Losses (FEMA 386-2)
   - Developing The Mitigation Plan: Identifying Mitigation Actions And Implementing Strategies (FEMA 386-3)
   - Bringing the Plan to Life: Implementing the Hazard Mitigation Plan (FEMA 386-4)
   - Using Benefit-Cost Review in Mitigation Planning (FEMA 386-5)

4. *Whittier Comprehensive Plan*. Prepared by and for City of Whittier. 2005.

5. *Whittier Coastal Management Plan 2007 Amendment*. Prepared by BP&D for the Whittier Coastal District, 2007.

Web Sites

American Planning Association:	http://www.planning.org
Association of State Floodplain Managers:	http://www.floods.org
Developing the Implementation Strategy:	www.pro.gov.uk
Federal Emergency Management Agency: Mitigation Planning	http://www.fema.gov/fima/planning.shtm
Community Rating System:	http://www.fema.gov/nfip/crs.htm
Flood Mitigation Assistance Program:	http://www.fema.gov/fima/planfma.shtm
Hazard Mitigation Grant Program:	http://www.fema.gov/fima/hmgp

Individual Assistance Programs:	http://www.fema.gov/rrr/inassist.shtm
Interim Final Rule:	http://www.access.gpo.govl
National Flood Insurance Program:	http://www.fema.gov/nfip
Public Assistance Program:	http://www.fema.gov/rrr/pa