
City of Kenai Hazard Mitigation Plan



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Prepared for:
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F	FEMA Approval Letter and City Council Adoption Resolution

Acronyms/Abbreviations

°F	Degrees Fahrenheit
ACS	American Community Survey
AEC	Alaska Earthquake Center
AFS	Alaska Fire Service
AICC	Alaska Interagency Coordination Center
AVO	Alaska Volcano Observatory
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
City	City of Kenai
DCCED	Department of Commerce, Community, and Economic Development
DCRA	Division of Community and Regional Affairs
DGGS	Division of Geological and Geophysical Survey
DHS&EM	Division of Homeland Security and Emergency Management
DMA 2000	Disaster Mitigation Act of 2000
DMVA	Department of Military and Veterans Affairs
DNR	Department of Natural Resources
DOF	Division of Forestry
EQ	Earthquake
F	Fire
F&E	Flooding and Erosion
FEMA	Federal Emergency Management Agency
FMA	Flood Mitigation Assistance
FP&S	Fire Prevention and Safety
FY	Fiscal Year
G	General
<i>g</i>	gravity as a measure of peak ground acceleration
HAZUS	Multi-Hazard Software
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HVAC	Heating, Ventilation, and Air Conditioning
KPB	Kenai Peninsula Borough
M	Magnitude
MAP	Mitigation Action Plan
mm	millimeters

MMI	Modified Mercalli Intensity
mph	miles per hour
NFIP	National Flood Insurance Program
NWS	National Weather Service
PDM	Pre-Disaster Mitigation
PGA	peak ground acceleration
Stafford Act	Robert T. Stafford Disaster Relief and Emergency Assistance Act
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic, and Environmental
SW	Severe Weather
TF	Technical Feasibility
UAF GI	University of Alaska Fairbanks Geophysical Institute
UHMA	United Hazard Mitigation Assistance
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
U.S.	United States
USC	United States Code
USGS	United States Geological Survey
V	Volcanic Ash
WUI	Wildland Urban Interface

This section provides a brief introduction to hazard mitigation planning, associated grants, and a description of this 2019 Hazard Mitigation Plan (HMP) for the City of Kenai (City).

1.1 HAZARD MITIGATION PLANNING

Hazard mitigation, as defined in Title 44 of the Code of Federal Regulations (CFR), Section §201.2, is “any sustained action taken to reduce or eliminate the long-term risk to people and property from natural hazards and their effects. Hazard mitigation is the only phase of emergency management specifically dedicated to breaking the cycle of damage reconstruction and repeated damage. As such, States and Local governments are encouraged to take advantage of funding provided by Hazard Mitigation Assistance (HMA) grant programs.” (FEMA, 2015c). Hazard mitigation is any work done to minimize the impacts of any type of hazard event before it occurs and aims to reduce losses from future disasters. Hazard mitigation is a process in which hazards are identified and profiled, people and facilities at risk are analyzed, and mitigation actions are developed. Implementation of mitigation actions, which include long-term strategies such as planning, policy changes, programs, projects, and other activities, is the end result of this process.

1.2 PLANNING REQUIREMENTS

1.2.1 Local Mitigation Plans

On October 30, 2000, Congress passed the Disaster Mitigation Act of 2000 (DMA 2000) (P.L. 106-390) which amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) (Title 42 of the United States Code [USC] 5121 et seq.) by repealing the act’s previous mitigation planning section (409) and replacing it with a new mitigation planning section (322). Section 322 directs State and Local entities to closely coordinate mitigation planning and implementation efforts. Additionally, it establishes the HMP requirement for the Federal Emergency Management Agency’s (FEMA) HMA.

On October 2, 2015, FEMA published the Mitigation Planning Final Rule in the Federal Register, [Docket ID: FEMA-2015-0012], 44 CFR Part 201, effective November 2, 2015. Planning requirements for Local entities are described in detail in Section §201.6. Locally-adopted and FEMA-approved HMPs qualify jurisdictions for several HMA grant programs. This 2019 HMP for the City complies with Title 44 CFR Section §201.6 and applicable FEMA guidance documents as well as the 2018 *State of Alaska HMP* by the Department of Military and Veterans Affairs (DMVA) Division of Homeland Security and Emergency Management (DHS&EM).

Section 322 of the Stafford Act (42 USC 5165) as amended by P.L. 106-390 provides for State and Local governments to undertake a risk-based approach to reducing risks to natural hazards through mitigation planning. The National Flood Insurance Act of 1968 (42 USC 4001 et seq.) as amended, further reinforces the need and requirement for HMPs, linking Flood Mitigation Assistance (FMA) programs to State and Local HMPs. This change also requires participating National Flood Insurance Program (NFIP) communities’ risk assessments and mitigation strategies to identify and address repetitively flood-damaged properties.

1.3 GRANT PROGRAMS WITH MITIGATION PLAN REQUIREMENTS

FEMA HMA grant programs provide funding to Local entities that have a FEMA-approved HMP. Two of the grants are authorized under the Stafford Act and DMA 2000, while the remaining

three are authorized under the National Flood Insurance Act and the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act. As of June 19, 2008, the grant programs were segregated. The Hazard Mitigation Grant Program (HMGP) is a competitive, disaster-funded grant program whereas the other Unified Mitigation Assistance Programs (Pre-Disaster Mitigation [PDM] and FMA, although competitive) rely on specific pre-disaster grant funding sources, sharing several common elements.

*“The DHS&EM FEMA HMA grant programs present a critical opportunity to protect individuals and property from natural hazards while simultaneously **reducing reliance on Federal disaster funds**. The HMA programs provide PDM grants annually. The statutory origins of the programs differ, but all share the common goal of reducing the loss of life and property due to natural hazards.*

The PDM program is authorized by the Stafford Act and focuses on mitigation project and planning activities that address multiple natural hazards, although these activities may also address hazards caused by manmade events. The FMA program is authorized by the National Flood Insurance Act and focuses on reducing claims against the NFIP” (FEMA, 2019h).

1.3.1 Hazard Mitigation Assistance (HMA) Unified Programs

The HMGP provides grants to Local entities to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. Projects must provide a long-term solution to a problem; for example, elevation of a home to reduce the risk of flood damages as opposed to buying sandbags and pumps to fight the flood. In addition, a project’s potential savings must be more than the cost of implementing the project. Funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage. The amount of funding available for the HMGP under a particular disaster declaration is limited. FEMA may provide a State or Local entity with up to 20% of the total aggregate disaster damage costs to fund HMGP project or planning grants. The cost-share for this grant is 75% Federal/25% non-Federal.

The PDM grant program provides funds to Local entities for hazard mitigation planning and mitigation project implementation prior to a disaster event. PDM grants are awarded on a nationally-competitive basis. Like HMGP funding, a PDM project’s potential savings must be more than the cost of implementing the project. In addition, funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage. The total amount of PDM funding available is appropriated by Congress on an annual basis. In Fiscal Years (FY) 2016 and 2017, PDM program funding totaled approximately \$90 million each year. The cost-share for this grant is 75% Federal/25% non-Federal.

The goal of the FMA grant program is to reduce or eliminate flood insurance claims under the NFIP. Particular emphasis for this program is placed on mitigating repetitive loss properties. The primary source of funding for this program is the

The City of Kenai does not participate in the NFIP.

National Flood Insurance Fund. Grant funding is available for three types of grants, including Planning, Project, and Technical Assistance. Project grants, which use the majority of the program's total funding, are awarded to States and Local entities to apply mitigation measures to reduce flood losses to properties insured under the NFIP. In FY 2016, FMA funding totaled \$199 million. In FY 2017, FMA funding totaled \$160 million. The cost-share for this grant is 75% Federal/25% non-Federal.

1.4 HMP DESCRIPTION

The remainder of this HMP consists of the following sections and appendices:

Prerequisites

Section 2 addresses the prerequisites of plan adoption, which includes adoption by the City Council. The adoption resolution is included in Appendix F.

Community Description

Section 3 provides a general history and background of the City, including historical trends for population and the demographic and economic conditions that have shaped the area.

Planning Process

Section 4 describes the planning process and identifies the Project Team Members, the meetings held as part of the planning process, and the key stakeholders within the City. In addition, this section documents public outreach activities (Appendix A) and the review and incorporation of relevant plans, reports, and other appropriate information.

Hazard Analysis

Section 5 describes the process through which the Project Team identified, screened, and selected the hazards to be profiled in this 2019 HMP. The hazard analysis includes the characteristics, history, location, extent, impact, and recurrence probability statements of future events for each hazard. In addition, historical and hazard location figures are included.

Vulnerability Analysis

Section 6 identifies potentially vulnerable assets—people, residential and nonresidential buildings, critical facilities, and critical infrastructure—in the City. The resulting information identifies the full range of hazards that the City could face and potential social impacts, damages, and economic losses. Land use and development are also discussed.

Mitigation Strategy

Section 7 defines the mitigation strategy which provides a blueprint for reducing the potential losses identified in the vulnerability analysis. The Project Team developed a list of mitigation goals and potential actions to address the risks facing the City. Mitigation actions include preventive actions, property protection techniques, natural resource protection strategies, structural projects, emergency services, and public information and awareness activities.

Plan Maintenance

Section 8 describes the Project Team's formal plan maintenance process to ensure that the 2019 HMP remains an active and applicable document. The process includes monitoring, evaluating (Appendix E), and updating the HMP; implementation through existing planning mechanisms; and continued public involvement.

References

Section 9 lists the reference materials used to prepare this HMP.

Appendix A

Appendix A provides public outreach information, including newsletters, meeting sign-in sheets, trip reports, and presentations.

Appendix B

Appendix B contains a glossary of terms that are used throughout this HMP.

Appendix C

Appendix C provides the FEMA crosswalk, which documents compliance of this HMP with FEMA criteria.

Appendix D

Appendix D contains the Benefit-Cost Analysis Fact Sheet used to prioritize mitigation actions.

Appendix E

Appendix E provides plan maintenance documents, such as an annual review sheet, the progress report form, and a community survey.

Appendix F

Appendix F provides the adoption resolution by the City Council and FEMA's approval letter.

2.1 ADOPTION BY CITY COUNCIL AND SUPPORTING DOCUMENTATION

Requirements for the adoption of this 2019 HMP by the local governing body, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 REQUIREMENTS: PREREQUISITES

Local Plan Adoption

Requirement §201.6(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).

Element

- Has the local governing body adopted the local hazard mitigation plan?
- Is supporting documentation, such as a resolution, included?

Source: FEMA, 2015.

The City is the local jurisdiction represented in this 2019 HMP. This HMP meets the requirements of the 2018 *State of Alaska HMP*, Section 322 of DMA 2000, and 44 CFR Section §201.6, respectively.

The local governing body of the City is the City Council. The City Council adopted the 2019 HMP by resolution on _____, 2020. A scanned copy of the resolution is included in Appendix F.

This section describes the location, history, demographics, and economy of the City.

3.1 LOCATION

Kenai is located on the western coast of the Kenai Peninsula in Southcentral Alaska, fronting Cook Inlet. It lies on the western boundary of the Kenai National Wildlife Refuge, on the Kenai Spur Highway. It is approximately 65 air miles and 160 highway miles southwest of Anchorage via the Sterling Highway at approximately 60.5537 North



Latitude and -151.2546 West Longitude. Kenai is located in the Kenai Peninsula Borough (KPB) Recording District (Department of Community, Commerce, and Economic Development [DCCED], Division of Community and Regional Affairs [DCRA], 2019).

The City covers approximately 29.9 square miles of land and 5.6 square miles of water. Kenai falls within the gulf coast transitional climate zone, characterized by a semi-arid atmosphere; long, cold winters; and mild summers. Summer temperatures typically range from 46 to 65 degrees Fahrenheit (°F), and winter temperatures from 4 to 22°F. Annual precipitation is 20 inches. Kenai's northern climate is tempered by Upper Cook Inlet to the west and the Kenai Mountain Range to the south and east. Average wind speeds are 7.8 miles per hour (mph) (WeatherSpark, 2019).

3.2 HISTORY

Prior to Russian settlement, Kenai was a Dena'ina Athabaskan village. Russian fur traders first arrived in 1741. At that time, about 1,000 Dena'ina lived in the village of Shk'ituk't, near the river. The traders called the people "Kenaitze" or "Kenai people." In 1791, a fortified Russian trading post, Fort St. Nicholas, was constructed for fur and fish trading. It was the second permanent Russian settlement in Alaska. In 1849, the Holy Assumption Russian Orthodox Church was established by Egumen Nicholai. In 1869, the U.S. Military established a post for the Dena'ina in the area, called Fort Kenay, which was abandoned in 1870 after Alaska was purchased by the U.S. A post office was established in 1899. Through the 1920s, commercial fishing was the primary activity. In 1940, homesteading enabled the area to develop. The first

dirt road from Anchorage was constructed in 1951. In 1957, oil was discovered at Swanson River, 20 miles northeast of the City - the first major Alaska oil strike. The City was incorporated in 1960. In 1965, offshore oil discoveries in Cook Inlet fueled a period of rapid growth. After rapid increases during the economic booms of the 1960s through the 1980s, population growth in Kenai began to stabilize by 2000, with more long-term residents and a generally older population. Several other communities, such as Soldotna, Nikiski, Kasilof, and Sterling, are within 20 miles of the City, giving the northwest peninsula a population of roughly 34,000. Kenai has been a growing center for oil exploration, production, and services since that time.

3.3 DEMOGRAPHICS

The 2010 U.S. Census recorded 7,100 residents for the City. The 2016 American Community Survey (ACS) recorded 7,551 residents, of which the median age was 37, indicating a relatively young population that is expected to continue increasing as depicted in Figure 1. Over 74% of the population is 18 years of age or older (ACS, 2016).

The City is a blended community. About 77% of residents recognize themselves as White, 11% of residents recognize themselves as Alaska Native, and 8% recognize themselves as two or more races. The percentage of males is 51.6%, and the percentage of females is 48.4%. The 2010 U.S. Census indicated that there are 3,508 households with the average household having approximately three individuals.

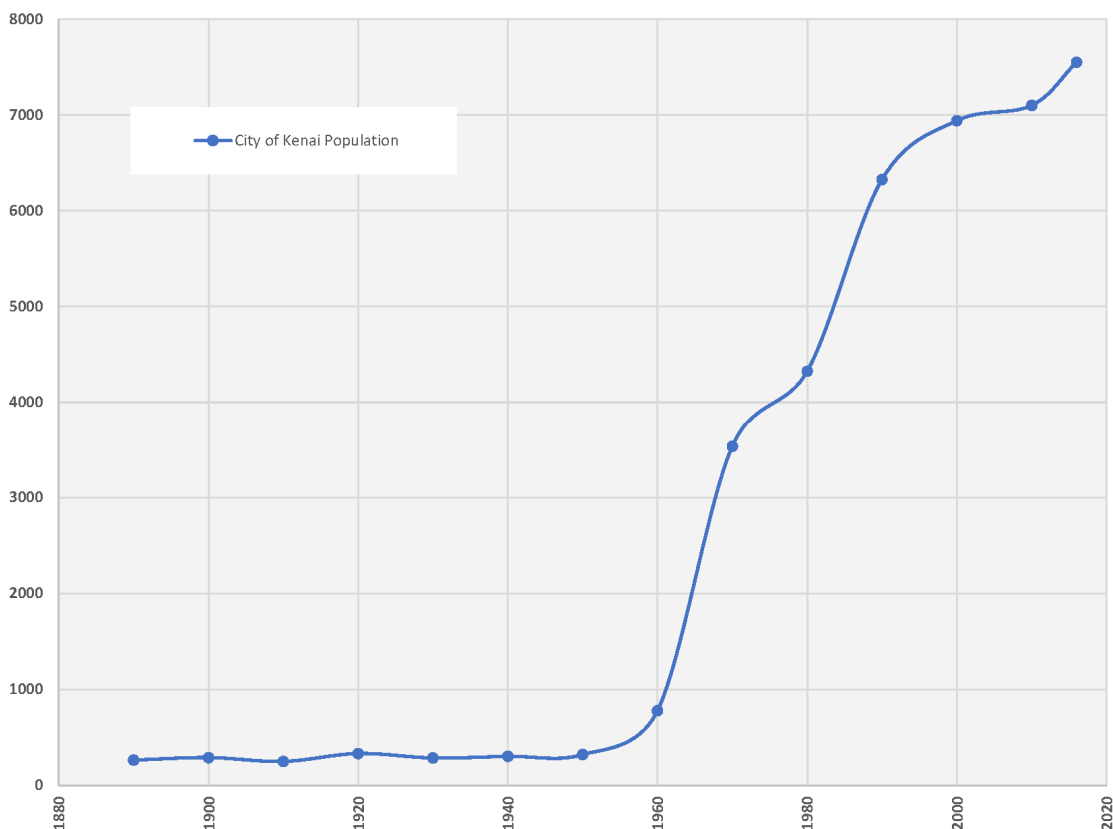


Figure 1. Kenai's Historic Population

3.4 ECONOMY

The City of Kenai's economic well-being is closely tied to general economic conditions in the Kenai/Soldotna area. This area continues to be the trade and service center for the western Kenai peninsula and a local government center. The area has an industrial base and a healthy visitor industry centered on the recreational fisheries of the Kenai River and Cook Inlet.

According to the 2010 U.S. Census, the median household income for the City was \$58,732. Approximately 991 individuals (14%) were reported to be living below the poverty level. The potential work force (those aged 16 years or older) for the City was estimated to be 5,820, of which 3,716 were actively employed.

The Kenai River is a major sport fishing location for Anchorage residents and tourists. The river is world-renowned for trophy king and silver salmon. The Kenaitze (Tanaina Athabascans) live borough-wide and utilize the rich resources of Cook Inlet.

This section provides an overview of the planning process; identifies the Planning Team members and key stakeholders; documents public outreach efforts; and summarizes the review and incorporation of existing plans, studies, and reports used to develop this HMP. Additional information regarding the Planning Team and public outreach efforts is provided in Appendix A. Requirements for the planning process, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Planning Process

Local Planning Process

Requirement §201.6(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

- Does the plan provide a narrative description of the process followed to prepare the plan?
- Does the plan indicate who was involved in the planning process?
- Does the plan indicate how the public was involved?
- Does the plan discuss the opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process?
- Does the planning process describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information?

Source: FEMA, 2015.

4.1 OVERVIEW OF PLANNING PROCESS

The DMVA DHS&EM provided funding and project oversight to LeMay Engineering & Consulting, Inc. Ms. Jennifer LeMay, PE, PMP guided the Hazard Mitigation Project Team to assist the City with development of the HMP.

The following five-step process occurred from August through December 2019.

1. **Organize resources:** Members of the Hazard Mitigation Project Team identified resources, including staff, agencies, and local community members, who could provide technical expertise and historical information needed in developing the HMP.
2. **Assess risks:** The Hazard Mitigation Project Team identified hazards specific to the City and developed a risk assessment for the identified hazards, including the vulnerability analysis, prior to and during the development of the mitigation strategy.
3. **Assess capabilities:** The Hazard Mitigation Project Team reviewed current administrative and technical, legal and regulatory, and fiscal capabilities to determine whether existing provisions and requirements adequately address relevant hazards.
4. **Develop a mitigation strategy:** After reviewing the risks posed by each hazard, the Hazard Mitigation Project Team developed a comprehensive range of potential mitigation goals and actions based on hazard events. Goals were then integrated into mitigation actions and were then prioritized based on community concerns with the top three hazards being fire, erosion of the Kenai Bluffs, and earthquakes.

5. Monitor, evaluate, and update the HMP: The Hazard Mitigation Project Team developed a process to monitor the HMP to ensure it will be used as intended while fulfilling community needs. The Hazard Mitigation Project Team then developed a process to evaluate the HMP on a yearly basis to compare how their decisions affect hazard impacts. They then outlined a method to share their successes with community members to encourage support for mitigation activities and to provide data for incorporating mitigation actions into existing planning mechanisms and providing data for the HMP’s five-year update. Opportunities are described in the Continued Public Involvement Section of this HMP (Section 8).

4.2 HAZARD MITIGATION PLANNING TEAM

Table 1 lists the Hazard Mitigation Planning Team members and contact information.

Table 1. Hazard Mitigation Planning Team

NAME	TITLE	ORGANIZATION	EMAIL
Elizabeth Appleby	City Planner	City of Kenai	eappleby@kenai.city
David Ross	Police Chief	City of Kenai	dross@kenai.city
Jeff Tucker	Fire Chief	City of Kenai	jtucker@kenai.city
Jeremiah Hamilton	Fire Marshal	City of Kenai	jhamilton@kenai.city
Bob Frates	Parks and Recreation Director	City of Kenai	bfrates@kenai.city
Mary Bondurant	Kenai Municipal Airport Director	City of Kenai	mbondurant@kenai.city
Scott Curtin	Public Works Director	City of Kenai	scurtin@kenai.city
Jennifer LeMay, PE, PMP	Mitigation Planner	LeMay Engineering & Consulting, Inc.	jlemay@lemayengineering.com
Rick Dembroski	State of Alaska PDM Project Manager	DHS&EM	rick.dembroski@alaska.gov
Brent Nichols, CFM	State of Alaska Hazard Mitigation Officer	DHS&EM	brent.nichols@alaska.gov

4.3 PUBLIC INVOLVEMENT & OPPORTUNITY FOR INTERESTED PARTIES TO PARTICIPATE

Table 2 lists the community’s public involvement initiatives to encourage participation and insight for the HMP effort.

Table 2. Public Involvement Mechanisms

Mechanism	Description
Newspaper Advertisement, dated October 25, 2019	On October 25, 2019, the City advertised in the <i>Peninsula Clarion</i> , a newspaper for the KPB with regional circulation. The newspaper advertisement contained the agenda for the October 30, 2019 Planning and Zoning Commission meeting as Item A: SCHEDULED PUBLIC COMMENT:

Mechanism	Description
	Jennifer LeMay, LeMay Engineering & Consulting, Inc. to discuss the City of Kenai Local Hazard Mitigation Plan. This advertisement is contained in Appendix A.
Newsletter #1 Distribution (November 8, 2019)	On November 8, 2019, the City distributed a newsletter describing the Draft 2019 HMP's availability and identifying a 30-day public comment period. The newsletter encouraged the community to provide comments and was posted at the City Hall, the Post Office, and the Kenai Community Library. The newsletter also invited the community to a December 4, 2019 City Council meeting for a public hearing on the HMP. The newsletter was posted on the City's website, City Facebook page, and read on radio to the KPB population.
Public Notice, dated November 29, 2019	On November 29, 2019, the City advertised in the <i>Peninsula Clarion</i> , a newspaper for the KPB with regional circulation. The newspaper advertisement contained the date of the December 4, 2019 City Council meeting but did not contain the agenda.
Radio and Video	The December 4, 2019 City Council meeting was broadcast via radio to the KPB, and a video of the meeting was posted on the City's website.

The 2010 KPB HMP included an annex which identified the City of Kenai's hazards. In 2019, the City of Kenai chose to have its own standalone HMP. Rather than begin the process at the stakeholder level, it was necessary for a rough draft to be developed which could be used by the community to provide constructive feedback. LeMay Engineering & Consulting, Inc. developed a standalone HMP with consultation from the City Planner. The Hazard Mitigation Planning Team fine-tuned the HMP via email and met on October 30, 2019 from 2-4 pm to further discuss input into the HMP.

On October 30, 2019 at 7 pm, Jennifer LeMay gave a hazard mitigation planning presentation as an agenda item for the regularly scheduled Planning and Zoning Commission meeting (see Appendix A for meeting attendees, agenda, Powerpoint® presentation slides, minutes, and trip report). Hazards were confirmed, the risk assessment was summarized, and mitigation actions were presented. The Planning and Zoning Commission recommended sending the HMP to the City Council.

A 30-day public comment period began on November 8, 2019 to allow the community the opportunity to read the HMP and provide comments. The Draft HMP was posted on the City's web page. A newsletter was also posted at City Hall, the Post Office, and the Kenai Community Library notifying the public of the availability of the Draft HMP and inviting the public to provide comments.

Neighboring communities were invited to participate with an advertisement in the *Peninsula Clarion*, a newspaper for the KPB with regional circulation. The City Council meeting was broadcast via radio and youtube to Kenai residents and residents of neighboring communities, and a video of the meeting was posted on the City's website. The KPB was also provided with the opportunity to comment (see Appendix A).

City personnel with the authority to regulate development were involved with the Draft HMP development and included the Fire Marshal, Airport Director, Public Works Director, and City Planner as well as the Planning and Zoning Commission and the Planning Department.

On December 4, 2019 at 6 pm, Jennifer LeMay presented an HMP summary as an agenda item for the regularly scheduled City Council meeting (see Appendix A for meeting attendees, agenda, Powerpoint® presentation slides, minutes, and trip report). A public hearing was held,

and comments are summarized in the trip report in Appendix A. The meeting was broadcast via radio, and a video of the meeting was posted on the City's website.

The HMP was updated based on public comments. This updated document known as the Draft HMP was then submitted to DHS&EM for review before being submitted to FEMA for evaluation.

4.4 INCORPORATION OF EXISTING PLANS AND OTHER RELEVANT INFORMATION

During the planning process, the Hazard Mitigation Project Team reviewed and incorporated information from existing plans, studies, and reports into the HMP. The following were reviewed and used as references for the jurisdiction information and hazard profiles in the risk assessment (see Section 6) of the HMP:

- *Draft KPB Comprehensive Plan, 2019*: provides the goals, visions, and conditions of the KPB. Kenai is a city within the KPB.
- *U.S. Army Corps of Engineers (USACE), Alaska Kenai Bluffs Bank Stabilization Section 116 Feasibility Study, Kenai, Alaska, 2018*: addresses storm damage, coastal erosion, and ice and glacial damage occurring at the Kenai Bluffs site. The Kenai Bluffs, lining the north shore of the Kenai River estuary for roughly 5,000 feet, have been receding at an average rate of approximately three feet per year, due to a combination of coastal storm surge, tidal currents, and other erosive forces. Public and private property, structures and infrastructure, and cultural resources have been lost and continue to be threatened by the receding bluff.
- *FEMA Region X – KPB, Alaska Risk Report for the KPB and the Incorporated Cities of Homer, Kachemak, Kenai, Seldovia, Seward, and Soldotna, 2017*: contains the results of an in-depth risk assessment for flood, earthquake, erosion, tsunami, and dam failure hazards for KPB cities, including a summary of the Risk Assessment Database.
- *City of Kenai Comprehensive Plan, 2016*: documents the City's effort to guide development in the community until 2030 and provides important information about the population, environment, economy, transportation, and land use.
- *City of Kenai's Annex to the KPB Local All-Hazard Mitigation Plan, 2010*: provides a brief overview of natural hazards that have the potential to affect the City.
- *City of Kenai Emergency Operations Plan, 2007*: addresses authorities, roles, and responsibilities for disaster-specific functions.
- *Kenai Area: Community Wildfire Protection Plan, 2006*: provides a risk assessment and mitigation plan for the City regarding wildfire.
- *State of Alaska, DCCED Community Profile*: provides historical and demographic information.

This section identifies and profiles the hazards that could potentially affect the City.

5.1 OVERVIEW OF A HAZARD ANALYSIS

A hazard analysis includes the identification, screening, and profiling of each hazard. Hazard identification is the process of recognizing the natural events that threaten an area. Natural hazards result from unexpected or uncontrollable natural events of sufficient magnitude. Even though a particular hazard may not have occurred in recent history in the study area, all-natural hazards that may potentially affect the study area are considered; the hazards that are unlikely to occur or for which the risk of damage is accepted as being very low, are eliminated from consideration. Human and Technological, and Terrorism-related hazards are beyond the scope of this HMP.

Hazard profiling is accomplished by describing hazards in terms of their characteristics, history, location, extent, breadth, magnitude, frequency, and recurrence probability. Hazards are identified through the collection of historical and anecdotal information, review of existing plans and studies, and preparation of hazard maps of the study area. Hazard maps are used to determine the geographic extent of the hazards and define the approximate boundaries of the areas at risk.

5.2 HAZARD IDENTIFICATION AND SCREENING

Requirements for hazard identification, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Risk Assessment: Identifying Hazards

Identifying Hazards

Requirement §201.6(c)(2)(i): The risk assessment shall include a] description of the type, 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

- Does the plan include a description of the types of all-natural hazards with the potential to affect the jurisdiction?
- Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the plan?
- Does the risk assessment identify the extent (i.e., breadth, magnitude, or severity) of each hazard addressed in the plan?
- Does the plan provide information on previous occurrences of each hazard?
- Does the plan include recurrence probability statements of future events (i.e., chance of occurrence) for each hazard addressed?

Source: FEMA, 2015.

For the first step of the hazard analysis, the Hazard Mitigation Project Team reviewed possible hazards that could affect the City according to the 2018 *State of Alaska HMP* (DHS&EM, 2018a). They then evaluated and screened the comprehensive list of potential hazards based on a range of factors, including prior knowledge or perception of their threat and the relative risk presented by each hazard, the ability to mitigate the hazard, and the known or expected availability of information on the hazard (see Table 3). The Hazard Mitigation Project Team determined that the hazards that have the potential to impact the City include: changes in the

cryosphere, earthquakes, flood/erosion, volcanic ashfall, severe weather, and wildland/conflagration fires. The remaining hazards excluded through the screening process were considered to pose a lower threat to life and property in the City due to the low likelihood of occurrence or the low probability that life and property would be significantly affected.

Table 3. Identification and Screening of Hazards

Hazard Type	Should It Be Profiled?	Explanation
Changes in the Cryosphere	Yes	Changes in the cryosphere is designated as a hazard in the 2018 <i>State of Alaska HMP</i> . The City suffers from “silent storms” where high-water storm surges erode and undercut the banks. This hazard is included under floods/erosion in Section 5.3. Both sea ice and river ice collect at the toe of the Kenai Bluffs during the winter months, although to what extent is dependent on temperatures, wind direction and intensity, tides, and ice concentration in Cook Inlet (USACE, 2018).
Earthquakes	Yes	Earthquakes are designated as a hazard in the 2018 <i>State of Alaska HMP</i> with a high probability of occurring in the KPB. The 1964 Great Alaska Earthquake and resulting tsunami caused significant damage in Seldovia. Land subsidence within the KPB occurred in Seward, Homer, Hope, and Seldovia, where some of the most drastic subsidence dropped land six feet. The City was relatively undamaged in the 1964 Great Alaska Earthquake. The 2018 earthquake that was centered in the Matanuska-Susitna Borough caused damage to the City dock and wellhouse.
Floods/Erosion	Yes	Flooding is designated as a hazard in the 2018 <i>State of Alaska HMP</i> with a high probability of occurring in the KPB. The 2017 FEMA Risk Report did not identify flooding as a concern for the City; the Wastewater Treatment Plant was identified in the report as having the potential to be affected by erosion due to its location within a parcel along an identified Cook Inlet erosion zone. The beach has been restored in the area near the Wastewater Treatment Plant, and Public Works does not have any concerns at this time. Only the Kenai Bluffs area will be discussed in the HMP with regards to erosion.
Ground Failure	No	The terrain in the City is not likely to produce ground failure.
Volcanic Ashfall	Yes	The City has been affected by volcanic ashfall from volcanoes in the past. Volcanoes are designated as a hazard in the 2018 <i>State of Alaska HMP</i> with a high probability of occurring in the KPB.
Severe Weather	Yes	Annual weather patterns, such as fog and high winds, are predominant threats. Severe weather is designated as a hazard in the 2018 <i>State of Alaska HMP</i> with a high probability of occurring in the KPB. High winds cause trees to fall on power lines.
Wildland/Conflagration Fires	Yes	Dead and dying spruce trees pose the greatest risk of wild fire on the entire KPB, including the City. Wildland fire is designated as a hazard in the 2018 <i>State of Alaska HMP</i> with a high probability of occurring in the KPB.
Tsunamis	No	The City is not at risk for tsunamis based on its location near the relatively shallow depth of upper Cook Inlet.

5.3 HAZARD PROFILE

Requirements for hazard profiles, as stipulated in DMA 2000 and its implementing regulations, are described below.

The specific hazards selected by the Planning Team for profiling have been examined in a methodical manner based on the following factors:

- Hazard Characteristics;
 - Typical event characteristics;
 - Potential climate change impacts are primarily discussed in the Changes in the Cryosphere hazard profile but are also identified where deemed appropriate within selected hazard profiles;
- History (geologic as well as previous occurrences);
- Location;
- Extent (breadth, magnitude, and severity);
- Impact (general impacts associated with each hazard are described in the following profiles, and detailed impacts to the City’s residents and critical facilities are further described in Section 6 as part of the overall vulnerability summary for each hazard); and
- Recurrence probability statement of future events.

The hazards profiled for the City are presented in the rest of Section 5.3. They are placed in alphabetical order which does not signify the importance level or risk.

5.3.1 Changes in the Cryosphere

5.3.1.1 *Hazard Characteristics*

The “cryosphere” is defined as those portions of Earth’s surface and subsurface where water is in solid form, including sea, lake, and river ice, snow cover, glaciers, ice caps and ice sheets, and frozen ground (e.g., permafrost). The components of the cryosphere play an important role in climate. Snow and ice reflect heat from the sun, helping to regulate the Earth’s temperature. They also hold Earth’s important water resources, and therefore, regulate sea levels and water availability in the spring and summer. The cryosphere is one of the first places where scientists are able to identify global climate change.

Hazards of the cryosphere can be subdivided into four major groups:

- Glaciers;
- Permafrost and periglacial;
- Sea ice; and
- Snow avalanche.

Glaciers, permafrost, and snow avalanche are not applicable to the City of Kenai. Of these four major groups, sea ice applies to the City of Kenai.

Sea ice is frozen ocean water that forms, grows, and melts in the ocean. Sea ice grows in Cook Inlet during the winter and melts during the summer. The winds from a fall storm can push sea ice onto the beach. The ice will then gouge the beach and cause other damage. Both sea ice and river ice collect at the toe of the Kenai Bluffs during the winter months, although to what extent is dependent on temperatures, wind direction and intensity, tides, and ice concentration in Cook Inlet. The average Kenai River ice freeze-up is December 10, and the average ice break-up is April 2. Ice can close the river to vessel traffic for short periods from December to early April (USACE, 2018).

5.3.1.2 Climate Factors

The cryosphere is strongly tied to climate, and thus, very responsive to climate warming. Changes in climate can modify natural processes and increase the magnitude and recurrence frequency of certain geologic hazards (e.g., floods caused by storm surge, erosion, and increased precipitation), which if not properly addressed, could have a damaging effect on Alaska's communities and infrastructure, as well as on the livelihoods and lifestyles of Alaskans. Wave climate and extreme water level events have the potential to change with climate and influence coastal erosion rates.

During the last several decades, Alaska has warmed twice as fast as the rest of the U.S. The major climatic factor leading to warming is an increase in air temperatures. Even in non-ice-rich soils, process-driven models show more material is available for erosion and transport when soil is thawed, which leads to increased exposure of underlying material to thermal and physical stressors.

5.3.1.3 Cryosphere Hazard History

The 2016 *City of Kenai Comprehensive Plan* noted a drying trend in wetlands and that trees are growing at higher altitudes. The 2019 Draft *KPB Comprehensive Plan* states the average May to August temperature has increased nearly 2°F over the last 50 years. The increase in temperature changed the U.S. Department of Agriculture (USDA) plant hardiness zones for the KPB. The 2015 USDA Climate Change Vulnerability Assessment for the Chugach National Forest predicted the following climate conditions: shorter winter months, more snowpack at higher elevations and less snowpack at lower elevations, less rain in spring and more rain in autumn, and a drying trend for the western KPB that may increase the risk of wildland fire.

5.3.1.4 Location, Extent, Impact, and Recurrence Probability

Location

Within the City, sea ice primarily occurs in Upper Cook Inlet, and river ice occurs at the mouth of the Kenai River. Snow occurs everywhere on land.

Extent

The entire state of Alaska is at risk of affects from climate change. The state has grown wetter, with a 30% increase in average precipitation between 1968 and 1990. The growing season has

lengthened by about 14 days. Models predict continued warming, including an increase in temperature by 1.5 to 5°F by 2030 and 5 to 18°F by 2100.

Impact

Impacts of a warming climate may include:

- Springs, seeps, or wet ground that is not typically wet;
- New cracks or bulges in the ground or pavement;
- Soil subsiding from a foundation;
- Secondary structures (decks, patios) tilting or moving away from main structures;
- Broken water line or other underground utility;
- Leaning structures that were previously straight;
- Offset fence lines;
- Sunken or dropped-down road beds;
- Rapid increase in stream levels, sometimes with increased turbidity;
- Rapid decrease in stream levels even though it is raining or has recently stopped; and
- Sticking doors and windows, visible spaces indicating frames out of plumb.

Recurrence Probability

Changes to the cryosphere are occurring and will continue to do so.

5.3.2 Earthquake

Alaska is one of the most seismically active regions in the world and is at risk of societal and economic losses due to damaging earthquakes. On average, Alaska has one “great” magnitude [(M) >8] earthquake every 13 years and one M 7-8 earthquake every year. Earthquakes have killed more than 130 people in Alaska during the past 60 years (DHS&EM, 2018a).

It is not possible to predict the time and location of the next big earthquake, but the active geology of Alaska guarantees that major damaging earthquakes will continue to occur and can affect almost anywhere in the state. Scientists have estimated where large earthquakes are most likely to occur, along with the probable levels of ground shaking to be expected. With this information, as well as information on soil properties and landslide potential, it is possible to estimate earthquake risks in any given area.

Alaska earthquake statistics include:

- Alaska is home to the second-largest earthquake ever recorded (1964 Great Alaska Earthquake, M 9.2);
- Alaska has 11% of the world’s recorded earthquakes; and

- Three of the eight largest earthquakes in the world occurred in Alaska.

Since 1900, Alaska has had an average of:

- 45 M 5-6 earthquakes per year;
- 320 M 4-5 earthquakes per year; and
- 1,000 earthquakes located in Alaska each month.

Source: Alaska Earthquake Center (AEC)

5.3.2.1 *Hazard Characteristics*

An earthquake is a sudden motion or trembling caused by a release of stress accumulated within or along the edge of Earth's tectonic plates. The effects of an earthquake can be felt far beyond the site of its occurrence. Earthquakes usually occur without warning, and after only a few seconds, can cause massive damage and extensive casualties. The most common effect of earthquakes is ground motion, or the vibration or shaking of the ground during an earthquake.

Ground motion generally increases with the amount of energy released and decreases with distance from the rupture area. An earthquake causes waves in the earth's interior (i.e., seismic waves) and along the earth's surface (i.e., surface waves). Two kinds of seismic waves occur: P (primary) waves are longitudinal or compressional waves similar in character to sound waves that cause back and forth oscillation along the direction of travel (vertical motion), and S (secondary) waves, also known as shear waves, are slower than P waves and cause structures to vibrate from side to side (horizontal motion). There are also two types of surface waves: Raleigh waves and Love waves. These waves travel more slowly and typically are more damaging than seismic waves because they cause larger motions and their frequency is close to harmonic frequencies for human structures and for sedimentary deposits.

In addition to ground motion, several secondary natural hazards can occur from earthquakes such as:

- **Strong Ground Motion** is ground shaking. Strong ground motion intensity is directly correlated with earthquake magnitude (i.e., the larger the earthquake magnitude, the more intense and widespread the ground shaking will be). The strong ground motion severity is also dependent on the distance from the energy source.
- **Surface Rupturing** occurs when the subsurface patch of fault that slips in an earthquake intersects the earth's surface. This causes discrete, differential ground movement during intense earthquake shaking. The relative crustal block motion is dictated by the rupture's fault type, which can be horizontal, vertical, or a combination of both. Earthquakes larger than a M of 6.5 have sufficient energy to create surface ruptures, but whether or not this occurs is dependent on the earthquake's depth. The shallower a depth at which a significant earthquake occurs, the more likely it is to create a surface rupture. Permanent displacement along faults can be substantial. Surface ruptures, as a product of intense strong ground motion, can cause severe damage to existing structures.

- Landslides/Debris Flows** occur as a result of horizontal seismic inertia forces induced in the slopes by ground shaking. The most common earthquake-induced landslides include shallow, disrupted landslides such as rock falls, rockslides, and soil slides. Debris flows are created when surface soil on steep slopes becomes completely saturated with water. Once the soil liquefies, it loses the ability to hold together and can flow downhill at very high speeds, taking vegetation and/or structures with it. Slide risks increase after an earthquake during a wet winter.

The severity of an earthquake can be expressed in terms of intensity and M. Intensity is based on the damage and observed effects on people and the natural and built environment. It varies from place to place depending on the location with respect to the earthquake rupture (where the fault moved). While the area directly above the rupture usually experiences the most intense earthquake effects (e.g., shaking), the total area affected can cover hundreds of thousands of square miles, depending on the earthquake’s M.

Larger earthquakes are less common than smaller earthquakes, such that the smallest earthquakes are extremely frequent, while the largest earthquakes are relatively infrequent.

Earthquakes are also classified by their felt effects (e.g., perceived shaking intensity). However, the effects of an earthquake are directly related to the distance from the earthquake rupture, among other parameters such as the type of crust where the earthquake occurs. In general, the closer one is to an earthquake’s epicenter, the more severe the felt effects and damage will be. An earthquake’s intensity is described by the Modified Mercalli Intensity (MMI) Scale. As shown in Table 4, the MMI Scale consists of 10 increasing levels of intensity that range from imperceptible to catastrophic destruction. Peak ground acceleration (PGA) is also used to measure earthquake intensity by quantifying how hard the earth shakes in a given location. PGA can be measured as acceleration due to gravity (g) (MMI, 2006).

Table 4. Perceived Shaking, Potential Damage, and Peak Ground Acceleration

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
PEAK VEL.(cm/s)	<0.02	0.1	1.4	4.7	9.6	20	41	86	>178
MMI scale	I	II-III	IV	V	VI	VII	VIII	IX	X+

M is the measure of the earthquake’s strength and is related to the amount of seismic energy released at the earthquake’s hypocenter, the actual location of the energy released inside the earth. It is based on the amplitude of the earthquake waves recorded on instruments, known as the Richter magnitude test scales, which have a common calibration.

5.3.2.2 History

The KPB is subject to numerous earthquake events of varying magnitudes. Several fault lines traverse the KPB, including the Lake Clark Fault, Bruin Bay Fault, Sterling Fault, Border Ranges Fault, and Eagle River Fault. The region’s tectonic activity, documented back to 1933, includes 258 earthquakes centered within the KPB that registered over a M of 4.5 (FEMAj, 2017).

A 7.1 earthquake with an epicenter north of Anchorage on November 30, 2018 damaged some City facilities. Damage was not as extensive as that in the Municipality of Anchorage or the Matanuska-Susitna Borough since the epicenter was farther away from Kenai. The Kenai City Dock was damaged with structural cracks in the concrete. Well House #1 and the building surrounding the well house were damaged. A water main break in a residential neighborhood resulting from the earthquake about a week after its occurrence was fixed by the City’s Public Works Department.

One of the largest earthquake events in the KPB region occurred 53 miles west of Anchor Point on January 24, 2016, with a M of 7.1. This earthquake, referred to as the 2016 Old Iliamna Earthquake, occurred 123.4 kilometers below ground, approximately 54 miles west of Anchor Point. It was reported that the shaking could be felt from Fairbanks to Juneau. The earthquake caused immediate regionwide power outages, gas leaks, and fires, which destroyed four homes. Additionally, businesses reported damaged merchandise, and the Kalifornsky Beach Road dropped down a foot, creating a 150-foot-long-crack. The Red Cross provided shelters for those whose homes were damaged, and for residents unable to return home due to closed roads. No fatalities were reported, and the structural damage was minimal.

As a result of the 2016 Old Iliamna Earthquake, the City felt the greatest impact when a gas line broke on Lilac Lane and released 406,000 cubic feet of natural gas (KBBI, 2016). The Pipeline and Hazardous Materials Safety Administration and the Regulatory Commission of Alaska didn’t cite any corrosion or pre-existing problem with the line. There were two house explosions, and a fire claimed two more, resulting in a total of four homes on Lilac Lane being completely destroyed. Lindsay Hobson, a spokeswoman for Enstar Natural Gas, stated, “But for the earthquake, there wouldn’t have been any damage to the line at all. The earthquake moved the line, and we had the resulting release of gas.”

Since 1931, 27 earthquakes have been recorded with a M of 5.0 or greater within a 50-mile radius of the approximate center of the City (60.559454° N, 151.233000° W) (Table 5).

Table 5. Historical Earthquakes within a 50-Mile Radius of the Approximate Center of the City

Date	Latitude	Longitude	Depth	M	Place
2017-05-30	60.8341	-151.8152	81.2	5.2	33km WNW of Nikiski, Alaska
2017-05-07	60.1828	-151.6783	67.2	5.3	29km SW of Cohoe, Alaska
2014-05-10	60.0101	-152.126	89.1	5.8	30km NNW of Anchor Point, Alaska
2012-12-04	61.24	-150.7682	63.7	5.8	Southern Alaska
2011-06-16	60.7649	-151.076	58.9	5.1	Kenai Peninsula, Alaska
2009-08-19	61.2279	-150.8579	66.4	5.1	Southern Alaska
2004-05-30	61.056	-152.2015	124.9	5.3	Southern Alaska
2004-03-05	60.5023	-151.64	61.7	5	Kenai Peninsula, Alaska
2001-01-25	60.114	-152.363	86.9	5.5	Southern Alaska
1999-04-18	60.387	-151.852	73.4	5.3	Kenai Peninsula, Alaska
1995-05-24	61.007	-150.119	41.8	5.6	Southern Alaska
1994-04-25	60.899	-151.142	67.9	5.4	Kenai Peninsula, Alaska
1991-12-07	60.954	-150.344	50.9	5.2	Kenai Peninsula, Alaska
1990-08-13	60.115	-152.006	87.6	5.5	Southern Alaska
1990-03-09	60.307	-152.286	84.9	5.3	Southern Alaska
1984-04-18	60.833	-152.067	95	5.1	Southern Alaska
1971-06-02	61.055	-151.147	29	5	Southern Alaska
1960-06-30	60.3	-150.9	55	5.9	Kenai Peninsula, Alaska

1958-11-19	60.46	-150.91	46	5.9	Kenai Peninsula, Alaska
1958-01-24	60.16	-151.76	52	6.4	Kenai Peninsula, Alaska
1954-10-03	60.651	-150.392	61.5	6.4	Kenai Peninsula, Alaska
1941-07-30	60.927	-151.033	35	6.4	Kenai Peninsula, Alaska
1940-10-11	60	-150.5		6	Kenai Peninsula, Alaska
1934-06-18	60.855	-151.316	15	6	Kenai Peninsula, Alaska
1933-06-13	61	-151		6.25	Southern Alaska
1933-04-27	61.131	-151.004	15	6.8	Southern Alaska
1931-12-24	60	-152	100	6.25	Kenai Peninsula, Alaska

5.3.2.3 Location, Extent, Impact, and Recurrence Probability

Location

The Uniform Building Code rates the entire state of Alaska in Earthquake Zone 4, the highest hazard level. Figure 2 shows the locations of active and potentially active faults in Alaska. Approximately 75% of Alaska’s detected earthquakes occur in the Alaska Peninsula, Aleutian, Cook Inlet, and Anchorage areas. About 15% occur in Southeast Alaska, and the remaining 10% occur in the Interior. The greatest earthquake in North American history occurred in the Alaska-Aleutian Seismic zone. That earthquake was a M of 9.2, lasting between four and five minutes and was felt over a 7,000,000 square mile area. The megathrust zone where the North Pacific Plate plunges beneath the North American Plate still has the potential to generate earthquakes up to a M of 9.

Extent

Although Southcentral Alaska is in a high seismic risk zone, the City was relatively undamaged in the 1964 Great Alaska Earthquake; however, the potential for seismic events remains high.

“Alaska has changed significantly since the damaging 1964 earthquake, and the population has more than doubled. Many new buildings are designed to withstand intense shaking; some older buildings have been reinforced, and development has been discouraged in some particularly hazardous areas.

Despite these precautions, and because practices to reduce vulnerability to earthquakes are not applied consistently in regions of high risk, future earthquakes may still cause life-threatening damage to buildings, cause items within buildings to be dangerously tossed about, and disrupt basic utilities and critical facilities.

FEMA estimates that with the present infrastructure and policies, Alaska will have the second highest average annualized earthquake-loss ratio (ratio of average annual losses to infrastructure) in the country. Reducing those losses requires public commitment to earthquake-conscious siting, design, and construction. The Seismic Hazards Safety Commission is committed to addressing these issues. Earthquake-risk mitigation measures developed by similar boards in other states have prevented hundreds of millions of dollars in losses and significant reductions in casualties when compared to other seismically active areas of the world that do not implement effective mitigation measures. The San Francisco (1989), Northridge (1994), and Nisqually (2001) earthquakes caused comparatively low losses as a result of

mitigation measures implemented in those areas. Many of these measures were recommended by the states' seismic safety commissions."

Source: HAZUS 99 Estimated Annualized Earthquake Losses for the U.S., FEMA Report 66. September 2000. Via DHS&EM, 2018a.

Figure 2. Active and Potentially Active Faults in Alaska



Impact

Two earthquake risk assessments were performed by FEMA using multi-hazard software (HAZUS) (FEMAj, 2017). The first assessment used a U.S. Geological Survey (USGS) ShakeMap created from the January 2016 M 7.1 Old Iliamna earthquake event and provides an estimate of expected earthquake losses. The second assessment simulated the 1964 Great Alaska Earthquake with a M of 9.2 (using a USGS-developed shaking scenario) to predict losses if the event were to happen in 2017. The results for the City are summarized in Table 6. See Table 7 for a detailed breakout of impacted facilities for the City.

Table 6. Hazus Earthquake Results for M7.1 and M9.2 Earthquakes in the City of Kenai

Total Estimated Value of Improved Parcels	Total Number of Improved Parcels	M 7.1 Event		M 9.2 Event	
		Total Dollar Loss	Loss Ratio (Dollar Losses/Total Value)	Total Dollar Loss	Loss Ratio (Dollar Losses/Total Value)
\$1,525,005,650	3,652	\$2,482,040	0.16%	\$52,539,885	3.45%

Recurrence Probability

While it is not possible to predict an earthquake, the USGS has developed Earthquake Probability Maps that use the most recent earthquake rate and probability models. These

models are derived from earthquake rate, location, and M data as well as from mapping of active faults, from the USGS National Seismic Hazard Mapping Project.

Table 7. FEMA RiskMap Identified Areas of Mitigation Interest

Category	Name	Total Value (Building and Contents)	Estimated Loss from M9.2 Earthquake	M9.2 Earthquake Loss Ratio
Water Treatment Facility	Kenai Wastewater Treatment Facility	\$14,625,200	\$453,829	3.1%
School	Kenai Central High School*	\$115,594,200	\$4,971,042	4.3%
School	Kenai Middle School*	\$46,243,200	\$1,988,654	4.3%
City Office	Kenai City Hall	\$3,279,950	\$123,822	3.78%
Fire Station	Kenai Fire Department	\$3,279,950	\$123,822	3.78%
City Office	Kenai Fire Department	\$3,279,950	\$123,822	3.78%
Police Station	Kenai Police Station	\$3,279,950	\$123,822	3.78%
Emergency Shelter	LDS Chapel	\$3,459,400	\$129,867	3.75%
Emergency Shelter	Kaleidoscope Charter School	\$20,886,600	\$783,338	3.75%
Federal Office	U.S. Army Corps of Engineers' Kenai Field Office	\$879,600	\$32,401	3.68%
Park	Beaver Creek Park	\$15,800	\$552	3.49%
School	Mountain View Elementary*	\$27,087,400	\$942,826	3.48%

Note: Hazards are considered identified if the following applies:

1. Earthquake: Subject has a M 9.2 Earthquake Loss Ratio greater than 3.48%.

* Facility is also a designated Emergency Shelter.

The results of each code type are summarized in Table 8.

Table 8. Moderate- and High-Code Buildings in the City of Kenai

Total Moderate-Code Buildings	Percent Moderate-Code Buildings	Total High-Code Buildings	Percent High-Code Buildings	Total Number of Buildings
1,077	29.49%	2,575	70.51%	3,652

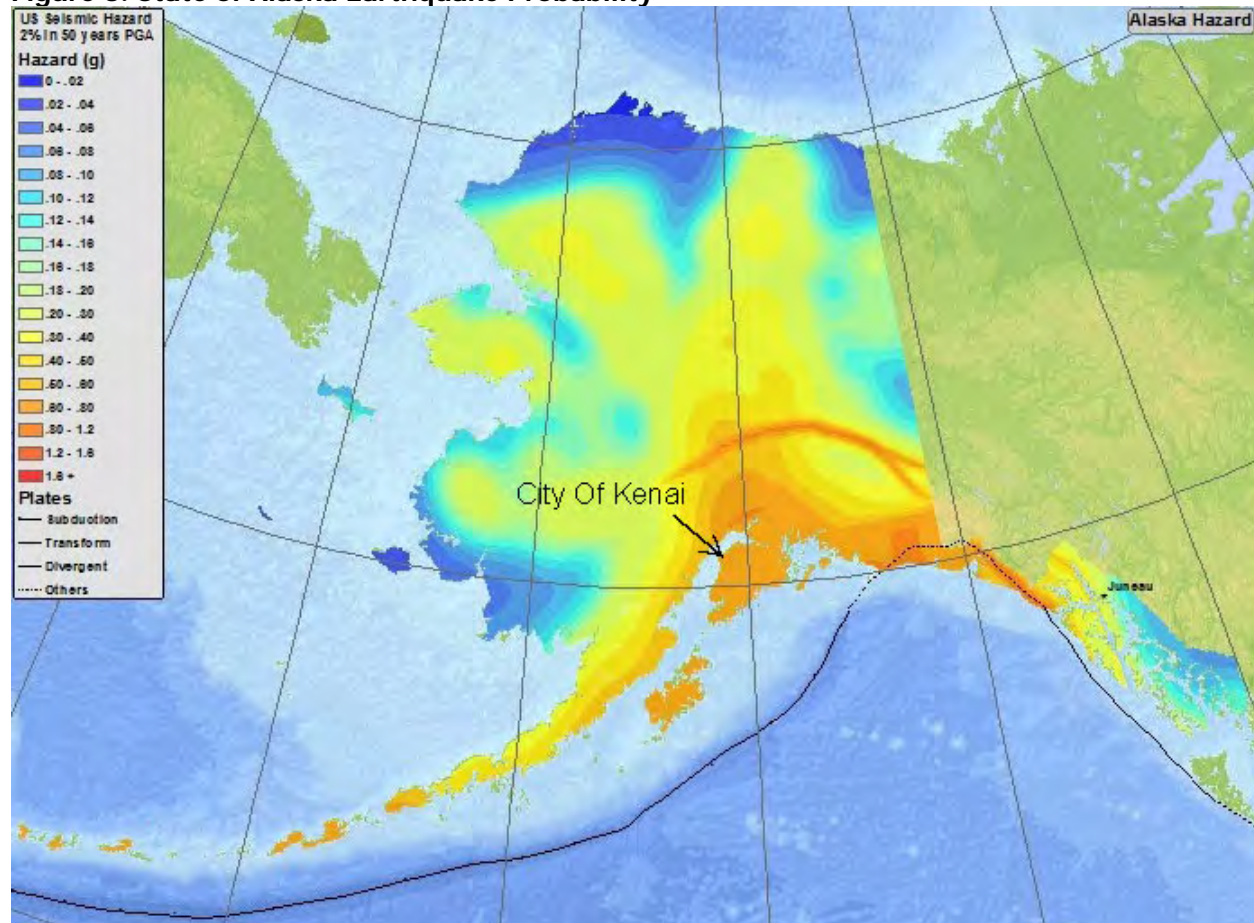
Notes: 1. Pre-code buildings were built before 1941, without a wooden frame.

2. Moderate-code means buildings were constructed after 1941, but with a wood frame and may include some earthquake building components.

3. High-code means buildings built after 1975.

The measure of peak ground acceleration is relative to the acceleration due to gravity (1 g). At 1 g vertical acceleration, objects will be lofted off the ground as it moves down, and then experience twice their own weight when the ground moves up. One g of horizontal acceleration will make flat ground feel as though it is sloped at 45 degrees – steep enough that most things would fall. Figure 3 indicates that the USGS earthquake probability model places the probability of an earthquake in the City of Kenai with a likelihood of experiencing severe shaking (0.60g to 0.80g peak ground acceleration) at a 2% probability in 50 years, based on the USGS Alaska hazard model. A 2% probability in 50 years is the rare, large earthquake, and statistically, it happens on average every 2,500 years.

Figure 3. State of Alaska Earthquake Probability



5.3.3 Flood and Erosion

5.3.3.1 Hazard Characteristics

Floods

Approximately 6,600 miles of Alaska’s coastline and many low-lying areas along Alaska’s riverbanks are subject to severe flooding and erosion. The U.S. Government Accountability Office reported in 2003 that flooding and erosion affect 184 out of 213 (86%) of Alaska Native villages. Many of the problems are long-standing, although studies indicate that increased flooding and erosion are being caused in part by changes in the cryosphere (DHS&EM, 2018a).

Flooding is the overflow of excess water from a stream, river, lake, reservoir, glacier, or coastal body of water onto adjacent floodplains or normally dry land. Floodplains are lowlands adjacent to water bodies that are subject to recurring floods. Floods are natural events that are considered hazards only when people and property are affected. Flooding is Alaska’s most common disaster, often costing in excess of one million dollars annually, causing major disruptions to society and occasionally loss of life (DHS&EM, 2018a).

Many floods are predictable based on rainfall patterns. In the City, most of the annual precipitation is received from August through October with September being the wettest. This rainfall leads to flooding in winter. Spring snowmelt increases runoff, which can cause flooding.

To develop flood predictions, the National Weather Service (NWS) and DHS&EM operate a flood-forecasting network in the most populated parts of Alaska (River Watch), including the KPB. Predictions are also difficult for many of the smaller rivers because of the short time span between when the precipitation occurs and the flooding starts.

Erosion

Erosion is the action of surface processes (such as water) that remove soil, rock, or dissolved material from one location and transport it to another location. Erosion can be gradual or occur quite quickly as the result of a flash flood, storm, or other event. Most of the geomorphic change to a river system is due to peak flow events that can dramatically increase the erosion rate. Erosion is a problem in developed areas where disappearing land threatens development and infrastructure (DHS&EM, 2018a). Erosion rarely causes death or injury. However, erosion causes the destruction of property, development, and infrastructure. There are three main types of erosion that affect human activity in the City:

- Coastal erosion;
- Riverine erosion; and
- Wind erosion.

Coastal and Riverine Erosion

Coastal erosion is the wearing away of coastal land. This term is commonly used to describe the horizontal retreat of the shoreline along the ocean, or the vertical down cutting along the shores. Erosion is considered a function of larger processes of shoreline change, which includes erosion and accretion. Erosion results when more sediment is lost along a particular shoreline than is redeposited by the water body. Accretion results when more sediment is deposited along a particular shoreline than is lost. When these two processes are balanced, the shoreline is stable. Some erosion is related to redistributing sediment on a beach; moving sediment from bluffs to sand flats, especially under the influence of sea-level rise. In assessing the erosion hazard, it is important to realize that there is a temporal, or time aspect associated with the average rate at which a shoreline is either eroding or accreting. Over a long-term period (years), a shoreline is considered to be eroding, accreting, or stable. A hazard evaluation should focus on the long-term erosion situation. However, in the short-term, it is important to understand that storms can erode a shoreline that is, over the long-term, classified as accreting, and vice versa.

Riverine erosion results from the force of flowing water into and adjacent to river channels. This erosion affects the bed and banks of the channel and can alter or preclude any channel navigation or riverbank development. In less stable braided channel breaches, erosion and deposition of materials are a constant issue. In more stable meandering channels, episodes of erosion may occur occasionally.

Erosion is measured as a rate, with respect to either a linear retreat (i.e., feet of shoreline recession per year) or volumetric loss (i.e., cubic yards of eroded sediment per linear foot of shoreline frontage per year). Erosion rates are not uniform, and vary both over time at any single location and at any given time along the coast. Annual variations are the result of seasonal changes in wave action and water levels.

Erosion is caused by coastal storms and flood events; changes in the geometry of tidal inlets, river outlets, and bay entrances; man-made structures and human activities such as shore protection structures and dredging; and local scour around buildings and other structures. Major erosion occurs when there is a high tide and large storm waves that carry away the base material of the bluff making the slopes steeper. These steeper slopes are more susceptible to erosion by wind and surface or groundwater.

Wind Erosion

Wind erosion is when wind is responsible for the removal, movement, and redepositing of land. It occurs when soils are exposed to high-velocity wind. The wind will pick up the soil and carry it away. The wind moves soil particles 0.1-0.5 millimeters (mm) in size in a hopping or bouncing fashion (known as saltation) and those greater than 0.5 mm by rolling (known as soil creep). The finest particles (less than 0.1 mm) 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. Loess, deposits of silt laid down by wind action, can reduce visibility causing automobile accidents, hinder machinery, and have a negative effect on air and water quality, creating animal and human health concerns. Wind erosion also causes damage to public utilities and infrastructure.

Combined Coastal, Riverine, and Wind Erosion

Most of the City is unaffected by erosion. The City's Historic District and residential areas adjacent to the Kenai Bluffs have been affected by coastal erosion. The City has lost land and structures due to the erosion. Roads have been abandoned, and sewer mains relocated. In 2000, a sewer line was relocated due to the erosion on Mission Street. The relocation of the line and subsequent roadwork was in excess of \$300,000; repairs were funded using the State of Alaska Capital Improvements program.

An example of coastal, riverine, and wind erosion working together is represented in Figure 4 on the Kenai Bluffs. The Kenai Bluffs are 5,000 linear feet of bluff (high bank) located in the City along the north bank of the Kenai River at the mouth to Cook Inlet (see Figure 5). Figures 6 and 7 show photographs taken in 2018 with the erosive forces labeled.

The Kenai Bluffs height ranges between 55 to 70 feet, and the bluff face is receding at an average rate of three feet per year. A review of aerial photographs that extended over a 56-year period of record indicate that the erosion rate ranges from two to four feet per year. The erosion is episodic, and the amount of bluff loss at any particular location can vary from chronic to an acute large loss of bluff face over a short period. Public and private property, structures and infrastructure, and cultural resources have been lost and continue to be threatened by the receding bluff. The bluff consists of unconsolidated sediments that remain unstable because it is exposed to Cook Inlet coastal storms and extreme floodtides that have the fourth largest range in the world of 31.4 feet. Tidal currents and wave action during flood tides attack the toe of the bluff, removing sediments that originate from the bluff face and accumulate at its toe. Coastal storms also degrade the structural integrity of the exposed lower bluff face. In order for the bluff to stabilize, an effective structural project alternative will

Figure 4. Erosion Mechanism Schematic

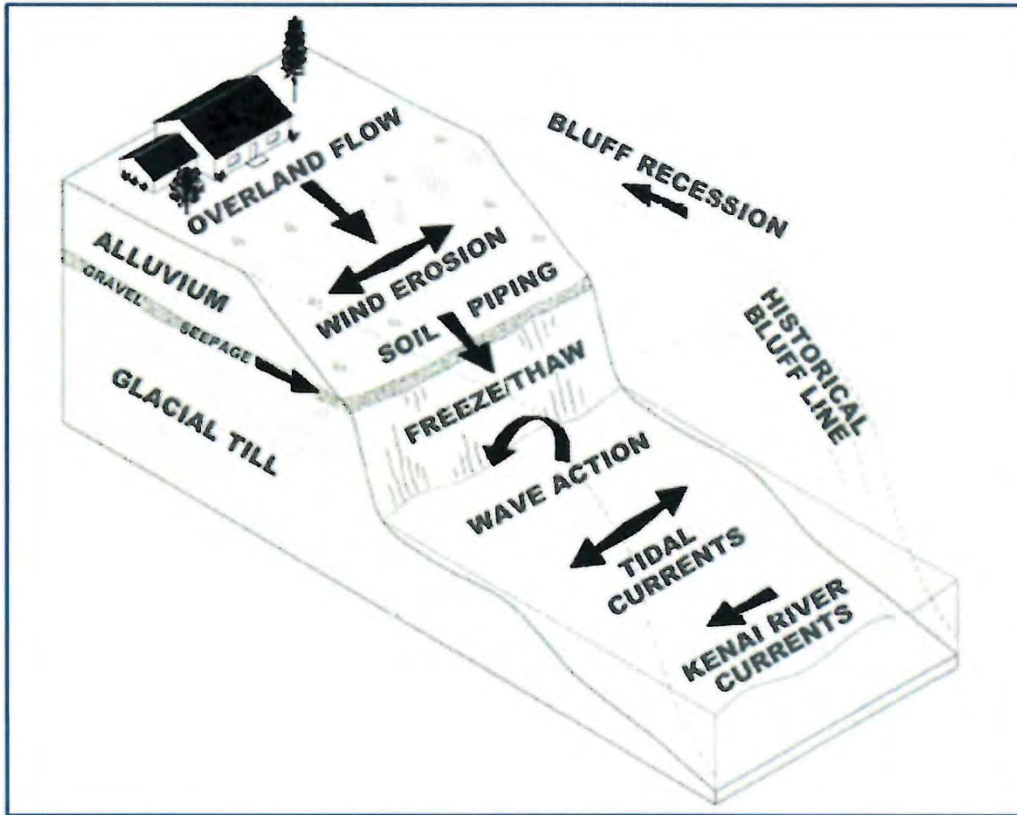


Figure 5. Kenai Bluffs Location

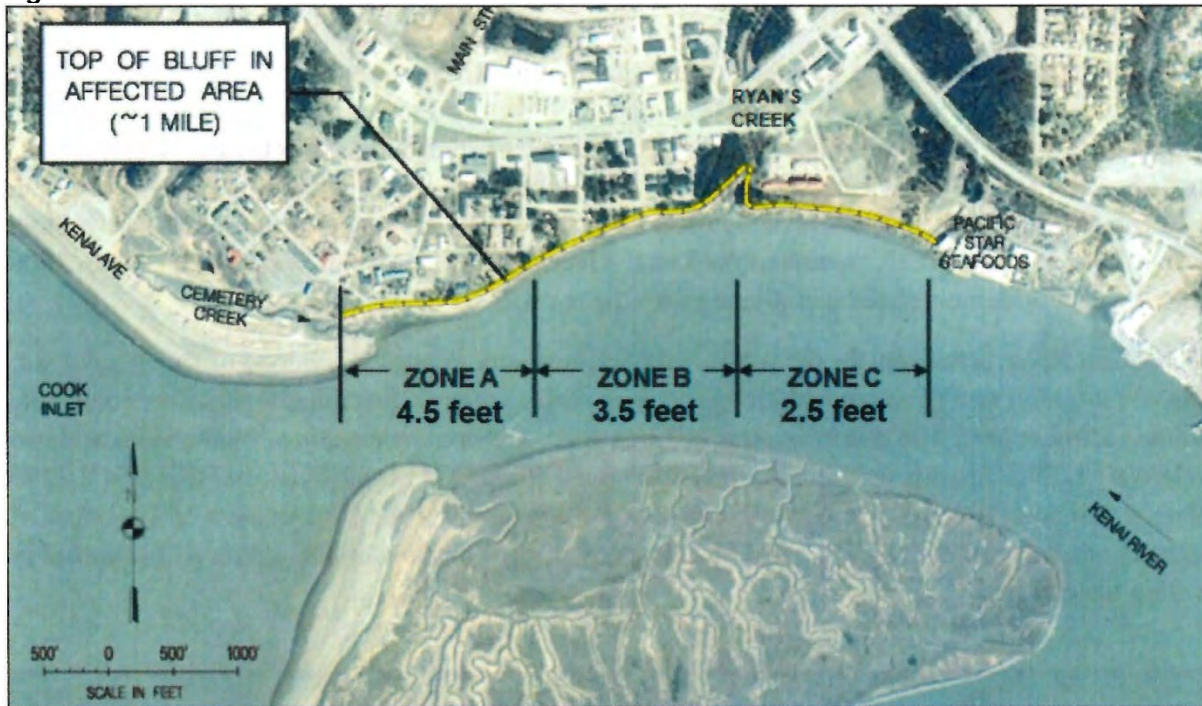


Figure 6. Kenai Bluffs Eroded Surface

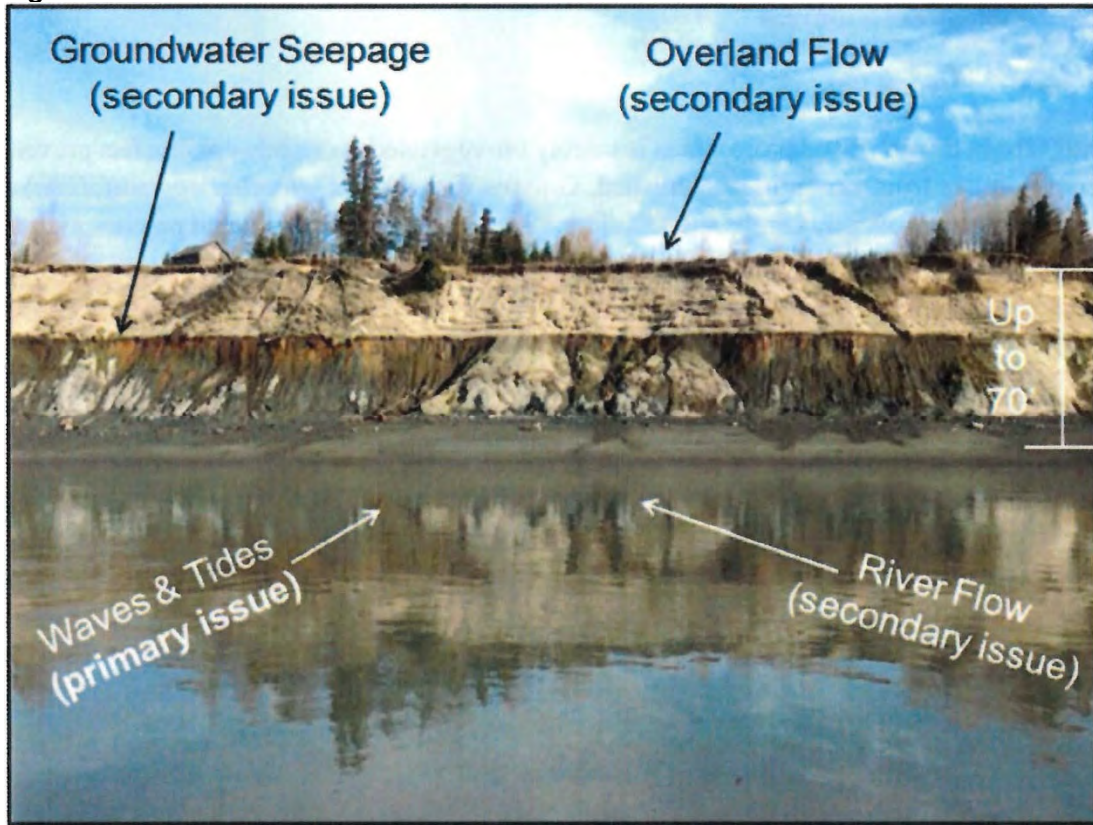


Figure 7. Storm Event at Kenai Bluffs



need to prevent the removal of accumulated sediment at the bluff and the structural damage of the lower bluff. The USACE completed a feasibility study in November 2018 that recommended a protective berm at the bluff toe. This Bluff Stabilization project includes constructing a berm at the bluff toe that is designed to prevent the removal of accumulated sediment between the bluff toe and the berm and prevent storm damages to the lower portion of the bluff. With the bluff toe protection in place, it will eventually stabilize, and the bluff surface will erode back naturally to a more stable slope, which is estimated to take up to 15 years (USACE, 2018). The City supports this option and is pursuing the design phase of this project.

In 2009, the City of Kenai added permanent fencing to the north beach dunes to help prevent bluff erosion. The fencing helped ensure that man-made destruction of vegetation did not compromise the integrity of the dunes. A similar fencing project was completed in the summer of 2010 on the south beach. The dunes were at risk of destruction from the annual personal use dipnet fishery if the fencing was not installed. The fencing fulfilled its purpose.

Erosion on the Kenai River, predominantly outside the City, is of great concern to resource management agencies because the increased sedimentation and loss of streamside cover associated with acceleration rates may threaten salmon returns to the river. The City's gross revenue from the 2019 personal use salmon fishery on the Kenai River was expected to be \$416,000.

5.3.3.2 Climate Factors

Climate and weather are the two primary drivers of flooding and erosion in Alaska. Weather (i.e., the day-to-day state of the atmosphere) affects these hazards in the short-term with individual episodes of rainfall, wind, and temperature that initiate or intensify individual episodes of flooding or erosion. Climate is affecting the long-term incident rate and severity of these hazards, especially in Alaska, which is particularly vulnerable due to its high northern latitude and the unique importance of snow, ice, and permafrost.

5.3.3.3 Flood and Erosion History

The City has two flood and erosion events in the DHS&EM Disaster Cost Index (DHS&EM, 2018b). These events are listed below.

96-180. Southcentral Fall Floods declared September 21, 1995 by Governor Knowles, then FEMA declared (DR-1072) on October 13, 1996: Record rainfall in Southcentral Alaska caused widespread flooding in the KPB, Matanuska-Susitna Borough, and the Municipality of Anchorage. On September 29, 1995, the Governor amended the original declaration to include Chugach, and the Copper River Regional Education Attendance areas, including the communities of Whittier and Cordova, and the Richardson, Copper River, and Edgerton Highway areas which suffered severe damage to numerous personal residences, flooding, eroding of public roadways, destruction and significant damage to bridges, flood control dikes and levees, water and sewer facilities, power, and harbor facilities. On October 13, 1995, the President declared this event as a major disaster under the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Individual Assistance totaled \$699K for 190 applicants. Public

assistance totaled \$7.97 million for 21 applicants with 140 DSRs. Hazard mitigation totaled \$1.2 million. The total for this disaster was \$10.5 million.

The City of Kenai mobilized City boats, vehicles, and safety equipment to intercept and extract huge quantities of debris such as docks, sheds, large liquefied petroleum gas tanks, fuels storage tanks, and damaged boats from the Kenai River before this debris caused further property damage and before it could flow into Cook Inlet shipping lanes.

13-F-243. 2013 October KPB Flood Disaster declared by Governor Parnell on November 18, 2013, then FEMA declared January 16, 2014 (DR-4161): Beginning October 27, 2013, the KPB received substantial amounts of rain following several weather systems that had previously inundated low-lying areas. On October 26, the NWS issued a flood watch for areas around Western Prince William Sound due to a slow-moving system which brought widespread rainfall to the mainland. The forecast called for local amounts in excess of five inches of rain. Seward, Homer, and other areas of the KPB received heavy rain and flooding which caused landslides, bridge, and airport and road closures. Damages were reported in Seward, Homer, Kenai, Anchor Point, and the Tyonek area along Beluga Road. Flood damages affecting many individual homes were reported, and several businesses were also impacted.

5.3.3.4 Location, Extent, Impact, and Recurrence Probability

Location

Figure 8 is from the 2010 City Annex to the KPB HMP and shows estimated Kenai Bluff Erosion to 2057 (City, 2010). The 2017 FEMA RiskMap study did not identify any areas of concern for the City with regards to flooding (FEMAj, 2017).

The City has experienced significant erosion. Figure 9 displays a coastal erosion rate along Cook Inlet near the City. Shorelines were compiled from three different time periods in the 1950s, 1960s, and 2000s used for the 2017 Risk Report analysis.

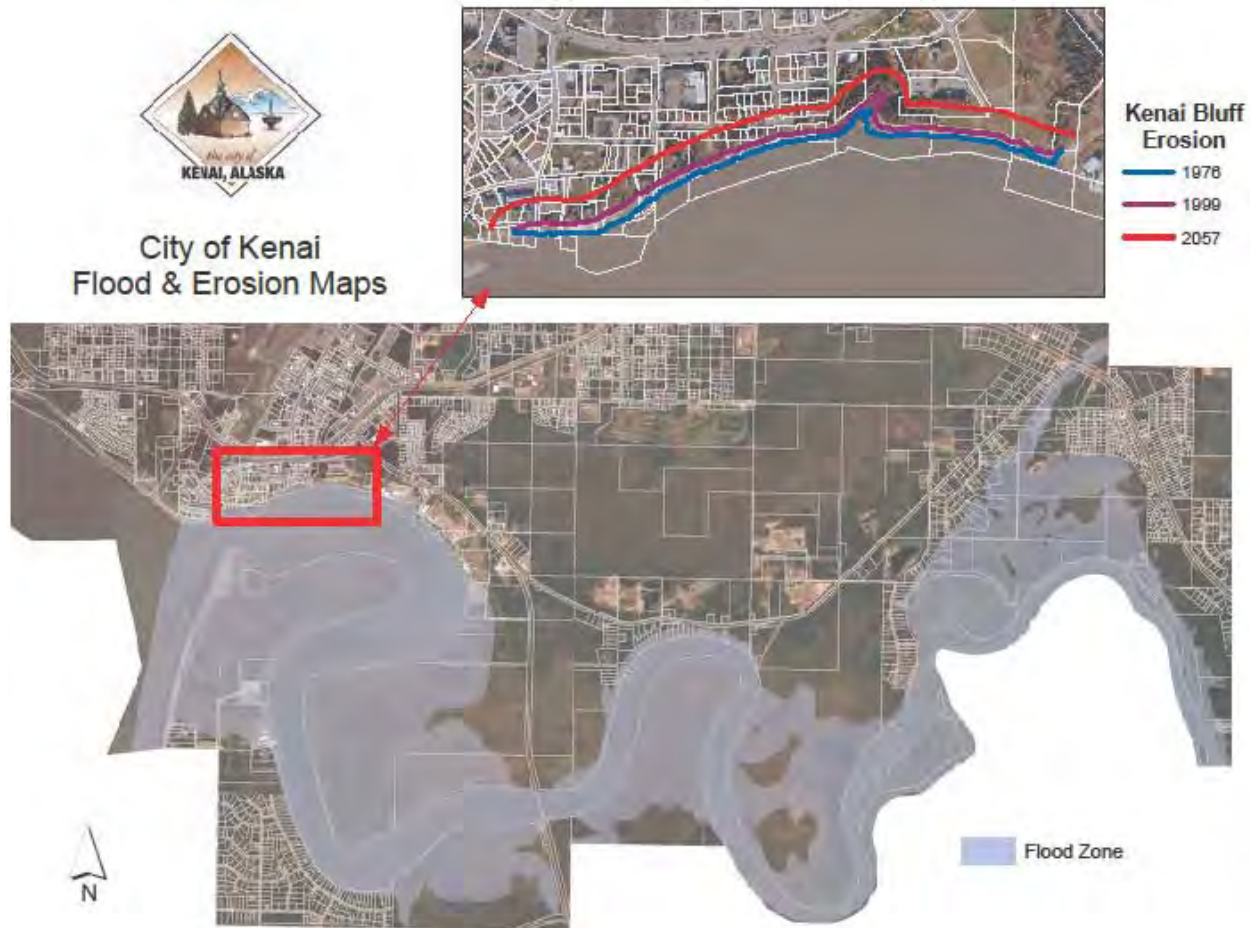
It is important to note that the Kenai Bluffs are not limited to the mile-long stretch of the Kenai River mouth encompassed by the USACE study, but also in the broader area of the Kenai River mouth that has become so heavily involved in the personal use dip-net fishery. Bluff erosion in this broader area has been significantly affected by the human impacts of this fishery itself and by the impacts of increased use of the beach year-round. There are three distinct areas at the mouth of the Kenai River affected by bluff erosion:

- The mile-long stretch of river encompassed by the USACE study;
- The dunes on the north and south beaches, which protect against bluff erosion and which need protection themselves; and
- The sheer bluff on the north beach parallel to Toyon Way, which is unprotected by dunes or anything else.

Extent

A variety of natural and human-induced factors influence the erosion process. River orientation and proximity to up and downstream river bends can influence erosion rates. Embankment

Figure 8. Kenai Bluffs Erosion



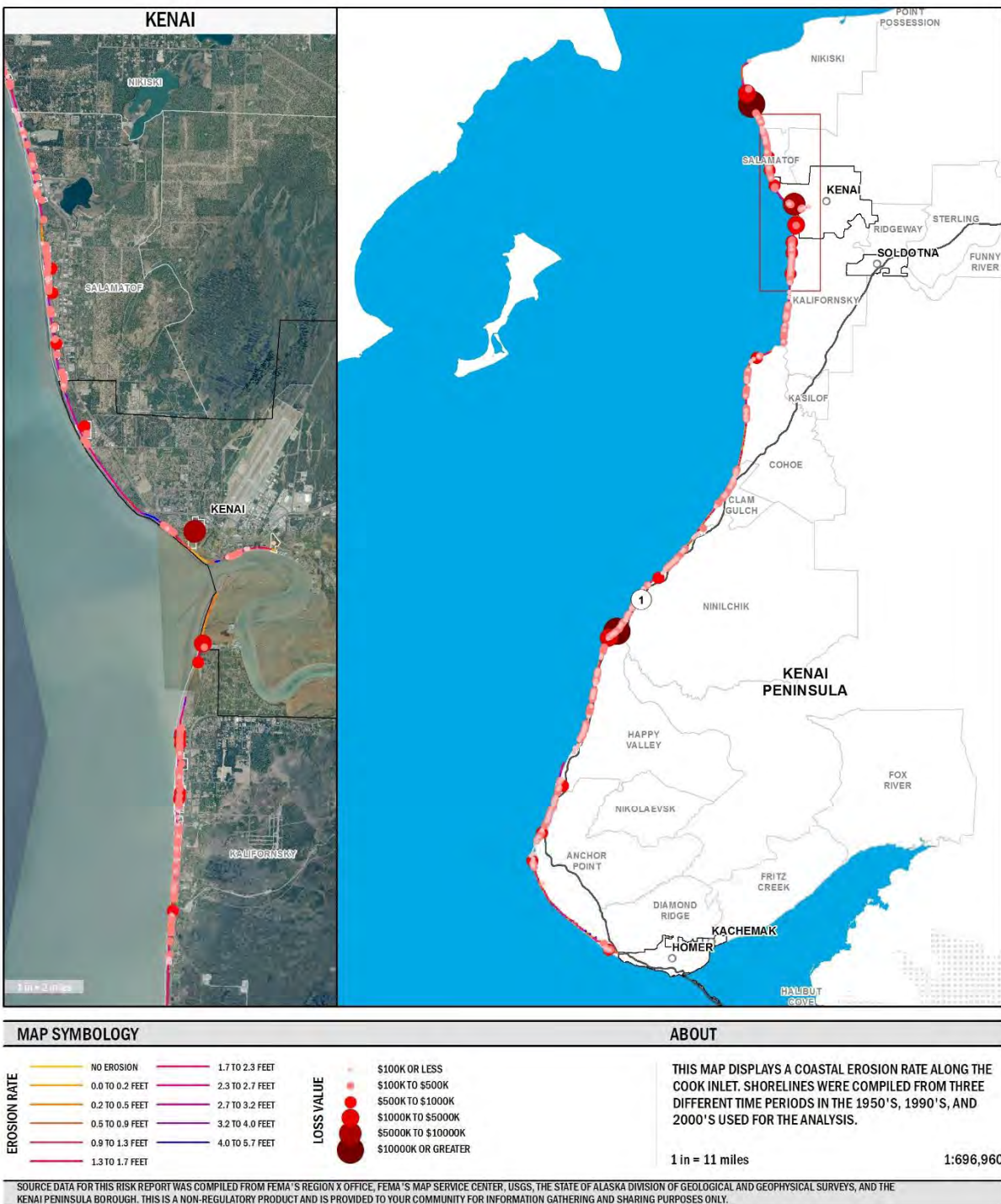
composition also influences erosion rates, as sand and silt erode easily, whereas boulders or large rocks are more erosion-resistant. Other factors that may influence erosion include:

- Geomorphology;
- Amount of encroachment in the high hazard zone;
- Proximity to erosion inducing structures;
- Nature of the topography;
- Density of development;
- Structure types along the embankment; and
- Embankment elevation.

The various erosion mechanisms acting on the Kenai Bluffs include:

- Wind scour;
- Groundwater seepage and piping;
- Overland flow over the bluff;

Figure 9. Kenai Coastal Erosion



- Freeze thaw cycles; and
- Wave action and currents at the toe of the bluff.

Impact

The ongoing condition of the receding Kenai Bluffs has resulted in:

- Lost land to the sea: commercial, municipal, non-profit (e.g., Kenai Bible Church built in 1940):
 - o 7 parcels have been completely lost;
 - o 18 parcels have suffered land loss; and
 - o Nearly all threatened parcels have lost value.
- Lost and damaged cultural resources (i.e., historical, potentially historical, and archeological sites):
 - o 4 historic wooden structures;
 - o Property of the historic Kenai Bible Church;
 - o Human remains have eroded out of the bluff; and
 - o Prehistoric house depressions have been lost or are exposed.
- Abandoned and/or condemned structures: residential, commercial, and municipal.
- Threatened structures and infrastructure: residential, commercial, non-profit, and municipal (e.g., Kenai Senior Center).
- Relocation of utilities and roads.

In addition, the ongoing receding Kenai Bluffs has had other negative impacts (i.e., other social effects) as listed below:

- Lack of development and investment in Old Town.
- Cultural vulnerability with local tribes and the local population.
- Under use of public-use areas by locals and tourists (e.g., scenic overlooks and nearby parks).
- Health and safety issues (The unstable bluff is preventing activities at the base and near the top edge of the bluff, although soft sediments on the beach area may continue to prevent activities at the base.).
- Negatively impacted social connectedness, identity, resiliency, leisure, and recreation.
- Contributes to uncertainty in community planning.

Recurrence Probability

Future populations of the City can expect to receive an increased number of erosion events due to greater moisture content in warmer air.

5.3.4 Volcanoes and Ashfall

5.3.4.1 *Hazard Characteristics*

Alaska is home to 41 historically active volcanoes stretching across the entire southern portion of the State from the Wrangell Mountains to the far Western Aleutians. An average of one to two eruptions per year occurs in Alaska. Figure 10 shows regional volcanoes located in the vicinity of the City.

Volcanic Ash

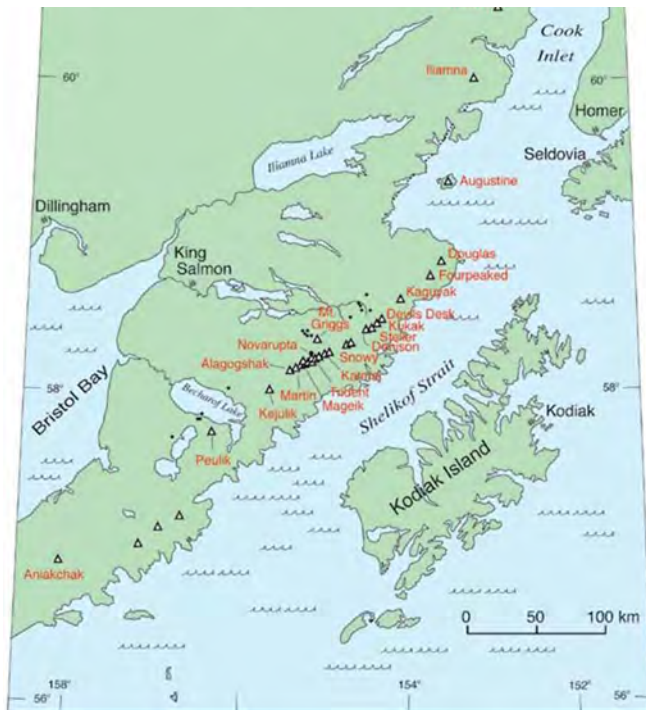
Volcanic ash, also called tephra, is fine fragments of solidified lava and rock crystals ejected into the air by a volcanic explosion. The fragments range in size, with the larger falling nearer the source. Ash is a problem near the source because of its high temperatures (may cause fires), burial (the weight can cause structural collapses; for example, it was 100 miles from Novarupta to Kodiak where structures collapsed), and impact of falling fragments. Further away, the primary hazard to humans is damage to machinery (including airplanes in flight), decreased visibility, and inhaling the fine ash (long-term inhalation can lead to lung cancer), but lightning in large ash clouds can also pose a hazard. In Alaska, this is a major problem as many of the major flight routes are near historically active volcanoes. Ash accumulation may also interfere with the distribution of electricity due to shorting of transformers and other electrical components (ash is an excellent conductor of electricity).

The largest volcanic eruption of the 20th century occurred at Novarupta Volcano in June 1912. The eruption started by generating an ash cloud that grew to thousands of miles wide during the three-day event. Within four hours of the eruption, ash started falling on Kodiak, darkening the City. It became hard to breathe because of the ash and sulfur dioxide gas. The water became undrinkable and unable to support aquatic life. Roofs collapsed under the weight of the ash. Some buildings were destroyed by ash avalanches while others burned after being struck by lightning from the ash cloud. Similar conditions could be found all over the area. Some villages ended up being abandoned, including Katmai and Savonoski Villages. The ash and acid rain also negatively affected animal and plant life. Large animals were blinded, and many starved because their food was eliminated.

5.3.4.2 *History*

The Alaska Volcano Observatory (AVO), which is a cooperative program of the USGS, Alaska Department of Natural Resources (DNR) Division of Geological and Geophysical Survey (DGGS), and the University of Alaska Fairbanks Geophysical Institute (UAF GI), monitors the seismic activity at 23 of Alaska's 41 active volcanoes in real time. In addition, satellite images of all Alaskan and Russian volcanoes are analyzed daily for evidence of ash plumes and elevated surface temperatures. Russian volcanoes are also a concern to Alaska as prevailing winds could carry large ash plumes from Kamchatka into Alaskan air space. AVO also researches the individual history of Alaska's active volcanoes and produces hazard assessment maps. The Alaska Tsunami Warning Center, located in Palmer, also monitors volcanic and earthquake activity throughout the Pacific region.

Figure 10. Regional Volcanos



The City has experienced volcanic ash in 1989, 1990, and 1992 from Mt. Redoubt and Mt. Spurr. These eruptions disrupted transportation and industry, particularly jet aircraft (Figure 11). Following the 1989-1990 eruptions, debris flows caused temporary closing of the Drift River Oil Terminal. A similar eruption event occurred again in 2009 affecting the offloading of 3.7 million gallons of crude oil from the oil terminal. The KPB received ashfall in 2009, but the wind direction spared the City. The Kenai Municipal Airport has an AVO tracking device, and no ash was present in 2009. Media reports, the KPB website, and the Kenai communications center, operated by the Kenai Police Department, adequately informed citizens of volcanic precautions. The City government took steps to minimize damage to vehicles, buildings, and

computer equipment. The City administration feels the above actions were more than adequate to mitigate potential damage from volcanic ash fallout to residential and commercial assets.

During the 1990 event, a KLM 747 jet aircraft, with 245 passengers and crew aboard, temporarily lost power in all four engines when it entered the volcanic plume. It would have crashed into the mountains had the crew not been able to restart their engines about 4,000 feet above ground.

Figure 11. Areas Affected by Ash Falls



5.3.4.3 *Location, Extent, Impact, and Recurrence Probability*

Location

Figure 11 illustrates the spread of ash fall which is dependent on wind direction.

Extent

The single greatest volcanic hazard in the City is airborne ash, fine fragments of rock blown high into the atmosphere during explosive volcanic eruptions. For any given eruption, the depth of ash deposited at any given location depends on the total volume of ash ejected, the wind direction, and the distance between the volcano and a given location.

Extreme ashfall events, similar to the 1912 event, would have similar extreme consequences including building damage up to and including collapses, disruption of travel (air, sea, land), disruption of water, electric power and communications, and health and environmental impacts. Smaller ashfall events would result in little or no building damage, but would still have significant impacts, including:

- Respiratory problems for at-risk populations such as young children, people with respiratory problems and the elderly;
- Disruption of air, marine, and land traffic;
- Clean-up and ash removal from roofs, gutters, sidewalks, roads, vehicles, mechanical systems and ductwork, engines, and mechanical equipment;
- Clogging of filters and possible severe damage to vehicle engines, furnaces, heat pumps, air conditioners, commercial and public buildings' combined heating,

- ventilation, and air conditioning (HVAC) systems and other engines and mechanical equipment;
- Disruption of public water supplies drawn from surface waters, including degradation of water quality (high turbidity) and increased maintenance requirements at water treatment plants;
 - Disruption/clogging of storm water drainage systems;
 - Disruption of electric power from ash-induced short circuits in distribution lines, transmission lines, and substations; and
 - Disruption of communications.

A major factor in determining ashfall is wind direction. Additionally, if there is a large ashfall, wind could blow and redistribute ashfall several times which would be a prolonged hazard.

Impact

The volcanic eruptions of 1989, 1990, 1992, and 2009 caused widespread distribution of ash over the central and southern peninsula and resulted in power outages and disruption of traffic. Volcanic ash nearly caused the greatest loss of life of any disaster event in Alaska.

Another impact of major ashfall is a breakdown of soil cover, accelerating erosion. This impact was seen on the flanks of Okmok in the eastern Aleutian Islands following the 2008 eruption. Former grasslands were cut with networks of deep, rapidly eroding gullies.

Ash fall from volcanic eruptions is a threat to health and to equipment that may draw in fine, abrasive particles. During times of high winds, these fine particles pose a significant health threat.

The City has experienced a few tenths of an inch of ashfall on residents' vehicles. Planes do not fly. People do not operate motorized equipment. Air quality is poor. The City's policy is for people to shelter in place in their homes.

Recurrence Probability

The recurrence probability for the future residents of the City would remain the same as for current residents.

5.3.5 Severe Weather

5.3.5.1 Hazard Characteristics

In contemporary usage, climate change commonly refers to the change in global or regional climate patterns that spans from the mid- to late 20th century to the present. Evidence collected by scientists and engineers from around the world tells an unambiguous story: the planet is warming. Climate change at high northern latitudes, such as Alaska, is causing rapid and severe environmental change.

Severe weather occurs throughout Alaska with extremes experienced by the City that include increasing high winds, winter storms, heavy and drifting snow, heavy rain/freezing rain/ice storms, and cold.

High Winds

High winds occur in Alaska when there are winter low-pressure systems in the North Pacific Ocean and the Gulf of Alaska. Alaska's high winds can equal cyclonic force. In Alaska, high winds (winds in excess of 60 mph) occur frequently over coastal areas along the Gulf of Alaska. They can also combine with loose snow to produce blizzards.

Localized downdrafts and downbursts are also common wind hazards. Downbursts are often generated by thunderstorms. Downbursts are areas of rapidly falling rain-cooled air. Upon reaching the ground, downbursts spread out in all directions in excess of 125 mph. Both types of wind, commonly lasting five to seven minutes, are hazardous to aviation. These winds reach hurricane force and have the potential to seriously damage community infrastructure (especially above ground utility lines) while disrupting vital marine transportation.

Winter Storms

Winter storms include a variety of phenomena described above and may include several components such as wind, snow, and ice storms. Ice storms include freezing rain, sleet, and hail and can be the most devastating of winter weather phenomena; often causing automobile accidents, power outages, and personal injury. Freezing rain coats every surface it falls on with an icy glaze. Freezing rain most commonly starts in a narrow band on the cold side of a warm front, where surface temperatures are at or just below freezing temperatures. Ice crystals high in the atmosphere grow by collecting water vapor molecules, sometimes supplied by evaporating cloud droplets. As the crystals fall, they encounter a layer of warm air where the particles melt and collapse into raindrops. As the raindrops approach the ground, they encounter a layer of cold air and cool to temperatures below freezing.

Heavy and Drifting Snow

Heavy snow generally means an accumulation of more than 12 to 24 inches of snow inside of 24 hours and often brings transportation to a stop. Airports and major roadways will close, disrupting supply flow and emergency response service access. Excessive accumulation will collapse roofs, knock down trees and power lines, damage parked light aircraft, and capsize small boats. Heavy snow increases flooding risks. Heavy snow is associated with vehicle accidents, overexertion, and hypothermia. Drifting is the uneven distribution of snowfall and snow depth caused by strong surface winds. Drifting snow may occur during or after a snowfall.

Heavy Rain/Freezing Rain/Ice Storm

Freezing rain and ice storms describe occasions when excessive ice accumulations are expected during a heavy rain event. They are a particularly hazardous winter weather phenomena and often cause numerous automobile accidents, power outages, and personal injury. Ice storms form from freezing rain and pass through a thin layer of cold air just above the ground and cool to below freezing. The drops remain in a liquid state until they impact a surface and freeze on contact. Ice accumulations can damage trees, utility poles, and communication towers which disrupts transportation, power, and communications.

Cold

The definition of extreme cold varies according to the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered “extreme”. In Alaska, extreme cold usually involves temperatures - 40 °F with additional wind chills. Excessive cold may accompany winter storms or can occur without storm activity during clear skies with high barometric pressure. Extreme cold accompanied by wind exacerbates exposure injuries such as frostbite and hypothermia.

Extreme cold interferes with infrastructure across Alaska for days or sometimes weeks at a time. Liquid fuels may congeal or freeze, denying motorized transportation, heat, and electricity generation. In desperation, some people choose to burn propane stoves indoors, increasing their risk to carbon monoxide poisoning. Aircraft may be grounded, delaying the resupply of food and emergency supplies.

5.3.5.2 Climate Change Influences

Increases in carbon dioxide, methane, and other gases in the atmosphere are generally warming and changing the climate worldwide by trapping heat that would have escaped back into space. Trees and other plants cannot absorb as much carbon dioxide through photosynthesis as is produced by burning fossil fuels. Therefore, carbon dioxide builds up and changes precipitation patterns, increases storms, wildfires, and flooding frequency and intensity; and substantially changes flora, fauna, fish, and wildlife habitats.

Alaska’s temperature rise rate has been twice the average of the rest of the U.S. in recent decades. During the period from 1949 to 2014, the Statewide average annual air temperature increased by 3°F, and the average winter temperature increased by 6°F (ACRC, 2018). This included considerable annual and regional variability, and was accompanied by a greater number of extremely warm days and fewer extremely cold days (CCSP, 2008). The Statewide average annual precipitation during this same period has increased by about 10%, with recent decades showing amounts largely above normal, but with substantial annual and regional variability (Shulski and Wendler, 2007, ACRC, 2018).

Global climate is projected to continue changing over this century, and changes to Alaska’s climate are expected to be unprecedented (Chapin et al, 2014). Average annual temperatures in Alaska are projected to rise by an additional 2°F to 4°F by 2050, and by 6°F to 12°F by the end of the century depending on emission levels (Stewart et al, 2013). Projections of annual

precipitation show an increase across Alaska as part of the broad pattern of increases projected for high northern latitudes.

Snow cover extent and depth have been decreasing in most places in Alaska for nearly three decades. Warmer winter temperatures change the precipitation frequency of snow and rain, and are producing more frequent rain-on-snow events.

5.3.5.3 History

The City of Kenai has a history of two windstorm events in the DHS&EM Disaster Cost Index (DHS&EM, 2018b). These events are listed below.

12-237. 2011 Kenai Peninsula Windstorm declared by Governor Parnell on December 12, 2011, then FEMA declared February 2, 2012 (DR-4054): On November 1, 12, 15, and 16, 2011, a series of major windstorms caused widespread power outages threatening life and property. Power was disrupted to 17,300 homes and businesses. Local utilities, Homer Electric Association and Chugach Electric, employed several work crews to restore power to the area. Public Infrastructure, commercial property, and personal property damages were reported in the metropolitan areas and throughout the borough. DHS&EM received local declarations from the KPB requesting state disaster assistance to cover immediate response, public, and individual costs. In the City of Kenai, pipes were frozen and burst at City Hall and Vintage Pointe facilities. The primary response by City personnel was to remove downed trees and debris from high winds, supply temporary power to critical facilities during the storm, and respond to burst pipes in buildings without power.

AK-17-262, 2017 December KPB Storm declared by Governor Walker on January 19, 2018, then FEMA declared on June 18, 2018 (DR-4369): On December 4, 2017, a fast-moving storm system moving northward out of the Gulf of Alaska brought widespread high winds to coastal areas on both the east and west sides of the KPB. In the Lower Cook Inlet area, this storm system created high winds gusting 30-40 mph, reaching a maximum wind speed of 58 mph, producing seven to ten-foot waves that impacted the Cook Inlet coastline from Homer to Kenai.

5.3.5.4 Location, Extent, Impact, and Recurrence Probability

Location

In the City, there is potential for weather disasters. High winds can topple trees, damage roofs and windows, and result in power outages. Heavy snow can cause power outages or collapse roofs of buildings. Storms can make travel difficult. Extreme weather is most prevalent during the winter with any combination of cold temperatures, strong winds, storm surge, and heavy snow.

Extent

Severe weather is a normal part of living in Alaska. However, sometimes the confluence of elements produces extreme conditions. Being prepared is the key to survival. Alternate forms of home heat and lighting, stored food, appropriate clothing, and advance planning are critical.

The most common forms of damage to structures as a result of severe wind includes loss of roofing materials, damage to doors and hinges, broken water lines due to freezing, fallen trees, structural failure of out-buildings, fallen or damaged exterior lights, flag poles, cell towers, and antennae. Overhanging signs on businesses and satellite dishes become airborne projectiles under certain conditions.

Heavy snow brings another set of damages. Structural deflection or collapse of structures is common. Deflection causes cracks or breakage of interior walls and finishes. Falling ice from roof eaves can knock out electric meters, damage vehicles, break windows, and threaten injury to passersby. Sliding snow can cause damages described above plus cause damage to roof mounted vents and other equipment. Wind packed snow and ice can block windows and emergency exits.

Impact

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. 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.

The most vulnerable City residents to any of the hazards of severe weather are the homeless who lack adequate shelter and those on fixed incomes who may not be able to adequately heat their homes.

Extreme weather also interferes with community infrastructure and its proper functions. It can cause fuel to congeal in storage tanks and supply lines, stopping electric power generation, which in turn causes heaters and furnaces to stop. Without electricity, heaters and furnaces do not work, causing water and sewer pipes to freeze or rupture. If extreme cold conditions are combined with low or no snow cover, the ground's frost depth can increase, disturbing buried pipes. The greatest danger from extreme cold is its effect on people. Prolonged exposure to the cold can cause frostbite or hypothermia and become life-threatening. Infants and elderly people are most susceptible. The risk of hypothermia due to exposure greatly increases during episodes of extreme cold, and carbon monoxide poisoning is possible as people use supplemental heating devices not intended for indoor use during extreme weather events.

While the scope, severity, and pace of future climate change impacts are difficult to predict, it is clear that potential changes could impact U.S. agencies' ability to fulfill their respective missions. The challenges posed by climate change, such as more intense storms, frequency of heavy precipitation, heat waves, drought, and extreme flooding could significantly alter the types and magnitudes of hazards faced by communities and the emergency management professionals serving them.

Recurrence Probability

Alaska will continue to experience diverse and seasonal weather events. Severe weather will occur annually in the City. Severe wind and rain are becoming more likely with climate change, while extreme snow and cold are becoming less likely.

5.3.6 Wildfire and Conflagration Fire

During the five-year period spanning 2013 through 2018, over 82 fire-related fatalities were recorded in Alaska. Since 2013, the State has declared over 3,077 fire-related emergencies or disasters (DHS&EM, 2018a).

For the purposes of profiling the hazard in Alaska, fires in this HMP are characterized by their primary fuel sources into two categories:

- Wildland fire, which consumes natural vegetation.
- Community fire conflagration, which propagates among structures and infrastructure.

While fire is critical for maintaining the viability of Alaska's ecosystems, it must be tempered with the need to protect human life and property. This is particularly true of fires burning in "wildland urban interface" areas, where structures and other human development meet or intermingle with undeveloped wildland. Wildland urban interface (WUI) has gained importance throughout Alaska with increased development adjacent to wildlands.

Urban conflagration is a large destructive fire that is widespread throughout an urban area or community involving one or more developed areas in the community. In contrast to the commonly destructive individual property fire, conflagrations frequently overwhelm resources and damage infrastructure.

Firefighter and public safety are the primary concern of each local fire response agency. In Alaska, thousands of acres burn every year in 300 to 800 fires, primarily between the months of March and October. According to the Alaska Interagency Coordination Center (AICC), Alaska lost 7,815,368 acres from 2013 to 2017. This figure consisted of the 2,408 wildland fires that started throughout that same time period. This is an average of 3,246 acres per wildland fire (DHS&EM, 2018a).

The KPB, including the City of Kenai, has experienced a regional spruce bark-beetle outbreak. Fire risk has also increased in recent years due to spruce bark beetle infestations which have affected both white and black spruce forest stands. Alaska's 10.25 million-acre KPB has experienced a regional spruce bark-beetle outbreak that peaked in 1996 and continues to spread to uninfected areas. Up to 2004, an estimated four million acres of spruce in southcentral Alaska have been affected. While spruce bark beetle outbreaks are natural events, the magnitude of spruce mortality during historic episodes was typically much less (20% to 30%) than the current infestation in which mortality rates exceeded 90% (KPB, 2006).

Dead and dying spruce trees present a wildfire hazard when standing because they can support intense, rapidly moving fires. These insect-killed trees also present a hazard after they have fallen because they can support very intense surface fires. Wildfire in either fuel type is very difficult for firefighters to control by direct attack.

5.3.6.1 Management in Alaska

In Alaska, fire management is the responsibility of three agencies: Alaska Department of Forestry (DOF), Bureau of Land Management (BLM) (through the Alaska Fire Service (AFS)), and U.S. Forest Service (USFS). See Figure 12. Each agency provides firefighting coverage for a portion of the State regardless of land ownership. These agencies have cooperated to develop a state-wide interagency wildland fire management plan. In the KPB, the DOF has the responsibility to manage fire response. In 2006, the City adopted a Community Wildfire Protection Plan for its entire acreage. The Alaska Interagency Fire Management Plan has mapped the City as Full.

5.3.6.2 Hazard Characteristics

A wildland fire is a type of wildfire that spreads through consumption of vegetation. It often begins unnoticed, spreads quickly, and is usually signaled by dense smoke that may be visible for miles around. Wildland fires can be caused by human activities (such as arson or unattended campfires) or by natural events such as lightning. Wildland fires often occur in forests or other areas with ample vegetation. In addition to wildland fires, wildfires can be classified as tundra fires, urban fires, interface or intermix fires, and prescribed burns.

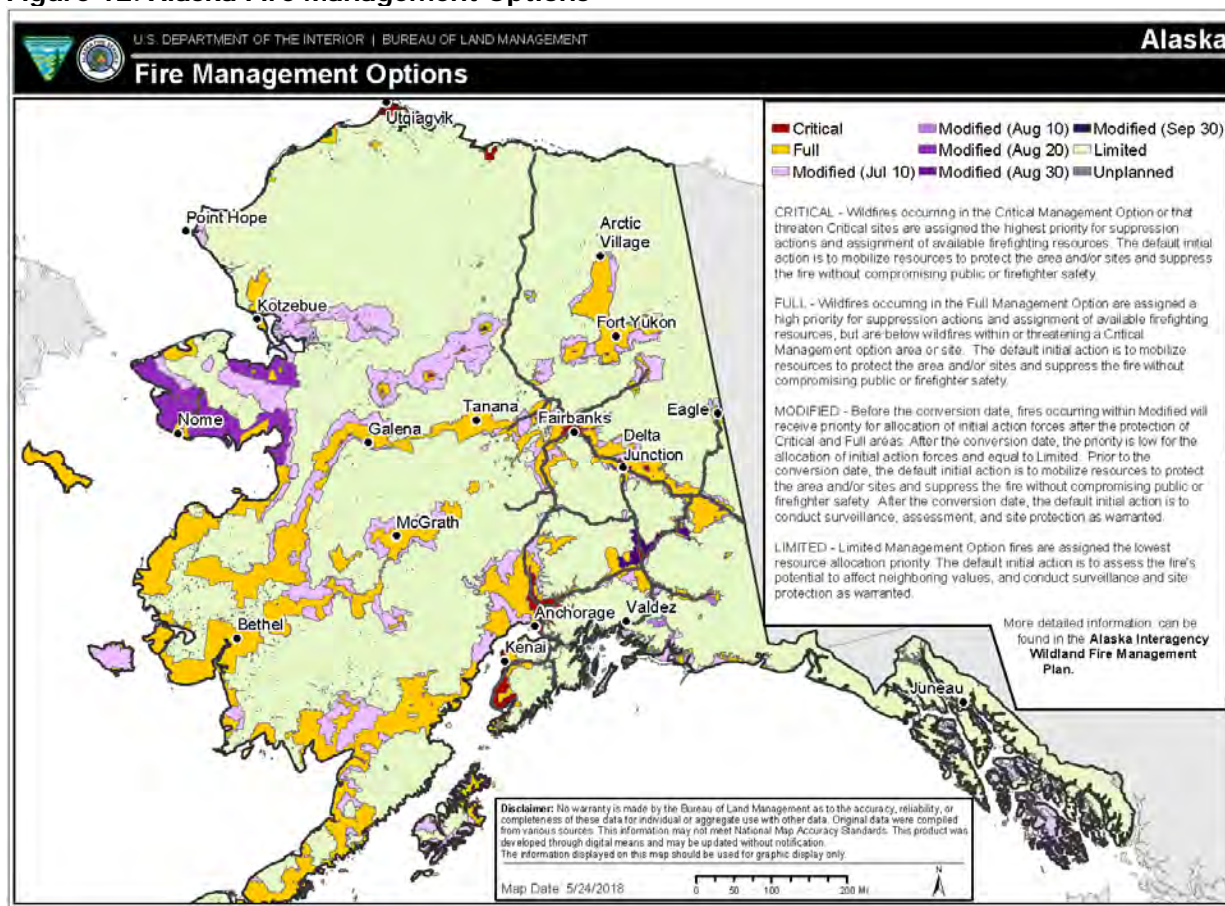
The following three factors contribute significantly to wildland fire behavior and can be used to identify wildland fire hazard areas.

- **Topography:** As slope increases, the rate of wildland fire spread increases. South-facing slopes are also subject to more solar radiation, making them drier, and thereby, intensifying wildland fire behavior. However, ridgetops may mark the end of wildland fire spread since fire spreads more slowly or may even be unable to spread downhill.
- **Fuel:** The type and condition of vegetation plays a significant role in the occurrence and spread of wildland fires. Certain types of plants are more susceptible to burning or will burn with greater intensity. Dense or overgrown vegetation increases the amount of combustible material available to fuel the fire (referred to as the “fuel load”). The ratio of living to dead plant matter is also important. Climate change is deemed to increase wildfire risk significantly during periods of prolonged drought as the moisture content of both living and dead plant matter decreases. The fuel load continuity, both horizontally and vertically, is also an important factor.
- **Weather:** The most variable factor affecting wildland fire behavior is weather. Temperature, humidity, wind, and lightning can affect chances for ignition and spread of fire. Extreme weather, such as high temperatures and low humidity, can lead to extreme wildland fire activity. By contrast, cooling and higher humidity often signal reduced wildland fire occurrence and easier containment. Climate change increases the susceptibility of vegetation to fire due to longer dry seasons.

The frequency and severity of wildland fires is also dependent on other hazards, such as lightning, drought, and infestations (such as the damage caused by spruce-bark beetle infestations or spruce needle aphids). The risk of wildfire has increased significantly over the past two decades, due in large part to the spruce-bark beetle infestation. If not promptly

controlled, wildland fires may grow into an emergency or disaster. Even small fires can threaten lives and resources and destroy improved properties; they can also impact transportation corridors and/or infrastructure. In addition to affecting people, wildland fires may severely affect livestock and pets. Such events may require emergency water/food, evacuation, and shelter.

Figure 12. Alaska Fire Management Options



The indirect effects of wildland fires can be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large, intense fires can harm the soil, waterways, and the land itself. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode quickly and enhance rivers and stream siltation, thereby enhancing flood potential, harming aquatic life, and degrading water quality. Lands stripped of vegetation are also subject to increased debris flow hazards.

Conflagration fires are very difficult to control. Complicating factors are wind, temperature, slope, proximity of structures, and community firefighting capability, as well as building construction and contents. Additional factors facing response efforts are hazardous substance releases, structure collapse, water service interruptions, unorganized evacuations, and loss of emergency shelters. Historical national conflagration examples include the Chicago City Fire of 1871 and the San Francisco City Fire following the 1906 earthquake. There have been no conflagration fires within the City of Kenai.

Many wildland firefighters are neither equipped nor trained for conflagration fires. When wildland firefighters encounter structure, vehicle, dump or other non-vegetative fires during the performance of their wildland fire suppression duties, firefighting efforts are often limited to wildland areas.

Structural fire suppression within defined service areas is the responsibility of the Kenai Fire Department.

5.3.6.3 Climate Factors

According to the Global Climate Change Impacts in the U.S., published in 2009 by the U.S. Global Change Research Program, “Under changing climate conditions, the average area burned per year in Alaska is projected to double by the middle of this century. By the end of this century, area burned by fire is projected to triple under a moderate greenhouse gas emissions scenario and to quadruple under a higher emissions scenario” (DHS&EM, 2018a).

Since 1990, Alaska has experienced nearly twice the number of wildfires per decade compared to a period from 1950 to 1980. Additionally, the sparsely-populated arctic region experienced only three wildfires over 1,000 acres from 1950 to 1970. Since 2000, there have been over 33 large wildfires in this same region.

The average duration of the wildfire season in the arctic region runs from May through July. Other regions south of the arctic may run from late April through mid-September. Average annual precipitation in Alaska has increased since 1950, but not quite as much as the average annual temperature.

Wind blows down dead trees that have been affected by spruce-bark beetles. As air temperatures warm, spruce-bark beetles spread; typically, this occurs when temperatures are over 60 °F.

5.3.6.4 History

The City does not have a history of fire events in the DHS&EM Disaster Cost Index (DHS&EM, 2018b). AICC maintains a website to consolidate Alaska’s tundra fire information. Information in Table 9 and Figure 13 for the City and surrounding area were obtained from this site. Figure 14 shows the State’s fire risk (DHS&EM, 2018a).

Table 9. Historical Wildland Fires

Fire Name	Fire Year	Estimated Acres	Latitude	Longitude	Specific Cause
Berry	1945	200	60.5499992	-151.2166595	Unknown
Norene Fire	1953	2.5	60.583889	-151.3333282	Debris Burning
Peterkin	1958	3	60.5499992	-151.0833282	Debris Burning
Spur	1968	5	60.5666667	-151.2833333	Debris Burning
Crowder	1969	2	60.5833333	-151.2333333	Equipment
Cement Plant	1969	250	60.55	-151.1833333	Smoking
Wildwood	1970	46	60.5833333	-151.3	Playing / Matches
Candlelight	1984	80	60.5499992	-151.1833344	Other
Bigeddy	1999	5.5	60.51667	-151.0833	Other
Cannery Rd. #1	2009	1.5	60.521389	-151.2763824	Other
California Ave.	2009	1.5	60.5825005	-151.2938843	Unknown
Marathon Rd.	2009	10.9	60.5811119	-151.2302704	Equipment

Redoubt	2019	1.4	60.57805	-151.275	
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(AICC, 2019)

5.3.6.5 *Location, Extent, Impact, and Recurrence Probability*

Location

Nearly every community in the KPB’s wildfire risk is very high or extreme due to dead and dying spruce trees. Within the City, trees infested by the spruce bark beetle became a mitigation priority in the late 1990s, with firefighters conducting door-to-door educational campaigns in high-risk neighborhoods delivering information packets to homeowners on how to develop a defensible space around their properties.

Historically significant fires within the City included the 1969 Swanson River Fire and the Swires Road fire in the mid-1980s. The City experiences small wildland fires throughout the summer months, with the most recent being a 10-acre fire during the summer of 2009 which the City of Kenai Fire Department and DOF responded to cooperatively.

The KPB typically experiences wildfires, and in 2019, the Swan Lake fire was caused by lightning in June and burned 142,542 acres before it was 20% contained in August, northwest of Cooper Landing and to the east and northeast of Sterling. Smoke was a concern for the City of Kenai depending on which direction the wind blew. Fire burned adjacent to the road in some areas, and the only road to Anchorage was closed at times.

Extent

Generally, fire vulnerability dramatically increases in the late summer and early fall as vegetation dries out, decreasing plant moisture content, and increasing the ratio of dead fuel to living fuel. However, various other factors, including humidity, wind speed and direction, fuel load and type, and topography can contribute to the intensity and spread of wildland fires. The common causes of wildland fires in Alaska include lightning strikes and human negligence.

Fuel, weather, and topography influence wildland fire behavior. Fuel (e.g., slash, dry undergrowth, flammable vegetation) determines how much energy the fire releases, how quickly the fire spreads, and how much effort is needed to contain the fire. Weather is the most variable factor. High temperatures and low humidity encourage fire activity while low temperatures and high humidity retard fire spread. Wind affects the speed and direction of fire spread. Topography directs the movement of air, which also affects fire behavior. When the terrain funnels air, as happens in a canyon, it can lead to faster spreading. Fire also spreads up slope faster than down slope.

Impact

Impacts of a wildland fire that interfaces with the population center could grow into an emergency or disaster if not properly controlled. A small fire can threaten lives and resources and destroy property. In addition to impacting people, wildland fires may severely impact livestock and pets. Such events may require emergency watering and feeding, evacuation, and alternative shelter.

Indirect impacts of wildland fires can be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large, intense fires can harm the soil, waterways, and the land itself. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode quickly and enhance siltation of rivers and streams, thus increasing flood potential, harming aquatic life, and degrading water quality.

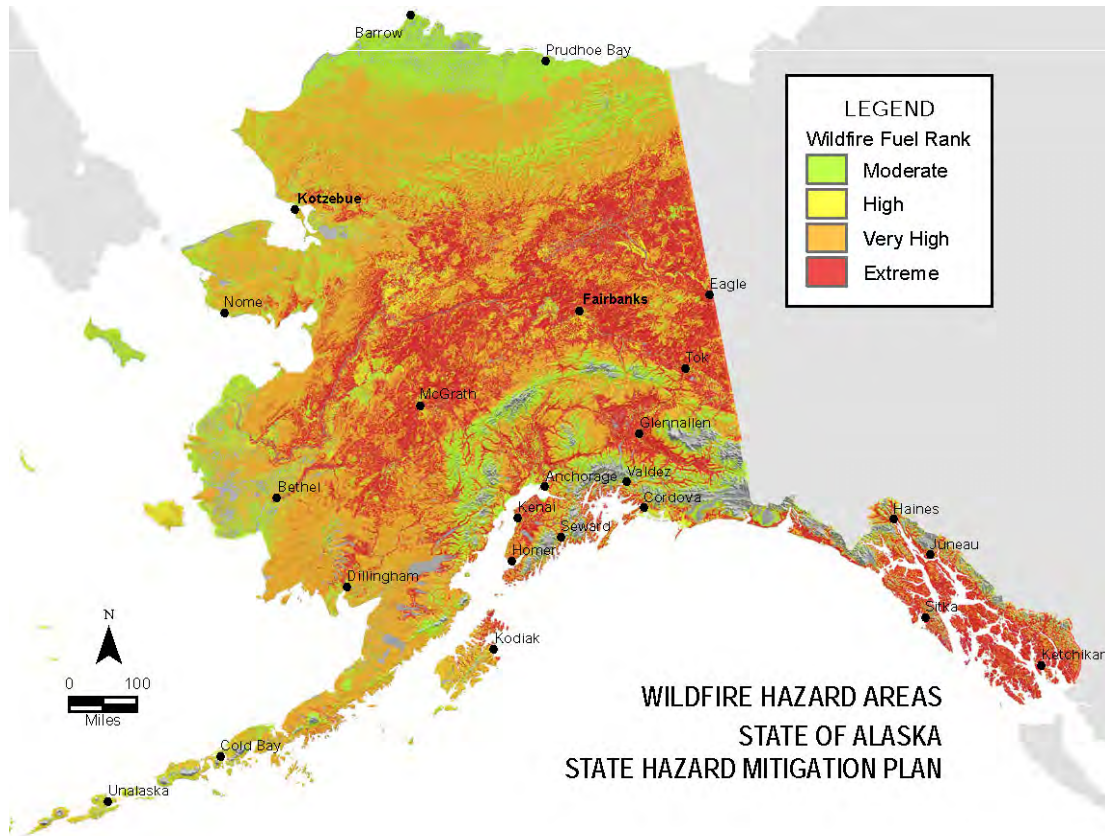
Recurrence Probability

Increased community development, fire fuel accumulation, and weather pattern uncertainties indicate that seasonal wildfires will continue into the future.

Figure 13. Kenai Wildland Fire History



Figure 14. City's Wildland Fire Risk



This section provides an overview of the vulnerability analysis.

6.1 OVERVIEW OF A VULNERABILITY ANALYSIS

A vulnerability analysis predicts the exposure extent that may result from a given hazard event and its impact intensity within the planning area. This qualitative analysis provides data to identify and prioritize potential mitigation measures by allowing the community to focus attention on areas with the greatest risk. A vulnerability or risk analysis is divided into the following five focus areas:

1. Asset Inventory;
2. Infrastructure Risk, Vulnerability, and Losses from Identified Hazards;
3. Development Changes and Trends;
4. Data Limitations; and
5. Vulnerability Assessments.

DMA 2000 requirements and implementing state governance regulations for developing risk and vulnerability assessment initiatives are described below.

DMA 2000 Requirements: Risk Assessment, Assessing Vulnerability, Overview

Assessing Vulnerability: Overview

§201.6(c)(2)(ii): The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described. This description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of:

§201.6(c)(2)(ii)(A): The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.

§201.6(c)(2)(ii)(B): 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.

§201.6(c)(2)(ii)(C): 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

- Does the plan include a description of the jurisdiction's vulnerability to each hazard?
- Does the plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?
- Does the plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas?
- Does the plan estimate potential dollar losses to vulnerable structures?
- Does the plan describe the methodology used to prepare the estimate?

Source: FEMA, 2015.

6.2 CURRENT ASSET EXPOSURE ANALYSIS

6.2.1 Asset Inventory

Assets that may be affected by hazard events include population (for community-wide hazards), residential buildings, and critical facilities and infrastructure. Assets are grouped into two

structure types: critical infrastructure and residential properties. The assets and associated values throughout the City are identified and discussed in detail in the following subsections.

6.2.1.1 Population and Building Stock

The City’s total population for 2010 was 7,100, and the 2016 ACS reported a population of 7,551 (Table 10).

Table 10. Estimated Population and Building Inventory

Population		Residential Buildings	
2010 Census	2016 ACS Data	Total Building Count ¹	Total Value of Buildings ¹
7,100	7,551	3,267	Planning Team: \$627,248,400

Sources: 2010 U.S. Census and 2016 ACS Certified population data.

¹ The Kenai Assessing Department provided these numbers in November 2019. The average value per dwelling based on 2019 certified values is \$191,995.

6.2.1.2 Critical Infrastructure

Critical infrastructure is defined as a facility that provides essential products and services to the general public, such as preserving quality of life while fulfilling important public safety, emergency response, and disaster recovery functions. Critical facilities and infrastructure for the City are profiled in this HMP and include the following (see also Table 11):

- Government: City administrative offices, departments, or agencies;
- Emergency Response: including police and fire personnel services; and fire-fighting equipment; and
- Health Care: medical clinics, congregate living, health, residential and continuing care, and retirement facilities.

Table 11. Alaska’s Critical Infrastructure

• Hospitals, Clinics, & Assisted Living Facilities	• Satellite Facilities	• Power Generation Facilities	• Oil & Gas Pipeline Structures & Facilities	• Schools
• Fire Stations	• Radio Transmission Facilities	• Potable Water Treatment Facilities	• Service Maintenance Facilities	• Community Washeterias
• Police Stations	• Highways and Roads	• Reservoirs & Water Supply Lines	• Community Halls & Civic Centers	• National Guard Facilities
• Emergency Operations Centers	• Critical Bridges	• Waste Water Treatment Facilities	• Community Stores	• Landfills & Incinerators
• Any Designated Emergency Shelter	• Airports	• Fuel Storage Facilities	• Community Freezer Facilities	• Community Cemeteries
• Telecommunications Structures & Facilities		• Harbors / Docks / Ports		

6.2.1.3 Infrastructure Risk, Vulnerability, and Losses from Identified Hazards

Table 12 provides critical facilities and infrastructure identified for the City. See Figure 15 for a critical facilities map. Vulnerabilities are described further In Section 6.2.1.6.

6.2.1.4 Land Use and Development Trends

Requirements for land use and development trends, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Recommendations: Risk Assessment, Assessing Vulnerability, Analyzing Development Trends

Assessing Vulnerability: Analyzing Development Trends

Requirement §201.6(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

- Does the plan describe land uses and development trends?

Source: FEMA, 2015.

The City has been a deferred code enforcement entity since the late 1970s enforcing local building, fire, and life safety codes in plan reviews for new construction. This provides local access and oversight in new construction without requiring plans being sent through the State Fire Marshal's office in Anchorage.

Zoning changes are needed to comply with the 2016 *City of Kenai Comprehensive Plan* and to prevent infrastructure loss near the eroding Kenai Bluffs. Public Works has been addressing this for several years, and the City has restricted new construction near hazardous areas, and infrastructure has been relocated to prevent added loss or damage (water and sewer lines, utilities, etc.).

The 2016 *City of Kenai Comprehensive Plan* projects modest economic growth and population increase. The region's main economic sectors of energy, fishing/fish processing, and tourism also experienced modest growth. Kenai is expected to continue as a trade and services center for the region. Consistent with regional and national trends, the proportion of people aged 65 and older is expected to increase within the City. The City of Kenai's median age is lower than the national median age and slightly higher than the State of Alaska's median age.

Approximately 1,680 homes and businesses (4,000-5,000 users) are connected to the City's water and sewer system. This is approximately 70% of the City's population. The City has four operational well houses and a wastewater treatment plant. A new 1,000,000-gallon water reservoir was constructed in 2016. Of the 99 miles of roads in Kenai, the City of Kenai maintains approximately 60 miles, including approximately 15 miles of gravel-surfaced roads. Improvements to the road system to create more vehicle and pedestrian traffic in the City Center and provide safety and efficiency in travel could include paving more streets, constructing sidewalks, creating trail linkages, and expanding road shoulders. The Kenai Municipal Airport is currently undergoing a major remodeling. The Kenai Municipal Airport is the largest airport within the KPB and is an important distribution center in the area.

The City has an ample supply of vacant land for future development. Development near existing City services will make the best use of public development expenditures. Commercial and retail development along the highway corridors has created a linear City form. Residential development is dispersed, and multiple commercial centers are emerging in the City.

6.2.1.5 *Data Limitations*

The vulnerability estimates provided herein use the best data currently available, and the methodologies applied result in a risk approximation. These estimates may be used to understand relative risk from hazards and potential losses. However, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning hazards and their effects on the built environment as well as the use of approximations and simplifications that are necessary for a comprehensive analysis.

It is also important to note that the quantitative vulnerability assessment results are limited to the exposure of people, buildings, and critical facilities and infrastructure to the identified hazards. It was beyond the scope of this HMP to develop a more detailed or comprehensive assessment of risk (including annualized losses, people injured or killed, shelter requirements, loss of facility/system function, and economic losses). Such impacts may be addressed with future updates of this HMP.

6.2.1.6 *Vulnerability Assessments*

Hazards are assessed with regards to their vulnerabilities in this section.

Flood and Erosion Vulnerabilities

The 2018 State of Alaska HMP categorizes the KPB at risk of experiencing high flooding and erosion impacts. City Dock facilities are somewhat vulnerable to flood conditions, but were constructed with those events in mind, and generally remain usable in a flood event.

The City does not participate in the NFIP. This decision was made in the 1980s, and current staff do not know the reasoning behind the decision other than there was/is not much development in the floodplain. The current Planning Department is open to considering participation in the NFIP after further evaluation.

The Kenai Bluffs erosion is an important concern of the City's. The City has taken steps to preserve the integrity of protective dunes by installing permanent fencing.

Kenai's erosion-threatened population and infrastructure potentially include: the existing, transient, and future population, residential structures, critical facilities, and infrastructure that are exposed to changing flooding and erosion impacts.

Fire Vulnerabilities

The 2018 *State of Alaska HMP* categorizes the KPB at risk of experiencing high fire impacts. Impacts associated with a fire event include the potential for loss of life and property. Buildings closer to the outer edge of town, those with a lot of vegetation surrounding the structure, and those constructed with wood are some of the buildings that are more vulnerable to the impacts of fire.

The City maintains a defensible space around all City facilities as a preventative measure for wildland fires.

Dry forest conditions increase fire fuels and insect infestations. These conditions create optimum conditions for fire propagation, especially around housing and other areas where fire fuels are not controlled near public or private structures. Future populations, residential

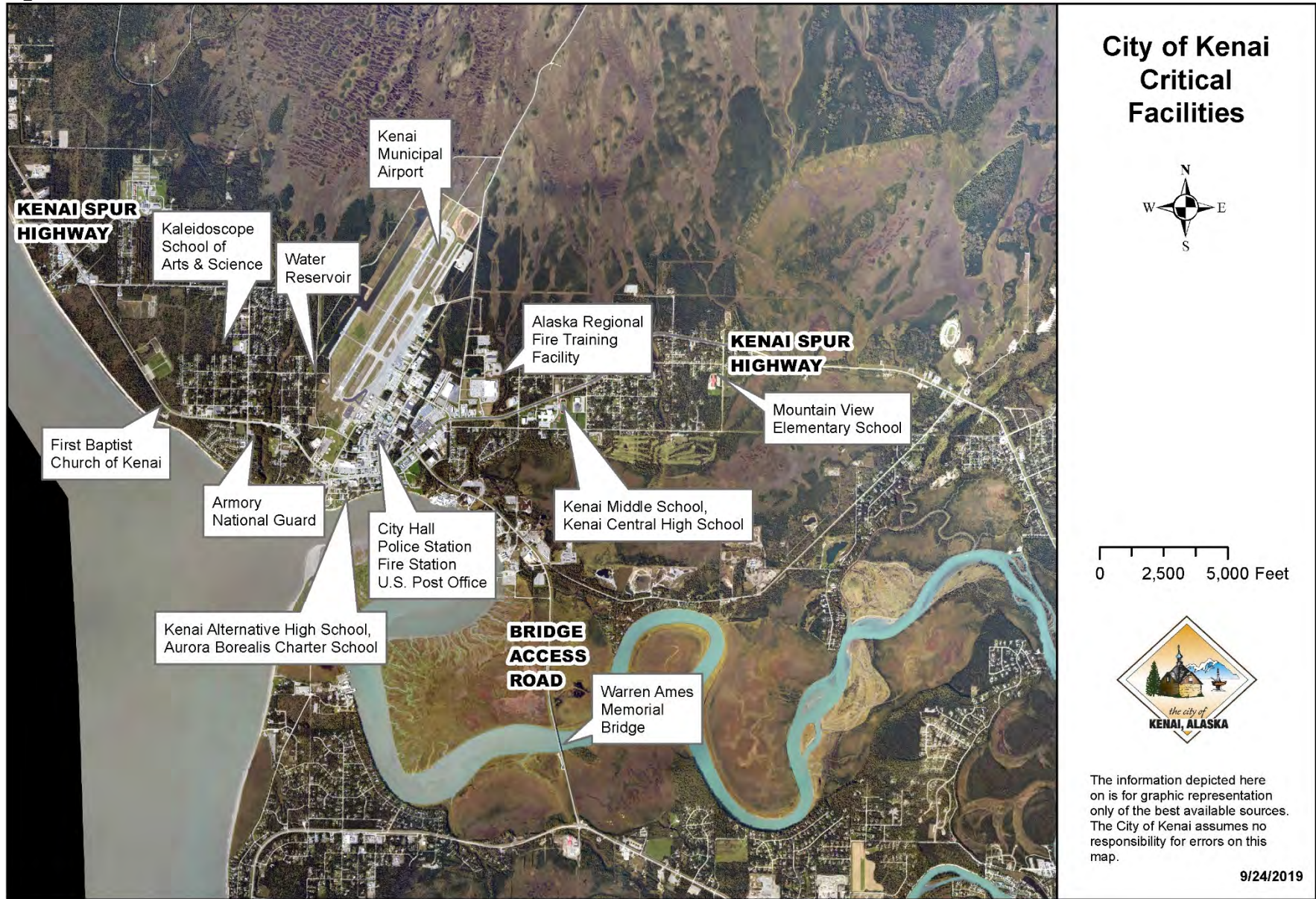
structures, critical facilities, and infrastructure located in dryer regions of Alaska are anticipated to experience increased fire events compared to historical impacts.

Table 12. Kenai’s Critical Facilities

Type of Facility	Facilities	Address	Latitude	Longitude	Estimated Value (2019 KPB Estimate)	Number of Occupants	Building Type	Volcanic Ashfall	Earthquake	Flood/Erosion	Cryosphere	Weather (Severe)	Fire
Government	City Hall	210 Fidalgo Avenue	60.559085	-151.248688	\$831,600	20	Class 6, Type 1 Steel	x	x		x	x	x
	National Guard	105 South Forest Drive	60.559036	-151.276414	\$1,086,800	20	Class 51C Galvanized Steel	x	x		x	x	x
	U.S. Post Office	140 Bidarka Street	60.557799	-151.248010	\$2,709,600	15	Stucco	x	x		x	x	x
Transportation	Kenai Municipal Airport – Passenger Terminal	305 North Willow Street	60.565269	-151.246915	\$14,000,000	200	Airport	x	x	x	x	x	x
Emergency Response	Kenai Public Safety (Police Station and Fire Station)	107 South Willow Street	60.559112	-151.250225	\$2,387,900	30	Concrete Block (Jail), Class 1 Wood Frame	x	x		x	x	x
Education	Mountain View Elementary School*	315 Swires Road	60.565476	-151.176598	\$13,543,700	480	Class 1 Wood Frame	x	x		x	x	x
	Kenai Alternative High School, Aurora Borealis Charter School	705 Frontage Road	60.554048	-151.253699	\$11,817,000	80	Class 1 Wood Frame	x	x		x	x	x
	Kaleidoscope School of Arts & Science*	549 North Forest Drive	60.568725	-151.279090	\$10,443,300	290	Class 1 Wood Frame	x	x		x	x	x
	Kenai Middle School*	201 North Tinker Lane	60.562831	-151.206125	\$23,121,600	360	Class 1 Wood Frame	x	x		x	x	x
	Kenai Central High School*	9583 Kenai Spur Highway	60.561267	-151.212238	\$55,754,300	500	Class 1 Wood Frame	x	x		x	x	x
Medical	Kenai has Medical Clinics, but the nearest hospital is in neighboring Soldotna	N/A	N/A	N/A	N/A	N/A	N/A						
Community	Alaska Regional Fire Training Facility	450 Daubenspeck Circle	60.566308	-151.225563	\$6,626,500	50	Class 1 Steel	x	x		x	x	x
	First Baptist Church*	12815 Kenai Spur Highway	60.560715	-151.295380	\$798,100	100	Class 1 Wood Frame	x	x	x	x	x	x
Road	Kenai Spur Highway (approx. 10.5 miles)	N/A	N/A	N/A	N/A	N/A	N/A	x	x	x	x	x	x
	Bridge Access Road (3.5 miles)	N/A	N/A	N/A	N/A	N/A	N/A	x	x	x	x	x	x
Bridge	Warren Ames Memorial Bridge	Bridge Access Road	60.526740	-151.209042	N/A	N/A	N/A	x	x	x	x	x	x
Utility	Electric – Homer Electric	N/A	N/A	N/A	N/A	N/A	N/A	x	x	x	x	x	x
	Telephone – GCI	N/A	N/A	N/A	N/A	N/A	N/A	x	x	x	x	x	x
	Gas – ENSTAR	N/A	N/A	N/A	N/A	N/A	N/A	x	x	x	x	x	x
	Wastewater Treatment Plant	N/A	60.442466	-151.276836	\$7,301,200	5	Sewage Treatment Plant	x	x	x	x	x	x
	Four Wellheads	N/A	N/A	N/A	N/A	N/A	N/A	x	x	x	x	x	
	Water Reservoir	N/A	60.564703	-151.260959	\$2,750,000	N/A	N/A	x	x		x	x	
Totals					\$153,173,600								

*Shelters

Figure 15. Critical Facilities Locations



Earthquake Vulnerabilities

Alaska should expect the full spectrum of potential earthquake ground motion scenarios. Severe shaking may result in infrastructure damage that is equally as extreme. Although all structures are at some risk due to earthquakes, short wooden buildings are less vulnerable than multi-story and complex masonry/steel structures. The majority of Alaska's schools, State, and Federal buildings are built and sited based on stringent seismic construction standards and are expected to survive major earthquake events.

The 2018 *State of Alaska HMP* categorizes the KPB at risk of experiencing high earthquake impacts. Protective measures are in place to minimize damage such as housing emergency generators inside critical facilities and meeting construction standards for the seismic zone.

Due to Alaska's highly active geologic setting at a tectonic plate boundary, existing and future populations, residential structures, critical facilities, and infrastructure will be exposed to continued earthquakes of various magnitudes—from those that are barely felt to those that detrimentally affect large regions of the State.

Severe Weather Vulnerabilities

The 2018 *State of Alaska HMP* categorizes the KPB at risk of experiencing high severe weather impacts. Impacts associated with severe weather events include roof collapse, trees and power lines falling, damage to light aircraft and sinking small boats, and injury and death resulting from snow machine or vehicle accidents and overexertion while shoveling (all due to heavy snow). A quick thaw after a heavy snow can also cause substantial flooding. Impacts from extreme cold include hypothermia, halting transportation from fog and ice, congealed fuel, frozen pipes, disruption in utilities, frozen pipes, and carbon monoxide poisoning. Buildings that are older and/or not constructed with materials designed to withstand heavy snow and wind (e.g., hurricane ties on crossbeams) are more vulnerable to the impacts of severe weather. The entire State is threatened by severe weather events.

Severe weather will occur annually in Kenai. Climate change impacts vary across Alaska. These conditions will negatively impact existing and future populations, residential structures, critical facilities, and infrastructure.

Volcanic Ashfall Vulnerabilities

The 2018 *State of Alaska HMP* categorizes the KPB at risk of experiencing high volcanic impacts. Impacts associated with an ashfall event include the potential for ashfall to damage motors and impair air quality.

Changes in the Cryosphere Vulnerabilities

Alaska can expect to experience ever-changing effects from melting polar ice sheets, mountain glaciers, and other cryosphere impacts. According to mapping completed by the USGS, Kenai does not have permafrost at ground level. Sea ice and river ice affect Kenai.

Similar to weather vulnerabilities, changing cryospheric conditions also vary across Alaska. Therefore, the entire population and infrastructure could be vulnerable to recurrent cryosphere hazard impacts.

A mitigation strategy provides the blueprint for implementing desired activities that will enable the City to continue to save lives and preserve infrastructure by systematically reducing hazard impacts, damages, and community disruptions. This section outlines the process for preparing a mitigation strategy including:

1. Develop Mitigation Goals to mitigate the hazards and risks identified (see Sections 5 and 6).
2. Identify Mitigation Actions to meet the Mitigation Goals.
3. Evaluate Mitigation Actions.
 - a. Describe and analyze Local mitigation policies, programs, and funding sources.
 - b. Evaluate Federal and State hazard management policies, programs, capabilities, and funding sources.
4. Implement the Mitigation Action Plan (MAP).

Within this section, the Hazard Mitigation Project Team developed mitigation goals and potential mitigation actions.

7.1 DEVELOPING MITIGATION GOALS

Requirements for hazard mitigation goals, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Mitigation Strategy –Hazard Mitigation Goals
Local Hazard Mitigation Goals
Requirement §201.6(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
■ Does the plan include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards?
<i>Source: FEMA, 2015.</i>

The exposure analysis results were used as a basis for developing the mitigation goals and actions. Mitigation goals are defined as general guidelines that describe what a community wants to achieve in terms of hazard and loss prevention. Goal statements are typically long-range, policy-oriented statements representing community-wide visions. As such, goals were developed to reduce or avoid long-term vulnerabilities to identified hazards (Table 13). Goals are numbered according to the order of hazard priority; hazard designations are abbreviated as:

- F&E (Flooding and Erosion);
- F (Fire);
- EQ (Earthquakes);
- V (Volcanic Ash);
- SW (Severe Weather); and

- G (General).

Table 13. Mitigation Goals

No.	Goal Description
F&E1a	Reduce or eliminate the erosion of the bluff at the mouth of the Kenai River. Note that this goal incorporates the changes to the cryosphere hazard with the erosion hazard.
F&E1b	Reduce or eliminate property damage and influx of debris into waterways due to floods by raising public awareness and through zoning changes.
F2	Reduce or eliminate loss of homes and property due to fires.
EQ 3	Prepare citizens and the built environment to better survive the hazards associated with earthquakes.
V 4	Educate citizens to adequately protect themselves and property from hazards of volcanic ash.
SW 5	Educate citizens and the built environment to better survive the hazards associated with severe weather.
G 6	Identify ways for the City to better prepare for an emergency.

7.2 IDENTIFYING MITIGATION ACTIONS

Requirements for identification and analysis of mitigation actions, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Mitigation Strategy - Identification and Analysis of Mitigation Actions
<p>Identification and Analysis of Mitigation Actions</p> <p>Requirement §201.6(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.</p> <p>Element</p> <ul style="list-style-type: none"> ■ Does the plan identify and analyze a comprehensive range of specific mitigation actions and projects for each hazard? ■ Do the identified actions and projects address reducing the effects of hazards on new buildings and infrastructure? ■ Do the identified actions and projects address reducing the effects of hazards on existing buildings and infrastructure? <p><i>Source: FEMA, 2015.</i></p>

After mitigation goals and actions were developed, the Planning Team assessed the potential mitigation actions to carry forward into the mitigation strategy. Mitigation actions are activities, measures, or projects that help achieve the goals of an HMP. Mitigation actions are usually grouped into three broad categories: property protection, public education and awareness, and structural projects. The Planning Team placed particular emphasis on projects and programs that reduce the effects of hazards on both new and existing buildings and infrastructure. These potential projects are listed in Table 16.

7.3 EVALUATING AND PRIORITIZING MITIGATION ACTIONS

Requirements for the evaluation and implementation of mitigation actions, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Mitigation Strategy - Implementation of Mitigation Actions
<p>Implementation of Mitigation Actions</p>

DMA 2000 Requirements: Mitigation Strategy - Implementation of Mitigation Actions
<p>Requirement: §201.6(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 Government. 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.</p> <p>Element</p> <ul style="list-style-type: none"> ■ Does the mitigation strategy include how the actions are prioritized? ■ Does the mitigation strategy address how the actions will be implemented and administered? ■ Does the prioritization process include an emphasis on the use of a cost-benefit review to maximize benefits? <p><i>Source: FEMA, 2015.</i></p>

The Planning Team identified mitigation actions on October 30, 2019, to determine which actions would be retained in the MAP. The MAP contained in Table 14 represents potential mitigation projects and programs. The Hazard Mitigation Planning Team ranked the top three hazards with the potential to impact Kenai as erosion, fire, and earthquakes.

Table 14. Mitigation Goals and Potential Actions

Goals		Actions	
No.	Description	ID	Description
F&E1a	Reduce or eliminate the erosion of the bluff at the mouth of the Kenai River.	A	Implement the recommendation from the 2018 USACE Report.
		B	Maintain (and expand as needed) dune protection measures on the north and south beaches in the vicinity of the Kenai River mouth.
		C	Explore and implement bluff protection measures for the sheer bluff on the north beach, which is currently unprotected.
F&E1b	Reduce or eliminate property damage and influx of debris into waterways due to floods by raising public awareness and through zoning changes.	A	Continue cooperative efforts of the KPB, City of Kenai Planning and Zoning Commission, City Council, and land owners/developers to enforce a 50-foot setback of items on properties adjacent to waterways.
		B	Evaluate the feasibility of participating in the NFIP.
F2	Reduce or eliminate loss of homes and property due to fires.	A	Promote the development of FireWise neighborhoods to include the removal of fuels and increased awareness of fire hazards in the community.
		B	Develop a wildland hazard map based on vegetation data that ranks land based upon its likely susceptibility to the spruce bark beetle.
		C	Map hydrant locations. Extend water lines as needed to increase coverage.
		D	Clear dead trees in high priority areas such as those that would be an immediate hazard to road right-of-ways or structures.
EQ 3	Prepare citizens and the built environment to better survive the hazards associated with earthquakes.	A	Raise public awareness of potential threats and necessary preparations to increase survivability of citizens and structures.

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V 4	Prepare citizens to adequately protect themselves and property from hazards of volcanic ash.	A	Educate the public to prepare for the harmful effects of volcanic ash fallout to life and property.
SW 5	Educate citizens and the built environment to better survive the hazards associated with severe weather.	A	Enforce building codes for structures to withstand high winds.
G 6	Identify ways for the City to better prepare for an emergency.	A	Update the City's Emergency Operating Plan from 2007 to ensure the appropriate response to natural hazards.
		B	Update the Alaska Fire Training Facility as an Emergency Operations Command Center.

The requirements for the evaluation and implementation of mitigation actions, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Mitigation Strategy - Implementation of Mitigation Actions

Implementation of Mitigation Actions

Requirement: §201.6(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.

Element

- ☐ Does the mitigation strategy include how the actions are prioritized?
- ☐ Does the mitigation strategy address how the actions will be implemented and administered?
- ☐ Does the prioritization process include an emphasis on the use of a cost-benefit review to maximize benefits?

Source: FEMA, 2015.

The Hazard Mitigation Project Team reviewed the simplified social, technical, administrative, political, legal, economic, and environmental (STAPLEE) evaluation criteria (Table 15) and the Benefit-Cost Analysis Fact Sheet (Appendix D) to consider the opportunities and constraints of implementing each particular mitigation action. For each action considered for implementation, a qualitative statement is provided regarding the benefits and costs and, where available, the technical feasibility. A detailed cost-benefit analysis is anticipated as part of the application process for those projects the City chooses to implement.

Table 15. Evaluation Criteria for Mitigation Actions
Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE)

Evaluation Category	Discussion "It is important to consider..."	Considerations
Social	The public support for the overall mitigation strategy and specific mitigation actions.	Community acceptance Adversely affects population

Evaluation Category	Discussion "It is important to consider..."	Considerations
Technical	If the mitigation action is technically feasible and if it is the whole or partial solution.	Technical feasibility Long-term solutions Secondary impacts
Administrative	If the community has the personnel and administrative capabilities necessary to implement the action or whether outside help will be necessary.	Staffing Funding allocation Maintenance/operations
Political	What the community and its members feel about issues related to the environment, economic development, safety, and emergency management.	Political support Local champion Public support
Legal	Whether the community has the legal authority to implement the action, or whether the community must pass new regulations.	Local, Tribal, State, and Federal authority Potential legal challenge
Economic	If the action can be funded with current or future internal and external sources, if the costs seem reasonable for the size of the project, and if enough information is available to complete a FEMA Benefit-Cost Analysis.	Benefit/cost of action Contributes to other economic goals Outside funding required FEMA Benefit-Cost Analysis
Environmental	The impact on the environment because of public desire for a sustainable and environmentally healthy community.	Effect on local flora and fauna Consistent with community environmental goals Consistent with Local, Tribal, State, and Federal laws

On October 29, 2019, the Hazard Mitigation Project Team considered each hazard’s history, extent, and probability to determine each mitigation action’s priority. A rating system based on high, medium, or low was used. High priorities are associated with actions for hazards that impact the community on an annual or near annual basis and generate impacts to critical facilities and/or people. Prioritizing the mitigation actions in the MAP Matrix was completed on December 4, 2019, to provide the City with an approach to implementing the MAP. Table 16 defines the mitigation action priorities.

7.4 IMPLEMENTING A MITIGATION ACTION PLAN

Requirements for Local Government policies in mitigation strategies, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Mitigation Strategy
<p>Implementation of Mitigation Actions</p> <p>Requirement: §201.6(c)(3)(iii): [The mitigation strategy section shall include]: an action plan describing how the actions 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.</p> <p>Element</p> <ul style="list-style-type: none"> ■ Does the plan contain a mitigation action plan?

Table 16 defines the MAP.

Table 16. City Mitigation Action Plan

(See acronym and abbreviations list for complete titles)

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
F&E1a	Implement Kenai Bluffs protection measure recommended in the 2018 USACE Kenai Bluffs study.	High	City Planner	City, USACE, Legislature Capital Budget	2020-2025	B/C: The USACE has already completed the study and identified the best solution. TF: The City is seeking funding opportunities.
F&E1b	Establish zoning and building restrictions for the Kenai Bluffs area, and develop a plan to move infrastructure back from the bluff.	High	City Planner	City	2020	B/C: This project would prevent infrastructure from being eroded into the bluff below. TF: This project is feasible using existing community resources and construction standards. Equipment and materials require grant funding.
F&E1c	Maintain (and expand as needed) dune protection measures on the north and south beaches in the vicinity of the Kenai River mouth.	High	City Planner	City	2020	B/C: Fences in 2009 and 2010 made a difference. TF: Fences are relatively inexpensive and easily implemented.
F&E1d	Explore and implement bluff protection measures for the sheer bluff on the north beach, which is currently unprotected.	High	City Planner	City	2020	B/C: Temporary signs have worked in the past. Permanent signs should be considered to remind people their actions cause damage to the bluff. TF: This project is easily implemented.
F&E1e	Continue cooperative efforts of the KPB, City of Kenai Planning & Zoning Commission, City Council, and land owners/developers to enforce a 50-foot setback of items on properties adjacent to waterways.	High	City Planner	City	Ongoing	B/C: The Kenai River Overlay mandates a 50-foot building setback from the mean high water line of the Kenai River. KPB regulations for development in this area meet the objective to minimize damage in the event of a flood.

Mitigation Strategy

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
						TF: The City has the necessary resources to enforce regulations already in place.
F&E1f	Evaluate the feasibility of participating in the NFIP.	Medium	City Planner	City	2020	B/C: The KPB participates in the NFIP. TF: The KPB would act as the Floodplain Manager.
F2a	Promote FireWise programs including public education programs in schools and neighborhoods.	High	Fire Chief	Minimal cost anticipated; City	2020	B/C: This is an easily-implemented mitigation action. TF: This action could be accomplished by the Fire Department at minimal cost.
F2b	Promote the development of defensible space and landscaping techniques to community and home construction contractor participation.	High	Fire Chief	Minimal cost anticipated; City	Spring 2020	B/C: This is an easily-implemented mitigation action. TF: This action could be accomplished by the Fire Department at minimal cost.
F2c	Encourage the reduction of fuels in hazardous areas and egress routes in coordination with the Kenai Peninsula Spruce Bark Beetle Mitigation Office, State Forestry, and land owners.	High	Fire Chief	City, DHS Preparedness Technical Assistance Program, HMGP, PDM Grants	2020	B/C: National statistics state that there is a \$10 benefit for every \$1 spent on wildfire mitigation. Flyers and radio ads are inexpensive. TF: This action could be accomplished by the Fire Department at minimal cost. Homeowners and property owners would be responsible for their own lots. Funding would be needed for City property.
F2d	Develop a wildland hazard map based on vegetation data that ranks land based upon its likely susceptibility to the spruce bark beetle.	High	KPB/City Planner	Funding has already been obtained	Spring 2020	B/C: KPB has mapping expertise. TF: This action is already in progress.

Mitigation Strategy

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
F2e	Map hydrant locations. Extend water lines as needed to increase coverage.	High	Public Works Director	Funding has already been obtained	Spring 2020	B/C: Public Works has expertise. TF: This action is already in progress.
EQ3a	In an effort to reduce property damage, the City will continue to adopt and enforce current building codes and construction standards that address the seismic concerns for the KPB.	High	City Planner	City	Ongoing	B/C: The City has already adopted the codes and enforces them. TF: Codes are already implemented.
EQ3b	Prepare citizens and the built environment to better survive the hazards associated with earthquakes through the promotion of public education and the practice of sheltering in place. Encourage the preparation of citizens for self-sufficiency on a post-earthquake scenario.	High	City Planner	City	Ongoing	B/C: A comprehensive earthquake safety program, delivered as appropriate to all ages and audiences will save lives. Seismic standard construction will increase survivability of occupants. TF: Codes are already implemented.
V4	Continue cooperative effort with KPB, Office of Emergency Management, local media, and City of Kenai websites to provide the public with preparedness information prior to and during periods of increased volcano seismic activity.	High	City Planner	City, KPB, AVO	Ongoing	B/C: During 2009 volcanic activity, the public was adequately informed for preparedness via the KPB and AVO websites as well as collaboration of City Government and local media. Continue preparedness exercises. TF: Regularly practice EOP.
SW5	In an effort to reduce property damage, the City will continue to adopt and enforce current building codes and construction standards that address high winds. Prepare citizens and the built environment to better survive the hazards associated with keeping power on such as backup generators. Residents should do self-assessments on their own properties	High	Individual Homeowner	Individual Homeowner	2020	B/C: Homeowners are responsible for the defensiveness of their property in a natural disaster. Prevention now may save property in the future. TF: Residents would be responsible for following

Mitigation Strategy

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
	and create open space around their houses accordingly so that trees do not fall on houses and powerlines.					City codes and construction standards.
G6a	Update the City's Emergency Operating Plan to ensure the appropriate response to natural hazards.	Medium	Fire Chief	City, Denali Commission	2020	<p>B/C: Sustained mitigation outreach programs have minimal cost and will help build and support area-wide capacity. This type of activity enables the public to prepare for, respond to, and recover from disasters. Coordinated planning ensures effective damage abatement and ensures proper attention is assigned to reduce losses and damage to structures and residents.</p> <p>TF: This low-cost activity can be combined with recurring community meetings where hazard-specific information can be presented in small increments. This activity is ongoing, demonstrating its feasibility.</p>
G6b	Update the Alaska Fire Training Facility as an Emergency Operations Command Center.	Medium	City Manager	City, HMGP, PDM	2020-2025	<p>B/C: The City needs to evaluate their EOC needs and determine if this building should be updated to replace the existing EOC. This building has many desirable features for an EOC.</p> <p>TF: This building is sitting empty in the community and appears to meet criteria.</p>

This section describes a formal plan maintenance process to ensure that this HMP remains an active and applicable document. It includes an explanation of how the City’s Hazard Mitigation Project Team intends to organize their efforts to ensure that improvements and revisions to the HMP occur in a well-managed, efficient, and coordinated manner.

The following three process steps are addressed in detail here:

1. Monitoring, evaluating, and updating the HMP;
2. Implementation through existing planning mechanisms; and
3. Continued public involvement.

8.1 MONITORING, EVALUATING, AND UPDATING THE HMP

Requirements for monitoring, evaluating, and updating the HMP, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Plan Maintenance Process - Monitoring, Evaluating, and Updating the Plan

Monitoring, Evaluating and Updating the Plan

Requirement §201.6(c)(4)(i, ii, and iii): [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; b] a process by which local government incorporates the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate; and c] discussion on how the community will continue public participation in the plan maintenance process.

Element

- Does the plan describe the method and schedule of monitoring the plan, including the responsible department?
- Does the plan describe a system for monitoring implementation of mitigation measures and project closeouts?
- Does the plan describe the method and schedule for updating the plan within the five-year cycle?

Source: FEMA, 2015.

This HMP was prepared as a collaborative effort among the Hazard Mitigation Project Team and LeMay Engineering & Consulting, Inc. To maintain momentum, the City Planner will use the Hazard Mitigation Project Team to monitor, evaluate, and update the HMP. Each authority identified in Table 16 will be responsible for implementing the MAP. The City Planner will serve as the primary point of contact and will coordinate local efforts to monitor, evaluate, and revise the HMP.

Each member of the Hazard Mitigation Project Team will conduct an annual review during the anniversary week of the HMP’s official FEMA approval date to monitor the progress in implementing the HMP, particularly the MAP. As shown in Appendix E, the Annual Review Worksheet will provide the basis for possible changes in the HMP MAP by refocusing on new or more threatening hazards, adjusting to changes to or increases in resource allocations, and engaging additional support for the HMP implementation. The City Planner will initiate the annual review two months prior to the scheduled planning meeting date to ensure that all data is assembled for discussion with the Hazard Mitigation Project Team. The findings from these reviews will be presented at the annual Hazard Mitigation Project Team Meeting. Each review, as shown on the Annual Review Worksheet, will include an evaluation of the following:

- Participation of authorities and others in the HMP implementation;

- Notable changes in the risk of natural or human-caused hazards;
- Impacts of land development activities and related programs on hazard mitigation;
- Progress made with the MAP (identify problems and suggest improvements as necessary and provide progress reports on implemented mitigation actions); and
- The adequacy of local resources for implementation of the HMP.

A system of reviewing the progress on achieving the mitigation goals and implementing the MAP activities and projects will also be accomplished during the annual review process. During each annual review, each authority administering a mitigation project will submit a Progress Report to the Hazard Mitigation Project Team. As shown in Appendix E, the report will include the current status of the mitigation project, including any changes made to the project, the identification of implementation problems and appropriate strategies to overcome them, and whether or not the project has helped achieve the appropriate goals identified in the HMP.

In addition to the annual review, the Hazard Mitigation Project Team will update the HMP every five years. To ensure that this update occurs, in the fourth year following adoption of the HMP, the Hazard Mitigation Project Team will undertake the following activities:

- Request grant assistance from DHS&EM and FEMA to update the HMP (this can take up to one year to obtain and one year to update the HMP);
- Thoroughly analyze and update the risk of natural hazards;
- Provide a new annual review (as noted above), plus a review of the three previous annual reviews;
- Provide a detailed review and revision of the mitigation strategy;
- Prepare an updated MAP for the City;
- Prepare an updated Draft HMP;
- Submit an updated Draft HMP to DHS&EM and FEMA for approval;
- Submit the DSH&EM- and FEMA-approved plan for adoption by the City Council; and
- Return adoption resolution to FEMA to receive formal approval.

8.2 IMPLEMENTATION THROUGH EXISTING PLANNING MECHANISMS

Requirements for implementation through existing planning mechanisms, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Plan Maintenance Process - Incorporation into Existing Planning Mechanisms

Incorporation into Existing Planning Mechanisms

Requirements §201.6(c)(4)(ii): [The plan shall include a] process by which the Local Government integrates the HMP into other ongoing City planning efforts as well as other planning mechanisms such as comprehensive or capital improvement plans when appropriate.

Element

- Does the plan identify other planning mechanisms available for incorporating the mitigation requirements of the mitigation plan?
- Does the plan include a process by which the City government will incorporate the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?

Source: FEMA, 2015.

After the adoption of the HMP, the City Planner will ensure that the HMP, in particular each Mitigation Action Project, is incorporated into existing planning mechanisms. The City Planner will achieve this incorporation by undertaking the following activities.

- Conduct a review of the community-specific regulatory tools to assess the integration of the mitigation strategy. These regulatory tools are identified in the capability assessment section (Tables 17-19).
- Work with pertinent community departments to increase awareness of the HMP and provide assistance in integrating the mitigation strategy (including the MAP) into relevant planning mechanisms. Implementation of these requirements may require updating or amending specific planning mechanisms.
- The City Planner will be responsible for providing a copy of this HMP to contractors focused on developing new or updating existing Local Plans and ensuring that this HMP is incorporated into plans as applicable.

The City will involve the public to continually reshape and update this HMP. A paper copy of this HMP will be available at City Hall. This HMP will also be stored on the State DCCED/DCRA's plans website for public reference. Planners are encouraged to integrate components of this HMP into their own plans.

The following tables outline the resources available to the City for mitigation related funding and training. The tables delineate the City's regulatory tools, technical specialists, and financial resources available for project management.

Table 17. Regulatory Tools

Regulatory Tools (ordinances, codes, plans)	Existing?	Comments (Year of most recent update; problems administering it, etc.)
Economic Development Plan	2019	KPB Comprehensive Economic Development Strategy
Comprehensive Plan	2016	City of Kenai Comprehensive Plan
Emergency Operations Plan	2007	City of Kenai Emergency Operations Plan
Land Use Plan	Yes	In the 2016 City of Kenai Comprehensive Plan
Transportation Plan	2003	Kenai Peninsula Borough Transportation Plan
Building code	Yes	The City can exercise this authority.
Zoning ordinances	Yes	The City can exercise this authority.
Subdivision ordinances or regulations	Yes	The City can exercise this authority.
Special purpose ordinances	Yes	The City can exercise this authority.
Land Use Regulation	Yes	The City can exercise this authority.

Local Resources

The City has a number of planning and land management tools that will allow it to implement hazard mitigation activities. The resources available in these areas are summarized below.

Table 18. Administrative and Technical Resources

Staff/Personnel Resources	Y/N	Department/Agency and Position
Planner or engineer with knowledge of land development and land management practices	Yes	City Planner
Engineer or professional trained in construction practices related to buildings and/or infrastructure	Yes	Department of Public Works
Planner or engineer with an understanding of natural and/or human-caused hazards	Yes	City Planner
Floodplain Manager	Yes	Jimmy C. Smith, State Floodplain Manager KPB Floodplain Manager
Surveyors	No	The City may hire surveying consulting services.
Staff with education or expertise to assess the jurisdiction's vulnerability to hazards	Yes	City Planner
Personnel skilled in GIS and/or HAZUS-MH	Yes	City Planner
Scientists familiar with the hazards of the jurisdiction	No	U.S. Fish & Wildlife Service; Alaska Dept. of Fish & Game
Emergency Manager	Yes	City Manager, Kenai Peninsula Borough
Finance (Grant writers)	Yes	Finance Director

Public Information Officer	Yes	City Manager
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The following table includes additional information on existing City authority, policies, and programs.

Table 19. Financial Resources for Hazard Mitigation

Financial Resource	Accessible or Eligible to Use for Mitigation Activities
General funds	Limited funding, can exercise this authority with voter approval.
Community Development Block Grants	Limited funding, can exercise this authority with voter approval.
Capital Improvement Projects Funding	Limited funding, can exercise this authority with voter approval.
Authority to levy taxes for specific purposes	Limited funding, can exercise this authority with voter approval.
Incur debt through general obligation bonds	Can exercise this authority with voter approval.
Incur debt through special tax and revenue bonds	Can exercise this authority with voter approval.
Incur debt through private activity bonds	Can exercise this authority with voter approval.
Hazard Mitigation Grant Program (HMGP)	FEMA funding which is available to local communities after a Presidentially-declared disaster. It can be used to fund both pre- and post-disaster mitigation plans and projects.
Pre-Disaster Mitigation (PDM) grant program	FEMA funding which is available on an annual basis. This grant can only be used to fund pre-disaster mitigation plans and projects only.
Flood Mitigation Assistance (FMA) grant program	FEMA funding which is available on an annual basis. This grant can be used to mitigate repetitively-flooded structures and infrastructure to protect repetitive flood structures.
United State Fire Administration (USFA) Grants	The purpose of these grants is to assist state, regional, national, or local organizations to address fire prevention and safety. The primary goal is to reach high-risk target groups including children, seniors, and firefighters.
Fire Mitigation Fees	Finance future fire protection facilities and fire capital expenditures required.

8.3 CONTINUED PUBLIC INVOLVEMENT

Requirements for continued public involvement, as stipulated in DMA 2000 and its implementing regulations, are described below.

<p style="text-align: center;">DMA 2000 Requirements: Plan Maintenance Process - Continued Public Involvement</p> <p>Continued Public Involvement</p> <p>Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the Government will continue public participation in the plan maintenance process.</p> <p>Element</p> <ul style="list-style-type: none">■ Does the plan explain how continued public participation will be obtained? <p><i>Source: FEMA, 2015.</i></p>

The City is dedicated to involving the public directly in the continual reshaping and updating of the HMP. A paper copy of the HMP and any proposed changes will be available at the City Planning Office. An address and phone number of the City Planner to whom people can direct their comments or concerns will also be available at the City Office.

The City Planner will also identify opportunities to raise community awareness about the HMP and the hazards that affect the area with. The City will host a booth at the Community Health Fair that occurs each spring. The purpose of the booth will be to remind the public about the importance of mitigation and hand out community surveys (see Appendix E) to gauge what areas of mitigation the community feels is relevant. Any public comments received regarding the HMP will be collected by the City Planner, included in the annual report, and considered during future HMP updates.

8.4 POTENTIAL FUNDING RESOURCES

Federal Resources

The Federal government requires Local Governments to have an HMP in place to be eligible for mitigation funding opportunities through FEMA such as the UHMA Programs and the HMGP. The Mitigation Technical Assistance Programs available to Local governments are also a valuable resource. FEMA may also provide temporary housing assistance through rental assistance, mobile homes, furniture rental, mortgage assistance, and emergency home repairs. The Disaster Preparedness Improvement Grant also promotes educational opportunities with respect to hazard awareness and mitigation.

- FEMA, through its Emergency Management Institute, offers training in many aspects of emergency management, including hazard mitigation. FEMA has also developed a large number of documents that address implementing hazard mitigation at the local level. Key resource documents are available from the FEMA Publication Warehouse (1-800-480-2520) and are briefly described here:
 - How-to Guides. FEMA has developed a series of how-to guides to assist States, communities, and Tribes in enhancing their hazard mitigation planning capabilities. The first four guides describe the four major phases of hazard mitigation planning. The last five how-to guides address special topics that arise in hazard mitigation planning such as conducting cost-benefit analysis and preparing multi-jurisdictional

- plans. The use of worksheets, checklists, and tables make these guides a practical source of guidance to address all stages of the hazard mitigation planning process. They also include special tips on meeting DMA 2000 requirements.
- Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments. FEMA DAP-12, September 1990. This handbook explains the basic concepts of hazard mitigation and shows State, Tribal, and Local governments how they can develop and achieve mitigation goals within the context of FEMA's post-disaster hazard mitigation planning requirements. The handbook focuses on approaches to mitigation, with an emphasis on multi-objective planning.
 - Mitigation Resources for Success compact disc (CD). FEMA 372, September 2001. This CD contains a wealth of information about mitigation and is useful for State, Tribal, and Local government planners and other stakeholders in the mitigation process. It provides mitigation case studies, success stories, information about Federal mitigation programs, suggestions for mitigation measures to homes and businesses, appropriate relevant mitigation publications, and contact information.
 - A Guide to Federal Aid in Disasters. FEMA 262, April 1995. When disasters exceed the capabilities of State, Tribal, and Local governments, the President's disaster assistance programs (administered by FEMA) is the primary source of Federal assistance. This handbook discusses the procedures and process for obtaining this assistance, and provides a brief overview of each program.
 - The Emergency Management Guide for Business and Industry. FEMA 141, October 1993. This guide provides a step-by-step approach to emergency management planning, response, and recovery. It also details a planning process that businesses can follow to better prepare for a wide range of hazards and emergency events. This effort can enhance a business's ability to recover from financial losses, loss of market share, damages to equipment, and product or business interruptions. This guide could be of great assistance to a community's industries and businesses located in hazard prone areas.
 - The FEMA Hazard Mitigation Assistance Guidance and Addendum, February 5, 2015. The guidance introduces the five HMA grant programs, funding opportunities, award information, eligibility, application and submission information, application review process, administering the grant, contracts, additional program guidance, additional project guidance, and contains information and resource appendices (FEMA, 2015).
 - Department of Agriculture (USDA). Assistance provided includes: Emergency Conservation Program, Non-Insured Assistance, Emergency Watershed Protection, Rural Housing Service, Rural Utilities Service, and Rural Business and Cooperative Service.
 - Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy, Weatherization Assistance Program. This program minimizes the adverse effects of high energy costs on low-income, elderly, and handicapped citizens through client education activities and weatherization services such as an all-around safety check of major energy systems, including heating system modifications and insulation checks.

- Department of Health and Human Services, Administration of Children & Families, Administration for Native Americans (ANA). The ANA awards funds through grants to American Indians, Native Americans, Native Alaskans, Native Hawaiians, and Pacific Islanders. These grants are awarded to individual organizations that successfully apply for discretionary funds. ANA publishes in the Federal Register an announcement of funds available, the primary areas of focus, review criteria, and the method of application.
- Department of Housing and Urban Development (HUD), Office of Homes and Communities, Section 108 Loan Guarantee Programs. This program provides loan guarantees as security for Federal loans for acquisition, rehabilitation, relocation, clearance, site preparation, special economic development activities, and construction of certain public facilities and housing.
- Department of Housing and Urban Development, Community Development Block Grants (HUD/CDBG). Provides grant assistance and technical assistance to aid communities in planning activities that address issues detrimental to the health and safety of local residents, such as housing rehabilitation, public services, community facilities, and infrastructure improvements that would primarily benefit low-and moderate-income persons.
- Department of Labor (DOL), Employment and Training Administration, Disaster Unemployment Assistance. Provides weekly unemployment subsistence grants for those who become unemployed because of a major disaster or emergency. Applicants must have exhausted all benefits for which they would normally be eligible.
- Federal Financial Institutions. Member banks of Federal Deposit Insurance Corporation, Financial Reporting Standards or Federal Home Loan Bank Board may be permitted to waive early withdrawal penalties for Certificates of Deposit and Individual Retirement Accounts.
- Internal Revenue Service (IRS), Tax Relief. Provides extensions to current year's tax return, allows deductions for disaster losses, and allows amendment of previous tax returns to reflect loss back to three years.
- U.S. Small Business Administration (SBA). May provide low-interest disaster loans to individuals and businesses that have suffered a loss due to a disaster. Requests for SBA loan assistance should be submitted to DHS&EM.
- USACE Alaska District's Civil Works Branch studies potential water resource projects in Alaska. These studies analyze and solve water resource issues of concern to the local communities. These issues may involve navigational improvements, flood control or ecosystem restoration. The agency also tracks flood hazard data for over 300 Alaskan communities on floodplains or the sea coast. These data help local communities assess the risk of floods to their communities and prepare for potential future floods. The USACE is a member and co-chair of the Alaska Climate Change Sub-Cabinet.

State Resources

- DHS&EM is responsible for improving hazard mitigation technical assistance for Tribal and Local governments for the State of Alaska. Providing hazard mitigation training,

current hazard information, and communication facilitation with other agencies will enhance local hazard mitigation efforts. DHS&EM administers FEMA mitigation grants to mitigate future disaster damages such as those that may affect infrastructure including the elevation, relocation, or acquisition of hazard-prone properties. DHS&EM also provides mitigation funding resources for mitigation planning.

- Division of Senior Services (DSS): Provides special outreach services for seniors, including food, shelter, and clothing.
- Division of Insurance (DOI): Provides assistance in obtaining copies of policies and provides information regarding filing claims.
- Department of Military and Veterans Affairs (DMVA): Provides damage appraisals and settlements for VA-insured homes, and assists with filing of survivor benefits.
- The Community Health and Emergency Medical Services (CHEMS) is a section within the Division of Public Health within the Department of Health and Social Services (DHSS). DHSS is charged with promoting and protecting the public health and one of CHEMS' responsibilities is developing, implementing, and maintaining a statewide comprehensive emergency medical services system. The department's statutory mandate (Alaska Statute 18.08.010) requires it to:
 - Coordinate public and private agencies engaged in the planning and delivery of emergency medical services, including trauma care, to plan an emergency medical services system;
 - Assist public and private agencies to deliver emergency medical services, including trauma care, through the award of grants in aid;
 - Conduct, encourage, and approve programs of education and training designed to upgrade the knowledge and skills of health personnel involved in emergency medical services, including trauma care; and
 - Establish and maintain a process under which hospitals and clinics can represent themselves to be trauma centers because they voluntarily meet criteria adopted by the department which are based on an applicable national evaluation system.
- DCRA within the DCCED. DCRA administers the HUD/CDBG, FMA Program, and the Climate Change Sub-Cabinet's Interagency Working Group's program funds and administers various flood and erosion mitigation projects, including the elevation, relocation, or acquisition of flood-prone homes and businesses throughout the State. This department also administers programs for State "distressed" and "targeted" communities.
- Division of Environmental Conservation (DEC). The DEC's primary roles and responsibilities concerning hazards mitigation are ensuring safe food and safe water, and pollution prevention and pollution response. DEC ensures water treatment plants, landfills, and bulk fuel storage tank farms are safely constructed and operated in communities. Agency and facility response plans include hazards identification and pollution prevention and response strategies.

- Department of Transportation and Public Facilities (DOT/PF) personnel provide technical assistance to the various emergency management programs, to include mitigation. This assistance is addressed in the DHS&EM-DOT/PF Memorandum of Agreement and includes, but, is not limited to: environmental reviews, archaeological surveys, and historic preservation reviews.

In addition, DOT/PF and DHS&EM coordinate buy-out projects to ensure that there are no potential right-of-way conflicts with future use of land for bridge and highway projects, and collaborate on earthquake mitigation.

Additionally, DOT/PF provides safe, efficient, economical, and effective operation of the State's highways, harbors, and airports. DOT/PF uses its Planning, Design and Engineering, Maintenance and Operations, and Intelligent Transportation Systems resources to identify the hazard, plan and initiate mitigation activities to meet the transportation needs of Alaskans and make Alaska a better place to live and work. DOT/PF budgets for the temporary replacement bridges and materials necessary to make the multi-modal transportation system operational following a natural disaster.

- The Department of Natural Resources (DNR) administers various projects designed to reduce stream bank erosion, reduce localized flooding, improve drainage, and improve discharge water quality through the stormwater grant program funds. Within DNR, the Division of Geological and Geophysical Survey (DGGs) is responsible for the use and development of Alaska's mineral, land, and water resources, and collaboration on earthquake mitigation.
 - DNR's DGGs collects and distributes information about the State's geologic resources and hazards. Their geologists and support staff are leaders in researching Alaska's geology and implementing technological tools to most efficiently collect, interpret, publish, archive, and disseminate that information to the public
 - The DNR's Division of Forestry (DOF) participates in a statewide wildfire control program in cooperation with the forest industry, rural fire departments, and other agencies. Prescribed burning may increase the risks of fire hazards; however, prescribed burning reduces the availability of fire fuels, and therefore, the potential for future, more serious fires.
 - DOF also manages various wildland fire programs, activities, and grant programs such as the FireWise Program, the Community Forestry Program (CFP) and the Volunteer Fire Assistance and Rural Fire Assistance Grant (VFA-RFAG) programs.

Other Funding Sources and Resources

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

- FEMA, <http://www.fema.gov> - includes links to information, resources, and grants that communities can use in planning and implementation of sustainable measures.
- American Planning Association (APA), <http://www.planning.org> - a non-profit professional association that serves as a resource for planners, elected officials, and citizens concerned with planning and growth initiatives.

- Institute for Business and Home Safety (IBHS), <http://ibhs.org> - an initiative of the insurance industry to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters.
- American Red Cross (ARC). Provides for the critical needs of individuals such as food, clothing, shelter, and supplemental medical needs. Provides recovery needs such as furniture, home repair, home purchasing, essential tools, and some bill payment may be provided.
- Crisis Counseling Program. Provides grants to State and Borough Mental Health Departments, which in turn provide training for screening, diagnosing, and counseling techniques. Also provides funds for counseling, outreach, and consultation for those affected by disaster.

- ACRC (Alaska Climate Research Center). 2018: Temperature Change in Alaska. Available: <http://climate.gi.alaska.edu/ClimTrends/Change/TempChange.html> (August 2019).
- AEC (Alaska Earthquake Center). 2019. Available: <http://earthquake.alaska.edu/>. (August 2019).
- AICC (Alaska Interagency Coordination Center). 2019. Available: <http://fire.ak.blm.gov/aicc.php>. (August 2019).
- CCSP (U.S. Climate Change Science Program). 2008. *Weather and Climate Extremes in a Changing Climate – Regions of Focus – North America, Hawaii, Caribbean, and U.S. Pacific Islands. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research*. Vol. 3.3T.R. Karl, G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray, Eds. Department of Commerce, NOAA's National Climatic Data Center, 164 pp.
- City of Kenai. 2016. *Imagine Kenai 2030: City of Kenai Comprehensive Plan*. Available: <https://www.kenai.city/planning/page/comprehensive-plan> (August 2019).
- City of Kenai. 2010. *ANNEX to the Kenai Peninsula Borough Local All Hazard Mitigation Plan*. (August 2019).
- City of Kenai. 2007. *City of Kenai Emergency Operations Plan*. (November 2019).
- DCCED/DCRA (Department of Community and Commerce and Economic Development [DCCED]/Division of Community and Regional Affairs [DCRA]). 2019. Community Profile: <https://dccd.maps.arcgis.com/apps/MapJournal/index.html?appid=0cc86ef7d286440f816f08f46467409a>. (August 2019).
- DHS&EM (Division of Homeland Security and Emergency Management). 2018a. *Alaska State Hazard Mitigation Plan, October 2018*. Accessed January 2019.
- DHS&EM. 2018b. *Disaster Cost Index June 30, 2018*. Accessed January 2018.
- FEMA-a, (Federal Emergency Management Agency), “Local Mitigation Plan Review Guide – September 30, 2011.” Available: https://www.fema.gov/media-library-data/20130726-1809-25045-7498/plan_review_guide_final_9_30_11.pdf (January 2019).
- FEMA-b, “Mitigation Planning How-To Guides, 2013.” Available: <https://www.fema.gov/media-library/resources-documents/collections/6> (January 2019).
- FEMA-c, “Local Mitigation Planning Handbook.” Updated January 1, 2015. Available: <https://www.fema.gov/media-library/assets/documents/31598> (January 2019).
- FEMA-d, “Local Mitigation Assistance Guidance and Addendum, February 27, 2015. Available: <https://www.fema.gov/media-library/assets/documents/103279> (January 2019).
- FEMA-e, “Mitigation Planning Fact Sheet, February 27, 2015. Available: <https://www.fema.gov/media-library/assets/documents/5756> (January 2019).

- FEMA-f, "Hazard Mitigation Assistance Cost Share Guide, May 2016. Available: <https://www.fema.gov/media-library-data/1463766664964-4e6dd22652cb7c8a6162904f3b1b2022/FinalHMACostShareGuide508.pdf> (January 2019).
- FEMA-g, "Flood Frequently Asked Questions." Available: <https://www.floodsmart.gov/faqs> (August 2019).
- FEMA-h, "Flood Facts." Available: <https://www.floodsmart.gov/why/why-buy-flood-insurance> (August 2019).
- FEMA-i, "Community Status Book Report." Available: <http://www.fema.gov/cis/AK.html> (August 2019).
- FEMA-j, "*FEMA Region X – Kenai Peninsula Borough and the Incorporated Cities of Homer, Kachemak, Kenai, Seldovia, Seward, and Soldotna Risk Report*". December 2017. Available: https://www.commerce.alaska.gov/web/Portals/4/pub/Risk_Report_Kenai_Final.pdf (August 2019).
- KBBI. February 29, 2016. "Enstar Identifies Cause of Gas Explosions in Kenai." Jenny Neyman, Homer.
- KPB. March 2006. *Kenai Area Community Wildfire Protection Plan*. Prepared by Spruce Bark Beetle Program.
- KPB. 2019. *Draft Kenai Peninsula Borough Comprehensive Plan*.
- MMI. 2006. *Modified Mercalli Intensity Scale*. Michigan Technical University. Available: <http://www.geo.mtu.edu/UPSeis/Mercalli.html>. (August 2011).
- Shulski, M., and G. Wendler. 2007. *The Climate of Alaska*. University of Alaska Press. 208 pp.
- Stewart, B. C., K. E. Kunkel, L.E. Stevens, L. Sun, and J. E. Walsh. 2013. *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment: Part 7. Climate of Alaska*. NOAA Technical Report NESDIS 142-7. 60 pp.
- USACE. (U.S. Army Corps of Engineers). November 2018. *Kenai Bluffs Bank Stabilization Section 116 Feasibility Study, Kenai, Alaska*. (August 2018).
- WeatherSpark. 2019. Available: <https://weatherspark.com/y/215/Average-Weather-in-Kenai-Alaska-United-States-Year-Round#Sections-Wind>.

APPENDIX B. Definitions

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

Avalanche: Mass of snow and ice falling suddenly down a mountain slope and often taking with it earth, rocks and rubble of every description.

Base Flood Elevation: The computed elevation to which floodwater is anticipated to rise during the base flood. Base Flood Elevations are shown on FIRMs and on the flood profiles. The Base Flood Elevation is the regulatory requirement for the elevation or floodproofing of structures. The relationship between the Base Flood Elevation and a structure's elevation determines the flood insurance premium.

Borough: The basic unit of local government in Alaska, analogous to counties in other states.

Building: Any structure used or intended for supporting or sheltering any use or occupancy.

Building Code: The regulations adopted by a local governing body principally setting forth standards for the construction, addition, modification, and repair of buildings and other structures for the purpose of protecting the health, safety, and general welfare of the public.

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

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

Dam: A structure built across a waterway to impound water.

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

Disaster Mitigation Act (DMA 2000) (public Law 106-390): This act was signed into law on October 10, 2000. This legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur.

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

Elevation: The raising of a structure to place it above flood waters, generally above the base flood elevation, on an extended support structure.

Emergency Operations Plan: A document that: describes how people and property will be protected in disaster and disaster threat situations; details who is responsible for carrying out specific actions; identifies the personnel, equipment, facilities,

supplies, and other resources available for use in the disaster; and outlines how all actions will be coordinated.

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

Federal Disaster Declaration: See Presidential Disaster Declaration.

Federal Emergency Management Agency (FEMA): A federal agency created in 1979 to provide a single point of accountability for all federal activities related to hazard mitigation, preparedness, response, and recovery.

Flash Flood: A flood event occurring with little or no warning where water levels rise at an extremely fast rate.

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

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

"Flood frequencies:" Frequencies are determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. The frequency is the chance of a flood occurring during a given timeframe. It is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1% chance, and the 10-year flood has a 10% chance of occurring in any given year.

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

Governing Body: The legislative body of a jurisdiction such as a municipal or Borough assembly or a city council.

Hazard: A source of potential danger or adverse condition. Any situation that has the potential for causing personal injury or death, or damage to property and the environment.

Hazard Event: A specific occurrence of a particular type of hazard.

Hazard Identification: The process of identifying hazards that threaten an area.

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

Hazard Mitigation Grant Program: The program authorized under section 404 of the Stafford Act, which may provide funding for mitigation measures identified through the

evaluation of natural hazards conducted under §322 of the Disaster Mitigation Act 2000.

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

Hydro Unit: Short for Hydrologic Unit. A drainage area delineated to nest in a multi-level, hierarchical drainage system. Its boundaries are defined by hydrographic and topographic criteria that delineate an area of land upstream from a specific point on a river, stream, or similar surface water. A hydrologic unit can accept surface water directly from upstream drainage areas, and indirectly from associated surface areas such as remnant, non-contributing, and diversions to form a drainage area with single or multiple outlet points.

Infrastructure: The public services of a community that have a direct impact to the quality of life. Infrastructure refers to communication technology such as phone lines or Internet access, vital services such as public water supply and sewer treatment facilities, and includes an area's transportation system, regional dams or bridges, etc.

Inundation: The maximum horizontal distance inland reached by a tsunami.

Landslide: Downward movement of a slope and materials under the force of gravity.

Liquefaction: The phenomenon that occurs when ground shaking cause's loose soils to lose strength and act like a thick or viscous fluid. Liquefaction causes two types of ground failure: lateral spread and loss of bearing strength.

Local Government: Any county, Borough, municipality, city, township, public authority, school district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency, or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity, for which an application for assistance is made by a State or political subdivision of a state.

Magma: Molten rock originating from the Earth's interior.

Magnitude: A measure of the strength of a hazard event. The magnitude (also referred to as severity) of a given hazard event is usually determined using technical measures specific to the hazard.

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

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

Municipality: A political subdivision incorporated under the laws of the state that is a home rule or general law city, a home rule or general law borough, or a unified municipality.

Natural Disaster: Any natural catastrophe, including any hurricane, tornado, storm, high water, wind, driven water, tsunami, earthquake, volcanic eruption, landslide, snowstorm, fire, or drought. (44 CFR Subpart M206.401).

New Construction: New construction means structures for which the “start of construction” on or after the effective date of a floodplain management regulation adopted by a community and includes any subsequent improvement to such structures.

One Hundred (100)-Year: The flood elevation that has a one-percent chance of occurring in any given year. It is also known as the Base Flood.

Overlay Zone: Overlay zones (overlay districts) create a framework for conservation or development of special geographical areas. In a special resource overlay district, overlay provisions typically impose greater restrictions on the development of land, but only regarding those parcels whose development, as permitted under the zoning, may threaten the viability of the natural resource. In a development area overlay district, the provisions may impose restrictions as well, but also may provide zoning incentives and waivers to encourage certain types and styles of development. Overlay zone provisions are often complemented by the adoption of other innovative zoning techniques, such as floating zones, special permits, incentive zoning, cluster development and special site plan or subdivision regulations, to name a few.

Period: A length of time. For waves, it is the length of time between two successive peaks or troughs, which may vary due to interference of waves. Tsunami periods generally range from 5 to 60 minutes.

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

Preparedness: The steps taken to decide what to do if essential services break down, developing a plan for contingencies, and practicing the plan. Preparedness ensures that people are ready for a disaster and will respond to it effectively.

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

Probability: A statistical measure of the likelihood that a hazard event will occur.

Recovery: The long-term activities beyond the initial crisis period and emergency response phase of disaster operations that focus on returning all systems in the community to a normal status or to reconstitute these systems to a new, less vulnerable condition.

Response: Those activities and programs designed to address the immediate and short-term effects of the onset of an emergency or disaster.

Retrofit: The strengthening of existing structures to mitigate disaster risks.

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

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

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

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

Run-up: The maximum vertical height of a tsunami in relation to sea level.

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

Stafford Act: 1) The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended. 2) The Stafford Act provides an orderly and continuing means of assistance by the Federal Government to State, local and tribal governments in carrying out their responsibilities to alleviate the suffering and damage which result from disaster.

State Disaster Declaration: A disaster emergency shall be declared by executive order or proclamation of the Governor upon finding that a disaster has occurred or that the occurrence or the threat of a disaster is imminent. The state of disaster emergency shall continue until the governor finds that the threat or danger has passed or that the disaster has been dealt with to the extent that emergency conditions no longer exist and terminates the state of disaster emergency by executive order or proclamation. Along with other provisions, this declaration allows the governor to utilize all available resources of the State as reasonably necessary, direct and compel the evacuation of all or part of the population from any stricken or threatened area if necessary, prescribe routes, modes of transportation and destinations in connection with evacuation and control ingress and egress to and from disaster area. It is required before a Presidential Disaster Declaration can be requested.

State Hazard Mitigation Officer (SHMO): The SHMO is the representative of state government who is the primary point of contact with FEMA, other state and Federal agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities.

Storm Surge: Rise in the water surface above normal water level on open coast due to the action of wind stress and atmospheric pressure on the water surface.

Stream: A body of water flowing in a natural surface channel. Flow may be continuous or only during wet periods. Streams that flow only during wet periods are termed “intermittent streams.”

Structure: That which is constructed above or below ground in some definite manner for any use or purpose.

Subdivision Regulations: Ordinances or regulations governing the subdivision of land with respect to things such as adequacy and suitability of building sites and utilities and public facilities.

Tectonic Plate: Torsionally rigid, thin segments of the earth’s lithosphere that may be assumed to move horizontally and adjoin other plates. It is the friction between plate boundaries that causes seismic activity.

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

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

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

Volcano: A volcano is an opening, or rupture, in a planet's surface or crust, which allows hot magma, ash, and gases to escape from below the surface. Volcanoes are generally found where tectonic plates are diverging or converging. A mid-oceanic ridge, for example the Mid-Atlantic Ridge, has examples of volcanoes caused by divergent tectonic plates pulling apart; the Pacific Ring of Fire has examples of volcanoes caused by convergent tectonic plates coming together.

Vulnerability: Describes how exposed or susceptible to damage an asset is. Vulnerability depends on an asset’s construction, contents, and the economic value of its functions. The vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power – if an electrical substation is flooded, it will affect not only the

substation itself, but a number of businesses as well. Other, indirect effects can be much more widespread and damaging than direct ones.

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

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

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

Water Surface Elevation: Water surface elevation means the height, in relation to the National Geodetic Vertical Datum (NGVD) of 1929, (or other datum, where specified) of floods of various magnitudes and frequencies in the floodplains of coastal riverine areas.

Water Table: The uppermost zone of water saturation in the ground.

Wetlands: Areas that are inundated or saturated frequently and for long enough to support vegetative or aquatic life requiring saturated or seasonally saturated soil conditions for growth and reproduction.

Wildfire: An uncontrolled fire that spreads through vegetative fuels, exposing and possibly consuming structures.

Worst Case Scenario: The term "worst case scenario" is somewhat self-explanatory. It includes the potential for a "cascade effect", which was assumed in analyzing the risk from each hazard. The term "cascade effect" is used to describe the triggering of several hazard occurrences from an initial event. An earthquake for instance, might also trigger avalanches, collapsed buildings, transportation and utility disruptions, and hazardous material releases, each of which might trigger additional events, all part of the same incident.

Zoning Ordinance: An ordinance under the state or local government's police powers that divides an area into districts and, within each district, regulates the use of land and buildings, height, and bulk of buildings or other structures, and the density of population.

Appendix A: Public Involvement

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Department of Military and Veterans Affairs

Division of Homeland Security and
Emergency Management

P.O. Box 5750
JBER, AK 99505-0750
Main: 907.428.7000
Fax: 907.428.7009
www.ready.alaska.gov

May 23, 2018

Elizabeth Appleby, City Planner
City of Kenai
210 Fidalgo Avenue
Kenai, Alaska 99611

RE: Letter of Commitment for the City of Kenai to participate in Local Hazard Mitigation Planning delivered by the State of Alaska Division of Homeland Security and Emergency Management.

Dear Ms Appleby:

The State of Alaska Division of Homeland Security and Emergency Management (DHS&EM), in cooperation with the Federal Emergency management Agency (FEMA), is seeking funding to provide your community with a Local Hazard Mitigation Plan. In cooperation with your community, the planning would be completed using State technical assistance and State managed contracting.

Mitigation planning gives your community a great opportunity to assess the disaster hazards facing your community, consider the risks from those hazards and then consider as a community how to reduce or eliminate the losses from those hazards in the future. As you know the City of Kenai can potentially be affected by a wide range of hazards including wildfires, earthquakes, and water-related events so this planning process could be critical to reduced effects from these events.

Having a FEMA approved hazard mitigation plan will also make your community eligible for hazard mitigation grant funds to construct mitigation projects that will make your community more resilient in future disasters.

The development of your plan will be the responsibility of contractors hired by the State of Alaska. To be successful, your community will be required to cooperate during the development planning process including:

- Providing community information on previous disasters, damage and hazards
- Assist with information that will allow a vulnerability analysis and an identification of risks
- Work with the plan developers to formulate community mitigation goals and actions
- Host at least two public community meetings to review and edit the plan drafts
- Formally present the completed plan as a community document to the community's governing body for adoption

Therefore, with an understanding of the requirements for community participation in the hazard mitigation planning process; I Elizabeth Appleby, City Planner commit the City of Kenai to the DHS&EM local hazard mitigation planning effort.

Executed this 29th day of May 2018.

Elizabeth Appleby
(Jurisdiction official's signature)

Affidavit: By signing below, I certify that the **AGENDA**, a printed copy of which is attached, was published in the Peninsula Clarion, a newspaper of general circulation on the 25th day of October, 2019.

Wilma E Anderson

WILMA E. ANDERSON, PLANNING ASSISTANT

WITNESS SIGNATURE:

Kayla Feltman
PWA

Title:

Date: October 28, 2019



AGENDA
CITY OF KENAI PLANNING & ZONING COMMISSION
REGULAR MEETING
OCTOBER 30, 2019 - 7:00 P.M.
www.kenai.city

- A. SCHEDULED PUBLIC COMMENT** – Jennifer LeMay, LeMay Engineering & Consulting, Inc. to Discuss the City of Kenai Local Hazard Mitigation Plan
- B. CONSIDERATION OF PLATS**
 - 1. Resolution PZ2019-40** – Original Preliminary Plat of Valhalla Heights Osland Replat, submitted by Edge Survey and Design, Inc., 43335 K-Beach Rd., Suite 16B, Soldotna AK 99669, on behalf of Tyler Scott Osland, 236 Riverwatch Dr., Soldotna, AK 99669
 - 2. Resolution PZ2019-41** – Original Preliminary Plat of Valhalla Heights 2019 Replat, submitted by McLane Consulting, Inc., P.O. Box 468, Soldotna AK 99669, on behalf of Jeremiah N. and Jennifer Cates, 415 Phillips Dr., Kenai, AK 99611
 - 3. Resolution PZ2019-42** – Original Preliminary Plat of Valhalla Heights White Replat, submitted by McLane Consulting, Inc., P.O. Box 468, Soldotna AK 99669, on behalf of John J. and Mary L. White, 5327 Kenai Spur Highway, Kenai, AK 99611
- C. PUBLIC HEARINGS** - None
- D. UNFINISHED BUSINESS** - None
- E. NEW BUSINESS** - None

The meeting will commence at 7:00 p.m. in the Kenai City Hall Council Chambers at 210 Fidalgo Avenue, Kenai, Alaska. For more information, please contact Wilma Anderson, Planning Assistant, at (907) 283-8237 or e-mail: wanderson@kenai.city.

Wilma E. Anderson
Planning & Zoning Administration

Publish: October 25, 2019

2434354



Kenai Planning and Zoning Commission - Regular Meeting

October 30, 2019 – 7:00 PM

Kenai City Council Chambers

210 Fidalgo Avenue, Kenai, Alaska

<https://www.kenai.city>

AGENDA

A. CALL TO ORDER

1. Pledge of Allegiance
2. Roll Call
3. Agenda Approval
4. Consent Agenda
5. *Excused Absences

All items listed with an asterisk () are considered to be routine and non-controversial by the Commission and will be approved by one motion. There will be no separate discussion of these items unless a Commission Member so requests, in which case the item will be removed from the Consent Agenda and considered in its normal sequence on the agenda as part of the General Orders.

B. APPROVAL OF MINUTES

1. *September 25, 2019

C. SCHEDULED PUBLIC COMMENT

Public comment limited to ten (10) minutes per speaker)

1. Jennifer LeMay, LeMay Engineering & Consulting, Inc. to Discuss the City of Kenai Local Hazard Mitigation Plan

D. UNSCHEDULED PUBLIC COMMENT

(Public comment limited to three (3) minutes per speaker; thirty (30) minutes aggregated)

E. CONSIDERATION OF PLATS

1. **Resolution PZ2019-40** - Original Preliminary Plat of Valhalla Heights Osmond Replat, submitted by Edge Survey and Design, P.O. Box 468, Soldotna AK 99669, on behalf of Jeremiah N. and Jennifer Cates, 415 Phillips Dr., Kenai, AK 99611

2. **Resolution PZ2019-41** - Original Preliminary Plat of Valhalla Heights 2019 Replat, submitted by McLane Consulting, Inc., P.O. Box 468, Soldotna AK 99669, on behalf of Jeremiah N. and Jennifer Cates, 415 Phillips Dr., Kenai, AK 99611
3. **Resolution PZ2019-42** – Original Preliminary Plat of Valhalla Heights White Replat, submitted by McLane Consulting, Inc., P.O. Box 468, Soldotna, AK 99669, on behalf of John J. and Mary L. White, 5327 Kenai Spur Highway, Kenai, AK 99611

F. **PUBLIC HEARINGS**

G. **UNFINISHED BUSINESS**

H. **NEW BUSINESS**

I. **PENDING ITEMS**

J. **REPORTS**

1. City Council
2. Borough Planning
3. Administrative Report

K. **ADDITIONAL PUBLIC COMMENT**

(Public comment limited to three (3) minutes per speaker; thirty (30) minutes aggregated)

L. **INFORMATIONAL ITEMS**

1. Planning and Zoning Resolutions – Third Quarter 2019
2. Building Permits – Third Quarter 2019
3. Code Violations – Third Quarter 2019

M. **NEXT MEETING ATTENDANCE NOTIFICATION**

1. November 13, 2019 - 7.pm - Regular Meeting

N. **COMMISSION COMMENTS AND QUESTIONS**

O. **ADJOURNMENT**

Kenai Planning Team Meeting for the 2019 Hazard Mitigation Plan

October 30, 2019

2 pm at Kenai City Council Chambers

Name	Department Represented	Contact Information (email)
Jeff Tucker	Fire	jtucker@kenai.city
Elizabeth Appleby	P&Z	eappleby@kenai.city
JENNIFER LEMAY	CONTRACTOR	jlemay@lemayengineering.com
Jeremiah Hamilton	Fire	jhamilton@kenai.city
BOB FRATES	Parks & Rec.	bfrates@kenai.city
DAN ROSS	Police	drosse@kenai.city
Mary Mandurant	Kenai Airport	mandurant@kenai.city
Scott Curtin	Public Works	scurtin@kenai.city

Kenai Public Meeting #1 for the 2019 Hazard Mitigation Plan

October 30, 2019

7 pm at Kenai City Council Chambers

Name	Organization Represented or Kenai Resident	Contact Information (email)
Victoria Askin	Kenai P+Z Commission	eott@ptalaska.net
Tim McIntyre	Kenai Planning & Zoning Commission	timcintyre@gmail.com
JOSEPH HALSTED	P+Z	Joe@digitrak.com
Gary Greenberg	"	Ggreenberg@akmapco.com
Elizabeth Appleby	City Planner City of Kenai	eappleby@kenai.city
JEFF TWAIT	KENAI P+Z Commish	jtwait@aicloud.com
Bob Molloy	City Council Liaison to Planning + Zoning	bmolloy@kenai.city
Jeremiah Cates	Kenai Resident	—
Jennifer Cates	Kenai Resident	—
JENNIFER LEMAY	LEMAY ENGINEERING + CONSULTING, INC.	jlemay@lemayengineering.com

Hazard Mitigation Planning Process

Development of a City of Kenai Hazard Mitigation Plan

Plans must be updated every five years and approved by DHS&EM and FEMA and then be adopted by the community via City Council resolution for the community to remain eligible for FEMA grant funding.

Public Meeting #1: October 30, 2019

An annex to the Kenai Peninsula Borough Hazard Mitigation Plan was prepared in 2010 and briefly listed natural hazard risks for the City of Kenai. The Plan has expired. LeMay Engineering & Consulting, Inc. was hired by DHS&EM to assist in creating a stand alone City of Kenai Hazard Mitigation Plan. The effort to develop this Plan is a public process, and you are invited to participate.

Today is Public Meeting #1 as part of the regularly-scheduled Planning & Zoning Commission meeting on October 30, 2019. Within the next two weeks, the City will post the Draft 2019 Hazard Mitigation Plan on its website for review by the community and begin a 30-day public comment period. Public Meeting #2 will occur December 4 at the regularly-scheduled City Council meeting and will serve as a public hearing and forum to provide comments on the Plan.

Today's meeting is a forum to present a summary of the planning process and evaluate mitigation actions for the community. I welcome your input. Comments can be provided during this meeting or by email or phone. Send Jennifer LeMay, PE, PMP an email at jlemay@lemayengineering.com or call her at (907) 350-6061.

For the Hazard Mitigation Plan, we're interested in information related to:

- Hazard Identification,
- Profiles (characteristics),
- Previous occurrences,
- Locations,
- Extents (breadth, magnitude, and severity),
- Impacts, and
- Recurrence probability statements.

Which hazards are applicable for the City of Kenai?

- Flood/Erosion ★
- Wildland/Conflagration Fires ★
- Earthquakes ★
- Volcanic Ashfall ★
- Severe Weather ★
- Changes in the Cryosphere ★

Plan Process

- Public Meeting #1 on October 30, 2019.
- Draft Plan available for public comment (Second Week of November, 2019).
- Public hearing for Draft Plan (December 4, 2019).
- State/FEMA review and pre-approval of Draft Plan.
- Newsletter announcing Final Plan (the public may still comment).
- City Council adoption.
- Final Approval from State/FEMA.

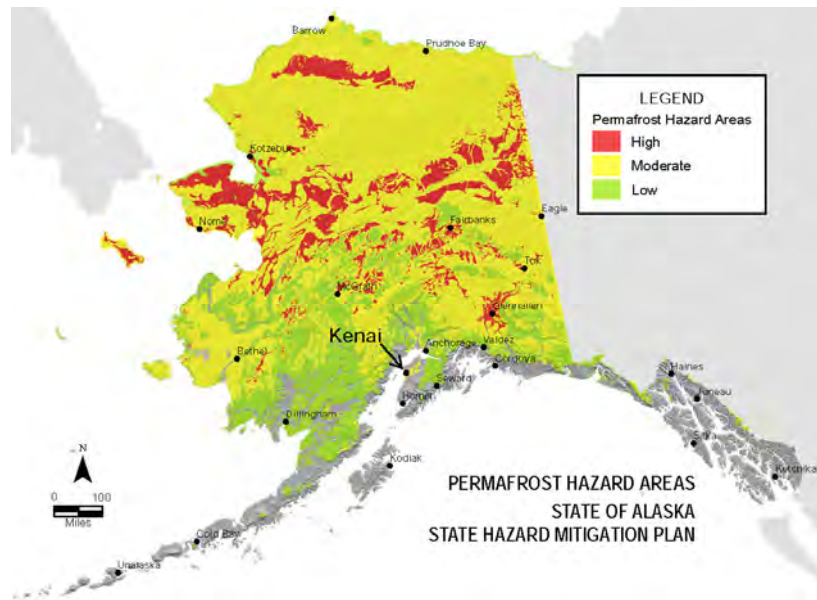
After the 2019 Hazard Mitigation Plan is completed, approved, and adopted, the City of Kenai will be eligible to apply for mitigation project funds from DHS&EM and FEMA for five years until the plan requires an update in 2025.

Contacts:

Jennifer LeMay, PE, PMP, LeMay Engineering & Consulting, Inc. Planner (907) 350-6061
Brent Nichols, CFM, State of Alaska DHS&EM Hazard Mitigation Officer (907) 428-7085

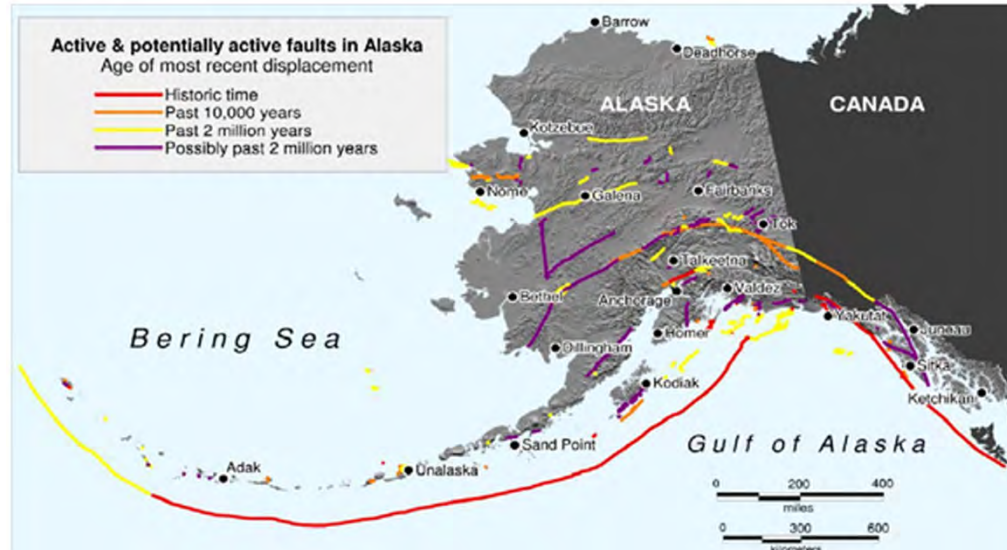
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- The City of Kenai is not affected by glaciers, permafrost, or avalanches.
- According to the 2018 U.S. Army Corps of Engineers' Kenai Bluffs' report, both sea ice and river ice collect at the toe of the Kenai Bluffs during winter months. Ice gouges the beach and causes damage.



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- The entire geographic area of Alaska is prone to earthquake effects. The most recent large earthquake occurred on January 24, 2016, with a magnitude of 7.1 and was located 53 miles west of Anchorage Point. A total of four homes were destroyed on Lilac Lane.
- The USGS earthquake probability model places the probability of an earthquake with a likelihood of experiencing strong shaking within Kenai at 0.6 to 0.8 g PGA with a 2% probability in 50 years. A 2% probability in 50 years is a rare, large earthquake, and statistically, it happens on average every 2,500 years.



Flood/Erosion

- The 2017 FEMA Risk Map study did not identify any areas of concern for the City of Kenai with regards to flooding.
- The 2017 FEMA Risk Map study identified the Wastewater Treatment Plant at risk of erosion.
- The Kenai Bluffs are 5,000 linear feet of high bank located in the City along the north bank of the Kenai River at the mouth of Cook Inlet. The U.S. Army Corps of Engineers completed a feasibility study in September 2018 that recommended installation of a protective berm at the bluff toe.

Severe Weather

In Kenai, severe weather consists of high winds and ice storms.

Wildland/Conflagration Fires

Historically, significant fires within the City include the 1969 Swanson River Fire and the Swires Road fire in the mid-1980s. The City also experiences small wildland fires throughout the summer months which the City of Kenai Fire Department and the Alaska Department of Forestry responded to cooperatively. No conflagration fires have occurred in the City of Kenai.

Mitigation Goals for the City of Kenai

Goal ID	Description
1	Reduce or eliminate loss of homes and property due to fires.
2	Reduce or eliminate the erosion of the bluff at the mouth of the Kenai River.
3	Prepare citizens and the built environment to better survive the hazards associated with earthquakes.
4	Prepare citizens to adequately protect themselves and property from the hazards of volcanic ash.
5	Update the City's Emergency Operating Plan to ensure the appropriate response to natural hazards.
6	Update the ARFT as an Emergency Operations Command Center.

Mitigation Actions for the City of Kenai

Action ID	Description	Priority	Responsible Party	Potential Funding	Time-frame
1	Promote the FireWise program including public education programs in school and neighborhoods. Promote the development of defensible space and landscaping techniques to community and home construction contractor participation. Encourage the reduction of fuels in hazardous areas and egress routes in coordination with the Kenai Peninsula Spruce Bark Beetle Mitigation Office, State Forestry, and land owners. Trees infected with spruce bark beetle need to be identified and removed.	High	Fire Chief	DHS Preparedness Technical Assistance Program, HMGP, PDM Grants	>1 year
2	Seek funding for bluff protection measure recommended in the 2018 U.S. Army Corps of Engineers' Kenai Bluffs study.	High	City Planner	City, USACE, State Legislature	1-5 years

Mitigation Actions for the City of Kenai

Action ID	Description	Pri- ority	Respon- sible Party	Potential Funding	Time- frame
3	In an effort to reduce property damage, the City will continue to adopt and enforce current building codes and construction standards that address the seismic concerns for the KPB. Prepare citizens and the built environment to better survive the hazards associated with earthquakes through the promotion of public education and the practice of sheltering in place. Encourage the preparation of citizens for self-sufficiency on a post-earthquake scenario.	High	City Planner	KPB School District, Emergency Services, DHS&EM	Ongoing
4	Continue cooperative effort with Kenai Peninsula Borough Office of Emergency Management, local media, and City of Kenai websites to provide the public with preparedness information prior to and during periods of increased volcano seismic activity.	High	City Planner	City, KPB, AVO	Ongoing
5	Update the City's Emergency Operating Plan to ensure the appropriate response to natural hazards.	High	Fire Chief	Fire Department	2020
6	Update the ARFT as an Emergency Operations Command Center.	Medium	City Manager		2020-2025

Vulnerability of the City of Kenai

Population

- ▶ 2010 U.S. Census was 7,100.
- ▶ 2016 ACS Data was 7,551.

Houses and Critical Infrastructure

- ▶ 3,221 single-family residential structures per 2016 ACS.
- ▶ Critical facilities and infrastructure are being identified.



**LeMay Engineering
& Consulting, Inc.**

Jennifer L. LeMay, PE, PMP
Vice President
4272 Chelsea Way
Anchorage, AK 99504
(907) 350-6061
jlemay@lemayengineering.com

November 1, 2019

Brent A. Nichols, EMSII, CFM
State Hazard Mitigation Officer
Department of Military and Veterans Affairs (DMVA)
Division of Homeland Security and Emergency Management (DHS&EM)
P.O. Box 5750
JBER, AK 99505-5750

Subject: Hazard Mitigation Planning Process Trip Report

On October 30, 2019, I traveled to Kenai, Alaska. The purpose of this trip was to conduct an introductory meeting, gather hazard data, review with community leaders the applicable hazards for the area, review potential mitigation strategies, and identify the critical facilities within the community.

I met with the Hazard Mitigation Project Team from 2-4 pm to discuss the planning process, identify City hazard concerns, and confer about critical facilities and infrastructure.

At 7:00 pm, I attended the Planning and Zoning Commission meeting and gave a Powerpoint[®] presentation of the hazard mitigation planning process. The presentation will be included in Appendix A of the HMP.

If you have any questions, please do not hesitate to call me at (907) 350-6061.

11/1/19

Jennifer L. LeMay, PE, PMP/Date
LeMay Engineering & Consulting, Inc.

City of Kenai Hazard Mitigation Plan

Newsletter #1: November 8, 2019



Photo Credit: Eagle Eye Gallery.

The State of Alaska, Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management (DHS&EM) was awarded a Pre-Disaster Mitigation Program grant from the Federal Emergency Management Agency (FEMA) to develop a hazard mitigation plan (HMP) for the City of Kenai. This plan will assist the City as a valuable resource tool in making decisions. Additionally, communities must have a State- and FEMA-approved and community-adopted HMP to receive FEMA pre- and post- disaster grants.

You're Invited to Comment on the Plan: The purpose of Newsletter #1 is to announce the availability of the Draft HMP and invite you to provide comments, identify key issues or concerns, and improve mitigation ideas. This plan has been posted on the City website and a printed copy is available at City Hall for your review. Comments can be provided verbally to Jennifer LeMay at (907) 350-6061 or emailed to jlemay@lemayengineering.com.

Attend the December 4, 2019, Presentation at the regularly scheduled 6:00 pm City Council Meeting at the City Council Chambers, 210 Fidalgo Avenue: Jennifer LeMay will provide a summary of the HMP process as a scheduled public speaker. You're invited to provide input and comment on the Draft HMP.

For more information, contact:

Elizabeth Appleby, City Planner (907) 283-8235

Jennifer LeMay, PE, PMP, Lead Planner, (907) 350-6061

Brent Nichols, DMVA DHS&EM Hazard Mitigation Officer (907) 428-7085



Search

Planning and Zoning

Draft Hazard Mitigation Plan

The State of Alaska, Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management (DHS&EM) was awarded a Pre-Disaster Mitigation Program grant from the Federal Emergency Management Agency (FEMA) to develop a hazard mitigation plan (HMP) for the City of Kenai. This plan will assist the City as a valuable resource tool in making decisions.

Communities must have a State- and FEMA-approved and community-adopted HMP to receive FEMA pre- and post-disaster grants.

You're Invited to Comment on the Plan through 12/8/19:

View a pdf of the plan on this webpage or request a printed version at City Hall from Elizabeth Appleby, City Planner. Comments can be provided verbally to Jennifer LeMay at (907) 350-6061 or emailed to jlemay@lemayengineering.com.

Public Hearing 12/4/19:

Attend the December 4, 2019 regularly scheduled 6:00 pm City Council Meeting at the City Council Chambers, 210 Fidalgo Avenue for more information. One of the agenda items will be a summary of the HMP process by Jennifer LeMay. You are invited to provide input to the HMP.

For more information, contact:


Elizabeth Appleby, City Planner (907) 283-8235

Jennifer LeMay, PE, PMP, Lead Planner, (907) 350-6061

Brent Nichols, DMVA DHS&EM Hazard Mitigation Officer
(907) 428-7085

Supporting Documents

 Nov. 2019 DRAFT City of Kenai Hazard Mitigation Plan (10 MB)

 Nov. 2019 Newsletter #1 - City of Kenai HMP Update (260 KB)

Contact Information

Planning and Zoning

planning@kenai.city

210 Fidalgo Avenue

Kenai, Alaska 99611

Phone (907) 283-8237

Fax (907) 283-3014

[View Full Contact Details](#)

[Home](#) | [Staff Login](#) | [KMC](#)
210 Fidalgo Ave. Kenai, AK 99611 (907) 283-7535



Kenai City Council - Regular Meeting

December 04, 2019 – 6:00 PM

Kenai City Council Chambers

210 Fidalgo Avenue, Kenai, Alaska

www.kenai.city

AGENDA

A. CALL TO ORDER

1. Pledge of Allegiance
2. Roll Call
3. Agenda Approval
4. Consent Agenda (*Public comment limited to three (3) minutes per speaker; thirty (30) minutes aggregated*)

All items listed with an asterisk () are considered to be routine and non-controversial by the council and will be approved by one motion. There will be no separate discussion of these items unless a council member so requests, in which case the item will be removed from the consent agenda and considered in its normal sequence on the agenda as part of the General Orders.

B. SCHEDULED PUBLIC COMMENTS

(Public comment limited to ten (10) minutes per speaker)

1. **Branden Bornemann, Kenai Watershed Forum** - The Value of Non-profits in Our Community and a Highlight of the Ways in Which the Kenai Watershed Forum and the City of Kenai Have Successfully Partnered with One Another Past, Present, and Future.
2. **Jennifer LeMay, Lemay Engineering** - City of Kenai Draft Hazard Mitigation Plan Presentation.
3. **Joy Merriner, BDO Inc.** - Presentation of the FY19 City of Kenai Comprehensive Annual Financial Report.

C. UNSCHEDULED PUBLIC COMMENTS

(Public comment limited to three (3) minutes per speaker; thirty (30) minutes aggregated)

D. PUBLIC HEARINGS

1. **Ordinance No. 3095-2019** - Increasing Estimated Revenues and Appropriations in the General Fund – Police Department and Accepting a Grant from the Department of Justice for the Purchase of Ballistic Vests. (Administration)
2. **Ordinance No. 3096-2019** - Determining that Real Property Described as Lot One (1), Aleyeska Subdivision Part 3, According to Plat No. 1531 and Lot One A (1-A), Aleyeska Subdivision Part 3, According to Plat K-1531, City-Owned Airport Land Located Outside the Airport Reserve, is not Needed for a Public Purpose and Authorizing the Sale of the Property to MITAK, LLC. (Administration)
3. **Ordinance No. 3097-2019** - Increasing Estimated Revenues and Appropriations in the Terminal Improvements Capital Fund, and Authorizing an Increase to the Construction Purchase Order to Blazy Construction, Inc. (Administration)
4. **Resolution No. 2019-71** - Repealing Policy No. 2017-02, Supervisory Sub-Committee. (Council Member Knackstedt) *[Clerk's Note: At its November 6 meeting Council postponed this item to the December 4 meeting; a motion to adopt is on the floor.]*
 - **Substitute Resolution No. 2019-71** – Amending Council Policy 2017-02, Establishing Procedures and Responsibilities of the Sub-Committee of Council for the Supervision of the City Attorney, City Clerk, and City Manager for Improved Efficiency. (Council Members Knackstedt and Navarre)
5. **Resolution No. 2019-76** - Identifying the Projects to be Funded through State of Alaska Grant No. 15-DC-078 for Personal Use Fishery Related Improvements on North and South Beaches. (Administration)
6. **Resolution No. 2019-77** - Authorizing a Sole Source Purchase Agreement for Proprietary Water Treatment Chemicals for the City's Water Treatment Plant to Nalco, an Ecolab Company. (Administration)
7. **Resolution No. 2019-78** - Authorizing the City Manager to Enter Into an Amended Restaurant Concession Agreement with the Kenai Municipal Airport. (Administration)

E. MINUTES

1. *Regular Meeting of November 6, 2019. (City Clerk)

F. UNFINISHED BUSINESS

G. NEW BUSINESS

1. ***Action/Approval** - Bills to be Ratified. (Administration)
2. ***Ordinance No. 3098-2019** - Increasing Estimated Revenues and Appropriations in the General Fund, Police Department and Amending Kenai Municipal Code Sections 23.25.040 – Appointee Compensation, 23.25.065 – Shift Differential Pay, 23.50.010 – Employee Classification, and 23.55.030 – Qualification Pay to Improve

Recruitment and Retention for Police Officers and Other Eligible Employees Receiving Shift Differential Pay. (Administration)

3. ***Ordinance No. 3099-2019** - Amending Kenai Municipal Code Section 23.50.010 – Employee Classification to Amend Class Titles in the Public Works Water and Sewer and Wastewater Classes.(Administration)
4. ***Ordinance No. 3100-2019** - Increasing Estimated Revenues and Appropriations by \$4,786.53 in the General Fund - Police Department for Drug Investigation Overtime Expenditures. (Administration)
5. **Discussion** - Old Town Kenai Signage. (Council Member Knackstedt)
6. **Discussion** - Kenai Peninsula Borough Substitute Ordinance 2019-24 - Adopting KPB 20.80, Subdivision Private Streets and Gated Subdivisions. (Administration)
7. **Discussion** - Potential Parcel Purchase by Ron Hyde. (Administration)

H. COMMISSION / COMMITTEE REPORTS

1. Council on Aging
2. Airport Commission
3. Harbor Commission
4. Parks and Recreation Commission
5. Planning and Zoning Commission
6. Beautification Committee
7. Mini-Grant Steering Committee

I. REPORT OF THE MAYOR

J. ADMINISTRATION REPORTS

1. City Manager
2. City Attorney
3. City Clerk

K. ADDITIONAL PUBLIC COMMENT

1. Citizens Comments (*Public comment limited to five (5) minutes per speaker*)
2. Council Comments

L. EXECUTIVE SESSION

1. Review and Discussion of the Terms of an Employment Agreement Extension for the City Manager which Pursuant to AS 44.62.310(C)(2) May be a Subject that Tends to Prejudice the Reputation and Character of the Applicant and per AS 44.62.310(c)(1) is a Matter of which the Immediate Knowledge may have an Adverse Effect Upon the Finances of the City.

M. PENDING ITEMS

N. ADJOURNMENT

O. INFORMATION ITEMS

1. Purchase Orders between \$2,500 and \$15,000.
2. Notice of two Right-of-Way Leases for the Alaska LNG Project

The agenda and supporting documents are posted on the City's website at www.kenai.city. Copies of resolutions and ordinances are available at the City Clerk's Office or outside the Council Chamber prior to the meeting. For additional information, please contact the City Clerk's Office at 907-283-8231.

Public Meeting #2 for the 2019 Hazard Mitigation Plan

December 4, 2019, City Council Meeting

6 pm at Kenai City Council Chambers

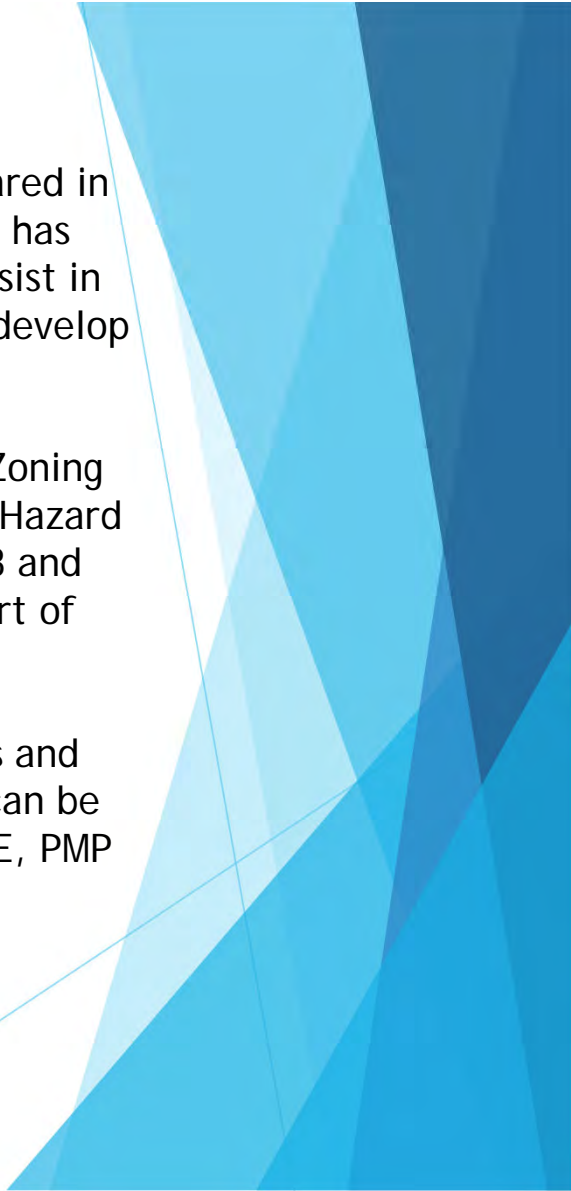
Name	Department Represented	Contact Information (email)
Glenese Pettey	City Council	gpettey@kenai.city
Bob Molloy	City Council	bmolloy@kenai.city
Robert Peterkin	City Council	rpeterkin@kenai.city
Brian Gabriel	City Council	bgabriel@kenai.city
Tim Navarre	City Council	tnavarre@kenai.city
Jim Glendening	City Council	jglendening@kenai.city
Henry Krackstett	City Council	hkrackstett@kenai.city
BILL DUNN	CITIZEN	dunnwmr@gmail.com
JENNIFER LEMAY	CONSULTANT	jlemay@lemayengineering.com

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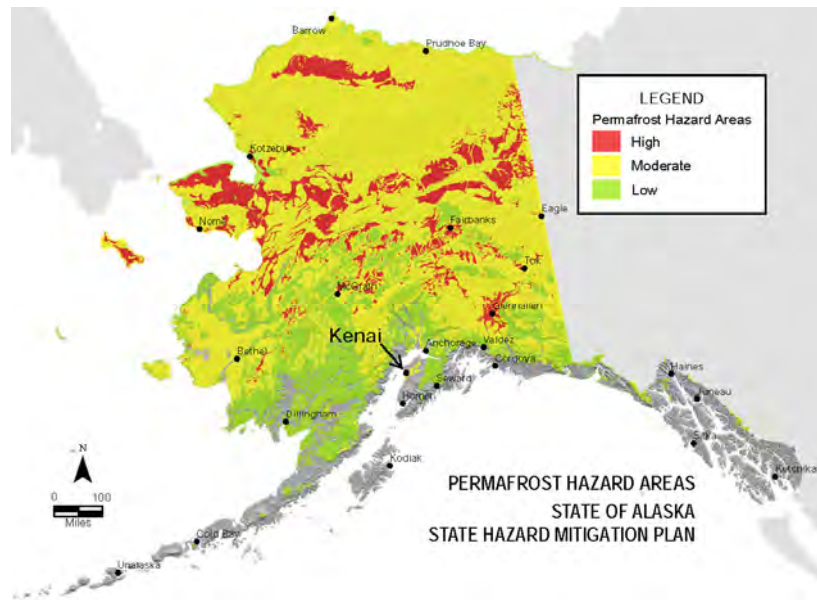
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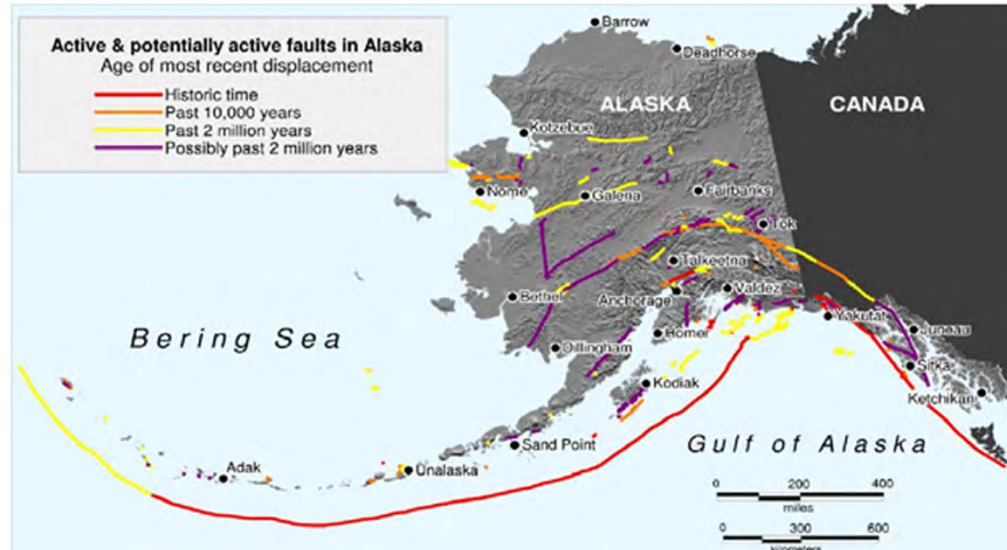
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Mitigation Actions for the City of Kenai

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- ▶ 3,221 single-family residential structures per 2016 ACS.
- ▶ Critical facilities and infrastructure are being identified.



**LeMay Engineering
& Consulting, Inc.**

Jennifer L. LeMay, PE, PMP
Vice President
4272 Chelsea Way
Anchorage, AK 99504
(907) 350-6061
jlemay@lemayengineering.com

December 6, 2019

Brent A. Nichols, EMSII, CFM
State Hazard Mitigation Officer
Department of Military and Veterans Affairs (DMVA)
Division of Homeland Security and Emergency Management (DHS&EM)
P.O. Box 5750
JBER, AK 99505-5750

Subject: Hazard Mitigation Planning Trip Report

On December 4, 2019, I traveled to Kenai, Alaska. At 6:00 pm, I attended the City Council meeting and gave a Powerpoint® presentation summarizing the hazard mitigation process for the City of Kenai. The presentation will be included in Appendix A of the HMP.

City procedures did not allow me to pass the sign-in sheet around the room to obtain an accurate list of all meeting attendees. The City Clerk wrote the names and emails of the Council Members on the sheet. There were 25 people in attendance at the time I gave my presentation. Three emails were received that provided comments, and I've attached the emails to this trip report. I've incorporated all comments into the Draft HMP that I am submitting for State and FEMA review.

If you have any questions, please do not hesitate to call me at (907) 350-6061.

12/6/19

Jennifer L. LeMay, PE, PMP/Date
LeMay Engineering & Consulting, Inc.

From: Elizabeth Appleby <eappleby@kenai.city>
Sent: Thursday, November 14, 2019 2:29 PM
To: jlemay@lemayengineering.com
Subject: FW: Updated Draft Hazard Mitigation Plan (HMP) - for review

Hi Jennifer,

Below are comments from Mary Bondurant, Airport Director on the draft HMP. I would think cell towers would be designed to withstand high winds. I'll have to update my map label for her comment on the Fire Training Facility labeling.

--Elizabeth

From: Mary Bondurant <mbondurant@kenai.city>
Sent: Thursday, November 14, 2019 2:24 PM
To: Elizabeth Appleby <eappleby@kenai.city>; Christine Cunningham <ccunningham@kenai.city>; David Ross <dross@kenai.city>; Jeff Tucker <jtucker@kenai.city>; Jeremy Hamilton <jhamilton@kenai.city>; Bob Frates <bfrates@kenai.city>; Scott Curtin <scurtin@kenai.city>; Paul Ostrander <postrander@kenai.city>
Subject: RE: Updated Draft Hazard Mitigation Plan (HMP) - for review

Below are my comments:

Page 10 - Table 1 – Scott Curtin's email is incorrect – should be scurtin@kenai.city

Page 40 - Section 5.3.5.4

Just a comment – I did not see any mention of “cell towers”. Can cell towers blow over in severe winds?

Page 46 – 5.3.6.5 Location – 1st paragraph

2 spelling errors – firefighter~~es~~ & camptaigns

Page 51 – 6.2.1.4 5th paragraph (not counting shaded table) last sentence –

Should be “the largest airport within (not with) the KPB”

Page 53 – Table 12.

Under Community – delete BEACON s/b Alaska Regional Fire Training Facility

Page 54 – Figure 15 – rename Beacon Fire Training Facility to Alaska Regional Fire Training Facility

From: Elizabeth Appleby <eappleby@kenai.city>
Sent: Tuesday, November 12, 2019 10:29 AM
To: Christine Cunningham <ccunningham@kenai.city>; David Ross <dross@kenai.city>; Jeff Tucker <jtucker@kenai.city>; Jeremy Hamilton <jhamilton@kenai.city>; Bob Frates <bfrates@kenai.city>; Mary Bondurant <mbondurant@kenai.city>; Scott Curtin <scurtin@kenai.city>; Paul Ostrander <postrander@kenai.city>
Subject: Updated Draft Hazard Mitigation Plan (HMP) - for review

Hi,

Attached is the updated draft HMP for your review. Thank you for your time a couple weeks ago to discuss the plan. I don't intend to meet again, but please provide any comments to me via email on the draft HMP and I will forward them to Jennifer with LeMay Engineering.

Jennifer will be a scheduled public speaker at the 12/4/19 City Council meeting to discuss the draft HMP. Later in December, she will submit the draft HMP for State and federal review before it comes back to the City of Kenai for formal adoption in Spring 2020. The plan will also then be formally adopted by the Borough as the updated City of Kenai HMP annex to the Borough HMP.

Thank you again for your input!

Elizabeth Appleby, AICP
City Planner
City of Kenai
210 Fidalgo Avenue
Kenai, AK 99611
(907) 283-8235/phone
eappleby@kenai.city



From: Elizabeth Appleby <eappleby@kenai.city>
Sent: Thursday, December 5, 2019 11:30 AM
To: Jennifer LeMay
Subject: City of Kenai HMP - Erosion as #1 priority

Hi Jennifer,

After hearing comments from City Council, the City Manager, and the public, I would like to change the priority ranking in the draft HMP and make erosion the #1 priority hazard in Kenai, wildland fire would then be #2, and earthquake would remain #3, the rest the same ranking. I brought this up at our Department Head meeting this morning, which includes several members of the HMP Planning Team. No objection to this ranking change was voiced and this change will align better with other current and past plans created by the City.

Thank you for making this change and facilitating a good discussion at the City Council meeting last night!

Elizabeth Appleby, AICP
City Planner
City of Kenai
210 Fidalgo Avenue
Kenai, AK 99611
(907) 283-8235/phone
eappleby@kenai.city



jlemay@lemayengineering.com

From: Bill Dunn <dunnwmr@gmail.com>
Sent: Friday, December 6, 2019 4:41 PM
To: jlemay@lemayengineering.com
Cc: cityclerk@kenai.city; postrander@kenai.city; eappleby@kenai.city
Subject: City of Kenai Hazard Mitigaion Plan
Attachments: WRDtoJLL KenaiHMP 2019-12-06.pdf

Dear Ms. Lemay:

Attached please find a letter addressing the Kenai HMP. I appreciate the opportunity to comment. Please let me know if you need anything further from me. Many thanks for your help.

All the best,
Bill Dunn

WILLIAM R. DUNN
Box 163
Kenai, Alaska 99611

(907) 394-2887
dunnwmr@gmail.com

December 6, 2019

Jennifer L. LeMay, PE, PMP
Vice-President
LeMay Engineering & Consulting, Inc.
jlemay@lemayengineering.com

Re: Kenai Hazard Mitigation Plan (HMP)

Dear Ms. LeMay:

Thank you for your work on the City of Kenai Hazard Mitigation Plan. The draft submitted for the Kenai City Council meeting (December 4, 2019) provides an admirable account of the major natural hazards facing the City. Bluff erosion in the vicinity of the Kenai River mouth is among the chief hazards facing the City and its property owners.

I write today to advocate that the City adopt the goal of mitigating bluff erosion not only in the mile-long stretch of the river mouth encompassed by the US Army Corps of Engineers (USACE) feasibility study (November, 2018), but also in the broader area of the Kenai River mouth that has become so heavily involved in the personal use dip-net fishery. Bluff erosion in this broader area has been significantly affected by the human impacts of this fishery itself and by the impacts of increased use of the beach year-round. For example, there has been a considerable increase in vehicular traffic on the beach since the dip-net fishery has become so popular.

As the HMP report states, in 2009 and 2010 the City installed fencing to protect dunes on both the north and south beaches. This mitigation effort was both desperately needed and hugely successful in curtailing the destruction of these environmentally sensitive areas. On the north beach, however, just beyond the limit of the fencing that protects the dunes, below my home, little has been done to protect the fragile and environmentally sensitive bluff. The City has posted small temporary signs during the few weeks of the dip-net fishery, but once these signs are removed the bluff is defenseless. People thoughtlessly climb on the bluff, doing real and appreciable damage.

The Kenai City Manager has recently agreed to provide more robust signage for a longer period of time both prior to and after the dip-net fishery, and that should help. As I see it, this is a good first step toward mitigating the hazard of bluff erosion in this area. Of course, the “gold standard” of mitigation for this type of erosion would involve bluff toe stabilization by means of

an engineered barrier or berm. That would be a costly project, for which I expect the City would have no appetite at this time, but I believe there are other, less costly mitigation measures that might be explored and implemented.

In your presentation of the draft HMP to the City Council December 4, 2019, you stated that the HMP is not a binding document but an important statement of the City's goals in the mitigation of identified hazards. Such a statement serves as a starting point, a first step, in securing grant funding for worthy projects. As I see it, there are three distinct areas at the mouth of the Kenai River affected by the bluff erosion hazard: (a) the mile-long stretch of river encompassed by the USACE feasibility study; (b) the dunes on the north and south beaches, which protect against bluff erosion and which need protection themselves; and (c) the sheer bluff on the north beach parallel to Toyon Way, which is unprotected by dunes or anything else.

In the current draft of the HMP, only the first area appears to be covered in Table 16 of the Mitigation Strategy, "City Mitigation Action Plan." I suggest adding two items to this action plan between Action ID Items F&E2a and F&E2b:

1. Maintain (and expand as needed) dune protection measures on the north and south beaches in the vicinity of the Kenai River mouth.
2. Explore and implement bluff protection measures for the sheer bluff on the north beach, which is currently unprotected.

Naturally, I am concerned about the bluff erosion hazard near my home. There are about a dozen structures along this unprotected stretch of sheer bluff, beautiful homes with stunningly beautiful views of mountains, sea and sky, well worth protecting to the homeowners and, I hope, to the City.

Very truly yours,



Bill Dunn

cc. Kenai City Mayor and Council Members (by City Clerk)
Paul Ostrander, City Manager
Elizabeth Appleby, City Planner

jlemay@lemayengineering.com

From: Elizabeth Appleby <eappleby@kenai.city>
Sent: Tuesday, December 17, 2019 4:44 PM
To: jlemay@lemayengineering.com
Subject: FW: KPB 2019 HMP Update - Completed
Attachments: Ordinance 2019-31.pdf

Hi Jennifer,

I just received this email about the Kenai Peninsula Borough HMP. We may need to add a line about their plan to our final plan.

Thank you and Merry Christmas!

--Elizabeth

From: Ahlberg, Brenda <bahlberg@kpb.us>
Sent: Tuesday, December 17, 2019 4:42 PM
To: Elizabeth Appleby <eappleby@kenai.city>; 'jczarnezi@soldotna.org' <jczarnezi@soldotna.org>; 'rabboud@ci.homer.ak.us' <rabboud@ci.homer.ak.us>; Heidi Geagel <cityclerk@cityofseldovia.com>; 'Jennifer Carroll' <JCarroll@ci.homer.ak.us>; Jackie Wilde (jwilde@cityofseward.net) <jwilde@cityofseward.net>; 'kachemak@xyz.net' <kachemak@xyz.net>
Cc: Best, Max <MBest@kpb.us>; Toll, Mary <MTOLL@kpb.us>; Nelson, Dan <dnelson@kpb.us>
Subject: KPB 2019 HMP Update - Completed

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Greetings all:

The borough's 2019 Hazard Mitigation Plan update has been completed and has been recognized by FEMA. I'm just waiting on their official "plan approved" letter. The borough's webpage will be updated upon receipt of the letter.

Fast FYI on other city efforts: The borough planning commission followed by the assembly will be recognizing the city of Homer's plan in January. I understand that the city of Kenai's plan update is in the home stretch as well as the city of Seward. Please let me know, and we'll introduce an ordinance as appropriate.

NOTE: the borough's adoption of a city's plan is simply a formality to recognize it as an annex. The borough's adoption of a city's plan is NOT required by the state or by FEMA. Feel free to forward this email to others.

Merry Christmas, B

Brenda Ahlberg
Community & Fiscal Projects Manager

Public Information Officer, MPIO, Type 1 (t)
907-714-2153 direct
907-231-6505 mobile
907-714-2377 fax

bahlberg@kpb.us

www.kpb.us – Information by departments

www.kpboem.com – Updates from agencies responding to area-wide emergencies on the Kenai.

[@Kenai.Peninsula.Borough](https://www.facebook.com/Kenai.Peninsula.Borough) – Facebook Page

KENAI PENINSULA BOROUGH

144 North Binkley Street

Soldotna, Alaska 99669



Introduced by: Mayor
Date: 11/05/19
Hearing: 12/03/19
Action: Enacted
Vote: 9 Yes, 0 No, 0 Absent

**KENAI PENINSULA BOROUGH
ORDINANCE 2019-31**

**AN ORDINANCE ADOPTING THE UPDATED 2019 KENAI PENINSULA BOROUGH
HAZARD MITIGATION PLAN AND REMOVING THE WORD “ALL” FROM
KPB 2.80.010**

WHEREAS, the Kenai Peninsula Borough is vulnerable to damages from natural hazard events which pose a threat to public health and safety and could result in property loss and economic hardship; and

WHEREAS, the KPB Hazard Mitigation Plan (“Plan”), formally titled All-Hazard Mitigation Plan, recommends actions to protect people and property at risk from natural and man-made hazards that will reduce future public and personal costs of disaster response and recovery, and will reinforce the borough’s leadership in emergency preparedness efforts; and

WHEREAS, the assembly initially adopted the Plan in 2004 and subsequently adopted updated Plans in July 2010 and June 2014; and

WHEREAS, the Federal Emergency Management Agency (“FEMA”) disaster recovery funding and grant programs require regular updates to the mitigation plans; and

WHEREAS, the 2019 Plan has been updated to meet FEMA’s requirements through the work of the KPB Planning Department and the State of Alaska Division of Homeland Security & Emergency Management; and

WHEREAS, the word “all” is being removed from KPB 2.80.010 in recognition that the plan does not and cannot cover all possible hazards; and

WHEREAS, the planning commission held a public hearing on this ordinance at its August 12, 2019 meeting and recommended approval by unanimous consent;

NOW, THEREFORE, BE IT ORDAINED BY THE ASSEMBLY OF THE KENAI PENINSULA BOROUGH:


SECTION 1. That KPB 2.80.010 is hereby amended as follows:

2.80.010. Adoption of [ALL-] hazard mitigation plan.

The document entitled Kenai Peninsula [ALL-H]Hazard Mitigation Plan which includes the Interagency All Lands/All Hands Action Plan is hereby adopted as the [ALL-] hazard mitigation plan for the Kenai Peninsula Borough. The mayor is authorized to make administrative changes to these plans provided the assembly shall be advised of all such changes.

SECTION 2. That this ordinance takes effect immediately upon its enactment.

ENACTED BY THE ASSEMBLY OF THE KENAI PENINSULA BOROUGH THIS 3RD DAY OF DECEMBER, 2019.

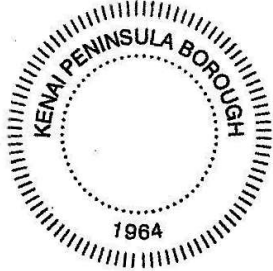


Kelly Cooper, Assembly President

ATTEST:



Johni Blankenship, MMC, Borough Clerk



- Yes: Bjorkman, Blakeley, Carpenter, Cox, Dunne, Hibbert, Johnson, Smalley, Cooper
- No: None
- Absent: None

Appendix B: Glossary

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APPENDIX B. Definitions

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

Avalanche: Mass of snow and ice falling suddenly down a mountain slope and often taking with it earth, rocks and rubble of every description.

Base Flood Elevation: The computed elevation to which floodwater is anticipated to rise during the base flood. Base Flood Elevations are shown on FIRMs and on the flood profiles. The Base Flood Elevation is the regulatory requirement for the elevation or floodproofing of structures. The relationship between the Base Flood Elevation and a structure's elevation determines the flood insurance premium.

Borough: The basic unit of local government in Alaska, analogous to counties in other states.

Building: Any structure used or intended for supporting or sheltering any use or occupancy.

Building Code: The regulations adopted by a local governing body principally setting forth standards for the construction, addition, modification, and repair of buildings and other structures for the purpose of protecting the health, safety, and general welfare of the public.

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

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

Dam: A structure built across a waterway to impound water.

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

Disaster Mitigation Act (DMA 2000) (public Law 106-390): This act was signed into law on October 10, 2000. This legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur.

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

Elevation: The raising of a structure to place it above flood waters, generally above the base flood elevation, on an extended support structure.

Emergency Operations Plan: A document that: describes how people and property will be protected in disaster and disaster threat situations; details who is responsible for carrying out specific actions; identifies the personnel, equipment, facilities,

supplies, and other resources available for use in the disaster; and outlines how all actions will be coordinated.

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

Federal Disaster Declaration: See Presidential Disaster Declaration.

Federal Emergency Management Agency (FEMA): A federal agency created in 1979 to provide a single point of accountability for all federal activities related to hazard mitigation, preparedness, response, and recovery.

Flash Flood: A flood event occurring with little or no warning where water levels rise at an extremely fast rate.

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

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

"Flood frequencies:" Frequencies are determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. The frequency is the chance of a flood occurring during a given timeframe. It is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1% chance, and the 10-year flood has a 10% chance of occurring in any given year.

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

Governing Body: The legislative body of a jurisdiction such as a municipal or Borough assembly or a city council.

Hazard: A source of potential danger or adverse condition. Any situation that has the potential for causing personal injury or death, or damage to property and the environment.

Hazard Event: A specific occurrence of a particular type of hazard.

Hazard Identification: The process of identifying hazards that threaten an area.

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

Hazard Mitigation Grant Program: The program authorized under section 404 of the Stafford Act, which may provide funding for mitigation measures identified through the

evaluation of natural hazards conducted under §322 of the Disaster Mitigation Act 2000.

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

Hydro Unit: Short for Hydrologic Unit. A drainage area delineated to nest in a multi-level, hierarchical drainage system. Its boundaries are defined by hydrographic and topographic criteria that delineate an area of land upstream from a specific point on a river, stream, or similar surface water. A hydrologic unit can accept surface water directly from upstream drainage areas, and indirectly from associated surface areas such as remnant, non-contributing, and diversions to form a drainage area with single or multiple outlet points.

Infrastructure: The public services of a community that have a direct impact to the quality of life. Infrastructure refers to communication technology such as phone lines or Internet access, vital services such as public water supply and sewer treatment facilities, and includes an area's transportation system, regional dams or bridges, etc.

Inundation: The maximum horizontal distance inland reached by a tsunami.

Landslide: Downward movement of a slope and materials under the force of gravity.

Liquefaction: The phenomenon that occurs when ground shaking cause's loose soils to lose strength and act like a thick or viscous fluid. Liquefaction causes two types of ground failure: lateral spread and loss of bearing strength.

Local Government: Any county, Borough, municipality, city, township, public authority, school district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency, or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity, for which an application for assistance is made by a State or political subdivision of a state.

Magma: Molten rock originating from the Earth's interior.

Magnitude: A measure of the strength of a hazard event. The magnitude (also referred to as severity) of a given hazard event is usually determined using technical measures specific to the hazard.

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

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

Municipality: A political subdivision incorporated under the laws of the state that is a home rule or general law city, a home rule or general law borough, or a unified municipality.

Natural Disaster: Any natural catastrophe, including any hurricane, tornado, storm, high water, wind, driven water, tsunami, earthquake, volcanic eruption, landslide, snowstorm, fire, or drought. (44 CFR Subpart M206.401).

New Construction: New construction means structures for which the “start of construction” on or after the effective date of a floodplain management regulation adopted by a community and includes any subsequent improvement to such structures.

One Hundred (100)-Year: The flood elevation that has a one-percent chance of occurring in any given year. It is also known as the Base Flood.

Overlay Zone: Overlay zones (overlay districts) create a framework for conservation or development of special geographical areas. In a special resource overlay district, overlay provisions typically impose greater restrictions on the development of land, but only regarding those parcels whose development, as permitted under the zoning, may threaten the viability of the natural resource. In a development area overlay district, the provisions may impose restrictions as well, but also may provide zoning incentives and waivers to encourage certain types and styles of development. Overlay zone provisions are often complemented by the adoption of other innovative zoning techniques, such as floating zones, special permits, incentive zoning, cluster development and special site plan or subdivision regulations, to name a few.

Period: A length of time. For waves, it is the length of time between two successive peaks or troughs, which may vary due to interference of waves. Tsunami periods generally range from 5 to 60 minutes.

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

Preparedness: The steps taken to decide what to do if essential services break down, developing a plan for contingencies, and practicing the plan. Preparedness ensures that people are ready for a disaster and will respond to it effectively.

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

Probability: A statistical measure of the likelihood that a hazard event will occur.

Recovery: The long-term activities beyond the initial crisis period and emergency response phase of disaster operations that focus on returning all systems in the community to a normal status or to reconstitute these systems to a new, less vulnerable condition.

Response: Those activities and programs designed to address the immediate and short-term effects of the onset of an emergency or disaster.

Retrofit: The strengthening of existing structures to mitigate disaster risks.

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

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

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

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

Run-up: The maximum vertical height of a tsunami in relation to sea level.

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

Stafford Act: 1) The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended. 2) The Stafford Act provides an orderly and continuing means of assistance by the Federal Government to State, local and tribal governments in carrying out their responsibilities to alleviate the suffering and damage which result from disaster.

State Disaster Declaration: A disaster emergency shall be declared by executive order or proclamation of the Governor upon finding that a disaster has occurred or that the occurrence or the threat of a disaster is imminent. The state of disaster emergency shall continue until the governor finds that the threat or danger has passed or that the disaster has been dealt with to the extent that emergency conditions no longer exist and terminates the state of disaster emergency by executive order or proclamation. Along with other provisions, this declaration allows the governor to utilize all available resources of the State as reasonably necessary, direct and compel the evacuation of all or part of the population from any stricken or threatened area if necessary, prescribe routes, modes of transportation and destinations in connection with evacuation and control ingress and egress to and from disaster area. It is required before a Presidential Disaster Declaration can be requested.

State Hazard Mitigation Officer (SHMO): The SHMO is the representative of state government who is the primary point of contact with FEMA, other state and Federal agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities.

Storm Surge: Rise in the water surface above normal water level on open coast due to the action of wind stress and atmospheric pressure on the water surface.

Stream: A body of water flowing in a natural surface channel. Flow may be continuous or only during wet periods. Streams that flow only during wet periods are termed “intermittent streams.”

Structure: That which is constructed above or below ground in some definite manner for any use or purpose.

Subdivision Regulations: Ordinances or regulations governing the subdivision of land with respect to things such as adequacy and suitability of building sites and utilities and public facilities.

Tectonic Plate: Torsionally rigid, thin segments of the earth’s lithosphere that may be assumed to move horizontally and adjoin other plates. It is the friction between plate boundaries that causes seismic activity.

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

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

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

Volcano: A volcano is an opening, or rupture, in a planet's surface or crust, which allows hot magma, ash, and gases to escape from below the surface. Volcanoes are generally found where tectonic plates are diverging or converging. A mid-oceanic ridge, for example the Mid-Atlantic Ridge, has examples of volcanoes caused by divergent tectonic plates pulling apart; the Pacific Ring of Fire has examples of volcanoes caused by convergent tectonic plates coming together.

Vulnerability: Describes how exposed or susceptible to damage an asset is. Vulnerability depends on an asset’s construction, contents, and the economic value of its functions. The vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power – if an electrical substation is flooded, it will affect not only the

substation itself, but a number of businesses as well. Other, indirect effects can be much more widespread and damaging than direct ones.

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

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

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

Water Surface Elevation: Water surface elevation means the height, in relation to the National Geodetic Vertical Datum (NGVD) of 1929, (or other datum, where specified) of floods of various magnitudes and frequencies in the floodplains of coastal riverine areas.

Water Table: The uppermost zone of water saturation in the ground.

Wetlands: Areas that are inundated or saturated frequently and for long enough to support vegetative or aquatic life requiring saturated or seasonally saturated soil conditions for growth and reproduction.

Wildfire: An uncontrolled fire that spreads through vegetative fuels, exposing and possibly consuming structures.

Worst Case Scenario: The term "worst case scenario" is somewhat self-explanatory. It includes the potential for a "cascade effect", which was assumed in analyzing the risk from each hazard. The term "cascade effect" is used to describe the triggering of several hazard occurrences from an initial event. An earthquake for instance, might also trigger avalanches, collapsed buildings, transportation and utility disruptions, and hazardous material releases, each of which might trigger additional events, all part of the same incident.

Zoning Ordinance: An ordinance under the state or local government's police powers that divides an area into districts and, within each district, regulates the use of land and buildings, height, and bulk of buildings or other structures, and the density of population.

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Appendix C: FEMA Review Tool

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APPENDIX A: LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA’s evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan’s strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: Kenai, Alaska (Region 10)	Title of Plan: The City of Kenai Hazard Mitigation Plan	Date of Plan: December 9, 2019
Local Point of Contact: Elizabeth Appleby	Address: City of Kenai 210 Fidalgo Avenue Kenai, AK 99611	
Title: City Planner		
Agency: City of Kenai		
Phone Number: (907) 283-8235	E-Mail: eappleby@kenai.city	

State Reviewer:	Title:	Date:

FEMA Reviewer:	Title:	Date:
Date Received in FEMA Region (insert #)		
Plan Not Approved		
Plan Approvable Pending Adoption		
Plan Approved		

**SECTION 1:
REGULATION CHECKLIST**

1. REGULATION CHECKLIST	Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)			
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	PDF 16-19, 85-131	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	PDF 17-18, 88, 105-108	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	PDF 16-19, 88-90, 104-112, 125-131	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	PDF 18-19, 83-84	X	
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	PDF 77, 167-171	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	PDF 72-73	X	
ELEMENT A: REQUIRED REVISIONS			

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT				
B1. Does the Plan include a description of the type, location, and extent of all-natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Changes in the Cryosphere: PDF 22-24; Earthquake: 24-26, 28-29; Flood/Erosion: 31-39; Volcanic Ashfall: 41, 43-44; Severe Weather: 45-48; Fire: 49-55	X		
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Changes in the Cryosphere: PDF 23-24; Earthquake: 26-31; Flood/Erosion: 36-37; Volcanic Ashfall: 41-42, 44; Severe Weather: 47, 49; Fire: 52-54	X		
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Changes in the Cryosphere: PDF 24, 62; Earthquake: 29-30, 62; Flood/Erosion: 39-40, 59; Volcanic Ashfall: 44, 62; Severe Weather: 48, 62; Fire: 53-54, 59; Overall Vulnerability: 59-62	X		
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	PDF 9, 59	X		
<u>ELEMENT B: REQUIRED REVISIONS</u>				

ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction’s existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	PDF 12, 75-76	X	
C2. Does the Plan address each jurisdiction’s participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	PDF 9, 59	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	PDF 63-64	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	PDF 64-71	X	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	PDF 67-71, 157-160	X	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	PDF 73-74	X	
<u>ELEMENT C: REQUIRED REVISIONS</u>			

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)				
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	N/A			
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	N/A			
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	N/A			
<u>ELEMENT D: REQUIRED REVISIONS</u>				
ELEMENT E. PLAN ADOPTION				
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	Adoption Letter to be included in Appendix F once it is issued			X
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	N/A			
<u>ELEMENT E: REQUIRED REVISIONS</u>				
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)				
F1.				
F2.				
<u>ELEMENT F: REQUIRED REVISIONS</u>				

SECTION 2: PLAN ASSESSMENT

INSTRUCTIONS: The purpose of the Plan Assessment is to offer the local community more comprehensive feedback to the community on the quality and utility of the plan in a narrative format. The audience for the Plan Assessment is not only the plan developer/local community planner, but also elected officials, local departments and agencies, and others involved in implementing the Local Mitigation Plan. The Plan Assessment must be completed by FEMA. The Assessment is an opportunity for FEMA to provide feedback and information to the community on: 1) suggested improvements to the Plan; 2) specific sections in the Plan where the community has gone above and beyond minimum requirements; 3) recommendations for plan implementation; and 4) ongoing partnership(s) and information on other FEMA programs, specifically RiskMAP and Hazard Mitigation Assistance programs. The Plan Assessment is divided into two sections:

1. Plan Strengths and Opportunities for Improvement
2. Resources for Implementing Your Approved Plan

Plan Strengths and Opportunities for Improvement is organized according to the plan Elements listed in the Regulation Checklist. Each Element includes a series of italicized bulleted items that are suggested topics for consideration while evaluating plans, but it is not intended to be a comprehensive list. FEMA Mitigation Planners are not required to answer each bullet item, and should use them as a guide to paraphrase their own written assessment (2-3 sentences) of each Element.

The Plan Assessment must not reiterate the required revisions from the Regulation Checklist or be regulatory in nature, and should be open-ended and to provide the community with suggestions for improvements or recommended revisions. The recommended revisions are suggestions for improvement and are not required to be made for the Plan to meet Federal regulatory requirements. The italicized text should be deleted once FEMA has added comments regarding strengths of the plan and potential improvements for future plan revisions. It is recommended that the Plan Assessment be a short synopsis of the overall strengths and weaknesses of the Plan (no longer than two pages), rather than a complete recap section by section.

Resources for Implementing Your Approved Plan provides a place for FEMA to offer information, data sources and general suggestions on the overall plan implementation and maintenance process. Information on other possible sources of assistance including, but not limited to, existing publications, grant funding or training opportunities, can be provided. States may add state and local resources, if available.

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

Plan Strengths:

Opportunities for Improvement:

Element B: Hazard Identification and Risk Assessment

Plan Strengths:

Opportunities for Improvement:

Element C: Mitigation Strategy

Plan Strengths:

Opportunities for Improvement:

Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

Plan Strengths:

Opportunities for Improvement:

B. Resources for Implementing Your Approved Plan

The **Region 10 Integrating Natural Hazard Mitigation into Comprehensive Planning** is a resource specific to Region 10 states and provides examples of how communities are integrating natural hazard mitigation strategies into comprehensive planning. You can find it in the FEMA Library at <http://www.fema.gov/media-library/assets/documents/89725>.

The **Integrating Hazard Mitigation Into Local Planning: Case Studies and Tools for Community Officials** resource provides practical guidance on how to incorporate risk reduction strategies into existing local plans, policies, codes, and programs that guide community development or redevelopment patterns. It includes recommended steps and tools to assist with local integration efforts, along with ideas for overcoming possible impediments, and presents a series of case studies to demonstrate successful integration in practice. You can find it in the FEMA Library at <http://www.fema.gov/library/viewRecord.do?id=7130>.

The **Mitigation Ideas: A Resource for Reducing Risk from Natural Hazards** resource presents ideas for how to mitigate the impacts of different natural hazards, from drought and sea level rise, to severe winter weather and wildfire. The document also includes ideas for actions that communities can take to reduce risk to multiple hazards, such as incorporating a hazard risk assessment into the local development review process. You can find it in the FEMA Library at <http://www.fema.gov/library/viewRecord.do?id=6938>.

The **Local Mitigation Planning Handbook** provides guidance to local governments on developing or updating hazard mitigation plans to meet and go above the requirements. You can find it in the FEMA Library at <http://www.fema.gov/library/viewRecord.do?id=7209>.

The **Integration Hazard Mitigation and Climate Adaptation Planning: Case Studies and Lessons Learned** resource is a 2014 ICLEI publication for San Diego with a clear methodology that could assist in next steps for integration impacts of climate change throughout mitigation actions. <http://icleiusa.org/wp-content/uploads/2015/08/Integrating-Hazard-Mitigation-and-Climate-Adaptation-Planning.pdf>

The **Local Mitigation Plan Review Guide and Tool** resource is available through FEMA's Library and should be referred to for the next plan update. <http://www.fema.gov/library/viewRecord.do?id=4859>

Volcanic Eruption Mitigation Measures: For information on Mitigation Actions for Volcanic Eruptions that would satisfy the C4 requirement, please visit: <http://earthzine.org/2011/03/21/volcanic-crisis-management-and-mitigation-strategies-a-multi-risk-framework-case-study/> and <http://www.gvess.org/publ.html>.

The FEMA Region 10 **Risk Mapping, Analysis, and Planning program (Risk MAP)** releases a monthly newsletter that includes information about upcoming events and training opportunities, as well as hazard and risk related news from around the Region. Past newsletters can be viewed at <http://www.starr->

team.com/starr/RegionalWorkspaces/RegionX/Pages/default.aspx. If you would like to receive future newsletters, email rxnewsletter@starr-team.com and ask to be included.

The mitigation strategy may include eligible projects to be funded through FEMA's hazard mitigation grant programs (Pre-Disaster Mitigation, Hazard Mitigation Grant Program, and Flood Mitigation Assistance). Contact your State Hazard Mitigation Officer, Brent Nichols at Brent.Nichols@alaska.gov, for more information.

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Appendix D: Benefit-Cost Analysis Fact Sheet

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Benefit Cost Analysis Fact Sheet

Hazard mitigation projects are specifically aimed at reducing or eliminating future damages. Although hazard mitigation projects may sometimes be implemented in conjunction with the repair of damages from a declared disaster, the focus of hazard mitigation projects is on strengthening, elevating, relocating, or otherwise improving buildings, infrastructure, or other facilities to enhance their ability to withstand the damaging impacts of future disasters. In some cases, hazard mitigation projects may also include training or public education programs if such programs can be demonstrated to reduce future expected damages.

A Benefit-Cost Analysis (BCA) provides an estimate of the “benefits” and “costs” of a proposed hazard mitigation project. The “benefits” considered are avoided future damages and losses that are expected to accrue as a result of the mitigation project. In other words, benefits are the reduction in expected future damages and losses (i.e., the difference in expected future damages before and after the mitigation project). The costs considered are those necessary to implement the specific mitigation project under evaluation. Costs are generally well-determined for specific projects for which engineering design studies have been completed. The timing and severity of benefits, however, must be estimated probabilistically because they depend on the improved performance of the building or facility in future hazard events.

All benefit-costs must be:

- Credible and well documented
- Prepared in accordance with accepted BCA practices
- Cost-effective ($BCR \geq 1.0$)

General Data Requirements:

- All data entries (other than FEMA) standard or default values) must be documented in the application.
- Data must be from a credible source.
- Provide complete copies of reports and engineering analyses.
- Detailed cost estimate.
- Identify the hazard (e.g., flood, wind, seismic).
- Discuss how the proposed measure will mitigate against future damages.
- Document the project’s useful life.
- Document the proposed Level of Protection.
- The Very Limited Data (VLD) BCA module cannot be used to support cost-effectiveness (screening purposes only).
- Alternative BCA software must be approved in writing by FEMA HQ and FEMA Region 10 staff prior to submittal of the application.

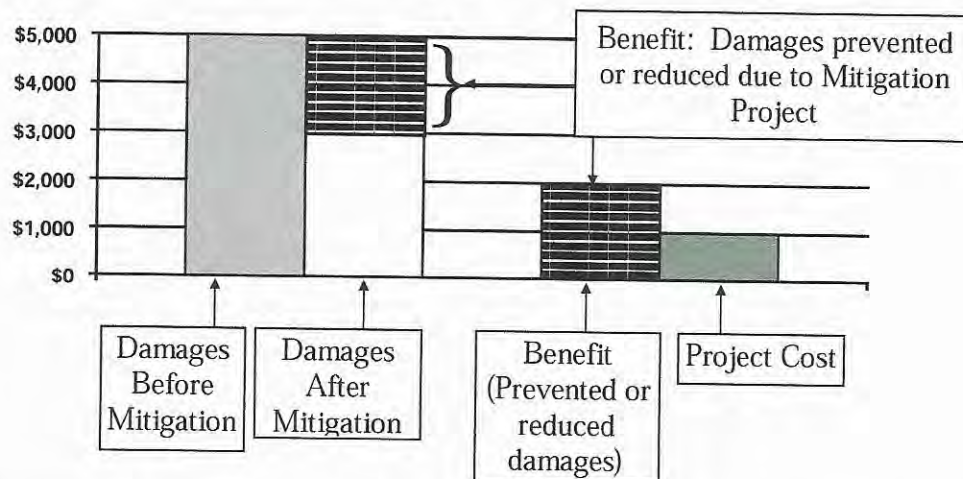
Damage and Benefit Data

- Well documented for each damage event.
- Include estimated frequency and method of determination per damage event.
- Data used in place of FEMA standard or default values must be documented and justified.
- The Level of Protection must be documented and readily apparent.

Benefit Cost Analysis Process

How to Determine Cost-Effectiveness of Mitigation Projects

When Congress enacted the Stafford Act's mitigation provisions, one of the criteria to determine priorities for mitigation funding was cost effectiveness. This cost effective provision was in response to the recognition that there would never be enough funding to completely mitigate against every hazard. To determine the cost effectiveness of proposed mitigation projects, FEMA implemented a benefit cost analysis (BCA) requirement to mitigation grant funding applications. The basic requirement of the BCA is that the benefit of the mitigation project must equal or exceed the cost, a benefit cost ratio (BCR) of 1:1 or greater. Over several years, FEMA developed a set standard values for use in BCA and custom software that establishes mitigation benefits and calculates the BCR. Benefit cost analysis submitted to FEMA to justify mitigation funding requires substantial documentation of project costs and benefits. FEMA provides the custom BCA software and training online at <https://www.fema.gov/benefit-cost-analysis>. An overview of the BCA process for a mitigation projects follows.



FEMA Basic Benefit-Cost Model. For more information about FEMA's Benefit-Cost Modules, please contact the FEMA Region X Mitigation Division at 425-487-4600.

It is important to understand that benefit-cost analysis is basically the same for each type of hazard mitigation project. The only differences are the types of data that are used in the calculations, depending on whether the project is for floods, earthquakes, or other natural hazards. For example, whereas the depth of flooding is used to estimate damage for flood mitigation projects, the severity of ground shaking is used to estimate damage for earthquake mitigation projects.

Calculating the Benefit - Cost Ratio

In the graph above, cost-effectiveness is determined by comparing the project cost of \$1,000, to the value of damages prevented after the mitigation measure, which is \$2,000. 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

Benefit Cost Analysis Process

by how much. To derive the BCR, divide the benefits by the cost ($\$2,000 \div \$1,000$); if the result is 1.0 or greater, then the project is cost-effective. In this instance, the BCR is 2.0, which far exceeds the 1.0 level. On the other hand, if the cost of the project is \$2,000 and the benefits are only \$1,000, the project would have a BCR of 0.50 ($\$1,000 \div \$2,000$) and would not be cost-effective.

Conducting a benefit-cost analysis determines 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. However, if the project is not cost-effective, then it is generally not eligible for FEMA mitigation grant funding.

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 (e.g., discount rate and mitigation project's useful lifetime)

These four key elements and their relationships to one another are detailed in the following example.

Consider a 1,500 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, over the life of a project, exceed 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.

Benefit Cost Fact Sheet

- When using the Limited Data (LD) BCA module, users cannot extrapolate data for higher frequency events for unknown lower frequency events.

Building Data

- Should include FEMA Elevation Certificates for elevation projects or projects using First Floor Elevations (FFE's).
- Include data for building type (tax records or photos).
- Contents claims that exceed 30 percent of building replacement value (BRV) must be fully documented.
- Method for determining BRVs must be documented. BRVs based on tax records must include the multiplier from the County Tax Assessor.
- Identify the amount of damage that will result in demolition of the structure (FEMA standard is 50 percent of pre-damage structure value).
- Include the site location (e.g., miles inland) for the hurricane module.

Use Correct Occupancy Data

- Design occupancy for hurricane shelter portion of tornado module.
- Average occupancy per hour for the tornado shelter portion of the tornado module.
- Average occupancy for seismic modules.

Questions to Be Answered

- Has the level of risk been identified?
- Are all hazards identified?
- Is the BCA fully documented and accompanied by technical support data?
- Will residual risk occur after the mitigation project is implemented?

Common Shortcomings

- Incomplete documentation.
- Inconsistencies among data in the application, BCA module runs, and the technical support data.
- Lack of technical support data.
- Lack of a detailed cost estimate.
- Use of discount rate other than FEMA-required amount of 7 percent.
- Overriding FEMA default values without providing documentation and justification.
- Lack of information on building type, size, number of stories, and value.
- Lack of documentation and credibility for FFE's.
- Use of incorrect project useful life (not every mitigation measure equals 100 years).

Appendix E: Plan Maintenance Documents

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Annual Review Questionnaire

PLAN SECTION	QUESTIONS	YES	NO	COMMENTS
PLANNING PROCESS	Are there internal or external organizations and agencies that have been invaluable to the planning process or to mitigation action?			
	Are there procedures (e.g., meeting announcements, plan updates) that can be done more efficiently?			
	Has the Task Force undertaken any public outreach activities regarding the MHMP or implementation of mitigation actions?			
HAZARD PROFILES	Has a natural and/or human-caused disaster occurred in this reporting period?			
	Are there natural and/or human-caused hazards that have not been addressed in this HMP and should be?			
	Are additional maps or new hazard studies available? If so, what have they revealed?			
VULNERABILITY ANALYSIS	Do any new critical facilities or infrastructure need to be added to the asset lists?			
	Have there been changes in development patterns that could influence the effects of hazards or create additional risks?			
MITIGATION STRATEGY	Are there different or additional resources (financial, technical, and human) that are now available for mitigation planning within the			
	Are the goals still applicable?			
	Should new mitigation actions be added to the a community's Mitigation Action Plan?			
	Do existing mitigation actions listed in a community's Mitigation Action Plan need to be reprioritized?			
	Are the mitigation actions listed in a community's Mitigation Action Plan appropriate for available resources?			

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Plan Goal (s) Addressed:

Goal: _____

Indicator of Success: _____

Project Status

Project Cost Status

Project on schedule

Cost unchanged

Project completed

Cost overrun*

Project delayed*

*explain: _____

*explain: _____

Cost underrun*

Project canceled

*explain: _____

Summary of progress on project for this report:

A. What was accomplished during this reporting period?

B. What obstacles, problems, or delays did you encounter, if any?

C. How was each problem resolved?

Next Steps: What is/are the next step(s) to be accomplished over the next reporting period?

Other Comments:

Community Local Hazard Mitigation Plan Survey

- C. Earthquakes? 0 1 2 3
- d. Volcanoes? 0 1 2 3
- e. Snow Avalanche? 0 1 2 3
- f. Tsunami/Seiches? 0 1 2 3
- g. Severe weather storms? 0 1 2 3
- h. Ground failure (landslide, permafrost)? 0 1 2 3
- i. Coastal erosion? 0 1 2 3
- j. Climate change? 0 1 2 3
- k. Other hazards? 0 1 2 3

Please Specify:

3. How vulnerable to displacement, evacuation or life-safety is the community from:

- a. Flooding? 0 1 2 3
- b. Wildfire? 0 1 2 3
- C. Earthquakes? 0 1 2 3
- d. Volcanoes? 0 1 2 3
- e. Snow Avalanche? 0 1 2 3
- f. Tsunami/Seiches? 0 1 2 3
- g. Severe weather storms? 0 1 2 3
- h. Ground failure (landslide, permafrost)? 0 1 2 3
- i. Coastal erosion? 0 1 2 3
- j. Climate change? 0 1 2 3
- k. Other hazards? 0 1 2 3

Please Specify:

4. Do you have a record of damages incurred during past flood events? Yes No

If yes, please describe: _____

Preparedness

Preparedness activities are often the first line of defense for protection of your family and the community. In the following list, please check those activities that you have done, plan to do in the near future, have not done, or are unable to do. Please check one answer for each preparedness activity.

Community Local Hazard Mitigation Plan Survey

Have you or someone in your household:	Have Done	Plan to do	Not Done	Unable to do
Attended meetings or received written information on natural disasters or emergency preparedness?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Talked with family members about what to do in case of a disaster or emergency?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Made a "Household/Family Emergency Plan" in order to decide what everyone would do in the event of a disaster?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prepared a "Disaster Supply Kit" (extra food, water, medications, batteries, first aid items, and other emergency supplies)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In the last year, has anyone in your household been trained in First Aid or CPR?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. Would you be willing to make your home more resistant to natural disasters? Yes No

6. Would you be willing to spend more money on your home to make it more disaster resistant? Yes No Don't know

7. How much are you willing to spend to better protect your home from natural disasters? (Check only one)

<input type="checkbox"/>	Less than \$100	<input type="checkbox"/>	Desire to relocate for protection
<input type="checkbox"/>	\$100-\$499	<input type="checkbox"/>	Other, please explain
<input type="checkbox"/>	\$500 and above		
<input type="checkbox"/>	Nothing / Don't know		
<input type="checkbox"/>	Whatever it takes		

Mitigation Activities

A component of the Local Hazard Mitigation Plan activities is developing and documenting additional mitigation strategies that will aid the community in protecting life and property from the impacts of future natural disasters.

Mitigation activities are those types of actions you can take to protect your home and property from natural hazard events such as floods, severe weather, and wildfire. Please check the box for the following statements to best describe their importance to you. Your responses will help us determine your community's priorities for planning for these mitigation activities.

Statement	Very Important	Somewhat Important	Neutral	Not Very Important	Not Important
Protecting private property	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Community Local Hazard Mitigation Plan Survey

Protecting critical facilities (medical facilities, school, police/fire department, water/sewer, landfill)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Preventing development in hazard areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Protecting natural environment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Protecting historical and cultural landmarks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Promoting cooperation within the community	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Protecting and reducing damage to utilities, roads, or water tank	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strengthening emergency services (clinic workers, police/fire)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. Do you have other suggestions for possible mitigation actions/strategies?

General Household Information

9. Please indicate your age: _____

and Gender: Male Female

10. Please indicate your level of education:

<input type="checkbox"/>	Grade school/no schooling	<input type="checkbox"/>	College degree
<input type="checkbox"/>	Some high school	<input type="checkbox"/>	Postgraduate degree
<input type="checkbox"/>	High school graduate/GED	<input type="checkbox"/>	Other, please specify
<input type="checkbox"/>	Some college/trade school		

11. How long have you lived in Kenai?

Less than 5 years 5 to 10 years 11 to 20 years 21 or more years

12. Do you have internet access? Yes No

13. Do you own or rent your home? Own Rent

If you have any questions regarding this survey or would like to learn about other ways that you can participate in the development of the Local Hazard Mitigation Plan, please contact the City of Kenai Planner.

Thank You for Your Participation!

This survey may be submitted anonymously; however, if you provide us with your name and contact information below we will have the ability to follow up with you to learn more about your ideas or concerns (optional):

Name: _____

Address: _____

Phone: _____

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Appendix F: Adoption Resolution and Approval Letter

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