All Hazards Mitigation Plan Update

Anchorage, Alaska

Prepared for:

Municipality of Anchorage
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Submitted by: Chair of the Assembly at the Request of the Mayor
Prepared by: Public Works Department
For Reading: June 28, 2011

CLERK'S OFFICE
APPROVED
Date: 6-28-11

ANCHORAGE, ALASKA
No. AR 2011-163

A RESOLUTION OF THE MUNICIPALITY OF ANCHORAGE ADOPTING THE ANCHORAGE ALL-HAZARDS MITIGATION PLAN UPDATE.

WHEREAS, Anchorage is vulnerable to a variety of natural and technological hazards that have in the past and can in the future affect public safety, damage or destroy public property, disrupt the local economy, and impact the quality of life; and

WHEREAS, the Municipality of Anchorage recognizes the economic and community benefits of having an updated community all-hazards mitigation plan with strategies to avoid or reduce damage and disruption resulting from natural and technological hazards; and

WHEREAS, the Federal Emergency Management Agency (FEMA) may grant hazard mitigation funding to Anchorage during a Federal-declared disaster; and

WHEREAS, federal law requires the Municipality of Anchorage to have an approved all-hazards mitigation plan in order to receive hazard mitigation grant funds associated with a federally-declared disaster; and

WHEREAS, the Municipality of Anchorage, with community input, has prepared the *Anchorage All-Hazards Mitigation Plan Update*; and

WHEREAS, FEMA has reviewed and approved the plan subject to adoption by the Municipality of Anchorage; now therefore

THE ANCHORAGE ASSEMBLY RESOLVES:

Section 1. That the *Anchorage All-Hazards Mitigation Plan Update* approved by FEMA is hereby adopted.

Section 2: That this resolution shall take effect immediately upon passage and approval by the Anchorage Assembly.

PASSED AND APPROVED by the Anchorage Assembly this 28th day of June, 2011.

Debbie Ossiander
Chair

ATTEST:

Barbara S. Gruenstein
Municipal Clerk

EXECUTIVE SUMMARY

The Municipality of Anchorage (MOA) is vulnerable to a wide range of natural, technological, and human/societal hazards including earthquakes, avalanches, and hazardous material accidents. These hazards can affect the safety of residents, damage or destroy public and private property, disrupt the local economy, and negatively impact the quality of life.

Typically, we cannot eliminate these hazards altogether but we can lessen their impact by undertaking hazard mitigation activities. Hazard mitigation activities are those that reduce or eliminate the long-term risk to property and human life from hazards. Examples of hazard mitigation activities include elevating a structure out of a floodplain, bolting a structure to its foundation and developing a hazard mitigation plan.

The Disaster Mitigation Act of 2000 (DMA 2000) requires that local governments have a local mitigation plan approved by the Federal Emergency Management Agency (FEMA) as a condition for receiving future FEMA mitigation funds. This hazard mitigation plan was developed to fulfill federal and state hazard mitigation planning requirements.

Development and implementation of this plan has been directed by the Anchorage Hazard Mitigation Planning Team consisting of representatives from a variety of municipal departments including the Office of Emergency Management, Project Management & Engineering, Maintenance & Operations, Anchorage School District, Anchorage Water & Wastewater Utility, Anchorage Police Department and Anchorage Fire Department.

Upon approval by FEMA, this plan will be formally adopted by the MOA Assembly.

FEMA REQUIREMENTS

According to the FEMA regulations, a mitigation plan must identify the hazards that occur in Anchorage, contain a strategy to mitigate those hazards and a method of monitoring and updating the plan.

HAZARDS IN ANCHORAGE

The hazards that may occur in Anchorage include:

Natural	Technological	Human/Societal
Earthquake	Dam Failure	Civil Disturbance
Wildfire	Energy Emergency	Terrorism
Extreme Weather	Urban Fire	Weapons of Mass Destruction (Chemical, Biological, Radiological, Nuclear, or Explosive Agents)
Flooding	Hazardous Materials Release	
Avalanche	Radiation Accident	
Ground Failure/Landslide	Transportation Accident	
Volcanic Ash Fall	Air Pollution	
Severe Erosion	Communications Failure	
Infectious Disease		
Food/Water Contamination		

The 2005 plan focused on natural hazards. In this update, the plan was expanded to include technological hazards. Human/societal hazards will be addressed in future updates of the plan.

For each hazard, there is a description of the hazard's characteristics, the location where the hazard can occur, previous occurrences of the hazard, and what is vulnerable to the hazard. Where possible, the location of the hazard area has been mapped.

MITIGATION STRATEGY

The mitigation strategy includes goals, objectives and action items that, when implemented, will make the MOA safer. The goals and objectives are:

Goal 1: Education/Coordination: Develop coordinated and proactive public policies, emergency plans and procedures, and educational programs that minimize the risk to the community from natural, technological, and human/societal hazards and disasters.
(From Anchorage 2020, LRTP, Housing & Community Development Consolidated Plan, Work Force & Economic Development Plan)

Objective 1.1 *Increase coordination among Municipal departments.*

Objective 1.2 *Educate individuals and businesses about hazards, disaster preparedness, and mitigation.*

Objective 1.3 *Increase coordination between hazard mitigation goals and existing and future plans, including the incorporation of effective hazard mitigation strategies into the Capital Improvement Program.*

Objective 1.4 *Coordinate with the Alaska Division of Insurance.*

Objective 1.5 *Educate public officials, developers, realtors, contractors, building owners, and the general public about hazard risks and building requirements.*

Objective 1.6 *Partner with Municipal Departments and other agencies serving vulnerable populations to minimize harm in the event of an emergency.*

Goal 2: Land Use/Planning: Develop an urban place that functions in harmony with its natural setting and is mindful of its natural technological and human/societal hazards.
(From Anchorage 2020, LRTP, Housing & Community Development Consolidated Plan)

Objective 2.1 *Continue to provide for floodplain management to protect residents and property from the hazards of development in floodplains.*

Objective 2.2 *Land use regulations shall include new design requirements that are responsive to Anchorage's climate and natural setting.*

Objective 2.3 *Use environmentally and conservation-friendly materials in mitigation projects whenever possible and economically feasible.*

Objective 2.4 *Adopt and enforce public policies to minimize impacts of development and enhance safe construction in high hazard areas.*

Objective 2.5 *Integrate new hazards and risk information into building codes and land use planning mechanisms.*

Goal 3: Emergency Management: Create and maintain a community where people and property are safe.
(From Anchorage 2020, LRTP, Housing & Community Development Consolidated Plan, Work Force & Economic Development Plan)

Objective 3.1 *Develop mechanisms in advance of a major emergency to cope with subsequent rebuilding and recovery phases.*

Objective 3.2 *Consider the secondary effects of disasters, such as hazardous waste and hazardous materials spills, when planning and developing mitigation projects.*

Objective 3.3 *Minimize increases in hazard vulnerability.*

Objective 3.4 *Ensure compliance with the Emergency Planning and Community Right-to-Know Act of 1986*[1].

[1] The Emergency Planning and Community Right-to-Know Act "establishes" requirements for Federal, State and local governments, Indian Tribes, and industry regarding emergency planning and "Community Right-to-Know" reporting on hazardous and toxic chemicals. The Community Right-to-Know provisions help increase the public's knowledge and access to information on chemicals at individual facilities, their uses, and releases into the

Objective 3.5 Improve road connectivity for evacuation purposes.

Objective 3.6 Promote disaster contingency planning and facility safety among institutions that provide essential services such as food, clothing, shelter, and health care.

Objective 3.7 Improve disaster warning systems.

Objective 3.8 Promote appropriate hazard mitigation of all public and privately owned property within the Municipality of Anchorage including, but not limited to, residential units, commercial structures, educational institutions, health care facilities, public gathering places, and infrastructure systems.

Objective 3.9 Promote mitigation of historic buildings.

Objective 3.10 Promote post-disaster mitigation as part of repair and recovery.

Goal 4: Protection of Public/Critical Facilities: Make MOA-owned facilities as disaster-resistant as feasible.

Objective 4.1 Encourage a structural review of new facilities.

Objective 4.2 Consider known hazards when siting new facilities and systems.

Objective 4.3 Perform structural retrofitting of existing structures.

Objective 4.4 All public facilities should have a pollution prevention plan.

Objective 4.5 Incorporate non-structural mitigation into existing buildings.

Objective 4.6 Implement mitigation programs that protect critical Municipal facilities and services and promote reliability of lifeline systems to minimize impacts from hazards, to maintain operations, and to expedite recovery in an emergency.

Objective 4.7 Create redundancies for critical networks such as water, sewer, digital data, power, and communications.

Objective 4.8 Formalize best practices for protecting systems and networks.

Goal 5: Support Wildfire Mitigation.

Objective 5.1 Support the AFD Wildfire Strategic Plan.

Objective 5.2 Promote FireWise homes through the concepts in Firewise Alaska; landscaping and vegetation management; structure protection through preparedness; building design, siting, and construction material; and homeowner awareness.

Objective 5.3 Promote vegetation management in greenbelts and parks to limit fire spread.

Objective 5.4 Maintain the wildfire risk model.

Objective 5.5 Maintain and develop additional water resources.

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environment. States and communities, working with facilities, can use the information to improve chemical safety and protect public health and the environment" (EPA, 2000).

Goal 6: Information: Ensure information is easy to access and up to date.

Objective 6.1 Convert all hazard maps to GIS format.

Objective 6.2 Identify hazards not already mapped.

Objective 6.3 Map all currently unmapped regulated flood-prone areas.

Objective 6.4 Update drainage studies.

Goal 7: Economy/Business: Maintain Anchorage's (and the State's) economic vitality

Objective 7.1 Partner with private sector, including small businesses, to promote structural and non-structural hazard mitigation as part of standard business practice.

Objective 7.2 Educate businesses about contingency planning citywide, targeting small businesses and those located in high-risk areas.

Objective 7.3 Partner with private sector to promote employee education about disaster preparedness while on the job and at home.

Objective 7.4 Minimize economic loss.

ACTION ITEMS

Action 1. Identify department responsible for coordinating hazard mitigation activities.

Action 2. Review composition of departments represented on the hazard mitigation planning committee.

Action 3. Review and update prioritization strategy (in Appendix G). Upon completion, prioritize action items.

Action 4. Hold semi-annual meetings of the hazard mitigation committee.

Action 5. The MOA shall develop a program to educate the community on the various methods of making structures and their contents more disaster-resistant, which would include workshops, literature, and public safety announcements.

Action 6. Continue the Emergency Watch Program.

Action 7. Develop a recovery plan.

Action 8. Acquire updated air photos or LiDAR information for the entire MOA

Action 9. Identify necessary warning system improvements.

Action 10. Utilize essential strategies to implement public safety policies 98, 99, and 100 of *Anchorage 2020 – Anchorage Bowl Comprehensive Plan* (9-10-02 public safety amendments; AO 2002-119). Essential strategies include emergency management plan, public safety plan, design for public safety, public facilities site selection criteria, and geohazards management.

Action 11. Continue to require new and renovated MOA buildings to go through the FM Global Engineering Review.

Action 12. Develop siting requirements for facilities built with Municipal funds.

Action 13. Replace, retrofit, or construct new fire stations as listed in the AFD's 2009-2015 Strategic Plan.

Action 14. Replace, retrofit, or construct new police stations as listed in the APD's Strategic Plan.

Action 15. Complete the Port of Anchorage expansion.

Action 16. Prepare 1 or 2 grant applications that can be submitted to DHS&EM when funds are available.

Action 17. Consider developing a building inventory database.

Action 18. Create a volcanic ash recovery plan.

Action 19. Obtain GIS data used to create the seismic landslide hazards maps from the USGS Report titled "Maps showing Seismic Landslide Hazards in Anchorage, Alaska."

Action 20. Pursue funding to seismically retrofit MOA-owned facilities that will be needed during and after a hazard.

Action 21. Install gas shut-off valves in MOA-owned public facilities used in response/recovery efforts.

Action 22. Install gas shut-off valves in all ASD public schools.

Action 23. Investigate the cost-effectiveness of making school windows shatter-resistant by installing a coating on the windows or replacing the windows.

Action 24. Repair the Port of Anchorage pilings under Terminal I as necessary.

Action 25. Continue to identify municipal fire stations, police stations, emergency facilities, and other facilities that need to be seismically retrofitted or rebuilt to current seismic standards.

Action 26. Continue and expand seismic monitoring instrumentation of buildings, other major structures, and free field sites throughout the Municipality, and establish funding support for locally based monitoring and data analysis from these instruments.

Action 27. Incorporate the action items identified in the Downtown Seismic Risk Assessment into the All-Hazards Mitigation Plan.

Action 28. Review existing zoning to determine if additional wildfire mitigation measures could be incorporated.

Action 29. Identify strategies or actions to address homeowners in the Eagle River area being denied homeowners insurance due to their wildfire risk.

Action 30. Maintain the wildfire risk model.

Action 31. Continue and maintain vegetation management.

Action 32. Develop additional water resources for wildfire response purposes.

Action 33. The MOA shall continue to apply floodplain management regulations for development in the flood plain and floodway.

Action 34. The MOA shall continue to utilize the FEMA Flood Insurance Rate Map to define the special flood hazard area, the floodway, and the floodplain.

Action 35. Annually review and amend, as appropriate, a list of potential flood mitigation projects such as culvert replacement, channel rehabilitation and property acquisition.

Action 36. Annually identify and prioritize FIRMs that need to be updated.

Action 37. Update the Flood Insurance Study.

Action 38. Address localized flooding caused by the culvert near Arctic Boulevard and Valley of the Moon Park.

Action 39. Annually review the list of drainage studies that need updating.

Action 40. Complete the Peters Creek Flooding and Erosion Control Project

Action 41. Update snow avalanche mapping for Chugiak/Eagle River, Anchorage Bowl, and Turnagain Arm/Girdwood.

Action 42. Map estimated dam inundation areas within the Municipality and evaluate alternative methods to mitigate the potential risk of a dam failure in these areas.

Action 43. Retrofit the Lake O' the Hills Dam.

Action 44. Identify all MOA facilities that need an industrial storm water pollution prevention plan (SWPPP).

Action 45. Continue to comply with Right to Know Act.

Action 46. Continue to support DHHS's air pollution monitoring, prevention, and education programs.

Action 47. Create an inventory of respite centers to be used during an air quality emergency.

Action 48. Continue the Communicable Disease Reporting and Screening program.

Action 49. Identify ways to have information on reportable infectious diseases reported to DHSS in a timelier manner.

Action 50. Continue the Tuberculosis Control Program.

Action 51. Continue the Immunization Clinic.

Action 52. Continue to support DHHS's food safety & sanitation program.

Plan Maintenance

This plan will be maintained through a series of annual evaluations, evaluations after major hazard events, and a formal re-adoption every five years. On an annual basis, the plan will be evaluated to:

- monitor progress made on plan recommendations during the previous 12 months.

- identify mitigation accomplishments in projects, programs and policies.
- update the status of mitigation projects included on the city's Capital Improvement Program list, and elsewhere.
- ensure new mitigation needs are identified.
- identify new mitigation projects.
- review project prioritization to ensure it reflects current conditions.
- modify or remove existing initiatives, and the justification for doing so.
- incorporate changes in membership to the MOA Hazard Mitigation Planning Committee.

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CHAPTER 1 - INTRODUCTION

1.1 BACKGROUND

The Municipality of Anchorage (MOA) is vulnerable to a wide range of natural, technological, and human/societal hazards including earthquakes, avalanches, and hazardous material accidents. These hazards can affect the safety of residents, damage or destroy public and private property, disrupt the local economy, and negatively impact the quality of life.

Typically, we cannot eliminate these hazards altogether, but we can lessen their impact by participating in hazard mitigation. Hazard mitigation is any action taken to reduce or eliminate the long-term risk to property and human life from hazards.

Benefits of hazard mitigation include…

- Reduced loss of life, property, essential services, critical facilities, and economic hardship
- Reduced short-term and long-term recovery and reconstruction costs
- Increased cooperation and communication within the community through the planning process
- Expedited pre-disaster and post-disaster grant funding
- Increased disaster resilience
- Improved environmental quality
- Improved economic vitality
- Improved quality of life

There is a wide variety of hazard mitigation activities available. They can be structural in nature, such as reinforcing a building's foundation or constructing a levee, or they can be non-structural, such as rezoning a flood-prone area or securing a water heater to a wall. Mitigation activities can focus on preventing the damage from occurring in the first place (by limiting development in hazard-prone areas), or by protecting against damage (strengthening existing or future development so that it is not damaged by a hazard event). More information about hazard mitigation activities can be found in Chapter 6.

One of the most effective tools to reduce vulnerability to hazards is a local hazard mitigation plan. A hazard mitigation plan identifies what hazards exist in the community and establishes goals and specific mitigation activities to be undertaken.

To encourage communities to develop hazard mitigation plans, the United States Congress passed the Disaster Mitigation Act of 2000 (DMA 2000). This Act requires local governments to have a Federal Emergency Management Agency (FEMA)-approved mitigation plan by November 2004 to remain eligible for FEMA Hazard Mitigation Grant Program (HMGP) funding and Pre-Disaster Mitigation (PDM) grants.

This plan for the MOA has been prepared in coordination with the State of Alaska (SOA) Division of Homeland Security and Emergency Management (DHS&EM) to ensure it meets all applicable DMA 2000 requirements. FEMA's Local Mitigation Plan Crosswalk, found in

Appendix A, provides a summary of federal and state minimum standards and documents where each requirement is met within the plan.

1.2 PURPOSE

The purpose of this plan is to:

- Identify hazards[1], mitigation goals and objectives, and potential mitigation projects within the MOA.
- Fulfill the DMA 2000 Local Hazard Mitigation Plan requirements.
- Serve as a qualifying document for hazard mitigation programs coordinated through the DHS&EM.

1.3 HOW THIS PLAN WILL BE USED

A hazard mitigation plan is not intended to be developed and forgotten, because it is the implementation of the plan that is essential. To be effective, the goals of the plan need to be incorporated into the everyday activities of the Municipality. As a result, this plan should be used to modify existing MOA plans and policies so that they support the Municipality's hazard mitigation goals. Issues related to emergency response are not included in this plan; these issues should be addressed in the MOA's Emergency Operations Plan (EOP).

1.4 SUMMARY OF HAZARDS IN THE MUNICIPALITY OF ANCHORAGE

According to the MOA's 2007 EOP, Anchorage is vulnerable to three main types of hazards: natural, technological, and human/societal hazards. Table 1.1 shows the types of potential hazards in the MOA. More information about natural and technological hazards can be found in Chapter 4. Human/Societal hazards will be addressed in a future update.

Table 1.1 Potential Hazards in Anchorage

Natural	Technological	Human/Societal
Earthquake	Dam Failure	Civil Disturbance
Wildfire	Energy Emergency	Terrorism
Extreme Weather	Urban Fire	Weapons of Mass Destruction (Chemical, Biological, Radiological, Nuclear, or Explosive Agents)
Flooding	Hazardous Materials Release	
Avalanche	Radiation Accident	
Ground Failure/Landslide	Transportation Accident	
Volcanic Ash Fall	Air Pollution	
Severe Erosion	Communications Failure	

[1] Hazard information is from various federal, state, public, and private sources and is for planning purposes only. The information should not be used for purposes it was not intended for including permit applications or for construction.

Infectious Disease		
Food/Water Contamination		

Source: 2007 MOA Emergency Operations Plan

Hazards can be measured in terms of their frequency and severity. Frequency is the number of times the hazard has occurred. Severity measures how bad the situation can be and is based on several factors, including the number of deaths/injuries; how long critical facilities are shut down; extent of property damage; effect on economy; and the effect on response systems. Table 1.2 shows the frequency and severity of Anchorage's potential hazards.

Table 1.2 Hazard Rating Matrix

Severity	Frequency: Has not occurred yet	Low (11-100 years)	Medium (5-10 years)	High (1-4 years)
Catastrophic (Deaths or Injuries: 50 or more)	Pandemic Infectious Disease Food/Water Contamination Terrorism Weapons of Mass Destruction	Severe Earthquake		
Critical	Radiation Release		Wildfire	Communications Failure
Limited	Energy Emergency	Civil Disturbance	Ground Failure/Landslide	Avalanche Extreme Weather Urban Fire Transportation Accident
Negligible	Dam Failure Severe Erosion		Volcano Ash Fall	Minor Infectious Disease Minor Earthquake Flooding Air Pollution Hazardous Materials Release

Catastrophic: More than 50 deaths/injuries; complete shutdown of critical facilities for 20 days or more; more than 50% property damage; severe long-term effects on economy; severely affects state/local/private sectors' capabilities to begin or sustain recovery activities; overwhelms local and state response resources.

Critical: 10-50 deaths/injuries; shutdown of critical facilities for 8-30 days; 25-50% property damage; short-term effect on economy; temporarily (24-48 hours) overwhelms response resources.

Limited: Fewer than 10 deaths/injuries; shutdown of critical facilities for 3-7 days; 10-25% property damage; temporary effect on economy; no effect on response system.

Negligible: Minor injuries; no deaths; shutdown of critical facilities for fewer than 3 days; less than 10% property damage; no effect on economy; no effect on response system.

Source: 2007 EOP

After the hazards are identified, the potential consequences of the hazard are considered. One potential consequence is property damage. Potential property damage was estimated using Geographical Information System (GIS) analysis. Table 1.3 summarizes the number of parcels and the taxable value (land and structure) that are vulnerable to each hazard. These values represent the parcels that could be vulnerable to a hazard event, the actual number and location of parcels impacted will vary depending on the size and location of the event.

Table 1.3 Vulnerability Summary

Hazard	Number of Parcels	Taxable Value
Earthquake	83,457	$28,372,800,000
Wildfire	83,457	$28,372,800,000
Extreme Weather	83,457	$28,372,800,000
Flooding	5,496	$2,382,470,000
Avalanche	80	$11,570,000
Ground Failure/Landslide	5,602	$2,560,672,600
Volcanic Ash Fall	83,457	$28,372,800,000
Severe Erosion	N/A	N/A
Infectious Disease	N/A	N/A
Food/Water Contamination	N/A	N/A
Dam Failure	N/A	N/A
Energy Emergency	83,457	$28,372,800,000
Urban Fire	1,174	$1,157,683,300
Hazardous Materials Release	83,457	$28,372,800,000
Power Failure	83,457	$28,372,800,000
Radiation Accident	83,457	$28,372,800,000
Air Pollution	83,457	$28,372,800,000
Communications Failure	83,457	$28,372,800,000

Source: MOA and HDR, 2009

Additional information about the property, infrastructure, and populations vulnerable to each hazard can be found in Chapter 4.

1.5 SCOPE

This plan is an update of the 2005 Anchorage All Hazard Mitigation Plan. Chapter 2 (Community Profile) and Chapter 3 (Asset Inventory) were updated to reflect the current conditions. Chapter 4 was expanded to include technological hazards. Other changes to Chapter 4 involved updating the natural hazards information, including the vulnerability tables. The volcano section was revised to focus more on volcanic ash, as this is the biggest

threat to the MOA compared to other aspects of a volcanic event. The tsunami section was deleted as the depth of Cook Inlet makes the tsunami risk to Anchorage extremely low (West Coast and Alaska Tsunami Warning Center, 2005). Selected ongoing and completed mitigation success stories were also included. In Chapter 5 only minor updates to the plan's goals and objectives were required. Review by MOA staff determined that most were still valid. All action items were updated to reflect their current status, and additional action items were identified. Minor modifications were also made to Chapter 6 (plan maintenance) to better document the process. In addition, modifications to the plan were made to improve readability and ease of use whenever possible. A more detailed summary of changes can be found in Appendix A.

1.6 ORGANIZATION OF THE PLAN

The plan is organized as follows:

Chapter 1

Chapter 1 is an introduction to the plan and includes the purpose, scope, and organization of the plan, as well as a description of the planning process.

Chapter 2

Chapter 2 is a community profile providing an overview of the MOA's:

- Location,
- Natural Setting,
- History,
- Demographics, and
- Economy.

Chapter 3

Chapter 3 is an asset inventory identifying what development could be vulnerable to a hazard event.

Chapter 4

Chapter 4 provides details about the hazards that can occur in Anchorage. For each hazard, there is a description of the hazard's characteristics, the location where the hazard can occur, previous occurrences of the hazard, and what is vulnerable to the hazard. Where possible, the location of the hazard area has been mapped.

Chapter 5

Chapter 5 contains the MOA's mitigation strategy, including mitigation goals, objectives, and action items. This chapter also contains information about how the mitigation measures will be implemented.

Chapter 6

This chapter is devoted to the maintenance, evaluation, and updating of the plan.

Chapter 7

This chapter lists the references used in the development of the plan.

Appendices

The appendices contain the plan's supporting documentation.

1.7 PLANNING PROCESS

The planning process was lead by the MOA's Project Management and Engineering (PM&E) department. A consulting firm, HDR Alaska, Inc., was retained to assist with the planning process and update of the plan.

The planning process began with an invitation to MOA departments to participate in the process as part of the MOA Hazard Mitigation Planning Committee. As work on the plan developed, additional departments were added to the committee. The following departments (and roles where available) were involved in the development of the updated all-hazards mitigation plan:

- PM&E
    - Watershed Manager
    - Flood Hazard Administrator
- Maintenance & Operations (M&O)
- Anchorage Fire Department (AFD)
    - Deputy Chief
    - Wildfire Program Manager
- Anchorage Police Department (APD)
- Office of Emergency Management (OEM)
    - Director
    - Special Administration Assistant
- Planning & Development Services (P&DS)
    - Senior Planner/Geotechnical Advisory Committee Liaison
- Anchorage School District (ASD)
- Mayor's Office
- Building Safety
- Department of Health and Human Services (DHHS)
- Port of Anchorage
    - Port Engineer

The all-hazards mitigation plan update process began with a MOA planning committee meeting to introduce the process, to inform representatives about the process, and to identify what would be expected from them. This meeting was held on September 3, 2009.

The next step was to review the asset inventory to determine if there were any changes to be made to the list of critical facilities. Each department was responsible for reviewing the list of facilities and identifying the hazards to which the facility was exposed.

Simultaneously, the hazard section was updated. The natural hazard section was updated and the technological hazard section was drafted based on a review of existing literature, consultation with state and federal agencies and MOA departments, and interviews with MOA staff.

The next step was to review the existing goals, objectives, and action items to identify any changes that might be necessary. First, the existing goals and objectives were reviewed by the planning committee and changes were identified. Each department was also asked to review the list of action items to identify the current status of each action item and to identify new action items for their department. Based on input from the planning committee, additional goals and objectives were then added and a list of action items was developed.

The next task was to develop a draft of the updated all-hazards mitigation plan. The draft was circulated internally within the MOA for review and comment. Once the comments were incorporated into the draft updated plan, it was made available for review by the public and other interested parties. Based on the comments provided on the public review draft, the plan was revised and submitted to DHS&EM and FEMA for approval. After FEMA approved the plan, it went the MOA Assembly for adoption. This process is summarized in Figure 1.1.

Figure 1.1 The Planning Process

1.8 PUBLIC INVOLVEMENT

To ensure there were adequate opportunities for citizen input, several techniques were used over the course of the project. To kick off the plan update process, an announcement was placed on the home page of MOA's website (www.muni.org). Email announcements were sent to a wide variety of email lists including Local Emergency Planning Committee (LEPC), American Red Cross – Alaska Chapter, Civil Air Patrol, and *Anchorage Daily News* Community Datebook. The email lists had a distribution of more than 1,000 email addresses. In addition, presentations were given to the MOA's Geotechnical Advisory Commission and the Girdwood Board of Supervisors.

Upon completion of the public review draft, the plan was placed on the MOA website for a 30-day review and comment period, and an announcement was placed on the MOA home page. An email announcement was sent out to the same email lists as before, announcing the availability of the draft plan and requesting comments.

The public involvement activities are summarized in Appendix C.

CHAPTER 2 - COMMUNITY PROFILE

This chapter is a brief community profile for Anchorage. It contains information about Anchorage's location, history, demographics, economy, and natural setting. This information provides an overview of the MOA's physical and socioeconomic characteristics. A community profile is important because it provides an overview of the community and can be used in conjunction with the asset inventory as a reference when identifying the potential impacts of a hazard event.

2.1 LOCATION

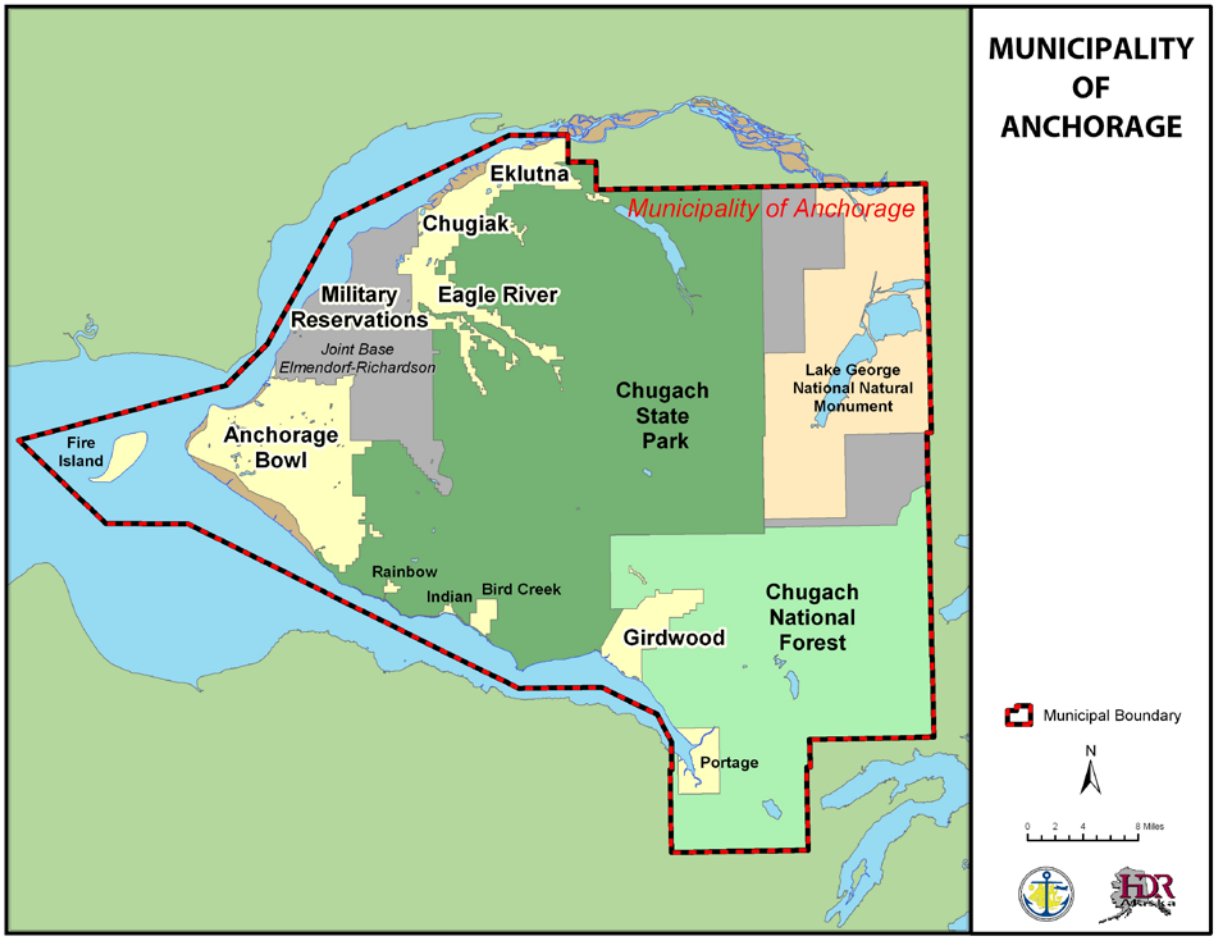
The MOA is located in Southcentral Alaska at the head of Cook Inlet. It is a 1,955-square-mile area between northern Prince William Sound and upper Cook Inlet. The area consists of mostly rugged mountainous terrain, 84 percent of which is taken up by national forest or state parklands and tidelands. Six percent is occupied by military reservations. Only the remaining 10 percent of the entire MOA is inhabited.

The Anchorage Bowl is the most urbanized area of the MOA. It occupies approximately 100 square miles, bounded by Chugach State Park, Turnagain and Knik Arms, and Joint Base Elmendorf - Richardson (JBER) (see Figure 2.1). Settlements north of the Fort Richardson Military Reservation include Eagle River, Chugiak, Birchwood, Peters Creek, and Eklutna. Most of this lowland area is between the Chugach Mountains and Knik Arm. South of the Anchorage Bowl are the Turnagain Arm communities of Girdwood, Indian, Rainbow, Bird, and Portage.

2.2 NATURAL SETTING

Anchorage has a unique natural setting, as it is an urban area surrounded by wilderness and water. Several thousand acres of municipal greenbelts and parklands link developed areas with surrounding natural open space and wildlife habitat in Chugach State Park (the second largest state park in the country), the Chugach National Forest, and the 50-square-mile Anchorage Coastal Wildlife Refuge. Anchorage has five salmon species and 52 mammal species, including wolf, bear, lynx, and moose.

Figure 2.1 Municipality of Anchorage



2.3 HISTORY[2]

The Anchorage area was originally inhabited by the Dena'ina Athabascan Indians. The Native Village of Eklutna was one of eight winter settlements and is the last occupied Dena'ina village in the MOA.

2.3.1 ANCHORAGE BOWL

Anchorage was founded in 1914 when the government established the field headquarters for the construction of the Alaska Railroad at Ship Creek. Soon after, in 1920, Anchorage was incorporated as a city.

Between 1940 and 1990, Anchorage grew in spurts. Military build-ups, post-1964 earthquake reconstruction, the Trans Alaska Pipeline construction in the mid-1970s, and the early 1980s petroleum boom each pumped up the economy and spurred rapid community growth. Often, the aftermath was recession. By the 1990s, Anchorage had a much more diverse and stable economy, resulting in modest and steady community growth.

[2] Information was taken with permission from *Anchorage 2020: Anchorage Bowl Comprehensive Plan*, the *Girdwood Area Plan*, and the *Chugiak-Eagle River Comprehensive Plan Update*.

2.3.2 CHUGIAK/EAGLE RIVER

The area north of the Anchorage Bowl saw additional development after 1900 when traders and prospectors began to arrive in the area looking for minerals and routes to the gold fields. As a result of federal involvement (home for Native Children and the Eklutna hydroelectric project), Eklutna was the dominant settlement in the area in the 1920s. However, growth occurred closer to Anchorage, with the creation of Fort Richardson Army Reservation and Elmendorf Air Force Base. Many military personnel and civilians associated with military construction jobs moved into the area. The Chugiak/Eagle River area continued to grow as people looked for a more rural lifestyle than that offered in the Anchorage Bowl. Commercial enterprises subsequently followed the population to the area.

2.3.3 GIRDWOOD

Girdwood was founded just before the turn of the century as a supply and transport center for the area's placer and lode gold mines. The mining claims operated through the 1930s, when they stopped due either to the exhaustion of lode deposits or to lawsuits and presidential orders to stop environmentally destructive hydro-mining. In the 1920s, the construction of the Alaska Railroad benefited Girdwood, because the town was a source of timber for rail ties.

Development in the Girdwood area was revived in 1949 because of the construction of the Seward Highway. Much of the growth and development in Girdwood since the 1950s has been associated with skiing and other recreational opportunities.

2.4 DEMOGRAPHICS

For most of its history, Anchorage grew as a community of immigrants and newcomers from outside the state, and Alaska Natives from rural areas within the state. For decades, a seasonal boom-bust economy and military personnel rotations made Anchorage a fast-growing town of transient residents without a strong stake in the community. Those who stayed as permanent residents lived in Anchorage by personal choice, not by chance of birth. They were rooted by their liking for the place and for the distinctive lifestyle it offered. At the time of the 1990 census, barely a quarter of Anchorage residents were born in Alaska.

In the 1990s, economic stability and military cutbacks dramatically slowed immigration and reduced annual population turnover by half. As a result, Anchorage's population has become much less transient and more committed to long-term community betterment.

The majority of the MOA's population lives in the Anchorage Bowl (see Table 2.1), although the number preferring the lifestyle offered by the smaller outlying communities is increasing. The population residing on the military bases is declining.

Table 2.1 Historic Population of the Municipality of Anchorage

Year	Anchorage Bowl	Chugiak/Eagle River	Turnagain Arm	Military Bases	Total
1980	143,351	12,858	876	17,346	174,431
1990	184,557	25,324	1,360	15,097	226,338
1998	213,919	31,654	2,108	11,117	258,798
*2006	233,844	34,139	2,243	12,587	282,813

*Source: Anchorage 2020. *Source: MOA, 2007*

Today, Anchorage's population is diverse. Racial and ethnic minorities are the fastest-growing segment of the population and account for about 28 percent of the total population. Alaska Natives make up about seven percent of the total population and are the largest minority group. There are also substantial African American, Asian/Pacific Islander, and Hispanic communities, each making up about six percent of the total population. Table 2.2 is a profile of the general demographic characteristics for the MOA from the 2008 American Community Survey.

Table 2.2 Profile of General Demographic Characteristics for the Municipality of Anchorage (2008 Estimate)

	Number	Percent
Total population	278,716	100.0
SEX AND AGE		
Male	141,854	50.9
Female	136,862	49.1
Under 5 years	21,167	7.6
5 to 9 years	20,451	7.3
10 to 14 years	19,209	6.9
15 to 19 years	20,563	7.4
20 to 24 years	21,514	7.7
25 to 34 years	42,581	15.3
35 to 44 years	41,975	15.1
45 to 54 years	44,142	15.8
55 to 59 years	16,543	5.9
60 to 64 years	11,733	4.2
65 to 74 years	11,518	4.1
75 to 84 years	5,592	2.0
85 years and over	1,728	0.6
Median age (years)	33.4	(X)
18 years and over	205,052	73.6
Male	104,106	37.4

	Number	Percent
Female	100,946	36.2
21 years and over	193,402	69.4
62 years and over	24,638	8.8
65 years and over	18,838	6.8
Male	8,415	3.0
Female	10,423	3.7
RACE		
One race	252,663	90.7
Two or more races	26,053	9.3
One Race	252,663	90.7
White	194,447	69.8
Black or African American	16,559	5.9
American Indian and Alaska Native	15,050	5.4
Asian	16,854	6.0
Asian Indian	115	0.0
Chinese	1,265	0.5
Filipino	8,491	3.0
Japanese	623	0.2
Korean	2,650	1.0
Vietnamese	623	0.2
Other Asian [1]	2,650	1.0
Native Hawaiian and Other Pacific Islander	372	0.1
Native Hawaiian	3,338	1.2
Guamanian or Chamorro	3,169	1.1
Samoan	831	0.3
Other Pacific Islander [2]	11	0.0
Some other race	1,516	0.5
Two or more races	26,053	9.3
White and Black or African American	4,898	1.8
White and American Indian and Alaska Native	11,276	4.0
White and Asian	3,501	1.3
Black or African American and American Indian and Alaska Native	951	0.3
RACE ALONE OR IN COMBINATION WITH ONE OR MORE OTHER RACES[3]		
White	217,102	77.9
Black or African American	24,774	8.9
American Indian and Alaska Native	29,781	10.7
Asian	22,383	8.0
Native Hawaiian and Other Pacific Islander	4,535	1.6
Some other race	8,345	3.0
HISPANIC OR LATINO AND RACE		
Total population	278,716	100.0
Hispanic or Latino (of any race)	22,108	7.9
Mexican	11,329	4.1
Puerto Rican	2,937	1.1

	Number	Percent
Cuban	637	0.2
Other Hispanic or Latino	7,205	2.6
Not Hispanic or Latino	256,608	92.1
White alone	183,603	65.9
Black or African American alone	15,765	5.7
American Indian and Alaska Native alone	14,502	5.2
Asian alone	16,650	6.0
Native Hawaiian and Other Pacific Islander alone	3,077	1.1
American Indian and Alaska Native alone	14,502	5.2
Asian alone	16,650	6.0
Native Hawaiian and Other Pacific Islander alone	3,077	1.1
Some other race alone	327	0.1
Two or more races	22,684	8.1
Two races including Some other race	347	0.1
Two races excluding Some other race, and Three or more races	22,337	8.0
RELATIONSHIP		
Total population	278,716	100.0
In households	273,185	98.0
Householder	103,271	37.1
Spouse	51,941	18.6
Child	83,991	30.1
Other relatives	15,029	5.4
Nonrelatives	18,953	6.8
Unmarried partner	7,431	2.7
In group quarters	5,531	2.0
HOUSEHOLDS BY TYPE		
Total households	103,271	100.0
Family households (families)	69,645	67.4
With own children under 18 years	36,022	34.9
Married-couple family	52,045	50.4
With own children under 18 years	24,587	23.8
Male householder, no wife present, family	5,911	5.7
With own children under 18 years	3,282	3.2
Female householder, no husband present	11,689	11.3
With own children under 18 years	8,153	7.9
Nonfamily households	33,626	32.6
Householder living alone	25,540	24.7
Householder 65 years and over	4,579	4.4
Households with individuals under 18 years	39,159	37.9
Households with individuals 65 years and over	13,622	13.2
Average household size	2.65	(NA)
Average family size	3.17	(NA)

	Number	Percent

(NA) Not applicable.

[1] Other Asian alone, or two or more Asian categories.

[2] Other Pacific Islander alone, or two or more Native Hawaiian and Other Pacific Islander categories.

[3] In combination with one or more other races listed. The six numbers may add to more than the total population and the six percentages may add to more than 100 percent because individuals may report more than one race.

Source: U.S. Census Bureau,2006-2008 American Community Survey 3-Year Estimates

2.4.1 FUTURE POPULATION

Population increases are expected throughout the MOA. A recent study by the Institute of Social and Economic Research (ISER) at the University of Alaska Anchorage (UAA) projects that in 2015, the MOA will have approximately 110,300 households and a population of 288,800 and (ISER, 2009). By 2035, this number is expected to increase to 136,600 households and a population of 351,300 (ISER, 2009). Most of the population growth will occur in the Anchorage Bowl. The ISER projection of total employment in the MOA is 151,400 in 2015 and will increase to 177,600 in 2035 (ISER, 2009).

Table 2.3 shows employment, population, and housing demand in Chugiak/Eagle River in 2005 and 2025. Table 2.4 shows employment, population, and housing demand in Girdwood in 1993 and 2013.

Table 2.3 Employment, Population, and Housing Demand in Chugiak/Eagle River

	2005 Estimates	2020 Forecast	2025 Forecast
Total Employment	4,405*	N/A	7,904
Total Population	34,100	46,144	52,695
Total New Housing Demand	11,864	N/A	19,164

*Source: Chugiak-Eagle River Comprehensive Plan Update, 2006; *2004 Estimate*

Table 2.4 Employment, Population, and Housing Demand in Girdwood

	1993 Estimates	2013 Forecast
Total Employment	610	2,483
Total Population	3,230	8,175
Total New Housing Demand	1,314	2,873

Source: The Girdwood Area Plan, 1995

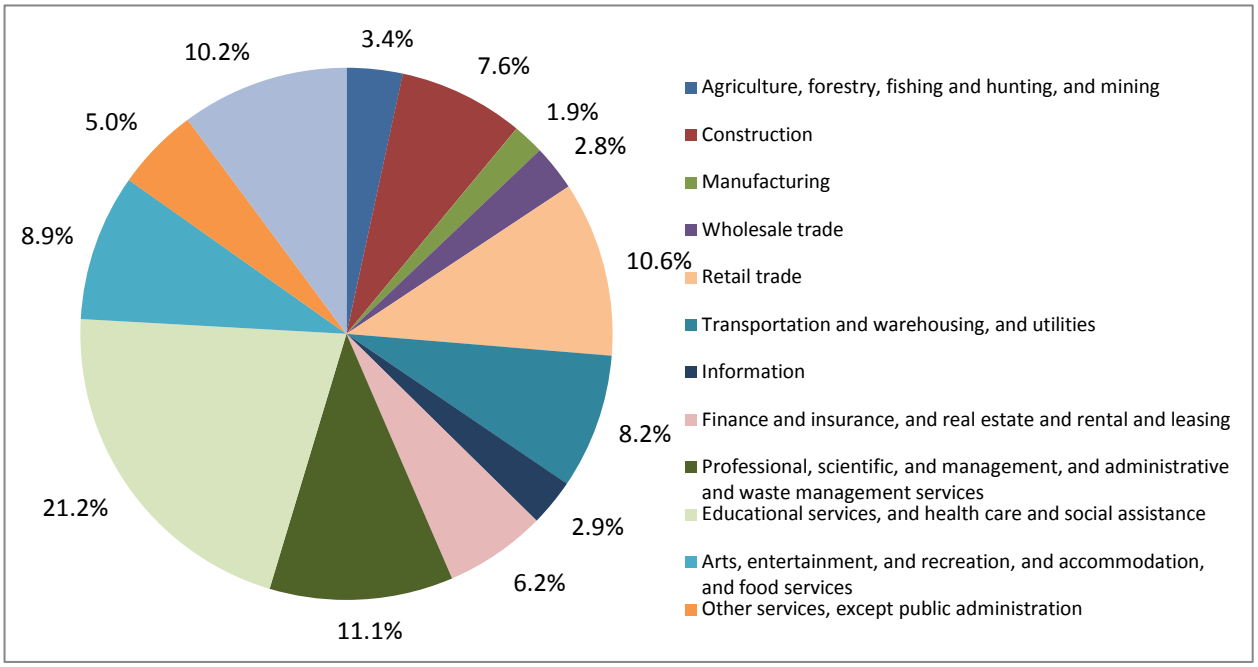
The figures from the 1995 Girdwood Area Plan, shown in Table 2.4, represent the most recent population and employment growth forecasts for Girdwood published in a municipal plan. The Planning Department, in a 2006 growth forecasting analysis, updated the Girdwood population estimate, forecasting approximately 5,900 residents in the year 2030. This number represents a slower growth rate for Girdwood than was predicted in 1995. The population of Girdwood is expected to remain at less than 1 percent of the total Municipality population.

The Planning Department is preparing updates to its long-range forecasts of population, housing, and employment in Anchorage Bowl and Girdwood. Forecasts for Chugiak-Eagle River are also being reviewed for the update to the municipal Long-Range Transportation Plan (LRTP). These updated data are anticipated to be available later in 2010.

2.5 ECONOMY

At first glance, Anchorage appears off the beaten path, lying as far north as Helsinki, Finland, and almost as far west as Honolulu, Hawaii. However, its location, together with air, road, port, and rail transportation facilities, is the city's prime economic asset. Anchorage has capitalized on its location and versatile transportation assets to build a solid economic base. The community is firmly established as the statewide trade, finance, service, transportation, and administrative center and is the distribution gateway for central, western, and northern Alaska. Federal Express and the United Postal Service have made Anchorage a major hub and other firms have expanded their air cargo operations. With over 15 billion pounds of landed cargo, Ted Stevens Anchorage International Airport (TSAIA) is one of the nation's busiest air cargo airports (Federal Aviation Administration, 2010). Figure 2.2 shows employment by industry in the MOA.

Figure 2.2 Employment by Industry: Municipality of Anchorage



Source: 2006-2008 American Community Survey

The educational services, and health care services, and social assistance industry are the largest in the MOA. The growth in the health care sector is due largely to the expansion of hospitals and more local provision of services. Residents from outside Anchorage often receive treatment in Anchorage, and Anchorage residents can stay in Anchorage for more of their medical care instead of having to go to the "Lower 48."

Tourism is a growing part of the economy (Anchorage Visitor and Convention Bureau, undated). Anchorage has received an increasing number of visitors due to the increase in conventions being held in Anchorage and visits associated with the cruise ship facilities in Seward. In 2010, Holland America brought a cruise ship directly to the Port of Anchorage and has more stops scheduled for 2011 (Anchorage Convention and Visitor Bureau, 2010).

In the Chugiak/Eagle River area, local retail growth in response to the increasing population has made retail trade the area's largest employment sector. Services are second, and the third-largest employment sector is government. Many government jobs are associated with education, although some are with the U.S. Postal Service and the Alaska Department of Corrections. Many residents commute to the Anchorage Bowl for employment (MOA, 2006)[3]. Approximately 85% of all workers in the Chugiak/Eagle River area work in the Anchorage Bowl (Department of Transportation and Public Facilities, 2009).

Girdwood's biggest economic sector is services, and the largest employer is the Alyeska Resort. The service industry has more than triple the amount of employment than the next closest category—construction. The third-largest employment sector is trade, mostly associated with tourism. There is seasonality to employment in Girdwood, as many of the jobs are associated with skiing in the winter or with the summer tourists. Many Girdwood residents who are not employed in the tourism sector commute into the Anchorage Bowl.

[3] Approximately 9,000 residents from the Matanuska-Susitna Borough also commute into the Anchorage Bowl (Department of Transportation & Public Facilities, 2009).

CHAPTER 3 – ASSET INVENTORY

Before a community can develop its mitigation strategy, it needs to know what should be protected. The purpose of this chapter is to identify what needs to be protected, including Anchorage's critical facilities. Anchorage has many other assets that should be protected, including its infrastructure and existing development. This information will be used in Chapter 4 to describe Anchorage's vulnerability to each hazard.

3.1 INFRASTRUCTURE

Infrastructure is the basic facilities and services needed for a community. Anchorage's infrastructure includes roads, water supplies, wastewater treatment plants, water and wastewater pipes, power plants, electrical lines, bridges, ports, airports, railroads, telecommunications equipment, schools, etc. The critical facilities matrix in Appendix D lists the hazards to which each facility is exposed.

3.1.1 SCHOOLS

The following is a list of public schools in Anchorage. In addition to those listed below, there are several private schools. Schools identified with an asterisk (*) after their name may be used as a shelter. School locations are shown in Figure 3.1.

Charter

- Alaska Native Cultural
- Aquarian
- Eagle Academy
- Family Partnership
- Frontier Charter School
- Highland Tech High School
- Rilke Schule
- Winterberry

Elementary

- Abbott Loop Elementary
- Airport Heights Elementary
- Alpenglow Elementary*
- Aurora Elementary
- Baxter Elementary
- Bayshore Elementary
- Bear Valley Elementary*
- Birchwood ABC
- Bowman Willard Elementary*
- Campbell Elementary*
- Chester Valley Elementary
- Chinook Elementary
- Chugach Optional Elementary
- Chugiak Elementary
- College Gate Elementary
- Creekside Park Elementary
- Denali Elementary
- Eagle River Elementary
- Fairview Elementary
- Fire Lake Elementary*
- Girdwood Elementary
- Gladys Wood Elementary
- Government Hill Elementary
- Homestead Elementary
- Huffman Elementary
- Inlet View Elementary
- Kasuun Elementary*
- Kincaid Elementary*
- Klatt Elementary*
- Lake Hood Elementary*

- Lake Otis Elementary
- Mountain View Elementary*
- Mt. Iliamna Elementary
- Mt. Spurr Elementary
- Muldoon Elementary
- North Star Elementary
- Northern Lights ABC
- Northwood Elementary
- Nunaka Valley Elementary
- O'Malley Elementary
- Ocean View Elementary*
- Orion Elementary
- Ptarmigan Elementary
- Rabbit Creek Elementary
- Ravenwood Elementary*
- Rogers Park Elementary
- Russian Jack Elementary*
- Sand Lake Elementary
- Scenic Park Elementary
- Spring Hill Elementary*
- Susitna Elementary
- Taku Elementary*
- Trailside Elementary
- Tudor Elementary
- Turnagain Elementary
- Tyson Elementary
- Ursa Major Elementary
- Ursa Minor Elementary
- Williwaw Elementary*
- Willow Crest Elementary
- Wonder Park Elementary

Middle

- Begich Middle School
- Central Middle School of Science
- Clark Middle School
- Goldenview Middle School*
- Gruening Middle School*
- Hanshew Middle School
- Mears Middle School*
- Mirror Lake Middle School*
- Romig Middle School
- Wendler Middle School

High

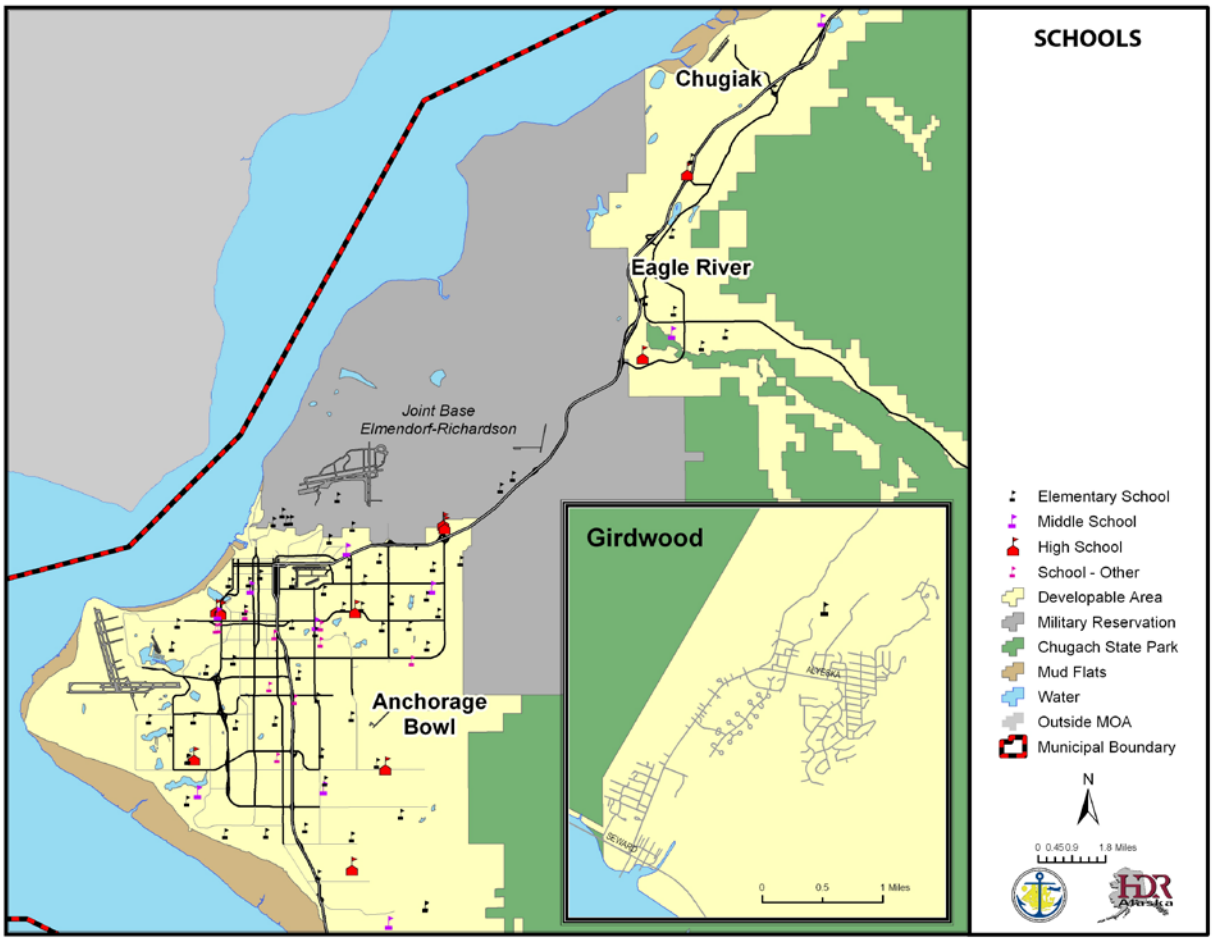
- Bartlett High School
- Chugiak High School
- Dimond High School
- Eagle River High School
- East High School
- MyHigh
- Service High School
- South Anchorage High School
- West High School

Other

- ACE/ACT Program
- Alaska State School for the Deaf and Hard of Hearing
- AVAIL Program
- Benson Secondary/SEARCH
- Booth Secondary
- Bragaw Residential
- COHO School
- Continuation Program
- Crossroads
- Debarr Residential
- Jesse Lee
- King Career Center
- Maplewood
- McKinley Heights
- McLaughlin
- My High
- North Star
- Polaris K-12
- Providence Girls
- Providence Heights
- SAVE High

- Steller Secondary
- Whaley School

Figure 3.1 Schools



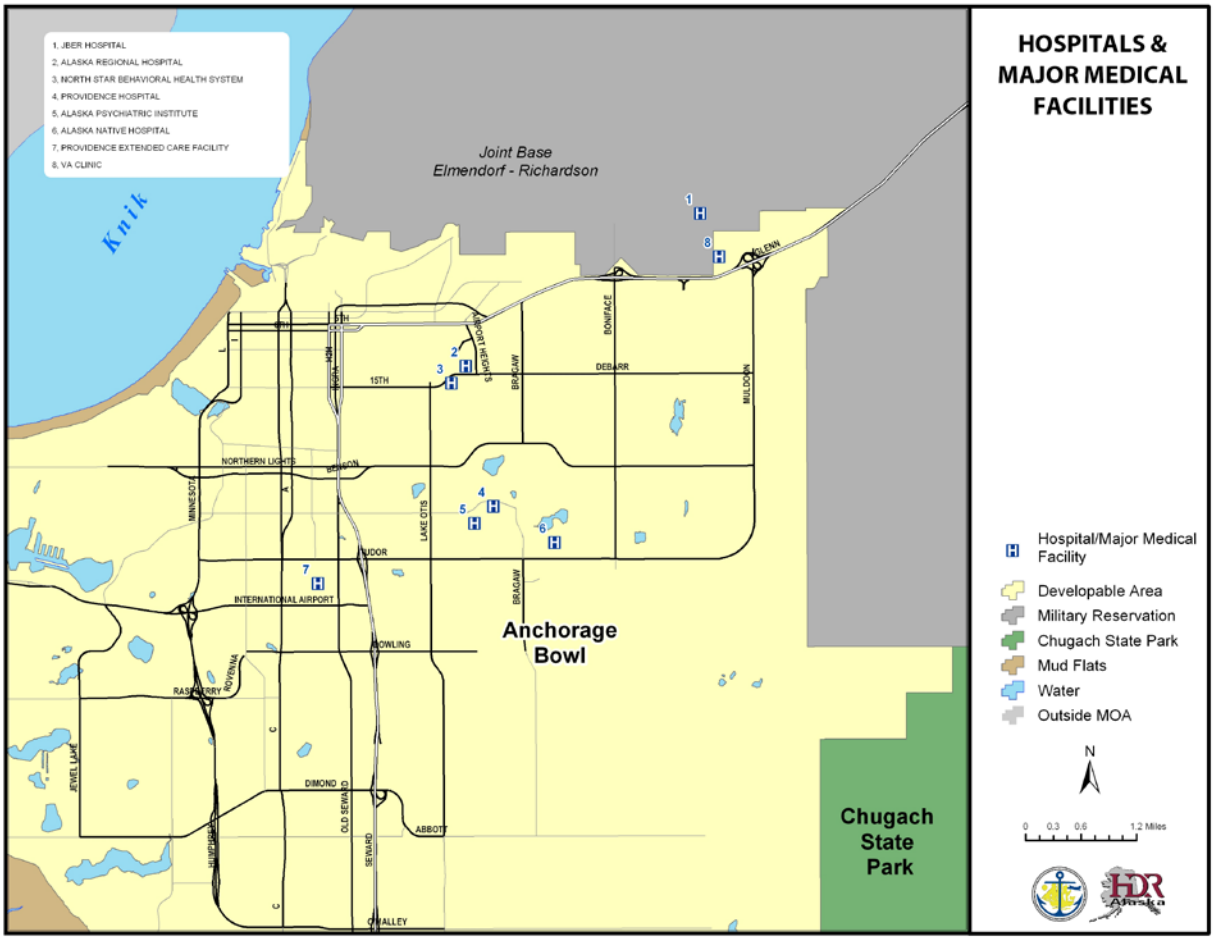
3.1.2 HOSPITALS AND MEDICAL FACILITIES

The main hospitals in Anchorage are:

- JBER Hospital
- Veterans Affairs (VA) Clinic
- Alaska Regional Hospital
- North Star Behavioral Health System
- Providence Hospital
- Alaska Psychiatric Institute
- Alaska Native Medical Center
- Providence Extended Care Facility

The locations of these facilities are shown in Figure 3.2.

Figure 3.2 Hospitals and Major Medical Facilities



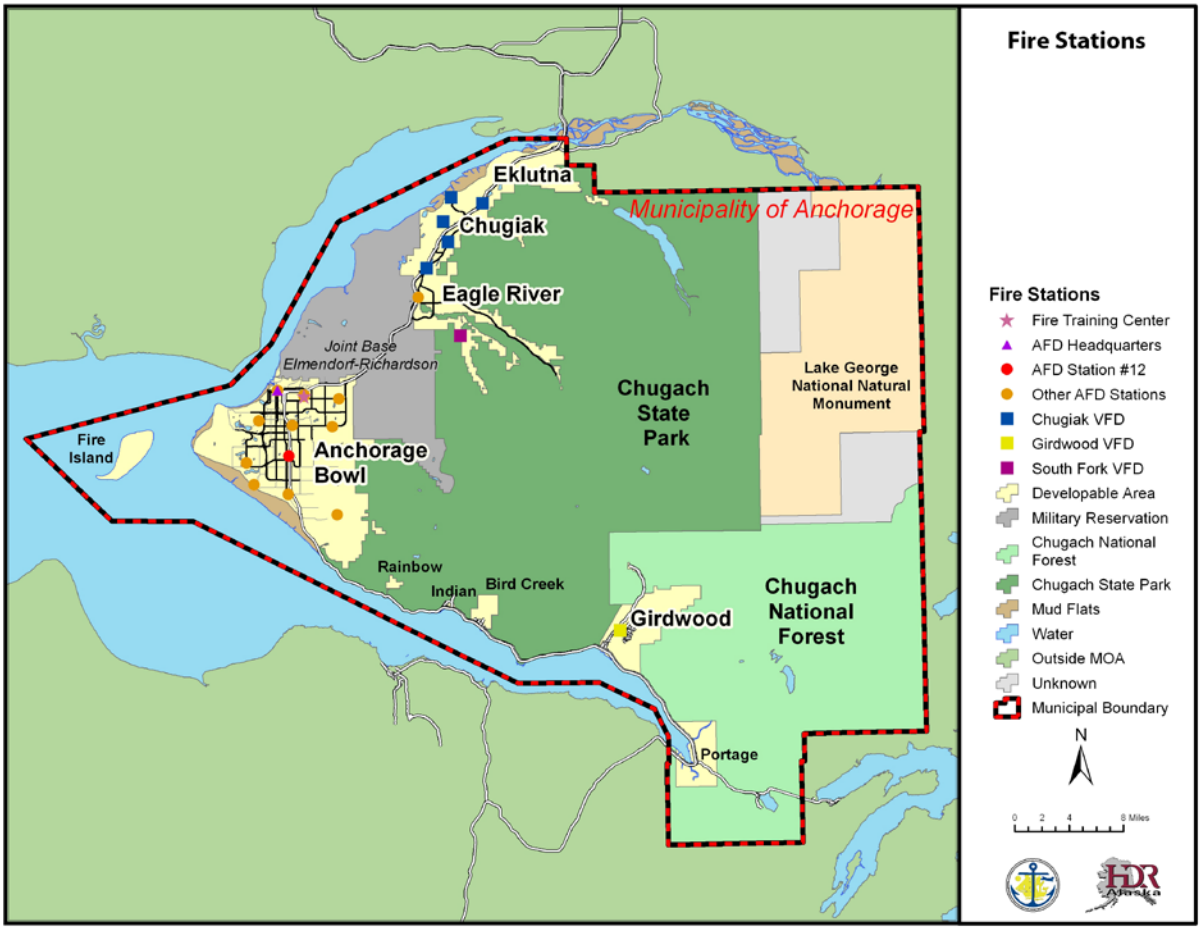
3.1.3 FIRE DEPARTMENTS

Fire protection in MOA is provided by several sources. The AFD covers most of the Anchorage Bowl. Outside the Bowl, communities rely on volunteer fire departments. The fire stations in MOA are:

- AFD Fire Station #1
- AFD Fire Station #3
- AFD Fire Station #4
- AFD Fire Station #5
- AFD Fire Station #6
- AFD Fire Station #7
- AFD Fire Station #8
- AFD Fire Station #9
- AFD Fire Station #10
- AFD Fire Station #11
- AFD Fire Station #12
- South Fork Volunteer Fire Department (also called AFD Fire Station #13)
- Chugiak Volunteer Fire Department #1
- Chugiak Volunteer Fire Department #2
- Chugiak Volunteer Fire Department #3
- Chugiak Volunteer Fire Department #4
- Chugiak Volunteer Fire Department #5
- Girdwood Volunteer Fire Department

The locations of these stations are shown in Figure 3.3.

Figure 3.3 Fire Stations



3.1.4 LAW ENFORCEMENT

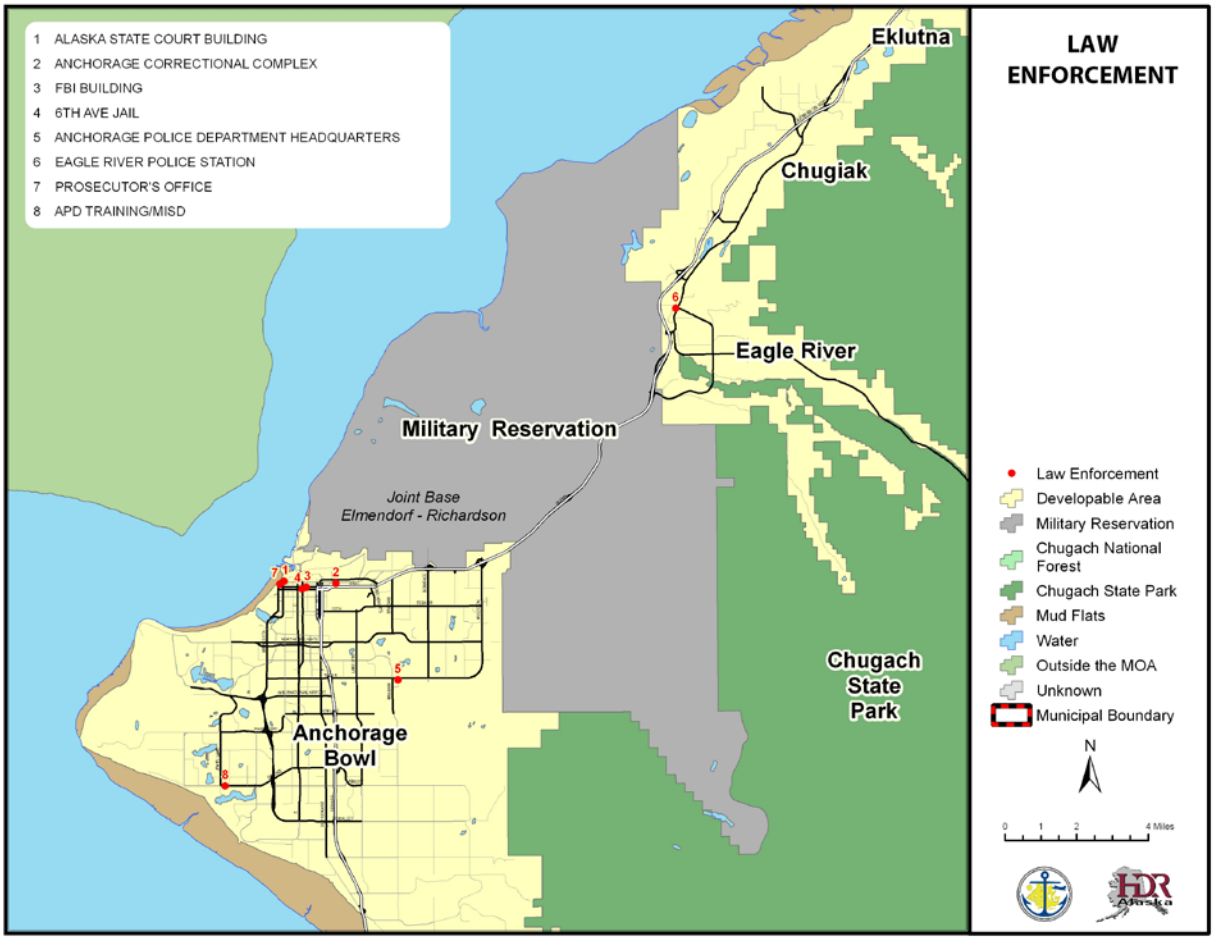
Police protection is provided by the APD and the Alaska State Troopers (AST). The Federal Bureau of Investigation (FBI) has an office in Anchorage. The law enforcement facilities in Anchorage include:

- Alaska State Troopers Headquarters
- Anchorage Police Department Headquarters
- Eagle River Police Substation[4]
- APD Training/Miscellaneous
- Alaska State Court Building
- Anchorage Correctional Complex
- FBI Building
- Prosecutor's Office

The locations of these facilities are shown in Figure 3.4.

[4] There are other APD substations in the MOA. They are not listed here because they are not staffed facilities.

Figure 3.4 Law Enforcement Facilities



3.1.5 WATER SOURCES

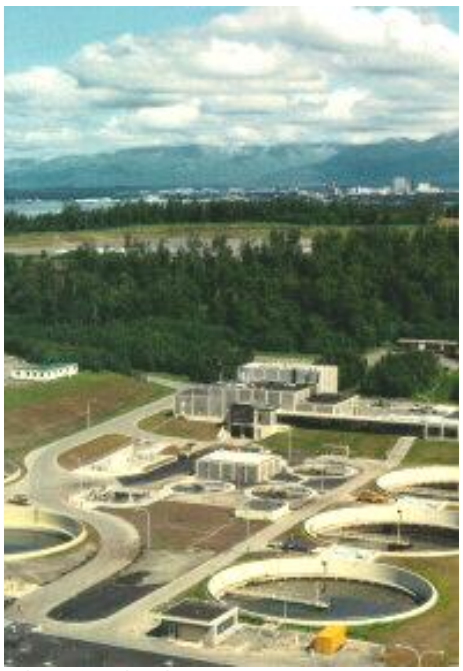
The MOA gets its potable water from three sources:

- Eklutna Water Treatment Plant (Eklutna Lake)
- Ship Creek Water Treatment Plant
- Wells

The Eagle River/Chugiak area relies on the Eklutna Water Treatment Plant; the Anchorage Bowl is supplied by the Eklutna Water Treatment Plant and the Ship Creek Water Treatment Plant, while Girdwood relies on wells.

3.1.6 WASTEWATER TREATMENT FACILITIES

The MOA has three wastewater treatment facilities:



John M. Asplund Wastewater Treatment Facility. *Image from AWWU.*

- John M. Asplund Wastewater Treatment Facility
- Eagle River Wastewater Treatment Facility
- Girdwood Wastewater Treatment Facility

3.1.7 ELECTRICITY

Within MOA, electricity is provided by three utilities:

- Municipal Light & Power (MOA-owned)
- Chugach Electric Association
- Matanuska Electric Association

These utilities operate several power plants within MOA, including:

- George M. Sullivan Plant 2
- Generation Plant One (also known as Hank Nikkels Plant 1)
- Eklutna Hydroelectric Power Plant

In addition to the power plants, each utility operates substations and electrical (transmission and distribution) lines.

3.1.8 AIRPORTS

The largest airport in MOA is TSAIA. It serves passenger and cargo travel. Merrill Field is one of the largest general aviation (limited to aircraft that weigh 12,500 pounds or less) airports in the United States. Lake Hood, Anchorage's only seaplane base, is considered to be the largest and most active seaplane base in the world (Alaska Department of Transportation & Public Facilities, 2006). However, many local lakes are used for floatplanes in the summer months. Other airports in the MOA are located in Birchwood and Girdwood.

3.1.9 RAIL

The Alaska Railroad (ARRC) is headquartered in Anchorage, near Ship Creek. The main ARRC depot is near the headquarters, and the Bill Sheffield Depot is located at the Ted Stevens Anchorage International Airport. Within MOA, the ARRC has more than 100 miles of track.

3.1.10 ROAD

Within the MOA, there are more than 1,000 lane miles[5] of road, with numerous bridges, overpasses, etc. Most of the roads in the Anchorage Bowl are in the Anchorage Roads and Drainage Service Area (ARDSA). Other parts of Anchorage are in Limited Road Service Areas. One of the largest is the Chugiak, Birchwood, Eagle River Rural Road Service Area (CBERRRSA), which has more than 350 lane miles of roadway. Some roadways, including the Seward and Glenn Highways, are owned and maintained by the State.

[5] Lane miles refer to a way of measuring a roadway based on its length and the number of lanes it has. A two lane street that is one mile long has two lane miles.

3.1.11 OTHER UTILITIES

Natural Gas Utilities

- ENSTAR

Telephone/Communication Utilities

- GCI
- Alaska Communications Systems (ACS)
- Spark Wireless
- AT&T
- Alaska Digitel
- Alaska Telecom
- Matanuska Telephone Association (MTA) Wireless

3.1.12 HISTORICAL SITES

According to the National Register Information System, the MOA has the following sites listed on the National Register of Historic Places. The State Historic Preservation Office's (SHPO) Alaska Heritage Resources Survey (AHRS) has many more sites considered historically significant within MOA. Because the AHRS has numerous entries and is not available to the general public, information about these sites is not listed here. For more information about these resources, please contact the SHPO.

Table 3.1 National Register of Historic Places

Resource Name	Address	City	Listed
A. E. C. Cottage No. 23	618 Christensen Dr.	Anchorage	1990-06-11
Alaska Engineering Commission Cottage No. 25	645 W. 3rd Ave.	Anchorage	1996-02-16
Alex, Mike, Cabin	Off AK 1	Eklutna	1982-09-08
Anchorage Cemetery	535 E. 9th Ave.	Anchorage	1993-04-26
Anchorage City Hall	524 W. 4th Ave.	Anchorage	1980-12-02
Anchorage Depot	411 W. 1st Ave.	Anchorage	1999-08-27
Anchorage Hotel Annex	330 E St.	Anchorage	1999-04-15
Anderson, Oscar, House	4th Ave. extended	Anchorage	1978-06-13
Beluga Point Site	Address Restricted	Anchorage	1978-03-30
Campus Center	University Drive	Anchorage	1979-06-22
Civil Works Residential Dwellings	786 and 800 Delaney St.	Anchorage	2004-07-21
Crow Creek Consolidated Gold Mining Company	NE of Girdwood	Girdwood	1978-09-13
David, Leopold, House	605 W. 2nd Ave.	Anchorage	1986-07-24
Eklutna Power Plant	NE of Anchorage	Anchorage	1980-06-20
Federal Building-U.S. Courthouse	601 W. 4th Ave.	Anchorage	1978-06-23

Resource Name	Address	City	Listed
Fourth Avenue Theatre (AHRS Site No. ANC-284)	630 W. 4th Ave.	Anchorage	1982-10-05
Gill, Oscar, House	1344 W. 10th Ave.	Anchorage	2001-02-02
Indian Valley Mine	Address Restricted	Indian	1989-10-25
KENI Radio Building	1777 Forest Park Dr.	Anchorage	1988-04-18
Kimball's Store	500 and 504 W. 5th Ave.	Anchorage	1986-07-24
Loussac-Sogn Building	425 D St.	Anchorage	1998-05-20
McKinley Tower Apartments	337 E. 4th Ave.	Anchorage	2008-09-12
Mt. Alyeska Roundhouse	Approx. 2 mi. W of Alyeska	Girdwood	2003-11-05
Old St. Nicholas Russian Orthodox Church	Eklutna Village Rd.	Eklutna	1972-03-24
Pioneer School House	3rd Ave. and Eagle St.	Anchorage	1980-12-03
Potter Section House	Off AK 1	Anchorage	1985-12-06
Site Summit	Off Arctic Valley Rd., 12.5 mi. E of Anchorage	Anchorage	1996-07-11
Spring Creek Lodge	18939 Old Glenn Hwy.	Chugiak	2001-09-09
Wendler Building[6]	400 D St.	Anchorage	1988-06-24

Source: National Register of Historic Places

3.2 EXISTING DEVELOPMENT IN MOA

Anchorage's history has shaped its development patterns, making the Anchorage Bowl the dominant area locale in terms of developed areas in the region. Table 3.2 shows the number of parcels (by land use) in the Anchorage Bowl, the Turnagain Arm area (including Girdwood), and the Chugiak/Eagle River area. Table 3.3 shows the taxable value of the land and buildings in the MOA by land use. The number of parcels was used as a substitute for the number of structures, as it is assumed that the non-vacant parcels include existing structures (which determine the land use).

Table 3.2 Number of Parcels by Land Use

Type of Parcels	In Turnagain Communities	In Chugiak/Eagle River	In Anchorage Bowl
Residential		10,137	53,600
Commercial		195	3,370
Industrial		109	1,642
Institutional		129	594
Parks, Open Space, and		354	1,204

[6] The Wendler Building does not appear on the National Park Service's National Register of Historic Places Database. However, the weekly register listing for 1988 states this property was entered in the National Register (National Park Service, 1998).

Recreation			
Transportation-Related		137	584
Other Land Uses		97	95
Vacant Land		2,093	4,750
Unidentified	1,965	695	1,825
Total	**1,965**	**13,946**	**67,664**

Source: MOA GIS, 2009

Table 3.3 Total Parcels and Taxable Value for MOA

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	63,711	$5,766,405,700	$13,213,579,200	$18,979,984,900
Commercial	3,546	$1,690,127,200	$2,862,701,850	$4,552,829,050
Industrial	1,674	$502,003,600	$573,493,400	$1,075,497,000
Institutional	717	$175,304,800	$433,943,800	$609,248,600
Parks	1,174	$17,570,700	$11,216,800	$28,787,500
Transportation	430	$21,429,600	$229,500	$21,659,100
Other	869	$13,316,500	$300,200	$13,616,700
Vacant	6,843	$818,046,700	$434,800,700	$1,252,847,400
Unidentified	4,493	$721,943,328	$1,116,386,372	$1,838,329,700
Total	83,457	$9,726,148,128	$18,646,651,822	$28,372,799,950

Source: MOA GIS, 2009

3.3 FUTURE DEVELOPMENT

Like many areas of the United States, Anchorage is expecting increased growth and development in the future. As shown in Tables 3.2 and 3.3, there are more than 5,000 parcels that could still be developed. In addition, the other parcels may be redeveloped. These activities may increase Anchorage's vulnerability to hazardous events in the future.

Anchorage 2020, the Chugiak Eagle River Comprehensive Plan Update, the Girdwood Area Plan, and numerous other plans all describe future development in the MOA. A few items are highlighted below because they could have a strong influence in the MOA's future vulnerability. It is important to know and track where and what will be developed in the future to plan for its protection and to mitigate hazards during development.

3.3.1 HOUSING

According to Anchorage 2020, housing increases in the Anchorage Bowl will be fairly consistent across all parts of the bowl. The type of new housing varies, although most of the new housing in Northwest (95 percent), Northeast (93 percent), and Central (79 percent), will be multi-family units. In these three areas, almost all the small amount of other new housing will be single-family urban. In Southwest, most of the housing will be single-family urban (68 percent) with an additional 30 percent being multi-family. In the Southeast, most new housing will be single-family urban (43 percent). Multi-family units will make up 30 percent, and the remaining 27 percent will be single-family rural.

3.3.2 INFRASTRUCTURE

It is expected that MOA will experience more utility development, including:

- Electrical infrastructure improvements and a new electrical substation to serve southeast Anchorage. The location for the substation has yet to be identified. For more information on potential improvements, please contact Chugach Electric or Municipal Light & Power.
- New water and sewer lines (locations to be determined during the Water Master Plan and the Wastewater Master Plan updates). For more details about this process, please visit http://www.awwu.biz/website/2005_WaterMasterPlan/2005WaterMasterPlan.htm and http://www.awwu.biz/website/2006_WastewaterMasterPlan/2006_WasteWaterMP_Intro.htm , respectively.

3.3.3 TRANSPORTATION

There are several major transportation projects under consideration in the MOA, including improvements to the New Seward Highway and the Glenn Highway, a crossing of Knik Arm, the extension of Dowling Road from Old Seward Highway, and the development of a Ship Creek Intermodal Facility. For more information about possible new transportation facilities, please see the Anchorage Bowl 2025 Long Range Transportation Plan (LRTP) with 2027 Revisions.

3.3.4 OTHER PLANS

In addition to the plans mentioned above, Table 3.4 lists several plans that help guide where future development in the MOA will occur.

Table 3.4 MOA Publications, Studies, and Adopted Plans

Name of Plan	Year of Adoption or Publication
Downtown Anchorage Comprehensive Plan	2007
Eagle River Central Business District (CBD) Revitalization Plan	2003
Hillside District Plan	2010
Midtown District Plan	In Progress
Turnagain Arm Comprehensive Plan	2009
Anchorage Industrial Land Assessment	2009
University and Medical District Framework Master Plan	2003
Capital Improvement Program 2008-2013	
Chugiak-Eagle River 2027 Long Range Transportation Plan	2007
Non-Motorized Transportation Plan (consists of the following 3 elements) Anchorage Bicycle Plan	March 2010

Anchorage Pedestrian Plan	October 2007
Areawide Trails Plan	In Progress

CHAPTER 4 - HAZARDS IN THE MUNICIPALITY OF ANCHORAGE

One of the requirements of a hazard mitigation plan is that it describes the hazards that affect a jurisdiction. This chapter profiles the hazards that occur in the MOA by identifying each hazard's location, extent, previous occurrences, and the likelihood of future events.

Hazard mitigation plans are also required to summarize the vulnerability to the hazards. The vulnerability information was calculated by identifying the parcels that intersect each of the hazard zones. Some notes about this method are:

- Not all the hazard GIS layers used to perform this analysis cover the entire MOA. Most include only a portion of the Municipality. (Parcels could be at risk but the risk area has not been mapped and included in the GIS yet.)
- The taxable value is based on 2008 MOA tax assessor data.
- Using the taxable value underestimates the vulnerability because:
    - Some parcels, such as schools, religious facilities, and military land, are not taxed and therefore do not have a taxable value.
    - According to the MOA Tax Assessor's office, the there are 1,950 tax exempt parcels in the MOA and have an exempt land value of $189,863,500 and an exempt building value of $159,420,268 for a total of $349,283,768. The values under represent the value of these buildings. As these parcels are tax exempt, the tax assessor does not have the resources to develop accurate values on an annual basis.
    - Some parcels are treated as economic units (separate parcels that are treated as one for tax purposes) and do not have taxable values listed.
    - Taxable value does not consider the value of the contents.
    - The taxable value is the sum of the land and building taxable values. This is different from the total taxable value listed in the tax assessor's file because tax exemptions have been applied to those totals.
    - If a parcel was in multiple risk areas, the entire parcel was considered to be in the highest risk area (i.e., no partial parcels). However, depending on how much of the parcel is in the hazard zone and site specific factors, existing or future structures may not be at risk.
    - The number of unidentified parcels could be wrong due to data issues (i.e., extra polygons in the GIS file, not all tax records associated with a parcel, etc.).

It is important to remember that the information listed in this chapter is meant to provide an overview of each hazard. While based on the best available information, the information is for planning purposes and should not be used for purposes which it was not intended such as securing permits, or for construction.

As part of this update, MOA departments, along with several state and federal agencies, were contacted to find out if new information was available. When available, the additional information was incorporated into the plan. The tables showing the number of parcels vulnerable to each hazard have been updated. The section on volcanoes was revised to focus more on volcanic ash as this is the biggest threat to the MOA compared to other aspects of a volcanic event. Tsunami section was removed. The technological hazards section (Section 4.2) was also added to this update. Throughout this chapter, text boxes highlighting completed or on-going mitigation success stories have also been included.

After consultation with the National Weather Service (NWS), winter storms were removed from the extreme weather section because it is too generic. The types of extreme weather events experienced in the MOA are better reflected by the other types of events in this section.

Future plan updates should continue to make the hazard descriptions and vulnerabilities more MOA-specific.

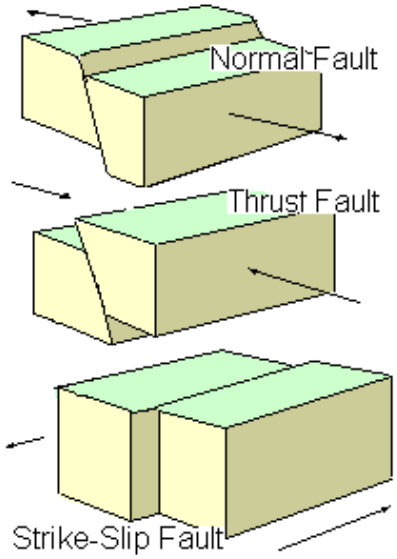
4.1 NATURAL HAZARDS

Natural hazards are unexpected or uncontrollable events caused by nature, such as earthquakes, floods, or volcanic eruptions. In some cases, although rare, they can be human-triggered, such as a human-triggered avalanche. The impacts of a natural hazard can also be worse based on human development and changes to the landscape.

The majority of the following information describing these hazards is from the October 2010 State Hazard Mitigation Plan and is used by permission from the DHS&EM.

4.1.1 EARTHQUAKES

An earthquake is the shaking of the earth's surface. Most large earthquakes are caused by the sudden release of accumulated stresses as the Earth's crustal plates move against each other. Other earthquakes occur along faults that lie within these plates. The dangers associated with earthquakes include ground shaking, ground failure, and surface faulting as well as secondary hazards, such as avalanches or landslides.



Three types of faults.
Image courtesy of USGS.

Ground shaking is responsible for most of the damage. Ground shaking is the result of the three classes of seismic waves generated by an earthquake. Primary waves (P waves) are the first waves, often felt as a sharp jolt. Secondary, or shear, waves (S 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 waves, but they can carry the bulk of the energy in a large earthquake.

The intensity of the shaking is dependent on many factors, including the magnitude of the quake, the geology of the area, distance from the epicenter, building design, and local construction practices. The amount of damage to buildings depends on how the specific characteristics of each incoming wave interact with the buildings' height, shape, and construction materials.

Surface faulting is the differential movement of the two sides of a fault. There are three general types of faulting: strike-slip, normal, and thrust (reverse). 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 (or reverse) faults have one side moving up and over the fault relative to the other side.

Secondary Hazards

Secondary effects from an earthquake include seismically induced ground failure, snow avalanches, tsunamis, landslides, and infrastructure failure. These will be discussed in greater detail in other sections of the plan.

Richter Scale
On the Richter scale, magnitude is expressed in whole numbers and decimals. A 5.0 earthquake is a moderate event; a 6.0 characterizes a strong event; a 7.0 is a major earthquake; and a great earthquake exceeds 8.0. The scale is logarithmic and open-ended.

Magnitude and Intensity

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. Each earthquake will have only one magnitude but may have many intensities. Earthquake magnitude is usually reported according to the standard Richter scale (M_L) for small to moderate earthquakes. Large earthquakes are reported according to the moment-magnitude scale (M_W) 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 (MMI). This scale has 12 categories ranging from not felt to total

Peak Ground Acceleration
Peak ground acceleration (PGA) in percent of g with 10% probability of exceedance in 50 years represents the ground motions that can be reasonably expected in a 50-year period. The acceleration values are the *peak* or maximum values expected during the earthquake. The "10% probability of exceedance in 50 years" refers to the fact that earthquakes are somewhat random in occurrence. One cannot predict exactly whether an earthquake of a given size will or will not occur in the next 50 years. PGA maps with a 10% probability of exceedance in 50 years means there is a 10% chance (1 chance in 10) that the ground acceleration values shown on the map will be exceeded in a 50-year time period.

destruction. Different MMI 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 in Anchorage are a major factor in determining an earthquake's intensity, as areas with unconsolidated fill, liquefiable soils, or that are susceptible to lateral spread will sustain more damage than areas with shallow bedrock. Seismic landslide hazard is a key local issue and is discussed in more detail in see section 4.1.6 Landslide/Ground Failure.

Location

The entire MOA faces a significant threat from earthquakes. Earthquakes that result from the Pacific Plate subducting beneath the North American Plate are more likely to impact the MOA (Haeussler, 2010).

The MOA is currently conducting a seismic risk assessment for the downtown area. When complete, this study should be used to supplement the information presented in this plan.

Likelihood of Occurrence

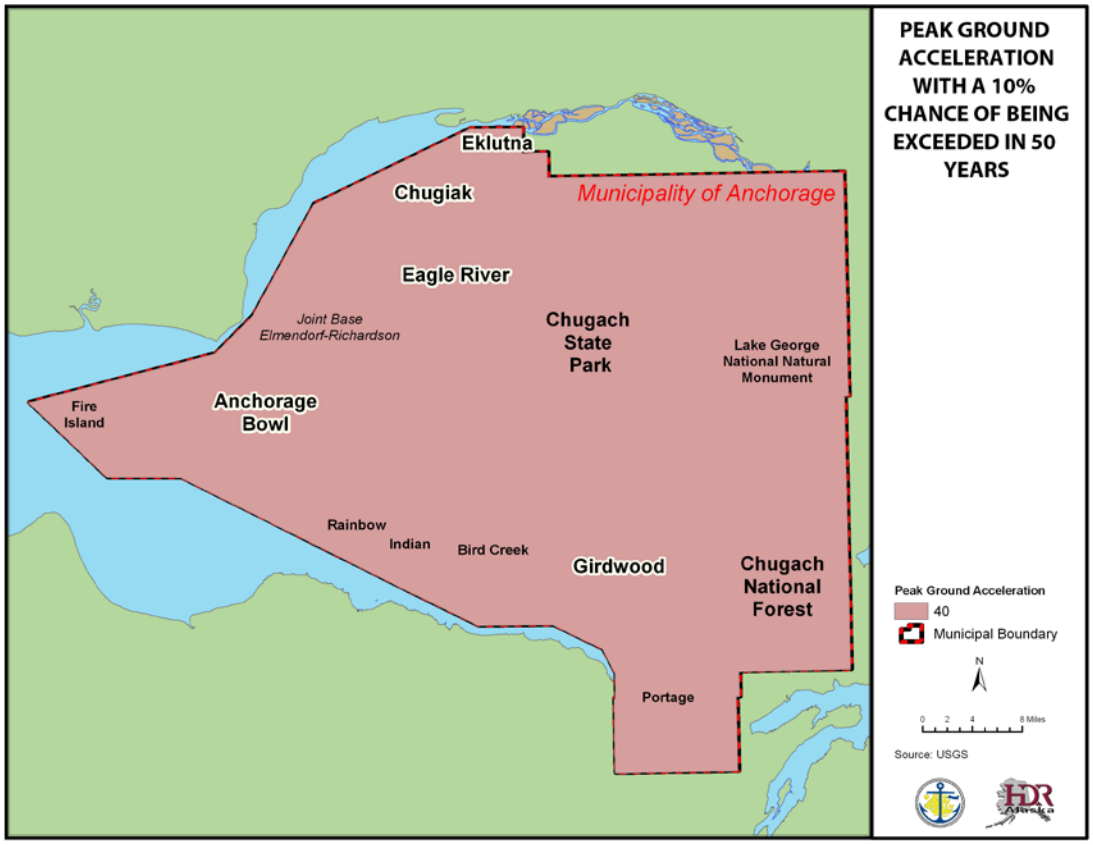
While it is impossible to know when the next earthquake will affect MOA, given the MOA's seismic history, earthquakes will continue to occur. An event similar to the 1964 earthquake usually occurs every 300 to 900 years so the MOA is less likely to experience one in the near future. (Haeussler, 2010). However, given Anchorage's geologic situation, a dangerous damaging earthquake with a lower magnitude of 7 or 8 could occur at any time in the MOA.

Figure 4.1 shows the peak ground acceleration with a 10% probability of exceedance in 50 years; that represents events that are reasonably expected to occur. Peak ground acceleration (PGA) is one method to measure the strength of ground movements. The MOA has a peak ground acceleration of 40%g (Westin et al, 2007). This can be considered a high seismic hazard.

ASD – Gas Shutoff Valve Installation

The Anchorage School District has installed seismic gas shut-off values in all 22 schools than could be used as shelters. These devices automatically shut off gas to the school in the event of a major seismic event reducing the possibility of a post-earthquake fire.

Figure 4.1 Peak Ground Acceleration with a 10% Chance of Being Exceeded in 50 Years



Historic Events

1964 Good Friday Earthquake

The best known earthquake in Anchorage's history is the March 27, 1964 Good Friday earthquake. This 9.2 M_W earthquake is the largest ever recorded in North America and the second largest in the world. The shaking lasted between four and five minutes and was felt over an area of approximately seven million square miles.

The Government Hill School after the 1964 Good Friday earthquake.

Image courtesy of USGS.

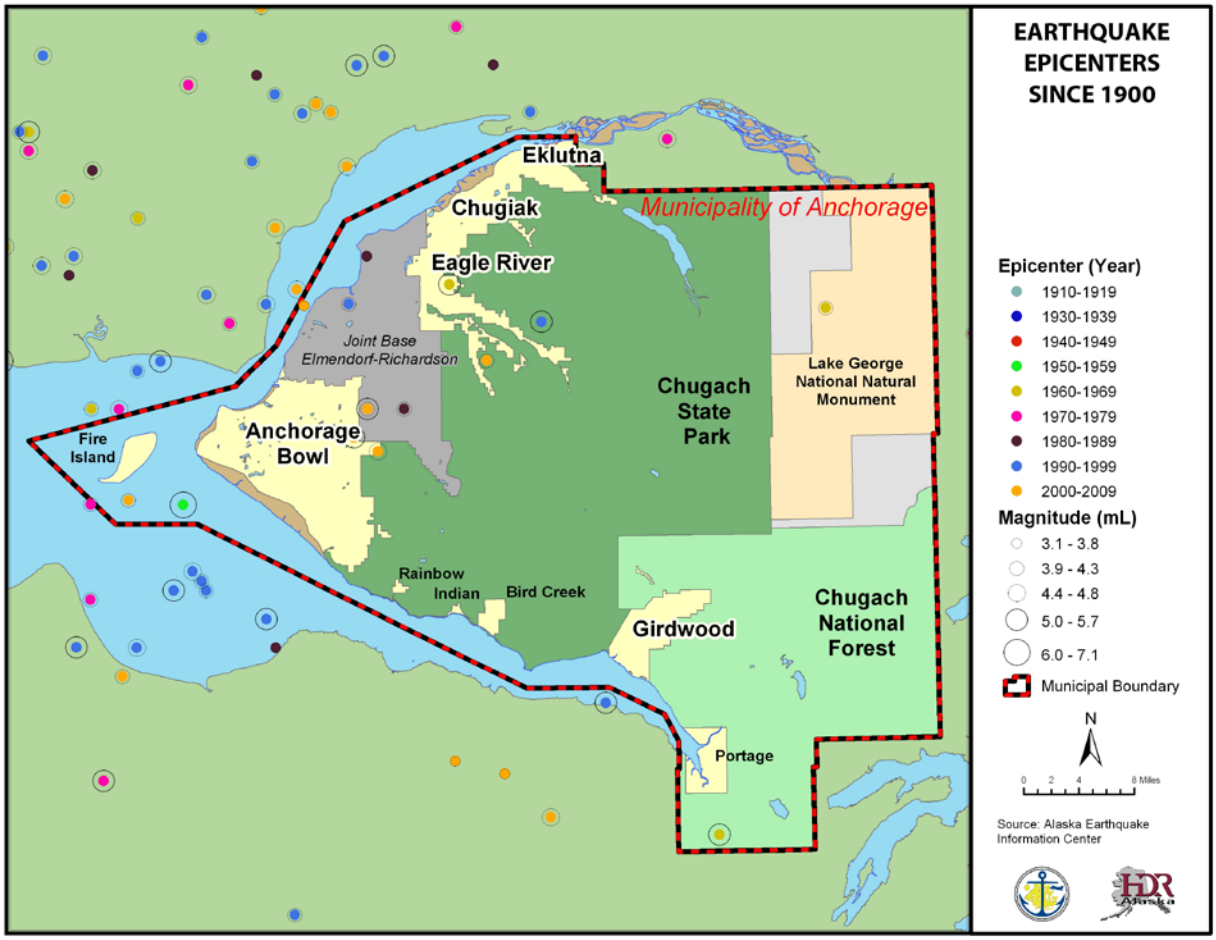
This earthquake occurred at approximately 5:36 pm. The timing of the event may have saved many lives, as several structures with the most damage, such as the Government Hill School, were unoccupied at this time. In 1973, the National Research Council observed that this event could have had 50 times the number of deaths and 60 times as much property damage if it had affected a more densely populated area during work/school hours (Combellick, 1985:6).

The ground shaking caused a significant amount of ground deformation as well as triggering landslides and tsunamis. The Turnagain Heights landslide was the most damaging, with more than 100 homes destroyed. Most of the fatalities associated with this event were actually caused by the resulting tsunamis, not the actual earthquake.

Other Events

Small earthquakes occur frequently in the Anchorage area. The Alaska Earthquake Information Center (AEIC) keeps records about earthquakes in Alaska. A search of the AEIC database revealed that since 1900, there have been 15 events having a magnitude greater than 4.0 that have had an epicenter within the MOA boundary. Figure 4.2 shows the epicenters of earthquakes near MOA since 1900. Events with an epicenter outside MOA could impact MOA, depending on their location and the amount of energy released.

Figure 4.2 Earthquake Epicenters Since 1900



Vulnerability

Because an earthquake could affect the entire Municipality, the entire MOA is represented in Table 4.1. However, it is unlikely that all parcels represented in Table 4.1 would be destroyed in the event of an earthquake. The exact number and location of impacted parcels will

depend on the size and location of the earthquake. The type of building also plays a role. For example, unreinforced masonry buildings tend to be more vulnerable to earthquake damage than wood framed buildings. Taller buildings are usually considered more vulnerable because they can experience more lateral force during an earthquake and they tend to have more people in them. Many of the MOA's taller buildings are located in Downtown and Midtown. In addition, infrastructure, including roads and utilities, and other development is vulnerable to an earthquake. The disruptions to the transportation infrastructure including bridges can have an impact on emergency response activities.

Table 4.1 Earthquake Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	63,711	$5,766,405,700	$13,213,579,200	$18,979,984,900
Commercial	3,546	$1,690,127,200	$2,862,701,850	$4,552,829,050
Industrial	1,674	$502,003,600	$573,493,400	$1,075,497,000
Institutional	717	$175,304,800	$433,943,800	$609,248,600
Parks	1,174	$17,570,700	$11,216,800	$28,787,500
Transportation	430	$21,429,600	$229,500	$21,659,100
Other	869	$13,316,500	$300,200	$13,616,700
Vacant	6,843	$818,046,700	$434,800,700	$1,252,847,400
Unidentified	4,493	$721,943,328	$1,116,386,372	$1,838,329,700
Total	83,457	$9,726,148,128	$18,646,651,822	$28,372,799,950

Source: MOA GIS, 2009

Overall, the impact of an earthquake on life, health, and safety will vary depending on the size and location of the event. Earthquakes have a higher potential for injuries and fatalities than many of the other hazards in the MOA. While everyone in the MOA could be impacted by an earthquake, some populations, such as those living in poorly constructed housing may be more vulnerable than other populations. There were nine deaths in Anchorage (5 in downtown, 3 in Turnagain Heights, and 1 at TSAIA) from the 1964 earthquake (Sokolowski, undated). Additional research is needed to quantify the number of people that could be injured or killed during an earthquake. In addition, people could be impacted by the loss of utilities and business closures. The MOA is also likely to experience a decrease in tourism.

The seismic risk assessment for downtown includes estimating the impacts of a major earthquake in downtown Anchorage. The assessment is scheduled to be completed in 2010 and should be used to supplement the information presented here.

4.1.2 WILDFIRE

The MOA's location in the boreal forest makes wildfires (sometimes called a wildland urban interface fire) a concern. For the purposes of this plan, a wildfire is a fire that burns within the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

The creation and maintenance of the fire requires the interaction of heat, fuel, and oxygen. This is often referred to as the fire triangle.

The Fire Triangle. Image from Northern & Intermountain Regions of the U.S. Forest Service.

Fire Behavior

Fuel, weather, and topography influence wildland fire behavior. Wildland fire behavior can be erratic and extreme, causing fire whirls and firestorms that can endanger the lives of firefighters trying to suppress the blaze. The danger increases when the fire involves developed areas with structures, property and populations. The additional fuel load, high value property, life safety risk, and the need for simultaneous evacuation and suppression add significant wildfires firefighting challenges.

Fuel[7]

Fuel determines how much energy the fire releases, how quickly the fire spreads, and how much effort is needed to contain the fire. The primary fuels in wildland fires are living and dead vegetation. Fuels differ in how readily they ignite and how hot or long they burn. This depends on the following characteristics:

- Moisture content
- Size and shape
- Fuel loading
- Horizontal continuity of fuels
- Vertical arrangement of fuels

Weather

Weather is the most variable and uncontrollable factor in wildland fire fighting. Weather includes temperature, relative humidity, wind, and precipitation. High temperatures and low humidity encourage fire activity, while low temperatures and high humidity help retard fire behavior. Wind dramatically effects fire behavior and is a critical factor in fire spread and control.

[7] Adapted from Eli, 2003 and wildlandfire.com

Topography

Topography directs the movement of air, which can also affect fire behavior. When the terrain funnels air, as in a canyon, it can lead to faster spreading. Fire can also travel up-slope quicker than it goes down. Burning material can roll down the slope and ignite fires below. Certain areas in the MOA with glaciers, including the Eagle River and Eklutna Valleys, may experience local glacial wind effects dramatically influencing fire behavior.

Slope orientation also influences fire behavior. Forests on southern or southwestern slopes (those exposed to the sun) generally have lower humidity and higher temperatures than those on northern or northeast slopes. Consequently, fire hazard is often higher on south- and southwest-facing hills.

Location

The entire MOA has the potential for wildfires. The AFD has identified a 345,309-acre study area for wildfire exposure. Approximately 17,088 acres of this study area are exposed to hazardous wildfire conditions (MOA, 2010b). The exact location of the wildfire hazard changes because it depends on a combination of factors, including availability of fuels, availability of ignition sources, and weather. Because of the changing conditions, the AFD has developed an Anchorage Fire Exposure Model to calculate wildfire exposure. For current information on wildfire exposure, please contact the Wildfire Mitigation Division of the AFD.

According to the AFD, the factors contributing to Anchorage's wildfire risk include:

- Mixed hardwood and conifer forests that burn readily in high fire danger conditions. White spruce trees have persistent branches that contribute to ladder fuels. Black spruce trees have a very low moisture content that allows them to burn easily when ambient weather conditions provide for low relative humidity, high temperatures, and dry duff layers in the soil.
- Residential and rural neighborhoods exist throughout forested stands that have been affected by the spruce bark beetle. In the MOA, this area extends over 85,000 acres. Dead trees resulting from beetle attacks contribute to forest fuel accumulations that create high risk for wildfire.
- Mutual aid resources to help the AFD may take an hour or more to arrive on site. Suppression resources from the SOA Division of Forestry must travel to Anchorage from Palmer and other locations outside the MOA.
- On the south Anchorage Hillside, Eagle River Valley, South Fork, and other sites around the MOA, there are limited water resources to help fight a wildland fire.
- Many neighborhoods in the MOA have limited ingress and egress routes for suppression apparatus to enter and for residents to evacuate.
- The hilly topography throughout the area contributes to increased rate of fire spread. Where the Miller's Reach Fire of 1996 spread across mostly flat terrain and still burned more than 400 structures, a wildfire in South Anchorage would spread even faster because fire spread rates increase with slope.
- The spring fire season is a dry time in Southcentral Alaska. Dry foliage on trees and dead bluejoint grass burn readily soon after snow melts.

In addition, the AFD has been conducting neighborhood wildfire assessments. These assessments are considered works in progress and

are re-evaluated throughout the fire season. The assessments contain an evaluation of the hazard; potential hazards/complications, such as power lines; potential staging areas for equipment; water sources, potential safety zones (to wait out passing fire); and potential evacuation sites. They exist for the following areas:

- Tudor Road to Abbott Road, including Far North Bicentennial Park
- Eagle River
- Hiland Road, South Fork
- DeArmoun Road to Potter Creek Heights
- Chugiak

Individual neighborhood assessments are available through the AFD.

The AFD Wildfire Home Assessment
The AFD will provide home assessments to provide homeowners with specific recommendations for vegetation management and home maintenance activities to reduce a home's potential to ignite during a wildfire. The AFD is also able to provide financial assistance to remove dead, beetle killed spruce trees and densely growing coniferous trees.

Likelihood of Occurrence

The high fire danger months are typically May through August in the MOA; however, wildfires can occur in other months. Wildfires are more likely to occur during drought or low-precipitation times and are less likely to occur during high-precipitation times and when snow is on the ground.

Wildfires in the MOA are more likely to be caused by humans than by other sources. As development increases in areas with high wildfire potential, the chances of wildfire also increase. The AFD is taking measures to reduce the risk of fires by controlling the amount of fuel available. The AFD does this through controlled burns, homeowner education, and the development of firebreaks.

Historic Events

No declared wildfire disasters have been identified to date in the MOA. However, the potential exists. Every year, the AFD puts out dozens of fires that could be disastrous if not contained early. Between 2001 and 2009, the number of wildfires per year in the MOA ranged from 82 fires in 2006 to 150 fires in 2002. Between 2001 and 2006, the MOA had 622 wildfire calls that burned approximately 200 acres (Table 4.2).

Table 4.2 Wildfires in the MOA, 2001 – 2006

Cause	Number	Percent	Acres
Undetermined/Other	260	41.80	76.30
Misuse of Fire/Unintentional	176	28.30	41.20
Intentional/Incendiary	82	13.18	12.70
Smoking	65	10.45	9.30
Act of Nature/Natural	26	4.18	18.10
Equipment	13	2.09	42.70

Total	622	100.00	200.30

Source: CWPP, 2007

Other Wildfire Events

O'Malley/Hillside Fire, 1973

In May 1973, a small brush fire at a private home, fanned by 40 mile per hour (mph) winds, burned out of control in the foothills of the Chugach range. The fire threatened 25 homes and forced several families to evacuate. By the time firefighters contained the blaze, 300 acres of brush and timber were destroyed.

Dowling Road Fire, 2003

A wildfire near the east end of Dowling Road was ignited by a homeless person's fire. This fire burned approximately 2.5 acres.

Otter Lake Fire, 2006

The Otter Lake Fire began in an approximately five-mile area near the ARRC tracks on Fort Richardson. The fire quickly expanded to approximately 50 acres before it was extinguished.

Piper Fire, 2008

On July 2, 2008, a wildfire burned 10 acres of Municipal park land. This fire was ignited by a homeless person. The AFD was able to extinguish the fire before it reached nearby subdivisions.

Eklutna Lake fires 1999, 2010

There have been two wildfires over 100 acres in the MOA's Eklutna Lake Valley in the last twenty years. In 1999 a landowner ignited a fire to clear brush on a windy day and the fire escaped control and burned over 200 acres. The fire threatened homes and potentially the MOA's Eklutna Lake water treatment facility. In May of 2010 there was a wildfire that burned over 1000 acres at the far end of the lake that threatened Eklutna State Park developments and homes near the lake.

Vulnerability

In 2001, Anchorage was declared a community-at-risk for wildfire by the U.S. Department of Agriculture (USDA) Forest Service (USFS). According to the AFD, a wildfire could occur anywhere in the MOA, so the entire MOA is represented in Table 4.3. Only a portion of these properties are likely to be affected by a given event. The number and location of the impacted parcels depend on the size and location of the wildfire event.

Wildfires have the potential to destroy property and vegetation. Without vegetation, these areas may experience soil erosion which can have an impact on water quality. Wildfires may reduce the amount of animal habitat. Wildfires may also cause injuries or loss of life. Fire response systems are well prepared to deal with wildfires so large numbers of injuries or

fatalities are not expected. Additional research would be required to identify the number of people who could be injured or killed as the result of a wildfire.

Table 4.3 Wildfire Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	63,711	$5,766,405,700	$13,213,579,200	$18,979,984,900
Commercial	3,546	$1,690,127,200	$2,862,701,850	$4,552,829,050
Industrial	1,674	$502,003,600	$573,493,400	$1,075,497,000
Institutional	717	$175,304,800	$433,943,800	$609,248,600
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Transportation	430	$21,429,600	$229,500	$21,659,100
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Unidentified	4,493	$721,943,328	$1,116,386,372	$1,838,329,700
Total	83,457	$9,726,148,128	$18,646,651,822	$28,372,799,950

Source: MOA GIS, 2009

More detailed information has not been calculated because the information will change depending on current conditions. For the latest vulnerability information, please contact the Wildfire Mitigation division of the AFD.

4.1.3 EXTREME WEATHER

Extreme weather is a broad category that includes heavy snow, extreme cold, ice storms (freezing rain), high wind, thunder & lightning, hail, coastal storms, and storm surge. High winds, ice storms, and heavy snow are the most likely types of extreme weather in the MOA.

Heavy Snow

Heavy snow is generally considered to be more than six inches of accumulation in less than 12 hours. (Albanese, 2010b). Heavy snow can have a significant impact on an area. Until the snow can be removed, airports and roadways experience delay, or are closed completely, stopping the flow of traffic, supplies and disrupting emergency and medical services. Heavy snow loads can damage light aircraft and sink small boats. It can also cause roofs to collapse and knock down trees and power lines.

Heavy snowfalls can cause secondary hazards. In the mountains, heavy snow can lead to avalanches. A quick thaw can cause flooding, especially along small streams and in urban areas. The cost of snow removal, repairing damages, and the loss of business can have severe economic impacts.

Snow Terminology

A heavy snow is considered to be 6 or more inches of snow in 12 hours. The NWS criteria for a heavy snow advisory is 6 to 11 inches in 12 hours or 12 to 23 inches in 24 hours. A heavy snow warning may be issues for 12 or more inches of snow in 12 hours or 24 or more inches of snow in 24 hours.

Snow Squalls are periods of moderate to heavy snowfall, intense, but of limited duration, accompanied by strong, gusty surface winds, and possibly lightning.

A Snow Shower is a short duration of moderate snowfall.

Snow Flurries are an intermittent light snowfall of short duration with no measurable accumulation.

Blowing Snow is wind-driven snow that reduces surface visibility. Blowing snow can be falling snow or snow that already has accumulated but is picked up and blown by strong winds.

Drifting Snow is an uneven distribution of snowfall and snow depth caused by strong surface winds. Drifting snow may occur during or after a snowfall.

Location

The entire Municipality can get heavy snow but Girdwood tends to receive more snow than other areas. In general, the location of heavy snowfall depends on the weather system involved. The typical storm is a low pressure system originating in Prince William Sound that moves in from the East. This results in heavier snow on the hillside, and less as you get further from the mountains. When the storm is out of the south, the snowfall is heavier in West Anchorage (Vonderheide, 2003). Occasionally, air comes up Cook Inlet and hits the mountains. This may lead to heavy snow on the upper hillside and less in the bowl area (Vonderheide, 2003). Blizzards are rare events in the MOA but could occur along the Turnagain Arm. See Figure 4.3 for the average annual snowfall pattern in MOA.

Snowfall Records

Normal snowfall – 69.5'
Top 5 Highest Winter Snowfall
171.8 inches.....1955-1956
123.1 inches.....1949-1950
121.1 inches.....1994-1995
111.5 inches.....2003-2004
111.0 inches.....1948-1949

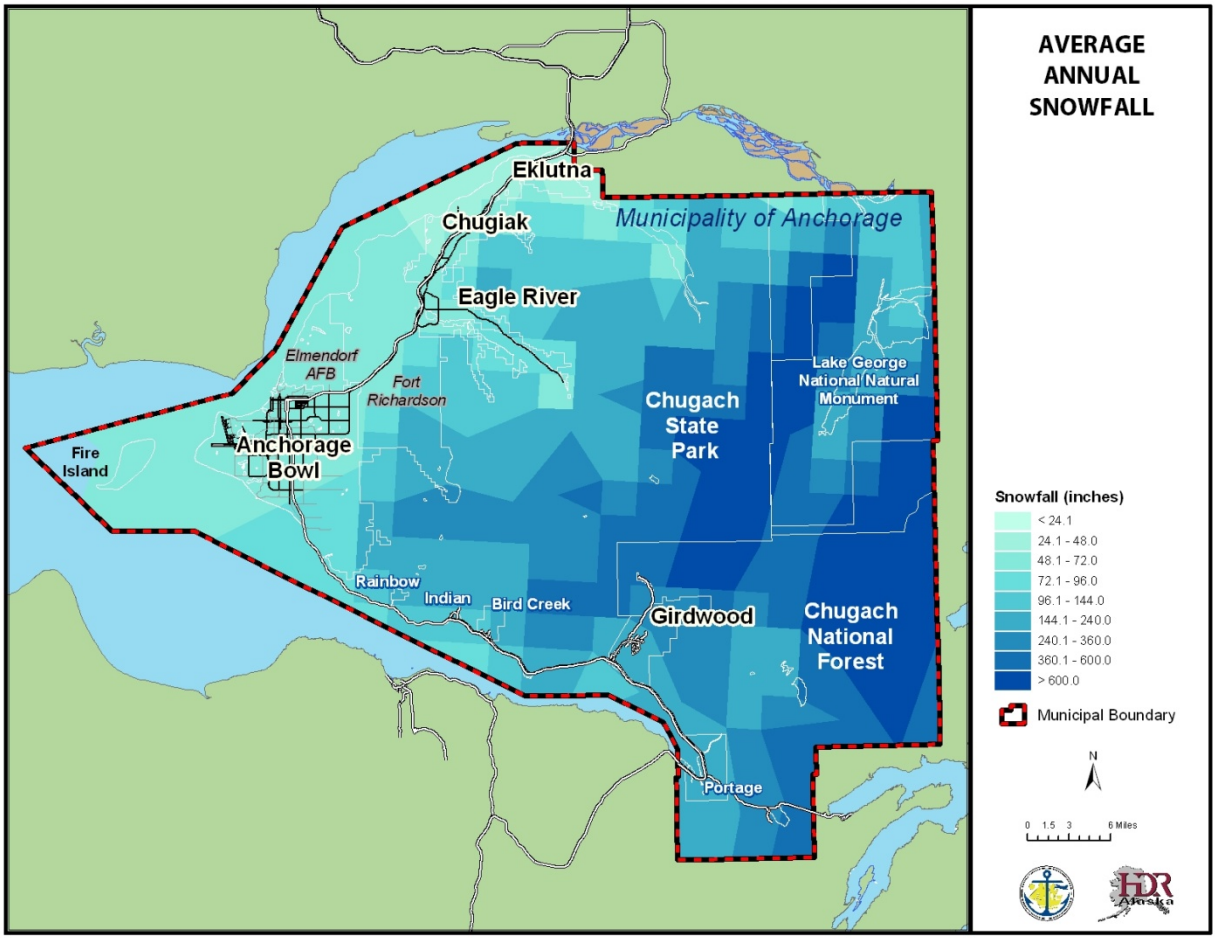
Top 5 Lowest Winter Snowfall
30.4 inches.....1957-1958
32.6 inches.....1941-1942
32.9 inches.....1980-1981
36.8 inches.....2002-2003
38.5 inches.....1960-1961

Source: National Weather Service Anchorage Forecast Office's Climate Records List, (1917 – current) Available at http://pafc.arh.noaa.gov/misc.php?p

Likeliness of Occurrence

While snow falls frequently in Anchorage during the winter, most snowfalls are not usually heavy. Anchorage tends to experience one or two heavy snowfalls each winter (Albanese, 2010). However, these tend not to result in disaster declarations. The occurrence of heavy snowfall events depends on the weather conditions.

Figure 4.3 Average Annual Snowfall



Historic Events

2002 Heavy Snow Fall

Record heavy snow occurred in MOA on March 17, 2002 when two to three feet of snow fell in less than 24 hours. TSAIA recorded a total of 28.7 inches while an observer near Lake Hood measured over 33 inches. The Municipality was essentially shut down because of the accumulating snow. Fortunately, the storm occurred on a Sunday morning when fewer businesses are open. The following day, both military bases, both universities, and many businesses remained closed, while Anchorage schools remained closed for two days. It took four days for snowplows to reach all areas of the city.

Other Snow Events

On March 20, 2001, 8-12 inches of snow fell in the Anchorage Bowl-Eagle River area.

Vulnerability

As a heavy snowfall could affect the entire Municipality, the entire MOA is represented in Table 4.4. Heavy snowfall can also damage infrastructure and critical facilities. Heavy snowfalls make transportation difficult, especially by road, and result in more money spent on snow

plow services. Transportation may be distributed more in steeper areas such as the Hillside and parts of Eagle River. High numbers of injuries and fatalities are not expected with a heavy snow event. Heavy snow can have a greater impact on people who need access to medical services, emergency services, pedestrians, and people who rely on public transportation. The cost of fuel to heat homes during times of heavy snow can be a financial burden on populations with low or fixed incomes. According to the 2005-2009 American Community Survey 5-Year Estimates, the MOA had approximately 10,506 households with a household income less than $25,000. Homeless populations are also vulnerable. According to the January 2009 single-night homeless count, there were 2,962 homeless people in Anchorage (UAA Justice Center, 2009). Heavy snows may also result in school and business closures which may result in some individuals having a loss of income.

Table 4.4 Heavy Snow Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	63,711	$5,766,405,700	$13,213,579,200	$18,979,984,900
Commercial	3,546	$1,690,127,200	$2,862,701,850	$4,552,829,050
Industrial	1,674	$502,003,600	$573,493,400	$1,075,497,000
Institutional	717	$175,304,800	$433,943,800	$609,248,600
Parks	1,174	$17,570,700	$11,216,800	$28,787,500
Transportation	430	$21,429,600	$229,500	$21,659,100
Other	869	$13,316,500	$300,200	$13,616,700
Vacant	6,843	$818,046,700	$434,800,700	$1,252,847,400
Unidentified	4,493	$721,943,328	$1,116,386,372	$1,838,329,700
Total	83,457	$9,726,148,128	$18,646,651,822	$28,372,799,950

Source: MOA GIS, 2009

Heavy Rain

There is no universal definition of heavy rain. Generally, when rainfall is sufficient to cause localized or widespread flooding, it is considered heavy. The NWS is most concerned about potential flooding with 10% of an area's annual rainfall occurs in one day (Albanese, 2010b).

Heavy rains are sometimes associated with a weather system called the "Pineapple Express". This weather system originates in Hawaii and usually brings heavy rain with it. This rain can lead to flooding. The "Pineapple Express" may also melt snow contributing to flooding.

Precipitation Records

Normal Precipitation: 16.08 inches

Highest Annual Precipitation: 27.75 inches (1989)

Lowest Annual Precipitation: 8.08 inches (1969)

Longest Consecutive Days with Measurable Precipitation: 17 days (September 12 – 28, 1979)

Consecutive Days Without Precipitation:

47 (January 6 – February 21, 1939)

Source: National Weather Service Anchorage Forecast Office's Climate Records List, (1917 – current)

Location

The Girdwood area receives the most rainfall in the MOA. See Figure 4.4 for the average annual rainfall pattern. Rainfall also varies with time of year with most precipitation occurring in late summer and fall. Table 4.5 summarizes precipitation in the MOA.

Figure 4.4 Average Annual Rainfall

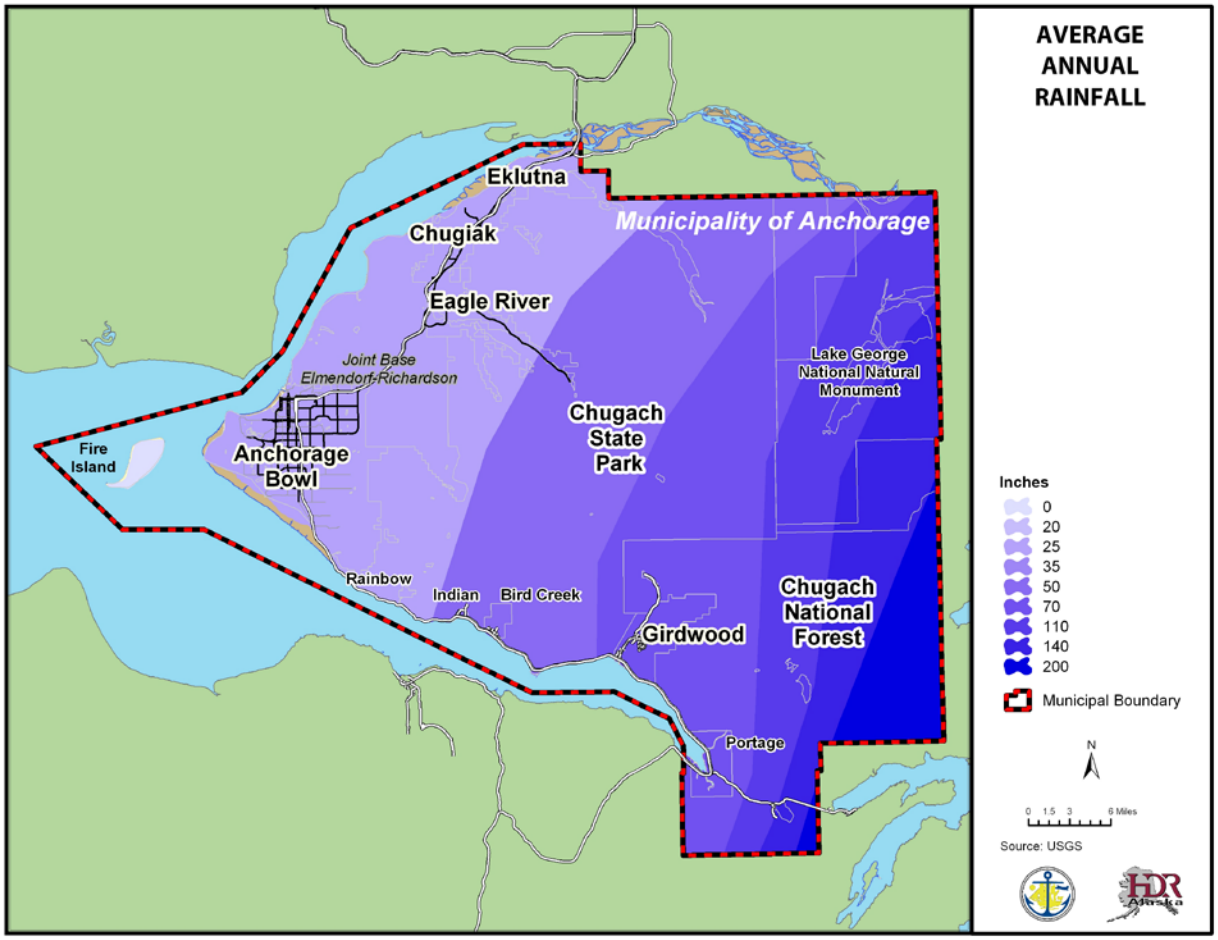


Table 4.5 Precipitation in the MOA

	(a)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
PRECIPITATION (in.)													
Water Equivalent													
-Normal		0.79	0.7	0.69	0.67	0.73	1.14	1.71	2.44	2.70	2.03	1.11	1.12
-Maximum Monthly	42	2.71	3.07	2.76	1.91	1.93	3.40	4.44	9.77	6.64	4.11	2.84	2.67
-Year		1987	1955	1979	1977	1989	1962	1958	1989	1990	1986	1976	1955
-Minimum Monthly	42	0.02	0.07	T	T	0.02	0.17	0.42	0.33	0.76	0.35	0.08	0.09
-Year		1982	1958	1983	1969	1957	1993	1.72	1969	1973	1960	1985	1995
-Maximum in 24 hrs	42	1.19	1.16	1.25	0.78	1.18	1.84	2.06	4.12	1.92	1.60	1.66	1.62
-Year		1961	1956	1986	1989	1980	1962	1956	1989	1961	1986	1964	1955
Snow, Ice Pellets, Hail													
-Maximum Monthly	42	27.5	48.5	31.0	27.6	3.9	0.0	0.0	0.0	4.6	27.1	38.8	41.6
-Year		1990	1955	1979	1963	1963				1965	1982	1994	1955
-Maximum in 24 hrs	42	10.5	12.4	14.5	9.1	3.9	0.0	0.0	0.0	3.5	11.2	16.4	17.7
-Year		1955	1956	1959	1955	1963				1965	1991	1964	1955

Likelihood of Occurrence

The occurrence of heavy rain depends on the weather conditions.

Historic Events

No significant historic heavy rainfalls that have resulted in a declared disaster have been identified. However, heavy rainfalls have resulted in flood events. For more information, please see the flood section.

Vulnerability

As a heavy rain could affect the entire Municipality, the entire MOA is represented in Table 4.6. The flooding associated with a heavy rain is typically the greatest concern. For more information, please see the flood section. High numbers of injuries and fatalities are not anticipated with a heavy rain event.

Table 4.6 Heavy Rain Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	63,711	$5,766,405,700	$13,213,579,200	$18,979,984,900
Commercial	3,546	$1,690,127,200	$2,862,701,850	$4,552,829,050
Industrial	1,674	$502,003,600	$573,493,400	$1,075,497,000
Institutional	717	$175,304,800	$433,943,800	$609,248,600
Parks	1,174	$17,570,700	$11,216,800	$28,787,500
Transportation	430	$21,429,600	$229,500	$21,659,100
Other	869	$13,316,500	$300,200	$13,616,700
Vacant	6,843	$818,046,700	$434,800,700	$1,252,847,400
Unidentified	4,493	$721,943,328	$1,116,386,372	$1,838,329,700
Total	83,457	$9,726,148,128	$18,646,651,822	$28,372,799,950

Source: MOA GIS, 2009

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 –40º Fahrenheit (F). Excessive cold may accompany winter storms, be left in their wake, or can occur without storm activity.

Extreme cold can also bring transportation to a halt for days or weeks at a time. Aircraft may be grounded due to extreme cold and ice fog conditions. Long cold spells can cause rivers to freeze which increases the likelihood of ice jams and ice jam related flooding. If extreme cold conditions are combined with low or no snow cover, the ground's frost depth can increase, and disturb buried utility pipes.

The greatest danger from extreme cold is to people. Prolonged exposure to the cold can cause frostbite or hypothermia and become life threatening, especially for infants and the elderly. Carbon monoxide (CO) poisonings also increase as people use supplemental heating devices.

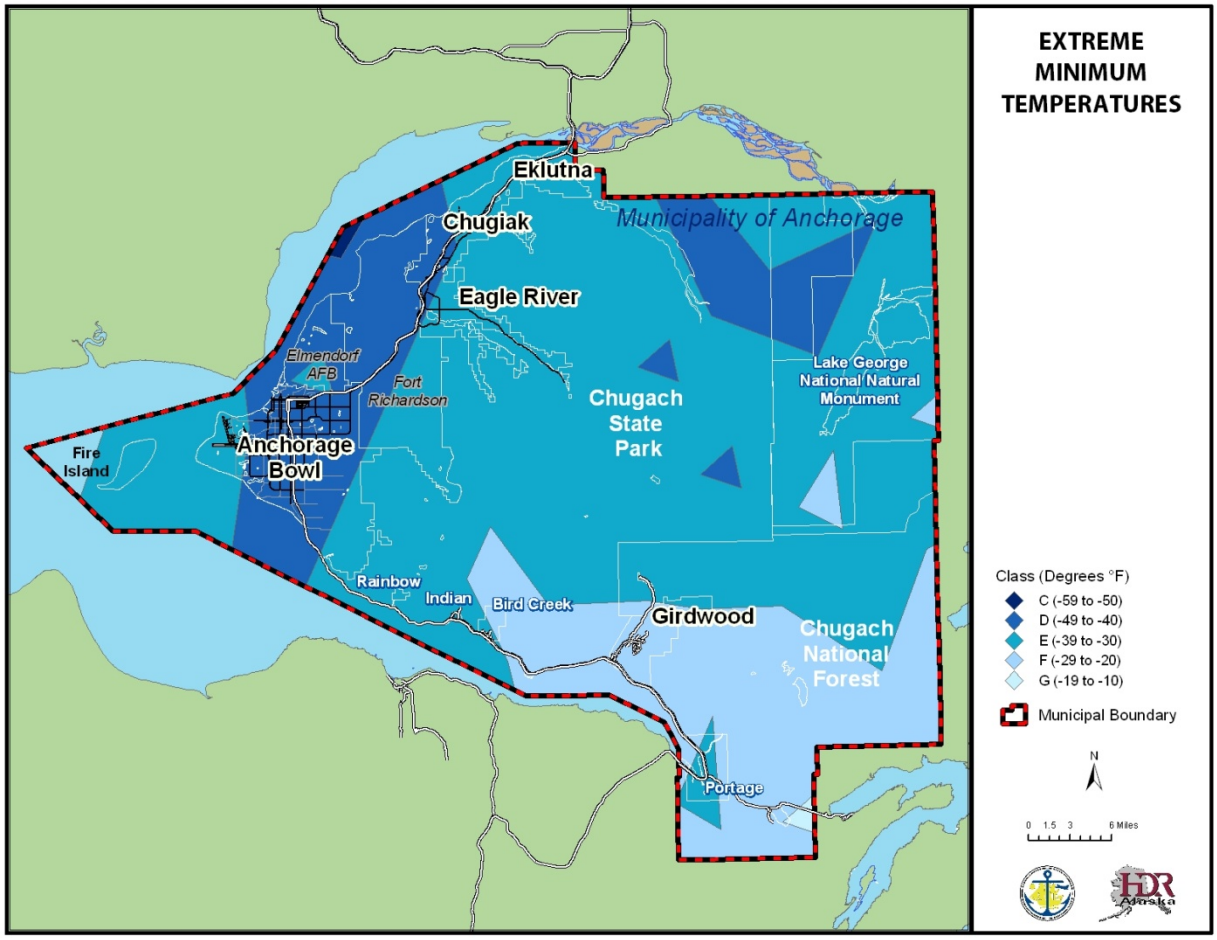
Frostbite is damage to body tissue caused by that tissue being frozen. Frostbite causes a loss of feeling and a white or pale appearance in the extremities.

Hypothermia is low body temperature. Normal body temperature is 98.6ºF. When body temperature drops to 95ºF, however, immediate medical help is needed. Hypothermia also can occur with prolonged exposure to temperatures above freezing.

Location

In MOA, the official temperature is recorded at TSAIA. Due to its close proximity to open water, the airport tends to be warmer than the rest of Anchorage. For example, east Anchorage is generally 10 to 15 degrees cooler than at the airport (Vonderheide, 2003). The Chugiak/Eagle River area tends to get the coolest temperatures in the winter. See Figure 4.5 for the extreme minimum temperatures.

Figure 4.5 Extreme Minimum Temperatures



The coldest months in Anchorage are generally December, January, and February. The temperature tends to decrease, the further inland you are. Table 4.7 summarizes the temperature in the MOA.

Table 4.7 Temperatures

	(a)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE (Deg. F)														
Normals														
-Daily Maximum		21.4	25.8	33.1	42.8	54.4	61.6	65.2	63.0	55.2	40.5	27.2	22.5	42.7
-Daily Minimum		8.4	11.5	18.1	28.6	38.8	47.2	51.7	49.5	41.6	28.7	15.1	10.0	29.1
-Monthly		14.9	18.7	25.7	35.8	46.6	54.4	58.4	56.3	48.4	34.6	21.2	16.3	35.9
Extremes														
-Record Highest	42	50	48	5.1	65	77	85	82	82	73	6.1	53	48	85
-Year		1961	1991	1984	1976	1969	1969	1989	1978	1957	1993	1979	1992	JUN 1969
-Record Lowest	42	-34	-26	-24	-4	17	33	38	31	19	-5	-21	-30	-34
-Year		1975	1956	1971	1985	1964	1961	1964	1984	1992	1956	1956	1964	JAN 1975
NORMAL DEGREE DAYS														
Heating (base 65 Deg. F)		1553	1296	1218	876	570	318	205	70	498	942	1314	1510	10570
Cooling (base 65 Deg. F)		0	0	0	0	0	0	0	0	0	0	0	0	0
MEAN SKY COVER(tenths)														
Sunrise - Sunset	42	7.1	7.0	6.7	7.2	7.7	7.9	7.9	7.9	7.9	7.7	7.3	7.5	7.5
MEAN NUMBER OF DAYS:														
Sunrise to Sunset														
-Clear	42	7.0	6.7	7.6	5.6	4.0	2.7	3.4	3.3	3.7	5.0	5.7	5.8	60.5
-Partly Cloudy	42	4.6	3.6	5.4	6.1	6.5	6.9	5.8	6.1	5.4	4.6	4.7	4.0	63.7
-Cloudy	42	19.4	18.0	17.9	18.3	20.6	20.4	21.8	21.6	20.9	21.3	19.6	21.2	241.0
Precipitation														
.01 inches or more	31	7.8	7.8	7.4	6.0	7.2	7.9	11.5	13.4	14.5	12.2	9.6	11.0	116.3
Snow, Ice Pellets, Hail														
1.0 inches or more	31	2.8	3.1	2.7	1.5	0.0	0.0	0.0	0.0	0.2	2.3	3.5	4.6	20.8
Thunderstorms	42	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.2	0.1	0.0	0.0	0.0	1.0
Heavy Fog Visibility														
1/4 mile or less	42	6.0	4.4	1.5	0.7	0.3	0.1	0.2	0.9	1.3	2.1	3.7	5.0	26.2
Temperature Deg. F														
-Maximum														
70 Deg. F and above	31	0.0	0.0	0.0	0.0	0.5	3.3	6.5	3.4	0.1	0.0	0.0	0.0	13.9
32 Deg. F and below	31	24.7	19.7	11.7	2.0	0.0	0.0	0.0	0.0	0.0	4.6	20.8	24.5	108.1
-Minimum														
32 Deg. F and below	31	30.5	27.2	28.3	20.3	2.7	0.0	0.0	0.1	3.2	19.8	28.2	30.2	190.5
0 Deg. F and below	31	9.5	7.2	2.3	0.*	0.0	0.0	0.0	0.0	0.0	0.1	3.2	7.2	29.5

Source: Alaska Climate Research Center, 2010

Likelihood of Occurrence

Extreme cold temperatures could happen every winter, depending on weather conditions. However, it is rare for temperatures in the MOA to be colder than -50°F (Albanese, 2010).

Historic Events

Extreme cold temperatures can be especially problematic if they are associated with low snow levels as happened in the winter of 1995-1996. The combination of these two factors resulted in the ground freezing to a greater depth than usual (more than 10 feet compared to the usual three of four feet). As utility pipes, including water and wastewater, are buried to a depth of 10 feet, some pipes froze and subsequently broke. Repairing the broken pipes was a massive undertaking as the ground had to be thawed before work could commence (Vonderheide, 2003).

Vulnerability

As extreme cold could affect the entire Municipality, the entire MOA is represented in Table 4.8. An extreme cold event is likely to result less property damage than other hazards such as a earthquake. In the MOA, typically buried pipes are most vulnerable to an extreme cold event. Homeless populations and people who have difficultly heating their homes (due to poor insulation, unable to afford heating costs, etc.) also tend to be more vulnerable. According to the January 2009 single-night homeless count, there were 2,962 homeless people in Anchorage (UAA Justice Center, 2009). While the exact number of people is unavailable, several homeless people have died in Anchorage due to hypothermia in recent years. According to the 2005-2009 American Community Survey 5-Year Estimates, the MOA had approximately 10,506 households with a household income less than $25,000.

Table 4.8 Extreme Cold Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	63,711	$5,766,405,700	$13,213,579,200	$18,979,984,900
Commercial	3,546	$1,690,127,200	$2,862,701,850	$4,552,829,050
Industrial	1,674	$502,003,600	$573,493,400	$1,075,497,000
Institutional	717	$175,304,800	$433,943,800	$609,248,600
Parks	1,174	$17,570,700	$11,216,800	$28,787,500
Transportation	430	$21,429,600	$229,500	$21,659,100
Other	869	$13,316,500	$300,200	$13,616,700
Vacant	6,843	$818,046,700	$434,800,700	$1,252,847,400
Unidentified	4,493	$721,943,328	$1,116,386,372	$1,838,329,700
Total	83,457	$9,726,148,128	$18,646,651,822	$28,372,799,950

Source: MOA GIS, 2009

Ice Storms

Ice storm is the term used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Ice storms result from the accumulation of freezing rain (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. Ice storms can be devastating and are often the cause of automobile accidents, power outages and personal injuries.

Glace ice, also known as black ice, which occurs when rains hits the cold ground and turns into ice, is possible in the MOA. It is responsible for multiple traffic accidents every winter.

Location

Ice storms can occur anywhere but the atmospheric conditions that can lead to ice storms occur most frequently around Cook Inlet. Freezing rains often approach from the west as storms from the Bering Sea move westward and mix with the pre-existing cold air in the MOA area.

Likelihood of Occurrence

The future occurrence of ice storms in the MOA depends on the weather conditions. Typically, there are a few episodes of light freezing rain each winter. The NWS will issue a freezing rain advisory which is for freezing rain up to 0.24 inches accumulation of ice. In the MOA, most events have an accumulation less than a tenth of an inch (Albanese, 2010b).
More commonly, rain will fall on ice or snow pack covered roads which result in difficult driving conditions. This can occur when there is a storm in the Bering Sea/Bristol Bay area that has ample warm air advecting over the region and is accompanied by a strong southeast Chinook wind.

Historic Events

No significant historic ice storms have been identified. In November 2010, there were several days of freezing rain that made the roads slick and resulted in school closures. There was also an ice event in the mid-1990s (Albanese, 2010).

Vulnerability

As an ice storm could affect the entire Municipality, the entire MOA is represented in Table 4.9. An ice storm is likely to result in less building and property damage than other hazards. An ice storm has the potential to damage power lines. Infrastructure, especially above ground power lines are also vulnerable to ice. Ice storms can also increase the number of traffic accidents. Large numbers of injuries and fatalities are not anticipated with an ice storm. Ice storm related power outages can affect people who rely on electricity for life-safety items such as respirators, monitoring equipment or medication that needs to be kept refrigerated.

Table 4.9 Ice Storm Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	63,711	$5,766,405,700	$13,213,579,200	$18,979,984,900
Commercial	3,546	$1,690,127,200	$2,862,701,850	$4,552,829,050
Industrial	1,674	$502,003,600	$573,493,400	$1,075,497,000
Institutional	717	$175,304,800	$433,943,800	$609,248,600
Parks	1,174	$17,570,700	$11,216,800	$28,787,500
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Total	83,457	$9,726,148,128	$18,646,651,822	$28,372,799,950

Source: MOA GIS, 2009

High Winds

High winds are generally considered to be winds in excess of 73 mph (Albanese, 2010b). A strong wind can be considered to be between 45 and 72 mph (Albenese, 2010b). They can lead to dangerous wind chill temperatures or combine with loose snow to produce blinding

blizzard conditions. High winds have the potential to cause serious damage to a community's infrastructure, especially above ground utility lines. With early season high wind events, like the event in September 2010, high winds can cause trees to be blow over and uprooted. Later in the year, when trees are free of leaves and the ground is frozen, trees are more likely to break or have limbs broken off than being uprooted (Albanese, 2010b).

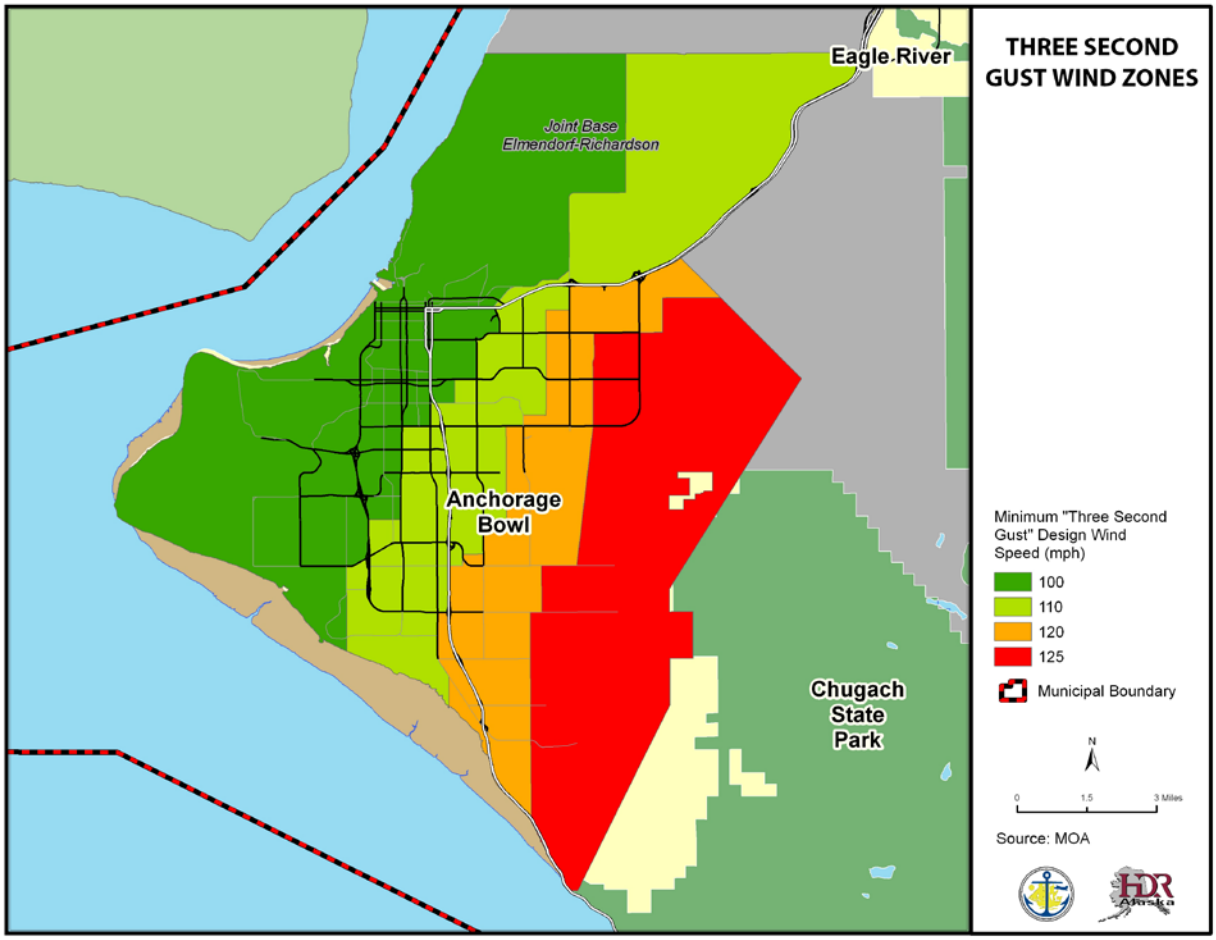
In mountainous areas, down slope windstorms created by temperature and pressure differences across the terrain can produce winds in excess of 100 mph. These windstorms can be particularly damaging as they are gusty in character and may seem to come from several directions.

Location

Typically, high wind warnings are for the Hillside and along Turnagain Arm. These areas common get high winds but the impacts is not that great until the winds are above 85 mph (Albanese, 2010b). When winds exceed 85 mph, it is not unusual for there to be damage. The damage is more widespread (especially along the Hillside and in East Anchorage), when the winds exceed 100 mph. Weaker winds (in the 50 to 60 mph range) will have more of an impact in the downtown area (Albanese, 2010b).

In the MOA, the basic wind speed, for the determination of the wind loads is determined in accordance with the Anchorage "Three Second Gust" wind zone map. This Anchorage Area-Wide Wind Speed Study noted that Anchorage gets strong winds from the southerly direction in the summer and northerly directions during the winter (RWDI, 1998).

Figure 4.6 50-Year Wind Speed



Localized high winds can also occur (see Table 4.10). The most well known local wind is the Chugach wind which blows off the Chugach Mountains. These Chugach winds are really Chinook winds (a strong warm wind) and mostly affect the eastern side of the Anchorage Bowl. There can be winds just in the Turnagain Arm area, which affects traffic on the New Seward Highway (Vonderheide, 2003). Winds near McHugh Creek can get in the 80-90 mph range (Vonderheide, 2003). There is a Knik Valley wind, which brings warm air from Prince William Sound. The hillside area can experience a Chinook/Chugach wind. Eagle River can get winds from the Southeast. Localized winds in Bear Valley can reach 125 mph.

Table 4.10 Wind Speeds

	(a)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
WIND														
Mean Speed (mph)	42	6.4	6.9	7.0	73	8.4	8.4	7.3	6.9	6.7	6.7	6.5	6.3	7.1
Prevailing Direction		NNE	N	N	N	S	S	S	S	NNE	N	NNE	NNE	N
through 1964	38	03	04	03	15	35	17	16	02	22	03	04	05	03
Fastest Mile		61	52	51	35	33	30	29	31	35	40	41	41	61

-Direction(!!)		1971	1979	1989	1964	1964	1971	1957	1987	1993	1966	1978	1964	JAN
-Speed(mph)														1971
-Year	16	E	NE	NE	SE	S	SE	SE	N	S	S	NE	SE	
Peak Gust	16	64	61	75	43	43	46	40	44	48	55	55	55	NE
-Direction(!!)		1986	1994	1989	1987	1988	1985	1980	1987	1985	1987	1990	1992	75
-Speed(mph)														MAR
-Date														1989

Likelihood of Occurrence

High wind advisories, watches, and warnings are frequently issued by the National Weather Service (NWS) for different parts of Anchorage.

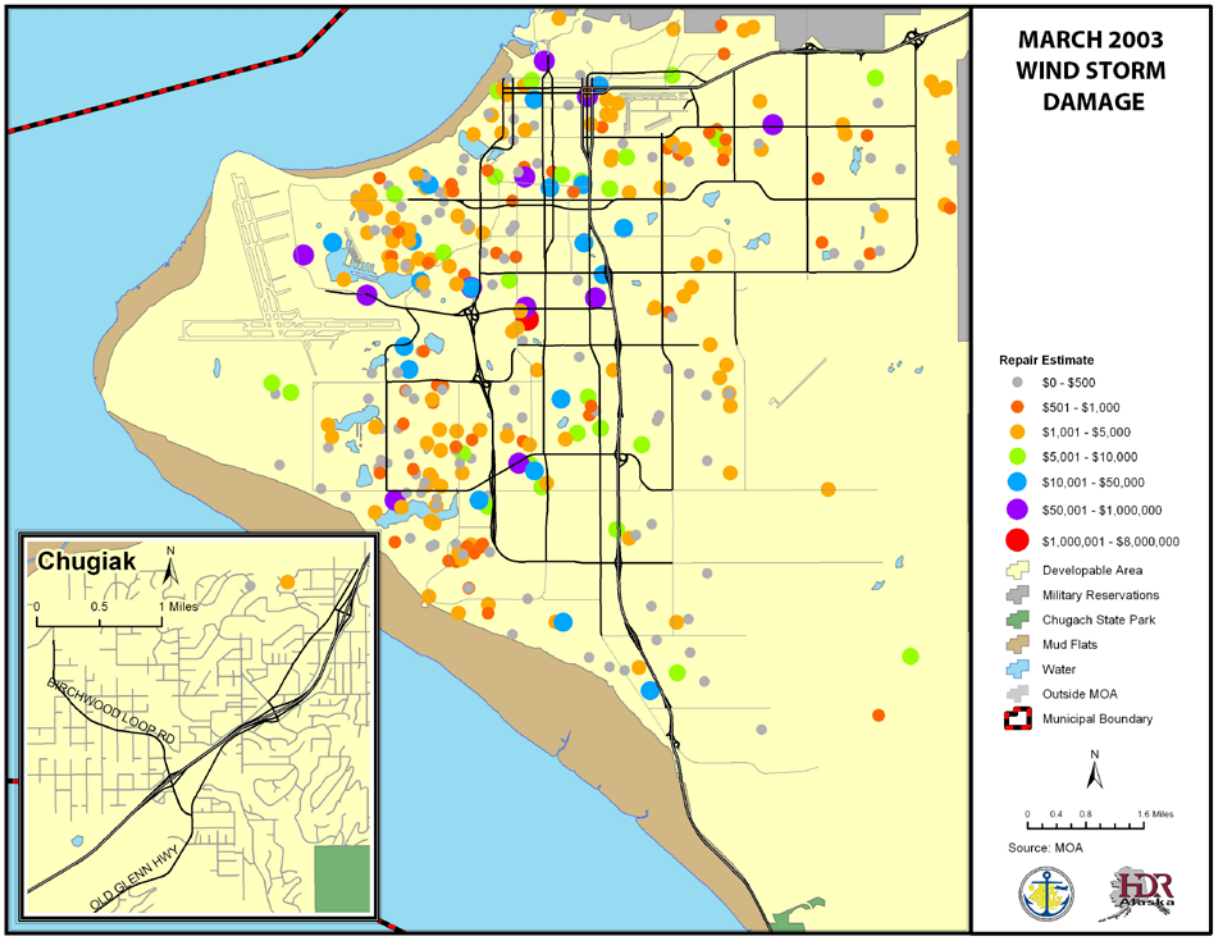
Historic Events

2003 Winter Storm – Federal Disaster 1461

In March 2003, a winter storm brought high winds and freezing temperatures to Anchorage and surrounding communities for several days. This event involved a Bora wind, which is a very cold northerly wind (sometimes called the Matanuska wind). Bora winds are rare in Anchorage, and usually only occur every 10 to 15 years (Vonderheide, 2003). Prior to this event, the last one occurred in 1989.

Within the Municipality, the worst effects occurred in the west Anchorage area. Ted Stevens Anchorage International Airport had record high winds, sustained winds around 92-94 mph and a peak gust of 109 mph (Scott, Baines, and Papineau, 2003). Damage for the event in MOA alone exceeded $3.5 Million. MOA conducted a voluntary on-line survey about the damage caused by storm. The survey results are displayed in Figure 4.7.

Figure 4.7 March 2003 Wind Storm Damage



2000 Central Gulf Coast Storm - Federal Disaster 1316

In December 1999 and January 2000, there was series of severe winter storms (involving high winds and avalanches) that caused damage throughout Southcentral Alaska. Anchorage was one of many jurisdictions included in a Federal Disaster Declaration. In Anchorage, damage from this event included one fatality, property damage, disruption of electrical service, and interruption of rail and road access south of the Potter Weigh Station.

April 1980 Windstorm

On April 1, 1980, a Chinook wind with maximum gust speeds estimated at 134 mph caused approximately $25 million in damages.

Other Wind Events (From RWDI 1998a and b)

- December 3, 1994 - southeasterly downslope wind storm
- February 20, 1994 – northeasterly wind storm
- November 22, 1993 - southeasterly downslope wind storm
- February 3, 1993 – northeasterly wind storm
- December 1, 1992 windstorm - southeasterly downslope wind storm

    - Had maximum gust speeds estimated at 112mph
- December 26, 1991 - southeasterly downslope wind storm
- March 4, 1989 – northeasterly wind storm
- November 9, 1986 – southeasterly downslope wind storm
- February 14, 1979 – northeasterly windstorm

Vulnerability

The entire MOA was not included in the Anchorage Area-Wide Wind Speed Study. The area included in the study is shown on Figure 4.6. The size of each wind speed zone is shown in Table 4.11. The vulnerability tables for each wind speed zone (Tables 4.12 – 4.15) only reflect the area included in the study.

Table 4.11 Area of Wind Speed Zones

Minimum "Three Second Gust" Design Wind Speed (mph)	Fastest Mile	Acres
100	85	31,489
110	95	21,545
120	104	12,120
125	109	22,372

Table 4.12 100 mph "Three Second Gust" Vulnerability in the Anchorage Building Service Area

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	19,432	$598,995,840	$1,290,770,000	$1,750,800,000
Commercial	2,236	$827,427,800	$174,494,050	$388,345,500
Industrial	804	$157,860,000	$215,828,200	$373,688,200
Institutional	322	$86,576,500	$197,819,000	$284,395,500
Parks, Open Space & Recreation Areas	487	$8,815,500	$2,169,700	$10,985,200
Transportation Related	521	$21,716,800	$3,000	$21,719,800
Other	44	$6,153,500	$0	$6,153,500
Vacant	1,234	$185,642,600	$101,271,700	$286,914,300
Unidentified	25,080	$1,893,188,540	$1,982,355,650	$3,123,002,000
Total	19,432	$598,995,840	$1,290,770,000	$1,750,800,000

Source: MOA GIS, 2009

Table 4.13 110 mph "Three Second Gust" Vulnerability in the Anchorage Building Service Area

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	11,348	$952,380,100	$800,095,540	$1,112,378,090
Commercial	891	$636,452,000	$839,019,050	$147,547,105
Industrial	750	$291,318,700	$269,341,600	$560,660,300

Institutional	139	$45,078,400	$62,603,400	$107,681,800
Parks, Open Space & Recreation Areas	189	$866,100	$0	$866,100
Transportation Related	17	$84,000	$255,400	$339,400
Other	17	$0	$0	$0
Vacant	1,448	$218,877,000	$82,325,700	$301,202,700
Unidentified	14,799	$2,145,056,300	$2,053,640,690	$2,230,675,495
Total	11,348	$952,380,100	$800,095,540	$1,112,378,090

Source: MOA GIS, 2009

Table 4.14 120 mph "Three Second Gust" Vulnerability in the Anchorage Building Service Area

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	13,266	$1,120,723,400	$715,836,370	$697,651,500
Commercial	225	$136,207,900	$181,844,000	$318,051,900
Industrial	72	$38,489,200	$36,454,800	$74,944,000
Institutional	99	$46,747,000	$127,060,000	$173,807,000
Parks, Open Space & Recreation Areas	230	$7,662,400	$8,946,700	$16,609,100
Transportation Related	24	$349,900	$297,200	$647,100
Other	18	$0	$0	$0
Vacant	629	$92,029,800	$39,945,800	$131,975,600
Unidentified	14,563	$1,442,209,600	$1,110,384,870	$1,413,686,200
Total	13,266	$1,120,723,400	$715,836,370	$697,651,500

Source: MOA GIS, 2009

Table 4.15 125 mph "Three Second Gust" Vulnerability in the Anchorage Building Service Area

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	9,501	$958,256,600	$235,780,600	$314,527,600
Commercial	20	$16,068,700	$14,604,200	$30,672,900
Industrial	19	$4,138,400	$6,865,200	$11,003,600
Institutional	45	$3,709,800	$25,810,200	$29,520,000
Parks, Open Space & Recreation Areas	187	$226,700	$100,400	$327,100
Transportation Related	24	$0	$0	$0
Other	4	$0	$0	$0
Vacant	1,217	$167,354,200	$138,976,900	$306,331,100
Unidentified	11,017	$1,149,754,400	$422,137,500	$692,382,300
Total	9,501	$958,256,600	$235,780,600	$314,527,600

Source: MOA GIS, 2009

In general, a windstorm is more likely to cause property damage than injuries and fatalities. High winds can cause falling trees and branches which can bring down utility lines and cause property damage. Windstorms can lead to power failures which can affect people who rely on electricity for life-safety items such as respirators, monitoring equipment or medication that needs to be kept refrigerated. Power failures can also cause school and business closures. Fallen trees and branches can block roads making it difficult to travel around town. Areas that are near forested areas such as the Hillside may be more vulnerable.

F o g

Fog is basically a cloud on the ground. When the air is saturated with water vapor, a drop in temperature will cause the excess water vapor to condense into water droplets. These droplets, if thick enough, will turn into fog.

When it is foggy, ice can be deposited on the roadways, causing black ice conditions (Vonderheide, 2003).

Location

Fog is more frequent in West Anchorage. In the fall and early winter, a northerly wind comes from the north and reduces visibility. In East Anchorage, the drainage winds from the mountains mix the air to help keep the area relatively fog free.

Fog can also occur in the lower parts of Eagle River, but it is rare in the higher elevations.

Likelihood of Occurrence

Fog is likely to occur when the climatic conditions are right. Fog events are usually short-term with no lasting effects.

Historic Events

No significant historic fog events have been identified to date.

Vulnerability

As fog could affect the entire Municipality, the entire MOA is represented in Table 4.16. Property damage does not typically occur during a dense fog event. Dense fog can reduce visibility leading to an increase in traffic accidents. Traffic accidents have the potential to result in injuries and fatalities. Large numbers of injuries and fatalities due to dense fog is not anticipated. Dense fog may result in closures at local airports.

Table 4.16 Fog Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	63,711	$5,766,405,700	$13,213,579,200	$18,979,984,900
Commercial	3,546	$1,690,127,200	$2,862,701,850	$4,552,829,050
Industrial	1,674	$502,003,600	$573,493,400	$1,075,497,000

Institutional	717	$175,304,800	$433,943,800	$609,248,600
Parks	1,174	$17,570,700	$11,216,800	$28,787,500
Transportation	430	$21,429,600	$229,500	$21,659,100
Other	869	$13,316,500	$300,200	$13,616,700
Vacant	6,843	$818,046,700	$434,800,700	$1,252,847,400
Unidentified	4,493	$721,943,328	$1,116,386,372	$1,838,329,700
Total	83,457	$9,726,148,128	$18,646,651,822	$28,372,799,950

Source: MOA GIS, 2009

Other Weather Events

Other extreme weather events that are possible, but rare, in the MOA include:

- Tornados
- Coastal Storms
- Storm Surges
- Thunder and Lightning
- Hail

4.1.4 FLOODING

Flooding occurs when weather, geology, and hydrology combine to create conditions where river and stream waters flow outside of their usual course and "spill" beyond their banks. In the MOA, these natural factors can be exacerbated by development and result in an increase in the frequency of flood events. The MOA spans a wide range of climatic and geologic regions, resulting in considerable variation in precipitation. Primary factors in the amount of precipitation and area will receive are elevation and slope aspect, or direction. Within the MOA, annual precipitation varies from less than 15 inches at TSAIA to over 70 inches in Girdwood and along Turnagain Arm. Snowmelt from the Chugach Mountains provides a continuous water source throughout the year, and can contribute significantly to the development of flooding.

Types of Flooding

Riverine, icing, and urban flooding are the three types [8]of flooding that primarily affect the MOA. Riverine flooding is the overbank flooding of rivers and streams. The natural processes of flooding add sediment and nutrients to fertile floodplain areas. Riverine flooding can be the result of rainfall runoff or snowmelt and can occur on any of the rivers and streams within the MOA. Riverine flooding occurred on many rivers and creeks during the falls of 1995, 1997, 2002, and 2005.

Icing, also called aufeis, occurs when the growth of large bodies of ice on the streambed during freeze-up or breakup creates an obstruction to normal streamflow, causing river and streams to leave their banks. This can occur on many streams within the MOA. During the

[8] Flooding types are not exclusive categories and a flood event could have elements of multiple types of floods.

winters of 2003 and 2006, aufeis lead to overbank flooding on many creeks including Peters Creek and Rabbit Creek.

Urban flooding results from the conversion of land from wetlands or woodlands to parking lots and roads, through which the land loses its ability to absorb rainfall, causing runoff to overwhelm natural and manmade drainages.

Within the MOA, other types of flooding that may occur infrequently include:

Ice Jam Floods – the MOA tends not to have the typical ice jam flood like other parts of Alaska. In the MOA, when an ice jam flood occurs, it tends to be the result of ice collecting in a channel constriction such as a culvert. During a rain event or a sudden thaw, runoff enters a stream before the stream ice can melt, resulting in a flood. This type of flooding is more likely on larger creeks such as Campbell Creek.

Flash Floods - These floods are characterized by a rapid rise in water level and are often caused by heavy rain on small stream basins, ice jam formation, or by dam failure. Flash floods are usually swift moving and debris filled, which cause them to be very powerful and destructive. Steep coastal areas in general are subject to flash floods. A flash flood could occur downstream of a Lake o' the Hills Dam. For more information, please see section 4.2.1, Dam Failure.

Fluctuating Lake Level Floods - Generally, lakes buffer downstream flooding due to the storage capacity of the lake. But when lake inflow is excessive, flooding of the lake shore area can occur.

Alluvial Fan Floods - Alluvial fans are areas of eroded rock and soil deposited by rivers. When various forms of debris fill the existing river channels on the alluvial fan, the water overflows and is forced to cut a new channel. Fast, debris-filled water causes erosion and flooding problems over large areas. The Girdwood area is prone to this type of flooding.

Glacial Outburst Floods - A glacial outburst flood, also known as a jökulhlaup, is a sudden release of water from a glacier or a glacier-dammed lake. They can fail by overtopping, earthquake activity, melting from volcanic activity, or draining through conduits in the glacier dam.

Subglacial releases occur when enough hydrostatic pressure occurs from accumulated water to "float" the glacial ice. Water then drains rapidly from the bottom of the lake. This type of flooding can occur on Lake George.

Other problems related to flooding are deposition and stream bank erosion. 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. 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, fish habitat, and land and property.

A flood can injure or kill people as well as damage property. A flood may disrupt public utilities including water supplies and water treatment facilities. It can impact the transportation system by washing out roads or damaging bridges and culverts. This can make it difficult for emergency responders to get where they are needed.

Overflowing wastewater treatment systems can expose people to raw sewage which may make them ill. If a flooded building has not been treated properly, mold and mildew may develop which can become a health hazard especially for people with respiratory issues. The contents of a building such as household furnishing can be lost if they are washed away. Important papers, photographs, and similar items may be damaged. Standing pools of water may become breeding grounds for mosquitoes.

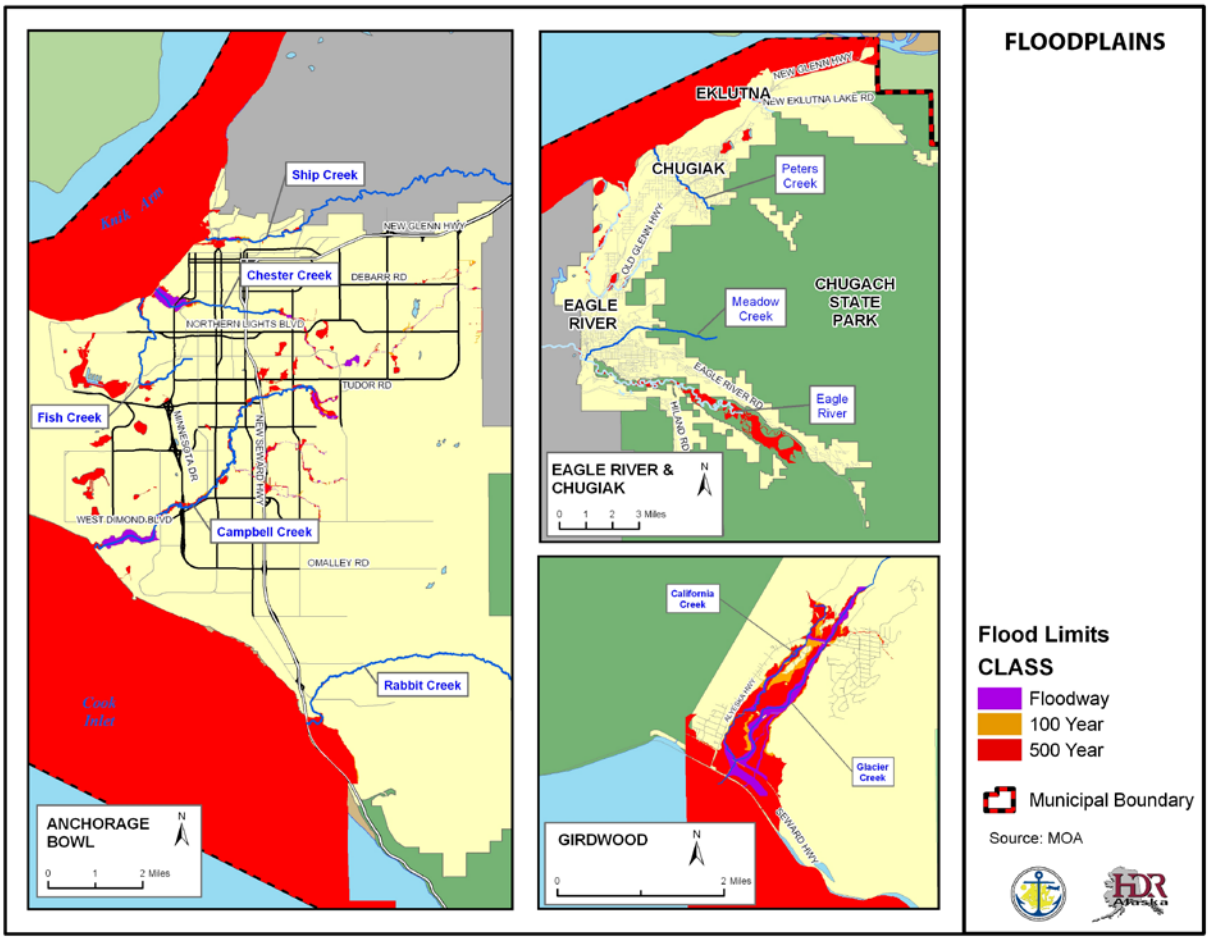
L o c a t i o n

The MOA has many small streams and larger rivers that are susceptible to annual flooding events. Large rivers include the the Glacier Creek, Twentymile River, Portage Creek, Placer River, Ship Creek, and Eagle River. Smaller streams include California Creek, Virgin Creek, Alyeska Creek, Fire Creek, Chester Creek, Campbell Creek, Little Campbell Creek, Fish Creek, Furrow Creek, Rabbit Creek, Meadow Creek, Fire Creek, and Peters Creek. Additionally, the shorelines of many of the small lakes in Anchorage are subject to periodic flooding. Coastal areas may experience flooding associated with extreme high tides.

The flood hazard varies by location and type of flooding. The FEMA Flood Insurance Study from 2009 identifies potential areas of flooding. The study excluded Fire Island, Elmendorf Air Force Base, Fort Richardson Military Reservation, and Kincaid Park (referred to in the study as the Point Campbell Military Reservation). According to this report, most of the development land in MOA is "low, swampy, and subject to inundate from flooding" (FEMA, 2009). The MOA is currently in the process of updating their Flood Insurance Study. The update study is expected to be released in early mid-2011.

Figure 4.8 shows flood-prone areas in the MOA. This map is for illustrative purposes, as not all the floodplains identified on MOA's Flood Insurance Rate Maps (FIRM) are on this map. The main flood-prone areas are near Glacier and California Creeks in Girdwood, near Eagle River Road in Eagle River, Potter's Marsh, and along Campbell and Chester Creeks in Anchorage. Please see the appropriate FIRM for more detailed flood information.

Figure 4.8 Flood-Prone Areas in the MOA



Much of Girdwood is subject to flooding because Girdwood valley occupies a fluvial valley drained by Glacier and California Creeks. The mouth of the valley is at sea level and gains elevation inland of the Seward Highway (MOA, 1996). The entire mouth of the Girdwood valley and the area adjacent to Glacier Creek to the airport is essentially within the 100-year floodplain. Other areas susceptible to flooding are California, Alyeska, and Virgin Creeks. The primary cause of flooding is runoff during heavy rainfall or during rapid snowmelt during the spring (MOA, 1995).

Likelihood of Occurrence

Coastal areas are more likely to flood when there is a storm that causes storm surge, high waves, or intense rainfall. Riverine flooding is more likely to occur in the spring when the snowpack is melting. There is also more chance of flooding in heavy snow seasons. Riverine flooding can also occur in response to heavy

Property Owner Outreach

On an annual basis, the MOA sends an informational letter to people who own property located in a floodplain. The letter provides an overview of flooding sources within the MOA, the causes of flooding, recent flooding events, flood insurance, floodplain regulation, flood safety tips and a list of contacts where home owners can obtain additional information.

rainfall in upstream areas. Glacier outburst floods are not very predictable.

Historic Events

Summer 2008

During the summer of 2008, an intense localized "cloudburst" caused flooding on the east side of the Anchorage Bowl. Stormwater runoff exceeded the capacity of the constructed and natural drainage system. Floodwaters flowed into the crawlspaces and lower floors of some local residences.

Winter of 2003 and 2006

During the winters of 2003 and 2006, colder than normal temperatures, combined with later than normal snowfall, caused the formation of aufeis in local streams, leading to overbank flooding, particularly on Peters Creek.

Peters Creek Flooding
In 2006, Peters Creek has some of the worst flooding local residents have seen in 50 years. The Anchorage Soil and Water Conservation District (ASWCD) had to blast a series of ice dams on Peters Creek to reopen the creek channel and stop the flooding. Since then, the ASWCD has been working on the Peters Creek Flooding and Erosion Control Project address the flooding issue.

Fall of 1995, 1997, 2002, and 2005

The "Pineapple Express" brought warm weather to Anchorage in the fall of 1995, 1997, 2002, and 2005. The warmer than average temperatures, combined with prolonged precipitation, resulted in flooding throughout Southcentral Alaska, including the MOA. The 1995 event resulted in a federal disaster and is discussed below.

In September 1995, there was a federal disaster declaration (AK-1072-DR) due to flooding caused by heavy rainfall. Most of the damages were outside the MOA, but Girdwood was negatively impacted. Officials in Girdwood had to shut down the wastewater treatment plant when it was overwhelmed by large volumes of mud and water. This resulted in raw sewage being washed into local creeks.

Other Flood Events

August 30, 1989

In August 1989, more than 5 inches of rain fell in the Anchorage area, causing heavy flooding along drainage systems in the MOA. The flooding was concentrated at homes and businesses along Campbell, Chester, and Ship creeks. The flooding resulted in a State Disaster Declaration.

February 10, 1978

During February 1978, the south fork of Campbell Creek experienced flooding and glaciation. Glaciation is when a stream freezes to the bottom or a culvert freezes full. The water flowing on top of the ice also freezes, so more ice develops and spreads into the overbank areas.

The flooding affected an area bounded by East 80th Avenue, Spruce Avenue, Lake Otis Parkway, and Abbott Loop Road. Many residential structures were threatened with water, ice, and contamination of surface and subsurface water. The flooding resulted in a State Disaster Declaration.

June 1966

Glacial outburst flooding last occurred on Lake George in June 1966. Between 1914 and 1966, the lake flooded almost every June or July. Prior to 1914, however, flooding occurred irregularly. These flood events were caused by the Knik Glacier blocking the valley of Lake George, trapping glacier and snow meltwater. The lake enlarges and the water erodes the glacier until it breaks out. The released water can be flowing as fast as 150 million gallons per minute. The flooding threatened structures on the Knik River floodplain (Davis, 1980).

Other flooding events are listed in Table 4.17.

Table 4.17 Historic Flooding

Flooding Source and Location	Maximum Discharge (cfs)	Date	Estimated Recurrence Interval (Years)
Ship Creek Near Anchorage	1,860	June 1949	50.0
South Fork Campbell Creek at mouth	891	June 1949	100.0
Chester Creek	N/A	April 1963	5.0
Rabbit Creek	N/A	June 1964	100.0
Eagle River	6,240	September 1967	N/A
Glacier Creek at Girdwood	7,710	September 1967	20.0
Ship Creek Below Power Plant at Elmendorf Air Force Base	1,600	August 1971	20.0
Campbell Creek Near Dimond Boulevard	421	August 1971	1.7
Chester Creek At Arctic Boulevard At Anchorage	95	August 1971	1.1
Peters Creek	N/A	August 1971	50.0
Meadow Creek	N/A	August 1971	5.0

From: Flood Insurance Study, 2002

Vulnerability

The MOA has almost 10,000 acres of floodplain and more than 3,500 parcels that are partially or wholly located within the floodplain. Ongoing development increases the developed area that is vulnerable to flooding as natural areas that have historically functioned as flood storage are displaced.

Parcels adjacent to waterbodies are the most vulnerable to flooding. The vulnerability shown in Tables 4.18 and 4.19 are based on the Municipality's flood limit GIS file shown in Figure 4.9. The number and location of parcels impacted may be different during different events. Flood waters may cause road closures leading to a disruption of the transportation infrastructure. While the exact number of people living in the 2,827 residential parcels in a known floodplain, based on the MOA average household size of 2.65, the number of people who could be affected by a flood event is approximately 7,492. Large numbers of injuries and fatalities are not anticipated with a flood event however people could be impacted by the need to evacuate their home, water damaged belongings, and the cost of clean-up activities. Proper clean-up after a flood event is important to prevent mold from developing.

Table 4.18 100-YearFloodplain Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	1,729	$250,211,600	$402,190,100	$652,401,700
Commercial	120	$57,329,100	$87,014,800	$144,343,900
Industrial	142	$35,095,200	$25,527,000	$60,622,200
Institutional	33	$24,777,900	$54,878,200	$79,656,100
Parks, Open Space & Recreation Areas	417	$2,340,300	$84,500	$2,424,800
Transportation Related	52	$21,275,900	$229,500	$21,505,400
Other	82	$12,210,500	$0	$12,210,500
Vacant	412	$68,447,800	$48,233,200	$116,681,000
Unidentified	604	$89,713,700	$322,208,600	$411,922,300
Total	**3,591**	**$561,402,000**	**$940,365,900**	**$1,501,767,900**

Source: MOA GIS, 2009

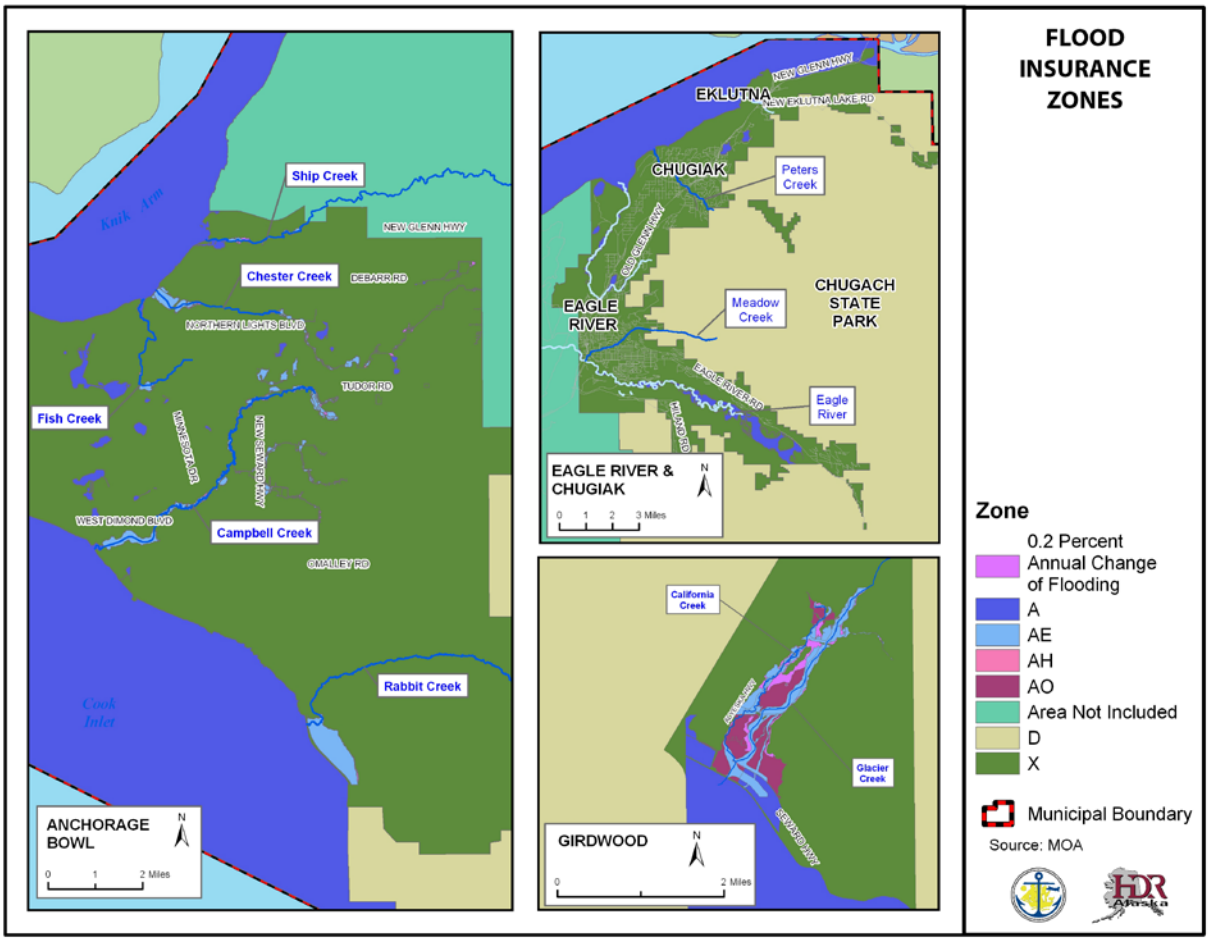
Table 4.19 500-Year Floodplain Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	1,098	$143,425,900	$239,413,100	$382,839,000
Commercial	75	$27,945,500	$40,687,000	$68,632,500
Industrial	71	$9,692,700	$7,439,300	$17,132,000
Institutional	20	$16,007,200	$16,698,700	$32,705,900
Parks, Open Space & Recreation Areas	264	$580,100	$84,500	$664,600
Transportation Related	7	$0	$0	$0
Other	5	$0	$0	$0
Vacant	152	$29,446,700	$12,375,500	$41,822,200
Unidentified	213	$42,445,100	$294,460,800	$336,905,900
Total	**1,905**	**$269,543,200**	**$611,158,900**	**$880,702,100**

Source: MOA GIS, 2009

For more information about potential vulnerabilities, please see the 2009 Flood Insurance Study.

Figure 4.9 Flood Insurance Zones



None of the above properties has been identified as a repetitive loss property. A repetitive loss property is defined in the Flood Insurance Manual as a National Flood Insurance Program (NFIP) "insured structure that has had at least two paid flood losses of more than $1,000 each in any 10-year period since 1978."

Flood Insurance

The Municipality of Anchorage participates in the NFIP, which makes federally backed flood insurance available for all structures, whether or not they are located within the floodplain. Membership within NFIP —and the availability of flood insurance to municipal residents — requires the MOA to manage its floodplain in ways that meet or exceed standards set by FEMA. Federal financial assistance requires the purchase of flood insurance for buildings located within the Special Flood Hazard Area, a requirement that affects nearly all mortgages financed through commercial lending institutions. While the mandatory flood insurance purchase requirement has been in effect in the MOA since 1970, this requirement was often

overlooked by lending institutions. Today, however, all institutions are complying with the applicable flood insurance purchase requirements, and are reviewing all mortgage loans to determine whether flood insurance is required and should have been required in the past. Currently, the MOA has 350 NFIP policies, for a total premium of $223,542. There have been 14 closed paid losses.

The MOA has participated in the NFIP since 1979. The first FIRM became effective in 1979 and the current effective map date is September 25, 2009. The MOA makes PDF versions of the FIRM maps available through their Web site. Digital FIRMs are available through FEMA's Map Service Center. The MOA's floodplain ordinance exceeds the FEMA and state minimum requirements by having a 1-foot freeboard requirement, prohibiting critical facilities from being located in a floodplain, and prohibiting most types of floodway development. The floodplain permitting process is described in Appendix E.

The MOA has a dedicated floodplain manager, whose primary duty is floodplain management. Currently, the MOA has a Certified Floodplain Manager on staff. The MOA also currently provides the following administrative services: map and records depository, permit review, cooperative technical partners mapping, assistance with letters of map changes preparation, technical and design assistance, and agency coordination. The only change that would improve the effectiveness of the NFIP program would be the addition of more support from the development community and some sectors of the MOA.

The MOA is in good standing with the NFIP and there are no outstanding compliance issues. The most recent Community Assistance Visit or Community Assistance Contact was in 2007 and there are none scheduled or needed at this time.

Community Rating System

The MOA participated in the Community Rating System (CRS); the current CRS class ranking is 6. The CRS Verification Report included in Appendix E describes the categories and activities that provide CRS points. Activities that may improve the class, if any, are included in the mitigation strategy.

4.1.5 AVALANCHE

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 avalanche material, 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 of avalanches include cornice collapse, ice, and slush.

Loose Snow Avalanches

Loose snow avalanches, sometimes called point releases, generally occur when a small amount of uncohesive snow slips and causes additional uncohesive snow to travel downhill.

They occur frequently as small, local cold dry "sluffs" that remove excess snow (involving just the upper layers of snow) and keep the slopes relatively safe. Loose avalanches are often small. Most dry loose snow avalanche do not have enough size to cause damage (American Avalanche Association, 2002). Wet loose snow avalanches, most commonly occurring in the spring, also tend to be small but are more likely to cause damage (American Avalanche Association, 2002). Loose snow avalanches can also trigger slab avalanches.

Loose snow avalanches typically occur on slopes above 35 degrees, and leave 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 snowpack. The weakness exists when a relatively strong, cohesive snow layer overlies weaker snow or is not well bonded to the underlying layer. Weaknesses are caused by changes in the thickness and type of snow cover due to changes in temperature or multiple snowfalls. The interface fails for several reasons. It can fail naturally due to 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 over which the slab slides 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 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

Ice fall avalanches result from the sudden fall of broken glacier ice down a steep slope. They can be unpredictable. They are unrelated to temperature, time of day, or other typical avalanche factors.

Slush Avalanches

Slush avalanches occur mostly in high latitudes. One 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 degrees. The snowpack 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 at the base of the snow cover.

Slush avalanches can travel slowly or reach speeds up to more than 40 mph. Their depth is variable as well, ranging from 1 foot to more than 50 feet.

Avalanche Terrain Factors

There are several factors that influence avalanche conditions. The main factors are 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 25 degrees, there usually is not enough stress on the snowpack to cause it to slide. Above 60 degrees, the snow tends to "sluff" off and does not accumulate. It is uncommon for avalanches to occur outside this slope angle range.

Slope aspect, also called 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 bonds between snow grains, weakening snowpack. Shaded slopes are potentially more unstable because 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 is 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.

Avalanche Impact Pressures Related to Damage

Impact Pressures		Potential Damage
Kilopascals (kPa)	Pounds per square foot (Lbs/ft^2)	
2-4	40-80	Break windows
3-6	60-100	Push in doors, damage walls, roofs
10	200	Severely damage wood frame structures
20-30	400-600	Destroy wood frame structures, break trees
50-100	1000-2000	Destroy mature forests
>300	>6000	Move large boulders

Source Mears 1992.

The track is the actual path followed by an avalanche. The track has milder slopes, between 15 and 30 degrees. This is where the 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.

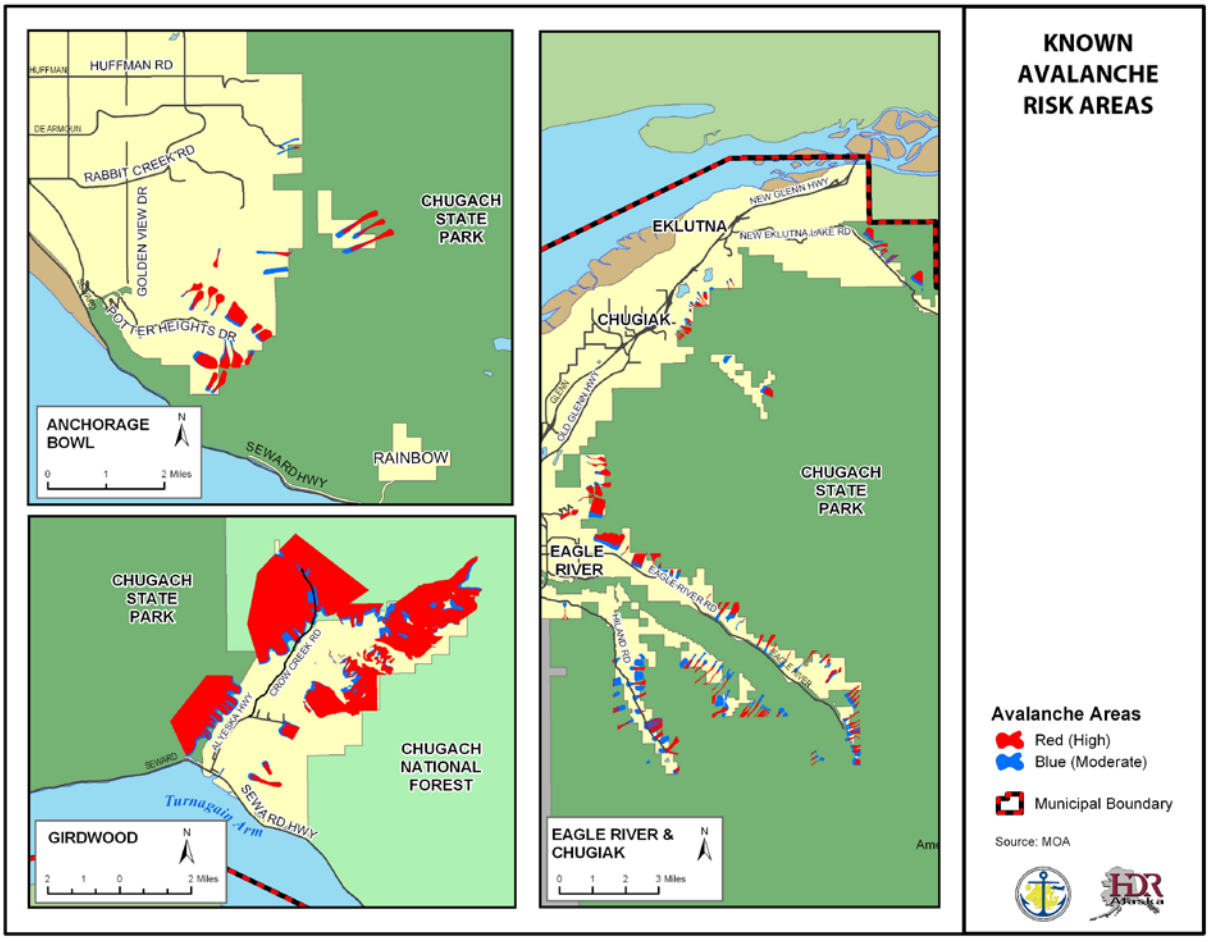
The run-out zone is a flatter area—around 5 to 15 degrees. It is located at the path base where the avalanche slows down, resulting in snow and debris deposition.

The impact pressure determines the amount of damage caused by an avalanche. The impact pressure is related to the density, volume (mass), and velocity of the avalanche.

Location

Avalanches can occur anywhere, but gullies, steep snow-covered slopes, and areas below steep ridges are particularly susceptible. To identify avalanche-prone areas in Anchorage, the Anchorage Snow Avalanche Zoning Analysis was conducted in 1982 by Arthur Mears. This report identified moderate (blue) and high (red) hazard areas, as shown in Figure 4.10.

Figure 4.10 Known Avalanche Risk Areas



The report describes the red zone as subject to avalanches with a 10-year average return period and the blue zone as prone to avalanches with a 100-year average return period. This means that a 10-year avalanche has a 10% annual probability, while a 100-year event has a 1% probability. Because an average return period is used, a 10-year avalanche has a return period of 3 to 30 years, while a 100-year avalanche has a return period of approximately 30 to 300 years. Events greater than a 100-year avalanche will affect parcels outside the blue zone.

The area with the potential for the largest avalanches is the Girdwood/Crow Creek area. Evidence of snow avalanches is prominent along the mountainsides above the Girdwood valley. The western mountainside has high and moderate avalanche danger from Turnagain Arm to California Creek. Avalanche hazard is moderate to high on the eastern mountainside at the head of the valley, near the day lodge and resort area, and southeast of Virgin Creek. Alyeska's daylodge and day parking are located partially in both the moderate and high avalanche hazard areas. Part of the original base area hotel and condos are in a moderate hazard area.

Other areas south of the Anchorage Bowl that may experience avalanches are Bird Creek, Indian, and Rainbow. North of the Anchorage Bowl, the areas near the South Fork of Eagle River, Eagle River, Peters Creek (especially near what is locally known as 4-mile), and Mirror Lake/N.W. Spur of Mt. Eklutna have avalanche potential. For more details, please refer to the Anchorage Snow Avalanche Zoning Analysis.

Another avalanche-prone area is the Seward Highway between the flats near Bird Point and the entrance to the Girdwood valley (CSAC, 2004). This may be one of the most dangerous stretches of highway for avalanches due to traffic volume. In this area, avalanches have caused numerous accidents, killed at least five people, and caused other deaths from drowning by sweeping people into Turnagain arm (CSAC, 2004).

Likelihood of Occurrence

Multiple avalanches occur every year, but they usually occur in more remote areas. The number and location depends on the conditions —the formation of weak layers in the snow, wind loading, terrain, etc. On a large scale, avalanches are hard to predict because winter conditions change and can vary from hour to hour.

Historic Events

The most remembered avalanches in recent history are those associated with the 2002 winter storms. Those avalanches resulted in road and rail access to Girdwood being blocked, disruption of electrical service, property damage, and the death of a heavy equipment operator who was clearing debris from an earlier avalanche off the Seward Highway.

2000 Central Gulf Coast Storm - Federal Disaster 1316

In December 1999 and January 2000, a series of severe winter storms triggered avalanches and flooding throughout Southcentral Alaska. Anchorage was one of many jurisdictions included in a Federal Disaster Declaration. In Anchorage, damage from this event included

one fatality, property damage, disruption of electrical service, and interruption of rail and road access south of the Potter Weigh Station.

The section of New Seward Highway from Bird Point to Girdwood is very avalanche-prone. Between 1951 (when the Seward Highway opened, and 1998) avalanches have blocked the road at least 485 times and have been a factor in more than 60 accidents (CSAC, 2004). In 1998, a six-mile stretch of highway was relocated (from mountainside to a new sea-level route) and was expected to reduce avalanche danger by approximately 70 percent. See Table 4.20 for additional historic avalanche events.

Table 4.20 Known Historic Avalanche Events

Date	Description
February 13, 2010	An avalanche near Mile 7.3 of Hiland Road in Eagle River resulted in a cross-country skier being fatally injured.
March 25, 2009	An avalanche hit an ARRC freight train approximately 5-20 miles south of Portage. Several of the rail cars were buried by the avalanche but there were no fatalities.
January 3, 2006	An avalanche on Ragged Top Mountain near Girdwood, Resulted in fatal injuries to a skier.
February 9, 2006	A snowshoer was fatally injured on Flat Top Mountain.
February 28, 2004	A cornice gave way on Bryon Glacier Peak, near Portage, and triggered an avalanche resulting in the death of a mountain climber.
January 22, 2004	A block of ice slide off the roof of a Forest Service warehouse near Portage and killed a Forest Service employee.
November 11, 2003	A self-triggered slab avalanche occurred in the Chugach State Park on Triangle Peak near the head of the South Fork of the Eagle River Valley. One man was partially buried but his two companions were able to dig him out.
April 1, 2002	An avalanche occurred on the south side of Mount Magnificent, killing two snowshoers. A third man was caught in the avalanche but was able to free himself. The avalanche triggered other slides in the area.
March 28, 2002	Two backcountry skiers and two dogs triggered an avalanche in the south bowl of Three Bowl Path near Mile 6.6 of Hiland Road in Eagle River. One skier was buried under 4 feet of debris and was rescued by the other skier. The following day, while searching for the dogs, a rescuer triggered another slide that hit a house. The slide damaged the fence but not the house; however, there were several feet of debris against the back wall.
November 11, 2000	On the North Gully of Flat Top Mountain, in Chugach State Park, one person was severely injured when he was caught by a small slab avalanche.
February 1, 2000	Avalanche near Bird Flats on the Seward Highway. An Alaska Railroad employee who was helping clear previous slides from the highway was killed when the avalanche struck the bulldozer he was operating. Three avalanches occurred that day. This specific avalanche occurred at the Five Fingers chute, and was estimated to have crossed the highway at between 100 and 125 miles per hour. Slides also occurred at Mile 5.7 on the Eklutna Lake Road, Mile 7.5 of the Old Glenn Highway, and the Glenn Highway at Mile 95.

Date	Description
	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.
January 25, 2000	An avalanche occurred in the High Traverse area of Alyeska Resort. All skiers in the area were accounted for.
March 1999	An avalanche at Alyeska Resort partially buried two skiers. This was the first time in 25 years that an avalanche hit skiers at the resort.
December 7,1997	One woman was killed in a self-triggered soft slab avalanche while hiking on the Crow Pass Trail. Her companion was not caught by the avalanche but was unable to locate her.
April 1997	There was a series of avalanches between April 5th and 11th that involved skiers, climbers, and snowmachiners. A snowmachiner was killed in one of those accidents. http://www.sarinfo.bc.ca/Library/Rescues/girwood.AK
1987-88	Several (34) avalanches reached the Seward Highway. Some of the avalanches resulted in temporary highway closures and downed power poles. One avalanche, near Super Scooper (MP 94), struck a vehicle on the highway.
January 1980	Near MP 94, in a chute called Super Scooper, an avalanche hit a vehicle and derailed 4 locomotives and 13 cars of a freight train. Later that winter, avalanches blocked the road again, closing it for 4 days.
March 1979	A series of storms near Bird Hill caused 24 avalanches over several weeks. One slide, with 33 separate tongues, buried 2 miles of highway, closing it for 3 days.
1978	Seward Highway was blocked at least 17 times. One series of slides trapped 20 cars on Bird Hill. Another slide, near MP 99, hit one car and took high voltage lines off 13 poles.
1959-60	The Seward Highway was blocked by avalanches at least 81 times because of frequent blizzards in the Bird Hill area.
1952	On the Girdwood Flats near MP 91.8, an avalanche hit several cars on the highway. One person got out of their vehicle and was hit by a second slide and subsequently died.
1920	Near MP 91, an avalanche buried an Alaska Railroad train. As the train's occupants started to dig themselves out, the train was struck by a second slide. This slide buried 25 people and 4 killed others. It has been reported that several people were swept into Turnagain Arm and drowned.
1918	An avalanche near the present Seward Highway MP 92 killed several draft horses and knocked a telegraph pole over.

Additional avalanche events are listed in Mears, 1993 and Mears, 1982.

Vulnerability

Avalanche vulnerability is calculated using the areas in the MOA's avalanche GIS file (shown in Figure 4.10). The number of parcels in a high-risk avalanche area is shown in Table 4.21, while those in a moderate-risk area are shown in Table 4.22. Only a portion of these parcels are

likely to be impacted by a given avalanche event. Other development including above ground utility lines can also be vulnerable to avalanches.

Avalanches have the ability to cause injury and death to people in the impacted area. With the average household size in the MOA being 2.65, the 24 residential parcels there is approximately 64 people living in an area with a known avalanche risk. Most avalanche related fatalities involve outdoor recreationalists such as back country skiers, snowboarders and snowmachiners but not exclusively. Many times, the victim triggers the avalanche. Other people such as passing motorists can also be at risk. Avalanches have the ability to destroy buildings, cover buildings and roads with snow and debris. They can also take down utility lines.

Historically, avalanches have caused the closure of the Seward Highway isolating Girdwood from the rest of the MOA. The avalanche hazard may increase road maintenance costs. Depending on the conditions, more avalanche mitigation measures may be needed.

Table 4.21 High Avalanche Hazard Area Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	3	$179,400	$585,300	$764,700
Commercial	0	$0	$0	$0
Industrial	0	$0	$0	$0
Institutional	0	$0	$0	$0
Parks	0	$0	$0	$0
Transportation	0	$0	$0	$0
Other	1	$0	$0	$0
Vacant	8	$562,600	$0	$562,600
Unidentified	30	$1,280,600	$1,619,300	$2,899,900
Total	42	$2,022,600	$2,204,600	$4,227,200

Source: MOA GIS, 2009

Table 4.22 Moderate Avalanche Hazard Area Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	21	$1,349,700	$4,381,000	$5,730,700
Commercial	0	$0	$0	$0
Industrial	0	$0	$0	$0
Institutional	0	$0	$0	$0
Parks	0	$0	$0	$0
Transportation	0	$0	$0	$0
Other	0	$0	$0	$0
Vacant	9	$430,100	$94,300	$524,400
Unidentified	8	$355,300	$732,400	$1,087,700
Total	38	$2,135,100	$5,207,700	$7,342,800

Source: MOA GIS, 2009

4.1.6 LANDSLIDE/GROUND FAILURE

Ground failure is a general term used to describe hazards that affect the stability of the ground. It can occur in many different ways, including landslides, land subsidence, and failures related to seasonally frozen ground and permafrost. Frequently, ground failure occurs as the result of another hazard such as an earthquake or volcanic eruption. Seismically-induced ground failure is a major concern in the MOA.

Ground failure is tends to cause more property damage than injuries or fatalities. Property damage can occur to buildings and infrastructure such as buried pipes. Ground failure can cause damage to the transportation system including roads, bridges, and railroads. Areas threatened by ground failure may have lower real estate values which can result in lower property tax revenue.

Landslides

Landslide is a generic term for a variety of downslope movements of earth material under the influence of gravity. Some landslides occur rapidly, in mere seconds, while others might take weeks or longer to develop.

Landslides usually occur in steep areas, but not exclusively. They can occur as ground failure of river bluffs, cut-and-fill failures associated with road and building excavations, collapse of mine-waste piles, and slope failures associated with open-pit mines and quarries. Underwater landslides usually involve areas of low relief and slope gradients in lakes and reservoirs or in offshore marine settings.

It is hard to identify high and moderate zones of hazard intensity for different types of landslides. For example, hazard zones for rock falls can't be identified because the risk depends a lot on the size of the rocks involved. It is known that the bluff near Points Campbell and Woronzof is a "narrow zone of very unstable material with a strong risk of landslide" (Mason, 1997: 198-199). The area near Campbell Lake has a high risk of landslides (Mason, 1997). "Debris flows occur in small, steep drainage basins throughout the" Glacier/Winner Creek area (Mears, 1993:13).

Landslides can occur naturally or be triggered by human activities. They occur naturally when inherent weaknesses in the rock or soil combine with one or more triggering events such as heavy rain, snowmelt, changes in groundwater level, and seismic or volcanic activity. Landslides can be caused by long-term climate change that results in increased precipitation, ground saturation, and a rise in groundwater level, which reduces shear strength and increases the weight of the soil. Erosion that removes material from the base of a slope can also trigger landslides.

Human activities that trigger landslides are usually associated with construction, such as grading that removes material from the base, loads material at the top, or otherwise alters a

slope. Changing drainage patterns, groundwater level, slope, and surface water (for example, the addition of water to a slope from agricultural or landscape irrigation, roof downspouts, septic-tank effluent, or broken water or sewer lines) can also cause landslides.

Three main factors that influence landslides are topography, geology, and precipitation. Topography and geology are associated with each other; the steeper the slope, the greater the gravitational influence. Rock strength is important, as certain bedrock formations or rock types appear to be more prone than others to landsliding. Precipitation may erode and undermine slope surfaces. If precipitation is absorbed into the ground, it increases the pore water pressure and lubricates weak zones of rock or soil.

Secondary Effects

Landslides are often associated with other hazards. For example, a landslide may occur during floods because both involve precipitation, runoff, and ground saturation. Landslides are often associated with seismic and volcanic events. Some of the costliest landslides in American history were associated with the 1964 Good Friday earthquake in Alaska. It has been estimated that ground failure, not shaking, caused about 60% of the damage.

The secondary effects of landslides can extend the damage past the limits of the actual landslide. For example, a landslide that dams a river or creek can cause damage upstream due to flooding and downstream due to flooding that may result from a sudden dam break. Landslides can also trigger tsunamis and seiches.

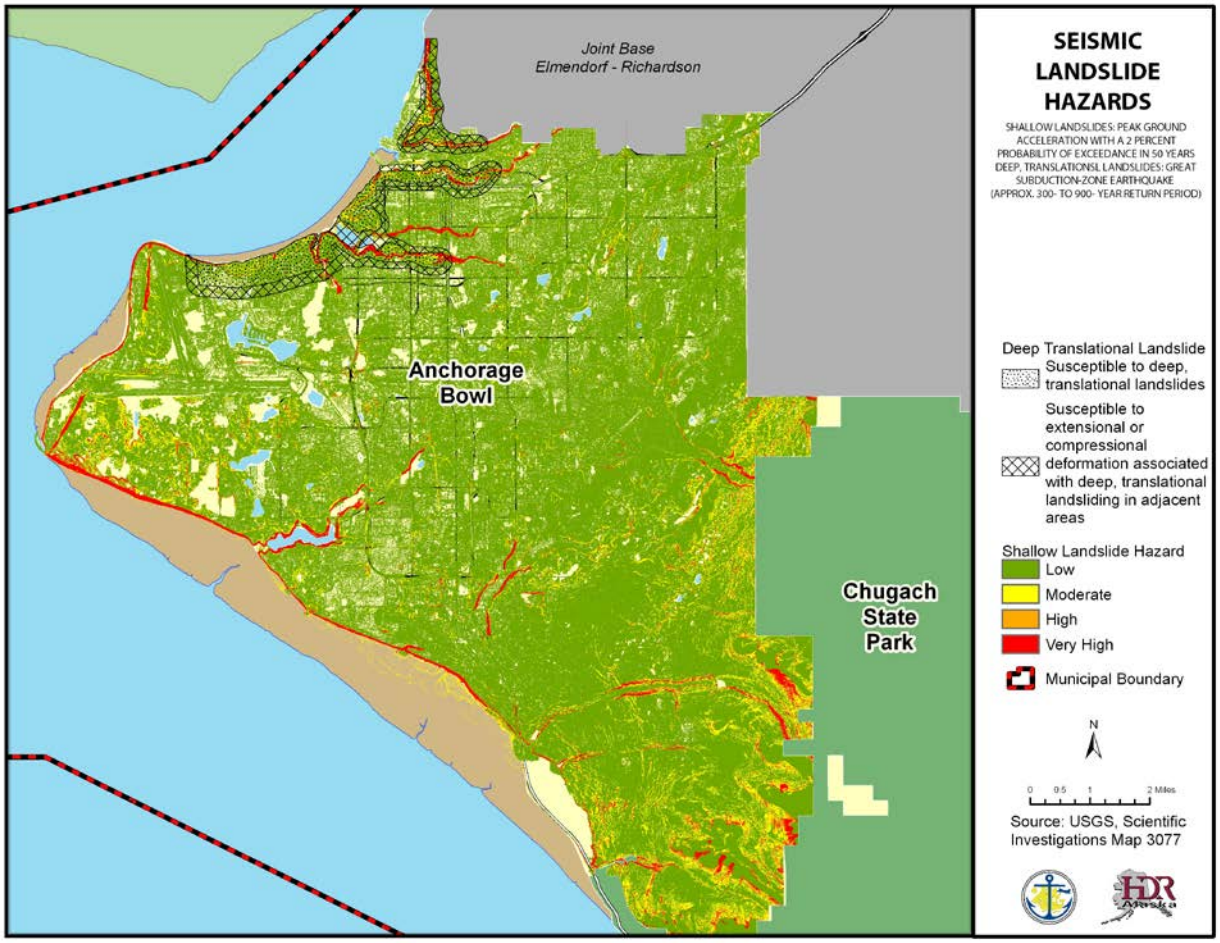
Seismically Induced Ground Failure

In 1979, a Geotechnical Hazards Assessment Study was developed to "inventory all geotechnical data significant with respect to geologic hazards, to analyze the data to provide an indication of the degree of hazard, and to designate those areas of potential hazards upon a series of maps" (Harding-Lawson, 1979:3). In 2009, the USGS published "Maps Showing Seismic Landslide Hazards in Anchorage, Alaska" to update the seismic landslide hazard map of the Anchorage Bowl.

Most landslides caused by the 1964 earthquake fall into two categories: "(1) deep, translational block-type landslides on sub-horizontal shear surfaces, and (2) shallower, more disrupted slides and slumps, on more steeply dipping shear surfaces, along coastal and stream bluffs and other steep slopes" (USGS, 2009). The translational block slides occurred mostly in the downtown and Turnagain Heights areas. These areas tend to have thick (over 30 feet) layers of Bootlegger Cove Formation clay. The shallower slides generally occurred in coastal areas and stream bluffs. The following figures show the seismic landslide hazard for deep translational landslides associated with great subduction zone earthquakes with return periods between approximately 300 and 900 years, shallow landslides with a 2 percent probability of exceedance in 50 years, and shallow landslides with a 10 percent probability of exceedance in 50 years.

The United States Geologic Survey (USGS) recently completed a report on seismic landslide hazards in the Anchorage Bowl (Jobson and Michael, 2009). According to this report, a large portion of the Anchorage Bowl has a low hazard but areas with moderate, high, and very high potential exist.

Figure 4.11 Seismic Landslide Hazards



As Figure 4.11 shows, the areas most likely for a deep translational landslide are Turnagain Heights, Downtown, Government Hill, and along the western portion of Chester Creek and Ship Creek. The areas most likely for shallow landslides are "steeper slopes, principally along coastal and stream bluffs and steep slopes bounding some glacial hills" (Westin and others, 2007). Areas that have high and very high shallow landslide hazard include the Government Hill, along Chester Creek, along the Turnagain and Knik Arms, and Campbell Lake. For a map showing the shallow landslide hazard for an event with a 10 percent probability of exceedance in 50 years (a return period of 475 years), please see http://pubs.usgs.gov/sim/3077/downloads/3077_sheet2.pdf

The Chugiak/Eagle River and Turnagain Arm areas were not included in this report. While landslides are possible in these areas, additional research is needed

Land Subsidence

Land subsidence is any sinking or downward settling of the Earth's surface. Underground mining for minerals, groundwater, or petroleum, and drainage of organic materials are typical causes of subsidence. These are rare in Alaska. More common causes of land subsidence in Alaska are sediment compaction and seismic or volcanic activity.

Based on previous experience, the Portage and Girdwood areas are susceptible to subsidence.

Seasonally Frozen Ground

Frost action is the seasonal freezing and thawing of water in the ground and its effect on the ground and development. Frost heave is when ice formation causes an upward displacement of the ground. When the ground ice thaws, the ground loses bearing strength and its ability to support structures is weakened. This is a widespread problem in Alaska.

Permafrost

Ground failure related to permafrost is not a significant problem in Anchorage. Permafrost is frozen ground in which a naturally occurring temperature below 32° F has existed for two or more years. Approximately 85 percent of Alaska lies within the permafrost region. Permafrost is continuous in extent over most of the Arctic, but becomes discontinuous and sporadic or isolated as one moves further south. Only the southern coastal margins are completely permafrost-free. Permafrost can form an extremely strong and stable foundation if kept frozen, but if allowed to thaw, the soil becomes extremely weak and fails. Permafrost can thaw in response to general climate changes and warming or human activity. As Figure 4.12 shows, permafrost is not common in Anchorage. In fact, "Anchorage is essentially free of permafrost except at very high locations" (United States Army Corps of Engineers, 2002).

Likelihood of Occurrence

Ground failure events are difficult to predict, as many of them are triggered by other events such as earthquakes.

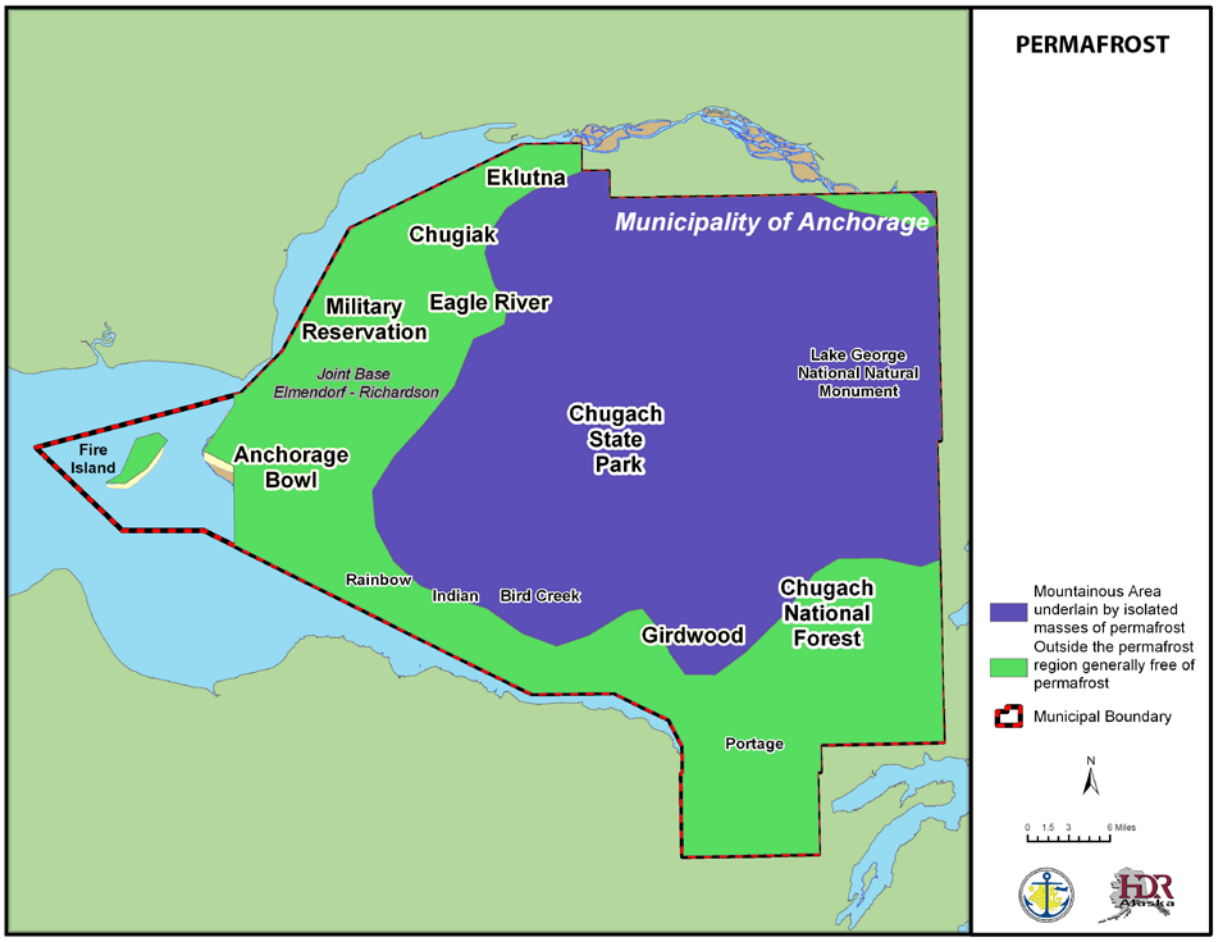
Historic Events

The 1964 Good Friday earthquake triggered a wide variety of falls, slides, and flows through Southcentral Alaska. The Anchorage area was heavily impacted because of Bootlegger Cove clay failures. Some of the more significant events occurred at 4th Avenue, L Street, Government Hill, and Turnagain Heights. Several less-devastating slides occurred throughout town, including slides at Point Woronzof and Potter Hill.

The Government Hill slide was a complex movement. Government Hill Elementary School was severely damaged by the translational slide. The south wing of the school dropped about 30 feet, while the east wing split lengthwise and collapsed. Part of this slide became an earth flow that spread 150 feet across the flats into the Alaska Railroad yards.

The Turnagain Heights landslide is also considered a complex movement. In fact, it was probably the most complex of all the Anchorage landslides associated with the Good Friday earthquake. The landslide likely began as a block slide, but evolved to include lateral spreading, slumping, and possibly other types of movement. This landslide caused serious damage to a housing development, in which three people died.

Figure 4.12 Permafrost



The earthquake caused at least one rock avalanche as a slab of rock became detached from the mountain peak overlooking Sherman Glacier. The rock slab disintegrated as it moved downhill, enabling it to reach high velocity and extend a great distance over the glacier. Rockslides were also triggered, including "one relatively significant event in the Winner Creek drainage" (Mears, 1993:12).

Extensive subsidence also occurred as a result of the 1964 Good Friday earthquake. The zone of subsidence covered about 110,039 square miles, including the north and west parts of Prince William Sound, the west part of the Chugach Mountains, most of Kenai Peninsula, and almost all the Kodiak Island group. Some areas experienced subsidence that exceeded seven feet, but most areas subsided less. For example, part of the Seward area is about 3.5 feet

lower than before the earthquake and portions of Whittier subsided more than five feet. The village of Portage, at the head of Turnagain Arm of Cook Inlet, experienced six feet of tectonic subsidence during the earthquake.

Vulnerability

An earthquake could cause seismically induced landslide. For information about earthquakes, please see Section 4.1. The susceptibility for seismically induced ground failure has been determined only for the part of the Municipality shown in Figure 4.11. Table 4.23 shows the parcels that are susceptible to a deep, translational landslide while Table 4.24 shows the parcels that are susceptible to deformation associated with deep, translational landslides in adjacent areas. A similar calculation could not be conducted to identify the vulnerability to the shallow landslide hazard as the file format did not permit this analysis. Based on an average MOA household size of 2.65, there is approximately 5,955 people living areas that are vulnerability to deep, translational landslides and an additional 3,729 living in the adjacent areas. Infrastructure, including buried pipes, are vulnerable to ground failure.

Table 4.23 Deep, Translational Landslide Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	2,247	$338,913,700	$495,810,100	$834,723,800
Commercial	356	$115,659,600	$283,113,300	$398,772,900
Industrial	70	$16,425,500	$24,059,500	$40,485,000
Institutional	34	$16,619,800	$12,302,100	$28,921,900
Parks	111	$3,166,600	$0	$3,166,600
Transportation	23	$6,300	$0	$6,300
Other	11	$0	$0	$0
Vacant	172	$20,006,200	$4,790,600	$24,796,800
Unidentified	66	$13,482,400	$10,836,100	$24,318,500
Total	**3,090**	**$524,280,100**	**$830,911,700**	**$1,355,191,800**

Source: MOA GIS, 2009

Table 4.24 Deformation in Adjacent Areas Vulnerability

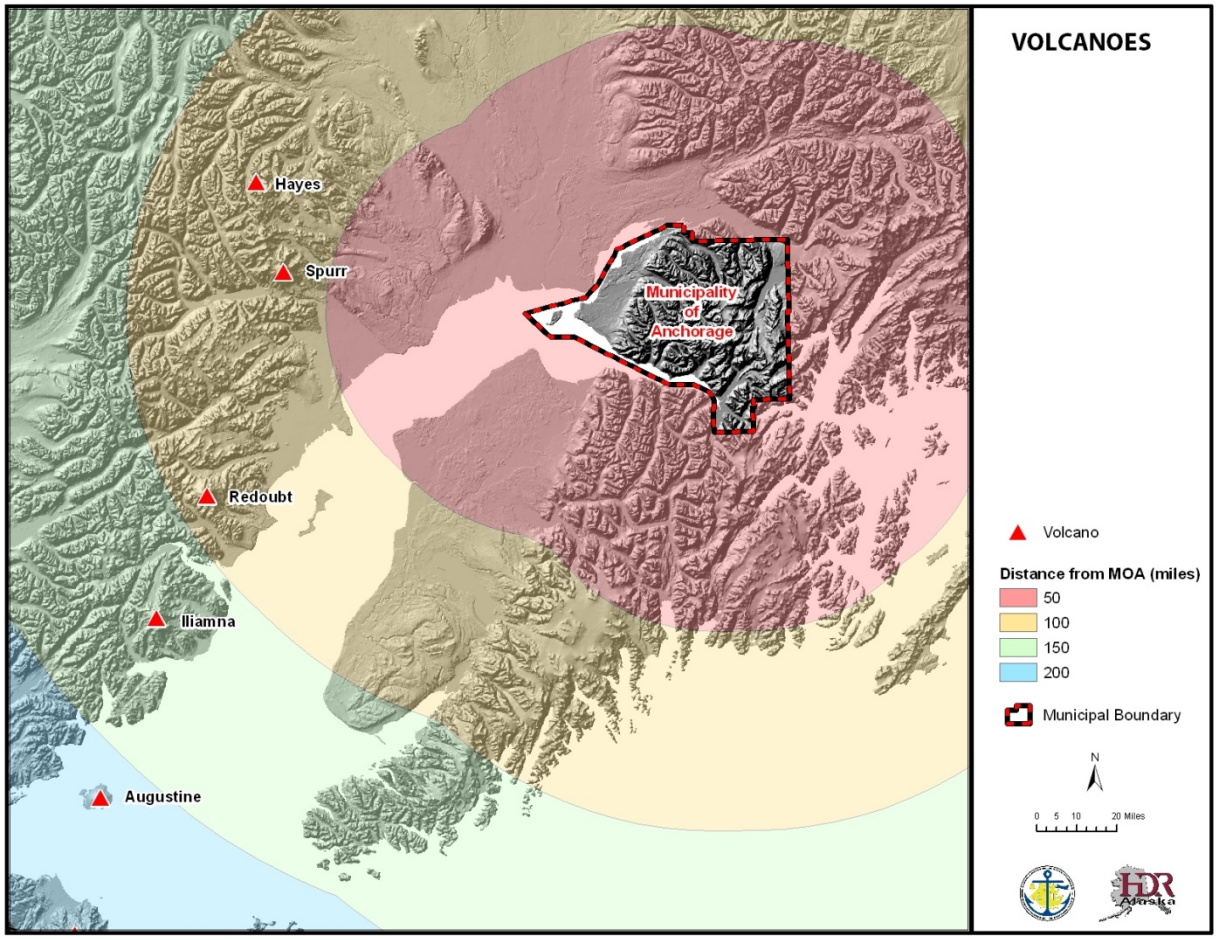
Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	1,407	$168,602,700	$283,742,900	$452,345,600
Commercial	598	$173,644,700	$432,950,200	$606,594,900
Industrial	147	$29,333,300	$45,104,900	$74,438,200
Institutional	45	$20,187,200	$26,197,000	$46,384,200
Parks	106	$1,073,300	$0	$1,073,300
Transportation	45	$0	$0	$0
Other	10	$0	$0	$0
Vacant	81	$10,552,600	$194,100	$10,746,700
Unidentified	73	$10,368,800	$3,529,100	$13,897,900
Total	**2,512**	**$413,762,600**	**$791,718,200**	**$1,205,480,800**

Source: MOA GIS, 2009

4.1.7 VOLCANIC ASH FALL

According to the Alaska Volcano Observatory (AVO), a volcano is "a vent in the surface of the Earth through which magma and associated gases and ash erupt; also, the form or structure (usually conical) that is produced by the ejected material" (AVO www.avo.alaska.edu, undated). Alaska is home to over 130 volcanoes with 90 of them being active in the last 10,000 years and over 50 have been active since approximately 1760. None of these volcanoes are located within the MOA (see Figure 4.13). Because of the distance between any volcano and the MOA, the MOA will not be likely be directly affected by most elements of a volcanic eruption that occurs in Alaska; with the exception of ash fall.

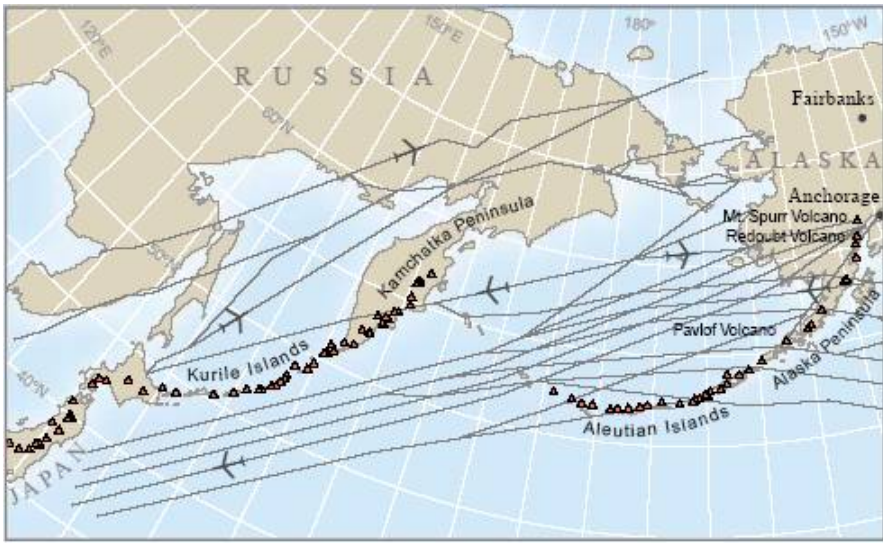
Figure 4.13 Volcanoes



There are a variety of hazards associated with a volcanic eruption, but the primary hazard to the MOA is volcanic ash fall. Volcanic ash consists of small jagged pieces (less than 1/12 inch in diameter) of rocks, minerals, and volcanic glass sent into the air by a volcano (Kenedi and others, 2000). Volcanic ash is created during an explosive volcanic eruption. Alaska's volcanic activity is dominated by explosive volcanism.

Volcanic ash can accumulate on roof tops, power lines or other structures causing them to collapse. Wet ash can conduct electricity and may cause short circuits or the failure of electrical components. Ash fall may interfere with telephone and radio communications. Ash can also interfere with the operation of mechanical equipment, including aircraft. In Alaska, this is a major problem, as many major flight routes are near historically active volcanoes; the main airport for the MOA and all of Alaska, the TSAIA along with Merrill Field, and JBER Elmendorf AFB air facilities, are all at risk from volcanic ash fall. Ash falling or resuspended can also reduce visibility and make roads and runways slippery making transportation difficult. Ash may be a health risk especially to people with cardiac or respiratory conditions, children and the elderly. Ash is abrasive and can injure eyes (Kenedi and others, 2000).

Figure 4.14 Flight Routes



Alaska's volcanoes and a schematic depiction of selected major North Pacific and Russian Far East air routes. SOURCE: AVO

Based on proximity, the volcanoes that are most likely to result in ash fall in the MOA are the five Cook Inlet Volcanoes, Hayes, Spurr, Redoubt, Iliamna and Augustine (figure 4.14). Of these, Augustine is considered the most historically active volcano in the Cook Inlet region (Wallace and others, 2010). For more information about these volcanoes, please see the respective volcano hazard report available on the AVO website at http://www.avo.alaska.edu/downloads/classresults.php?pregen=haz

Location

The entire MOA could be impacted by a volcanic ash event. Different areas of the MOA may be impacted by any given event depending on which volcano erupts, wind direction, and duration of the eruption. Due to the prevailing winds, the MOA could receive ash fall from any Cook Inlet volcano depending on wind conditions at the time of the eruption (Waythomas and others, 1997; Waythomas and Waitt, 1998). Recent lake-core studies in the Anchorage area indicate that Mount Spurr volcano is the most prolific source of ash fall in the MOA over the last 12,000 years (Wallace and others, 2010). It is also possible that ash could reach the MOA from a large eruption outside of the Cook Inlet region.

Likelihood of Occurrence

Volcanic activity that poses a risk to aircraft or local populations in Alaska is infrequent. The AVO actively monitors Alaska's volcanoes for signs of unrest. AVO is also responsible for issuing warnings of eruptions or activity that may lead to an eruption.

The MOA is more likely to experience ash fall from Spurr, Redoubt, and Augustine volcanoes because of the proximity of the MOA to these sources upwind. Based on geologic studies of the Cook Inlet volcanoes, Spurr, Redoubt, and Augustine are considered more frequently active than Hayes or Iliamna volcanoes, According to the USGS, "large-volume, explosive, ash-forming eruptions of Iliamna are probably unlikely in the future but significant disruptive small eruptions could occur (Waythomas and Miller, 1999). Hayes Volcano appears to be largely inactive in the past few thousand years and historical eruptions are unknown (USGS, 2002). However, the largest ash fall event in the MOA in the late Holocene occurred from Hayes Volcano (3,700–4,200 years ago).

Historic Events

In its nearly 100 years of existence, Anchorage has dealt with ash from historical eruptions of Spurr, Redoubt, and Augustine volcanoes. Additional information about these eruptions can be found in the respective Volcano-Hazard Assessments.

Spurr Volcano

In 1992, a series of three ash-producing eruptions occurred from Crater Peak, the active vent on Spurr Volcano. Ash fall from one of the three events occurred in the MOA (August 18) and triggered a disaster declaration. Approximately 0.12 inches (3 mm) of sand-sized ash fell in the MOA. The eruption caused health problems and property damage. Economic losses resulted from businesses, schools, and industrial facility closures. Cars, computers, and other electronic devices were damaged. TSAIA was closed for 20 hours. Two people had heart attacks while shoveling ash (Waythomas and Nye, 2002). Numerous air-quality alerts were issued for days following the ash-fall event due to resuspension of the ash deposit and air-quality was a concern until the first snow in the fall (Waythomas and Nye, 2002).

The only other historical eruption of Mount Spurr, was in July 1953. Ash from this eruption reached the MOA and deposited about twice as much ash as in 1992 (Waythomas and Nye, 2002).

Redoubt Volcano

The most recent eruption of Redoubt occurred in 2009 and produced at least 19 ash-producing explosions between March 22 and April 4 (Wallace and Schaefer, 2009). Only one such explosion on March 28 resulted in trace (< 0.8 mm or 0.031 in) ash fall in the MOA. Ash-fall impacts to the MOA were relatively minor due to the short duration (<1 hour) of ash fall and occurrence during winter months where the ash quickly mixed with snow on the ground preventing significant resuspension. Economic losses due to disruptions to airline travel were however, significant and the TSAIA was closed for 22 hours (March 28) and numerous flights were cancelled or rerouted throughout the eruption (Wallace and Schaefer, 2009).

Redoubt Volcano also erupted in 1989–1990 during which some 20 ash-producing explosions occurred (Scott and McGimsey, 1994). Ash fall in the MOA occurred on 3 occasions depositing trace amounts of ash (<0.8 mm or 0.031 in). The most serious impacts were economic losses due to disruptions to airline travel and the KLM Boeing 747-400 jet aircraft that temporarily lost power when it encounter the a diffuse volcanic ash plume causing millions of dollars in damage . The volcanic ash cloud affected flights from TSAIA, Merrill Field, and Elmendorf Air Force Base. As a result of eruption, the lost revenue to TSAIA is estimated at $2.6 million (Waythomas and others, 1997). The volcanic ash resulted in some school and business closures. Some people experienced respiratory problems from inhaling fine ash particles.

Augustine Volcano

The most recent eruption of Augustine occurred in 2006 when 13 major ash-producing explosions occurred between January 11 and mid-March. This was the fifth major eruption in 75 years (Power and others, 2010). Impacts from this event were considered minor with the biggest economic losses associated with cancelled, diverted, and rescheduled flights to avoid possible exposure to ash (Neal and others, 2010). The level of respirable particulate matter in the air within the MOA was reportedly elevated on several days during the eruption but did not exceed Environmental Protection Agency (EPA) standards (Wallace and others, 2010). There is no known significant property damage or adverse health affects associated with this eruption (Neal and others, 2010).

The 1986 eruption of Augustine (March-April) deposited trace (<0.8 mm or 0.031 in) amounts of ash in the MOA and caused significant disruptions to air traffic. A dome formed in the crater and caused some to fear it would subsequently collapse and trigger a tsunami along the east shore of Cook Inlet, as occurred in 1883. This eruption caused flights to and from TSAIA to be cancelled and military aircraft were evacuated from Elmendorf Air Force Base. The level of respirable particulate matter in the air within the MOA was elevated for several days in late March but remained just below the health emergency threshold (EPA national standard), although some sensitive people experienced respiratory problems. Many schools and businesses were temporarily closed (Swanson and Kinele, 1988).

A significant eruption also occurred in 1976 and produced ash plumes during January, February, and April. Minor ash fall (0.6 in or 1.5 mm) occurred in the MOA on January 24–25 (Shackelford, 1978). Advisories to remain indoors were issued and many schools and businesses were closed in the MOA. Some people experienced respiratory problems and visibility in some locations was reduced to about 300 feet (100 meters or less) (Waythomas and Waitt, 1998). Ash was ingested by the equipment at the Beluga power plant, the primary power supply for Anchorage (Swanson and Kinele, 1988).

Vulnerability

Because the ash from a volcanic eruption could affect the entire Municipality, the entire MOA is represented in Table 4.32. In general, weather patterns and wind direction during an eruption will influence where ash fall occurs. Air transportation is particularly vulnerable to

volcanic ash clouds as these clouds can travel great distances and cover broad areas. Ash may lead to increased traffic accidents as it reduces visibility and can make roadways slippery (IVHHN, unknown). Disruptions to the transportation system may cause delayed shipments of goods into the area.

Ashfall can disrupt power service. Power generation facilities may close to prevent equipment damage. As wet ash is conductive, equipment may need to be shut down to be properly cleaned or serviced (USGS, 2009a). Ash can contaminate water supplies making them unsafe to drink (IVHHN, unknown). Volcanic ash can cause changes in water quality (turbidity, acidity, and chemistry), increased wear on water delivery and treatment systems and high demand for water during cleanup activities (USGS 2009). Building roofs may collapse under the weight of the ash (IVHHN, unknown). In addition, volcanic ash also poses a health risk to people especially those cardiac or respiratory conditions such as asthma and emphysema (IVHHN, unknown). Volcanic ash can also cause eye irritation and skin irritation (IVHHN, unknown).

Table 4.32 Volcanic Ash Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	59,426	$3,066,038,500	$8,334,412,600	$11,398,571,591
Commercial	3,419	$605,885,600	$1,579,095,500	$2,132,773,711
Industrial	1,610	$180,641,800	$290,159,100	$469,225,809
Institutional	702	$26,876,800	$188,839,300	$90,308,164
Parks, Open Space & Recreation Areas	1,319	$107,600	$203,400	$311,000
Transportation Related	419	$236,100	$165,900	$402,000
Other	300	$352,000	$44,400	$307,600
Vacant	10,326	$570,157,400	$450,103,500	$1,015,367,523
Unidentified	4,325	$419,913,000	$924,182,300	$1,341,953,131
Total	81,846	$4,870,208,800	$11,767,206,000	$16,449,220,529

Source: MOA GIS, 2009

4.1.8 EROSION

Erosion is a process that involves the wearing away, transportation, and movement of land. Erosion rates can vary significantly because 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.

Erosion rarely causes death or injury. However, erosion causes the destruction of property, development, and infrastructure. In Alaska, coastal

Bluff erosion occurs when water runs off the land, forming gullies. It is also caused by wave action at the toe of the bluff or when a bluff collapses under the weight of a heavy snow or rainfall.

Beach erosion occurs when wave action removes the light sand.

erosion is the most destructive, riverine erosion a close second, and wind erosion a distant third.

Classifying erosion can be difficult, as there are multiple terms used to refer to the same type of erosion. For example, riverine erosion may be called stream erosion, stream bank erosion, or riverbank erosion, among other terms. Coastal erosion is sometimes referred to as tidal erosion. Sometimes bluff erosion is included in coastal erosion; other times they are considered two separate processes. The same goes for beach erosion. For this plan, coastal erosion encompasses bluff and beach erosion, while riverine erosion will be considered synonymous with stream erosion, stream bank erosion, and riverbank erosion.

Coastal Erosion

Coastal erosion is the wearing away of land, through natural activity or human influences, that results in loss of beach, shoreline, or dune material. Coastal erosion occurs over the area roughly from the top of the bluff out into the near-shore region, to about the 30-foot water depth. It is measured as the rate of change in position or the horizontal displacement of a shoreline over a period of time. Bluff recession is the most visible aspect of coastal erosion because it causes dramatic in the landscape. As a result, this aspect of coastal erosion usually receives the most attention.

On the coast, the forces of erosion are embodied in waves, currents, and wind. Surface and ground water flow, and freeze-thaw cycles may also play a role. Not all of these forces may be present at any particular location.

Coastal erosion can occur from rapid, short-term daily, seasonal, or annual natural events such as waves, storm surge, wind, coastal storms, and flooding, or from human activities including boat wakes and dredging. The most dramatic erosion often occurs during storms, particularly because the highest-energy waves are generated under storm conditions. Coastal erosion also may be from multi-year impacts and long-term climatic change such as sea-level rise, lack of sediment supply, subsidence, or long-term human factors such as the construction of shore protection structures and dams or aquifer depletion. Studies are underway to determine the effects generated from global warming.

Ironically, attempts to control erosion through shoreline protective measures such as groins, jetties, seawalls, or revetments can actually lead to increased erosion activity. This is because shoreline structures eliminate the natural wave run-up and sand deposition processes and can increase reflected wave action and currents at the waterline. The increased wave action can cause localized scour both in front of and behind structures and prevent the settlement of suspended sediment.

Fortunately, in Alaska, erosion is hindered by bottomfast ice, which is present on much of the Arctic coastline during the winter. These areas are fairly vulnerable while the ice is forming. The winds from a fall storm can push sea ice into the shorefast ice, driving it onto the beach. The ice will then gouge the beach and cause other damage.

Factors Influencing the Erosion Process

There are a variety of natural and human-induced factors that influence the erosion process. For example, shoreline orientation and exposure to prevailing winds, open ocean swells, and waves influence erosion rates. Beach composition influences erosion rates as well. For example, a beach composed of sand and silt, such as those near Shishmaref, is easily eroded, whereas beaches consisting primarily of boulders or large rocks are more resistant to erosion. Other factors may include:

- Shoreline type
- Geomorphology of the coast
- Structure types along the shoreline
- Density of development
- Amount of encroachment into the high hazard zone
- Proximity to erosion inducing coastal structures
- Nature of the coastal topography
- Elevation of coastal dunes and bluffs
- Shoreline exposure to wind and waves.

Definitions

Groin - A narrow, elongated coastal-engineering structure built on the beach perpendicular to the trend of the beach. Its purpose is to trap longshore drift to build up a section of beach.

Jetty - A narrow, elongated coastal-engineering structure built perpendicular to the shoreline at inlets to stabilize the position of a navigation channel, to shield vessels from wave forces, and to control the movement of sand along adjacent beaches to minimize the movement of sand into a channel.

Seawall - A vertical, wall-like coastal-engineering structure built parallel to the beach or duneline and usually located at the back of the beach or the seaward edge of the dune. It is designed to halt shoreline erosion by absorbing the impact of waves.

Revetment - An apron-like, sloped, coastal-engineering structure built on a dune face or fronting a seawall. It is designed to dissipate the force of storm waves and prevent undermining of a seawall, dune or placed fill.

Riverine Erosion

Rivers constantly alter their course, changing shape and depth, trying to find a balance between the sediment transport capacity of the water and the sediment supply. This process, called riverine erosion, is usually seen as the wearing away of riverbanks and riverbeds over a long period of time.

Riverine erosion is often initiated by failure of a riverbank, causing high sediment loads, or by heavy rainfall. This generates high volume and velocity run-off that will concentrate in the lower drainages within the river's catchment area. When the stress applied by these river flows exceeds the resistance of the riverbank material, erosion will occur. As the sediment load increases, fast-flowing rivers will erode their banks downstream. Eventually, the river becomes overloaded or velocity is reduced, leading to the deposition of sediment further downstream or in dams and reservoirs. The deposition may eventually lead to the river developing a new channel.

While all rivers change in the long-term, short-term rates of change vary significantly. In less-stable braided channel reaches, erosion and deposition of material are a constant issue. In more stable meandering channels, episodes of erosion may only occur occasionally. The

erosion rate depends on the sediment supply and amount of run-off reaching the river. These variables are affected by many things including earthquakes, floods, climatic changes, loss of bank vegetation, urbanization, and the construction of civil works in the waterway.

Riverine erosion has many consequences, including the loss of land and development on that land. It can cause increased sedimentation of harbors and river deltas, hinder channel navigation, and affect marine transportation.

Other problems include reduction in water quality due to high sediment loads, loss of native aquatic habitats, damage to public utilities (roads, bridges and dams) and maintenance costs from trying to prevent erosion sites.

Location

Most of the MOA is not impacted by riverine erosion, although it may occur in some localized areas. For example, "Peters, Meadow, and Rabbit Creeks experience high-velocity flows that can lead to extensive erosion of banks and washouts at inadequate stream crossings" (FEMA, 2002:11).

Likelihood of Occurrence

Riverine erosion will always occur in Anchorage because rivers and other flowing water bodies are constantly altering their course.

Historic Events

No significant riverine erosion events have been identified.

Vulnerability

A recent GIS file showing the location of riverine erosion is not available. Only property adjacent to a river may be affected by riverine erosion. Property is considered more vulnerable to riverine erosion that people.

Wind Erosion

Wind erosion is when wind is responsible for the removal, movement, and redeposition of land. It occurs when soils are exposed to high-velocity wind, which picks up the soil and carries it away. The wind moves soil particles 0.0039 -0.0197 inch in size in a hopping or bouncing fashion (known as saltation) and those larger than 0.0197 inch by rolling (known as soil creep). The finest particles (less than 0.0039 inches) are carried in suspension. Wind erosion can increase during periods of drought.

Wind erosion can cause a loss of topsoil, which can hinder agricultural production. The dust can reduce visibility, which can cause automobile accidents, hinder machinery, and have a negative effect on air and water quality, creating animal and human health concerns. Wind erosion can also cause damage to public utilities and infrastructure.

Location

Every parcel in MOA could be affected by wind erosion. Those in higher wind areas are more likely to experience wind erosion.

Likelihood of Occurrence

In Anchorage, wind erosion is not a significant problem, but it can occur during a weather event with strong winds.

Historic Events

No significant wind erosion events have been identified.

Vulnerability

Every parcel in MOA could be vulnerable to wind erosion, but this is not a significant threat. Property is considered more vulnerable to wind erosion than people.

Coastal Erosion

Coastal erosion is the long-term landward movement of the shoreline. It is generally associated with high-energy events such as coastal storms, flooding, etc. Coastal erosion can result from a series of short-term events such as storms. Alternatively, it can result from long-term processes such as changes in sea level or subsidence.

Coastal erosion is a natural process, but can be influenced by human activity such as dredging and boat wakes. Coastal erosion rarely causes death or injuries, but it can destroy buildings and infrastructure.

According to NHIRA, the degree of exposure to coastal erosion may be related to:

- Shoreline type
- Geomorphology of the coast
- Structure type along the shoreline
- Development density
- Amount of encroachment into the high-hazard zone
- Shoreline exposure to waves and wind
- Proximity to erosion-inducing coastal structures
- Nature of the coastal topography
- Elevation of coastal dunes and bluffs

Location

Coastal erosion is occurring west of TSAIA, as:

> …several hundred yards of bluff have eroded in this century, much of it since 1949. The bluffs erode when high-energy storms enter Cook Inlet and generate large waves at their bases. Storms arriving in the fall are the most dangerous because the bluffs are not yet frozen and their sediment can be easily eroded (Mason, 1997: 193).

Coastal erosion is also occurring near the Tony Knowles Coastal Trail because "piles of construction or earthquake rubble plus a rock revetment built by the state to protect the bike path are increasing local rates of shoreline erosion by blocking lateral beach sand transport" (Mason, 1997:198).

Point Woronzof has a lack of vegetation, lack of a talus pile at the base, and lack of a protective mudflat, which indicate erosion about two feet per year (Mason, 1997). Point Campbell is also eroding but at a slightly slower rate (Mason, 1997).

Likelihood of Occurrence

Coastal erosion is a natural process that continually occurs. Unlike other parts of Alaska, it would be rare to have a single event in the MOA associated with a significant amount of coastal erosion.

Historic Events

No significant coastal erosion events have been identified.

Vulnerability

Only coastal areas are vulnerable to coastal erosion. Property is considered more vulnerable to coastal erosion than people.

4.2 TECHNOLOGICAL HAZARDS

Technological hazards are hazards originating from technological or industrial accidents, dangerous procedures, infrastructure failures, or human error or omission.

4.2.1 DAM FAILURE

Alaska Statute 46.17.900(3) defines a dam as an, "artificial barrier and its appurtenant works, which may impound or divert water." Dam safety is regulated by Alaska Statute 46.17 and 11 Alaska Administrative Code 93 Article 3, Dam Safety, which became effective in May 1987.

Dam failures involve the unintended release of impounded water. A dam failure can destroy property and cause injury and death downstream. A dam failure does not always involve a total collapse of the dam. Dams may fail due to structural deficiencies, poor initial design or construction, lack of maintenance or repair, weakening of the dam through aging, debris blocking the spillway, other disasters such as earthquakes, improper operation, or vandalism.

In Alaska, dams exist for many purposes, some of which include:

- Hydroelectric
- Water supply
- Flood control and storm water management
- Recreation
- Fish and wildlife habitat
- Fire protection
- Mine tailings

The failure of a dam can be result in a major catastrophe with substantial economic impacts and loss of life. There are varying degrees of failure that can contribute to the uncontrolled release of water from the reservoir, ranging from improper gated spillway operation to the partial or full breach of the main structural component of the dam. Lesser degrees of failure often occur in advance of a catastrophic failure and are generally amenable to mitigation if detected and properly addressed. According to the State Hazard Mitigation Plan, there are several general causes of dam failure, including:

- Inadequate spillway capacity, which results in dam overtopping during extreme rainfall events.
- Internal erosion or piping caused by seepage through the embankment or foundation or along conduits.
- Improper or insufficient maintenance, leading to decay and deterioration.
- Inadequate design, improper construction materials, and poor workmanship.
- Operation issues.
- Failure of upstream dams on the same river system.
- Landslides into a dam's reservoir, creating a wave that overtops the dam.
- Seismic instability.

Location

According to DNR, there are 10 dams in the MOA (Table 4.26 and Figure 4.15).

Table 4.26 Dams Located Within the MOA

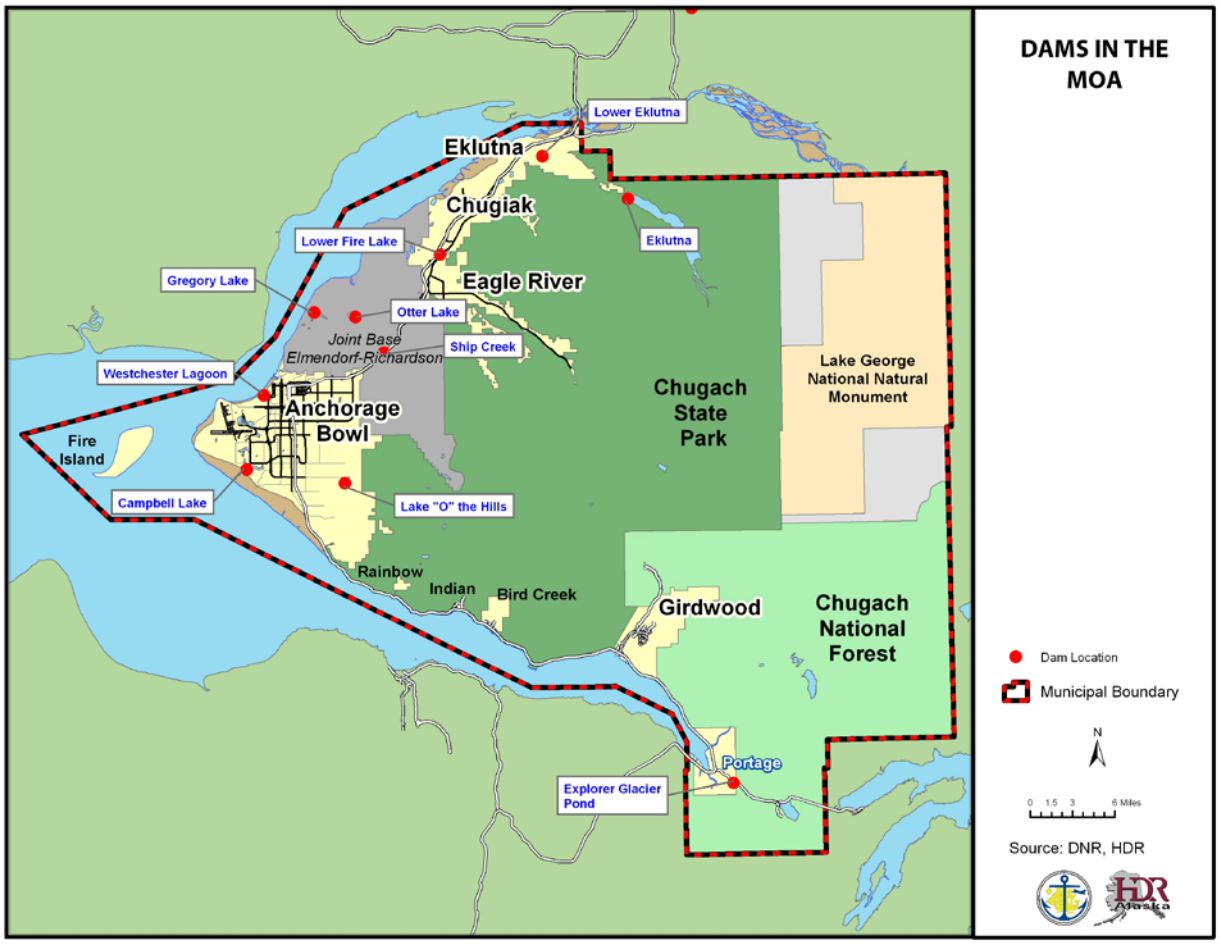
DAM ID	Name	Nearby Development	Hazard Potential Classification	Emergency Action Plan	Regulatory Jurisdiction
AK00033	Eklutna	Eklutna Village	High	Yes	State
AK00034	Lake "O" The Hills	Anchorage	High	Yes	State
AK00189	Lower Fire Lake Dam	Eagle River	High	Yes	State
AK00028	Campbell Lake Dam	Anchorage	Low	Not Required	State
AK00029	Westchester Lagoon Dam	Anchorage	Significant	No	State
AK00093	Lower Eklutna	Eklutna Village	Significant	No	State
AK00035	Ship Creek Dam	Anchorage	Low	Not Required	Federal
AK00036	Gregory Lake Dam	Elmendorf Air Force Base	Low	Not Required	Federal
AK00076	Otter Lake Dam	Ft. Richardson Army Base	Low	Not Required	Federal
AK82401	Explorer Glacier Pond Dam	Portage	Low	No	Federal

Source: State Hazard Mitigation Plan, 2010

Likelihood of Occurrence

Dam failures can occur wherever there is a dam. The risk increases as dams age and deteriorate from deferred maintenance and decay. Eighty percent of older dams designed and constructed before Alaska adopted dam safety regulations (1989) may have a higher risk due to design inadequacy. The State is especially concerned about those dams with known or suspected deficiencies because they pose a greater failure risk than properly designed and structurally sound dams. Currently, the only dam in the MOA that is being investigated for potential or known deficiencies is the Lake O' the Hills dam.

Figure 4.15 Map of Dams in the MOA



Historic Events

Only one dam failure in Alaska has resulted in a fatality. Anchorage's Lake O' the Hills dam failed in 1972, resulting in the downstream death of a child swept into a culvert by the floodwaters. The inundation map for this dam includes the grounds adjacent to O'Malley Elementary School, homes, and O'Malley Road. Table 4.27 lists the known dam failures in Anchorage since 1962.

Table 4.27 Dam Failures in Anchorage Since 1962

Name	NID No.	Description	Class	Height	Date of Failure	Type of Failure	Consequences	Suspected Cause
Campbell Lake Dam	AK00028	Earth embankment	Low	11	1964	Full breach	Repair costs	Foundation liquefaction, slope stability
Lake O' the Hills	AK00034	Earth embankment	High	13	1964	Unknown	Unknown	Seismic
Old Eklutna Dam	None	Earth and sheet pile	Low	NA	1964	Structural damage	Replacement costs	Seismic racking
Lake O' the Hills	AK00034	Earth embankment	High	13	1972	Full breach	One life lost	Inadequate low level outlet design, and construction,

								classic piping
Campbell Lake Dam	AK00028	Earth embankment	Low	11	1989	Full breach	Repair costs	Insufficient spillway capacity

Source: State Hazard Mitigation Plan,2010

Vulnerability

Areas located within the inundation area of a dam are vulnerable to dam failure. However, most dams within the MOA have not had their inundation areas mapped. The exceptions are the Lake O' the Hills dam and the Eklutna dam. The inundation mapping for these areas is several years old. The actual dam inundations areas may be different due to increased development in the area, changes in the amount of water being impounded, or other reasons. Maps are in Appendix F.

Lower Fire Lake Dam Rehabilitation

Located near to the Glenn Highway, the Lower Fire Lake Dam in Eagle River was built in the early 1960s as a culvert road crossing. Studies conducted in 1999 and 2000 indicated that the dam was near the end of its service life and was not big enough to accommodate a major rainfall/storm event. In addition, the dam embankment was slowly eroding due to leaking subsurface water. With these deficiencies, it was believed that the dam would likely fail by the year 2010. Given the amount of downstream development, and the likelihood of failure, the Lower Fire Lake Dam was considered the highest risk dam in the state (http://www.ak-prepared.com/plans/pdf_docs/StateHazardMitigationPlan07/5-12%20Dams.pdf). MOA PM&E was able to use a combination of State funds, a FEMA grant and other sources to rehabilitate the dam. The work was completed in 2005/2006.

4.2.2 ENERGY EMERGENCY

An energy emergency refers to the inability to produce and transmit sufficient quantities of energy to the public, businesses and industry. It can involve one or more energy resources such as heating oil, natural gas, gasoline, coal, or electricity.

An energy emergency can develop quickly. For example, a storm could cause a power line to break. It could also develop over days or weeks. For example, during the 1973 OPEC (Oil Producing and Exporting Countries) embargo, gasoline, fuel oil, and other petroleum derivates were in short supply. An energy emergency could even develop over years or decades. For example, increased development puts pressure on the amount of energy needed; if a utility company expands to meet that need but the revenue is not sufficient, the utility company could potentially close.

"Energy Watch" Campaign

The MOA and regional utility organizations have worked together to create a public awareness campaign designed to ask residents to conserve energy use in the event of an energy emergency.

The type of energy emergency of greatest concern in the MOA is the deliverability of natural gas. Because there had been an abundant and affordable supply of natural gas in Cook Inlet, it has become the primary fuel for heating and electricity in the MOA. In recent years, the natural gas reserves in Cook Inlet have been declining. There is presently sufficient gas to meet customer demand; however, as demand increases, that may change. There is also growing concern about deliverability, which is the ability to supply gas when and where it is needed. The gas fields no longer have adequate

pressure to provide gas at peak periods, so producers use compressors on the pipeline system to obtain the necessary pressure. If a compressor fails, the system may not be able to supply enough gas to meet the demand (MOA, 2009).

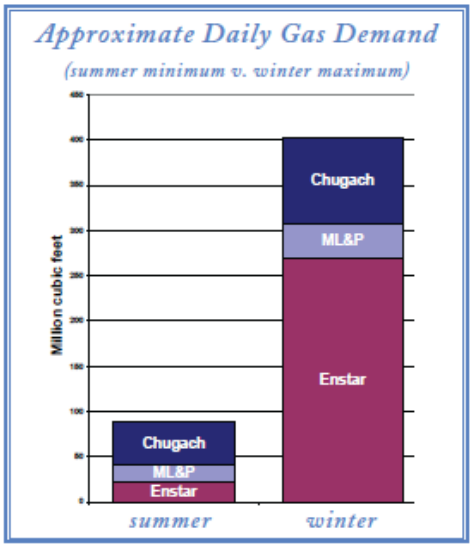
Location

All areas of the MOA are susceptible to energy emergencies.

Likelihood of Occurrence

Typically, several small localized power outages occur every year. However, a large-scale, extended-duration power outage is not considered likely. An energy emergency caused by the unavailability of natural gas is most likely during the evening hours during a prolonged cold snap (MOA, 2009). As Figure 4.16 shows, the demand for gas in the MOA is greater during the winter months.

Figure 4.16 Approximate Daily Gas Demand



Source: MOA, 2009

Historic Events

While power outages are not rare, they typically occur for a short duration and are limited to a small geographic area. There have been no known prolonged citywide power outages or other type of energy emergency recorded in Anchorage.

Vulnerability

The MOA is vulnerable to localized short-term energy emergencies. Because an energy emergency could affect the entire Municipality, the entire MOA is represented in Table 4.28. Power failures are more likely to affect people than the built environment though. As the MOA continues to grow, the amount of energy demanded will increase. This has the potential of increasing the city's vulnerability unless the energy supply also increases. Facilities that rely on electricity for life safety needs such as hospitals and nursing homes tend to be more vulnerable to an energy emergency. While these facilities tend to have back-up generators, they may not be able to meet the needs of the facility for an extended period of time. Extended power outages will also have negative impact on the local economy as many businesses will be unable to functions. Businesses with perishable inventories, such as grocery stores and restaurants may suffer permanent losses.

Table 4.28 Parcels Vulnerable to Energy Emergencies

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	63,711	$5,766,405,700	$13,213,579,200	$18,979,984,900

Commercial	3,546	$1,690,127,200	$2,862,701,850	$4,552,829,050
Industrial	1,674	$502,003,600	$573,493,400	$1,075,497,000
Institutional	717	$175,304,800	$433,943,800	$609,248,600
Parks	1,174	$17,570,700	$11,216,800	$28,787,500
Transportation	430	$21,429,600	$229,500	$21,659,100
Other	869	$13,316,500	$300,200	$13,616,700
Vacant	6,843	$818,046,700	$434,800,700	$1,252,847,400
Unidentified	4,493	$721,943,328	$1,116,386,372	$1,838,329,700
Total	83,457	$9,726,148,128	$18,646,651,822	$28,372,799,950

Source: MOA GIS, 2009

4.2.3 URBAN FIRE (CONFLAGRATION)

An urban fire is one involving a structure or property within an urban or developed area. For the purposes of this plan, urban fires are defined as major fires affecting (or with the potential to affect) multiple properties. These types of fires are rare in modern, developed cities but could happen if associated with another disaster such as an earthquake or during civil unrest, or multiple ignitions could occur simultaneously, overwhelming the fire department's ability to respond.

Location

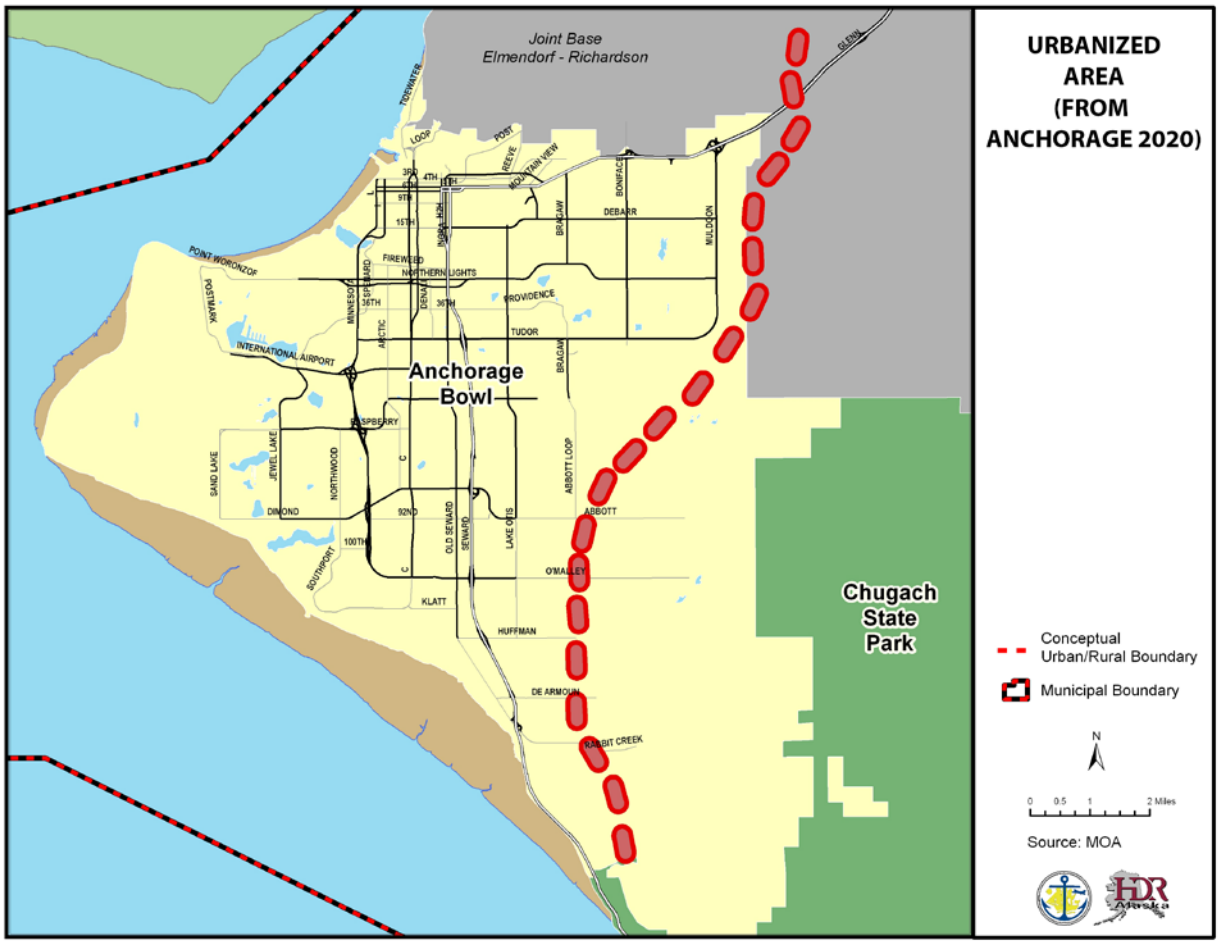
Every parcel in the urbanized portion of the MOA, as identified in Anchorage 2020 (see Figure 4.17) has the potential for a major urban fire. In general, the potential for a conflagration is higher in older areas of town (such as downtown Anchorage) where buildings may contain more flammable construction materials, antiquated electrical wiring, lots and buildings with high fuel loading or explosive contents, or similar issues, and in high-density areas that have structures located close to each other.

Parts of the Chugiak/Eagle River area also have the potential for a conflagration but a specific geographic area has not been identified. The downtown area, which tends to have older buildings and higher densities, is more likely than areas with newer buildings and lower densities.

Likelihood of Occurrence

In the MOA, there is not a significant likelihood of a major urban fire but the potential exists. Modern building codes, construction techniques, building materials have been developed to reduce the possibility of a major urban fire. A major urban fire is more likely to occur as the secondary effect of another hazard such as an earthquake as fire department resources may have to respond to multiple incidences simultaneously, water for fire fighting purposes may be unavailable, etc.

Figure 4.17 Map of Urbanized Area from Anchorage 2020



Historic Events

There have been no major urban fires in the MOA in recent years that have resulted in a disaster declaration. Fires within the urbanized portion of the MOA are usually quickly contained and are typically limited to one or two buildings.

One of the most significant urban fires in recent history occurred on June 5, 2007 at the Park Place Condominiums. This fire was accidentally started during plumbing maintenance. Damages from the fire were estimated at $19 million: $14 million in property loss and $5 million in personal content loss.

Vulnerability

Every parcel in the urbanized portion of the Anchorage Bowl could be vulnerable to a major urban fire and is represented in Table 4.29. This is not considered a significant threat. Hotels, nursing homes, theaters, daycares, assisted living facilities, nightclubs and other places where large groups of people tend to gather tend to have a higher potential for injuries and fatalities.

Table 4.29 Parcels Vulnerable to Urban Fire in the Anchorage Bowl

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	48,728	$4,317,834,400	$9,476,537,000	$13,794,371,400
Commercial	3,367	$1,613,098,300	$2,774,833,350	$4,387,931,650
Industrial	1,629	$489,220,400	$528,457,200	$1,017,677,600
Institutional	572	$165,145,900	$339,633,300	$504,779,200
Parks	998	$16,852,800	$2,475,800	$19,328,600
Transportation	24	$0	$0	$0
Other	570	$22,071,400	$300,200	$22,371,600
Vacant	65	$12,210,500	$0	$12,210,500
Unidentified	3,434	$521,621,000	$274,808,100	$796,429,100
Total	1,174	$408,855,828	$748,827,472	$1,157,683,300

Source: MOA GIS, 2009

A geographic boundary has not been established for the Eagle River area so the number of parcels and their value that could be impacted has not been calculated as part of this update.

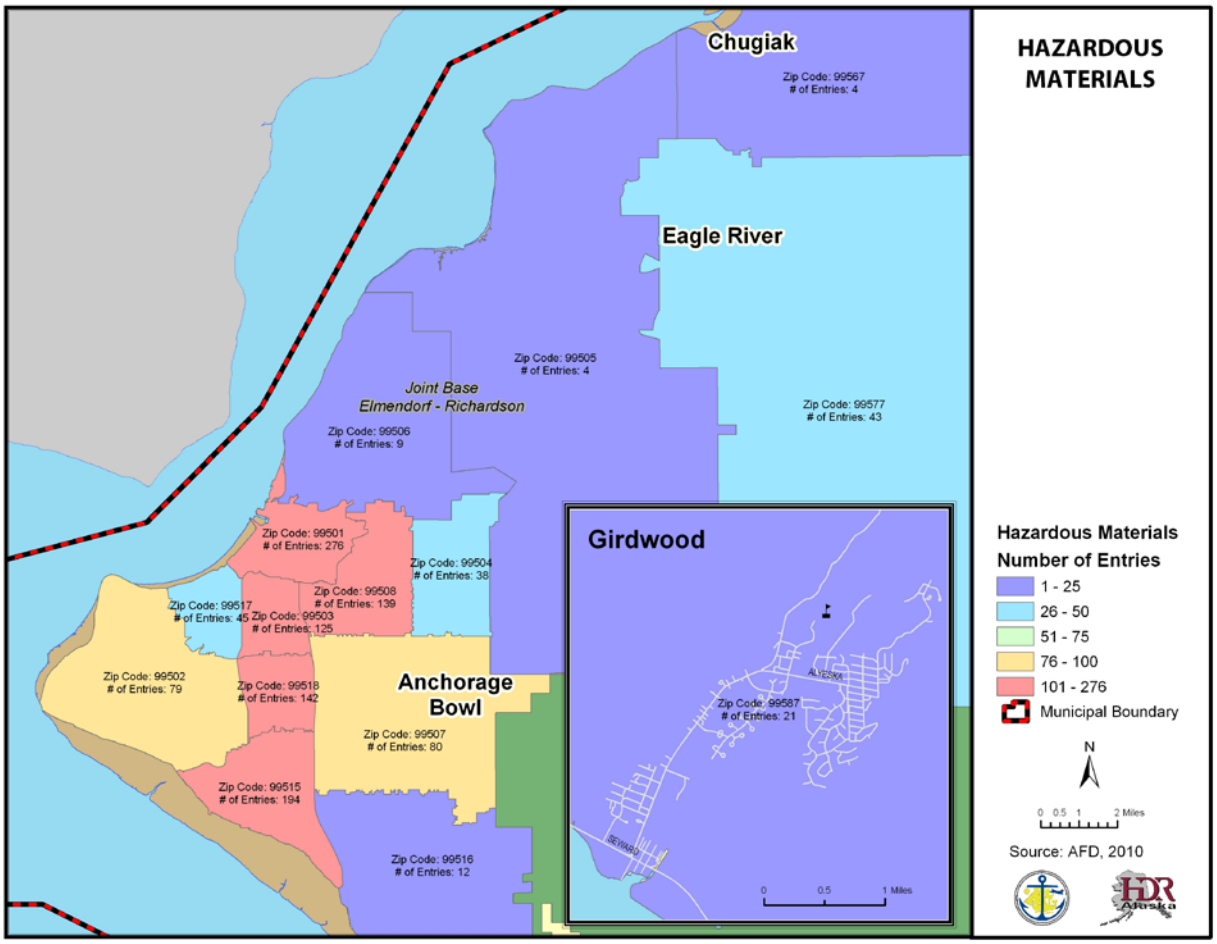
4.2.4 HAZARDOUS MATERIALS (HAZMAT) RELEASE

In general, a hazardous material is any substance or a material that has the potential to harm humans, animals, or the environment. A hazardous materials incident is the intentional or accidental release of toxic, combustible, illegal, or dangerous nuclear, biological, or chemical agents into the environment. The types of material that can cause a hazardous materials incident are wide ranging. Examples include materials such as chlorine, sulfuric acid, gasoline, medical/biological waste, etc. Many accidents happen at fixed sites (where hazardous materials are stored or handled), but incidents may also occur during transportation (by road, rail, pipeline or waterway). Terrorist incidents are not covered in this chapter.

Location

Hazardous materials incidents are more likely to occur where hazardous materials are located. Facilities that meet certain requirements are required to report information regarding the type and volume of hazardous materials to the State of Alaska and the AFD. According to the AFD records (as of April 22, 2010), zip code 99501 has the highest number (276) of reportable hazardous materials. This zip code includes the Ship Creek area which has a higher percentage of industrial land uses (see Figure 4.18).

Figure 4.18 Map of the Distribution of Hazardous Materials



The MOA Solid Waste Services Division has two sites to collect hazardous wastes. The first Hazardous Waste Collector Center is located at the Anchorage Regional Landfill (near the intersection of the Glenn Highway and Hiland Road). The second Household Hazardous Waste Collection Facility is located at the Central Transfer Station near E. 54th and Juneau (east of the Old Seward Highway). These sites are for household use only.

Transportation related incents are more likely on the main transportation routes such as the Seward and Glenn Highways and the Alaska Railroad. However, they can also occur on local roads or by air or marine vessel traffic.

Pipelines, such as the pipeline used to transport fuel from the Port of Anchorage to TSAIA, are another potential source of a hazardous materials incident.

Likelihood of Occurrence

Small-scale hazardous materials incidents occur every year although the exact number is unavailable. As the MOA continues to grow, it is likely that the number of facilities using hazardous materials will increase and so will the likelihood of a hazardous materials incident.

Historic Events

There have been no events that resulted in a declared disaster. However, small scale hazardous materials incidents have occurred. For example, on June 9, 2009, there was a chemical spill at TSAIA that resulted in a cargo hanger being evacuated for an hour.

Vulnerability

As a hazardous material incident could occur at a facility or during transportation, the entire MOA is considered vulnerable to a hazardous materials incident (see Table 4.30).

Table 4.30 Parcels Vulnerable to a Hazardous Material Incident

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	63,711	$5,766,405,700	$13,213,579,200	$18,979,984,900
Commercial	3,546	$1,690,127,200	$2,862,701,850	$4,552,829,050
Industrial	1,674	$502,003,600	$573,493,400	$1,075,497,000
Institutional	717	$175,304,800	$433,943,800	$609,248,600
Parks	1,174	$17,570,700	$11,216,800	$28,787,500
Transportation	430	$21,429,600	$229,500	$21,659,100
Other	869	$13,316,500	$300,200	$13,616,700
Vacant	6,843	$818,046,700	$434,800,700	$1,252,847,400
Unidentified	4,493	$721,943,328	$1,116,386,372	$1,838,329,700
Total	83,457	$9,726,148,128	$18,646,651,822	$28,372,799,950

Source: MOA GIS, 2009

Areas with higher concentrations of hazardous material usage, such as industrial areas, are more vulnerable. Zip code 99501 has the highest number of hazardous materials. People living in close proximity to a hazardous material incident are more vulnerable. The number of people vulnerable to a hazardous material incident will depend on the location of the event, the amount of material involved and the specific material involved.

4.2.5 RADIATION ACCIDENT

Radioactive materials are a type of hazardous material but are listed separately because radioactive material requires a specific and unique response. Radiological hazards exist, and accidents can occur whenever and wherever radioactive materials are stored, used, or transported. Hazards can range from relatively localized incidents involving small amounts of radioactive materials to large catastrophic events.

Location

Sources of radiation hazard are found in medical facilities and some industrial/laboratory facilities where radioactive materials and/or radiation-producing devices are found. Common places radioactive material is found are nuclear power plants, hospitals, universities, research laboratories, industries, major highways, railroads, and shipping yards. Some radiation (such

as radon) is naturally produced from decomposition of radioactive isotopes in soils and underlying strata.

There are no nuclear power plants in the MOA. The quantities of nuclear materials transported in Alaska are small compared to nuclear waste/cargo shipments in the contiguous United States. (Alaska Department of Environmental Conservation, 2009). According to the May 2009 Public Review Draft of the Alaska Federal/State Preparedness Plan for Response to Oil & Hazardous Substance Discharges/Releases, nuclear facilities (such as power plants, waste storage sites, and processing plants) in eastern Russia could impact Alaska because weather patterns have the potential to bring radioactive fallout to the state. Most Russian facilities are considered to have substandard construction and have had a history of reported and unreported releases (Alaska Department of Environmental Conservation, 2009).

Likelihood of Occurrence

No fatalities or serious injuries have been attributed to a radiological accident in the MOA. While an incident is possible, the likelihood is considered low.

Historic Events

In the MOA, there have been no declared disasters from a radiation accident. No other radiation events have been identified.

Vulnerability

Because radiological material can be airborne, the entire MOA is considered vulnerable and is represented in Table 4.31.

Table 4.31 Parcels Vulnerable to Radiation Releases

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	63,711	$5,766,405,700	$13,213,579,200	$18,979,984,900
Commercial	3,546	$1,690,127,200	$2,862,701,850	$4,552,829,050
Industrial	1,674	$502,003,600	$573,493,400	$1,075,497,000
Institutional	717	$175,304,800	$433,943,800	$609,248,600
Parks	1,174	$17,570,700	$11,216,800	$28,787,500
Transportation	430	$21,429,600	$229,500	$21,659,100
Other	869	$13,316,500	$300,200	$13,616,700
Vacant	6,843	$818,046,700	$434,800,700	$1,252,847,400
Unidentified	4,493	$721,943,328	$1,116,386,372	$1,838,329,700
Total	83,457	$9,726,148,128	$18,646,651,822	$28,372,799,950

Source: MOA GIS, 2009

4.2.6 TRANSPORTATION ACCIDENT

The transportation system in the MOA consists of air, road, rail, and marine systems. All of these modes have the potential for accidents that could lead to a disaster. For this plan, a transportation accident is any large-scale aircraft, vehicular, railroad, or marine accident, i.e., one that is not handled on a day-to-day basis by emergency responders.

Anchorage is home to many public airports, the largest of which is TSAIA. TSAIA is the major passenger and cargo facility and is located on the western edge of the city. Merrill Field, one of the busiest general aviation[8] airports in the country, is located just east of downtown. Several of the flight paths of both airports pass over developed parts of the Municipality. Other airports located within the MOA include Birchwood Airport and Girdwood Airport. There are also two military air fields on JBER. In addition, the MOA has one seaplane base (Lake Hood), although several lakes are used by seaplanes, including Sand Lake, Campbell Lake, and Lower Fire Lake.

The MOA is vulnerable to two major types of air transportation accidents; a crash involving a large passenger aircraft or a crash causing casualties on the ground. Mid-air collisions between two aircrafts are also possible.

As a coastal community, the MOA has the potential for marine accidents. The type of accident of greatest concern involves barges transporting materials, fuels, or other hazardous materials. Most goods designated for Alaska come through the Port of Anchorage. The Port also provides all of the jet fuel to JBER and 80 percent of the fuel to TSAIA (MOA, 2010). The Port also exports petroleum products.

Ferry service between the MOA and the Matanuska-Susitna Borough is planned but has not begun operating.

There are several major transportation routes in the MOA, including the Seward and Glenn Highways, which connect the MOA to adjacent boroughs (see Figure 4.19). There are approximately 1,800 miles of roadway in the MOA.

There are approximately 140 miles of railroad track in the MOA. The ARRC operates passenger and freight trains on this track.

Location

The majority of airplane crashes occur immediately before landing or after takeoff. The areas most likely to be impacted by a plane crash are under or close to the flight path, especially if they are within 5 miles of an airport (see Figure 4.19).

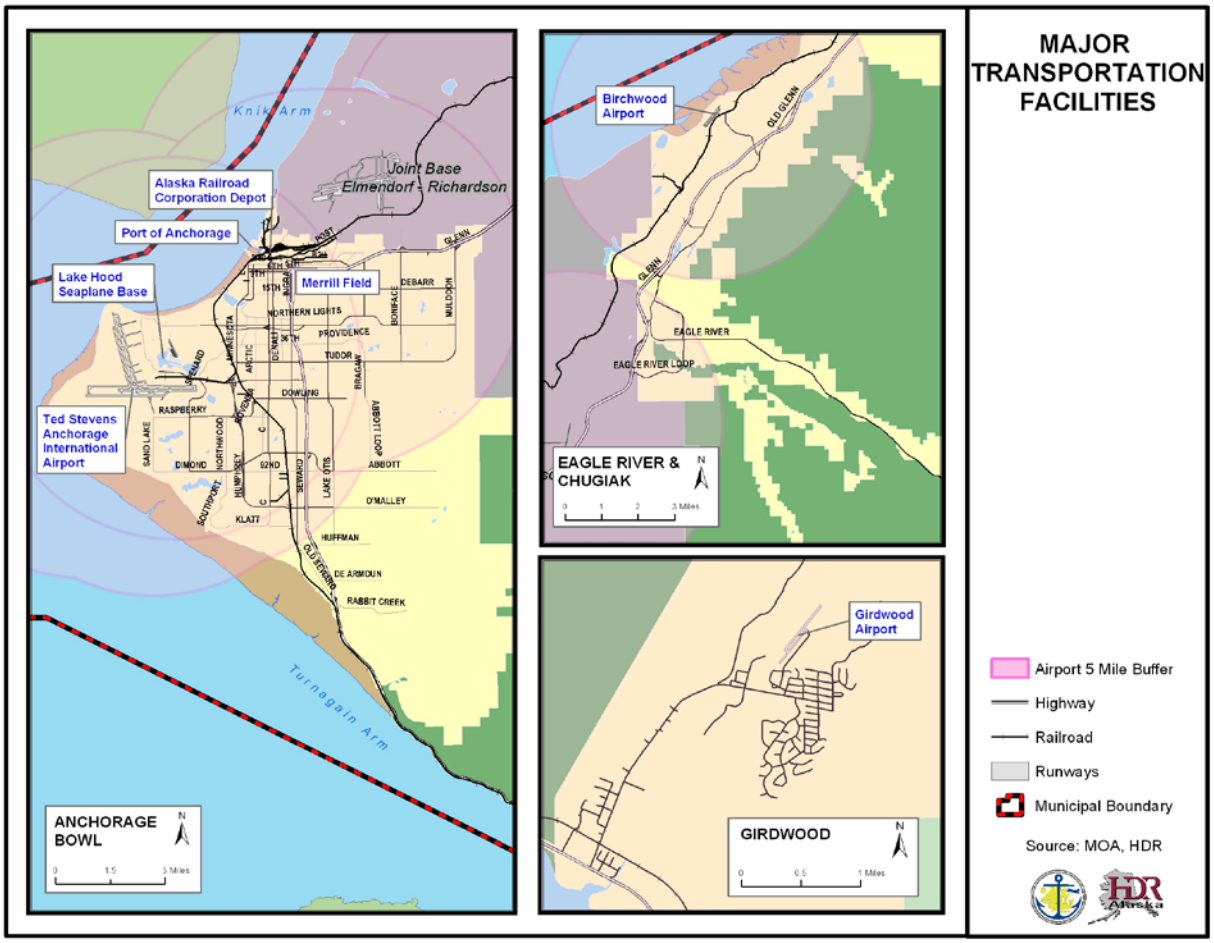
[8] General aviation refers to non-military flying except scheduled passenger airlines (Department of Transportation & Public Facilities, 2006).

A marine accident is more likely in the Port of Anchorage area and in shipping lanes but with the high tides in Anchorage and strong currents could rapidly affect the entire coastline.

A motor vehicle accident could occur on any roadway in the MOA, but is more likely on roads with higher traffic volumes.

A rail accident would occur along the railroad tracks.

Figure 4.19. Map of Major Transportation Facilities



Historic Events

From January 1, 2004 to December 14, 2009, there were 70 reported aircraft accidents/incidents within the MOA (National Transportation Safety Board, 2010). Most of the accidents/incidents were minor; only 3 of the 70 accidents involved fatalities.

On May 27, 2010, a small plane crashed shortly after takeoff from the Birchwood airport. The crash killed the five people on board. The crashed caused the closure of the ARRC tracks for several hours.

On June 29, 2010, a cargo plane crashed shortly after takeoff on Elmendorf Air Force Base. The crash killed all four crew members on board. The crash also damaged the ARRC's main rail line and a parallel siding, forcing train traffic to be suspended until repairs could be made.

On June 2, 2010, a plane crashed just after taking off from Merrill Field resulting in one fatality and four people seriously injured. The plane crash occurred during rush hour near a busy intersection (7th Avenue and Ingra Street). Traffic in the downtown area was disrupted for several hours due to road closures.

On September 22, 1995, an E-3B Airborne Warning and Control Systems (AWACS) jet carrying a crew of 24 crashed just after takeoff from Elmendorf Air Force Base. The cause of the crash was due to bird strikes.

The worst crash in Anchorage occurred on November 27, 1970. A DC-8-63F plane went off the end of the runway at TSAIA and was destroyed in a post-crash fire. The National Transportation Safety Board determined that the probable cause was that the plane was not traveling fast enough during takeoff. Of the 229 people on board, there were 47 fatalities (Embry-Riddle Aeronautical University, 1972).

Other aircraft accidents include:

- An in-flight engine separation on March 31, 1993
- A collision between two aircrafts at TSAIA on December 23, 1983
- A crash during landing on December 4, 1978; five of the seven people on board were fatally injured.

According to the Minerals Management Service's Alaskan Shipwreck online database, there have been approximately 19 marine accidents since 1900. The actual number of accidents is likely to be different because not all accidents are reported and because the location description may not be detailed enough to determine if the accident with within the MOA limits. Reported accidents include:

- A ship ran into the dock at the Port of Anchorage and damaged a 30-ton section of dock on February 10, 1972
- A ship ran into the Port of Anchorage dock on July 22, 1974 and damaged the pier
- A strong wind pushed a ship onto the mudflats on April 19, 1982
- A ship ran into the dock on March 17, 1985 and damaged part of the dock

Motor vehicles accidents are typically small-magnitude events, some with fatalities, but of no impact to the entire community. According to the 2008 MOA Annual Traffic Report, in 2008 there were 7,533 accidents, including 16 that involved fatalities. In the past, there have numerous accidents that resulted in roadway closures for several hours, but there have been no accidents that resulted in a disaster declaration.

According to the Federal Rail Administration database, there were 272 train accidents in the MOA from 2000 to 2009, with three fatalities.

Likelihood of Occurrence

Most airplane accidents are likely to involve general aviation aircraft. However, it is unlikely that a general aviation aircraft could cause a citywide emergency. However, the presence of large planes over the developed portion of the city makes a large crash a possibility.

Marine, road, and rail accidents that result in a citywide emergency are also possible; however, the likelihood is considered low.

Vulnerability

The entire MOA is vulnerable to a transportation accident and is shown in Table 4.32. In general, the areas closer to a transportation route are more vulnerable than areas further away. A major transportation accident could have an impact on the local economic if it results in a long-term shut down of that transportation mode.

Table 4.32 Parcels Vulnerable to Transportation Accidents

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	63,711	$5,766,405,700	$13,213,579,200	$18,979,984,900
Commercial	3,546	$1,690,127,200	$2,862,701,850	$4,552,829,050
Industrial	1,674	$502,003,600	$573,493,400	$1,075,497,000
Institutional	717	$175,304,800	$433,943,800	$609,248,600
Parks	1,174	$17,570,700	$11,216,800	$28,787,500
Transportation	430	$21,429,600	$229,500	$21,659,100
Other	869	$13,316,500	$300,200	$13,616,700
Vacant	6,843	$818,046,700	$434,800,700	$1,252,847,400
Unidentified	4,493	$721,943,328	$1,116,386,372	$1,838,329,700
Total	83,457	$9,726,148,128	$18,646,651,822	$28,372,799,950

Source: MOA GIS, 2009

In subsequent updates of the plan, additional research should be conducted to identify the areas vulnerable to each mode of transportation. For example, areas underneath the flight path for one of the airports would be more vulnerable to an airplane crash than other parts of the MOA.

4.2.7 AIR POLLUTION

Air pollution is the introduction of chemicals, particulates, or biological materials that can cause harm or discomfort to humans or other living organisms or damage to the natural environment, into the atmosphere. Air pollution comes from different sources, including industrial processes, vehicles, etc.

The U.S. Environmental Protection Agency (EPA) has set air quality standards for:

- (CO
- Ozone
- Sulfur dioxide
- Nitrogen dioxide
- Airborne lead
- Particulates (PM_{10} and $PM_{2.5}$)

There is no national standard for other substances that may cause air pollution.

In the MOA, the most likely sources of an air pollution disaster are volcanic ash and wildfire smoke. An air pollution disaster may also occur due to a fire or other event causing the release of toxic chemicals (Morris, 2010).

Plug In @ 20F

The MOA's Department of Health and Human Services has a Plug In @ 20F campaign that encourages people to use an engine block heater when temperatures are 20F or below to reduce engine wear and to reduce carbon monoxide emissions from cold starts.

Location

Every parcel in MOA has the potential to be affected by air pollution. Different parts of town may be affected by different events depending on the source of the pollution and the wind conditions. The location of volcanic ash fall is described in section 4.1.8. Wildfire smoke could be the result of a wildfire in the MOA, or neighboring communities including the Matanuska Susitna Borough and the Kenai Peninsula Borough. The location of hazardous materials is described in section 4.2.4.

Likelihood of Occurrence

According to the MOA's EOP, air pollution events occur every one to four years but tend to have negligible impacts. The likelihood of air pollution resulting in a disaster declaration is considered low.

Anchorage currently meets the standards for all six pollutants that have EPA standards. PM_{10} levels sometimes approach federal standards. The MOA periodically issues health advisories when air pollution levels reach or are predicted to reach unhealthy levels. In Anchorage, PM_{10} concentrations tend to be higher during breakup in late March and early April and during

freeze-up in late October and early November. Concentrations are typically lowest in mid-summer and mid-winter.

Historic Events

The Anchorage Bowl area was identified as having high levels of CO in the early 1970s. The National Ambient Air Quality Standards (NAAQS) for CO were violated every year from 1972 to 1994 and in 1996. In 1998, the EPA declared Anchorage a serious nonattainment area for CO. Anchorage has since attained compliance with the NAAQS and was designated a maintenance area in 2004. Although Anchorage has had previous (in 1996) violations of the national standard for carbon monoxide, no event has been substantial enough to result in a disaster declaration.

Anchorage has exceeded NAAQS related to natural events, including volcanic eruptions and wind storms. After the August 1992 eruption of the Mt. Spurr volcano, the NAAQS for PM_{10} were exceeded 18 times between 1993 and 1995. Wind storms in March 2001 and March 2003 also resulted in violations. As these were largely the result of natural events, the EPA has not considered them when evaluating the Anchorage Bowl's PM_{10} attainment status.

Other PM_{10} violations have resulted from maintenance of road sand and unpaved roads and parking lots. The MOA and the SOA have modified their road maintenance practices to reduce PM_{10} emissions.

Eagle River was designated a PM_{10} nonattainment area as the result of air quality violations between 1985 and 1987. A PM_{10} control plan was developed to address this situation. As most of the PM_{10} was the result of unpaved roads, the plan emphasized paving or surfacing gravel roads. This effort was considered a success, as no violations have been measured since October 1987.

Vulnerability

Every parcel in MOA could be vulnerable to air pollution (Table 4.33). The built environment has the potential to be impacted by a significant volcanic ash fall event. The built environment has less potential to be impacted by wildfire smoke or toxic gases. However, all MOA residents have the potential to be impacted. In general, the most vulnerable people are those with lung conditions including asthma, the elderly and children.

Table 4.33 Parcels Vulnerable to Air Pollution

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	63,711	$5,766,405,700	$13,213,579,200	$18,979,984,900
Commercial	3,546	$1,690,127,200	$2,862,701,850	$4,552,829,050
Industrial	1,674	$502,003,600	$573,493,400	$1,075,497,000
Institutional	717	$175,304,800	$433,943,800	$609,248,600
Parks	1,174	$17,570,700	$11,216,800	$28,787,500

Transportation	430	$21,429,600	$229,500	$21,659,100
Other	869	$13,316,500	$300,200	$13,616,700
Vacant	6,843	$818,046,700	$434,800,700	$1,252,847,400
Unidentified	4,493	$721,943,328	$1,116,386,372	$1,838,329,700
Total	83,457	$9,726,148,128	$18,646,651,822	$28,372,799,950

Source: MOA GIS, 2009

4.2.8 COMMUNICATIONS FAILURE

A communications failure is the interruption or loss of communications systems including transmission lines, communications satellites, and associated hardware and software necessary for the communications system to function. A communications failure may be the result of an equipment failure, human acts (deliberate or accidental) or the result of another hazard event.

When a communications failure occurs, it can have a wide range of affects. A failure that results in a small delay in response times by emergency service providers might have a minimal impact on the community in general even though it may be problematic to individuals who require those services. A failure of the 911 system or an emergency warning system has the potential to impact the entire community.

Location

All parts of the MOA have the potential to be impacted by a communications failure.

Likelihood of Occurrence

The likelihood of a large-scale extended communications failure is low. However, small scale failures with a short duration are frequent.

Historic Events

Communication failures in the MOA have been limited to small scale outages associated with equipment failures or natural events such as severe weather storms and mainly affecting landline and cellular telecommunication capabilities.

There have been no failures of the 911 system in the MOA since the late 1990s. Backup systems are in place so when the APD dispatch is unable to answer 911 calls, the calls are directed to the AFD. In the past 5 years, there have been 3 instances where the back-up system has been activated. Two of these events were caused by human error which the third event was caused by a computer failure (Kurtz, 2010).

On May 19, 2002, the APD dispatch and the 911 center was evacuated due to a fire/air conditioning overheating which resulted in Halon being discharged (Roberts, 2010).

Vulnerability

Anyone who relies on technology such as telephones, are somewhat vulnerable to experiencing some type of communications failure. Interruptions in day to day communications would create problems for businesses, public agencies, citizens, and emergency services. The most common problems would range from minor inconveniences of our citizens to loss of production and revenues for businesses. Emergency services could face more serious consequences, as nonexistent communications failure could escalate what would have been a minor emergency into a disaster situation.

4.2.9 INFECTIOUS DISEASE

Infectious diseases (sometimes called communicable diseases or transmissible diseases) are diseases caused by pathogenic microorganisms such as bacteria, viruses, parasites or fungi. When they are easily spread from person to person they can cause disaster situations. Examples of infectious diseases include influenza, avian influenza ("bird flu"), malaria, meningococcal meningitis, small pox, and tuberculosis. An infectious disease outbreak may occur as the primary event or may be a secondary event to another disaster. Common examples of infectious diseases in the MOA include tuberculosis and pertussis ("whooping cough").

Location

The entire Municipality has the potential to be impacted by an infectious disease event. An infectious disease may be more likely to spread in areas where more people come into contact with each other.

Likelihood of Occurrence

A likelihood of major infectious disease outbreak is considered rare. The likelihood of an infectious disease event would depend on the disease. For example every year, some percentage of the population is affected by influenza. If it is a mild strain, the severity of the epidemic is less than if it was a stronger strain of the virus. As the population increases, there is more opportunity for infectious diseases to spread.

History

There are no known infectious disease outbreaks in the MOA in recent years that have resulted in a disaster declaration. Even though there has been a lack of community-wide events, the MOA experiences small scale outbreaks on an annual basis. However, there are people treated for an infectious disease annually. For example, influenza is typically seen in Anchorage every year with cases of H1N1 and seasonal influenza being found in 2009. In 2006, 41 people with active tuberculosis were reported in the MOA (State of Alaska Epidemiology, 2007). Four of these patients died.

Vulnerability

There would be little threat to the natural or built environment from an infectious disease event. In general, members of the community with compromised immune systems, and the

elderly and very young children are more vulnerable. Those populations with poor access to health care may also be at increased vulnerability. Different populations may also be more vulnerable to different types on infectious diseases. For example, people 65 and older are typically affected by seasonal flu but this age group was less affected by the H1N1 virus than younger adults and children (US Department of Health and Human Services, 2010). In a large event, the capacity of the health care system may become overwhelmed and negatively impact the ability to treat patients efficiently.

4.2.10 FOOD/WATER CONTAMINATION

Food and water contamination refers to food and water that has been spoiled because it contains microorganisms (such as bacteria or parasites), chemicals, or other contaminants that make it unsafe for human consumption. Contamination can be unintentional (for example through improper handling or storage), or intentional. This section will discuss unintentional contamination with intentional contamination being discussed in a future plan update.

Location

Food and water contamination has the potential to occur everywhere in Anchorage but different areas may be impacted differently depending on the contamination. For example, contamination of the Municipal water supply is unlikely to affect areas that still rely on wells.

Vulnerability

The built environment has a low vulnerability to food and water contamination but people are vulnerable. The populations most at risk are those with weakened immune systems such as the elderly. Conferences, special events, and other activities that involve food service to large numbers of people are of more concern because of the potential for larger numbers of people being infected. The MOA's vulnerability to food and water contamination may increase as parasites, bacteria, etc. become more resistant to pesticides. In addition, new parasites and bacteria continue to be identified.

A food and water contamination event may occur as the result of another disaster. For example, an event that disrupts electrical service may lead to food being improperly refrigerated. Individuals who consume the improperly stored food may become ill as a result.

History

There are no known food or water contamination events that have resulted in a disaster declaration. However, there have been mild events impacting relatively small numbers of people. In recent years, one of the largest incidents occurred in 2008 when approximately 99 people became ill from the campylobacter bacteria. Health officials were able to determine that the illness was the result of eating contaminated peas from a local farm (State of Alaska Epidemiology, 2008).

4.3 HUMAN/SOCIETAL

These events are the result of deliberate human acts. The following human/societal hazards will be addressed in a future update:

4.3.1 ATTACK

4.3.2 CIVIL DISTURBANCE

4.3.3 TERRORISM

4.3.4 WMD: BIOLOGICAL, CHEMICAL, NUCLEAR

CHAPTER 5 - MITIGATION STRATEGY

The purpose of this chapter is to document the MOA's mitigation strategy, which is based on the findings presented in the preceding chapters. This chapter is divided into the following sections:

- Hazard Mitigation Goals and Objectives
- Hazard Mitigation Strategies
- Action Plan

The goals, objectives, and action items in this chapter are intended to guide everyday activities and provide a long-term hazard mitigation approach for the MOA to follow. The intent is that these goals, objectives, and action items will be incorporated into future MOA plans, policies, and projects. The goals are broad statements about what the MOA wants to achieve in terms of hazard mitigation. Objectives identify how the MOA will achieve those goals. The Action Plan items are specific actions that will be taken or projects that will be built to implement this mitigation plan.

A review of the goals and objectives done as part of the plan update has determined that the goals and objectives from the 2005 plan remain valid, with minor changes.

5.1 GOALS AND OBJECTIVES

Goal 1: Education/Coordination: Develop coordinated and proactive public policies, emergency plans and procedures, and educational programs that minimize the risk to the community from natural, technological, and human/societal hazards and disasters.
(From Anchorage 2020, LRTP, Housing & Community Development Consolidated Plan, Work Force & Economic Development Plan)

Objective 1.1 *Increase coordination among Municipal departments.*

Objective 1.2 *Educate individuals and businesses about hazards, disaster preparedness, and mitigation.*

Objective 1.3 *Increase coordination between hazard mitigation goals and existing and future plans, including the incorporation of effective hazard mitigation strategies into the Capital Improvement Program.*

Objective 1.4 *Coordinate with the Alaska Division of Insurance.*

Objective 1.5 *Educate public officials, developers, realtors, contractors, building owners, and the general public about hazard risks and building requirements.*

Objective 1.6 *Partner with Municipal Departments and other agencies serving vulnerable populations to minimize harm in the event of an emergency.*

Goal 2: Land Use/Planning: Develop an urban place that functions in harmony with its natural setting and is mindful of its natural technological and human/societal hazards.
(From Anchorage 2020, LRTP, Housing & Community Development Consolidated Plan)

Objective 2.1 *Continue to provide for floodplain management to protect residents and property from the hazards of development in floodplains.*

Objective 2.2 *Land use regulations shall include new design requirements that are responsive to Anchorage's climate and natural setting.*

Objective 2.3 *Use environmentally and conservation-friendly materials in mitigation projects whenever possible and economically feasible.*

Objective 2.4 *Adopt and enforce public policies to minimize impacts of development and enhance safe construction in high hazard areas.*

Objective 2.5 *Integrate new hazards and risk information into building codes and land use planning mechanisms.*

Goal 3: Emergency Management: Create and maintain a community where people and property are safe.
(From Anchorage 2020, LRTP, Housing & Community Development Consolidated Plan, Work Force & Economic Development Plan)

Objective 3.1 D*evelop mechanisms in advance of a major emergency to cope with subsequent rebuilding and recovery phases.*

Objective 3.2 *Consider the secondary effects of disasters, such as hazardous waste and hazardous materials spills, when planning and developing mitigation projects.*

Objective 3.3 *Minimize increases in hazard vulnerability.*

Objective 3.4 *Ensure compliance with the Emergency Planning and Community Right-to-Know Act of 1986*[1].

Objective 3.5 *Improve road connectivity for evacuation purposes.*

Objective 3.6 *Promote disaster contingency planning and facility safety among institutions that provide essential services such as food, clothing, shelter, and health care.*

Objective 3.7 *Improve disaster warning systems.*

Objective 3.8 *Promote appropriate hazard mitigation of all public and privately owned property within the Municipality of Anchorage including, but not limited to, residential units, commercial structures, educational institutions, health care facilities, public gathering places, and infrastructure systems.*

[1] The Emergency Planning and Community Right-to-Know Act "establishes" requirements for Federal, State and local governments, Indian Tribes, and industry regarding emergency planning and "Community Right-to-Know" reporting on hazardous and toxic chemicals. The Community Right-to-Know provisions help increase the public's knowledge and access to information on chemicals at individual facilities, their uses, and releases into the environment. States and communities, working with facilities, can use the information to improve chemical safety and protect public health and the environment" (EPA, 2000).

Objective 3.9 Promote mitigation of historic buildings.

Objective 3.10 Promote post-disaster mitigation as part of repair and recovery.

Goal 4: Protection of Public/Critical Facilities: Make MOA-owned facilities as disaster-resistant as feasible.

Objective 4.1 Encourage a structural review of new facilities.

Objective 4.2 Consider known hazards when siting new facilities and systems.

Objective 4.3 Perform structural retrofitting of existing structures.

Objective 4.4 All public facilities should have a pollution prevention plan.

Objective 4.5 Incorporate non-structural mitigation into existing buildings.

Objective 4.6 Implement mitigation programs that protect critical Municipal facilities and services and promote reliability of lifeline systems to minimize impacts from hazards, to maintain operations, and to expedite recovery in an emergency.

Objective 4.7 Create redundancies for critical networks such as water, sewer, digital data, power, and communications.

Objective 4.8 Formalize best practices for protecting systems and networks.

Goal 5: Support Wildfire Mitigation.

Objective 5.1 Support the AFD Wildfire Strategic Plan.

Objective 5.2 Promote FireWise homes through the concepts in Firewise Alaska; landscaping and vegetation management; structure protection through preparedness; building design, siting, and construction material; and homeowner awareness.

Objective 5.3 Promote vegetation management in greenbelts and parks to limit fire spread.

Objective 5.4 Maintain the wildfire risk model.

Objective 5.5 Maintain and develop additional water resources.

Goal 6: Information: Ensure information is easy to access and up to date.

Objective 6.1 Convert all hazard maps to GIS format.

Objective 6.2 Identify hazards not already mapped.

Objective 6.3 Map all currently unmapped regulated flood-prone areas.

Objective 6.4 Update drainage studies.

Goal 7: Economy/Business: Maintain Anchorage's (and the State's) economic vitality

Objective 7.1 Partner with private sector, including small businesses, to promote structural and non-structural hazard mitigation as part of standard business practice.

Objective 7.2 Educate businesses about contingency planning citywide, targeting small businesses and those located in high-risk areas.

Objective 7.3 Partner with private sector to promote employee education about disaster preparedness while on the job and at home.

Objective 7.4 Minimize economic loss.

5.2 IMPLEMENTATION

5.2.1 STRATEGIES

The MOA will implement the mitigation measures identified in this plan by using the comprehensive plan, Capital Improvement Plan, and other hazard mitigation tools they have at their disposal.

While there are many different ways to mitigate hazards, not all are appropriate for all situations. Each situation must be evaluated in order to decide what activities are the most appropriate. General strategies that can be used to mitigate hazards include:

Structural Features

Structural features are designed to control the hazard and restrict the exposed area. The construction of a structure such as a dam, levee, or avalanche deflection wall can lessen the impact of a hazard event. Structures are most appropriate to protect existing development. Structures can be incorporated into new development, but this should be discouraged in hazard-prone areas. The following departments can implement this strategy:

- PM&E
- Public Works

Land Use Planning

Land use planning can guide development away from hazard-prone areas. Planning is more effective at protecting future development. The responsibility for land use planning is with the Planning and Development Services Department.

Zoning

Zoning ordinances regulate development by dividing a community into areas and by establishing development criteria for each area. They may restrict certain uses in hazard-prone areas or add restrictions such as minimum elevations. Zoning is more effective with future development. Zoning can:

- Prevent new development in hazard-prone areas
- Preserve or establish low densities in hazard-prone areas
- Control changes in use and occupancy of structures in hazard-prone areas
- Establish performance standards
- Require special use permits

P&DS and the Planning and Zoning Commission have the primary responsibility for zoning in the MOA.

Subdivision Regulations

Subdivision regulations govern how a parcel of land can be subdivided into two or more smaller parcels. It is better to incorporate mitigation measures into subdivision regulations before a parcel of land is developed. These regulations are better at protecting future development than existing development. P&DS and the Platting Board administer the MOA's subdivision regulations.

Capital Improvement Plan

A Capital Improvement Plan (CIP) is used to guide major public expenditures for physical improvements over a given period of time. These expenditures can be used to mitigate existing and future development. For example, funds could be used to retrofit an existing structure, build a new levee, or purchase property. The lack of investment in infrastructure in hazard-prone areas may also act to restrict development, as it is too costly for a private developer to build the necessary improvements. All municipal departments have input into the CIP, but the Office of Management & Budget is the coordinating department.

Open Space Preservation

Open space preservation is a tool to keep existing open spaces in hazard-prone areas from being developed. This prevents putting more people and facilities at risk. Typically, a municipal government will acquire the property from a private property owner. The property then becomes zoned as open space, which limits the future development of the property. Property that is already government-owned can also be preserved as open space. Open space is usually managed by the Parks & Recreation Department.

Acquisition

Acquisition involves purchasing property in high-risk areas and demolishing any structures on it to prevent the structure from being damaged during a hazard event. The structure is demolished to ensure that it is not re-used in the future. This technique is appropriate for mitigation of existing structures. It can also be used to buy vacant land in high-risk areas to prevent development from occurring. Many departments would be involved in the acquisition of property and structures.

Relocation

Relocation is similar to acquisition, except that any structures on the property are relocated out of a hazard-prone area. The structure may be relocated to a different parcel or within the same parcel. This technique is also more appropriate for existing structures. Many departments would be involved in the relocation of structures.

Building Codes

Building codes are a compilation of laws, regulations, ordinances, or other statutory requirements adopted by a government legislative authority relating to the physical structure of buildings. They establish minimum requirements regarding the construction of a structure to protect public health, safety, and welfare. They apply to new buildings as well as those

undergoing significant renovations, which makes building codes helpful in protecting new and existing development. Enforcement is essential in order for building codes to be an effective hazard mitigation tool. It is also less expensive and easier to incorporate mitigation measures into new structures than it is to retrofit existing ones. P&DS is responsible for administering the building code in Anchorage.

Insurance

Insurance provides funding to rebuild a structure and replace its contents after a hazard event. Insurance is appropriate for mitigating existing structures. The problem with insurance is that it can make it easier to rebuild in a hazard-prone area, thus creating a repetitive loss situation. Because municipal governments such as the MOA are typically self-insured, this strategy is used more by private property owners. The Risk Management Department is responsible for ensuring the MOA's insurance needs are met.

Education

Education involves teaching the public about potential natural hazards, the importance of mitigation, and how to prepare for emergency situations. It is used to inform residents, business owners, visitors, etc. about the hazards in the area and what they can do to protect themselves and their property. Examples include real estate disclosure, homeowner wildfire reduction publications, and training. Many departments within the MOA can undertake education activities, including OEM, the Mayor's Office, AFD, and P&DS.

5.3 ACTION PLAN

The action plan consists of specific activities or projects that will be used to implement the goals and objectives of this hazard mitigation plan. The action items are categorized by the hazard being addressed with action items addressing more than one hazard being grouped in a multi-hazard category. The action plan contains many items that have no funding sources identified. The timelines are dependent upon obtaining funding. If and when funding becomes available, more specific timelines will be established. This list is in the early stages of development and will be updated as needed. For each item, several characteristics are listed, including:

- Purpose: Why this item is included in the action plan
- How Identified: How the action item was identified
- Coordination Organization : The primary organization to implement the action item
- Objective: The objectives being implemented
- Status/Timeline: What stage the project is at or the target start date
- Priority: The priority of the project as determined by the process established in Appendix G (Departments have not begun to use this tool and priorities will be included in the next version of the mitigation plan.)
- Cost: The estimated cost of the project (if known)
- Potential Funding Sources: Possible sources of funding (if known)

- Hazard : The hazard being addressed (for multi-hazard action items only)

Multi-Hazard

Action 1. Identify department responsible for coordinating hazard mitigation activities.

- Purpose: As department staffing levels, resources, and responsibilities change over time, the MOA should review which department is responsible for the hazard mitigation plan.
- How Identified: Planning Team
- Coordinating Organization: All departments
- Objective: 1.1
- Hazard: All
- Status/Timeline: Ongoing
- Priority: High
- Cost: Staff time
- Potential Funding Sources: General revenue

Action 2. Review composition of departments represented on the hazard mitigation planning committee.

- Purpose: As departmental responsibilities change and additional hazards are incorporated into this plan, the list of departments should be reviewed to ensure the appropriate departments are represented in the hazard mitigation planning process.
- How Identified: Planning Team
- Coordinating Organization: Dependent on the results on Action 1
- Objective: 1.1
- Hazard: All
- Status/Timeline: Ongoing
- Priority: High
- Cost: Staff time
- Potential Funding Sources: General revenue

Action 3. Review and update prioritization strategy (in Appendix G). Upon completion, prioritize action items.

- Purpose: Prioritizing the projects will help the MOA make decisions regarding how to allocate the resources available for hazard mitigation activities.
- How Identified: Consultant
- Coordinating Organization: Dependent on the results on Action 1
- Objective: 1.1, 1.3
- Hazard: All
- Status/Timeline: Ongoing
- Priority: To be determined
- Cost: Staff time

- Potential Funding Sources: Current funding

Action 4. Hold semi-annual meetings of the hazard mitigation committee.

- Purpose: To discuss hazard mitigation related items on a regular basis
- How Identified: From 2005 Plan
- Coordinating Organization: Dependent on the results on Action 1
- Objective: 1.1
- Hazard: All
- Status/Timeline: Ongoing
- Priority: High
- Cost: Staff time
- Potential Funding Sources: General revenue

Action 5. The MOA shall develop a program to educate the community on the various methods of making structures and their contents more disaster-resistant, which would include workshops, literature, and public safety announcements.

- Purpose: To educate people about hazard mitigation
- How Identified: From 2005 Plan
- Coordinating Organization: All departments
- Objective: 1.1, 1.2, 1.5, 7.1, 7.2, 7.3, 1.4, 5.1, 5.2
- Hazard: All
- Status/Timeline: Staff resources unavailable and unable to implement until a funding source is found.
- Priority: To be completed
- Cost: To be determined
- Potential Funding Sources: To be completed

Action 6. Continue the Emergency Watch Program.

- Purpose: To continue educating residents on basic emergency response strategies
- How Identified: Modification of Action Item #3 from 2005 Plan
- Coordinating Organization: OEM
- Objective: 1.2, 1.5, 3.8
- Hazard: All
- Status/Timeline: Ongoing
- Priority: To be completed
- Cost: To be completed
- Potential Funding Sources: Current funding or apply for FEMA grant

Action 7. Develop a recovery plan.

- Purpose: To identify how hazard mitigation can be incorporated into the re-construction of the MOA after a hazard event
- How Identified: From 2005 Plan

- Coordinating Organization: To be identified
- Objective: 3.1, 3.10, 4.2
- Hazard: All
- Status/Timeline: Staff resources unavailable and unable to implement until a funding source is found
- Priority: Low
- Cost: To be completed
- Potential Funding Sources: apply for FEMA grant

Action 8. Acquire updated air photos or LiDAR information for the entire MOA

- Purpose: To allow more accurate information analysis.
- How Identified: PM&E
- Coordinating Organization: to be identified
- Objective: 1.1, 2.1
- Hazard: All
- Status/Timeline: Less than 2 years
- Priority: To be completed
- Cost: to be completed
- Potential Funding Sources: to be determined

Action 9. Identify necessary warning system improvements.

- Purpose: To provide improved warnings to the residents of Anchorage
- How Identified: From 2005 Plan
- Coordinating Organization: OEM
- Objective: 3.7
- Hazard: All
- Status/Timeline: Ongoing
- Priority: To be completed
- Cost: To be completed
- Potential Funding Sources: Current funding, although grants and other funds may be needed to implement the improvements

Action 10. Utilize essential strategies to implement public safety policies 98, 99, and 100 of *Anchorage 2020 – Anchorage Bowl Comprehensive Plan* (9-10-02 public safety amendments; AO 2002-119). Essential strategies include emergency management plan, public safety plan, design for public safety, public facilities site selection criteria, and geohazards management.

- Purpose: To establish plans for emergency management and public safety levels of service, and to better integrate hazard mitigation into other Municipal plans and regulations
- How Identified: Modification of Action 8 From 2005 Plan
- Coordinating Organization: OEM/APD/AFP/P&DS

- Objective: 1.3, 2.2, 2.4, 2.5
- Hazard: All
- Status/Timeline: 5-10 years
- Priority: To be completed
- Cost: To be completed
- Potential Funding Sources: To be determined

Action 11. Continue to require new and renovated MOA buildings to go through the FM Global Engineering Review.

- Purpose: To ensure MOA buildings are as disaster-resistant as feasible
- How Identified: From 2005 Plan
- Coordinating Organization: Risk Management
- Objective: 6.1, 4.8
- Hazard: All
- Status/Timeline: Ongoing
- Priority: To be completed
- Cost: To be completed
- Potential Funding Sources: Current funding

Action 12. Develop siting requirements for facilities built with Municipal funds.

- Purpose: T o minimize increases in vulnerability
- How Identified: From 2005 Plan
- Coordinating Organization: M&O
- Objective: 4.2, 3.3, 3.2, 4.8
- Hazard: All
- Status/Timeline: Staff resources were unavailable to complete this action item. The time to complete this action is dependent on the availability of staff resources.
- Priority: To be completed
- Cost: To be determined
- Potential Funding Sources: Current funding

Action 13. Replace, retrofit, or construct new fire stations as listed in the AFD's 2009-2015 Strategic Plan.

- Purpose: To ensure the availability of emergency responders and their equipment after a hazard event
- How Identified: AFD Strategic Plan
- Coordinating Organization: AFD
- Objective: 4.6, 4.7, 4.3
- Hazard: All
- Status/Timeline: Ongoing
- Priority: To be completed
- Cost: Depends on project

- Potential Funding Sources: Possible Capital Improvement Bond Issue.

Action 14. Replace, retrofit, or construct new police stations as listed in the APD's Strategic Plan.

- Purpose: To ensure the availability of emergency responders and their equipment after a hazard event
- How Identified: APD
- Coordinating Organization: APD
- Objective: 4.6, 4.7, 4.3
- Hazard: All
- Status/Timeline: Ongoing
- Priority: To be completed
- Cost: Depends on project
- Potential Funding Sources: Possible Capital Improvement Bond Issue.

Action 15. Complete the Port of Anchorage expansion.

- Purpose: The port expansion will include modern infrastructure and systems, making it more hazard-resistant than the existing port.
- How Identified: Port of Anchorage
- Coordinating Organization: Port of Anchorage
- Objective: 3.3, 3.8, 4.2
- Hazard: Earthquake, extreme weather, hazardous materials, transportation accident
- Status/Timeline: This project is ongoing and is expected to be completed between 2015 and 2020. The actual completion date will depend on a variety of factors, including the availability of funding.
- Priority: To be completed
- Cost: Approximately $750 to 800 million
- Potential Funding Sources: Federal appropriations and grants, State grants, Port profits, revenue bonds

Action 16. Prepare 1 or 2 grant applications that can be submitted to DHS&EM when funds are available.

- Purpose: Developing grant applications in advance will allow adequate time to collect the necessary information and will allow the MOA to apply for grants that have short deadlines.
- Coordinating Organizations: All departments
- Objective: 1.1, 3.8, 4.3, 4.5,
- Hazard: All
- Status/Timeline: to be determined
- Priority: To be determined
- Cost: to be determined
- Potential Funding Sources: Current funding

Action 17. Consider developing a building inventory database.

- Purpose: Consolidating information such as building capacity, use as an emergency shelter, plan sets, etc. into a master database may be beneficial before, during, and after a disaster. This action item is to determine if this action item should be pursued further.
- Coordinating Organizations: Dependent on the results on Action 1
- Objective: 1.1, 3.8, 4.3, 4.5,
- Hazard: All
- Status/Timeline: to be determined
- Priority: To be determined
- Cost: staff time
- Potential Funding Sources: Current funding

Action 18. Create a volcanic ash recovery plan.

- Purpose: Ash can remain a hazard even after the initial events, because clean-up efforts can cause ash to become airborne. A plan that identifies the appropriate recovery methods can help ash be properly disposed of in a timely manner.
- How Identified: DHSS
- Coordinating Organization: DHHS
- Objective: 1.2, 1.5, 3.1, 7.4
- Hazard: Air pollution, volcanic ash
- Status/Timeline: Dependent on staff availability
- Priority: Low
- Cost: Staff time
- Potential Funding Sources: To be determined

Action 19. Obtain GIS data used to create the seismic landslide hazards maps from the USGS Report titled "Maps showing Seismic Landslide Hazards in Anchorage, Alaska."

- Purpose: To make the data more accessible
- How Identified: Consultant
- Coordinating Organization: P&DS
- Objective: 6.1
- Hazard: Earthquake, ground failure
- Status/Timeline: 1 year
- Priority: To be completed
- Cost: Less than 1 week of staff time
- Potential Funding Sources: Current funding

Earthquake

Action 20. Pursue funding to seismically retrofit MOA-owned facilities that will be needed during and after a hazard.

- Purpose: To limit the amount of damage caused by an earthquake
- How Identified: From 2005 Plan
- Coordinating Organization: M&O
- Objective: 3.9, 4.3, 2.3, 4.8
- Status/Timeline: Ongoing
- Priority: To be completed
- Cost: Depends on facility
- Potential Funding Sources: General funding, bonds, grants

Action 21. Install gas shut-off valves in MOA-owned public facilities used in response/recovery efforts.

- Purpose: To reduce the possibility of gas leaks after a hazard event
- How Identified: Modification of Action #19 from 2005 Plan
- Coordinating Organization: M&O
- Objective: 4.3, 4.6
- Status/Timeline: Ongoing; several MOA facilities have already been retrofitted.
- Priority: To be completed
- Cost: To be completed (approximately $5,000 to $7,000 per facility)
- Potential Funding Sources: General funding, bonds, grants

Action 22. Install gas shut-off valves in all ASD public schools.

- Purpose: To reduce the possibility of gas leaks after a hazard event
- How Identified: From 2005 Plan
- Coordinating Organization: ASD
- Objective: 4.3, 4.6
- Status/Timeline: Ongoing
- Priority: To be completed
- Cost: $1,000,000
- Potential Funding Sources: General funding, bonds, FEMA PDM & HMGP grants ($98,809 was available through a 2006 PDM grant. An HMGP application for an additional $676, 522 to complete the project is pending.)

Action 23. Investigate the cost-effectiveness of making school windows shatter-resistant by installing a coating on the windows or replacing the windows.

- Purpose: To prevent people from being injured by broken glass
- How Identified: Modification of Action Item #21 from 2005 Plan
- Coordinating Organization: ASD
- Objective: 4.3, 4.5, 4.6

- Status/Timeline: 1 year
- Priority: To be completed
- Cost: Under $100,000
- Potential Funding Sources: General funding

Action 24. Repair the Port of Anchorage pilings under Terminal I as necessary.

- Purpose: The pile thickness underneath Terminal I is below standard and could fail during an earthquake.
- How Identified: Modification of Action 24 from 2005 Plan
- Coordinating Organization: Port of Anchorage
- Objective: 7.4
- Status/Timeline: Ongoing. This action will no longer be needed when the Port expansion is complete.
- Priority: To be completed
- Cost: Between $1 and $2 million annually
- Potential Funding Sources: Existing funding

Action 25. Continue to identify municipal fire stations, police stations, emergency facilities, and other facilities that need to be seismically retrofitted or rebuilt to current seismic standards.

- Purpose: To ensure the availability of emergency responders and their equipment after a hazard event
- How Identified: Modified Action #27 from 2005 Plan
- Coordinating Organization: M&O
- Objective: 4.6, 4.7, 4.3
- Status/Timeline: Ongoing
- Priority: To be completed
- Cost: To be completed
- Potential Funding Sources: Possible Capital Improvement Bond Issue; seek grant funding from FEMA mitigation grant programs or other outside source as needed

Action 26. Continue and expand seismic monitoring instrumentation of buildings, other major structures, and free field sites throughout the Municipality, and establish funding support for locally based monitoring and data analysis from these instruments.

- Purpose: To obtain data that will help determine if buildings and other major structures located throughout the Municipality can safely withstand earthquake shaking intensities that can vary depending on underlying soil conditions. Data obtained through this effort could provide the basis for mitigating potential building damage or casualties/injuries through local amendments to the International Building Code.
- Coordinating Organizations: UAA, P&DS

- Objective: 2.5
- Status/Timeline: To be determined
- Priority: High
- Cost: To be completed
- Potential Funding Sources: To be indentified

Action 27. Incorporate the action items identified in the Downtown Seismic Risk Assessment into the All-Hazards Mitigation Plan.

- Purpose: To help ensure the action items identified in this assessment are coordinated with other MOA activities
- How Identified: Consultant
- Coordinating Organization: P&DS
- Objective: 1.3, 2.4, 3.3
- Status/Timeline: Within 1 year of the Seismic Risk Assessment being completed
- Priority: High
- Cost: Under $10,000
- Potential Funding Sources: Current funding

Wildfire

Action 28. Review existing zoning to determine if additional wildfire mitigation measures could be incorporated.

- Purpose: To help incorporate wildfire mitigation measures into future development
- How Identified: From 2005 Plan
- Coordinating Organization: P&DS/AFD
- Objective: 1.3, 2.2, 2.4, 2.5, 5.2
- Status/Timeline: Staff resources unavailable and unable to implement until a funding source is found
- Priority: To be completed
- Cost: To be completed
- Potential Funding Source: To be determined

Action 29. Identify strategies or actions to address homeowners in the Eagle River area being denied homeowners insurance due to their wildfire risk.

- Purpose: To identify why homeowners in the Eagle River area are being denied homeowners insurance and to identify potential solutions.
- Coordinating Organizations: AFD
- Objective: 1.5, 2.4, 3.8, 5.2
- Status/Timeline: less than 2 years
- Priority: To be determined
- Cost: to be determined
- Potential Funding Sources: Current funding

Action 30. Maintain the wildfire risk model.

- Purpose: To ensure the risk model is using the most current information
- How Identified: From 2005 Plan
- Coordinating Organization: AFD
- Objective: 5.4
- Status/Timeline: Ongoing
- Priority: To be completed
- Cost: To be completed
- Potential Funding Sources: Current funding

Action 31. Continue and maintain vegetation management.

- Purpose: To limit the amount of fuel available for wildfires
- How Identified: From 2005 Plan
- Coordinating Organization: AFD
- Objective: 5.3
- Status/Timeline: Ongoing
- Priority: To be completed
- Cost: To be completed
- Potential Funding Sources: Current funding

Action 32. Develop additional water resources for wildfire response purposes.

- Purpose: Developing additional water resources would assist in fighting wildfires.
- How Identified: From 2005 Plan
- Coordinating Organization: AFD
- Objective: 5.5
- Status/Timeline: Ongoing
- Priority: To be completed
- Cost: To be completed
- Potential Funding Sources: To be completed

Flood

Action 33. The MOA shall continue to apply floodplain management regulations for development in the flood plain and floodway.

- Purpose: To continue to minimize vulnerability to flooding
- How Identified: From 2005 Plan
- Coordinating Organization: PM&E
- Objective: 2.1
- Status/Timeline: Ongoing
- Priority: To be completed
- Cost: Included in the PM&E Watershed Management Budget

- Potential Funding Sources: Current funding

Action 34. The MOA shall continue to utilize the FEMA Flood Insurance Rate Map to define the special flood hazard area, the floodway, and the floodplain.

- Purpose: To define the special flood hazard area, the floodway, and the floodplain in a consistent manner
- How Identified: From 2005 Plan
- Coordinating Organization: PM&E
- Objective: 2.1
- Status/Timeline: Ongoing
- Priority: To be completed
- Cost: Included in the PM&E Watershed Management Budget
- Potential Funding Sources: Current funding

Action 35. Annually review and amend, as appropriate, a list of potential flood mitigation projects such as culvert replacement, channel rehabilitation and property acquisition.

- Purpose: To identify sites the MOA would like to consider purchasing
- How Identified: Modification of Action Item #7 From 2005 Plan
- Coordinating Organization: PM&E
- Objective: 2.1, 2.3
- Status/Timeline: Part of ongoing activities
- Priority: To be completed
- Cost: Staff time
- Potential Funding Sources: Current funding

Action 36. Annually identify and prioritize FIRMs that need to be updated.

- Purpose: Because all the FIRMs cannot be updated simultaneously, having a prioritized list would tell the city what to update when resources are available.
- How Identified: Modification of Action 14 from 2005 Plan
- Coordinating Organization: PM&E
- Objective: 6.3
- Status/Timeline: Ongoing
- Priority: To be completed
- Cost: Staff time
- Potential Funding Sources: General revenue, FEMA grant

Action 37. Update the Flood Insurance Study.

- Purpose: To update information about the flooding hazard in the MOA.
- Coordinating Organizations: PM&E
- Objective: 1.2, 2.1
- Status/Timeline: to be completed in early 2011

- Priority: To be determined
- Cost: under $20,000
- Potential Funding Sources: Current funding

Action 38. Address localized flooding caused by the culvert near Arctic Boulevard and Valley of the Moon Park.

- Purpose: To reduce localized flooding.
- How Identified: Modification of Action 31 from 2005 Plan
- Coordinating Organization: PM&E
- Objective: 2.1, 3.8
- Status/Timeline: This project is currently under construction and is scheduled to be completed in 2011.
- Priority: To be completed
- Cost: Approximately $100,000
- Potential Funding Sources: State grant

Action 39. Annually review the list of drainage studies that need updating.

- Purpose: To identify which drainage studies need to be updated and the order in which they should updated
- How Identified: Modification of Action 35 from 2005 Plan
- Coordinating Organization: Watershed Management
- Objective: 6.4
- Status/Timeline: Ongoing
- Priority: To be completed
- Cost: To be completed
- Potential Funding Sources: Current funding

Action 40. Complete the Peters Creek Flooding and Erosion Control Project

- Purpose: To complete reconnaissance, survey and design work in three locations of concern along Peters Creek, with minor construction to address the concerns at one site.
- How Identified: Anchorage Assembly
- Coordinating Organization: Anchorage Soil and Water Conservation District
- Objective: 2.1, 3.8
- Status/Timeline: Ongoing. This project is scheduled to be completed by June 30, 2014.
- Priority: To be completed
- Cost: To be completed
- Potential Funding Sources: State of Alaska

Avalanche

Action 41. Update snow avalanche mapping for Chugiak/Eagle River, Anchorage Bowl, and Turnagain Arm/Girdwood.

- Purpose: Utilize aerial photography, mapping, fieldwork, and analysis to update snow avalanche hazard maps that were produced in 1982 and to add snow avalanche areas that were not mapped in the 1982 project
- How Identified: Modification of Action 15 From 2005 Plan
- Coordinating Organization: P&DS
- Objective: 2.5, 6.1, 6.2
- Status/Timeline: To be determined
- Priority: To be determined
- Cost: To be determined
- Potential Funding Sources: To be determined

Dam Failure

Action 42. Map estimated dam inundation areas within the Municipality and evaluate alternative methods to mitigate the potential risk of a dam failure in these areas.

- Purpose: To assess and recommend alternative methods to mitigate the risk of dam failure on residents and structures located within estimated dam inundation areas
- How Identified: From 2005 Plan
- Coordinating Organization: PM&E/P&DS
- Objective: 6.1, 6.2
- Status/Timeline: A GIS layer for the Lake O' the Hills Dam is available. An electronic version of the Eklutna Lake dam inundation area 1 year.
- Priority: To be completed
- Cost: 1 week of staff time (may be less if the GIS layer can be acquired from the firm that developed the inundation area map)
- Potential Funding Sources: Current funding

Action 43. Retrofit the Lake O' the Hills Dam.

- Purpose: The Lake of the Hill Dam does not meet current standards. It needs to be upgraded to reduce the chance of a dam failure.
- How Identified: From 2005 Plan
- Coordinating Organization: PM&E
- Objective: 4.3
- Status/Timeline: In progress. The Lake O' the Hills homeowners association has funded improvements to the dam. Construction work has begun and is scheduled to be completed in 2011.
- Priority: To be completed
- Cost: To be completed

- Potential Funding Sources: Privately funded.

Hazardous Materials

Action 44. Identify all MOA facilities that need an industrial storm water pollution prevention plan (SWPPP).

- Purpose: To manage storm water runoff
- How Identified: Modification of Action 28 from 2005 Plan
- Coordinating Organization: PM&E
- Objective: 4.4, 2.3
- Status/Timeline: 5 years
- Priority: To be completed
- Cost: Staff time
- Potential Funding Sources: Current funding

Action 45. Continue to comply with Right to Know Act.

- Purpose: To remain in compliance with the Emergency Planning & Community Right to Know Act.
- How Identified: From 2005 Plan
- Coordinating Organization: AFD/ LEPC
- Objective: 3.4
- Status/Timeline: Ongoing
- Priority: To be completed
- Cost: Staff time
- Potential Funding Sources: Current funding

Air Pollution

Action 46. Continue to support DHHS's air pollution monitoring, prevention, and education programs.

- Purpose: To reduce the potential for a community-wide air quality emergency
- How Identified: DHSS
- Coordinating Organization: DHHS
- Objective: 3.3
- Status/Timeline: Ongoing
- Priority: To be determined
- Cost: Depends on program
- Potential Funding Sources: Current funding

Action 47. Create an inventory of respite centers to be used during an air quality emergency.

- Purpose: To identify MOA facilities with strong ventilation systems that can be used by people trying to get out of the smoke/air during an air pollution emergency

- How Identified: DHSS
- Coordinating Organization: DHHS
- Objective: 1.6, 3.8
- Status/Timeline: Dependent on staff availability
- Priority: Low
- Cost: Staff time
- Potential Funding Sources: Existing funding

Infectious Disease

Action 48. Continue the Communicable Disease Reporting and Screening program.

- Purpose: To reduce the potential for a community-wide infectious disease outbreak
- How Identified: Consultant
- Coordinating Organization: DHHS
- Objective: 1.6, 3.3
- Status/Timeline: Ongoing
- Priority: To be determined
- Cost: To be determined
- Potential Funding Sources: Current funding

Action 49. Identify ways to have information on reportable infectious diseases reported to DHSS in a timelier manner.

- Purpose: To be better able to address an infectious disease outbreak in its early stages and reduce the potential for it to become a community-wide event
- How Identified: DHSS
- Coordinating Organization: DHHS
- Objective: 1.2, 1.6
- Status/Timeline: Current resources are not adequate to pursue this action except on a small-scale.
- Priority: To be determined
- Cost: To be determined
- Potential Funding Sources: Additional funding would be required.

Action 50. Continue the Tuberculosis Control Program.

- Purpose: To help prevent the spread of tuberculosis in the MOA
- How Identified: DHHS
- Coordinating Organization: DHHS
- Objective: 1.6, 3.3
- Status/Timeline: Ongoing
- Priority: To be determined
- Cost: To be determined
- Potential Funding Sources: Current funding

Action 51. Continue the Immunization Clinic.

- Purpose: To help prevent outbreaks of infectious diseases
- How Identified: DHSS
- Coordinating Organization: DHHS
- Objective: 1.6, 3.3
- Status/Timeline: Ongoing
- Priority: To be determined
- Cost: To be determined
- Potential Funding Sources: Current funding

Food and Water Contamination

Action 52. Continue to support DHHS's food safety & sanitation program.

- Purpose: To reduce the potential for a community-wide food & water contamination event
- How Identified: Consultant
- Coordinating Organization: DHHS
- Objective: 3.3
- Status/Timeline: Ongoing
- Priority: To be determined
- Cost: To be determined
- Potential Funding Sources: Current funding

In the past several years, several of the action items identified in the 2005 Plan have been completed or other activities have occurred that make the action item no longer applicable. Table 5-1 summarizes action items from the 2005 plan that are not being included in this update.

Table 5-1. Status of Action Items Not Included in the Updated Plan

Action # (in 2005 Plan)	Description	Reason
22	Repair/replace the Lower Fire Lake Dam	Project Complete
25	Port of Anchorage – seismic retrofit Terminal I welds	Duplicate of Action 24
29	Establish a template that documents the information FEMA wants on each hazard event	FEMA guidelines are followed in EOC response procedures
30	Increase the use of HAZUS software	Insufficient resources to pursue
11	Conduct vulnerability analyses of shelters and traditional housing servicing vulnerable populations	MOA shelters are surveyed annually for Americans with Disabilities Act compliance and were originally built using Muni

		Building Codes
26	Port of Anchorage - seismic retrofit Terminal II – crane tie-downs.	Tie-downs have been installed
12	Identify alternative connections between Eagle River and the Anchorage Bowl	The proposed Knik Arm Crossing could be used as an alternative connection
9	Evaluate existing development guidelines to identify which ones, if any, should be revised to incorporate hazard mitigation activities	Incorporated in Action 11

CHAPTER 6 - PLAN MAINTENANCE

6.1 PLAN ADOPTION

The Municipality of Anchorage's Assembly will be responsible for adopting the Anchorage All-Hazards Mitigation Plan Update.

Prior to being adopted, the department responsible for the plan will submit it to the State Hazard Mitigation Officer (SHMO) at DHS&EM for review and approval. The SHMO will then submit the plan to the FEMA Region X for review and pre-adoption approval. The plan will be adopted for approval by the Anchorage Assembly. FEMA will then grant full approval of the plan and the MOA will be eligible for Hazard Mitigation Grant Programs funds.

6.2 MONITORING & EVALUATION

The Anchorage All-Hazards Mitigation Plan, like all plans, requires periodic review to ensure that it remain up to date, reflects current information, and still meets the goals of Anchorage. The MOA Hazard Mitigation Planning Committee will review the plan annually and after every federally declared disaster. The review will determine if there have been any significant changes in the Municipality that affect the Plan. If it is determined that significant changes have occurred, the plan will be amended in order to remain current.

Issues that may be addressed during the evaluation include:

- Are new or different goals, objectives, and action tasks needed?
- Are there any implementation problems?
  - Not enough funding?
  - Conflicts with other goals?
  - Is the plan achieving the desired result?
- Should other hazards be addressed?
- Do we have new information that should be incorporated?
- Does the prioritization of tasks/goals reflect current priorities?

6.3 UPDATING

This plan is intended to be a "living" document that will help inform all interested parties about the MOA's natural hazard mitigation policies and projects. It will be reviewed and updated on a regular basis. The mitigation strategies identified will act as a guide for MOA departments in determining projects for which to seek FEMA and other mitigation funds from outside sources.

6.3.1 ANNUAL REVIEW

The Responsible Department will oversee an annual plan review to make sure that all information is current. The review and update process is as follows:

1. The MOA Hazard Mitigation Planning Committee will meet to consider:
   - Progress made on plan recommendations during the previous 12 months;
   - Mitigation accomplishments in projects, programs, and policies;
   - Status of mitigation projects included on the MOA's CIP list;
   - New mitigation needs identified;
   - Cancellation of planned initiatives, and the justification for doing so; and
   - Changes in membership to the Committee.

   The meeting should occur approximately four months before FEMA PDM grants are due, to allow the MOA enough time to develop a grant application should they wish to apply.

2. The Responsible Department will request input from other departments and outside entities not represented on the MOA Hazard Mitigation Planning Committee on issues listed above. A special effort will be made to gather information on non-capital projects and programs important to mitigation.

3. The Responsible Department will make "minor" changes to the Plan, such as updates to the CIP, without seeking outside approval.

4. "Major" changes—those related to new policies or recommended projects—will go through a more formal review process, including a possible review by the MOA Hazard Mitigation Planning Committee.

5. To allow for ongoing public input, the Responsible Department will post the plan permanently on the MOA's website along with contact information that will encourage people to submit questions or comments.

6.3.2 FOLLOWING A MAJOR DISASTER

If disaster warrants Presidential Disaster Declaration, the Responsible Department will convene the MOA Hazard Mitigation Planning Committee within 2 months of the declaration date. For other events, the Responsible Department will determine if the committee should meet. Because recovery can be a long process and the full impact of a disaster may not be known for many months, this initial meeting may need to be followed by additional meetings over time.

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

- "Lessons Learned" from the disaster, and what new initiatives should be added to the plan to help reduce the likelihood of similar damage in the future

- Follow-up needed on items relevant to mitigation from any after-action reports produced by the Municipality
- Integration of mitigation into the recovery process

6.3.3 FIVE-YEAR UPDATE

Every five years, the plan will be updated and re-submitted for adoption to the MOA Assembly. Prior to this, the Responsible Department will use the following process to make sure all relevant parties are involved:

1. Follow steps 1 and 2 of the Annual Review process (Section 6.3.1).

2. Incorporate all relevant issues raised via the forums identified.

3. Hold public meetings and meetings with identified groups of interested parties and outside organizations to gain input and feedback.

4. Integrate relevant feedback and circulate revised plan to the Hazard Mitigation Committee.

5. The revised plan will then be introduced to the MOA Assembly for their review and to identify any concerns they might have regarding the plan.

6. Upon incorporation of the Assembly's comments, the revised plan will be submitted to the Alaska State Hazard Mitigation Officer for their review. The plan will be updated based on their comments.

7. The revised plan will then be submitted to FEMA for review. The plan will be updated based on FEMA's comments and re-submitted to FEMA if necessary to obtain a Criteria Met/Plan Not Adopted determination.

8. Submit the plan to the MOA Assembly for adoption by resolution.

9. Submit the adopted plan to FEMA.

The next five-year update process should begin in 2014, with Assembly Adoption occurring in 2015.

6.4 CONTINUED PUBLIC INVOLVEMENT

Before the Assembly approves the plan, it must be presented to the public. A public meeting will be held and a 30-day comment period provided before the plan is presented to the Assembly. However, because the plan is a living document, public involvement in the plan should be encouraged at all times. The MOA website will have a page devoted to the Anchorage All-Hazards Mitigation Plan. This page will have the most recent approved plan, a method of providing feedback on the plan, and notices about plan activities such as updates.

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Appendix A
Crosswalk

LOCAL MITIGATION PLAN REVIEW SUMMARY

The plan cannot be approved if the plan has not been formally adopted. Each requirement includes separate elements. All elements of the requirement must be rated "Satisfactory" in order for the requirement to be fulfilled and receive a score of "Satisfactory." Elements of each requirement are listed on the following pages of the Plan Review Crosswalk. A "Needs Improvement" score on elements shaded in gray (recommended but not required) will not preclude the plan from passing. Reviewer's comments must be provided for requirements receiving a **"Needs Improvement"** score.

Prerequisite(s) (Check Applicable Box)	**NOT MET**	**MET**
1. Adoption by the Local Governing Body: Section201.6(c)(5)		
OR		
2. Multi-Jurisdictional Plan Adoption: Section201.6(c)(5)		
AND		
3. Multi-Jurisdictional Planning Participation: Section201.6(a)(3)		

Planning Process	**N**	**S**
4. Documentation of the Planning Process: Section201.6(b) and Section201.6(c)(1)		

Risk Assessment	**N**	**S**
5. Identifying Hazards: Section201.6(c)(2)(i)		
6. Profiling Hazards: Section201.6(c)(2)(i)		
7. Assessing Vulnerability: Overview: Section201.6(c)(2)(ii)		
8. Assessing Vulnerability: Addressing Repetitive Loss Properties. Section201.6(c)(2)(ii)		
9. Assessing Vulnerability: Identifying Structures, Infrastructure, and Critical Facilities: Section201.6(c)(2)(ii)(B)		**N/A**
10. Assessing Vulnerability: Estimating Potential Losses: Section201.6(c)(2)(ii)(B)		**N/A**
11. Assessing Vulnerability: Analyzing Development Trends: Section201.6(c)(2)(ii)(C)		**N/A**
12. Multi-Jurisdictional Risk Assessment: Section201.6(c)(2)(iii)		**N/A**

*States that have additional requirements can add them in the appropriate sections of the *Local Multi-Hazard Mitigation Planning Guidance* or create a new section and modify this Plan Review Crosswalk to record the score for those requirements.

SCORING SYSTEM

Please check one of the following for each requirement.

N – Needs Improvement: The plan does not meet the minimum for the requirement. Reviewer's comments must be provided.

S – Satisfactory: The plan meets the minimum for the requirement. Reviewer's comments are encouraged, but not required.

Mitigation Strategy	**N**	**S**
13. Local Hazard Mitigation Goals: Section201.6(c)(3)(i)		
14. Identification and Analysis of Mitigation Actions: Section201.6(c)(3)(ii)		
15. Identification and Analysis of Mitigation Actions: NFIP Compliance. Section201.6(c)(3)(ii)		
16. Implementation of Mitigation Actions: Section201.6(c)(3)(iii)		
17. Multi-Jurisdictional Mitigation Actions: Section201.6(c)(3)(iv)		**N/A**

Plan Maintenance Process	**N**	**S**
18. Monitoring, Evaluating, and Updating the Plan: Section201.6(c)(4)(ii)		
19. Incorporation into Existing Planning Mechanisms: Section201.6(c)(4)(ii)		
20. Continued Public Involvement: Section201.6(c)(4)(iii)		

Additional State Requirements*	**N**	**S**
Insert State Requirement		**N/A**
Insert State Requirement		**N/A**
Insert State Requirement		**N/A**

LOCAL MITIGATION PLAN APPROVAL STATUS

PLAN NOT APPROVED ☐

See Reviewer's Comments _____

PLAN APPROVED	

Local Mitigation Plan Review and Approval Status

Jurisdiction: Municipality of Anchorage	**Title of Plan:** Anchorage All-Hazards Mitigation Plan	**Date of Plan:** April 2011
Local Point of Contact: Kristi	**Address:** Project Management and Engineering Division P.O. Box 196650 Anchorage, AK 99519-6650	
Title: Watershed Manager		
Agency: Municipality of Anchorage		
Phone Number: (907) 343-8058	**E-Mail:** BischofbergerKL@ci.anchorage.ak.us	

State Reviewer:	**Title:**	**Date:**

FEMA Reviewer:	**Title:**	**Date:**
Date Received in FEMA Region X		
Plan Not Approved		
Plan Approved		
Date Approved		

Jurisdiction:	**NFIP Status***			
	Y	**N**	**N/A**	**CRS Class**
1. Municipality of Anchorage	Y			69
2.				
3.				
4. [ATTACH PAGE(S) WITH ADDITIONAL JURISDICTIONS]				

*** Notes:** **Y = Participating** **N = Not Participating** **N/A = Not Mapped**

PREREQUISITE(S)

1. Adoption by the Local Governing Body

***Requirement Section201.6(c)(5)*:** *[The local hazard mitigation plan **shall** include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE NOT MET	SCORE MET
A. Has the local governing body adopted **new or updated** plan?		Pending State and FEMA approval		
B. Is supporting documentation, such as a resolution, included?		Pending State and FEMA approval		
		SUMMARY SCORE		

2. Multi-Jurisdictional Plan Adoption

***Requirement Section201.6(c)(5)*:** *For multi-jurisdictional plans, each jurisdiction requesting approval of the plan **must** document that it has been formally adopted.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE NOT MET	SCORE MET
A. Does the **new or updated** plan indicate the specific jurisdictions represented in the plan?	Chapter 3			
B. For each jurisdiction, has the local governing body adopted the **new or updated** plan?	Pre-adoption review.			
C. Is supporting documentation, such as a resolution, included for each participating jurisdiction?	Pre-adoption review.			
		SUMMARY SCORE		

3. Multi-Jurisdictional Planning Participation

***Requirement Section201.6(a)(3)*:** *Multi-jurisdictional plans (e.g., watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process … Statewide plans will not be accepted as multi-jurisdictional plans.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE NOT MET	SCORE MET
A. Does the **new or updated** plan describe **how** each jurisdiction participated in the plan's development?	Section 1.7 Appendix B			
B. Does the **updated plan** identify all participating jurisdictions, including new, continuing, and the jurisdictions that no longer participate in the plan?	Section 1.7 Appendix B			N/A

SUMMARY SCORE		

PLANNING PROCESS: ***Section****201.6(b): An open public involvement process is essential to the development of an effective plan.*

4. Documentation of the Planning Process

Requirement Section201.6(b): *In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process* ***shall*** *include:*

(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

Requirement Section201.6(c)(1): *[The plan* ***shall*** *document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.*

Element	**Location in the Plan** (section or annex and page #)	**Reviewer's Comments**	**SCORE** N	S
A. Does the plan provide a narrative description of the process followed to prepare the ~~**new or**~~ **updated** plan?	Section 1.7 Section 6.3.3			
B. Does the **new or updated** plan indicate who was involved in the **current** planning process? (For example, who led the development at the staff level and were there any external contributors such as contractors? Who participated on the plan committee, provided information, reviewed drafts, *etc*.?)	Section 1.7 Planning Process	MOA Hazard Mitigation Planning Committee		
C. Does the ~~**new or**~~ **updated** plan indicate how the public was involved? (Was the public provided an opportunity to comment on the plan during the drafting stage and prior to the plan approval?)	Fig. 11 Section 1.8 Appendix C	Planning Process Steps 1 and 3		
D. Does the ~~**new or**~~ **updated** plan discuss the opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process?	Section 1.8 Appendix C			
E. Does the planning process describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information?	Section1.4 Table 2.3 Table 2.4 Section 2.4.1 Section 3.3.2 Section 3.3.3	MOA's 2007 Emergency Operations Plan (EOP) *Chugiak-Eagle River Comprehensive Plan, 2006; *2004 Estimate* *The Girdwood Area Plan, 1995* Long-Range Transportation Plan Water Master Plan and the Wastewater Master Plan Other Plans		

F. Does the **updated plan** document how the planning team reviewed and analyzed each section of the plan and whether each section was revised as part of the update process?	Section 1.5 Scope Section1.7 Planning Process Chapter 4 Chapter 5. Mitigation Strategy Appendix B	Summary of changes by section/chapter. Beginning with, "As part of this update, MOA departments, along with several state and federal agencies, were contacted to find out if new information was available."… "A review of the goals and objectives done as part of the plan update has determined that the goals and objectives from the 2005 remain valid, with minor changes."		
		SUMMARY SCORE		

RISK ASSESSMENT: *Section201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.*

5. Identifying Hazards

Requirement Section201.6(c)(2)(i): *[The risk assessment **shall** include a] description of the type … of all natural hazards that can affect the jurisdiction.*

Element	**Location in the Plan** (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the ~~new or~~ **updated** plan include **a description** of the types of **all natural hazards** that affect the jurisdiction?	Section4	Earthquake, Wildfire, Extreme Weather, Flooding, Avalanche, Landslide / Ground Failure, Volcanic Ash fall, Erosion Tsunami section was removed.		
		SUMMARY SCORE		

6. Profiling Hazards

Requirement Section201.6(c)(2)(i): *[The risk assessment **shall** include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan **shall** include information on previous occurrences of hazard events and on the probability of future hazard events.*

Element	**Location in the Plan** (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the ~~new or~~ updated plan?	Section4.1.1 Location Figure 4.1 & 4.2	Earthquake		

	Section4.1.2 Location	Wildfire		
	Section4.1.3 Location Figure 4.3, 4.4, 4.5, 4.6, 4.7	Extreme Weather – Winter Storms, Heavy Snow, Heavy Rain, Extreme Cold, Ice Storms, High Winds, Fog		
	Section4.1.4 Location	Flooding		
	Fig. 4.8 Figure 4.9	Flood-Prone Areas in the MOA Flood Insurance Zones		
	Section4.1.5 Location	Avalanche		
	Fig. 4.10	Known Avalanche Risk Areas		
	Section 4.1.6 Location	Landslide/Ground Failure		
	Fig. 4.11	Seismic Landslide Hazards		
	Fig. 4.12	Permafrost		
	Section 4.1.7 Location	Volcanic Ash Fall – see comment		
	Fig. 4.13 Fig 4.14	Volcanoes Flight Routes		
	Section 4.1.8 Location	Erosion (Locations for Wind, Riverine and Coastal)		
	Section 4.2.1 Location	Dam Failure		
	Section 4.2.2 Location	Energy Emergency		
	Section 4.2.3 Location	Urban Fire (Conflagration)		
	Section 4.2.4	Hazardous Materials (Hazmat) Accident		

	Location Section 4.2.5 Location Section 4.2.6 Location Section 4.2.7 Location Section 4.2.8 Location Section 4.2.9 Location Section 4.2.10 Location	 Radiation Accident Transportation Accident Air Pollution Communications Failure Infectious Disease Food/Water Contamination		
B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?	Table 1.2 Section4.1.1 Magnitude and Intensity Section4.1.2 Section4.1.3 Section4.1.4 Section4.1.5 Section4.1.6 Section 4.1.7 Section4.1.8 Section 4.2.1	Hazard Rating Matrix Earthquake Wildfire Extreme Weather – Heavy Snow, Heavy Rain, Extreme Cold, Ice Storms, High Winds, Fog Flooding Avalanche- Landslide / Ground Failure Volcanic Ash fall Erosion Dam Failure		

	Section 4.2.2	Energy Emergency		
	Section 4.2.3	Urban Fire (Conflagration)		
	Section 4.2.4	Hazardous Materials (Hazmat) Accident		
	Section 4.2.5	Radiation Accident		
	Section 4.2.6	Transportation Accident		
	Section 4.2.7	Air Pollution		
	Section 4.2.8	Communications Failure		
	Section 4.2.9	Infectious Disease		
	Section 4.2.10	Food/Water Contamination		
C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?	Section4.1.1 Historic Events & Other Events	Earthquakes		
	Section4.1.2 Historic Events & Other Wildfire Events	Wildfire		
	Section4.1.3 Historic Events & Other Events	Extreme Weather – Winter Storms, Heavy Snow, Heavy Rain (redirects to Flood section), Extreme Cold, Ice Storms, High Winds, Fog (none identified, but recognized as hazard)		
	Fig. 4.4	March 2003 Winter Storm Damage		
	Fig 4.5	Average Annual Snowfall		
	Fig. 4.6	Average Annual Rainfall		
	Fig. 4.7	Extreme Minimum Temperatures		
	Section 4.1.4 Historic Events & Other Flood Events	Flooding		

	Table 4.19	Historic Flooding		
	Section 4.1.5 Historic Events	Avalanche		
	Table 4.22	Known Historic Avalanche Events		
	Section 4.1.6 Historic Events	Landslide / Ground Failure		
	Section4.1.8 Historic Events	Volcanic Ash Fall		
	Section4.1.9 Historic Events	Erosion: Riverine, Wind, Coastal		
	Section 4.2.1 Historic Events	Dam Failure		
	Table 4.27	Dam Failures in Alaska Since 1962		
	Section 4.2.2 Historic Events	Energy Emergency		
	Section 4.2.3 Historic Events	Urban Fire (Conflagration)		
	Section 4.2.4 Historic Events	Hazardous Materials (Hazmat) Accident		
	Section 4.2.5 Historic Events	Radiation Accident		
	Section 4.2.6 Historic Events	Transportation Accident		
	Section 4.2.7 Historic Events	Air Pollution		
	Section 4.2.8 Historic Events	Communications Failure		
	Section 4.2.9	Infectious Disease		

	Historic Events Section 4.2.10 Historic Events	 Food/Water Contamination		
D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?	Section 4.1.1 Likelihood of Occurrence	Earthquakes		
	Section 4.1.2 Likelihood of Occurrence	Wildfire		
	Section 4.1.3 Likelihood of Occurrence	Extreme Weather – Winter Storms, Heavy Snow, Heavy Rain, Extreme Cold, Ice Storms, High Winds, Fog		
	Section 4.1.4 Likelihood of Occurrence	Flooding		
	Section 4.1.5 Likelihood of Occurrence	Avalanche		
	Section 4.1.6 Likelihood of Occurrence	Landslide / Ground Failure		
	Section 4.1.7 Likelihood of Occurrence	Volcanic Ash Fall		
	Section 4.1.8 Likelihood of Occurrence	Erosion: Riverine, Wind, Coastal		
	Section 4.2.1 Likelihood of Occurrence	Dam Failure		
	Section 4.2.2 Likelihood of Occurrence	Energy Emergency		

	Section 4.2.3 Likelihood of Occurrence	Urban Fire (Conflagration)		
	Section 4.2.4 Likelihood of Occurrence	Hazardous Materials (Hazmat) Accident		
	Section 4.2.5 Likelihood of Occurrence	Radiation Accident		
	Section 4.2.6 Likelihood of Occurrence	Transportation Accident		
	Section 4.2.7 Likelihood of Occurrence	Air Pollution		
	Section 4.2.8 Likelihood of Occurrence	Communications Failure		
	Section 4.2.9 Likelihood of Occurrence	Infectious Disease		
	Section 4.2.10 Likelihood of Occurrence	Food/Water Contamination		
		SUMMARY SCORE		

7. Assessing Vulnerability: Overview

Requirement Section201.6(c)(2)(ii): *[The risk assessment **shall** include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community.*

Element	**Location in the Plan** (section or annex and page #)	**Reviewer's Comments**	**SCORE**	
			N	**S**

A. Does the ~~**new or**~~ **updated** plan include an overall summary description of the jurisdiction's vulnerability to each hazard?	Section 1.4 Table 1.1 Table 1.3	Summary of Hazards in the Municipality of Anchorage		
	Section 4.1.1 Vulnerability Table 4.1	Earthquakes		
	Section 4.1.2 Vulnerability Table 4.2	Wildfire		
	Section 4.1.3 Vulnerability Table 4.4 Table 4.6 Table 4.8 Table 4.9 Table 4.10 Table 4.12 - 4.15 Table 4.16	Extreme Weather: Winter Storm, Heavy Snow, Heavy Rain, Extreme Cold, Ice Storms, High Wind, Fog		
	Section 4.1.4 Vulnerability Table 4.18 – 4.19	Flooding		
	Section 4.1.5 Vulnerability Table 4.21 - 4.22	Avalanche		
	Section 4.1.6 Vulnerability Table 4.23 – 4.24	Landslide / Ground Failure		
	Section4.18 Vulnerability Table 4.25	Volcanic Ash Fall		
	Section4.19 Vulnerability	Erosion: Riverine, Wind, Coastal		
	Section 4.2.1 Vulnerability	Dam Failure		

	Section 4.2.2 Vulnerability Table 4.28	Energy Emergency		
	Section 4.2.3 Vulnerability Table 4.29	Urban Fire (Conflagration)		
	Section 4.2.4 Vulnerability Table 4.30	Hazardous Materials (Hazmat) Accident		
	Section 4.2.5 Vulnerability Table 4.31	Radiation Accident		
	Section 4.2.6 Vulnerability Table 4.32	Transportation Accident		
	Section 4.2.7 Vulnerability Table 4.33	Air Pollution		
	Section 4.2.8 Vulnerability	Communications Failure		
	Section 4.2.9 Vulnerability	Infectious Disease		
	Section 4.2.10 Vulnerability	Food/Water Contamination		
B. Does the ~~**new or**~~ **updated** plan address the impact of each hazard on the jurisdiction?	Section 4 throughout			
		SUMMARY SCORE		

8. Assessing Vulnerability: Addressing Repetitive Loss Properties

Requirement Section201.6(c)(2)(ii): *[The risk assessment]* ***must*** *also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged floods.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the ~~new or~~ updated plan describe vulnerability in terms of the types and numbers of repetitive loss properties located in the identified hazard areas?	Section4.1.4 Figure 4.9	**"**None of the above properties has been identified as a repetitive loss property"		
		SUMMARY SCORE		

9. Assessing Vulnerability: Identifying Structures

Requirement Section201.6(c)(2)(ii)(A): *The plan **should** describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area … .*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **~~new or~~ updated** plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?	Section 3 throughout Section 4 throughout Appendix D			
B. Does the **~~new or~~ updated** plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas?	Section 3.3 Section 4 throughout			
		SUMMARY SCORE		

10. Assessing Vulnerability: Estimating Potential Losses

Requirement Section201.6(c)(2)(ii)(B): *[The plan **should** describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate … .*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **~~new or~~ updated** plan estimate potential dollar losses to vulnerable structures?	Section 3 throughout Section 4 throughout			
B. Does the **~~new or~~ updated** plan describe the methodology used to prepare the estimate?	Section 3 throughout			

	Section 4 throughout			
		SUMMARY SCORE		

11. Assessing Vulnerability: Analyzing Development Trends

Requirement Section201.6(c)(2)(ii)(C): *[The plan **should** describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.*

Element	**Location in the Plan** (section or annex and page #)	**Reviewer's Comments**	**SCORE** N	S
A. Does the ~~**new or**~~ **updated** plan describe land uses and development trends?	Section 2.4.1 Section 3.3	Future Population Future Development		N/A
		SUMMARY SCORE		N/A

12. Multi-Jurisdictional Risk Assessment

Requirement Section201.6(c)(2)(iii): *For multi-jurisdictional plans, the risk assessment **must** assess each jurisdiction's risks where they vary from the risks facing the entire planning area.*

Element	**Location in the Plan** (section or annex and page #)	**Reviewer's Comments**	**SCORE** N	S
A. Does the ~~**new or**~~ **updated** plan include a risk assessment for each participating jurisdiction as needed to reflect unique or varied risks?	Section 4 throughout			
		SUMMARY SCORE		

MITIGATION STRATEGY: *Section201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.*

13. Local Hazard Mitigation Goals

Requirement Section201.6(c)(3)(i): *[The hazard mitigation strategy **shall** include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.*

Element	**Location in the Plan** (section or annex and page #)	**Reviewer's Comments**	**SCORE** N	S
A. Does the ~~**new or**~~ **updated** plan include a description of mitigation **goals** to reduce or avoid long-term vulnerabilities to the identified hazards?	Section 5.1	Goals and Objectives		

SUMMARY SCORE		

14. Identification and Analysis of Mitigation Actions

Requirement Section201.6(c)(3)(ii): *[The mitigation strategy **shall** include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.*

Element	**Location in the Plan** (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the ~~**new or**~~ **updated** plan identify and analyze a **comprehensive range** of specific mitigation actions and projects for each hazard?	Section 5.1 Section 5.3	Goals and Objectives Action Plan		
B Do the identified actions and projects address reducing the effects of hazards on **new** buildings and infrastructure?	Section 5.1 Section 5.2 Section 5.3	Goals and Objectives Strategies Action Plan		
C. Do the identified actions and projects address reducing the effects of hazards on **existing** buildings and infrastructure?	Section 5.1 Section 5.2 Section 5.3	Goals and Objectives Strategies Action Plan		
		SUMMARY SCORE		

15. Identification and Analysis of Mitigation Actions: National Flood Insurance Program (NFIP) Compliance

Requirement: Section201.6(c)(3)(ii): *[The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.*

Element	**Location in the Plan** (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the ~~**new or**~~ **updated** plan describe the jurisdiction (s) participation in the NFIP?	Section 4.1.4	Flood		
B. Does the mitigation strategy identify, analyze and prioritize actions related to continued compliance with the NFIP?	Section 4.1.4 Section 5.3	Flood Action Plan: Action 35		
		SUMMARY SCORE		

16. Implementation of Mitigation Actions

Requirement: Section201.6(c)(3)(iii): *[The mitigation strategy section **shall** include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization **shall** include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.*

	Location in the	SCORE

Element	**Plan** (section or annex and page #)	Reviewer's Comments	N	S
A. Does the ~~**new or**~~ **updated** mitigation strategy include how the actions are prioritized? (For example, is there a discussion of the process and criteria used?)	Appendix G			
B. Does the ~~**new or**~~ **updated** mitigation strategy address how the actions will be implemented and administered, including the responsible department, existing and potential resources and the timeframe to complete each action?	Section 5.3	Action Plan		
C. Does the ~~**new or**~~ **updated** prioritization process include an emphasis on the use of a cost-benefit review to maximize benefits?	Appendix G			
D. Does the **updated** plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred), does the updated plan describe why no changes occurred?	Section 5.3 Table 5-1.	Action Plan Status of Action Items not Included in Updated Plan		
		SUMMARY SCORE		

17. Multi-Jurisdictional Mitigation Actions

Requirement Section201.6(c)(3)(iv): *For multi-jurisdictional plans, there **must** be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.*

Element	**Location in the Plan** (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the ~~**new or**~~ **updated** plan include identifiable action items for each jurisdiction requesting FEMA approval of the plan?				
B. Does the **updated** plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred), does the updated plan describe why no changes occurred?				N/A
		SUMMARY SCORE		

PLAN MAINTENANCE PROCESS

18. Monitoring, Evaluating, and Updating the Plan

Requirement Section201.6(c)(4)(i): *[The plan maintenance process **shall** include a] section describing the method and schedule of monitoring, evaluating, and*

updating the mitigation plan within a five-year cycle.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the ~~new or~~ **updated** plan describe the method and schedule for monitoring the plan, including the responsible department?	Section 6.1, Section 6.3.1 – 6.3.2	Monitoring & Evaluation: Annual Review – Following a Major Disaster		
B. Does the ~~new or~~ **updated** plan describe the method and schedule for evaluating the plan, including how, when and by whom (i.e. the responsible department)?	Section 6.1	Monitoring & Evaluation: MOA Hazard Mitigation Planning Committee, annually and after every federally declared disaster, Issues that may be addressed during the evaluation include…		
C. Does the ~~new or~~ **updated** plan describe the method and schedule for updating the plan within the five-year cycle?	Section 6.3.3	Five-Year Update		
		SUMMARY SCORE		

19. Incorporation into Existing Planning Mechanisms

Requirement Section201.6(c)(4)(ii): *[The plan **shall** include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the ~~new or~~ **updated** plan identify other local planning mechanisms available for incorporating the mitigation requirements of the mitigation plan?	Section 3.3 Section 3.3.3 Section 5.2.1	Future Development Other Plans Strategies		
B. Does the ~~new or~~ **updated** plan include a process by which the local government will incorporate the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?	Section 1.3 Section 5.1 Section 5.3	How this Plan will be used Goals and Objectives Action Plan		
C. Does the **updated** plan explain how the local government incorporated the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?	Section 5.2.1	Implementation Strategies		
		SUMMARY SCORE		

Continued Public Involvement

Requirement Section201.6(c)(4)(iii): *[The plan maintenance process **shall** include a] discussion on how the community will continue public participation in the plan maintenance process.*

Element	**Location in the Plan** (section or annex and page #)	**Reviewer's Comments**	SCORE N	SCORE S
A. Does the ~~**new or**~~ **updated** plan explain how continued public participation will be obtained? (For example, will there be public notices, an on-going mitigation plan committee, or annual review meetings with stakeholders?)	Section 6.4	Continued Public Involvement		
		SUMMARY SCORE		

END OF REVIEW

Appendix B
Summary of Changes

This addendum is a summary of the substantive changes made during the 2010 update of the MOA All-Hazards Mitigation Plan.

Section	Summary of Change
1.3	Added "Issues related to emergency response are not included in this plan; these issues should be addressed in the MOA's Emergency Operations Plan (EOP)."
1.4	Based on discussions with the Alaska Volcano Observatory, the volcano hazard was changed to volcanic ash fall as this more accurately describes the hazard. Tsunami from the list of potential hazards as a tsunami in the MOA is considered unlikely. Updated the Vulnerability Summary. Added "Additional information about the property, infrastructure, and populations vulnerable to each hazard can be found in Chapter 4."
1.5	Summarizes the changes made as part of this plan update.
1.7	The planning process section was updated to reflect the process used during the update.
1.8	The Public Involvement section was revised to reflect the public involvement activities conducted as part of the update.
2.4	Demographic information was updated.
2.4.1	Future population was updated using the most recent forecast from the Institute of Social and Economic Research.
3.1.1	Updated the list of schools based on Anchorage School District records.
3.1.2	Updated the names and locations of the hospitals and major medical centers.
3.1.3	Updated the list of fire stations based on Anchorage Fire Department and State of Alaska Division of Homeland Security & Emergency Management.
3.2	Updated the tables on existing development.
3.3.4	Provided additional information on other plans that influence future development in the Municipality.
4	Added an approximate value of parcels without a taxable value. The value was provided by the Municipality's Tax Assessor office. All vulnerability tables were updated to reflect 2009 tax assessment values. Where possible, additional information about vulnerabilities was included.
4.1	Changed weather to climate based on comments from the National Weather Service

4.1.2	Minor revisions were made to the Wildfire section based on input from the Anchorage Fire Department
4.1.3	Winter storms was removed from the Extreme Weather section based on input from the National Weather Service. Winter storms is too general a category and the hazard is better captured by the other type of weather events included in this section.
	Updated definition of heavy snow based on National Weather Service input.
	Updated definition of high wind based on National Weather Service input.
4.1.4	The types of flooding section was revised based on input from Jeff Urbanus, the MOA Floodplain Manager. A section on Flood Insurance was added. A section on the Community Rating System was added.
4.1.6	The landslide/ground failure section was edited to focus on the seismic landslide hazard. The vulnerability analysis was conducted on a USGS file showing deep, translational landslide hazards in the Anchorage Bowl. A similar analysis was not conducted for the shallow landslide hazards because the data was provided in a raster format. Efforts to convert it to a vector format were unsuccessful.
4.1.7	Based on discussions with the Alaska Volcano Observatory, the volcano hazard was changed to volcanic ash fall as this more accurately describes the hazard.
4.2	The technological hazards section is new to this update and was developed in conjunction with MOA staff. The Dam Failure section was coordinated with Charlie Cobb, the State of Alaska Dam Safety Engineer.
5.1	Goals and Objectives were reviewed by the Municipality planning team and minor modifications were made.
5.3	The status of each Action Item was updated to reflect its current status. Action items to address technological hazards were added to the Action Plan. Based on input from MOA staff, additional action items were added to the plan.
5.3	Action items were classified according to the hazard being addressed. Action items that addressed more than 1 hazard were classified under multi-hazard.
1.3	Added “Issues related to emergency response are not included in this plan; these issues should be addressed in the MOA’s Emergency Operations Plan (EOP).”
1.4	Added “Additional information about the property, infrastructure, and populations vulnerable to each hazard can be found in Chapter 4.”

Appendix C
Public Involvement

APPENDIX C. PUBLIC INVOLVEMENT ACTIVITIES

As discussed in Section 1.8, the Municipality of Anchorage's mitigation planning included several efforts to seek public input into the planning process. This appendix documents those activities.

1. A special website was established (http://www.muni.org/Departments/works/project_management/Pages/All-HazardsMitigationPlanUpdate.aspx) to explain the update process and to solicit public input.

   This page was linked from the Office of Emergency Management and Watershed Management websites. The site was also advertised on the MOA's home page in the What's New section.

2. The plan was presented during three regular monthly meetings of the Geotechnical Advisory Commission. The first presentation on November 24, 2009, was to announce the start of the All-Hazards Mitigation Plan update process and to request input for the draft plan. The second presentation, on January 25, 2011, was to announce the availability of a MOA review draft of the All-Hazards Mitigation Plan and to request their review and feedback on the draft. The Public Review draft of the plan was also discussed during the meeting on March 22, 2011. Members of the public were welcome to attend all three meetings. Meeting agendas for the meetings are attached. Based on a recommendation from the Alaska Division of Homeland Security and Emergency Management, these meetings served as the public meetings for the plan update process. The plan was also discussed during the April 26th meeting.

3. To announce the start of the All-Hazards Mitigation Plan Update, an email notification was sent to a variety of email lists. A copy of the email text and lists are attached.

4. To announce the availability of a public review draft of the updated All-Hazards Mitigation Plan, an email notification was sent to the same email lists as above. A copy of the email text is attached.

5. A Planning and Zoning Commission work session was held on March 14, 2011.

Project Management and Engineering

Public Works

Project Management and Engineering

PM&E Home

PM&E Projects

Road Bonds

Community Council Survey Information

Project Bid Schedule

Project Funding

Average Bid Tabs

Flood Hazard Permits

Road Improvement Districts

Anchorage Road Closure and Delay Information

Online Publications/Forms

Contact Information

Municipality of Anchorage All-Hazards Mitigation Plan Update

The Municipality of Anchorage (MOA) is updating their All-Hazards Mitigation Plan. The goal of the All-Hazards Mitigation Plan is to reduce the amount of damage that may occur during a future disaster.

Municipality of Anchorage All-Hazards Mitigation Plan

In 2005, the MOA adopted the existing All-Hazards Mitigation Plan. This plan was designed to meet the federal regulations set forth in the Disaster Mitigation Act of 2000, which required all local, county, tribal, and state governments to develop a multi-hazard mitigation plan for their jurisdiction in order to be eligible for certain disaster-related funds. The existing plan is nearing the end of the 5-year planning cycle.

Plan Update Process

The plan update process will require re-establishing the MOA Hazards Mitigation Planning Team which is comprised of representatives from most departments. The planning team will meet regularly to work through the Hazards Mitigation Plan Update process. In addition, the public and other stakeholders such as non-profit groups will have the opportunity to participate in the update process.

The update process will require the review and revision of the following plan elements:

- Identification of hazards that may impact Anchorage
- Vulnerability Assessment
- Assessment of the MOA's capability to mitigate hazards
- Hazards mitigation goals and objectives
- Hazards mitigation actions and/or projects
- Implementation strategy
- Plan maintenance strategy

The March 2011 public review draft of the plan and the appendices is available at the following links.

Draft 2011 MOA Hazard Mitigation Plan. Appendices for this document can be found here.

The current 2004 MOA Hazard Mitigation Plan is located here.

How can I get involved or obtain more information?

For more information on this Hazards Mitigation Plan Update, please contact:

MOA Project Manager

Kristi Bischofberger, Watershed Manager
343-8058
BischofbergerKL@muni.org

Consultant

Laurie Cummings, AICP
HDR Alaska
2525 C Street, Suite 305
Anchorage, AK 99518
907-644-2065
laurie.cummings@hdrinc.com

MUNICIPALITY OF ANCHORAGE

Community Development Department
Planning Division, Long-Range Planning

Phone: 907-343-7921
Fax: 907-343-7927

Mayor Dan Sullivan

GEOTECHNICAL ADVISORY COMMISSION

May 19, 2011

Ms. Kristi Bischofberger
Project Management & Engineering Division
MOA Public Works Department
P.O. Box 196650
Anchorage, AK 99519-6650

RE: Anchorage All Hazards Mitigation Plan Update – Public Review Draft

Dear Ms. Bischofberger:

The project consultant, Laurie Cummings of HDR, attended the Geotechnical Advisory Commission meeting on April 26 to discuss comments raised in the Commission's March 31, 2011 letter to Project Management & Engineering (PM&E) pertaining to the draft Anchorage All Hazards Mitigation Plan Update. Based on that meeting, the Commission understands that PM&E and HDR believe the updated document satisfies FEMA's requirement for a hazard mitigation plan as a condition to qualifying for future FEMA mitigation funds. The Commission also understands that completion of the subject plan may be needed for a specific FEMA grant to the Municipality. Therefore, the Commission has no objection to the plan being forwarded to the Assembly for approval.

That being said, the Commission strongly believes that the value of such a plan could and should be much more than simply serving as a prerequisite for funding. Specifically, the plan should be a working document used by the Municipality to assure that planned facility upgrades and new developments incorporate improvements that will reduce the potential cost and injury should a hazard occur. Ms. Cummings indicated PM&E also shares this vision of the plan, but she acknowledged the shortcomings of the present draft as reflected in the Commission's previous comments, such as:

- hazards have not yet been qualified in terms of the direct risk of injury and monetary loss;
- recommendations need to be more specific and prioritized; and,
- the Municipality does not currently have a departmental mechanism to administer the plan.

Regarding the latter point, the Commission was pleased to learn from Ms. Cummings that PM&E is presently working with the Mayor's Office to identify a department that will be responsible for administering the plan.

The Commission looks forward to learning about the progress of this plan, and would welcome the opportunity to review and comment on future versions as the plan is improved. If you have any questions, please contact me at your convenience (646-9613), or David Tremont with the MOA Community Development Department (343-7915).

Sincerely,

Robert L. Scher, P.E.
Chair

cc: Jerry Weaver, Director, Community Development Department
Ron Wilde, Plan Review Engineer, Building Safety, Development Services Division

Municipality of Anchorage

Geotechnical Advisory Commission

AGENDA

Tuesday, April 26, 2011
12:00 Noon – 1:00 p.m.

Regular Meeting

Conference Room 170
Planning and Development Center
4700 Elmore Road
Anchorage, Alaska

I. ESTABLISHMENT OF QUORUM

II. CALL TO ORDER

III. MINUTES

A. February 22, 2011 ✓

B. March 22, 2011 ✓

IV. OLD BUSINESS

A. Action Item Follow-up from 3-22-11 Commission Meeting

1. Letter to Project Management & Engineering regarding the Commission's comments on the draft Anchorage All Hazards Mitigation Plan Update (Chair)

B. Anchorage All Hazards Mitigation Plan Update (discussion with project consultant)

V. NEW BUSINESS

A. Building Safety Handout AG.18

B. GAC 2010 Goals

C. Persons to Be Heard

VI. COMMITTEE REPORTS

VII. OTHER BUSINESS

A. State Seismic Hazards Safety Commission

B. Review of Action Items for the next Commission meeting

VIII. STAFF REPORT

IX. ADJOURNMENT

Next Meeting: May 24, 2011

Revised: 4/21/11

Municipality of Anchorage

Geotechnical Advisory Commission

A G E N D A

Tuesday, March 22, 2011
12:00 Noon – 1:00 p.m.

Regular Meeting

Conference Room 170
Planning and Development Center
4700 Elmore Road
Anchorage, Alaska

I. ESTABLISHMENT OF QUORUM

II. CALL TO ORDER

III. MINUTES
- A. None available

IV. OLD BUSINESS
- A. Action Item Follow-up from 2-22-11 Commission Meeting
  1. Email to Assembly Port Committee regarding documentation of peer reviews of Port design to date (Chair)
  2. Letter to Port regarding proposed oversight committee (Chair)
  3. Letter to Port transmitting seismic instrumentation proposal (Chair)
  4. Provide Name of MOA Maintenance/Operations contact (staff)
- B. Anchorage All Hazards Mitigation Plan Update

V. NEW BUSINESS
- A. Japan Earthquake and Tsunami (discussion)
- B. Persons to Be Heard

VI. COMMITTEE REPORTS

VII. OTHER BUSINESS
- A. State Seismic Hazards Safety Commission
- B. Review of Action Items for the next Commission meeting

VIII. STAFF REPORT

IX. ADJOURNMENT

Next Meeting: April 26, 2011

Revised: 3/18/11

Municipality of Anchorage

Geotechnical Advisory Commission

A G E N D A

Tuesday, January 25, 2011
12:00 Noon – 1:00 p.m.

Regular Meeting

Conference Room 170
Planning and Development Center
4700 Elmore Road
Anchorage, Alaska

I. ESTABLISHMENT OF QUORUM

II. CALL TO ORDER

III. SPECIAL ORDER OF BUSINESS

- A. Election of Chair and Vice Chair

IV. MINUTES (none)

V. OLD BUSINESS

- A. Action Item Follow-up from 12-28-10 Commission Meeting
  - 1. Review of past Commission/Port meeting tapes regarding instrumentation (staff)
  - 2. Provide Commission roster for review and updating (staff)
- B. GAC 001-11: Review of Draft Port Instrumentation Plan

VI. NEW BUSINESS

- A. GAC 002-11: Anchorage All Hazards Mitigation Plan Update (Laurie Cummings, HDR Alaska)
- B. Persons to Be Heard

VII. COMMITTEE REPORTS

VIII. OTHER BUSINESS

- A. State Seismic Hazards Safety Commission
- B. Review of Action Items for the next Commission meeting

IX. STAFF REPORT

X. ADJOURNMENT

Next Meeting: February 22, 2011

Revised: 1/21/11

Municipality of Anchorage

Geotechnical Advisory Commission

A G E N D A

Tuesday, November 24, 2009
12:00 Noon – 1:00 p.m.

Regular Meeting

Conference Room 170
Planning and Development Center
4700 Elmore Road
Anchorage, Alaska

I. ESTABLISHMENT OF QUORUM

II. CALL TO ORDER

III. MINUTES

A. August 25, 2009

IV. OLD BUSINESS

A. GAC 001-09 – Downtown Anchorage Seismic Risk Assessment and Land Use Regulations to Mitigate Seismic Risk (Status Report – Staff)

B. Persons to Be Heard

V. NEW BUSINESS

A. Municipality of Anchorage All Hazards Mitigation Plan Update
(Laurie Cummings, HDR, Kristi Bischofberger, MOA Watershed Management Div.)

VI. COMMITTEE REPORTS

VII. OTHER BUSINESS

VIII. STAFF REPORT

IX. ADJOURNMENT

Revised: 11/20/09

AGENCY LISTS

AGENCY	NAME	EMAIL
LEPC	Nikki Stokoe	stokoens@muni.org
ASD Security & Emergency Preparedness	Mark Mew	Mew_mark@asdk12.org
ASD Risk Management	Mike Klawitter	Klawitter_mike@asdk12.org
EPIN	Genevieve Maurits	mauritsgc@muni.org
APIP	Lisa Witzleben	Lisa.witzleben@alaska.gov
JMEPG	Paul Mitchell	p.mitchell@msrmc.com
ALMR	Sherry Shafer	sherryshafer@5starteam.net
SERC	Wanice Cowles	Wanice.cowles@alaska.gov
JTTF	Call FBI 276-4441 for info	
ALCOM	Amy Schwalber	Amy.schwalber@elmendorf.af.mil

PUBLIC LISTS

AGENCY	NAME	EMAIL
ARC	Mary Lowery	LoweryM@usa.redcross.org
Salvation Army	Jeff Dennis	jeff.dennis@usw.salvationarmy.org
Emergency Watch	Dawn Brantley	Brantleyd@muni.org
ARES	Michael O'Keefe	mok@gci.net
C.A.P.	Call 272-7227 for info	
APD Citizen's Police Academy	Jim Kaletka	jkaletka@apcaaa.org
UAA VIPS	Ron Swartz	anrcs@uaa.alaska.edu
ASD	Call Leslie Preston 742-4146 for info	
What's Up	Peg Tileston	pegt@gci.net
Anchorage Press Calendar	Call 561-7737 for info	
KSKA Public Calendar	Call 550-8400 for info	
MOA & OEM website homepages	Genevieve Maurits	mauritsgc@muni.org

ELECTED OFFICIAL & EMERGENCY MANAGERS

MOA Mayor	Dan Sullivan	sullivand@muni.org
MOA Emergency Manager	Kevin Spillers	spillerskp@muni.org
Mat-Su Borough Mayor	Talis Colberg	tcolberg@matsugov.us
Mat-Su Borough Emergency Manager	Tom Smayda	tsmayda@matsugov.us
Kenai Peninsula Borough Mayor	David Carey	dcarey@borough.kenai.ak.us
Kenai Peninsula Borough Emergency Management Coordinator	Scott Walden	swalden@borough.kenai.ak.us

Help the Municipality of Anchorage Update the All-Hazard Mitigation Plan!

The current Municipality of Anchorage (MOA) All-Hazard Mitigation Plan is nearing the end of the 5-year planning cycle and we need your help to update the plan. Hazard mitigation is sustained action taken to reduce or eliminate the long-term risk to people and their property from hazards. The planning team wants to ensure that this plan is comprehensive. The update process will require the review and revision of the following plan elements:

- Identification and description of hazards that may impact Anchorage
- Vulnerability assessment
- Assessment of the MOA's capability to mitigate hazards
- Hazard mitigation goals and objectives
- Hazard mitigation actions and projects
- Implementation strategy
- Plan maintenance strategy

If you are interested in assisting the planning team by providing comments or for more information on the All-Hazard Mitigation Plan Update, please visit http://www.muni.org/Departments/works/project_management/Pages/All-HazardsMitigationPlanUpdate.aspx

Comment Response Summary

Commenter	Comment Summary	How Addressed?
Steve Ribuffo, Deputy Port Director	The plan looks acceptable.	No changed required.
Sam Albanese, NWS	In Section 4.1.4, the text should refer to weather instead of climate.	Text changed to say weather.
Kristi Wallace, Alaska Volcano Observatory	Grammatical corrections	Changes made.
Chair, Geotechnical Advisory Commission	The plan has no clear and definitive statement pertaining to which municipal department will be responsible for administering the plan.	This is a known issue with the plan. The MOA is in the process of determining which department is the most appropriate department to be responsible for the hazard mitigation plan. Due to timing constraints, the decision was made to complete the plan update and note this as the plan's highest priority action item.
	The discussions of natural hazards is inconsistent, include information that is irrelevant and incorrect.	Additional information is needed to address these concerns and is being requested from the Commission. The description and content of each hazard section may vary depending on the amount of available information. As identified, incorrect information will be removed or replaced with more accurate information.
	Hazard vulnerabilities do not address life safety in terms of death or injuries to the population.	Information about the number of deaths or injuries was not available during the development of the plan. Where possible, additional information about the vulnerable populations was added to each hazard.
	Mitigation strategies include actions that are already pars of the Muncipality's planning and building codes or are too vague. It is not clear which strategies provide the most benefit to the population or built environment versus the cost to implement them.	The mitigation strategy includes action items that are currently being pursued by the MOA as well as actions they would like to undertake when resources are available. Appendix G includes a prioritization strategy for the action item that considers life safety and cost benefit as part of the prioritization process. It was decided that the prioritization of the action items should be done after the department that should be responsible for the hazard mitigation plan has been

		identified.

Appendix D
Critical Facility Matrix

CRITICAL FACILITY EXPOSURE

Natural Hazards

	Hazard									
	Earthquake	Wildfire	Extreme Weather	Flooding	Avalanche	Ground Failure/Landslide	Volcanic Ashfall	Severe Erosion	Infectious Disease	Food/Water Contamination
Facility Name										
Fire Departments										
AFD Fire Station #1	√	X	√	X	X	√	√	X	X	X
AFD Fire Station #3	√	X	√	X	X	√	√	X	X	X
AFD Fire Station #4	√	X	√	X	X	√	√	X	X	X
AFD Fire Station #5	√	X	√	X	X	√	√	X	X	X
AFD Fire Station #6	√	X	√	X	X	√	√	X	X	X
AFD Fire Station #7	√	X	√	X	X	√	√	X	X	X
AFD Fire Station #8	√	√	√	X	X	√	√	X	X	X
AFD Fire Station #9	√	X	√	X	X	√	√	X	X	X
AFD Fire Station #10	√	√	√	X	X	√	√	X	X	X
AFD Fire Station #11	√	X	√	X	X	√	√	X	X	X
AFD Fire Station #12	√	√	√	√	X	√	√	X	X	X
AFD Fire Station #14	√	X	√	X	X	√	√	X	X	X
AFD Fire Station #15	√	X	√	X	X	√	√	X	X	X
Chugiak Volunteer Fire Department #1	√	X	√	X	X	√	√	X	X	X
Chugiak Volunteer Fire Department #2	√	X	√	X	X	√	√	X	X	X
Chugiak Volunteer Fire Department #3	√	X	√	X	X	√	√	X	X	X
Girdwood Fire Department	√	X	√	√	X	√	√	X	X	X
Hospitals										
UASF Elmendorf Hospital	√	?	√	X	X	√	√	X	X	X
Anchorage Pioneer Home	√	?	√	X	X	√	√	X	X	X
VA Clinic	√	?	√	X	X	√	√	X	X	X

	Hazard									
	Earthquake	Wildfire	Extreme Weather	Flooding	Avalanche	Ground Failure/Landslide	Volcanic Ashfall	Severe Erosion	Infectious Disease	Food/Water Contamination
Alaska Regional Hospital	√	?	√	X	X	√	√	X	X	X
North Star Behavioral Health System	√	?	√	X	X	√	√	X	X	X
Providence Hospital	√	?	√	X	X	√	√	X	X	X
Alaska Psychiatric Institute	√	?	√	X	X	√	√	X	X	X
Alaska Native Hospital	√	?	√	X	X	√	√	X	X	X
Providence Extended Care Facility	√	?	√	X	X	√	√	X	X	X
Schools										
Charter										
Alaska Native Cultural	√	?	√	?	?	√	√	X	X	X
Aquarian	√	?	√	X	X	√	√	X	X	X
Eagle Academy	√	?	√	X	X	√	√	X	X	X
Family Partnership	√	?	√	X	X	√	√	X	X	X
Frontier Charter School	√	?	√	X	X	√	√	X	X	X
Highland Tech High School	√	?	√	X	X	√	√	X	X	X
Rilke Schule	√	?	√	?	?	√	√	X	X	X
Winterberry	√	?	√	?	?	√	√	X	X	X
Elementary										
Abbott Loop Elementary	√	√	√	X	X	√	√	X	X	X
Airport Heights Elementary	√	X	√	X	X	√	√	X	X	X
Alpenglow Elementary	√	X	√	X	X	√	√	X	X	X
Aurora Elementary	√	X	√	X	X	√	√	X	X	X
Baxter Elementary	√	X	√	X	X	√	√	X	X	X
Bayshore Elementary	√	X	√	X	X	√	√	X	X	X
Bear Valley Elementary	√	√	√	X	X	√	√	X	X	X

	Hazard									
	Earthquake	Wildfire	Extreme Weather	Flooding	Avalanche	Ground Failure/Landslide	Volcanic Ashfall	Severe Erosion	Infectious Disease	Food/Water Contamination
Birchwood ABC	√	X	√	X	X	√	√	X	X	X
Bowman Willard Elementary	√	X	√	X	X	√	√	X	X	X
Campbell Elementary	√	√	√	X	X	√	√	X	X	X
Chester Valley Elementary	√	X	√	√	X	√	√	X	X	X
Chinook Elementary	√	X	√	X	X	√	√	X	X	X
Chugach Optional Elementary	√	X	√	X	X	√	√	X	X	X
Chugiak Elementary	√	X	√	X	X	√	√	X	X	X
College Gate Elementary	√	X	√	X	X	√	√	X	X	X
Creekside Park Elementary	√	X	√	X	X	√	√	X	X	X
Denali Elementary	√	X	√	X	X	√	√	X	X	X
Eagle River Elementary	√	X	√	X	X	√	√	X	X	X
Fairview Elementary	√	X	√	X	X	√	√	X	X	X
Fire Lake Elementary	√	X	√	X	X	√	√	X	X	X
Girdwood Elementary*	√	X	√	X	X	√	√	X	X	X
Gladys Wood Elementary	√	X	√	X	X	√	√	X	X	X
Government Hill Elementary	√	X	√	X	X	√	√	X	X	X
Homestead Elementary	√	X	√	X	X	√	√	X	X	X
Huffman Elementary	√	X	√	X	X	√	√	X	X	X
Inlet View Elementary	√	X	√	X	X	√	√	X	X	X
Kasuun Elementary	√	X	√	X	X	√	√	X	X	X
Kincaid Elementary	√	X	√	X	X	√	√	X	X	X
Klatt Elementary	√	X	√	X	X	√	√	X	X	X
Lake Hood Elementary	√	X	√	X	X	√	√	X	X	X
Lake Otis Elementary	√	X	√	X	X	√	√	X	X	X
Mountain View Elementary	√	X	√	X	X	√	√	X	X	X
Mt. Iliamna Elementary	√	X	√	X	X	√	√	X	X	X

	Hazard									
	Earthquake	Wildfire	Extreme Weather	Flooding	Avalanche	Ground Failure/Landslide	Volcanic Ashfall	Severe Erosion	Infectious Disease	Food/Water Contamination
Mt. Spurr Elementary	√	X	√	X	X	√	√	X	X	X
Muldoon Elementary	√	X	√	X	X	√	√	X	X	X
North Star Elementary	√	X	√	X	X	√	√	X	X	X
Northern Lights ABC	√	X	√	X	X	√	√	X	X	X
Northwood Elementary	√	X	√	X	X	√	√	X	X	X
Nunaka Valley Elementary	√	X	√	X	X	√	√	X	X	X
O'Malley Elementary	√	√	√	X	X	√	√	X	X	X
Ocean View Elementary*	√	?	√	X	X	√	√	X	X	X
Orion Elementary	√	?	√	X	X	√	√	X	X	X
Ptarmigan Elementary	√	X	√	X	X	√	√	X	X	X
Rabbit Creek Elementary	√	X	√	X	X	√	√	X	X	X
Ravenwood Elementary	√	X	√	X	X	√	√	X	X	X
Rogers Park Elementary	√	X	√	X	X	√	√	X	X	X
Russian Jack Elementary*	√	X	√	X	X	√	√	X	X	X
Sand Lake Elementary	√	X	√	√	X	√	√	X	X	X
Scenic Park Elementary*	√	X	√	X	X	√	√	X	X	X
Spring Hill Elementary	√	√	√	X	X	√	√	X	X	X
Susitna Elementary	√	X	√	X	X	√	√	X	X	X
Taku Elementary	√	X	√	√	X	√	√	X	X	X
Trailside Elementary*	√	X	√	X	X	√	√	X	X	X
Tudor Elementary	√	X	√	X	X	√	√	X	X	X
Turnagain Elementary	√	X	√	X	X	√	√	X	X	X
Tyson Elementary*	√	X	√	X	X	√	√	X	X	X
Ursa Major Elementary	√	X	√	X	X	√	√	X	X	X
Ursa Minor Elementary	√	X	√	X	X	√	√	X	X	X
Williwaw Elementary	√	X	√	X	X	√	√	X	X	X
Willow Crest Elementary*	√	X	√	X	X	√	√	X	X	X

	Hazard									
	Earthquake	Wildfire	Extreme Weather	Flooding	Avalanche	Ground Failure/Landslide	Volcanic Ashfall	Severe Erosion	Infectious Disease	Food/Water Contamination
Wonder Park Elementary	√	X	√	X	X	√	√	X	X	X
Middle										
Begich Middle School*	√	X	√	X	X	√	√	X	X	X
Central Middle School of Science	√	X	√	X	X	√	√	X	X	X
Clark Middle School*	√	X	√	X	X	√	√	X	X	X
Goldenview Middle School*	√	X	√	X	X	√	√	X	X	X
Gruening Middle School*	√	X	√	X	X	√	√	X	X	X
Hanshew Middle School*	√	√	√	X	X	√	√	X	X	X
Mears Middle School*	√	X	√	√	X	√	√	X	X	X
Mirror Lake Middle School*	√	X	√	X	X	√	√	X	X	X
Romig Middle School*	√	X	√	X	X	√	√	X	X	X
Wendler Middle School*	√	X	√	X	X	√	√	X	X	X
High										
Bartlett High School*	√	X	√	X	X	√	√	X	X	X
Chugiak High School*	√	X	√	X	X	√	√	X	X	X
Dimond High School*	√	X	√	X	X	√	√	X	X	X
Eagle River High School*	√	X	√	X	X	√	√	X	X	X
East High School*	√	X	√	X	X	√	√	X	X	X
Service High School*	√	√	√	X	X	√	√	X	X	X
South Anchorage High School*	√	X	√	X	X	√	√	X	X	X
West High School*	√	X	√	X	X	√	√	X	X	X
Other										
ACE/ACT Program	√	?	√	X	X	√	√	X	X	X
Alaska State School for the Deaf and Hard of Hearing**	√	?	√	X	X	√	√	X	X	X
AVAIL Program	√	?	√	X	X	√	√	X	X	X
Benny Benson/SEARCH	√	?	√	X	X	√	√	X	X	X
Booth Secondary	√	?	√	X	X	√	√	X	X	X

	Hazard									
	Earthquake	Wildfire	Extreme Weather	Flooding	Avalanche	Ground Failure/Landslide	Volcanic Ashfall	Severe Erosion	Infectious Disease	Food/Water Contamination
Bragaw Residental	√	?	√	X	X	√	√	X	X	X
COHO School	√	?	√	X	X	√	√	X	X	X
Continuation Program	√	?	√	X	X	√	√	X	X	X
Crossroads	√	?	√	X	X	√	√	X	X	X
Debarr Residential**	√	?	√	X	X	√	√	X	X	X
Jesse Lee	√	?	√	X	X	√	√	X	X	X
King Career Center	√	?	√	X	X	√	√	X	X	X
Maplewood**	√	?	√	X	X	√	√	X	X	X
McKinley Heights	√	?	√	X	X	√	√	X	X	X
McLaughlin	√	?	√	X	X	√	√	X	X	X
My High**	√	?	√	X	X	√	√	X	X	X
North Star**	√	?	√	X	X	√	√	X	X	X
Polaris K-12	√	?	√	X	X	√	√	X	X	X
Providence Girls**	√	?	√	X	X	√	√	X	X	X
Providence Heights	√	?	√	X	X	√	√	X	X	X
SAVE High	√	?	√	X	X	√	√	X	X	X
Steller Secondary	√	?	√	X	X	√	√	X	X	X
Whaley	√	?	√	X	X	√	√	X	X	X
Law Enforcement										
Alaska State Court Building	√	?	√	X	X	√	√	X	X	X
Alaska State Troopers Headquarters	√	?	√	X	X	√	√	X	X	X
Anchorage Correctional Complex	√	?	√	X	X	√	√	X	X	X
Anchorage Police Department Headquarters	√	?	√	X	X	√	√	X	X	X

	Hazard									
	Earthquake	Wildfire	Extreme Weather	Flooding	Avalanche	Ground Failure/Landslide	Volcanic Ashfall	Severe Erosion	Infectious Disease	Food/Water Contamination
APD - Eagle River Substation	√	?	√	X	X	√	√	X	X	X
APD Training/Misc	√	?	√	X	X	√	√	X	X	X
FBI Building	√	?	√	X	X	√	√	X	X	X
Prosecutor's Office	√	?	√	X	X	√	√	X	X	X
Shelters (excluding schools used as shelters)										
Spenard Recreation Center	√	?	√	X	X	√	√	X	X	X
Fairview Recreation Center	√	?	√	X	X	√	√	X	X	X
Boys & Girl's Club, Mt. View	√	?	√	X	X	√	√	X	X	X
Egan Center	√	?	√	X	X	√	√	X	X	X
Sullivan Area	√	?	√	X	X	√	√	X	X	X
AT&T Pavilion (formerly Cellular One)	√	?	√	?	X	√	√	X	X	X
Subway Sports Center	√	?	√	?	X	√	√	X	X	X
Anchorage Senior Center	√	?	√	?	X	√	√	X	X	X
Chugiak Senior Center	√	?	√	?	?	?	√	?	?	?
Anchorage Square and Round Dance Center	√	?	√	?	X	√	√	X	X	X
Dena'ina Center	√	?	√	?	X	√	√	X	X	X
Kincaid Park	√	√	√	?	?	√	√	?	X	X
Change Point Church	√	?	√	?	X	√	√	X	X	X
UAA Sports Complex	√	?	√	?	X	√	√	X	X	X
UAA	√	?	√	?	?	√	√	X	X	X
UAA Student Union	√	?	√	?	?	√	√	X	X	X
Ben Boeke Ice Arena	√	?	√	?	X	√	√	X	X	X

	Hazard									
	Earthquake	Wildfire	Extreme Weather	Flooding	Avalanche	Ground Failure/Landslide	Volcanic Ashfall	Severe Erosion	Infectious Disease	Food/Water Contamination
Dempsey Anderson Ice Arena	√	?	√	?	?	?	√	?	X	X
Anchorage City Church	√	?	√	?	?	√	√	X	X	X
Jewel Lake Church	√	?	√	?	?	√	√	X	X	X
American Legion	√	?	√	?	?	√	√	X	X	X
Anchorage Bible Fellowship	√	?	√	?	?	√	√	X	X	X
Holy Cross Parish	√	?	√	?	?	√	√	X	X	X
St. Johns Methodist Church	√	?	√	?	?	√	√	X	X	X
Abbott Loop Church	√	?	√	?	?	√	√	X	X	X
St. Andrews Parish	√	?	√	?	?	√	√	X	X	X
Riverside Community Church	√	?	√	?	?	√	√	X	X	X
Community Covenant Church	√	?	√	?	?	√	√	X	X	X
Other Municipal Facilities										
Eklutna Water Treatment Facility	√	?	√	X	X	√	√	X	X	√
Eagle River Waste Treatment Facility	√	?	√	X	X	√	√	X	X	X
ML&P Plant #2	√	?	√	X	X	√	√	X	X	X
AWWU Ship Creek Treatment Facility	√	?	√	X	X	√	√	X	X	X
ML&P Plant #1	√	?	√	X	X	√	√	X	X	X
City Hall	√	?	√	X	X	√	√	X	X	X
Department of Health & Human Services	√	?	√	X	X	√	√	X	X	X
Point Woronzof Sewage Facility	√	?	√	X	X	√	√	X	X	X
AWWU Headquarters	√	?	√	X	X	√	√	X	X	X
Emergency Operations Center	√	X	√	X	X	√	√	X	X	X

	Hazard									
	Earthquake	Wildfire	Extreme Weather	Flooding	Avalanche	Ground Failure/Landslide	Volcanic Ashfall	Severe Erosion	Infectious Disease	Food/Water Contamination
Municipal Parks & Recreation	√	?	√	X	X	√	√	X	X	X
Michael Building	√	?	√	X	X	√	√	X	X	X
Permit and Development Center	√	X	√	X	X	√	√	X	X	X
Northwood Warm Storage Building	√	?	√	?	?	?	√	?	X	X
Northwood/Dispatch/Maintenance/Office Building	√	?	√	?	?	?	√	?	X	X

* Also acts as Shelter
**Not housed in MOA or ASD owned building

Legend

√	Yes
?	Unknown
X	No

CRITICAL FACTILITY EXPOSURE

Technological Hazards

	Hazard									
							Transportation Accident			
Facility Name	Air Pollution[1]	Dam Failure	Energy Emergency	Urban Fire	Hazardous Materials	Radiation Release	Aircraft	Marine	Motor Vehicle	Rail
Fire Departments	X	X	√	√	X	X	X	X	X	X
AFD Fire Station #1	X	X	√	√	X	X	X	X	X	X
AFD Fire Station #3	X	X	√	√	X	X	X	X	X	X
AFD Fire Station #4	X	X	√	√	X	X	X	X	X	X
AFD Fire Station #5	X	X	√	√	X	X	X	X	X	X
AFD Fire Station #6	X	X	√	√	X	X	X	X	X	X
AFD Fire Station #7	X	X	√	√	X	X	X	X	X	X
AFD Fire Station #8	X	X	√	√	X	X	X	X	X	X
AFD Fire Station #9	X	X	√	√	X	X	X	X	X	X
AFD Fire Station #10	X	X	√	√	X	X	X	X	X	X
AFD Fire Station #11	X	X	√	√	X	X	X	X	X	X
AFD Fire Station #12	X	X	√	√	X	X	X	X	X	X
AFD Fire Station #14	X	X	√	√	X	X	X	X	X	X
AFD Fire Station #15	X	X	√	√	X	X	X	X	X	X
Chugiak Volunteer Fire Department #1	X	X	√	√	X	X	X	X	X	X
Chugiak Volunteer Fire Department #2	X	X	√	√	X	X	X	X	X	X
Chugiak Volunteer Fire Department #3	X	X	√	√	X	X	X	X	X	X
Girdwood Volunteer Fire Department	X	X	√	√	X	X	X	X	X	X

[1] Excludes Volcanic Ash fall

	Hazard									
							Transportation Accident			
Facility Name	Air Pollution[1]	Dam Failure	Energy Emergency	Urban Fire	Hazardous Materials	Radiation Release	Aircraft	Marine	Motor Vehicle	Rail
Hospitals										
UASF Elmendorf Hospital	√	X	√	√	√	?	√	X	√	X
Anchorage Pioneer Home	√	?	√	√	√	?	√	?	√	?
VA Clinic	√	X	√	√	√	?	√	X	√	X
Alaska Regional Hospital	√	X	√	√	√	?	√	X	√	X
North Star Behavioral Health System	√	X	√	√	√	?	√	X	√	X
Providence Hospital	√	X	√	√	√	?	√	X	√	X
Alaska Psychiatric Institute	√	X	√	√	√	?	√	X	√	X
Alaska Native Hospital	√	X	√	√	√	?	√	X	√	X
Providence Extended Care Facility	√	X	√	√	√	?	√	X	√	X
Schools										
Charter										
Aquarian	√	X	√	√	√	?	√	X	√	?
Alaska Native Cultural	√	X	√	√	√	?	√	X	√	?
Eagle Academy	√	X	√	X	√	?	√	X	√	?
Family Partnership	√	X	√	√	√	?	√	X	√	?
Frontier Charter School	√	X	√	√	√	?	√	X	√	?
Highland Tech High School	√	X	√	√	√	?	√	X	√	?
Rilke Schule	√	X	√	√	√	?	√	X	√	?
Winterberry	√	X	√	√	√	?	√	X	√	√
Elementary										
Abbott Loop Elementary	√	X	√	√	√	?	√	X	√	?
Airport Heights Elementary	√	X	√	√	√	?	√	X	√	?
Alpenglow Elementary	√	X	√	X	√	?	√	X	√	?

	Hazard									
							Transportation Accident			
Facility Name	Air Pollution[1]	Dam Failure	Energy Emergency	Urban Fire	Hazardous Materials	Radiation Release	Aircraft	Marine	Motor Vehicle	Rail
Aurora Elementary	√	X	√	√	√	?	√	X	√	?
Baxter Elementary	√	X	√	√	√	?	√	X	√	?
Bayshore Elementary	√	X	√	√	√	?	√	X	√	?
Bear Valley Elementary	√	X	√	√	√	?	√	X	√	?
Birchwood ABC	√	X	√	X	√	?	√	X	√	?
Bowman Willard Elementary	√	X	√	√	√	?	√	X	√	?
Campbell Elementary	√	X	√	√	√	?	√	X	√	?
Chester Valley Elementary	√	X	√	√	√	?	√	X	√	?
Chinook Elementary	√	X	√	√	√	?	√	X	√	?
Chugach Optional Elementary	√	X	√	√	√	?	√	X	√	?
Chugiak Elementary	√	X	√	X	√	?	√	X	√	?
College Gate Elementary	√	X	√	√	√	?	√	X	√	?
Creekside Park Elementary	√	X	√	√	√	?	√	X	√	?
Denali Elementary	√	X	√	√	√	?	√	X	√	?
Eagle River Elementary	√	X	√	X	√	?	√	X	√	?
Fairview Elementary	√	X	√	√	√	?	√	X	√	?
Fire Lake Elementary	√	X	√	X	√	?	√	X	√	?
Girdwood Elementary*	√	X	√	√	√	?	√	X	√	?
Gladys Wood Elementary	√	X	√	√	√	?	√	X	√	?
Government Hill Elementary	√	X	√	√	√	?	√	X	√	?
Homestead Elementary	√	X	√	X	√	?	√	X	√	?
Huffman Elementary	√	X	√	√	√	?	√	X	√	?
Inlet View Elementary	√	X	√	√	√	?	√	X	√	?
Kasuun Elementary	√	X	√	√	√	?	√	X	√	?

	Hazard									
							Transportation Accident			
Facility Name	Air Pollution[1]	Dam Failure	Energy Emergency	Urban Fire	Hazardous Materials	Radiation Release	Aircraft	Marine	Motor Vehicle	Rail
Kincaid Elementary	√	X	√	√	√	?	√	X	√	?
Klatt Elementary	√	X	√	√	√	?	√	X	√	?
Lake Hood Elementary	√	X	√	√	√	?	√	X	√	?
Lake Otis Elementary	√	X	√	√	√	?	√	X	√	?
Mountain View Elementary	√	X	√	√	√	?	√	X	√	?
Mt. Iliamna Elementary	√	X	√	√	√	?	√	X	√	?
Mt. Spurr Elementary	√	X	√	√	√	?	√	X	√	?
Muldoon Elementary	√	X	√	√	√	?	√	X	√	?
North Star Elementary	√	X	√	√	√	?	√	X	√	?
Northern Lights ABC	√	X	√	√	√	?	√	X	√	?
Northwood Elementary	√	X	√	√	√	?	√	X	√	?
Nunaka Valley Elementary	√	X	√	√	√	?	√	X	√	?
O'Malley Elementary	√	?								
Ocean View Elementary*	√	X	√	√	√	?	√	X	√	?
Orion Elementary	√	X	√	√	√	?	√	X	√	?
Ptarmigan Elementary	√	X	√	√	√	?	√	X	√	?
Rabbit Creek Elementary	√	X	√	√	√	?	√	X	√	?
Ravenwood Elementary	√	X	√	X	√	?	√	X	√	?
Rogers Park Elementary	√	X	√	√	√	?	√	X	√	?
Russian Jack Elementary*	√	X	√	√	√	?	√	X	√	?
Sand Lake Elementary	√	X	√	√	√	?	√	X	√	?
Scenic Park Elementary*	√	X	√	√	√	?	√	X	√	?
Spring Hill Elementary	√	X	√	√	√	?	√	X	√	?
Susitna Elementary	√	X	√	√	√	?	√	X	√	?
Taku Elementary	√	X	√	√	√	?	√	X	√	?

	Hazard									
							Transportation Accident			
Facility Name	Air Pollution[1]	Dam Failure	Energy Emergency	Urban Fire	Hazardous Materials	Radiation Release	Aircraft	Marine	Motor Vehicle	Rail
Trailside Elementary*	√	X	√	√	√	?	√	X	√	?
Tudor Elementary	√	X	√	√	√	?	√	X	√	?
Turnagain Elementary	√	X	√	√	√	?	√	X	√	?
Tyson Elementary*	√	X	√	√	√	?	√	X	√	?
Ursa Major Elementary	√	X	√	X	√	?	√	X	√	?
Ursa Minor Elementary	√	X	√	X	√	?	√	X	√	?
Williwaw Elementary	√	X	√	√	√	?	√	X	√	?
Willow Crest Elementary*	√	X	√	√	√	?	√	X	√	?
Wonder Park Elementary	√	X	√	√	√	?	√	X	√	?
Middle										
Begich Middle School*	√	X	√	√	√	?	√	X	√	?
Central Middle School of Science	√	X	√	√	√	?	√	X	√	?
Clark Middle School*	√	X	√	√	√	?	√	X	√	?
Goldenview Middle School*	√	X	√	√	√	?	√	X	√	?
Gruening Middle School*	√	X	√	X	√	?	√	X	√	?
Hanshew Middle School	√	X	√	√	√	?	√	X	√	?
Mears Middle School*	√	X	√	√	√	?	√	X	√	?
Mirror Lake Middle School	√	X	√	X	√	?	√	X	√	?
Romig Middle School*	√	X	√	√	√	?	√	X	√	?
Wendler Middle School*	√	X	√	√	√	?	√	X	√	?
High										
Bartlett High School*	√	X	√	√	√	?	√	X	√	?
Chugiak High School*	√	X	√	X	√	?	√	X	√	?
Dimond High School*	√	X	√	√	√	?	√	X	√	?
Eagle River High School*	√	X	√	X	√	?	√	X	√	?
East High School*	√	X	√	√	√	?	√	X	√	?

	Hazard									
							Transportation Accident			
Facility Name	Air Pollution[1]	Dam Failure	Energy Emergency	Urban Fire	Hazardous Materials	Radiation Release	Aircraft	Marine	Motor Vehicle	Rail
Service High School*	√	X	√	√	√	?	√	X	√	?
South Anchorage High School*	√	X	√	√	√	?	√	X	√	?
West High School*	√	X	√	√	√	?	√	X	√	?
Other										
ACE/ACT Program	√	X	√	√	√	?	√	X	√	?
Alaska State School for the Deaf and Hard of Hearing**	√	X	√	√	√	?	√	X	√	?
AVAIL Program	√	X	√	√	√	?	√	X	√	?
Benny Benson/SEARCH	√	X	√	√	√	?	√	X	√	?
Booth Secondary	√	X	√	√	√	?	√	X	√	?
Bragaw Residential	√	X	√	√	√	?	√	X	√	?
COHO School	√	X	√	X	√	?	√	X	√	?
Continuation Program	√	X	√	√	√	?	√	X	√	?
Crossroads	√	X	√	√	√	?	√	X	√	?
Debarr Residential**	√	X	√	√	√	?	√	X	√	?
Jesse Lee	√	X	√	√	√	?	√	X	√	?
King Career Center	√	X	√	√	√	?	√	X	√	?
Maplewood**	√	X	√	√	√	?	√	X	√	?
McKinley Heights	√	X	√	√	√	?	√	X	√	?
McLaughlin	√	X	√	√	√	?	√	X	√	?
My High**	√	X	√	√	√	?	√	X	√	?
North Star**	√	X	√	√	√	?	√	X	√	?
Polaris K-12	√	X	√	√	√	?	√	X	√	?
Providence Girls**	√	X	√	√	√	?	√	X	√	?
Providence Heights	√	X	√	√	√	?	√	X	√	?
SAVE High	√	X	√	√	√	?	√	X	√	?

	Hazard									
							Transportation Accident			
Facility Name	Air Pollution[1]	Dam Failure	Energy Emergency	Urban Fire	Hazardous Materials	Radiation Release	Aircraft	Marine	Motor Vehicle	Rail
Steller Secondary	√	X	√	√	√	?	√	X	√	?
Whaley	√	X	√	√	√	?	√	X	√	?
Law Enforcement										
Alaska State Court Building	√	X	√	√	√	?	√	X	√	?
Alaska State Troopers Headquarters	√	X	√	√	√	?	√	X	√	X
Anchorage Correctional Complex	√	X	√	√	√	?	√	X	√	?
Anchorage Police Department Headquarters	√	X	√	√	√	?	√	X	√	?
APD Training/Misc	√	X	√	√	√	?	√	X	√	?
APD - Eagle River Substation	√	X	√	X	√	?	√	X	√	?
FBI Building	√	X	√	√	√	?	√	X	√	X
Prosecutor's Office	√	X	√	√	√	?	√	X	√	?
Shelters										
Chief William Tyson	√	X	√	√	√	?	√	X	√	X
Spenard Recreation Center	√	X	√	√	√	?	√	X	√	X
Fairview Recreation Center	√	X	√	√	√	?	√	X	√	X
Boys & Girl's Club, Mt. View	√	X	√	√	√	?	√	X	√	X
Egan Center	√	X	√	√	√	?	√	X	√	?
Sullivan Area	√	X	√	√	√	?	√	X	√	X
AT&T Pavilion (formerly Cellular One)	√	?	√	√	√	?	√	X	√	?
Subway Sports Center	√	?	√	√	√	?	√	X	√	?
Anchorage Senior Center	√	?	√	√	√	?	√	?	√	

	Hazard									
							Transportation Accident			
Facility Name	Air Pollution[1]	Dam Failure	Energy Emergency	Urban Fire	Hazardous Materials	Radiation Release	Aircraft	Marine	Motor Vehicle	Rail
Chugiak Senior Center	√	?	√	?	√	?	√	?	√	?
Anchorage Square and Round Dance Center	√	?	√	√	√	?	√	?	√	?
Dena'ina Center	√	?	√	√	√	?	√	?	√	?
Kincaid Park	√	?	√	√	√	?	√	?	√	?
Change Point Church	√	?	√	√	√	?	√	?	√	?
UAA Sports Complex	√	?	√	√	√	?	√	?	√	?
UAA	√	?	√	√	√	?	√	?	√	?
UAA Student Union	√	?	√	√	√	?	√	?	√	?
Ben Boeke Ice Arena	√	?	√	√	√	?	√	?	√	?
Dempsey Anderson Ice Arena	√	?	√	√	√	?	√	?	√	?
Anchorage City Church	√	?	√	√	√	?	√	?	√	?
Jewel Lake Church	√	?	√	√	√	?	√	?	√	?
American Legion	√	?	√	?	√	?	√	?	√	?
Anchorage Bible Fellowship	√	?	√	?	√	?	√	?	√	?
Holy Cross Parish	√	?	√	?	√	?	√	?	√	?
St. Johns Methodist Church	√	?	√	?	√	?	√	?	√	?
Abbott Loop Church	√	?	√	?	√	?	√	?	√	?
St. Andrews Parish	√	?	√	?	√	?	√	?	√	?
Riverside Community Church	√	?	√	?	√	?	√	?	√	?
Community Covenant Church	√	?	√	?	√	?	√	?	√	?
Other Municipal Facilities										
Eklutna Water Treatment Facility	√	?	√	X	?	?	√	X	√	?

	Hazard									
							Transportation Accident			
Facility Name	Air Pollution[1]	Dam Failure	Energy Emergency	Urban Fire	Hazardous Materials	Radiation Release	Aircraft	Marine	Motor Vehicle	Rail
Eagle River Waste Treatment Facility	√	?	√	X	?	?	√	X	√	?
ML&P Plant #2	√	X	√	√	?	?	√	?	√	X
AWWU Ship Creek Treatment Facility	√	?	√	√	?	?	√	?	√	?
ML&P Plant #1	√	?	√	√	?	?	√	?	√	?
City Hall	√	X	√	√	?	?	√	X	√	X
Department of Health & Human Services	√	?	√	√	√	X	√	X	X	X
Point Woronzof Sewage Facility	√	X	√	√	?	?	√	?	√	X
AWWU Headquarters	√	X	√	√	?	?	√	X	√	X
Emergency Operations Center	√	X	√	√	√	√	√	X	√	X
Municipal Parks & Recreation	√	X	√	√	?	?	√	X	√	X
Michael Building	√	X	√	√	?	?	√	X	√	X
Planning and Development Center	√	X	X	√	X	√	√	?	√	?
Northwood Warm Storage Building	√	?	√	√	?	?	√	?	√	?
Northwood/Dispatch/Maintenance/Office Building	√	?	√	√	?	?	√	?	√	?

* Also acts as Shelter

**Not housed in MOA or ASD buildings

Legend

√	Yes
?	Unknown
X	No

Appendix E
Flooding

Date Received:_____ Received By:_____

Project/Permit Number:_____

Fee:_____

(To be Completed by MOA)

Municipality of Anchorage
Project Management & Engineering Department
Mail: P.O. Box 196650, Anchorage, AK 99519-6650
4700 Elmore Road, Anchorage, AK 99507
Phone (907) 343-8135 Fax (907) 343-8088
www.muni.org

FLOOD HAZARD PERMIT APPLICATION

(Please fill out application completely; Indicate NA if necessary. Property information can be found at http://neighborhood.muni.org/ or http://redirect.muni.org/propappraisal/public.html)

PART I – APPLICANT INFORMATION

APPLICANT**:** _____

MAILING ADDRESS: _____

CITY:_____ STATE:_____ ZIP: _____

PHONE:_____ FAX: _____ EMAIL:_____

OWNER (If Different): _____

MAILING ADDRESS: _____

CITY:_____ STATE:_____ ZIP: _____

PHONE:_____ FAX: _____ EMAIL:_____

PART II - LOCATION OF PROPOSED PROJECT

TAX PARCEL ID(s): _____

SUBDIVISION: _____

LOT(s): _____ BLOCK: _____

ADDRESS/OTHER LOCATION INFORMATION: _____

_____

PART III – PROJECT DESCRIPTION:

PROPOSED WORK – CHECK ALL THAT APPLY

- ☐ STRUCTURE
  - ☐ RESIDENTIAL
  - ☐ COMMERCIAL
  - ☐ NEW CONSTRUCTION
  - ☐ ALTERATION
  - ☐ ADDITION
- ☐ MOBILE HOME
  - ☐ PRIVATE LOT
  - ☐ MOBILE HOME PARK
- ☐ GRADE/EXCAVATION/FILL
- ☐ ROAD CONSTRUCTION
- ☐ NEW SUBDIVISION
- ☐ WATERCOURSE ALTERATION
- ☐ BRIDGE/CULVERT (Please Circle)
- ☐ UTILITY
  - ☐ MAINLINE
  - ☐ SERVICE CONNECT
- ☐ OTHER _____

EXISTING STRUCTURES

1) FAIR MARKET VALUE OF STRUCTURE(s) BEFORE IMPROVEMENT: _____

2) COST OF IMPROVEMENTS: _____

ADDITIONAL IMPERVIOUS AREA TO BE ADDED TO THE FLOODPLAIN (ROOF, PAVEMENT, ETC) _____SQ. FT.

DETAILED PROJECT NARRATIVE (*Attach additional documentation if necessary*)

_____

_____

_____

_____

_____

_____

_____

_____

_____

PART IV – SUBMITTAL REQUIREMENTS

Check box to indicate information has been provided. ***All applications require the submittal of a site plan****.*

☐ SITE PLAN SHOWING THE NATURE, LOCATION, DIMENSIONS, AND ELEVATION (NGS 1972) OF THE PROPERTY LOCATED WITHIN THE FLOODPLAIN, EXISTING OR PROPOSED STRUCTURES, LOCATION OF PROPOSED FILL, LOCATION OF STORAGE OF MATERIALS INCLUDING FUEL, AND LOCATION OF DRAINAGE FACILITIES. (*Refer to Appendix A for clarification)*

☐ PROPOSED ELEVATION (NGS 1972) OF THE LOWEST FLOOR, INCLUDING BASEMENTS/CRAWLSPACES OF ALL STRUCTURES.

☐ PROPOSED ELEVATION (NGS 1972) OF ALL MACHINERY SERVING THE STRUCTURE INCLUDING FURNACES, HOTWATER HEATERS, AIR CONDITIONING, DUCTWORK, AND UTILITY METERS

☐ FOR NON-RESIDENTIAL CONSTRUCTION ONLY: ELEVATION AND CERTIFICATION BY A REGISTERED ENGINEER OR ARCHITECT THAT FLOOD-PROOFING METHODS FOR ANY NON-RESIDENTIAL STRUCTURES MEET THE FLOOD-PROOFING CRITERIA OF THE MUNICIPAL FLOOD ORDINANCE.

☐ BASE FLOOD ELEVATIONS FOR NEW SUBDIVISONS OR DEVELOPMENT

☐ WRITTEN DESCRIPTION, IF APPLICABLE, DESCRIBING THE EXTENT WHICH A WATERCOURSE WILL BE ALTERED OR RELOCATED AS A RESULT OF THE PROPOSED DEVELOPMENT

☐ NO-RISE CERTIFICATION PREPARED BY A REGISTERED PROFESSIONAL ENGINEER FOR ALL PROJECTS LOCATED IN THE FLOODWAY, AND FOR ALL HYDRAULIC STRUCTURES, DRAINAGE FACILITIES, AND FILL IN FLOOD AREAS WITH BASE FLOOD ELEVATIONS WHERE NO FLOODWAYS HAVE BEEN IDENTIFIED. (Refer to Appendix C)

ASSOCIATED PERMITS

MUNICIPAL PERMITS	PERMIT/CASE NUMBER
☐ RESIDENTIAL/COMMERCIAL BUILDING OR LAND USE PERMIT	_____
☐ FILL AND GRADE	_____
☐ STORM WATER POLLUTION PREVENTION PLAN (SWPPP)	_____NA_____
☐ PLANNING PLAT OR SITE PLAN REVIEW	_____

STATE AND FEDERAL PERMITS (Attach Documentation)	STATUS
☐ ARMY CORPS OF ENGINEERS 404 WETLAND PERMIT	_____
☐ FISH HABITAT PERMIT	_____
☐ COASTAL PROJECT REVIEW	_____
☐ OTHER _____	_____

ADDITIONAL REQUIREMENTS

IF A PERMIT CAN BE ISSUED FOR A PROPOSED STRUCTURE, IT WILL BE THE RESPONSIBILITY OF THE APPLICANT TO PROVIDE A FINAL AS-BUILT DRAWING AND ELEVATION CERTIFICATE PREPARED BY A REGISTERED PROFESSIONAL LAND SURVEYOR. A FINAL CERTIFICATE OF OCCUPANCY WILL NOT BE ISSUED UNTIL THESE DOCUMENTS HAVE BEEN SUBMITTED.

In signing this application, the landowner(s) or agent hereby grants the Municipality of Anchorage the right to enter the above described location to inspect the work proposed, in progress, or work completed.

I hereby affirm and certify that I am one of the owners or am under contract with the owners, and I believe that the above information and/or statements are true in all respects to the best of my knowledge.

_____ _____

SIGNATURE (*Check One)* ☐ *Owner* ☐ *Applicant* *Date Signed*

FLOOD HAZARD PERMIT FEES

NOTICE: All fees are payable at time of application.

If issuance of a permit for one of these types of developments is, after review, refused by the Municipality of Anchorage, one half of the permit fee deposited will be returned to the applicant.

PROJECT TYPE		FEE
Structure		
	Addition	$ 50.00
	Alteration	50.00
	New residential	200.00
	New commercial	200.00
Watercourse Alteration or Obstruction		600.00
Utility mainline		200.00
Utility service connect		50.00
New subdivision (Plus $200.00 per lot within the floodplain)		600.00
Mobile Home		
	Private Lot	100.00
	Mobile home park (Plus $50.00 per mobile home space within the floodplain)	200.00
Street/Road Construction		400.00
Bank/Slope Restoration (No in-channel work)		50.00
Other		50.00

FOR MOA USE ONLY

FEE CALCULATION	FEE
Structure	_____
Watercourse Alteration	_____
Utility	_____
Subdivision	_____
Mobile Home	_____
Street/Road Construction	_____
Bank/Slope Restoration	_____
Other:_____	_____
TOTAL	_____

APPENDIX A – SITE PLAN REQUIREMENTS

A SITE PLAN IS AN ACCURATE AND DETAILED MAP OF YOUR PROPERTY:

It shows the size, shape, and special features of your property; and the size and location of any buildings or other improvements to the property. Site plans show what currently exists on your property, and any changes or improvements you are proposing to make.

A SITE PLAN MUST CONTAIN THE FOLLOWING INFORMATION:

1. Legal description of parcel, north arrow, and scale
2. All property lines, easements and their dimensions
3. Names of adjacent roads, location of driveways
4. Location of streams, or lakes with setbacks indicated
5. Location, size, and shape of all buildings, existing and proposed, with elevation of lowest floor indicated
6. Location and dimensions of existing or proposed sewage systems
7. Location of all propane tanks, fuel tanks, and generators
8. Dimensions and depth of any fill on site
9. A survey showing the existing ground elevations at 4 corners of the building
10. Proposed ground elevations at 4 corners of the building, it applicable
11. Location of any proposed temporary construction fencing, buildings, fuel storage, and erosion control structures

ELEVATION NOTE: The Municipality of Anchorage requires all VERTICAL datum to be based on 1972 NGS datum. Assumed datum will not be accepted unless the property is located in areas where 1972 NGS datum has not been established.

For structures proposed in the flood plain, the lowest floor elevation must be one foot above the base flood elevation. **Crawlspace grade is also considered "floor elevation" for the purpose of this requirement.**

For those areas where 1972 NGS datum does not exist, a plot plan with contours, lot corner elevations using assumed datum, high-water mark and existing water levels of creeks, lakes, or streams, and proposed lowest living floor elevations, is required.

APPENDIX B- FLOODPLAIN CONSTRUCTION STANDARDS

USE OF FLOOD RESISTANT MATERIALS

The Federal Emergency Management Agency (FEMA) guidelines for flood resistant materials are contained in Technical Bulletin 2-93. This publication is available for review or reproduction upon request. This publication is also available on the Web.

Portions of buildings below the base flood elevation (BFE) are often constructed entirely out of concrete, which is considered a flood resistant material. It is also a common building practice to frame up from a concrete stem wall with wood construction to create a garage/storage space below the elevated first floor. Since garage spaces typically utilize sheetrock to achieve the necessary fire separation, construction of this type results in the use of materials subject to flood damage.

In order to comply with FEMA's guidelines for flood resistant materials as listed in Technical Bulletin 2-93, the use of untreated wood and sheetrock to cover wall members below the BFE is prohibited. The preferred design alternative (other than concrete walls) will be the use of pressure treated heavy timber construction (6"x10" horizontal, 8"x8" vertical) and pressure treated frame members. The ceiling can be protected with sheetrock if the first floor above the protected ceiling is one foot above the BFE and the sheetrock is less than one foot below that elevation. Cement board may be used as a substitute for sheetrock. Siding below the BFE shall utilize the acceptable materials listed in Technical Bulletin 2-93.

The area of a building below the BFE may only used for building access, parking and storage. No living space is permitted below the BFE.

REQUIRED ELEVATION

All construction below the BFE is susceptible to flooding and must consist of flood-resistant materials. The BFE will be established by this department and conveyed to the applicant for incorporation into the building plans. In order to adequately determine if flood-resistant materials are required, applicants proposing construction in flood prone areas shall provide a survey of existing ground elevations of the four corners of the proposed development and the proposed ground elevations of the proposed development.

The BFE shall be shown on the elevation drawings for the proposed structure. The BFE will be established by this department and conveyed to the applicant for incorporation into the building plans.

BASEMENTS

The Municipal Flood Ordinance requires that the lowest floor, including basement, be elevated one foot above the BFE. The National Flood Insurance Program defines a basement as "any area of the building having its floor subgrade (below ground level) on all sides."

Applicants proposing construction in flood prone areas will need to be aware of final interior and exterior grade levels of the proposed structure. Subgrade basements and crawlspaces can incur significant flood insurance penalties.

OPENINGS TO EQUALIZE HYDROSTATIC FLOOD FORCES

The Municipal Flood Ordinance requires that all fully enclosed areas below the lowest floor that are usable solely for parking, building access, or storage in an area other than a basement or crawl space shall have a minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area according to FEMA specifications. The bottom of all openings shall be no higher than one foot above grade. Openings may be equipped with screens, louvers or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.

The vents should be placed on opposing walls to allow the entry and exit of floodwaters. Detailed information about FEMA's flood venting requirement may be found in Technical Bulletin 1. This publication is available for review or reproduction upon request. This publication is also available on the Web.

ELECTRICAL GEAR AND EQUIPMENT

All electrical, heating, ventilation, plumbing and air conditioning equipment that is permanently affixed to a structure and which may be subject to floodwater damage shall be elevated a minimum of one foot above the BFE or higher unless otherwise constructed to prohibit the entry of flood waters. FEMA has published a document titled *Protecting Building Utilities from Flood Damage* that gives specific guidance on proper construction technique. This publication is available for review or reproduction upon request. This publication is also available on the Web.

FILL/ENCROACHMENT GUIDELINES

Proposed developments cumulatively may not increase base flood heights more that one-foot anywhere in the identified floodplain. (Applies only to floodplains with BFEs but without identified floodways.)

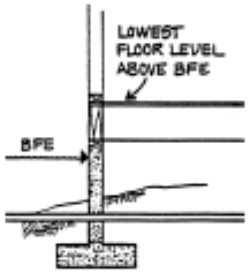
All watercourse alterations or modifications must not reduce the carrying capacity of the stream or increase BFEs. Watercourse alterations or modifications must not reduce the carrying capacity of the stream or increase BFEs. The applicant must submit an analysis that compares existing channel capacity with proposed capacity. Alteration or modification must maintain carrying capacity of the watercourse. Floodway regulations apply for alterations within a designated floodway (Appendix C).

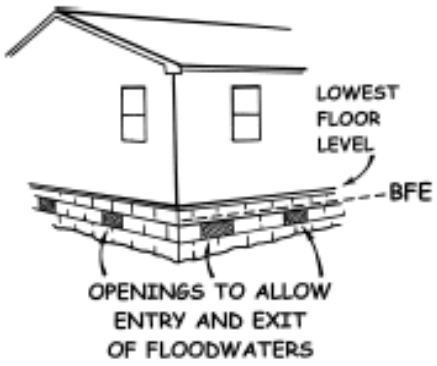
If fill is to be placed within the floodplain areas the applicant must include with the application the volume, height, and sideslope of the fill perimeter within the floodplain. The applicant must also indicate the method used to protect the fill from erosion. The placement must not interfere with any existing utilities or easements. Fill must not unreasonably obstruct or divert the flow of surface water to the detriment of adjacent or hydraulically affected property owners.

SPECIFIC FLOODPLAIN CONSTRUCTION STANDARDS

Residential Structures:

Residential structures must have the lowest floor including basement elevated at least to or above the BFE. This elevation requirement can be accomplished by any of the following three (3) methods:





1. Foundation Stem Walls:
The crawlspace must not be below grade. It must have as a minimum two permanent openings no more than one foot above grade. The total area of the openings must be no less than 1 square inch for every square foot of enclosed space. This helps to relieve hydrostatic pressure on the foundation during a flood. Any covers placed over the openings must be able to open automatically during flood flows without human intervention. Screens are acceptable if they permit entry and exit of floodwater.

2. Fill:
A poured slab placed over compacted fill can also be used to elevate the lowest floor of a structure to one foot above the BFE. Please note that when a building site is filled, it is still in the floodplain and no basements are permitted.

3. Piers, Piles and Posts:
This method is commonly used to avoid large fills and when flood heights are extreme. The supporting members must be designed to resist hydrostatic and hydrodynamic forces. Fully enclosed areas below the BFE can only be used for parking, access and limited storage. In addition, the following conditions must be met for any enclosed area below the BFE:

a) Service equipment (e.g., furnaces, water heaters, washers/dryers, etc.) are NOT

permitted below the BFE.

b) All walls, floors, and ceiling materials located below the BFE must be unfinished and constructed of materials resistant to flood damage.

c) The walls of any enclosed area below the BFE must be designed by a registered professional engineer or architect in a manner to prevent lateral movement, collapse or flotation of the structure. There must be at least two openings on each wall and the bottom of all openings must be no higher than one foot above grade.

Non-residential Structures

Must have the lowest floor including basement elevated to or above the BFE, or floodproofed at least one foot above BFE. If floodproofed, structures must be dry-floodproofed, which means keeping the water out. Non-residential (commercial) structures, together with attendant utility and sanitary facilities, are designed so that the structure is watertight below the base flood level. The walls are impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy. Additionally, the structure must be designed to:

- prevent seepage, collapse or cracking of basement walls
- prevent buckling of basement floors
- prevent back-up of water from sewer lines
- have all openings located one foot above BFE
- all protective features must operate automatically without human intervention

Note: Dry floodproofing measures must be certified by a licensed engineer and only apply to non-residential structures.

APPENDIX C – "NO-RISE" ANAYLSIS PROCEDURES

Section 60.3(d)(3) of the National Flood Insurance Program (NFIP) requires that the Municipality to prohibit encroachments, including fill, new construction, substantial improvements, and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the city during the occurrence of the base (100-year) flood discharge.

In most cases, the "No-Rise Certificate" must be supported by technical data based upon the standard step-backwater computer model utilized to develop the 100-year floodway shown on the Anchorage's effective Flood Insurance Rate Map (FIRM) or Flood Boundary and Floodway Map (FBFM) and the results tabulated on the Flood Insurance Study (FIS) for Anchorage.

The analysis procedure is outlined in the attached document from the Federal Emergency Management Agency. While the attached guidelines specifically address floodway development the same procedure can be used to determine the impact of projects in flood zones without BFEs has that have the potential to increase flood elevations.

U.S. Department of Homeland Security
Region X
130 228th Street, SW
Bothell, WA 98021-9796

FEMA

Procedures for "No-Rise" Certification
For Proposed Developments in the Regulatory Floodway

Section 60.3 (d) (3) of the National Flood Insurance Program (NFIP) regulations states that a community shall "prohibit encroachments, including fill, new construction, substantial improvements and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base (100-year) flood discharge."

Prior to issuing any building, grading or development permits involving activities in a regulatory floodway the community must obtain a certification stating the proposed development will not impact the pre-project base flood elevations, floodway elevations, or floodway data widths. The certification should be obtained from the applicant and be signed and sealed by a professional engineer.

The engineering or "no-rise" certification must be supported by technical data.

The supporting technical data should be based upon hydraulic analyses that utilize the same model used to prepare the effective Flood Insurance Study (FIS) report and Flood Insurance Rate Map (FIRM) unless it is demonstrated that the 'effective' hydraulic model is unavailable or its use is inappropriate. If an alternative hydraulic model is used, the new model must be calibrated to reproduce the FIS profiles within 0.5 feet. Hydraulic model used in the analysis must be on FEMA's accepted models list, or documentation must be provided showing the model meets the requirements of NFIP regulation 65.6(a)(6).

Although communities are required to review and approve the "no-rise" submittals, they may request, in writing, technical assistance and review from the FEMA regional office. However, if this alternative is chosen, the community must review the technical submittal package and verify that all supporting data, listed in the following paragraphs, are included in the package before forwarding to FEMA.

To support a "no-rise" certification for proposed developments encroaching into the regulatory floodway, a community will require that the following procedures be followed:

1. Current Effective Model: Submit a written request for the effective model for the specified stream and community, identifying the limits of the requested data. A fee will be assessed for providing the data. Send data requests to:

   Michael Baker Jr., Inc.
   3601 Eisenhower Avenue
   Alexandria, Virginia 22304
   (703) 960-8800

2. Duplicate Effective Model: Upon receipt of the effective computer model, the engineer should run the original model to duplicate the output in the effective (FIS).

3. Corrected Effective Model: The model that corrects any errors that occur in the Duplicate Effective model, adds any additional cross sections, or incorporates more detailed topographic information than that used in the current effective model. Floodway limits should be manually set at the new cross-section locations by measuring from the effective FIRM or FBFM. The cumulative reach lengths of the stream should also remain unchanged. The Corrected Effective model must not reflect any man-made physical changes since the date of the effective model.

4. Existing, or Pre-Project Conditions Model: Revise the Duplicate Effective or the Corrected Effective model to reflect any modifications that have occurred within the floodplain since the date of the Effective model but prior to the construction of the project. If no modifications have occurred since the date of the effective model, then the model would be identical to the Duplicate Effective or Corrected Effective model. The results of this Existing Conditions analysis will indicate the 100-yr elevations at the project site.

5. Proposed, or Post-Project Conditions Model: Modify the Existing Condition or Pre-Project Conditions Model (or Duplicate Effective model or Corrected Effective model, as appropriate) to reflect revised or post-project conditions. The overbank roughness coefficients should remain the same unless a reasonable explanation of how the proposed development will impact Manning's "n" values is included with the supporting data. The results of this analysis will indicate the 100-year elevation for proposed conditions at the project site. These results must indicate NO impact on the 100-year floodway elevations when compared to the Existing Conditions or Pre-Project Conditions model. If an increase results the project will require the submittal of a CLOMR prior to the start of the project.

The "no-rise" supporting data and a copy of the engineering certification must be submitted to and reviewed by the appropriate community official prior to issuing a permit.

The "no-rise" supporting data should include, but may not be limited to:

1) Copy of the Duplicate Effective model;

2) Copy of the Corrected Effective model;

3) Existing conditions, or Pre-Project conditions model

4) Proposed conditions or Post-Project conditions model.

5) FIRM and topographic map, showing floodplain and floodway, the additional cross-sections, the site location with the proposed topographic modification superimposed onto the maps, and a copy of the effective FIRM or FBFM showing the current regulatory floodway.

6) Documentation clearly stating analysis procedures. All modifications made to the original FIS model to represent revised existing conditions, as well as those made to the revised existing conditions model to represent proposed conditions, should be well documented and submitted with all supporting data.

7) Copy of effective Floodway Data Table copied from the (FIS) report.

8) Statement defining source of additional cross-section topographic data and supporting information.

9) Cross-section plots, of the added cross sections, for revised existing and proposed conditions.

10) Certified planimetric (boundary survey) information indicating the location of structures on the property.

11) Copy of the source from which input for original FIS model was taken.

12) CD with all input and output files.

13) Printout of output files from EDIT runs for all three floodway models.

The engineering "no-rise" certification and-supporting technical data must stipulate NO impact on the 100-year flood or floodway elevations at the new cross-sections and at all existing cross-sections anywhere in the model. Therefore, the revised computer model should be run for a sufficient distance (usually one mile, depending on hydraulic slope of

the stream) upstream and downstream of the development site to insure proper "no-rise" certification.

Attached is a sample "no-rise" certification form that can be completed by a registered professional engineer and supplied to the community along with the supporting technical data when applying for a development permit.

ENGINEERING "NO-RISE" CERTIFICATION

This is to certify that I am a duly qualified engineer licensed to practice in the State of _____.

It is to further certify that the attached technical data supports the fact that proposed _____ will
(Name of Development)
not impact the 100-year flood elevations, floodway elevations and floodway widths on _____ at published sections
(Name of Stream)
in the Flood Insurance Study for _____,
(Name of Community)
dated _____ and will not impact the 100-year flood elevations, floodway elevations, and floodway widths at unpublished cross-sections in the vicinity of the proposed development.

Attached are the following documents that support my findings:

_____
_____
_____

_____ _____
(Date) (Signature)

_____
(Title)

seal: _____
(Address)

COMMUNITY
RATING
SYSTEM

VERIFICATION REPORT

Municipality of Anchorage, AK **Verified Class 6**

NFIP Number: 020005 Cycle

Date of Verification Visit: August 7, 2008

This Verification Report is provided to explain the recommendations of Insurance Services Office, Inc. (ISO) to DHS/FEMA concerning credits under the Community Rating System (CRS) for the above named community.

A total of 2041 credit points are verified which results in a recommendation that the community be improve from a Class 7 to a CRS Class 6. The community has met the Class 6 prerequisite with a Building Code Effectiveness Grading Schedule (BCEGS) Classification of 2/2. The following is a summary of our findings with the total CRS credit points for each activity listed in parenthesis:

Activity 310 – Elevation Certificates: The Planning Department maintains elevation certificates for new and substantially improved buildings. Copies of elevation certificates are made available upon request. Elevation Certificates are also kept for post-FIRM buildings, maintained in computer format, and are listed on the community's website. Elevation Certificates, plans, regulations and other records are maintained in a secure location away from the permit office. (115 points)

Activity 320 – Map Information Service: Credit is provided for furnishing inquirers with flood zone information from the community's latest Flood Insurance Rate Map (FIRM), publicizing the service annually and maintaining records. (140 points)

Activity 330 – Outreach Projects: An outreach brochure is mailed annually to all properties in the community's Special Flood Hazard Area (SFHA). The community also provides flood information through displays at public buildings. (112 points)

Activity 340 – Hazard Disclosure: Credit is provided for state and community regulations requiring disclosure of flood hazards. (10 points)

Activity 350 – Flood Protection Information: Documents relating to floodplain management are available in the reference section of the Anchorage Public Library. Credit is also provided for floodplain information displayed on the community's website. (46 points)

Activity 360 – Flood Protection Assistance: The community provides technical advice and assistance to interested property owners and annually publicizes the service. (59 points)

Activity 420 – Open Space Preservation: Credit is provided for preserving approximately 3268 acres in the SFHA as open space. Credit is also provided for open space land that is deed restricted and preserved in a natural state. (628 points)

Activity 430 – Higher Regulatory Standards: Credit is provided for enforcing regulations that require freeboard for new and substantial improvement construction, foundation protection, cumulative substantial improvement, protection of critical facilities, natural and beneficial functions, and state mandated regulatory standards. Credit is also provided for a Building Code Effectiveness Grading Schedule (BCEGS) Classification of 2/2 and for staff education and certification as a floodplain manager. (320 points)

Activity 440 – Flood Data Maintenance: Credit is provided for maintaining and using digitized maps in the day to day management of the floodplain. Credit is also provided for maintaining copies of all previous FIRMs and Flood Insurance Study Reports. (137 points)

Activity 450 – Stormwater Management: The community enforces regulations for freeboard in non-SFHA zones, soil and erosion control, and water quality. (87 points)

Activity 540 – Drainage System Maintenance: A portion of the community's drainage system is inspected regularly throughout the year and maintenance is performed as needed by Anchorage Public Works Department. Records are being maintained for both inspections and required maintenance. Credit is also provided for an ongoing Capital Improvements Program. The community also enforces a regulation prohibiting dumping in the drainage system. (285 points)

Activity 610 – Flood Warning Program: Credit is provided for a program that provides timely identification of impending flood threats, disseminates warnings to appropriate floodplain residents, and coordinates flood response activities. (44 points)

Activity 630 – Dam Safety: All Alaska communities currently receive CRS credit for the state's dam safety program. Credit is also provided for a dam failure emergency response plan. (58 points)

Attached is the Community Calculations Worksheet that lists the verified credit points for the Community Rating System.

CEO Name / Address:

Michael K. Abbott
Municipal Manager
Post Office Box 196650
Anchorage, Alaska 99519-6650

CRS Coordinator Name / Address:

Jeffrey D. Urbanus
Flood Hazard Administrator
Post Office Box 196650
Anchorage, Alaska 99519-6650
(907) 343-8023

Date Report Prepared: April 7, 2009

Community : Municipality of Anchorage**,** AK **NFIP Number :** 020005

720 COMMUNITY CREDIT CALCULATIONS (Cycle):

CALCULATION SECTION :

Verified Activity Calculations:						Credit
c310	115					115
c320	140					140
c330	112					112
c340	10					10
c350	46					46
c360	59					59
c410		x CGA		=		
c420	576	x CGA	1.09	=		628
c430	294	x CGA	1.09	=		320
c440	126	x CGA	1.09	=		137
c450	80	x CGA	1.09	=		87
c510						
c520						
c530						
c540	285					285
c610	44					44
c620						
c630	58					58

722 Community Classification Calculation:

cT = total of above cT = 2041

Community Classification (from Appendix C): Class = 6

CEO Name/Address:

Michael K. Abbott
Municipal Manager
Post Office Box 196650
Anchorage, Alaska 99519-6650

CRS Coordinator Name/Address:

Jeffrey D. Urbanus
Flood Hazard Administrator
Post Office Box 196650
Anchorage, Alaska 99519-6650
(907) 343-8023

Date Report Prepared: April 7, 2009

Insurance Overview

As of 10/31/2009

Community:	ANCHORAGE, MUNICIPALITY OF	**State:**	ALASKA
County:	ANCHORAGE BOROUGH	**CID:**	020005

Overview
Occupancy
Zone
Pre/Post FIRM

Total by Community

Total Number of Policies:	350
Total Premiums:	$223,542
Insurance in Force:	$87,646,600
Total Number of Closed Paid Losses:	13
$ of Closed Paid Losses:	$147,425

Group Flood Insurance

Total Number of Policies:	0
Total Premiums:	$0
Insurance in Force:	$0
Total Number of Closed Paid Losses:	0
$ of Closed Paid Losses:	$0

Post Firm Minus Rated Policies

Total Number of Minus Rated Policies:	14
A Zone Minus Rated Policies:	14
V Zone Minus Rated Policies:	0

Manufactured Homes

Total Number of Policies:	0
Total Number of Closed Paid Losses:	0
$ of Closed Paid Losses:	$0

ICC

Total Number of ICC Closed Paid Losses:	0
$ of ICC CLosed Paid Losses:	$0

1316

Number of Properties by Community:	0

Substantial Damage Losses

Number of Substantial Damage Closed Paid Losses: 1

Insurance Occupancy

As of 10/31/2009

Community:	ANCHORAGE, MUNICIPALITY OF	**State:**	ALASKA
County:	ANCHORAGE BOROUGH	**CID:**	020005

Overview
Occupancy
Zone

Pre/Post FIRM

	Policies in Force	Premium	Insurance in Force	Number of Closed Paid Losses	$ of Closed Paid Losses	Adjustment Expense
Single Family	244	$138,638	$62,500,000	12	$145,779.81	$6,088.00
2-4 Family	42	$16,610	$8,578,600	0	$0.00	$0.00
All Other Residential	37	$5,892	$4,068,300	1	$1,645.56	$275.00
Non Residential	27	$62,402	$12,499,700	0	$0.00	$0.00
Total	350	$223,542	$87,646,600	13	$147,424.00	$6,363.00

	Policies in Force	Premium	Insurance in Force	Number of Closed Paid Losses	$ of Closed Paid Losses	Adjustment Expense
Condo	64	$13,034	$8,505,300	1	$6,087.53	$350.00
Non Condo	286	$210,508	$79,141,300	12	$141,337.84	$6,013.00
Total	350	$223,542	$87,646,600	13	$147,424.00	$6,363.00

Insurance Zone

As of 10/31/2009

Community: ANCHORAGE, MUNICIPALITY OF
State: ALASKA
County: ANCHORAGE BOROUGH
CID: 020005

Overview

Occupancy

Zone

Pre/Post FIRM

	Policies in Force	Premium	Insurance in Force	Number of Closed Paid Losses	$ of Closed Paid Losses	Adjustment Expense
A01-30 & AE Zones	133	$64,037	$26,769,200	4	$25,130.64	$1,325.00
A Zones	63	$86,662	$15,317,300	2	$34,681.36	$955.00
AO Zones	11	$6,266	$1,934,600	0	$0.00	$0.00
AH Zones	0	$0	$0	0	$0.00	$0.00
AR Zones	0	$0	$0	0	$0.00	$0.00
A99 Zones	0	$0	$0	0	$0.00	$0.00
V01-30 & VE Zones	0	$0	$0	0	$0.00	$0.00
V Zones	0	$0	$0	0	$0.00	$0.00

D Zones	3	$7,123	$911,200	1	$65,100.00	$1,953.00
B, C & X Zone						
Standard	13	$11,910	$3,190,300	1	$1,280.24	$225.00
Preferred	127	$47,544	$39,524,000	2	$3,048.88	$875.00
Total	350	$223,542	$87,646,600	10	$129,239.00	$5,333.00

Insurance Pre/Post FIRM

As of 10/31/2009

Community:	ANCHORAGE, MUNICIPALITY OF	**State:**	ALASKA
County:	ANCHORAGE BOROUGH	**CID:**	020005

Overview
Occupancy
Zone
Pre/Post FIRM

Pre-FIRM

	Policies in Force	Premium	Insurance in Force	Number of Closed Paid Losses	$ of Closed Paid Losses	Adjustment Expense
A01-30 & AE Zones	38	$34,380	$6,933,900	3	$20,498.64	$1,005.00
A Zones	9	$22,191	$2,892,100	2	$34,681.36	$955.00
AO Zones	3	$3,239	$490,000	0	$0.00	$0.00
AH Zones	0	$0	$0	0	$0.00	$0.00
AR Zones	0	$0	$0	0	$0.00	$0.00
A99 Zones	0	$0	$0	0	$0.00	$0.00
V01-30 & VE Zones	0	$0	$0	0	$0.00	$0.00
V Zones	0	$0	$0	0	$0.00	$0.00
D Zones	0	$0	$0	0	$0.00	$0.00
B, C & X Zone	49	$23,199	$14,780,700	3	$4,329.12	$1,100.00
Standard	7	$5,259	$1,250,700	1	$1,280.24	$225.00
Preferred	42	$17,940	$13,530,000	2	$3,048.88	$875.00
Grand Total	99	$83,009	$25,096,700	8	$59,508.00	$3,060.00

Post-FIRM

	Policies in Force	Premium	Insurance in Force	Number of Closed Paid Losses	$ of Closed Paid Losses	Adjustment Expense
A01-30 & AE Zones	95	$29,657	$19,835,300	1	$4,632.00	$320.00
A Zones	54	$64,471	$12,425,200	0	$0.00	$0.00

AO Zones	8	$3,027	$1,444,600	0	$0.00	$0.00
AH Zones	0	$0	$0	0	$0.00	$0.00
AR Zones	0	$0	$0	0	$0.00	$0.00
A99 Zones	0	$0	$0	0	$0.00	$0.00
V01-30 & VE Zones	0	$0	$0	0	$0.00	$0.00
V Zones	0	$0	$0	0	$0.00	$0.00
D Zones	3	$7,123	$911,200	1	$65,100.00	$1,953.00
B, C & X Zone	91	$36,255	$27,933,600	0	$0.00	$0.00
Standard	6	$6,651	$1,939,600	0	$0.00	$0.00
Preferred	85	$29,604	$25,994,000	0	$0.00	$0.00
Grand Total	251	$140,533	$62,549,900	2	$69,732.00	$2,273.00

COMMUNITY : ANCHORAGE, MUNICIPALITY OF

Community

State

Regional

National

	AE, A1-30, AO, AH, A	VE, V1-30, V	B, C, X	TOTAL
RL Buildings (Total)				
RL Buildings (Insured)				
RL Losses (Total)				
RL Losses (Insured)				
RL Payments (Total)				
Building				
Contents				
RL Payments (Insured)				
Building				
Contents				

Post - FIRM SFHA RL Buildings:

Insured Buildings with 4 or More Losses:
Insured Buildings with 2-3 Losses > Building Value:
Total Target RL Buildings: 0

Appendix F
Dam Inundation Areas

MATCH MAP 2

Note: Topographical contours are in meters
conversion: feet = meters x 3.2808

Cross Section 6 3.7 Miles D/S of Eklutna Dam	Eklutna Sunny Day	Eklutna PMF
Arrival Time (min)	10.2	7.7
Time to Peak (min)	50.0	40.0
Peak Elevation ft. (m)	609 (186)	618 (189)
Peak Flow (cfs)	38,800	95,900
Normal Elevation ft. (m)	591 (180)	591 (180)
W.S. Elevation Increase ft. (m)	18 (6)	27 (9)

Cross Section 4 1.9 Miles D/S of Eklutna Dam	Eklutna Sunny Day	Eklutna PMF
Arrival Time (min)	5.5	4.2
Time to Peak (min)	30.0	30.0
Peak Elevation ft. (m)	738 (225)	746 (227)
Peak Flow (cfs)	39,500	97,600
Normal Elevation ft.(m)	722 (220)	722 (220)
W.S. Elevation Increase ft. (m)	16 (5)	24 (7)

Cross Section 1 0.0 Miles D/S of Eklutna Dam	Eklutna Sunny Day	Eklutna PMF
Arrival Time (min)	0.0	0.0
Time to Peak (min)	0.0	0.0
Peak Elevation ft. (m)	866 (264)	877 (267)
Peak Flow (cfs)	41,100	102,200
Normal Elevation ft. (m)	828 (252)	828 (252)
W.S. Elevation Increase ft. (m)	38 (12)	49 (15)

Legend:

Inundation boundary for a Probable Maximum Flood (PMF) failure.

(1) Cross-Section locations where flood data provided.

Notes:

1. Because of the method, procedures and assumptions used to develop the flooded areas, limits of flooding shown and flood wave travel times are approximate and should be used only as a guideline for establishing evacuation zones. Actual areas inundated will depend on actual failure conditions and may differ from areas shown on the maps.
2. Flood inundation boundaries are interpreted from USGS 20 meter contour intervals and data is provided in meters and feet.
3. Due to the accuracy of the USGS base maps used the difference between the PMF and Sunny Day failure lines could not be shown and are therefore shown as the same line.

2000 0 2000 FEET

SCALE: 1" = 2000'

N

FIGURE 7-1

ANCHORAGE MUNICIPAL LIGHT & POWER

DAM FAILURE INUNDATION MAP FOR
EKLUTNA DAM

MAP NO. 1

Note: Topographical contours
are in meters
conversion: feet = meters x 3.2808

Legend:

Inundation boundary for a Probable Maximum Flood (PMF) failure.

(1) Cross-Section locations where flood data provided.

Notes:

1. Because of the method, procedures and assumptions used to develop the flooded areas, limits of flooding shown and flood wave travel times are approximate and should be used only as a guideline for establishing evacuation zones. Actual areas inundated will depend on actual failure conditions and may differ from areas shown on the maps.

2. Flood inundation boundaries are interpreted from USGS 20 meter contour intervals and data is provided in meters and feet.

3. Due to the accuracy of the USGS base maps used the difference between the PMF and Sunny Day failure lines could not be shown and are therefore shown as the same line.

Cross Section 11 7.4 Miles D/S of Eklutna Dam	Eklutna Sunny Day	Eklutna PMF
Arrival Time (min)	18.9	14.3
Time to Peak (min)	70	60
Peak Elevation ft.(m)	289 (88)	305 (93)
Peak Flow (cfs)	38,700	95,200
Normal Elevation ft (m)	262 (80)	262 (80)
W.S. Elevation Increase ft (m)	27 (8)	43 (13)

Cross Section 9 5.9 Miles D/S of Eklutna Dam	Eklutna Sunny Day	Eklutna PMF
Arrival Time (min)	15.3	11.5
Time to Peak (min)	70.0	50.0
Peak Elevation ft.(m)	409 (125)	417 (127)
Peak Flow (cfs)	38,700	95,500
Normal Elevation ft (m)	394 (120)	394 (120)
W.S. Elevation Increase ft (m)	15 (5)	23 (7)

Cross Section 14 9.4 Miles D/S of Eklutna Dam	Eklutna Sunny Day	Eklutna PMF
Arrival Time (min)	23.0	17.4
Time to Peak (min)	110.0	90.0
Peak Elevation ft.(m)	111 (34)	139 (42)
Peak Flow (cfs)	37,300	90,600
Normal Elevation ft (m)	84 (26)	84 (26)
W.S. Elevation Increase ft. (m)	27 (8)	55 (16)

2000 0 2000 FEET

SCALE: 1" = 2000'

N

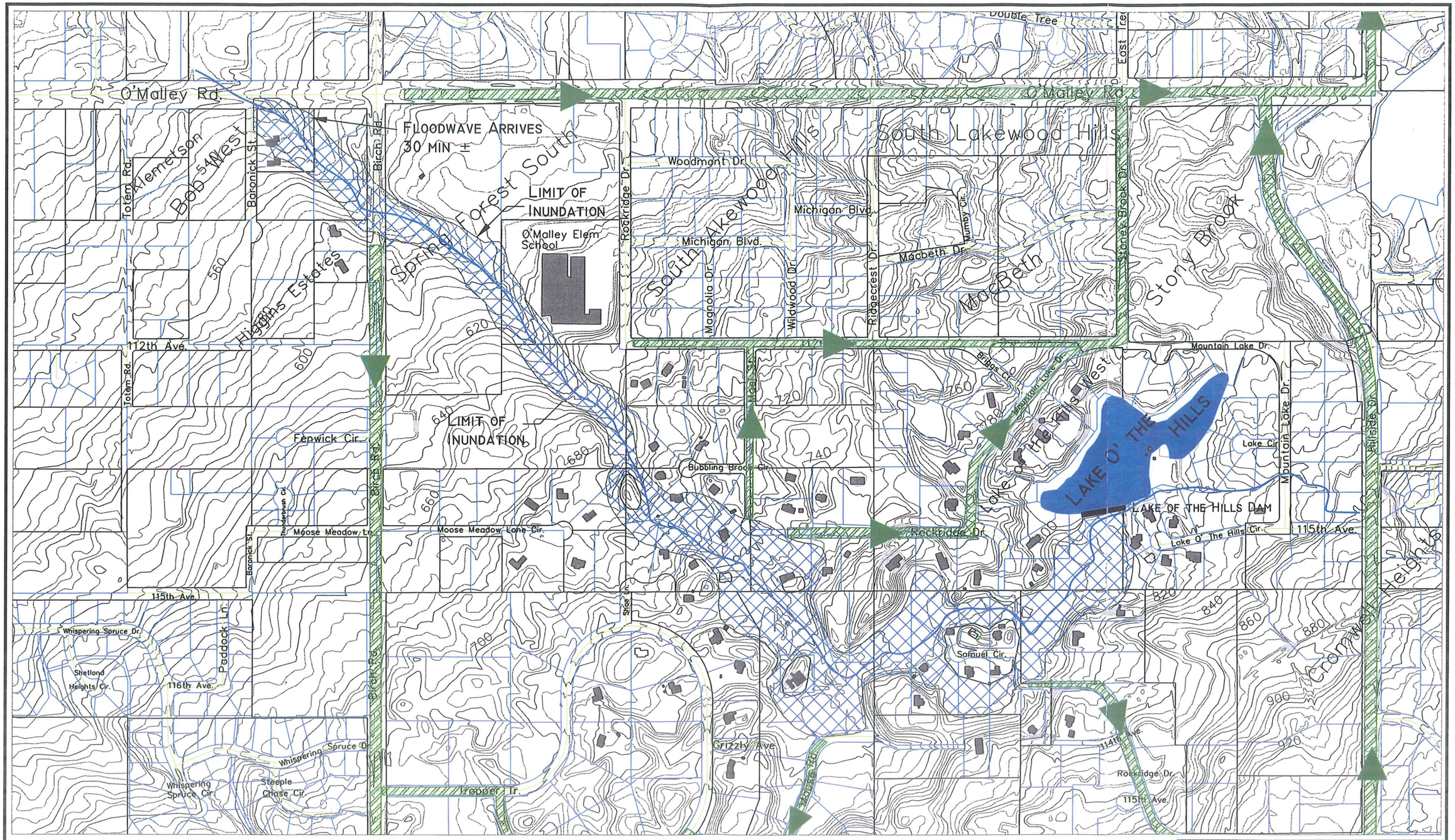
MATCH MAP 1

FIGURE 7-2

ANCHORAGE MUNICIPAL LIGHT & POWER

DAM FAILURE INUNDATION MAP FOR
EKLUTNA DAM

MAP NO. 2



LEGEND

Approximate Inundation 20 acres

Evacuation Routes

NOTES

Peak Flood ~2,000 cfs

Peak Depth ~ 12 ft above stream bottom

In Flow Design Flood 250 cfs (1/2 PMF)

0 250 500 1000

APPROXIMATE SCALE IN FEET

Lake O' The Hills Inundation Study
Anchorage, Alaska

INUNDATION MAP

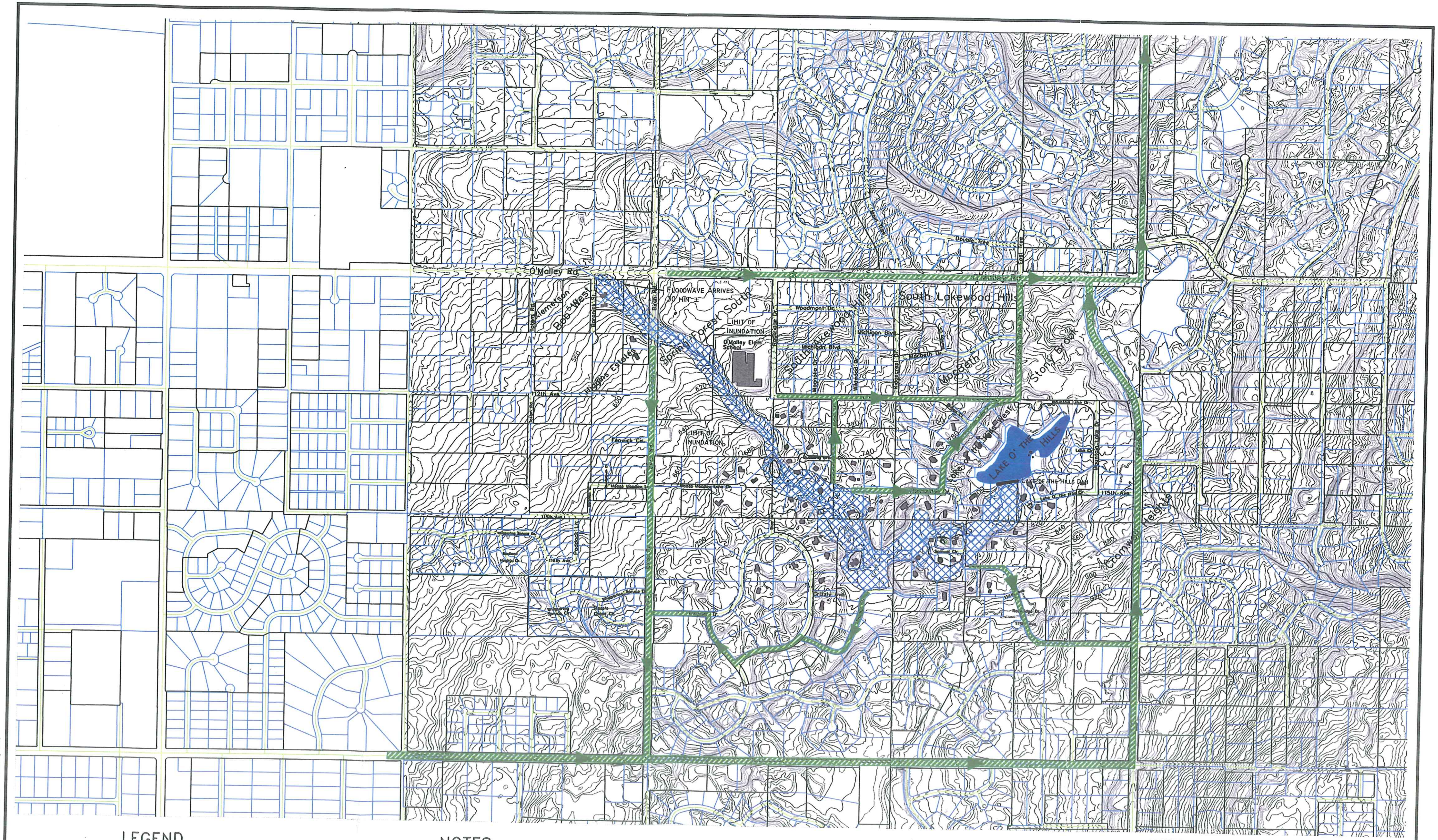
August 2001

32-1-01349

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

FIG. 2

1349inund.dwg 1:1 Shannon & Wilson, Inc



LEGEND

Approximate Inundation 20 acres

Evacuation Routes

NOTES

Peak Flood ~2,000 cfs

Peak Depth ~ 12 ft above stream bottom

In Flow Design Flood 250 cfs (1/2 PMF)

0 250 500 1000

APPROXIMATE SCALE IN FEET

N

Lake O' The Hills Inundation Study
Anchorage, Alaska

INUNDATION MAP

August 2001

32-1-01349

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

FIG. 1

1349Inund.dwg 1:1 Shannon & Wilson, Inc

Appendix G
Prioritization

PRIORITIZATION

It is acknowledged that there will be many projects that should be undertaken but there is a limited amount of resources available. Given that, projects must be prioritized to determine how to allocate resources.

The prioritization will be done by the committee and will be based on several criteria including:

- Life safety
- Compliance with an existing program/regulation
- Cost Benefit Analysis
- Co-ordination with existing documents/programs

Life safety
Activities that protect human lives will have priority over those that solely protect of property.

Compliance
The failure to comply with existing requirements could have wide ranging consequences such the ineligibility to participate in funding programs.

Cost Benefit Analysis
When possible, FEMA's cost-benefit analysis tools will be used to determine a project's cost-benefit ration. Those projects with a higher cost benefit ratio will be given a higher priority.

A cost benefit analysis provides a common basis that can be used to compare projects. When calculating a cost benefit ratio, the cost amount includes funds spent by FEMA, state, local, tribal, private and other dollars. It should include administrative and maintenance costs as well as indirect costs. Examples of costs include:

- Direct expenditures of construction materials

How to Determine Cost-Effectiveness Of Mitigation Projects

As the well-publicized devastation of floods, earthquakes, and hurricanes attests, disasters are random and inevitable events that we can't control. But how we reduce or mitigate, damage from disasters is something that we *can* control.

That is why FEMA funds hazard mitigation projects: to reduce future damages, losses, casualties, and other devastating impacts from disasters. Some examples of flood mitigation projects include elevating buildings or upgrading culverts. Projects in earthquake-prone areas might focus on retrofitting buildings to lower future damages and casualties. So instead of continuously picking up the pieces after disasters, states and communities can identify and carry out hazard mitigation measures that will reduce damage and hardship (the "loss") due to future disasters.

A key criterion for mitigation projects to be eligible for funding is that they must be cost-effective. If the project benefits are higher than the project costs, then the project is cost-effective. Benefit-cost analysis is used for all cost-effectiveness determinations, for flood and earthquake mitigation projects alike. At its most basic level, benefit-cost analysis determines whether the cost of investing in a mitigation project today (the "cost") will result in sufficiently reduced damages in the future (the "benefits") to justify spending money on the project. If the benefit is greater than the cost, then the project *is* cost-effective; if the benefit is less than the cost, then the project *is not* cost-effective.

- Costs to develop and administer a new overlay zone
- Increased business operation costs to comply with mitigation requirement

The benefits have to be estimated. The calculation includes direct and indirect benefits. Examples of benefits include the losses avoided due to mitigation activities, avoided loss of life, injury, property damage, environmental damage, community disruption and response costs avoided.

Calculating the Benefit-Cost Ratio

Cost-effectiveness is determined by comparing the project cost, to the value of damages prevented *after* the mitigation measure. Because the dollar-value of benefits exceeds the costs of funding the project, the project is cost-effective. This relationship is depicted numerically by dividing the benefits by the costs, resulting in a benefit-cost ratio (BCR). The BCR is simply a way of stating whether benefits exceed project costs, and by how much. To derive the BCR, divide the benefits by the cost. If the result is 1.0 or greater, then the project is cost-effective.

By conducting a benefit-cost analysis, you determine one of two things: either the project is cost-effective (BCR > 1.0) or it is not (BCR < 1.0). If the project is cost-effective, then no further work or analysis needs to be done; there is no third step other than to move the project to the next phase in the approval process. If, however, the project is not cost-effective, then it is not eligible for funding.

FEMA utilizes a computer software program to calculate a project's cost-effectiveness. The following is a technical illustration of how benefit-cost analysis works. There are four key elements to all benefit-cost analyses of hazard mitigation projects:

1. an estimate of damages and losses *before* mitigation
2. an estimate of damages and losses *after* mitigation
3. an estimate of the frequency and severity of the hazard causing damages (e.g. floods), and
4. the economic factors of the analysis (i.e. discount rate and mitigation project useful lifetime)

These four key elements and their relationships to one another are detailed in the following example.

EXAMPLE: Consider a 1500 square foot, one-story, single family residence located in the Acorn Park subdivision along Squirrel Creek. A proposed mitigation project will elevate the structure four feet at a cost of $20,000. Whether this project is cost-effective depends on the damages and losses from flooding without the mitigation project; the effectiveness of the mitigation project in reducing those damages and losses; the frequency that the house is flooded and the depth of the flood water; and, the mitigation project's useful lifetime.

If the pre-mitigation damages are frequent and/or severe, then the project is more likely to be cost-effective. Even minor damage that occurs frequently can exceed, over the life of a project, the up-front costs of implementing a mitigation measure. On the other hand, if the building in the example above only flooded once, then it may not be cost-effective to elevate, unless the damages were significant in relation to the value of the structure and its contents.

FEMA is trying to maximize its investment in damage reduction by focusing mitigation resources on those projects that have the best chance of making an impact on losses in property and life. Determining cost-effectiveness of mitigation projects is of critical importance, therefore, to ensure that FEMA is fulfilling its mission of not just responding to disasters, but also in reducing the economic loss and suffering that they bring.

Coordination
A project that is integrated into several plans, has gone through the public involvement process, etc. will have a higher priority as they reflect the desires of multiple departments and the public. Projects that have been contained within a single plan, or has no public involvement may not reflect the wider viewpoint.

Table G.1 shows how the criteria will be considered using a point system to give each project a score. This score will then be used to rank the projects. The department responsible for the project will initially develop the score for the project. The scores will then be evaluated by the Hazard Mitigation Planning Team to ensure that the projects are being consistently scored. For the purposes of this plan, action items will be given a prioritization of high, medium or low. A high value represents a score above 72 while a medium is between 37 and 72 and low is 36 or below. For each project, additional factors to be considered can be listed. At their discretion, the Hazard Mitigation Planning Team can evaluate these factors and alter the project's priority.

Once the priority has been determined, the Table G.2 lists the action items in order of their priority.

Table G.1 Prioritization of Projects

	Criteria	Weighting	Score			Total Points (weight X score)
			Low (1-3 possible points)	**Medium** (4-6 possible points)	**High** (7-9 possible points)	
1.	Life Safety	4	No people at risk	Fewer than 10 people affected	More than 10 people affected	
2.	Compliance with existing programs/regulations	3	Not needed	Encouraged	Required	
3.	Cost-Benefit	3	No cost-benefit analysis performed or results less than 1	Cost benefit between 1 and 2	Cost benefit greater than 2	
4.	Coordination with existing documents	2	No ties to existing plans	Mentioned in one or 2 plans. Plans without public involvement.	Well integrated into plans. Plans have gone through public input process.	
TOTAL POINTS						

Additional factors to consider (please note special reasons why this project should be funded (legal liability, social and environmental impacts, high visibility, etc):

Table G.2 Prioritized list of action items

Ranking	Action Item	Hazard	Score
1.	1. Identify department responsible for coordinating hazard mitigation activities.	All	N/A
2.	2. Review composition of departments represented on the hazard mitigation planning committee.	All	N/A

Note: upon completion of these two items, the remaining action items should be prioritized.