City of Unalaska
Hazard Mitigation Plan

December 4, 2013

Photo by
J. Dickson

This document was prepared under a grant from the Federal Emergency Management Agency (FEMA)'s Grant Programs Directorate, U.S. Department of Homeland Security, and the Alaska Division of Homeland Security and Emergency Management. Points of view or opinions expressed in this document are those of the authors and do not necessarily represent the official position or policies of FEMA's Grant Programs Directorate, the U.S. Department of Homeland Security, or the State of Alaska.

U.S. Department of Homeland Security
Region X
130 228th Street, SW
Bothell, WA 98021-9796

FEMA

December 5, 2013

Honorable Shirley Marquardt
Mayor, City of Unalaska
43 Raven Way
P.O. Box 610
Unalaska, Alaska 99685

Dear Mayor Marquardt:

The U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) has approved the ***City of Unalaska Hazard Mitigation Plan*** as a local plan as outlined in 44 CFR Part 201. With approval of this plan, the City of Unalaska is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through December 4, 2018.

The plan's approval provides eligibility to apply for hazard mitigation projects through your State. All requests for funding will be evaluated individually according to the specific eligibility and other requirements of the particular program under which the application is submitted. For example, a specific mitigation activity or project identified in the plan may not meet the eligibility requirements for FEMA funding, and even eligible mitigation activities are not automatically approved for FEMA funding under any of the aforementioned programs. Approved mitigation plans may be eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Additional information regarding the CRS can be found at www.fema.gov/business/nfip/crs.shtm or through your local floodplain manager.

Over the next five years, we encourage your community to follow the plan's schedule for its monitoring and updating, and to develop further mitigation actions. The plan must be reviewed, revised as appropriate, and resubmitted for approval within five years in order to continue project grant eligibility.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact our State counterpart, Alaska Division of Homeland Security and Emergency Management, which coordinates and administers these efforts for local entities.

Sincerely,

Mark Carey, Director
Mitigation Division

cc: Ann Gravier, Alaska Division of Homeland Security and Emergency Management

Enclosure

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City of Unalaska
Hazard Mitigation Plan
Executive Summary

The City of Unalaska is following the lead of state and federal authorities in adopting an "All Hazards" approach to its emergency planning activities.

The Unalaska All-Hazard Mitigation Plan (HMP) is a joint planning effort by the City of Unalaska, Qawalangin Tribe of Unalaska, and Ounalashka Corporation. This HMP is intended to serve Unalaska Island citizens and decision makers to implement actions that would reduce or eliminate future and potentially damaging natural hazard event impacts to their critical facilities and population.

This HMP was drafted and adopted to fulfill requirements mandated by the Disaster Mitigation Act of 2000, under Public Law 106-390, amending the Robert T. Stafford Disaster Relief and Emergency Assistance Act, and Title 42 of the United States Code (5121 et seq).

Local and Tribal governments are required to have a FEMA approved, City government adopted, and Tribal commitment for implementation (as appropriate) of natural hazard mitigation plan initiatives.

The methodology used for developing the Unalaska Hazard Mitigation Plan consisted of the following tasks:

- Plan development, review, and maintenance
- Public and agency coordination and involvement
- Critical facility inventory development
- Hazard impact area identification and description
- Population risk assessment and critical facility vulnerability identification
- Mitigation strategy development identifying, selecting, prioritizing, and implementing mitigation actions
- Local HMP adoption following a public hearing
- Tribal HMP implementation commitment
- Periodic evaluation, review, and update

The HMP is divided into eight sections: introduction, community description, planning process, HMP adoption, hazard profiles, vulnerability analysis, Mitigation strategy, and reference list, and appendices.

Unalaska is at risk from seven natural hazards: earthquakes, erosion, flood, ground failure, severe weather, tsunamis, and volcanic activity. The primary threat to Unalaska is from severe weather and storm events. The other natural hazard threats to Unalaska are volcanic activity, earthquakes, and tsunamis. Planning Team identified mitigation measures include:

- Promote recognition and mitigation of all natural hazards that affect the City of Unalaska (City), Qawalangin Tribe of Unalaska, and Ounalashka Corporation.
- Reduce possibility of losses from all natural hazards that affect the City.
- Cross reference Mitigation goals and actions with other City planning mechanisms and projects.

- Reduce vulnerability of structures to earthquake, erosion, flood, ground failure, tsunami, volcano, and severe weather damages.
- Maintaining city monitoring and warning systems, i.e. the City of Unalaska's Department of Public Safety warning siren system.
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The plan will be monitored, reviewed, and evaluated annually; and updated every five years. It will also be reviewed and updated as appropriate, such as when new funding sources become available, or after a disaster occurs that significantly affects Unalaska. In the event of a disaster, the update will be completed as soon as possible, but no later than the 12 months following the date the disaster occurs.

This plan serves as guidance for citizens and policy makers in Unalaska in order to mitigate potential natural hazard disaster damages. The purpose of the HMP is to ensure public awareness and involvement, and maintenance of hazard mitigation initiatives to best protect Unalaska and mitigate damages from natural hazards. Periodic review of this plan is necessary in order to continually evaluate its effectiveness and to make the most efficient use of mitigation resources as they become available.

The Unalaska Hazard Mitigation Plan developed initiatives will be incorporated into co-related to existing City, Tribal, and Corporation planning initiatives such as the Comprehensive, Capital Improvement, and the City Emergency Operations Plans.

City of Unalaska
Hazard Mitigation Plan

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Acronyms/Abbreviations

20/20 Plan	City of Unalaska's Comprehensive Plan, 2020
°F	Degrees Fahrenheit
ACCIMP	Alaska Climate Change Impact Mitigation Program
ACWF	Alaska Clean Water Fund
ADWF	Alaska Drinking Water Fund
AEA	Alaska Energy Authority
AEEE	Alternative Energy And Energy Efficiency
AFG	Assistance To Firefighters Grant
AHFC	Alaska Housing Finance Corporation
AICC	Alaska Interagency Coordination Center
AIDEA	Alaska Industrial Development And Export Authority
AK	Alaska
ANA	Administration For Native Americans
ARC	American Red Cross
AVEC	Alaska Village Electric Cooperative
BIA	Bureau Of Indian Affairs
CCP	Citizen Corps Program
CDBG	Community Development Block Grant
CFR	Code Of Federal Regulations
CFP	Community Forestry Program
CGP	Comprehensive Grant Program
City	City Of Unalaska
CWSRF	Clean Water State Revolving Fund
DCCED	Department Of Commerce, Community, And Economic Development
DCRA	Division Of Community And Regional Affairs
DEC	Department Of Environmental Conservation
Denali	Denali Commission
DHS	Department Of Homeland Security
DHS&EM	Division Of Homeland Security And Emergency Management
DHSS	Department Of Health And Social Services
DGGS	Division Of Geological And Geophysical Survey
DMA 2000	Disaster Mitigation Act Of 2000
DMVA	Department Of Military And Veterans Affairs
DNR	Department Of Natural Resources
DOE	Department Of Energy
DOF	Division Of Forestry
DOI	Division Of Insurance
DOL	Department Of Labor
DOT/PF	Department Of Transportation And Public Facilities
DPS	Director of Public Safety
DSS	Division Of Senior Services
EOC	Emergency Operations Center
EMPG	Emergency Management Performance Grant
EPA	Environmental Protection Agency

EQ	Earthquake
ER	Erosion
EWP	Emergency Watershed Protection Program
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FL	Flood
FMA	Flood Mitigation Assistance
FP&S	Fire Prevention And Safety
ft	Feet
FY	Fiscal Year
g	Gravity
GF	Ground Failure
GIS	Geospatial Information System
Hazus-MH	Hazard United States – Multi-Hazard Software
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HSGP	Homeland Security Grant Program
HUD	Housing And Urban Development
IBHS	Institute For Business And Home Safety
ICDBG	Indian Community Development Block Grant
IHBG	Indian Housing Block Grant
IHLGP	Indian Home Loan Guarantee Program
INAP	Indian And Native American Programs
IRS	Internal Revenue Service
Kts	Knots
LEG	Legislative Energy Grant
LEPC	Local Emergency Planning Committee
LSA	Unalaska Little South America
M	Magnitude
MAP	Mitigation Action Plan
MGL	Municipal Grants And Loans
MMI	Modified Mercalli Intensity
mph	Miles Per Hour
msl	Mean Sea Level
NAHASDA	Native American Housing Assistance And Self Determination Act
NFIP	National Flood Insurance Program
NIMS	National Incident Management System
NOAA	National Oceanic And Atmospheric Administration
NRF	National Response Framework
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
OC	Ounalashka Corporation
PCR	Parks Culture & Recreation Center
PDM	Pre-Disaster Mitigation
PGA	Peak Ground Acceleration

PNP	Private Non-Profits
RCASP	Remote Community Alert Systems
RD	
RL	Repetitive Loss
RFC	Repetitive Flood Claim
SAFER	Staffing For Adequate Fire And Emergency Response
SBA	U.S. Small Business Administration
SHMP	Alaska State Hazard Mitigation Plan
SHSP	State Homeland Security Program
SOA	State Of Alaska
Sq.	Square
SRL	Severe Repetitive Loss
Stafford Act	Robert T. Stafford Disaster Relief And Emergency Assistance Act
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic, And Environmental
TS	Tsunami
URS	Urs Corporation
US or U.S.	United States
USACE	United States Army Corps Of Engineers
USC	United States Code
USDA	United States Department Of Agriculture
USGS	United States Geological Survey
VFA-RFA	Volunteer Fire Assistance And Rural Fire Assistance Grant
VOL	Volcano
VSW	Village Safe Water
WARN	Warning, Alert, And Response Network
WHIP	Wildlife Habitat Incentives Program
WX	Weather

1 Introduction

This section provides a brief introduction to hazard mitigation planning, the grants associated with these requirements, and a description of this Hazard Mitigation Plan (HMP).

1.1 HAZARD MITIGATION PLANNING

In recent years, local hazard mitigation planning has been driven by a new Federal law. 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). This new section emphasized the need for State, Tribal, and local entities to closely coordinate mitigation planning and implementation efforts. In addition, it provided the legal basis for the Federal Emergency Management Agency's (FEMA) mitigation plan requirements for mitigation grant assistance.

To implement these planning requirements, FEMA published an Interim Final Rule in the Federal Register on February 26, 2002 (FEMA 2002a), 44 CFR Part 201 with subsequent updates. The planning requirements for local entities are described in detail in Section 2 and are identified in their appropriate sections throughout this HMP.

In October 2007 and July 2008, FEMA combined and expanded flood mitigation planning requirements with local hazard mitigation plans (44 CFR §201.6). Furthermore, all hazard mitigation assistance program planning requirements were combined eliminating duplicated mitigation plan requirements. This change also required participating National Flood Insurance Program (NFIP) communities' risk assessments and mitigation strategies to identify and address repetitively flood damaged properties. Local hazard mitigation plans now qualify communities for several Federal Hazard Mitigation Assistance (HMA) grant programs.

This HMP complies with Title 44 CFR current as of September 28, 2012 and applicable guidance documents.

1.2 GRANT PROGRAMS WITH MITIGATION PLAN REQUIREMENTS

FEMA HMA grant programs provide funding to States, Tribes, and local entities that have a FEMA-approved State, Tribal, or Local Mitigation Plan. 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. The Hazard Mitigation Grant Program (HMGP) is a competitive, disaster funded, grant program. Whereas the other Unified Mitigation Assistance Programs: Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA) programs although competitive, rely on specific pre-disaster grant funding sources, sharing several common elements.

> *"Hazard mitigation is any sustained action taken to reduce or eliminate long-term risk to people and property from natural hazards and their effects. This definition distinguishes actions that have a long-term impact from those that are more closely associated with immediate preparedness, response, and recovery activities. Hazard mitigation is the only phase of emergency management specifically dedicated to breaking the cycle of damage, reconstruction, and repeated damage. As such, States, Territories, Indian Tribal governments, and communities are encouraged to take advantage of funding provided by HMA programs in both the pre- and post-disaster timeframes.*

Together, these programs provide significant opportunities to reduce or eliminate potential losses to State, Tribal, and local assets through hazard mitigation planning and project grant funding. Each HMA program was authorized by separate legislative action, and as such, each program differs slightly in scope and intent.

The Hazard Mitigation Grant Program (HMGP) may provide funds to States, Territories, Indian Tribal governments, local governments, and eligible private non-profits (PNPs) following a Presidential major disaster declaration. The Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA) programs may provide funds annually to States, Territories, Indian Tribal governments, and local governments. While the statutory origins of the programs differ, all share the common goal of reducing the risk of loss of life and property due to natural hazards" (FEMA 2010).

1.2.1 Hazard Mitigation Assistance (HMA) Unified Programs

HMA grant program activities include:

Table 1-1 HMA Eligible Activities

Activities	HMGP	PDM	FMA
1. Mitigation Projects	√	√	√
Property Acquisition and Structure Demolition	√	√	√
Property Acquisition and Structure Relocation	√	√	√
Structure Elevation	√	√	√
Mitigation Reconstruction			
Dry Floodproofing of Historic Residential Structures	√	√	√
Dry Floodproofing of Non-residential Structures	√	√	√
Minor Localized Flood Reduction Projects	√	√	√
Structural Retrofitting of Existing Buildings	√	√	
Non-Structural Retrofitting of Existing Buildings and Facilities	√	√	
Safe Room Construction	√	√	
Infrastructure Retrofit	√	√	
Soil Stabilization	√	√	
Wildfire Mitigation	√	√	
Post-disaster Code Enforcement	√		
5% Initiative Projects	√		
2. Hazard Mitigation Planning	√	√	√
3. Management Costs	√	√	√

(FEMA 2012)

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 Tribe with up to 20 percent of the total aggregate disaster damage costs to fund HMGP project or planning grants. In Fiscal Year (FY) 2006 was approximately $232 million, FY 2007 was $316 million, FY 2008 was $1.246 billion, FY 2009 was $359 million, and FY 2010 was $23 million. The cost-share for these grants is 75 percent Federal/25 percent non-Federal. Communities that fulfill "Impoverished Community" criteria and receive FEMA Regional Administrator approval may be funded at percent 90 percent Federal/10 percent non-Federal.

The PDM grant program provides funds to State, Tribes, and local entities, including universities, 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 FY 2008, PDM program funding totaled approximately $114 million, FY 2009 was $90 million, and FY 2010 was $100 million. The cost-share for these grants is 75 percent Federal/25 percent 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 (RL) properties. The primary source of funding for this program is the National Flood Insurance Fund with funding available for planning and project grants. Project grants typically use the majority of the program's total funding. States, Tribes, and local entities apply to implement mitigation measures that potentially reduce flood losses to NFIP insured properties.

The City of Unalaska does not currently participate in the NFIP and is therefore ineligible for National Flood Insurance Act Grant Programs until they become a NFIP

HMP Layout Description

The HMP consists of the following sections and appendices:

Introduction

Section 1 defines what a hazard mitigation plan is, delineates federal requirements and authorities, and introduces the Hazard Mitigation Assistance program listing the various grant programs and their historical funding levels.

Community Description

Section 2 provides a general history and background of the City of Unalaska (City), including historical trends for population and the demographic and economic conditions that have shaped the area.

Planning Process

Section 3 describes the HMP update's planning process, identifies the Planning Team Members, the meetings held as part of the planning process, and the key stakeholders within the City of Unalaska and the surrounding area. This section documents public outreach activities (support documents are located in Appendix F); the review and incorporation of relevant plans, reports,

and other appropriate information; actions the City of Unalaska plans to implement to assure continued public participation; and their methods and schedule for keeping the plan current.

This section also describes the Planning Team's formal plan maintenance process to ensure that the HMP remains an active and applicable document throughout its 5-year lifecycle. The process includes monitoring, reviewing, evaluating (Appendix H – Maintenance Documents), updating the HMP; and implementation initiatives.

HMP Adoption

Section 4 describes the community's HMP adoption process (support documents are located in Appendix C)

Hazard Analysis

Section 5 describes the process through which the Planning Team identified, screened, and selected the hazards to for profiling in this version of the HMP. The hazard analysis includes the nature, previous occurrences (history), location, extent, impact, and future event recurrence probability for each hazard. In addition, historical impact and hazard location figures are included when available.

Vulnerability Analysis

Section 6 identifies the City of Unalaska's potentially vulnerable assets—people, residential and nonresidential buildings (where available), critical facilities, and critical infrastructure. 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 trends 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. This section lists the community's governmental authorities, policies, programs and resources.

The Planning Team developed a list of mitigation goals and potential actions to address the risks facing the City of Unalaska. Mitigation actions include preventive actions, property protection techniques, natural resource protection strategies, structural projects, emergency services, and public information and awareness activities. Mitigation strategies were developed to address NFIP insured properties (if applicable) while encouraging participation with the NFIP and the reduction of flood damage to flood-prone structures.

References

Section 8 lists reference materials and resources used to prepare this HMP.

Appendices

Appendix A: Delineates Federal, State, and other potential mitigation funding sources. This section will aid the community with researching and applying for funds to implement their mitigation strategy.

Appendix B: Provides the FEMA Local Mitigation Plan Review Tool, which documents compliance with FEMA criteria.

Appendix C: Provides the adoption resolution for the City of Unalaska.

Appendix D: Contains the City's critical facilities list.

Appendix E**:** **C**ontains Figures which represent the City's hazard areas and critical facilities located within the City's natural hazard areas.

Appendix F: Provides public outreach information, including newsletters.

Appendix G: Contains the Benefit-Cost Analysis Fact Sheet used to prioritize mitigation actions.

Appendix H**:** Provides the plan maintenance documents, such as an annual review sheet and the progress report form.

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This section describes the location, geography, history; demographics; and land use development trends of the City of Unalaska and Qawalangin Tribe of Unalaska.

2.1 LOCATION, GEOGRAPHY, AND HISTORY

"Unalaska overlooks Iliuliuk Bay and Dutch Harbor on Unalaska Island in the Aleutian Chain. It lies 800 air miles from Anchorage (a two- to three-hour flight) and 1,700 miles northwest of Seattle. The name Dutch Harbor is often applied to the portion of the city on Amaknak Island, which is connected to Unalaska Island by bridge. Dutch Harbor is actually within the boundaries of the City of Unalaska. It lies at approximately 53.873610 North Latitude and -166.536670 West Longitude. (Sec. 11, T073S, R118W, Seward Meridian and the Aleutians West Census Area.)" (Department of Community, Commerce, and Economic Development [DCCED], Division of Community and Regional Affairs [DCRA] 2012).

Figure 2-1 Unalaska Location Map

The Qawalangin Tribal website provides a brief history of present day Unalaska:

> *"The word Aleutian and the name "Aleut" was given to the native people by the first Russian explorers to visit the Aleutian Islands. Its meaning is unclear, so the present-day Natives of Unalaska and most of the Aleutian Islands prefer to call themselves Unangan, or the people of the passes. In the dialect of the eastern Aleutian Islands, the self-given term for this group of Native peoples is Unangan; in the western dialect, Unangas. Collectively, Unangax^ (with the "^" positioned directly over the "x") is the proper term for the Native people of the Aleutian region. This group of hunters, whalers and fishers are the original inhabitants of the Aleutian Island Chain, predating the Russian settlement of the region by thousands of years.*
>
> *Resources from the sea provided livelihood for the Unangan people as they still do today for not only the Unangan, but also many residents of Unalaska. The harsh climate and unforgiving topography of the islands created a Unangan culture both rich in art and oral tradition that lives today, and continues to grow and flourish in the present generation of Unangan People. Language, Unangan dance, and medicinal plants are being brought back and used as they always were over thousands of years. The Unangan People are mostly widely known for their ultra-fine grass basketry, sleek and efficient wood-frame iqyan (skin boats made of wood frames and marine mammal skin) and mastery in handling these skin boats at sea. The Unangan People are also well known for their excellence as marine mammal hunters, superior skin sewing and embroidery techniques, and beautiful, streamlined bentwood hats and visors.*
>
> *Historically, the Aleutian Island of Unalaska has been home to the Unangan people who through oral history have documented an estimated 8,000 years of trade and travel. Recent archaeological investigation in the Unalaska area gives evidence that the Unangan people have inhabited the Aleutian Islands for at least 9,000 years. Artifacts found in the archaeological site at Margaret Bay on the Island of Unalaska were ancient*

at the time the Egyptians were building the first step pyramids. By 1745, the Unangan People had come into contact with Russian explorers, fur traders and hunters who came across the Bering Straits to the Aleutian Islands such as Unalaska. There were inevitable clashes between the Russians and the native islanders, as the Russian's treatment of the Unangan was less than favorable. At this time, the explorers branded the Unangan/Unangas people with the name, "Aleut", a word of uncertain meaning and origin that has become a catchall name for various Alaska Native groups.

International commerce began in 1759 when Stephan Glotov and accompanying fur hunters spent two years on Unalaska and nearby Umnak Island. Soon under Russian control, the Unangan People were consolidated into fewer and fewer communities to accelerate the efficiency in which the Russians could take advantage of their hunting skills. The decline of the Unangan population was rapid and occurred for varied reasons, from genocide to contact diseases brought by the Russian newcomers.

According to Unalaska resident Moses Dirks, a linguist specialist and teacher of the Unangan Language at the high school in Unalaska, the word Unangan means people of the passes. The Aleutian Islands are home to the earliest known continually inhabited coastal site in North America" (Qawalangin 2012).

The City of Unalaska's Comprehensive Plan 2020 (20/20 Plan) provides some historical background for their community as:

"Unalaska (Iluulux) in Aleut; (Уналашка) in Russian) is a city in the Aleutians West Census Area of the Unorganized Borough of the State of Alaska and is located on Unalaska Island and neighboring Amaknak Island in the Aleutian Islands off of mainland Alaska.

The Unangan people, who were the first to inhabit the island of Unalaska, named it "Ounalashka" meaning „Near the Peninsula". The name Unalaska is probably an English variation of this name. The regional native corporation has adopted this moniker, and is known as the Ounalashka Corporation. Dutch Harbor was so named by the Russians because they believed that a Dutch vessel was the first European ship to enter the harbor" (UCP 2011).

The City covers approximately 111 square (sq.) miles of land and approximately101.3 sq. miles of water. Moderate maritime temperature changes occur along Alaska's Aleutian Islands. The City's maritime temperatures range from a winter low of 23 degrees Fahrenheit (°F) to a high of 56 °F. The area receives approximately 58 inches of rain and 61.2 inches of snow. (DCRA 2012, WRCC 2012).

The following is a brief sketch of the City's history:

15-20,000 Years ago	First people inhabiting the Unalaska region were those who are thought to have crossed over into Alaska from Siberia on the "Bering Land Bridge"
1741	Russian ships first reached the Aleutians. Fur hunters exploited resources, Russians enslaved Aleut inhabitants
1759	Approximately 3,000 Unangan (Today's Aleuts) utilized 24 locations on Unalaska and Amaknak Islands
	International commerce began – Unangan people worked with Stephan Glotov and accompanying fur hunters

1867	Alaska purchased by United States of American and Russian control ended
1880	Methodist Church opened a school, clinic, and the Jesse Lee Home for Orphans
1880s	Dutch Harbor flourished from coal and commercial trade
1890s	Klondike Gold Rush brought many through the Unimak Pass as the gateway to the northwest Alaska gold fields
1900s	Seafood processing plants are believed to have existed to process herring, salmon, and whale meat
1910	Fox farming provided economic benefits to the area as coal trade diminished due to oil use
1930s	The Great Depression caused the collapse of the fur industry.
1942	Military defense installations proved wise when Japanese aircraft attacked Dutch Harbor
1950	Aleutians renewed fish processing interest with halibut, salmon, and king crab
1960	The King Crab industry improved significantly
1989	The Qawalangin Tribe of Unalaska has held status as a federally recognized sovereign nation of the United States since 1989

(UCP 2011, Qawalangin 2012, DCRA 2012)

"Unalaska is a rapidly-growing and culturally-diverse community, primarily focused on fishing and fish-processing activities. Subsistence activities are important to the Unangan community and to many long-term non-Native residents, as well" (DCRA 2012).

2.2 DEMOGRAPHICS

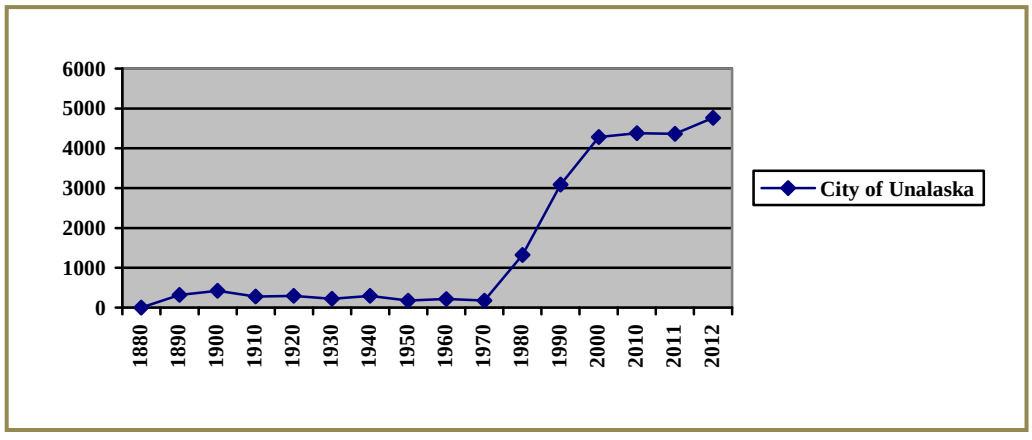

Figure 2-2 Unalaska Historic Population

The 2010 census recorded 4,376 residents, of which the median age was 40.7 indicating a relatively young population. The population of Unalaska is expected to remain steady because over half of the population is between 10 and 44 years of age. The City population is split between various races with the 39.2 percent (%) White, 32.6% Asian, 6.9% Black or African

American, and 2.2% Pacific Islanders with the remaining 13% as undefined nationality. The male and female composition is approximately 68.4 and 31.5 % respectively. The 2010 census revealed that there are 1,106 households with the average household having approximately 2.58 individuals. The most recent 2012 DCCED certified population is 4,768. Figure 3-2 illustrates the historic population of the City.

2.3 ECONOMY

The City's economy is primarily based on their very successful and historically established fishing industry which includes commercial fishing, fish processing, and fleet services (fuel, repairs, maintenance, trade, and transportation). Unalaska is situated within the Great Circle shipping route and is located within 50 miles from major trade routes between the Aleutian Islands to Pacific Rim and Bering Sea ports.

Commercial fish processors and fishing industry infrastructure include: Westward Seafoods, Unisea, Alyeska, Icicle, and Trident. (DCRA 2012)

Fishing processing is the principle industry in Unalaska, however, other general employment opportunities do exist within the community. Table 2-1 lists the U.S. Census Industry Classifications for the City of Unalaska.

Table 2-1 Labor Industry Classification Break-out for Unalaska

Industry	Estimate	Percentage
Civilian employed population 16 years and over	3,938	100%
Agriculture, forestry, fishing and hunting, and mining	43	1.1%
Construction	52	1.3%
Manufacturing	3,254	82.6%
Wholesale trade	18	0.5%
Retail trade	73	1.9%
Transportation and warehousing, and utilities	226	5.7%
Information	4	0.1%
Finance and insurance, and real estate and rental and leasing	30	0.8%
Professional, scientific, and management, and administrative and waste management services	20	0.5%
Educational services, and health care and social assistance	77	2.0%
Arts, entertainment, and recreation, and accommodation and food services	55	1.4%
Other services, except public administration	21	0.5%
Public administration	65	1.7%

According to the 2010 census, the median household income in Unalaska was $80,625 with a per capita income of $25,353. Approximately 11.5 % were reported to be living below the poverty level. The potential work force (those aged 16 years or older) in the City was estimated to be 4,140, of which 3,938 were actively employed. In 2010 the unemployment rate was 2.1 percent; however, this rate included part-time and seasonal jobs, and practical unemployment or underemployment is likely to be significantly higher.

Table 2-2 identifies the City of Unalaska's Top 2010 Occupations.

Table 2-2 2010 Top Occupations, Gender, and Age Group

Occupations	Number of workers	Female	Male	Age 45 and over	Age 50 and over
Meat, Poultry, and Fish Cutters and Trimmers	335	111	218	202	148
Material Moving Workers, All Other	142	18	124	86	52
Stock Clerks and Order Fillers GASLINE	50	9	41	19	11
Installation, Maintenance, and Repair Workers, All Other	49	0	49	30	22
Laborers and Freight, Stock, and Material Movers, Hand GASLINE	48	0	45	18	14
Office Clerks, General GASLINE	38	32	6	20	14
Maids and Housekeeping Cleaners GASLINE	31	20	11	21	14
Sales and Related Workers, All Other	28	19	8	7	5
Operating Engineers and Other Construction Equipment Operators GASLINE TOP JOB	25	3	22	11	7
Helpers--Installation, Maintenance, and Repair Workers GASLINE	24	7	17	6	5
General and Operations Managers TOP JOB	24	6	18	16	13
Cooks, Institution and Cafeteria GASLINE	20	9	11	11	7
Industrial Truck and Tractor Operators	20	1	19	10	5
Security Guards GASLINE	17	6	11	9	3
Welders, Cutters, Solderers, and Brazers GASLINE TOP JOB	17	2	15	1	0
Bookkeeping, Accounting, and Auditing Clerks GASLINE	17	15	2	4	2
Executive Secretaries and Executive Administrative Assistants GASLINE TOP JOB	16	16	0	6	4
Food Batchmakers	16	8	8	5	3
Janitors and Cleaners, Except Maids and Housekeeping Cleaners GASLINE	16	5	11	10	7
Lifeguards, Ski Patrol, and Other Recreational Protective Service	15	8	7	1	0
Maintenance and Repair Workers, General GASLINE TOP JOB	15	0	14	10	4
Heavy and Tractor-Trailer Truck Drivers GASLINE TOP JOB	15	0	15	7	3
Billing and Posting Clerks	14	12	2	6	5
First-Line Supervisors of Retail Sales Workers	14	6	8	5	3
Elementary School Teachers, Except Special Education TOP JOB	13	12	1	6	4

GASLINE: means the occupation has been identified as a core occupation involved in the gas line project.
TOP JOB: means the occupation is projected to have a high growth rate and numerous openings, and has an above average wage.
: means the occupation has been identified as green. Read more.

(Census 2010)

Figure 2-3depicts the 2010 US Census Pie Chart indicating the number of Resident Workers by Industry.

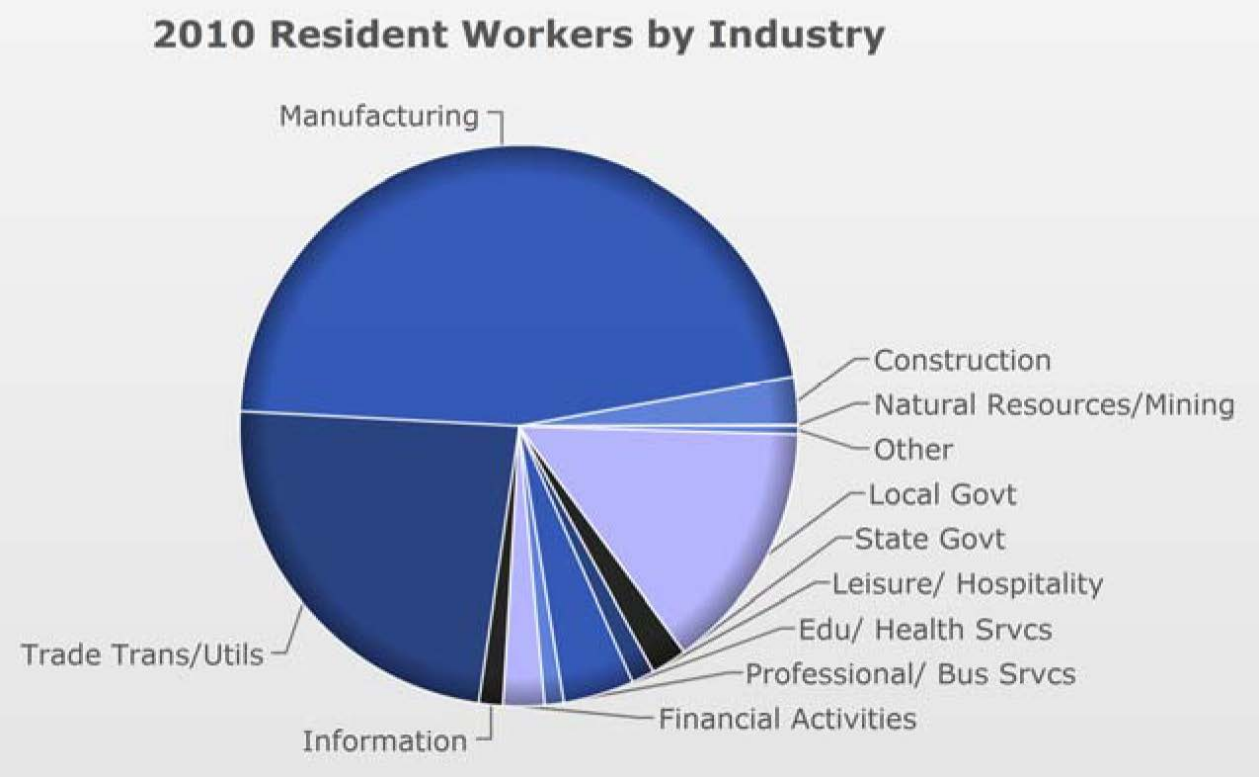

Figure 2-3 Resident Works by Industry (Census 2010)

Figure 2-4 depicts a photographic collage of the City.

Figure 2-4 Collage of Aerial Photographs – City of Unalaska (Unalaska 2012)

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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. Outreach support documents and meeting information regarding the Planning Team and public outreach efforts are provided in Appendix F.

The requirements for the planning process, as stipulated in DMA 2000 and its implementing regulations are described below.

DMA 2000 Requirements
1. REGULATION CHECKLIST
Local Planning Process §201.6(b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: Element §201.6(b)(1): An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval; §201.6(b)(2): An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and nonprofit interests to be involved in the planning process; and §201.6(b)(3): Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information. §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. §201.6(c)(4)(i): The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle. §201.6(c)(4)(iii): The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.
ELEMENT 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)) 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)) A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1)) A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3)) A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii)) 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))
Does the updated plan document how the planning team reviewed and analyzed each section of the plan and whether each section was revised as part of the update process? (Not applicable until 2013 update).
Source: FEMA, October 2011.

3.1 PLANNING PROCESS OVERVIEW

The State of Alaska, Division of Homeland Security and Emergency Management (DHS&EM) provided funding and project oversight to URS Corporation to facilitate and guide Planning Team development and HMP development.

The planning process began on May 22, 2012 with Mayor Shirley Marquardt's referral to Jamie Sunderland, Director of Public Safety; Jamie who organized a planning team to begin HMP development on October 31, 2012.

The Planning Team identified applicable City resources and capabilities during the meeting. URS explained how the HMP differed from current emergency plans. The Planning Team then discussed the City's rolls such as: acting as an advocate for the planning process, assisting with gathering information, and supporting public participation opportunities. There was also a brief discussion about hazards that affect the community such as erosion, sediment deposition, and permafrost impacts, which are increasing in intensity.

The Planning Team further discussed the hazard mitigation planning process, asking participants to help identify hazards that affect the City, to identify impacts to residential and critical facilities, and for assisting the Planning Team with identifying and prioritizing mitigation actions for potential future mitigation project funding

In summary, the following five-step process took place from May 2012 through April 2013.

1. Organize resources: Members of the Planning Team identified resources, including staff, agencies, and local community members, who could provide technical expertise and historical information needed in the development of the hazard mitigation plan.
2. Monitor, evaluate, and update the plan: The Planning Team developed a process to ensure the plan was monitored to ensure it was used as intended while fulfilling community needs. The team then developed a process to evaluate the plan to compare how their decisions affected 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 to provide data for the plans five year update.
3. Assess risks: The Planning Team identified the hazards specific to Unalaska, and with the assistance of a hazard mitigation planning consultant (URS), developed the risk assessment for seven identified hazards. The Planning Team reviewed the risk assessment, including the vulnerability analysis, prior to and during the development of the mitigation strategy.
4. Assess capabilities: The Planning Team reviewed current administrative and technical, legal and regulatory, and fiscal capabilities to determine whether existing provisions and requirements adequately address relevant hazards.
5. Develop a mitigation strategy: After reviewing the risks posed by each hazard, the Planning Team developed a comprehensive range of potential mitigation goals and actions. Subsequently, the Planning Team identified and prioritized the actions for implementation.

3.2 HAZARD MITIGATION PLANNING TEAM

The local Planning Team members are Director Public Safety Jamie Sunderland (Planning Team Leader), Fire Chief Abner Hoage, Director of Planning Erin Reinders, and Planning Administrator Rosie Glorso. Qawalangin Tribal President Denise Rankin, Qawalangin

Administrator Robin Waldron and Ounalashka Corporation CEO Rick Miller were contacted throughout the process as well.

Table 3-1 identifies the hazard complete mitigation Planning Team.

Table 3-1 Hazard Mitigation Planning Team

Name	Title	Organization	Key Input
Jamie Sunderland	Director of Public Safety	City of Unalaska	Planning Team Lead, HMP review.
Erin Reinders	Director of Planning	City of Unalaska	Planning Team Member, data input and HMP review.
Rosie Glorso	Planning Administrator	City of Unalaska	Planning Team Member, data input and HMP review.
Scott Simmons	Emergency Management, Hazard Mitigation, and Climate Change Planner	URS Corporation, Alaska	Temporary Team Member, Responsible for HMP development, lead writer, project coordination.

3.3 PUBLIC INVOLVEMENT & OPPORTUNITY FOR INTERESTED PARTIES TO PARTICIPATE

Table 3-2 lists the community's public involvement initiatives focused to encourage participation and insight for the HMP effort.

Table 3-2 Public Involvement Mechanisms

Mechanism	Description
Newsletter #1 Distribution (November 2012)	In November 2012, the jurisdiction distributed a newsletter intorducing the upcoming planning activity. The newsletter encouraged the whole community to provide hazard and critical facility information. It was posted at City Offices, bulletin boards, shopping centers, and Unalaska's websites to enable the widest dissemination.
Newsletter #2 Distribution (December 19, 2012)	In December 19, 2012, the jurisdiction distributed a newsletter describing the HMPs availability and present potential HMP projects for review. The newsletter encouraged the whole community to provide comments or input. It was posted at the City Office, and distributed to each postal box to ensure everyone was aware of the meeting.
Public Meeting Notice	Notice of the meeting was posted at City Hall, both post offices, and blast faxed to encourage communitywide participation, and the Department of Public Safety's website.
Public Meeting Notice	Advertised on the James Mason's electronic newspaper, the Dutch Harbor Telegraph

Initial contact was made with Mayor Shirley Marquardt on May 22, 2012; she was very excited that Unalaska was included within DHS&EM's Pre-Disaster Mitigation grant and the prospects of completing the hazard mitigation plan. Mayor Marquardt identified City Manager Chris Hladick and Director of Public Safety (DPS) Jamie Sunderland as project focal points-of-contact. Jamie Sunderland was selected as the Planning Team Chief.

DPS Sunderland quickly formed the Planning Team and began directing HMP data acquisition efforts. Mr. Sunderland introduced the hazard mitigation planning project and introductory newsletter during the December 19, 2012 Local Emergency Planning Committee Meeting (LEPC) describing the planning process. The newsletter was either faxed or emailed to relevant academia, nonprofits, and local, state, and federal agencies and placed on the DSH&EM website Fliers were posted throughout the community (both post offices and public bulletin boards) announcing the LEPC meetings' agenda.

The following agencies were invited to participate and review the HMP:

- University of Alaska Fairbanks, Geophysical Institute, Alaska Earthquake Information Center (UAF/GI/AEIC)
- Alaska Native Tribal Health Consortium-Community Development (ANTHC)
- Alaska Volcano Observatory (AVO)
- Association of Village Council Presidents (AVCP)
- Denali Commission
- Alaska Department of Environmental Conservation (DEC)
- DEC Division of Spill Prevention and Response (DSPR)
- DEC Village Safe Water (VSW)
- Alaska Department of Transportation and Public Facilities (DOT/PF)
- Alaska Department of Community, Commerce, and Economic Development (DCCED)
- DCCED, Division of Community Advocacy (DCRA)
- Alaska Department of Military and Veterans Affairs (DMVA)
- DMVA, Division of Homeland Security and Emergency Management (DHS&EM)
- US Environmental Protection Agency (EPA)
- National Weather Service (NWS) Northern Region
- NWS Southeast Region
- NWS Southcentral Region
- Natural Resources Conservation Service (NRCS)
- US Department of Agriculture (USDA)
- USDA Division of Rural Development (RD)
- US Army Corps Of Engineers (USACE)
- US Bureau of Indian Affairs (BIA)
- US Bureau of Land Management (BLM)
- US Department of Housing and Urban Development (HUD)
- US Fish & Wildlife Service (USFWS)

The Planning Team identified seven natural hazards: earthquake, erosion, flood, ground failure (avalanche and landslide), tsunami, volcano, and severe weather which periodically impact the City. The Planning Team also identified transportation and utility disruptions that could occur from various natural and manmade events.

URS described the specific information needed from the Planning Team to assess critical facility vulnerability and population risk by the location, value, and population within residential properties and critical facilities.

The risk assessment was completed after the community asset data was collected by the Planning Team over the winter of 2012/2013, which identified the assets that are exposed and vulnerable to specific hazards.

The Planning Team evaluated these facilities and their associated risks to facilitate GIS analysis and subsequent vulnerability assessment for Unalaska.

A Planning Team meeting was held on January 17, 2013 to review and prioritize the mitigation actions identified based on the results of the risk assessment. A second newsletter was prepared and delivered on February 4, 2012 describing the process to date, presenting the prioritized mitigation actions, and announcing the availability of the draft HMP for public review and comment.

The Planning Team held a special meeting January 18, 2013 to review the draft HMP for accuracy – ensuring it meets the City's needs. The meeting was productive with the Team highlighting several minor corrections or refinements. Changes were specifically targeted to plan development information, hazard impacts, community vulnerability analysis, and the mitigation strategy.

3.4 INCORPORATION OF EXISTING PLANS AND OTHER RELEVANT INFORMATION

During the planning process, the Planning Team reviewed and incorporated information from existing plans, studies, reports, and technical reports into the HMP. The following were available from two of the City's websites and were reviewed and used as references for the jurisdiction information and hazard profiles in the risk assessment of the HMP for the City (Table 3-3).

Table 3-3 Documents Reviewed

Existing plans, studies, reports, ordinances, etc.	Contents Summary (How will this information improve mitigation planning?)
City of Unalaska, Alaska, Recommended Community Development Plan, November, 1977	Explains the City's historic land-use initiatives and natural hazard impacts
Unalaska Comprehensive Plan 2020, February 22, 2011	Explains the City's current land use initiatives and natural hazard impacts
Unalaska Comprehensive Plan 2020 – Housing Plan, February 22, 2011.	Defined the City's housing trends, goals, and initiatives
Unalaska Economic Development Plan, March 2004	Defined the City's future economic goals
Unalaska Community Visions for the Future 1991-2000	Defined the City's vision for future development
Aleutians West Coastal Resource Service Area, Volume II, Resource Inventory and Analysis, Appendix C, Coastal Management Plan, Mitigation Opportunities in Unalaska, State Review Draft, Prepared June 2008 by LaRoche + Associates	Explains the City's coastal environment and desired initiatives

Table 3-3 Documents Reviewed

Existing plans, studies, reports, ordinances, etc.	Contents Summary (How will this information improve mitigation planning?)
Unalaska Road Improvement Master Plan	Defined the City's road conditions and threats
Earthquakes in Alaska, USGS Open-File Report 95-624, by Peter Haeussler and George Plafker	Defined the location's earthquake threat potential
DNR/DGGS, Preliminary Volcano-Hazard Assessment for Makushin Volcano, Alaska, Report of Investigation 2000-4	Defined the area's volcanic threat
State of Alaska, Department of Commerce, Community and Economic Development Community Profile	Provided historical and demographic information
State of Alaska Hazard Mitigation Plan (SHMP), 2010	Defined statewide hazards and their potential locational impacts

A complete list of references list is provided in Section 8.

3.5 PLAN MAINTENANCE

This section describes a formal plan maintenance process to ensure that the HMP remains an active and applicable document. It includes an explanation of how the City's Planning 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. Implementation into existing planning mechanisms
2. Continued public involvement
3. Monitoring, reviewing, evaluating, and updating the HMP

3.5.1 Implementation Into Existing Planning Mechanisms

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

DMA 2000 Requirements
1. REGULATION CHECKLIST
Incorporation into Existing Planning Mechanisms §201.6(b)(3): Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.
ELEMENT A Planning Process (Continued)
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information?
Source: FEMA, October 2011.

Once the HMP is community adopted and receives FEMA's final approval, Each Planning Team Member ensures that the HMP, in particular each Mitigation Action Project, is incorporated into existing planning mechanisms whenever possible. Each member of the Planning Team has 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 following capability assessment section
- Work with pertinent community departments to increase awareness of the HMP and provide assistance in integrating the mitigation strategy (including the Mitigation Action Plan) into relevant planning mechanisms. Implementation of these requirements may require updating or amending specific planning mechanisms

3.5.2 Continued Public Involvement

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

DMA 2000 Requirements
1. REGULATION CHECKLIST
Continued Public Involvement §201.6(c)(4)(iii): The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.
ELEMENT A Planning Process (Continued)
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))
Source: FEMA, October 2011.

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

The Planning Team will continue to identify opportunities to raise community awareness about the HMP and the hazards that affect the area. This effort could include attendance and provision of materials at City-sponsored events, outreach programs, and public mailings. Any public comments received regarding the HMP will be collected by the Planning Team Leader, included in the annual report, and considered during future HMP updates.

3.5.3 Monitoring, Reviewing, Evaluating, and Updating the HMP

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

DMA 2000 Requirements
Monitoring, Evaluating and Updating the Plan
§201.6(c)(4)(i): The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.
1. REGULATION CHECKLIST
ELEMENT A. Planning Process (Continued)
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?)
Source: FEMA, October 2011.

This section provides an explanation of how Unalaska's Planning 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. Review and revise the HMP to reflect development changes, project implementation progress, project priority changes, and resubmit
2. HMP resubmittal at the end of the plan's five year life cycle for State and FEMA review and approval
3. Continued mitigation initiative implementation

3.5.3.1 Monitoring the HMP

The HMP was prepared as a collaborative effort. To maintain momentum and build upon previous hazard mitigation planning efforts and successes, the City will continue to use the Planning Team to monitor, evaluate, and update the HMP. Each authority identified in the Mitigation Action Plan (MAP) matrix (Table 7-8) will be responsible for implementing the Mitigation Action Plan and determining whether their respective actions were effectively implemented. The Director of Public Safety, the hazard mitigation Planning Team Leader, (or designee), will serve as the primary point of contact and will coordinate local efforts to monitor, evaluate, revise, and tabulate HMP actions' status.

3.5.3.2 Reviewing the HMP

The City will review their success for achieving the HMP's mitigation goals and implementing the Mitigation Action Plan's activities and projects during the annual review process.

During each annual review, each agency or authority administering a mitigation project will submit a Progress Report (Appendix H) to the Planning Team. The report will include the current status of the mitigation project, including any project changes, a list of identified implementation problems (with an appropriate strategies to overcome them), and a statement of whether or not the project has helped achieve the appropriate goals identified in the plan.

3.5.3.3 *Evaluating the HMP*

The Annual Review Questionnaire (Appendix H) provides the basis for future HMP evaluations by guiding the Planning Team with identifying new or more threatening hazards, adjusting to changes to, or increases in, resource allocations, and garnering additional support for HMP implementation.

The Planning Team Leader 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 Planning Team. The findings from these reviews will be presented at the annual Planning Team Meeting. Each review, as shown on the Annual Review Worksheet, will include an evaluation of the following:

- Determine City authorities, outside agency, stakeholders, and resident's participation in HMP implementation success
- Identify notable risk changes for each identified and newly considered natural or human-caused hazards
- Consider land development activities and related programs' impacts on hazard mitigation
- Mitigation Action Plan implementation progress (identify problems and suggest improvements as necessary)
- Evaluate HMP local resource implementation for HMP identified activities

3.5.3.4 *Updating the HMP*

In addition to the annual review, the Planning Team will update the HMP every five years. The following section explains how the HMP will be reviewed, evaluated, and implementation successes described.

DMA 2000 Requirements
Reviewing, Evaluating, and Implementing the Plan §201.6(d)(3): A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit if for approval within 5 years in order to continue to be eligible for mitigation project grant funding.
ELEMENT D. Planning Process (Continued) *Update activities not applicable to the plan version*
D1. Was the Plan revised to reflect changes in development? (Requirement §201.6(d)(3))
D2. Was the Plan revised to reflect progress in local mitigation effort? (Requirement §201.6(d)(3))
D3. Was the Plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))
Source: FEMA, October 2011.

The City of Unalaska will annually review the HMP as described in Section 3.5.3.2 and update the HMP every five years (or when significant changes are made) by having the identified Planning Team review all Annual Review Questionnaires (Appendix H) to determine the success of implementing the HMP's Mitigation Action Plan.

The Annual Review Questionnaire will enable the Team to identify possible changes in the HMP Mitigation Action Plan by refocusing on new or more threatening hazards, resource availability, and acquiring stakeholder support for the HMP project implementation.

No later than the beginning of the fourth year following HMP adoption, the Planning Team will undertake the following activities:

- Request grant assistance from DHS&EM to update the HMP (this can take up to one year to obtain and one year to update the plan)
- Ensure that each authority administering a mitigation project will submit a Progress Report to the Planning Team
- Develop a chart to identify those HMP sections that need improvement, the section and page number of their location within the HMP, and describing the proposed changes
- Thoroughly analyze and update the natural hazard risks
    - Determine the current status of the mitigation projects
    - Identify the proposed Mitigation Plan Actions (projects) that were completed, deleted, or delayed. Each action should include a description of whether the project should remain on the list, be deleted because the action is no longer feasible, or reasons for the delay
    - Describe how each action's priority status has changed since the HMP was originally developed and subsequently approved by FEMA
    - Determine whether or not the project has helped achieve the appropriate goals identified in the plan
    - Describe whether the community has experienced any barriers preventing them from implementing their mitigation actions (projects) such as financial, legal, and/or political restrictions and stating appropriate strategies to overcome them
    - Update ongoing processes, and to change the proposed implementation date/duration timeline for delayed actions the City of Unalaska still desires to implement
    - Prepare a "new" MAP matrix for the City of Unalaska
- Prepare a new Draft Updated HMP
- Submit the updated draft HMP to the Division of Emergency Management (DHS&EM) and FEMA for review and approval

3.5.3.5 Formal State and FEMA HMP Review

Completed Hazard Mitigation Plans do not qualify the City of Unalaska for mitigation grant program eligibility until they have been reviewed and adopted by the City Council, and received State and FEMA final approval.

The Qawalangin Tribe of Unalaska, as a participant, must provide signatory evidence it intends to follow and implement applicable tribal activities to qualify the Qawalangin Tribe for applicable tribal grant opportunities.

The City of Unalaska will submit the draft HMP to the Division of Emergency Management (DHS&EM) for initial review and preliminary approval. Once any corrections are made, DHS&EM will forward the HMP to FEMA for their review and conditional approval.

Once the plan has fulfilled all FEMA criteria, the City will pass an HMP Adoption Resolution. A copy will be sent to FEMA for final HMP approval.

FEMA's final approval assures the City is eligible for applying for appropriate mitigation grant program funding. URS will send a final copy of the FEMA approved HMP to the City of Unalaska.

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4.1 ADOPTION BY LOCAL GOVERNING BODIES AND SUPPORTING DOCUMENTATION

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

DMA 2000 Requirements
Local Plan Adoption
§201.6(c)(5): [The plan shall include…] Documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County commissioner, Tribal Council). For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.
1. REGULATION CHECKLIST
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))
Source: FEMA, October 2011.

The City of Unalaska is represented in this HMP and meets the requirements of Section 409 of the Stafford Act and Section 322 of DMA 2000, and 44 CFR §201.6(c)(5).

The Unalaska City Council adopted the HMP on November 26, 2013 and submitted the final draft HMP to FEMA for formal approval.

A scanned copy of the vote record and the City's formal adoption are included in Appendix C.

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

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. Human and Technological, and Terrorism related hazards are beyond the scope of this plan. 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.

Hazard profiling is accomplished by describing hazards in terms of their nature, history, magnitude, frequency, location, extent, and probability. Hazards are identified through historical and anecdotal information collection, existing plans, studies, and map reviews, and study area hazard map preparations when appropriate. Hazard maps are used to define a hazard's geographic extent as well as define the approximate risk area boundaries.

DMA 2000 Requirements
Identifying Hazards §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. §201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.
1. REGULATION CHECKLIST
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? B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 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? B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods?
Source: FEMA, October 2011.

5.2 HAZARD IDENTIFICATION AND SCREENING

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

For the first step of the hazard analysis, on November 28, 2012 the Planning Team reviewed eight possible hazards that could affect the Aleutians West Census Area. 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 (Table 5-1). The Planning Team determined that seven hazards pose a great threat to the City: earthquake, erosion, flood, ground failure, tsunami, volcanic eruption, and severe weather.

Table 5-1 Identification and Screening of Hazards

Hazard Type	Should It Be Profiled?	Explanation
Natural Hazards		
Earthquake	Yes	Periodic, unpredictable occurrences. The City of Unalaska (City) experienced no damage from the 11/2003 Denali EQ, but experienced severe structural damage from the earthquake and its aftershocks, tsunamis, seiches, and flooding throughout the Resurrection Bay from the 1964 Good Friday Earthquake. The City has experienced nearly 2,500 earthquake impacts since 1973 with 111 that exceeded M 5.0 intensity.
Erosion	Yes	The City experiences storm surge, coastal ice run-up, and coastal wind erosion along the shoreline and riverine erosion along the area's river, streams, and creek embankments from high water flow, riverine ice flows, wind, surface runoff, and boat traffic wakes.
Flood	Yes	Snowmelt run-off and rainfall flooding occurs during spring thaw and the fall rainy season. Events occur from soil saturation. Several minor flood events cause damage. Severe damages occur from major floods.
Ground Failure (Avalanche, Landslide/Debris Flow, Permafrost, Subsidence)	Yes	Ground Failure occurs throughout Alaska from avalanches, landslides. However subsidence and permafrost do not exist on Unalaska Island. These hazards periodically cause houses to shift due to ground sinking and upheaval. The City has erosion damage along the area's extensive river, stream, and creek system's embankments. The City has also indicated that avalanches and landslides periodically occur in known locations. Permafrost does not exist along the Aleutian Islands.
Tsunami & Seiche	Yes	This hazard has historically threatened City infrastructure.
Volcano	Yes	Volcanic eruptions occur within the Aleutian Islands sending volcanic debris throughout the area and adversely impacting the City.
Weather, Severe	Yes	Annual weather patterns, severe cold, heavy rain, freezing rain, snow accumulations, storm surge, and wind, are the predominate threats. Intense wind and heavy rain are the primary impacts to the community. Severe weather events cause fuel price increases and frozen pipes. Heavy snow loads potentially damage house roofs. Winds potentially remove or damage roofs and moved houses off their foundations. Complex weather systems are the most severe bringing severe cold, wind, freezing rain, storm surge, and flooding.
Wildland/Urban Interface Fire	No	This hazard does not exist for the City.
Technological and Manmade Hazards		
Transportation and Utility Disruptions	Yes	

5.3 HAZARD PROFILE

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

DMA 2000 Requirements
Profiling Hazards Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
1. REGULATION CHECKLIST
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? (Requirement §201.6(c)(2)(i)) B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction?
Source: FEMA, October 2011.

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

- Nature (Type)
- History (Previous Occurrences)
- Location
- Extent (to include magnitude and severity)
- Impact (Section 5 provides general impacts associated with each hazard. Section 6 provides detailed impacts to Unalaska's residents and critical facilities)
- Probability of future events

NFIP insured Repetitive Loss Structures (RLS) are addressed in Section 6.0, Vulnerability Analysis.

Each hazard is assigned a rating based on the following criteria for probability (Table 5-2) and magnitude/severity (Table 5-3).

Table 5-2 Hazard Probability Criteria

Probability	Criteria
4 - Highly Likely	• Event is probable within the calendar year. • Event has up to 1 in 1 year chance of occurring (1/1=100 percent). • History of events is greater than 33 percent likely per year. • Event is "Highly Likely" to occur.
3 - Likely	• Event is probable within the next three years. • Event has up to 1 in 3 years chance of occurring (1/3=33 percent). • History of events is greater than 20per cent but less than or equal to 33 percent likely per year. • Event is "Likely" to occur.
2 - Possible	• Event is probable within the next five years. • Event has up to 1 in 5 years chance of occurring (1/5=20 percent). • History of events is greater than 10 percent but less than or equal to 20 percent likely per year. • Event could "Possibly" occur.
1 - Unlikely	• Event is possible within the next ten years. • Event has up to 1 in 10 years chance of occurring (1/10=10 percent). • History of events is less than or equal to 10 percent likely per year. • Event is "Unlikely" but is possible to occur.

Probability is determined based on historic events, using the criteria identified above, to provide the likelihood of a future event.

Similar to estimating probability, magnitude, and severity are determined based on historic events using the criteria identified above.

Table 5-3 Hazard Magnitude/Severity Criteria

Magnitude / Severity	Criteria
4 - Catastrophic	• Multiple deaths. • Complete shutdown of facilities for 30 or more days. • More than 50 percent of property is severely damaged.
3 - Critical	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least two weeks. • More than 25 percent of property is severely damaged.
2 - Limited	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than one week. • More than 10 percent of property is severely damaged.
1 - Negligible	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10 percent of property is severely damaged.

The hazards profiled for the City of Unalaska are presented throughout the remainder of Section 5.3. The presentation order does not signify their importance or risk level.

5.4 NATURAL HAZARDS

5.4.1 Earthquake

5.4.1.1 Nature

An earthquake is a sudden motion or trembling caused by a release of strain accumulated within or along the edge of the 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 fault or epicenter of the earthquake. 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 significantly less damaging than seismic waves.

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

- **Surface Faulting** is the differential movement of two sides of a fault at the earth's surface. Displacement along faults, both in terms of length and width, varies but can be significant (e.g., up to 20 feet [ft]), as can the length of the surface rupture (e.g., up to 200 miles). Surface faulting can cause severe damage to linear structures, including railways, highways, pipelines, and tunnels.
- **Liquefaction** occurs when seismic waves pass through saturated granular soil, distorting its granular structure, and causing some of the empty spaces between granules to collapse. Pore water pressure may also increase sufficiently to cause the soil to behave like a fluid for a brief period and cause deformations. Liquefaction causes lateral spreads (horizontal movements of commonly 10 to 15 ft, but up to 100 ft), flow failures (massive flows of soil, typically hundreds of ft, but up to 12 miles), and loss of bearing strength (soil deformations causing structures to settle or tip). Liquefaction can cause severe damage to property.
- **Landslides/Debris Flows** occur as a result of horizontal seismic inertia forces induced in the slopes by the 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 totally 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 magnitude. 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 epicenter, which is the point on the earth's surface that is directly above where the earthquake occurred. The severity of intensity generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. The scale most often used in the U.S. to measure intensity is the Modified Mercalli Intensity (MMI) Scale. As shown in Table 5-4, the MMI Scale consists of 12 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).

Magnitude (M) is the measure of the earthquake strength. It 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 (see Table 5-4).

Table 5-4 Magnitude/Intensity/Ground-Shaking Comparisons

Magnitude	Intensity	PGA (% *g*)	Perceived Shaking
0 – 4.3	I	<0.17	Not Felt
	II-III	0.17 – 1.4	Weak
4.3 – 4.8	IV	1.4 – 3.9	Light
	V	3.9 – 9.2	Moderate
4.8 – 6.2	VI	9.2 – 18	Strong
	VII	18 – 34	Very Strong
6.2 – 7.3	VIII	34 – 65	Severe
	IX	65 – 124	Violent
	X	124 +	Extreme
7.3 – 8.9	XI		
	XII		

(MMI 2006)

5.4.1.2 History

The USGS database lists approximately 2,381 earthquakes that have occurred within 100 miles, (150 km) of Unalaska since 1973. Their average magnitude (M) is approximately M3.8. The City experiences shaking from more distant earthquakes but this analysis was limited to events within 100 miles of the City.

Table 5-5 lists 106 of these historical earthquakes which exceeded M5.0 (listed by order of magnitude). Highlighted text within Table 5-5 indicates those that exceed M5.9. **Note: 12 exceeded M 6.0 (orange highlight and one exceeded M 7.0 (red highlight).*

The City of Unalaska has a great concern for mitigating earthquake damages for events which exceed M5.0. The Planning Team determined that since they do not experience damages from small earthquakes, they need only be concerned with earthquakes with a magnitude > M5.0.

Table 5-5 Historical Earthquakes for Unalaska

Year	Month	Day	Time	Latitude	Longitude	Magnitude	Distance (Miles)
1980	3	24	7:12 AM	52.969	-167.67	7.1	77.7
1987	2	27	9:36 AM	53.47	-167.291	6.8	41.6
2003	2	19	8:38 AM	53.645	-164.643	6.6	78.9
1975	11	30	12:00 AM	52.599	-167.184	6.6	92
2009	10	13	4:33 PM	52.754	-166.997	6.5	79.5
1982	1	25	12:28 PM	53.222	-165.719	6.5	55.9
1974	2	6	4:48 AM	53.799	-164.672	6.5	76.4
2009	10	13	4:48 AM	52.604	-167.118	6.4	90.7
1979	9	1	2:24 PM	53.978	-165.204	6.4	54.7
1979	5	25	7:12 AM	52.611	-167.019	6.2	89.5
1989	5	19	9:07 AM	54.305	-165.574	6.1	49.1
1992	2	13	9:36 AM	53.597	-165.734	6	37.9
1986	4	11	7:26 PM	54.164	-167.883	6	58.4
2006	9	1	4:04 AM	A	-166.392	5.9	8.7
1986	7	19	11:16 PM	53.352	-165.882	5.9	44.7
1974	4	20	7:12 AM	52.974	-167.375	5.9	70.8
2001	5	9	6:00 PM	53.641	-164.319	5.8	92
1986	7	19	7:55 PM	53.6	-167.171	5.8	31.7
1995	7	14	11:45 PM	53.315	-166.835	5.6	40.4
1986	6	9	5:45 AM	54.142	-168.132	5.6	67.1
1986	7	19	5:45 AM	53.339	-165.859	5.6	46
1986	7	19	1:12 AM	53.521	-167.301	5.6	39.8
2009	10	15	1:55 AM	52.853	-166.75	5.5	70.8
2002	3	1	7:55 PM	52.697	-166.695	5.5	81.4
1997	3	2	1:12 AM	53.543	-166.593	5.5	23
1991	10	19	12:43 PM	53.695	-167.137	5.5	27.3
1986	3	9	5:45 AM	54.256	-167.864	5.5	59.7
1982	9	12	6:14 PM	52.819	-167.053	5.5	75.8
1981	11	9	11:16 PM	53.221	-165.747	5.5	55.3
1976	4	20	7:12 PM	53.534	-165.465	5.5	49.7
2007	1	10	10:48 PM	53.669	-167.724	5.4	50.3
2000	5	25	10:19 PM	52.633	-167.066	5.4	88.2
1999	5	11	7:55 AM	53.591	-165.404	5.4	50.3
1993	4	4	4:48 AM	53.443	-164.52	5.4	87.6

Table 5-5 Historical Earthquakes for Unalaska

Year	Month	Day	Time	Latitude	Longitude	Magnitude	Distance (Miles)
1988	12	22	11:02 AM	53.983	-166.244	5.4	13.7
1987	9	1	7:40 AM	53.741	-167.125	5.4	25.5
2009	10	13	3:07 AM	52.719	-167.166	5.3	83.9
2009	12	3	6:00 AM	53.693	-165.518	5.3	43.5
1996	3	14	3:36 PM	54.204	-166.001	5.3	31.1
1994	12	26	4:19 PM	53.65	-164.508	5.3	84.5
1991	10	19	2:24 PM	53.865	-167.089	5.3	22.4
1987	5	26	11:45 PM	53.851	-167.019	5.3	19.3
1987	6	13	6:57 PM	53.768	-167.048	5.3	21.7
1984	6	12	11:16 AM	53.648	-165.218	5.3	55.9
1982	8	24	3:07 PM	53.645	-165.437	5.3	47.2
1973	1	16	2:24 PM	54.12	-165.543	5.3	43.5
2010	8	20	5:45 PM	54.156	-166.159	5.2	24.9
2008	8	7	9:21 AM	53.486	-167.47	5.2	46.6
2005	12	28	5:02 AM	53.374	-164.459	5.2	92
2002	1	19	10:19 AM	54	-167.264	5.2	30.4
2001	10	21	6:57 PM	52.721	-166.723	5.2	79.5
1996	3	14	2:24 PM	54.134	-165.844	5.2	32.9
1994	9	1	5:16 AM	52.77	-166.987	5.2	78.3
1994	10	28	5:02 PM	53.703	-165.803	5.2	31.7
1992	6	10	3:50 AM	53.581	-165.423	5.2	49.7
1991	9	24	10:19 AM	53.996	-164.297	5.2	91.3
1991	10	9	2:09 PM	53.516	-165.906	5.2	35.4
1991	10	19	6:57 AM	53.736	-167.234	5.2	29.8
1991	10	20	3:21 AM	53.819	-166.923	5.2	16.2
1988	2	6	6:14 PM	53.642	-167.09	5.2	27.3
1986	7	20	6:43 AM	53.53	-167.344	5.2	40.4
1976	1	4	4:48 AM	52.891	-166.758	5.2	68.4
1976	3	28	4:48 AM	52.701	-167.153	5.2	84.5
2012	1	25	5:02 PM	52.654	-167.049	5.1	87
2010	10	3	5:16 PM	52.73	-167.004	5.1	81.4
2003	10	3	7:12 AM	52.682	-167.022	5.1	84.5
1998	5	28	3:07 AM	53.137	-166.755	5.1	51.6
1996	6	4	2:09 AM	53.008	-167.66	5.1	75.2
1988	8	12	9:36 PM	53.098	-167.053	5.1	57.2
1987	3	16	3:21 PM	53.355	-167.248	5.1	46
1987	3	24	4:04 PM	53.223	-167.28	5.1	54.1
1987	4	11	8:52 AM	53.406	-167.213	5.1	42.3

Table 5-5 Historical Earthquakes for Unalaska

Year	Month	Day	Time	Latitude	Longitude	Magnitude	Distance (Miles)
1987	9	1	8:24 PM	53.77	-167.208	5.1	28
1986	7	19	1:40 PM	53.617	-167.408	5.1	39.8
1985	5	21	5:31 AM	53.815	-166.89	5.1	14.9
1985	1	6	10:19 AM	54.397	-166.18	5.1	38.5
1985	5	8	4:33 PM	53.935	-165.002	5.1	62.8
1982	9	12	12:57 PM	53.016	-167.104	5.1	63.4
1981	11	14	7:12 AM	54.067	-164.538	5.1	82
1975	1	6	7:12 PM	54.303	-165.78	5.1	42.3
1975	5	1	12:00 AM	52.709	-167.033	5.1	82.6
2010	8	23	7:26 PM	53.469	-164.523	5	87
2009	10	13	7:26 AM	52.663	-167.183	5	87.6
1996	3	14	9:36 PM	54.125	-165.826	5	33.6
1996	3	14	7:40 AM	54.156	-165.906	5	31.7
1996	3	14	8:24 PM	54.117	-166.123	5	23.6
1995	10	5	3:36 AM	53.719	-164.993	5	64
1994	4	20	9:36 AM	52.906	-166.8	5	67.7
1994	5	7	2:52 AM	53.338	-165.794	5	47.8
1993	3	20	12:28 PM	53.545	-166.049	5	29.8
1991	11	12	2:09 AM	53.679	-167.117	5	27.3
1988	7	1	10:48 AM	52.931	-166.771	5	65.9
1988	12	11	12:28 PM	53.324	-166.963	5	41.6
1987	9	1	8:52 PM	53.656	-166.956	5	22.4
1987	9	26	6:28 PM	52.897	-167.072	5	70.8
1987	12	30	2:38 PM	53.886	-165.797	5	29.8
1986	8	8	8:52 AM	53.594	-167.32	5	37.3
1986	9	26	3:36 PM	54.066	-165.204	5	55.9
1986	3	20	8:24 PM	54.202	-168.187	5	70.8
1984	7	30	12:14 PM	53.681	-165.581	5	41
1982	9	12	12:57 AM	52.642	-166.848	5	85.7
1982	9	16	11:31 PM	52.953	-167.026	5	66.5
1981	1	12	9:36 PM	52.833	-166.793	5	72.7
1976	2	19	2:24 AM	53.471	-164.5	5	87.6
1974	1	19	2:24 AM	52.936	-167.977	5	87.6
1974	11	20	12:00 AM	53.6	-165.253	5	55.9

(USGS 2013)

North America's strongest recorded earthquake occurred on March 27, 1964 in Prince William Sound measuring M9.2 and was felt by many residents throughout Alaska. Unalaska experienced severe ground motion from this historic event.

Figure 5-1 depicts those earthquakes within close proximity (50 to 80 miles) of Unalaska.

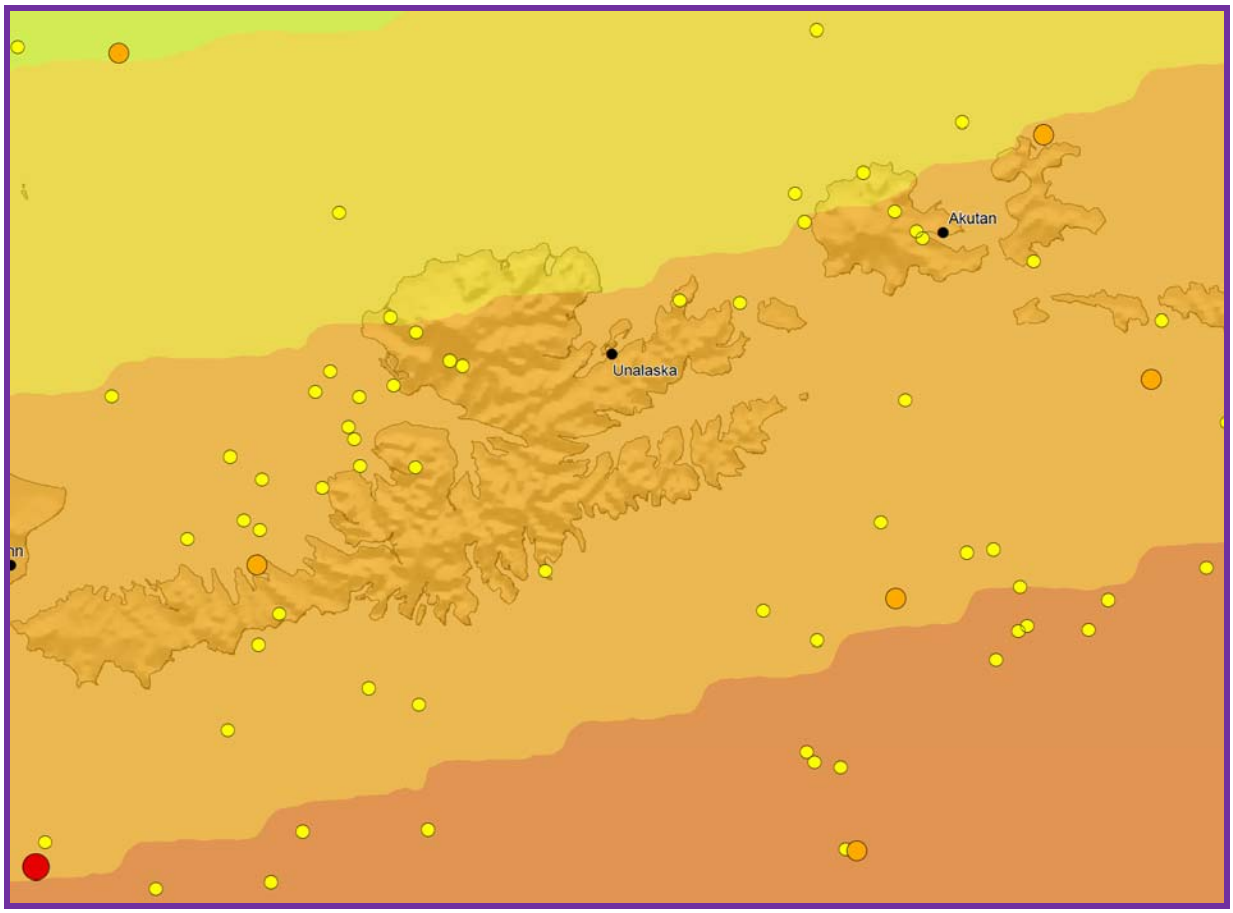


Figure 5-1 Earthquakes Adjacent to Unalaska (URS 2013)

The largest recorded earthquake that has occurred within 100 miles of the City measured M7.1, was 77.7 miles distant, occurring on March 24, 1980. This earthquake did not cause any damage to critical facilities, residences, non-residential buildings, or infrastructure.

Planning Team members stated that Unalaska has experienced no ground shaking from the November 3, 2002 M7.9 Denali EQ.

5.4.1.3 Location, Extent, Impact, and Probability of Future Events

Location

The entire geographic area of Alaska is prone to earthquake effects and especially the City of Unalaska who experience 2,381 earthquakes since 1973 with an average of nearly one earthquake per day.

Figure 5-2 shows the locations of active and potentially active faults in Alaska.

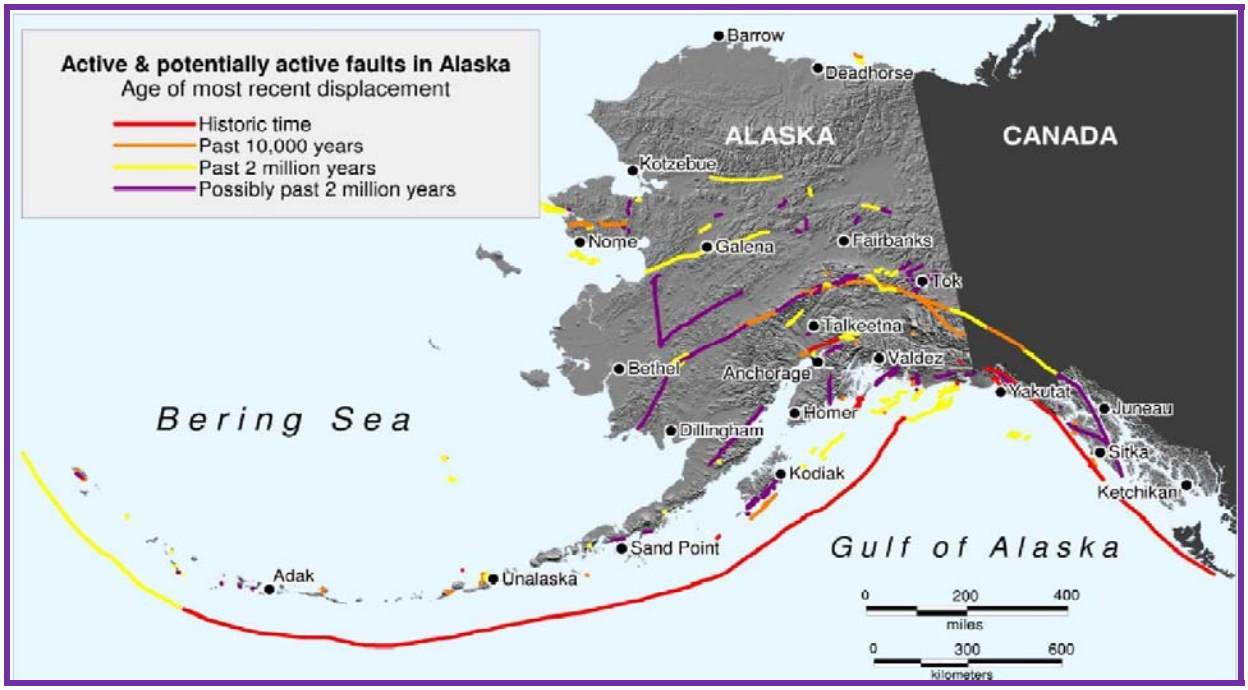


Figure 5-2 Active and Potentially Active Faults in Alaska

The Department of Geological and Geophysical Survey (DGGS) Neotectonic Map of Alaska (Figure 5-3) depicts Alaska's known earthquake fault locations. DGGS states,

> *"The Neotectonic Map of Alaska is the most comprehensive overview of Alaskan Neotectonics published to date; however, users of this map should be aware of the fact the map represents the author's understanding of Alaskan Neotectonics at the time of publication. Since publication of the Neotectonic map, our understanding of Alaskan Neotectonics has changed and earthquakes have continued to occur. For example, M7.9 Denali fault earthquake ruptured three faults, including the Susitna Glacier fault, which was previously undiscovered..."* (DGGS 2009).

Figure 5-3 Western Aleutian Island Area (from "Neotechtonic Map of Alaska") (DGGS 2009)

Extent

The average distance of the 111 recorded earthquakes that exceeded M5.0 was 54.55 (with a range from 8.7 to 92) miles from the City.

Based on historic earthquake events and the criteria identified in Table 5-3, the magnitude and severity of earthquake impacts in the City are considered Injuries and/or illnesses result in permanent disability; critical facilities could expect to be shut-down for at least two weeks; and more than 25 percent of property is severely damaged with potential long-term damage to transportation, infrastructure, and the economy.

Impact

The City is located in close proximity to the "Ring of Fire" which is more seismically active than the majority of the State. Impacts to the community such as significant ground movement that may result in infrastructure damage can be expected. Minor shaking may be seen or felt based on past events. Impacts to future populations, residences, critical facilities, and infrastructure are anticipated to remain the same.

Probability of Future Events

The City has received 111 earthquakes which exceeded M5.0, nine exceeded M6.0 and one measured M7.1. This is a significant threat where aircraft and marine infrastructure damages could result in city isolation from emergency response and critically needed assistance.

While it is not possible to predict when an earthquake will occur, Figure 5-4 was generated using the United States Geological Survey (USGS) Earthquake Mapping model and indicates an M5.0 or greater earthquake occurring within 100 years and 100 miles of the City is "Highly Likely" within the calendar year with up to 1 in 1 year chance of occurring (1/1=100 percent); due to an event history that is greater than 33 percent likely per year.

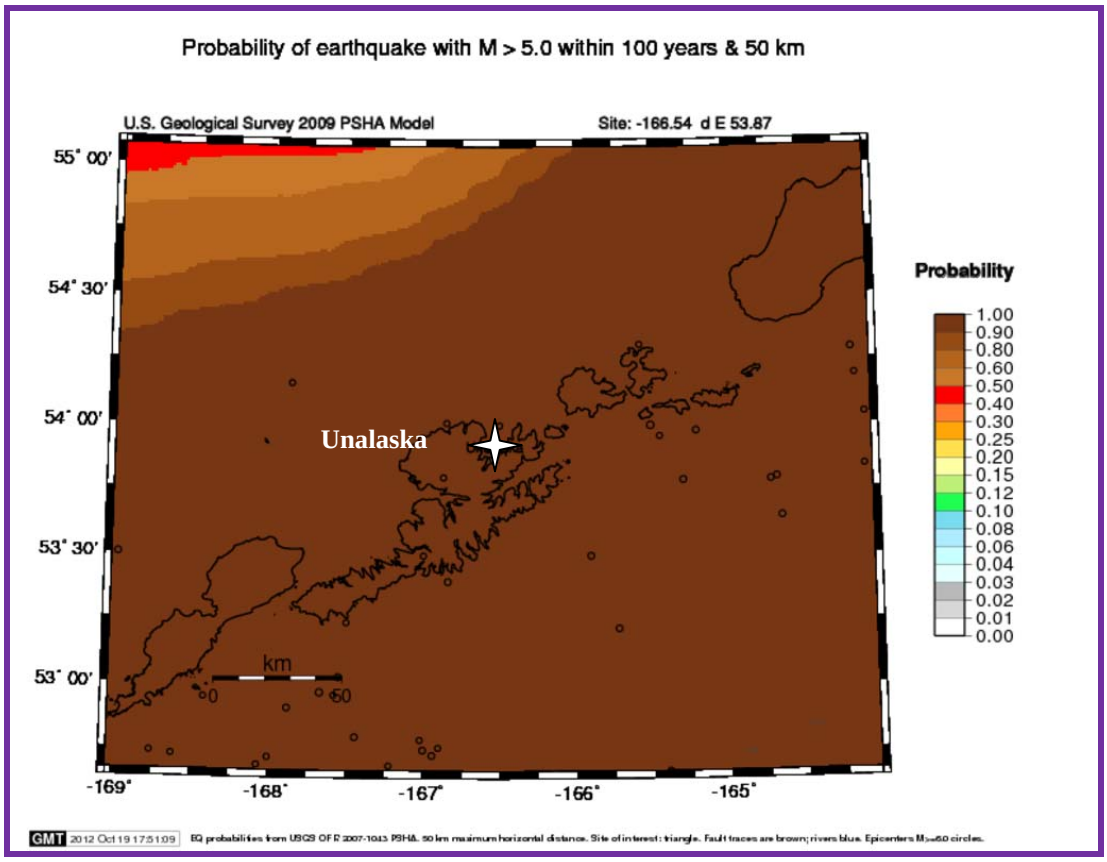


Figure 5-4 Unalaska Earthquake Probability (USGS 2012)

This 2009 Shake Map incorporates current seismicity in its development and is the most current map available for this area. Peter Haeussler, USGS, Alaska Region states, it is a viable representation to support probability inquiries.

> *"The occurrence of various small earthquakes does not change earthquake probabilities. In fact, in the most dramatic case, the probability of an earthquake on the Denali fault was/is the same the day before the 2002 earthquake as the day afterward. Those are time-independent probabilities. The things that change the hazard maps is changing the number of active faults or changing their slip rate" (Haeussler, 2009).*

As indicated in Figure 5-3, earthquake recurrence probability is rated "Highly Likely." An event which exceeds M 5.0 is probable within the calendar year with a 1 in 1 year chance of occurring (1/1=100 percent) as the earthquake event history is events is greater than 33 percent likely per year.

5.4.2 Erosion

5.4.2.1 Nature

Erosion rarely causes death or injury. However, erosion causes the destruction of property, development and infrastructure. Erosion is the wearing away, transportation, and movement of land. It is usually gradual but can occur rapidly as the result of floods, storms or other event or slowly as the result of long-term environmental changes such as melting permafrost. Erosion is a natural process, but its effects can be exacerbated by human activity.

Coastal and riverine erosion are problems for communities where disappearing land threatens development and infrastructure. Coastal erosion is a major erosion threat to the City as it threatens the embankment, structures, and utilities of Unalaska's residents.

Coastal erosion, sometimes referred to as tidal, bluff, or beach erosion, may other times encompass different categories altogether. For this profile, tidal, bluff and beach erosion will be nested within the term erosion.

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

The forces of erosion are embodied in waves, currents, and winds on the coast. Surface and ground water flow, and freeze-thaw cycles may also play a role. Not all of these forces may be present at any particular location. Coastal erosion can occur from rapid, short-term daily, seasonal, or annual natural events such as waves, storm surge, wind, coastal storms, and flooding, or from human activities including boat wakes and dredging. The most dramatic erosion often occurs during storms, particularly because the highest energy waves are generated under storm conditions.

Coastal erosion may also be due to multi-year impacts and long-term climatic change such as sea-level rise, lack of sediment supply, subsidence, or long-term human factors such as aquifer depletion or the construction of shore protection structures and dams.

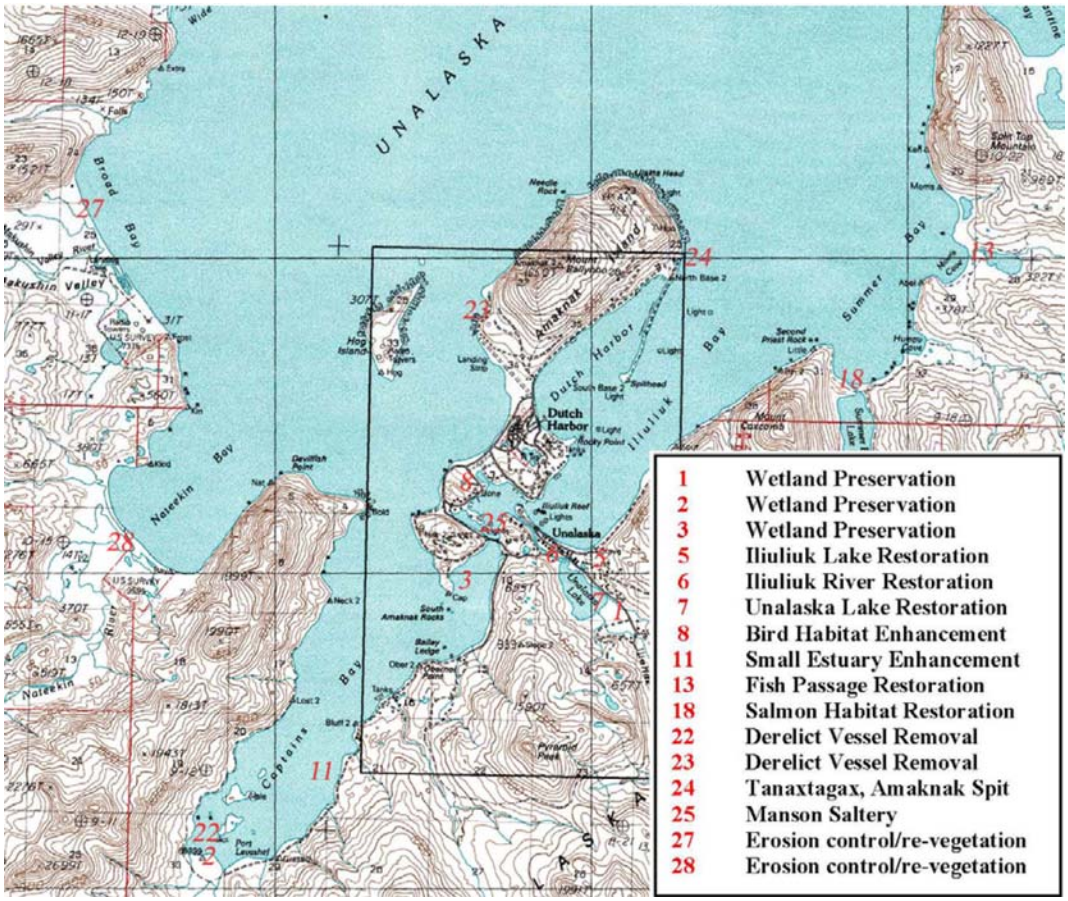
Riverine erosion results from the force of flowing water and ice formations in and adjacent to river channels. This erosion affects the bed and banks of the channel and can alter or preclude any channel navigation or riverbank development. In less stable braided channel reaches, erosion, and material deposition constant issues. In more stable meandering channels, erosion episodes may only occasionally occur.

Attempts to control erosion using shoreline protective measures such as groins, jetties, seawalls, or revetments can lead to increased erosion however the City Council feels that "no action leads to increased damages".

Land surface erosion results from flowing water across road surfaces due to poor or improper drainage during rain and snowmelt run-off which typically result from fall and winter sea storms.

5.4.2.2 History

The Aleutians West Coastal Resource Service Area, Volume II, Resource Inventory and Analysis, Appendix C, Coastal Management Plan, Mitigation Opportunities in Unalaska (2008 Coastal Management Plan), State Review Draft, Prepared June 2008 by LaRoche and Associates, summarized the City's environmentally impacted areas and potential mitigation opportunities that could reverse existing hazard impacts. The Coastal Management Plan identified erosion impacted areas on Map 1, photographs, and through project narratives:



"Map 1. Index to Mitigation Project Locations." (CMP 2008)

"3.1 Coastal Development Mitigation Opportunities

Project 6. Illiuliuk River Restoration

Goal: [R]estore and enhance the riverine and riparian functions (fish spawning habitat, erosion control, flood retention, recreation/subsistence use) that have been lost over time by incremental development activity and heavy use.

Figure 7 Upper Iliuliuk River. May 14, 2008.

Description: This project encompasses the length of the Illiuliuk River from the outlet of Unalaska Lake to its discharge into Illiuliuk Harbor, spanning a linear distance of approximately 3,000 feet. This is an important anadromous fish system in the Unalaska Bay area, and due to its location within the village of Unalaska is of high value for recreational and subsistence users (ADFG Anadromous Stream No. 302-31-10500).

Figure 8. Middle Iliuliuk River - erosion and trampling. May 14, 2008.

Figure 9. Middle Iliuliuk River facing upstream. May 13, 2008.

Stormwater run-off controls (paving, storm drain, oil separators) have been installed to help address problems with sedimentation, however many opportunities still exist. The project would involve restoring and enhancing the wetland and riparian functions of the site by correcting problems with shoreline trampling, erosion, and sedimentation. Public access that is designed to control and manage access points, such as a constructed trail or elevated boardwalk, could be incorporated into the project.

Objectives: [M]aintain and enhance traditional access while reducing impacts to shoreline associated with existing skiff docks; stabilize and revegetate the river banks and adjacent uplands; restore river substrates for pink salmon spawning; increase shallow water emergent vegetation.

Figure 10. Lower Iliuliuk River facing downstream toward mouth. May 13, 2008.

Implementation Issues/Feasibility: Depending on the access route that is selected, implementation of this project could require that access to the land along the riverbanks be obtained through an arrangement with the landowners or one of the formal land acquisition or

other preservation mechanisms previously described. If access is provided along the base of Haystack Mountain, acquisition would not be necessary as the city of Unalaska owns the land. The type of acquisition or preservation mechanism will have significant impact on feasibility.

Implementation would require coordination with the Army Corps of Engineers because it involves alteration of shorelines, placement of fill, and modification of drainage.

Many examples of controlled public access with elevated walkways using low impact development techniques such as pin foundations exist in Alaska. The Kenai River Management Plan provides a good example.

Project 19. Areawide Stormwater Run-off Control

Goal: [R]estore water quality and aquatic functions that have been impaired over time due to stormwater run-off and associated problems with erosion and sedimentation.

Description: The single-most commonly identified issue for the community of Unalaska is the lack of stormwater run-off control and associated problems with erosion and sedimentation. In areas of unstable soils or steep slopes, heavy accumulations of snow or intense rainfall contribute to erosion, mudslides, landslides, debris flow, and avalanches. The City of Unalaska encompasses 116 square miles of land with 38 miles of road maintained by the City. There are currently storm drains along Unalaska Lake, Summer Bay Road and Ballyhoo Road. Although progress has been made to pave roads and install catch basins to manage stormwater run-off and sedimentation, the majority of the road system remains un-paved and surface water run-off is directly into the rivers, lakes and nearshore marine waters.

Numerous opportunities exist at varying scales to address this area-wide problem including paving, ditching, installation of catch basins and sediment traps, and retention ponds as well as "Low Impact Development" approaches such as re-vegetation with native plant species.

Objectives: Perform an evaluation of water quality and functions that are impacted by stormwater run-off in various locations. Develop a formal project plan, including designs and cost estimates in consultation with resource agencies. Design, construct and implement appropriate techniques to manage and control stormwater run-off.

Implementation Issues/Feasibility: The feasibility of an areawide stormwater management system would vary considerably with the techniques employed. A suite of options at different scales of geography and complexity would have a greater chance of being implemented over time.

Project 20. Beach Stabilization/Re-vegetation - Areawide

Goal: [R]estore the functional values of the beach areas that were lost by the development of adjacent roadways.

Description: Most of the roads in the Unalaska area (Airport Road, Captains Bay Road, Front Street, Summer Bay Road, etc.) follow the coastline often impinging on the back beach zone. The compacted roadbed material does not provide a good substrate for natural colonization of vegetation, and therefore remains mostly unvegetated and is an area of active erosion. Also, the absence of vegetation allows the stormwater sediment to be transported and discharged into receiving waters.

The project would consist of stabilizing and re-vegetating the beach area. A coastal engineering evaluation of the project would be required to develop an appropriate project design. The project should also include access management plans that provide access to the beaches at specified

areas while preventing trampling and damage to developing vegetation. The project locations also present opportunities for an interpretive signage component.

The City conducted a similar project along Front Beach which has been successful although opportunities remain for additional enhancements in this location.

Figure 25. Front Street vegetated back beach berm. May 13, 2008.

Objectives: [C]reate a vegetated sea berm that mimics natural sea berms where practicable; create access point to the beach for recreation and subsistence use; install interpretive signage at access points.

Implementation Issues/Feasibility: A formalized restoration, enhancement and management plan, including engineering designs and cost estimates would be developed in consultation with resource agencies. Implementation would require coordination with the Army Corps of Engineers because it would involve placement of fill and alteration of shorelines.

Project 24. Tanaxtagax, Amaknak Spit Site

Goal: [E]xcavate and curate the Amaknak Spit Site (UNL-00055).

Description: The Amaknak Spit Site (UNL-00055) is near the town of Unalaska, on Unalaska Island. The site is situated at the base of Amaknak, or Dutch Harbor Spit, a mile long spindle of land stretching southward from the site to form a natural breakwater protecting the port of Dutch Harbor from the Bering Sea. The site and most of the surrounding land is owned by the Ounalashka Corporation.

The site has research history dating back to the 1970s, and thus has a number of synonyms in the literature – Uhlaktha Spit, Tanaxtagax, site "A", and Amaknak Spit. The AHRS lists the site as UNL-00055 or Tanaxtagax. This term may be related to the Unangan word tanasxa meaning "field' or "kitchen gardens", probably associated with the use of the rich organic sediments or midden sites around Unalaska Bay as gardens beginning in the Russian era. Tanaxtagax was a prehistoric Unagan village beginning as early as 3,000 BP.

The site has been documented and some restoration has occurred. However, due to erosion and deterioration, the site needs to excavated and artifacts curated. The mitigation project would fund the excavation. The project could be facilitated by the Museum of the Aleutians.

Objectives: [E]xcavate the Amaknak Spit Site (UNL-00055) and curate recovered artifacts.

Implementation Issues/Feasibility: The project is relatively straightforward and well defined as a result of previous studies. The site and most of the surrounding land is owned by the Ounalashka Corporation. The Museum of the Aleutians could coordinate appropriate agencies.

Figure 31. Tanaxtagax Interpretive Sign. May 14, 2008.

3.2 Utility and Transportation Mitigation Opportunities

Project 27. Erosion Control and Re-vegetation - Broad Bay

Goal: [R]estore the ground cover and the beach profile at Broad Bay.

Description: Broad Bay is located on the west side of Unalaska Bay at the mouth of the Makushin River. The area is zoned "subsistence tidelands" with adjacent "marine dependent industrial". Furthermore, the AWCRSA Coastal Management Plan has designated a portion this area for recreational and subsistence use as follows: Broad Bay - The area within 1000 feet of either side of the ordinary high water mark of the Makushin River. The designated area extends 300 feet offshore and 250 feet inland as measured from mean high water.

Figure 33. Broad Bay. May 13, 2008.

This project would involve contouring and reseeding with native plant materials, if practicable, to restore the ground cover and the beach profile.

Objectives: [S]tabilize and revegetate the river banks, riparian areas and adjacent uplands; develop a motorized vehicle management plan which may include an educational signage component.

Implementation Issues/Feasibility: The project is relatively straightforward. The challenge will be to maintain the restored areas and implement a motorized vehicle management plan in a remote area.

Project 28. Erosion Control and Re-vegetation - Nateekin Bay

Goal: [R]estore the ground cover and the beach profile at Nateekin Bay.

Description: Nateekin Bay is located on the west side of Unalaska Bay at the mouth of the Nateekin River. The area is zoned "developable tidelands" with adjacent "marine dependent industrial". Furthermore, the AWCRSA Coastal Management Plan has designated a portion this area for recreational subsistence use as follows: Nateekin Bay - The area within 1000 feet of either side of the ordinary high water mark of the Nateekin River. The designated area extends 300 feet offshore and 250 feet inland as measured from mean high water.

Figure 34. Nateekin Bay. May 13, 2008

This project would involve contouring and reseeding with native plant materials, if practicable, to restore the ground cover and the beach profile.

Objectives: [S]tabilize and revegetate the river banks, riparian areas and adjacent uplands; develop a motorized vehicle management plan which may include an educational signage component.

Implementation Issues/Feasibility: The project is relatively straightforward. The challenge will be to maintain the restored areas and implement a motorized vehicle management plan in a remote area"

(CMP 2008).

Unalaska experiences periodic flooding from rain and snow melt runoff as depicted in a community located media release.

> *"Rain and snowmelt eroded the banks of a creek flowing out of the Pyramid Valley and flooded the crab pot yard maintained by Offshore Systems, Inc. at the end of Captains Bay Road this morning. OSI's operating facilities manager, Craig Rice, said the moved earth divided the stream into three channels, which quickly swelled and flooded the pot yard and part of the road" (KIAL 2007).*

The original Russian inhabitants attempted to develop a plantation to grow Sitka Spruce in Unalaska. These trees are now located in a local park placed in the National Historic Landmarks Program under National Register Number 78000513. These trees are now threatened by flood and contamination:

"Statement of Significance (as of designation - June 2, 1978):

This is the site of the oldest recorded afforestation project (1805) on the North American continent, representing a Russian attempt to make the colony at Unalaska self-sufficient in timber. The number of trees originally planted is not known; however, in 1834, 24 trees stood. As of 1975, six original trees remained and there are hundreds of new seedlings.

Condition:

Adjacent construction has altered the topography of the surrounding land; drainage provisions are inadequate and the site is frequently flooded. Seepage from underground fuel tanks and a diesel fuel spill have tainted runoff and surrounding soils. The three remaining Sitka Spruce trees, which would normally live 400-500 years, are endangered by the flooding and contamination.

Recommendation/Change since last report:

The city is attempting to arrange with the private land owner for cleanup of the pollution. The city and owner should also install a new drainage system and consult with the U.S. Forest Service to restore the habitat. The city historical commission and parks department should educate the public on the ecological repercussions of construction and contaminants in the area.

(NHLP 1978)

Research shows that the Army Corp of Engineers (USACE) did not contact the City of Unalaska, however they did send research correspondence to the Present of the Qawalangin Tribe of Unalaska during their USACE's 2009 Baseline Erosion Assessment.

5.4.2.3 Location, Extent, Impact, and Probability of Future Events

Location

The 1977 Unalaska Recommended Community Development Plan states,

"I. Background for Planning

A. Physical Setting

2. Geology and Natural Features…

b. Erosion and Landslides. Creeping and sliding of the soil mantle is characteristic of the Unalaska soil types and is found extensively throughout the area. It results from a combination of the steep slopes and the high moisture content of the soil. Flows and landslide scars are particularly present on glacially-steepen[e]d valley walls. Landslides are recorded throughout the area and most often occur as small, isolated portions of steep slopes tumbling or sliding downward as a result of excessive water saturation, snow loading, avalanche or man's alteration of natural conditions. Areas which may be subject to slides are easily identified by their steep, smooth faces and slopes, and should be avoided when selecting potential development sites. Several such slide areas are present along Captains Bay Road, at points along the Pryamid Creek Road and at several locations on Amaknak Island. Many of the early military access reads, not having

been maintained over the years, show evidence of small scale landslide activity. The Natural Features Map, Figure 3, illustrates those observable locations.

Marine erosion and deposition are evident throughout the area. Steep hillsides and occasional cliffs indicate earlier and present-day wave erosion in less protected areas of the coastline. Exposed utility pipes and the eroded north end of the airport runway indicate heavy wave erosion on the north and westerly sides of Amaknak Island. Wave-cut rock benches, visible at low tide, are found along the moderately protected shores, but are not found on the protected shores. Beach deposits of boulders, gravel and sand are found at the heads of all but the most protected bays. Beach berms often exist along stretches of open coastline as is the case adjacent to the present landfill site on Iliuliuk Bay. Storm waves wash material up onto the beach building the higher flat areas which normally are not inundated by tidal action.

Wave action also constructs spits and bars. The two major spits in the community are the spit at Dutch Harbor extending nearly to the center of Iliuliuk Bay, and the spit upon which most of the mainland Unalaska community is built, between Iliuliuk River and Iliuliuk Bay. These formations exist in a state of natural balance and any interference with either the forces which created and maintain them or with their existing condition will tend to disrupt the balance and could lead to their possible destruction or substantial change in the existing balanced condition" (URCDP 1977).

Shannon and Wilson, Inc's. Unalaska Road Improvement Master Plan, February 2010 explains that the City has approximately 26 miles of roads with nearly 6.6 that are paved. The entire road system experiences severe pot-holing and rutting. However, the short paved section has damages unique to asphalt surfaces. Asphalt surfaces also experience joint failure, raveling, and fatigue (alligator) cracking.

- *On most of Airport Beach Road and all of East Broadway Avenue, the asphalt pavement was constructed by placing two panels of asphalt pavement. The longitudinal joints constructed in the 2004 project have raveled despite the fact that the contractor cut the joints and all of the joint densities*
- *The South Channel Bridge has raveled due to rapid cooling and inadequate compaction*
- *Fatigue cracking, also known as alligator cracking, is a series of interconnecting cracks caused by the fatigue of the asphalt pavement under repeated traffic loading….The cracks gradually propagate over time and chunks of asphalt can become dislodged from the paved surface. The divots gradually grow from frost and water erosion and can lead to potholes*

(Unalaska 2010)

Extent

A variety of natural and human-induced factors influence the erosion process within the community. Coastal orientation and proximity to ocean waves, currents, and storm surges can influence erosion rates. Embankment composition also influences erosion rates, as sand and silt will erode easily, whereas boulders or large rocks are more erosion resistant. Other factors that may influence coastal erosion include:

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

Climate change may also play a part in increasing coastal erosion. Rising sea levels and retreating sea ice may leave stretches of coastline open to increased exposure to wave action during normal and winter storm conditions.

The City's 1977 Community Development Plan indicated,

> ***f. Special Soil Conditions.***
>
> *Special attention needs to be given to such activities as stripping of vegetation, road construction and other potential erosion causing activities. The generally steep gradients prevalent in the Unalaska community, coupled with soil characteristics conducive to sliding, sloughing and soil fluction and high moisture content of the soils makes the soils prone to quick erosion and sliding. Evidence exists throughout the area of past road building efforts, mostly by the military, where slides have occurred. Old military maps of the area are covered with notations alerting to the presence of mud, rock, and snow slides. The City should be especially aware of this problem and develop road building standards which, through minimizing slope and angle of roadway cuts, reduces the slide hazard. While this may add to the initial cost in construction and may even preclude some areas from being developed or delay their development for some years, the long term benefits will be realized in lower maintenance costs and possible preservation of properties" (URCDP 1977).*

Based on the City's Coastal Management Plan, past erosion events, and the criteria identified in Table 5-3, the magnitude and severity of erosion impacts in the City are considered "limited" with potential for critical facilities to be shut down for more than a week, and more than 10 percent of property or critical infrastructure being severely damaged.

Impact

Impacts from erosion include loss of land and any development on that land. Erosion can cause increased sedimentation of river deltas and hinder channel navigation—affecting marine transport. Other impacts include reduction in water quality due to high sediment loads, loss of native aquatic habitats, damage to public utilities (fuel headers and electric and water/wastewater utilities), and economic impacts associated with the costs of trying to prevent or control erosion sites.

The Alaska Department of Natural Resources, Coastal Processes and Erosion Responses, October 6-7, 2009, UAA sponsored Seminar presentation Figure 5-5 depicts Alaska Department of Transportation and Public Facilities' Harvey Smith's photo and explaining potential mitigation options. And provides a photo depicting such efforts in Unalaska.

"A revetment slope armored by precast concrete dolosse is topped by a rock splash apron at the airport in Unalaska."

Figure 5-5 Precast Concrete Dolosse (DNR2009)

Probability of Future Events

Based on historical impacts and the criteria identified in Table 5-2, it is likely that erosion will occur in the next three years (event has up to 1 in 3 years chance of occurring) as the history of events is greater than 20 percent l but less than or equal to 33 percent likely per year.

5.4.3 Flood

5.4.3.1 Nature

Flooding is the accumulation of water where usually none occurs or the overflow of excess water from a stream, river, lake, reservoir, glacier, or coastal body of water onto adjacent floodplains. 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.

Flood events not only impact communities with high water levels, or fast flowing waters, but sediment transport also impacts infrastructure and barge and other river vessel access limitations. Dredging may be the only option to maintain an infrastructure's viability and longevity.

Four primary types of flooding occur in the City: rainfall-runoff, snowmelt, storm surge, and ice override floods.

Rainfall-Runoff Flooding occurs in late summer and early fall. The rainfall intensity, duration, distribution, and geomorphic characteristics of the watershed all play a role in determining the magnitude of the flood. Rainfall runoff flooding is the most common type of flood. This type of flood event generally results from weather systems that have associated prolonged rainfall.

Snowmelt Floods typically occur from April through June. The depths of the snowpack and spring weather patterns influence the magnitude of flooding.

Storm Surges, or coastal floods, occur when the sea is driven inland above the high-tide level onto land that is normally dry. Often, heavy surf conditions driven by high winds accompany a storm surge adding to the destructive-flooding water's force. The conditions that cause coastal

floods also can cause significant shoreline erosion as the flood waters undercut roads and other structures. Storm surge is a leading cause of property damage in Alaska.

The meteorological parameters conducive to coastal flooding are low atmospheric pressure, strong winds (blowing directly onshore or along the shore with the shoreline to the right of the direction of the flow), and winds maintained from roughly the same direction over a long distance across the open ocean (fetch).

Communities that are situated on low-lying coastal lands with gradually sloping bathymetry near the shore and exposure to strong winds with a long fetch over the water are particularly susceptible to coastal flooding. Several communities and villages along the Bristol Bay coast, the Bering Sea coast, the Arctic coast, and the Beaufort Sea coast have experienced significant damage from coastal floods over the past several decades. Most coastal flooding occurs during the late summer or early fall season in these locations. As shorefast ice forms along the coast before winter, the risk of coastal flooding abates, but, later freeze-ups greatly increase the risk of erosion, storm surge flooding and ice override events.

Ice Override is a phenomenon that occurs when motion of the sheet ice is initiated by wind stress acting on the surface of ice that is not confined. Onshore wind, coupled with conditions such as a smooth gradual sloping beach and high tides can cause ice sheets to slide up or "override" the beach and move inland as much as several hundreds of feet. Ice override typically occurs in fall and early winter (though events have been reported at other times) and is usually associated with coastal storms and storm surge but may also happen in calm weather.

Override advances are slow enough to allow people to move out of its path, and therefore poses little immediate safety hazard. Intact sheets of ice up to several feet thick moving into buildings or across roads and airports can however cause structural damage and impede travel. Shoreline protection in the form of bulkheads or other structures to break-up the ice can limit the movement of ice. In at least one occasion, a bulldozer was able to break-up the ice and prevent damage.

Timing of events

Many floods are predictable based on rainfall patterns. Most of the annual precipitation is received from April through October with August being the wettest. This rainfall leads to flooding in early/late summer and/or fall. Spring snowmelt increases runoff, which can cause flooding. It also breaks the winter ice cover, which causes localized ice-jam floods.

5.4.3.2 History

Coastal Management Plan summarized the City's environmentally impacted areas and potential mitigation opportunities that could reverse existing hazard impacts. As with erosion, the Coastal Management Plan identified the City's flood impacted areas within their project narratives as well as a few photos to highlight extent:

Project 5. Iliuliuk Lake Restoration

Goal: restore and enhance lacustrine wetland functions that were lost by isolation from Unalaska Lake.

Description: Two sections of Unalaska Lake that where isolated by the development of Broadway Road are potential sites for mitigation. The larger section is known as Iliuliuk Lake. New culverts were installed in recent years improving both circulation and fish passage. However flooding was a significant problem during a 2007 storm event. This project would involve restoring and enhancing the wetland functions and values by correcting problems with water circulation, drainage and adding riparian cover.

Figure 5. Iliuliuk Lake facing west from Dutton Road. November 29, 2007.

Figure 6. Iliuliuk Lake facing west from Dutton Road. May 12, 2008.

Objectives: increase water circulation, shoreline area and riparian cover; restrict access to portions of lake; remove trash and debris; preserve the site.

Implementation Issues/Feasibility: Implementation of this project would require that access to the land surrounding the lake be obtained through an arrangement with the landowners or one of the formal land acquisition or other preservation mechanisms previously described. The type of acquisition or preservation mechanism will have significant impact on feasibility.

Implementation would require coordination with the Army Corps of Engineers because it involves alteration of shorelines, placement of fill, and modification of drainage.

Construction of this project would not require any special equipment, skills or expertise that is not locally available" (CMP 2008).

Additionally, various other projects had additional flood mitigation concerns or identified initiatives:

- Project 6, Iliuliuk River Restoration
- Project 8, Bird Habitat Enhancement/Lake Ilulaq
- Project 18, Summers Bay Salmon Habitat Restoration
- Project 27, Erosion control/re-vegetation - Broad Bay
- Project 28, Erosion control/re-vegetation - Nateekin Bay
- Project 29, Area wide Invasive species control - vegetation

The US Army Corp of Engineers reported "There is no river gauge in the community. Insignificant floods were reported for 1985 and 1991. Most floods are rainfall related flood events. (USACE 2011).

The USACE provided limited flood impact data for Table 5-6.

Table 5-6 Historic Flood Events (NWS)

Location	Date	Event Type	Magnitude
Unalaska	1985	Flood	11 inches of rain in 24 hours
Unalaska	1991	Heavy Rainfall Flood	Iliuliuk River flooded public works area
Unalaska	2007	Winter Storm/Flood	Impacted neighborhoods.

(USACE 2012, NWS 2011, DHS&EM 2010)

5.4.3.3 Location, Extent, Impact, and Probability of Future Events

Location

The Planning Team indicated that Unalaska has a minor flooding impacts; most of which occur from rainfall and snowmelt run-off. Water collects in low terrain depressions and may rise to just below a structures first step with no water intrusion on the first floor (See photos in Section 5.3.3.2. The City's typical minor flood locations are:

- Iliuliuk River
- Iliuliuk Lake
- Lake Ilulaq
- Summers Bay
- Broad Bay
- Nateekin Bay

(Unalaska 2012)

Extent

Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence.

The following factors contribute to riverine flooding frequency and severity:

- Rainfall intensity and duration
- Antecedent moisture conditions
- Watershed conditions, including terrain steepness, soil types, amount, vegetation type, and development density
- The attenuating feature existence in the watershed, including natural features such as swamps and lakes and human-built features such as dams
- The flood control feature existence, such as levees and flood control channels
- Flow velocity
- Availability of sediment for transport, and the bed and embankment watercourse erodibility
- City location related to the base flood elevation as indicated with their certified high water mark

Impact

Nationwide, floods result in more deaths than any other natural hazard. Physical damage from floods includes the following:

- Structure flood inundation, causing water damage to structural elements and contents
- Erosion or scouring of stream banks, roadway embankments, foundations, footings for bridge piers, and other features
- Damage to structures, roads, bridges, culverts, and other features from high-velocity flow and debris carried by floodwaters. Such debris may also accumulate on bridge piers and in culverts, increasing loads on these features or causing overtopping or backwater damages
- Sewage and hazardous or toxic materials release as wastewater treatment plants or sewage lagoons are inundated, storage tanks are damaged, and pipelines are severed

Floods also result in economic losses through business and government facility closure, communications, utility (such as water and sewer), and transportation services disruptions. Floods result in excessive expenditures for emergency response, and generally disrupt the normal function of a community.

Impacts and problems also related to flooding are deposition and stream bank erosion (erosion is discussed in detail in Section 5.3.2). Deposition is the accumulation of soil, silt, and other particles on a river bottom or delta. Deposition leads to the destruction of fish habitat, presents a challenge for navigational purposes, and prevents access to historical boat and barge landing areas. Deposition also reduces channel capacity, resulting in increased flooding or bank erosion.

Stream bank erosion involves the removal of material from the stream bank. When bank erosion is excessive, it becomes a concern because it results in loss of streamside vegetation, loss of fish habitat, and loss of land and property (BKP 1988).

Probability of Future Events

Based on previous occurrences, USACE Floodplain Manager's report, and criteria in Table 5-2, there is a 1 in 5 year chance of occurring (1/5=20 percent). History of events is greater than 10 percent but less than or equal to 20 percent likely per year. There is no data identifying a 500-year (0.2 percent chance of occurring in a given year) flood threat in Unalaska.

5.4.4 Ground Failure

5.4.4.1 Nature

Ground failure describes gravitational soil movement. Soil movement influences can include rain snow and/or water saturation, seismic activity, melting permafrost, river or coastal embankment undercutting, or a combination of conditions on steep slopes.

Landslides are a dislodgment and fall of a mass of soil or rocks along a sloped surface, or for the dislodged mass itself. The term is used for varying phenomena, including mudflows, mudslides, debris flows, rock falls, rockslides, debris avalanches, debris slides, and slump-earth flows. The susceptibility of hillside and mountainous areas to landslides depends on variations in geology, topography, vegetation, and weather. Landslides may also be triggered or exacerbated by indiscriminate development of sloping ground, or the creation of cut-and-fill slopes in areas of unstable or inadequately stable geologic conditions.

Additionally, landslides often occur with other natural hazards, thereby exacerbating conditions, such as:

- Earthquake ground movement can trigger events ranging from rock falls and topples to massive slides
- Intense or prolonged precipitation that causes flooding can also saturate slopes and cause failures leading to landslides
- Wildfires can remove vegetation from hillsides significantly increasing runoff and landslide potential

Development, construction, and other human activities can also provoke ground failure events. Increased runoff, excavation in hillsides, shocks and vibrations from construction, non-engineered fill places excess load to the top of slopes, and changes in vegetation from fire, timber harvesting and land clearing have all led to landslide events. Broken underground water mains can also saturate soil and destabilize slopes, initiating slides. Something as simple as a blocked culvert can increase and alter water flow, thereby increasing the potential for a landslide event in an area with high natural risk. Weathering and decomposition of geologic material, and alterations in flow of surface or ground water can further increase the potential for landslides.

The USGS identifies six landslide types, distinguished by material type and movement mechanism including:

- **Slides,** the more accurate and restrictive use of the term landslide, refers to a mass movement of material, originating from a discrete weakness area that slides from stable underlying material. A *rotational slide* occurs when there is movement along a concave surface; a *translational slide* originates from movement along a flat surface.
- **Debris Flows** arise from saturated material that generally moves rapidly down a slope. A debris flow usually mobilizes from other types of landslide on a steep slope, then flows through confined channels, liquefying and gaining speed. Debris flows can travel at speeds of more than 35 mph for several miles. Other types of flows include debris avalanches, mudflows, creeps, earth flows, debris flows, and lahars.
- **Lateral Spreads** are a type of landslide generally occurs on gentle slope or flat terrain. Lateral spreads are characterized by liquefaction of fine-grained soils. The event is typically triggered by an earthquake or human-caused rapid ground motion.
- **Falls** are the free-fall movement of rocks and boulders detached from steep slopes or cliffs.
- **Topples** are rocks and boulders that rotate forward and may become falls.
- **Complex** is any combination of landslide types.

In Alaska, earthquakes, seasonally frozen ground, and permafrost are often agents of ground failure. Permafrost is defined as soil, sand, gravel, or bedrock that has remained below 32°F for two or more years. Permafrost can exist as massive ice wedges and lenses in poorly drained soils or as relatively dry matrix in well-drained gravel or bedrock. During the summer, the surficial soil material thaws to a depth of a few feet, but the underlying frozen materials prevent drainage. The surficial material that is subject to annual freezing and thawing is referred to as the "active layer".

Seasonal freezing can cause frost heaves and frost jacking. Frost heaves occur when ice forms in the ground and separates sediment pores, causing ground displacement. Frost jacking causes unheated structures to move upwards. Permafrost is frozen ground in which a naturally occurring temperature below 32ºF has existed for two or more years. (DHS&EM 2010).

Indicators of a possible ground failure 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

The State of Alaska 2010 State Hazard Mitigation Plan provides additional ground failure information defining mass movement types, topographic and geologic factors which influence ground failure which may pertain to Unalaska.

5.4.4.2 History

There are few written records defining ground failure impacts. However, the DHS&EM Disaster Cost Index lists one historical ground failure event affecting the City:

> **"49. Unalaska, December 13, 1985** A severe windstorm caused mudslides, road and port damage, and damage to public buildings. Public disaster assistance supplemented insurance settlements to assist in recovery." (DHS&EM 2011)

5.4.4.3 Location, Extent, Impact, and Probability of Future Events

Location

There are various ground failure locations on Unalaska Island. Sources include Makushin Volcano, glacial impacts, and island development. Steep, nearly vertical terrain is the most common landslide or snow avalanche location type. These locations are generally located adjacent to the road system which surrounds Unalaska's bays and coves.

The City's 1977 Community Development Plan describes ground failure events such as creeping and sliding soil, flows, landslides, avalanches, and development:

> *"…Creeping and sliding of the soil mantle is characteristic of the Unalaska soil types and is found extensively throughout the area. It results from a combination of the steep slopes and the high moisture content of the soil. Flows and landslide scars are particularly present on glacially-steepen[e]d valley walls. Landslides are recorded throughout the area and most often occur as small, isolated portions of steep slopes tumbling or sliding downward as a result of excessive water saturation, snow loading, avalanche or man's alteration of natural conditions. Areas which may be subject to slides are easily identified by their steep, smooth faces and slopes, and should be avoided when selecting potential development sites. Several such slide areas are present along Captains Bay Road, at points along the Pryamid Creek Road and at several locations on Amaknak Island. Many of the early military access reads, not having been maintained over the years, show evidence of small scale landslide activity. The Natural Features Map, Figure 3, illustrates those observable locations." (URCDP 1977).*
> (See HMP Figure 5-6).

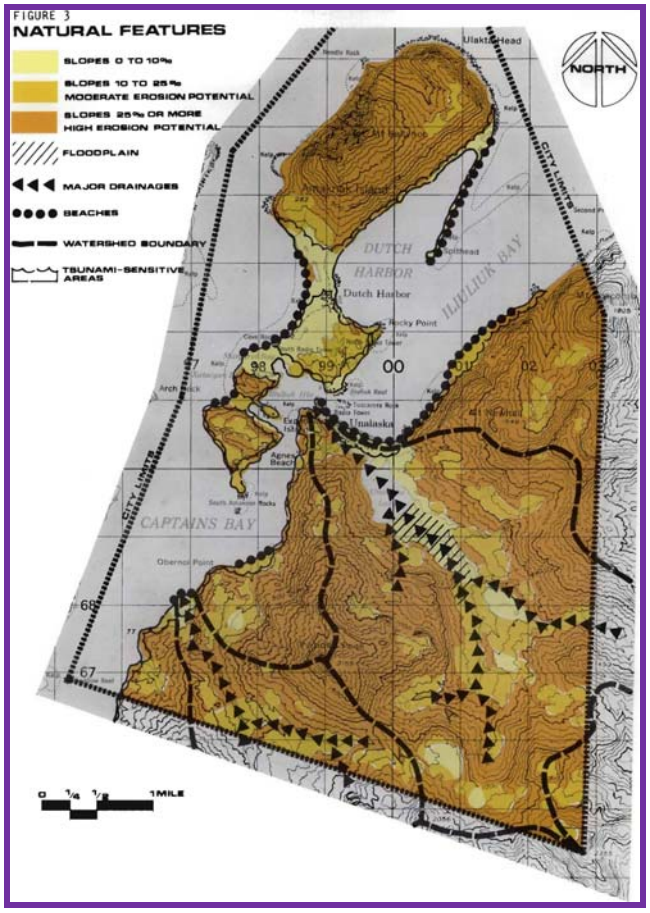


Figure 5-6 Natural Features Map *(URCDP 1977)*

According to permafrost and ice conditions map (Figure 5-7) developed for the National Snow and Ice Data Center/World Data Center for Glaciology located in the State Hazard Mitigation Plan (SHMP) (DHS&EM 2010), permafrost is not present on Unalaska Island, therefore the City has no permafrost threat.

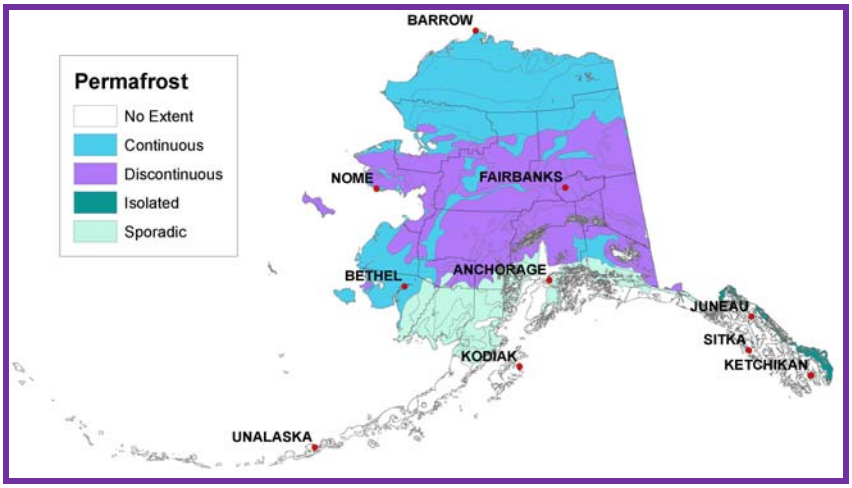


Figure 5-7 Permafrost and Ground Ice Map of Alaska (Brown et al 2001)

Extent

The damage magnitude could range from minor with some repairs required and little to no damage to transportation, infrastructure, or the economy to major if a critical facility (such as the airport) were damaged and transportation was effected.

Based on research and the Planning Team's knowledge of past ground failure and various degradation events and the criteria identified in Table 5-3, the extent of ground failure impacts in the City are considered limited. Impacts would not occur quickly but over time with warning signs. Therefore this hazard would not likely cause injuries or death, neither would it shutdown critical facilities and services. However, 10 percent of property is could be severely damaged.

Impact

Impacts associated with ground failure include surface subsidence, infrastructure, building, and/or road damage. Ground failure does not typically pose a sudden and catastrophic hazard; however landslides and avalanches may. Ground failure damage occur from improperly designed and constructed buildings that settle as the ground subsides, resulting in structure loss or expensive repairs. It may also impact buildings, communities, pipelines, airfields, as well as road and bridge design costs and location. To avoid costly damage to these facilities, careful planning and location and facility construction design is warranted.

The 2008 Coastal Management Plan describes potential impacts as:

> *"The single-most commonly identified issue for the community of Unalaska is the lack of stormwater run-off control and associated problems with erosion and sedimentation. In areas of unstable soils or steep slopes, heavy accumulations of snow or intense rainfall contribute to erosion, mudslides, landslides, debris flow, and avalanches. The City of Unalaska encompasses 116 square miles of land with 38 miles of road maintained by the City. There are currently storm drains along Unalaska Lake, Summer Bay Road and Ballyhoo Road. Although progress has been made to pave roads and install catch basins to manage stormwater run-off and sedimentation, the majority of the road system remains un-paved and surface water run-off is directly into the rivers, lakes and nearshore marine waters.*
>
> *Numerous opportunities exist at varying scales to address this area-wide problem including paving, ditching, installation of catch basins and sediment traps, and retention ponds as well as "Low Impact Development" approaches such as re-vegetation with native plant species" (CMP 2008)*

Probability of Future Events

Even though there are few written records defining ground failure impacts for the City, the Planning Team has solid evidence of their annually recurring landslide, avalanche, and ground failure damages throughout the community – to structures, roads, harbor areas, and the airport. The Planning Team stated the probability for ground failure follows the criteria in Table 5-2, the future damage probability resulting from ground failure is likely in the next three years (event has up to 1 in 3 years chance of occurring) as the history of events is greater than 20 percent but less than 33 percent likely per year.

5.4.5 Tsunami and Seiche

5.4.5.1 Nature

A tsunami is a series of waves generated in a body of water by an impulsive disturbance along the seafloor that vertically displaces the water. A seiche is an oscillating wave occurring within a partially or totally enclosed water body.

Subduction zone earthquakes at plate boundaries often cause tsunamis. However, submarine landslides, submarine volcanic eruptions, and the collapses of volcanic edifices can also generate tsunamis. A single tsunami may involve a series of waves, known as a train, of varying heights. In open water, tsunamis exhibit long wave periods (up to several hours) and wavelengths that can extend up to several hundred miles, unlike typical wind-generated swells on the ocean, which might have a period of about 10 seconds and a wavelength of 300 feet.

The actual height of a tsunami wave in open water is generally only 1 to 3 feet and is often practically unnoticeable to people on ships. The energy of a tsunami passes through the entire water column to the seabed. Tsunami waves may travel across the ocean at speeds up to 700 miles per hour (mph). As the wave approaches land, the sea shallows and the wave no longer travels as quickly, so the wave begins to "pile up" as the wave-front becomes steeper and taller, and less distance occurs between crests. Therefore, the wave can increase to a height of 90 feet or more as it approaches the coastline and compresses.

Tsunamis not only affect beaches that are open to the ocean, but also bay mouths, tidal flats, and the shores of large coastal rivers. Tsunami waves can also diffract around land masses and islands. Since tsunamis are not symmetrical, the waves may be much stronger in one direction than another, depending on the nature of the source and the surrounding geography. However, tsunamis do propagate outward from their source, so coasts in the shadow of affected land masses are usually fairly safe.

Local tsunamis and seiches may be generated from earthquakes, underwater landslides, atmospheric disturbances, or avalanches and last from a few minutes to a few hours. Initial waves typically occur quite soon after onslaught, with very little advance warning. They occur more in Alaska than any other part of the US.

Seiches occur within an enclosed water body such as a lake, harbor, cove or bay. They are locally event generated waves characterized as a "bathtub effect" where successive water waves move back and forth within the enclosed area until the energy is fully spent causing repeated impacts and damages.

5.4.5.2 History

The City of Unalaska is in close proximity to historic tsunamigenic events that have occurred along the Aleutian Trench. The West Coast/Alaska Tsunami Warning Center (WC/ATWC) lists the following earthquake generated tsunamis with observed or measured tsunami waves in Dutch Harbor (Table 5-7).

Table 5-7 Historic Aleutian Tsunamis –Waves at Dutch Harbor

Date	Location	Earthquake Moment Magnitude (MW)	Wave Height	Source	
			Ft./Meters	Latitude	Longitude
November 10, 1938	Alaska Peninsula	8.2 Mw	/0.1	54.48	-158.37
April 1, 1946	Near Unimak Island, Eastern Aleutian Islands, AK	8.6	Unknown	25.8	-163.5
March 9, 1957	South of Andreanof Islands, Central Aleutian Islands, AK	8.3	Unknown	51.5	-175.7
March 27, 1964	Prince William Sound	9.2	/0.35	61.05	-147.48
February 4, 1965	Rat Islands, Western Aleutian Islands, AK	8.7	<0.1	51.29	-178.49
May 7, 1986	Central Aleutian Islands, AK	8.0Mw	0.15	51.52	-166.54
February 21, 1991	Bering Sea	6.7 Mw	0.15	58.43	-175.45
June 10, 1996	Central Aleutian Islands, AK	7.9 Mw	0.6	51.56	-177.63

The 1964 tsunami tide gauge recorded the following tsunami wave heights (Figure 5-8):

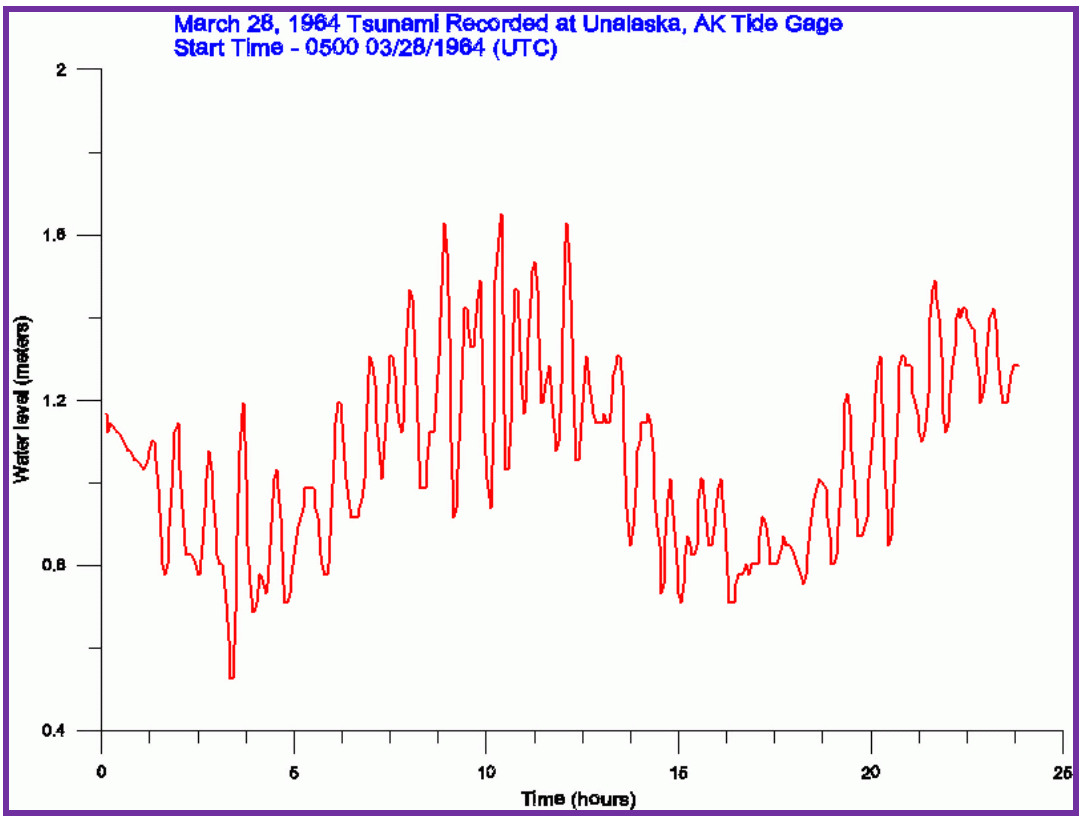


Figure 5-8 Unalaska Tide Gauge – 1964 Great Alaska Earthquake (

5.4.5.3 *Location, Extent, Impact, and Probability of Future Events*

Location

The State of Alaska, the University of Alaska Fairbanks, Geophysical Institute (UAF/GI), and the National Oceanic and Atmospheric Administration's (NOAA) Pacific Marine Environmental Laboratory (PMEL) indicate that Unalaska has a minor tsunami impact threat. Many believe their relatively protected location on the northern side of the island – away from Aleutian Trench created tsunami sources would protect them from severe impacts. However the UAF/GI conducted tsunami models that demonstrates the Harbor and airport areas may receive significant water current impacts with whirlpools as depicted in Figure 5-9, the UAF/GI's "specific scenario" model sequence - 65 minutes to 105 minutes series.

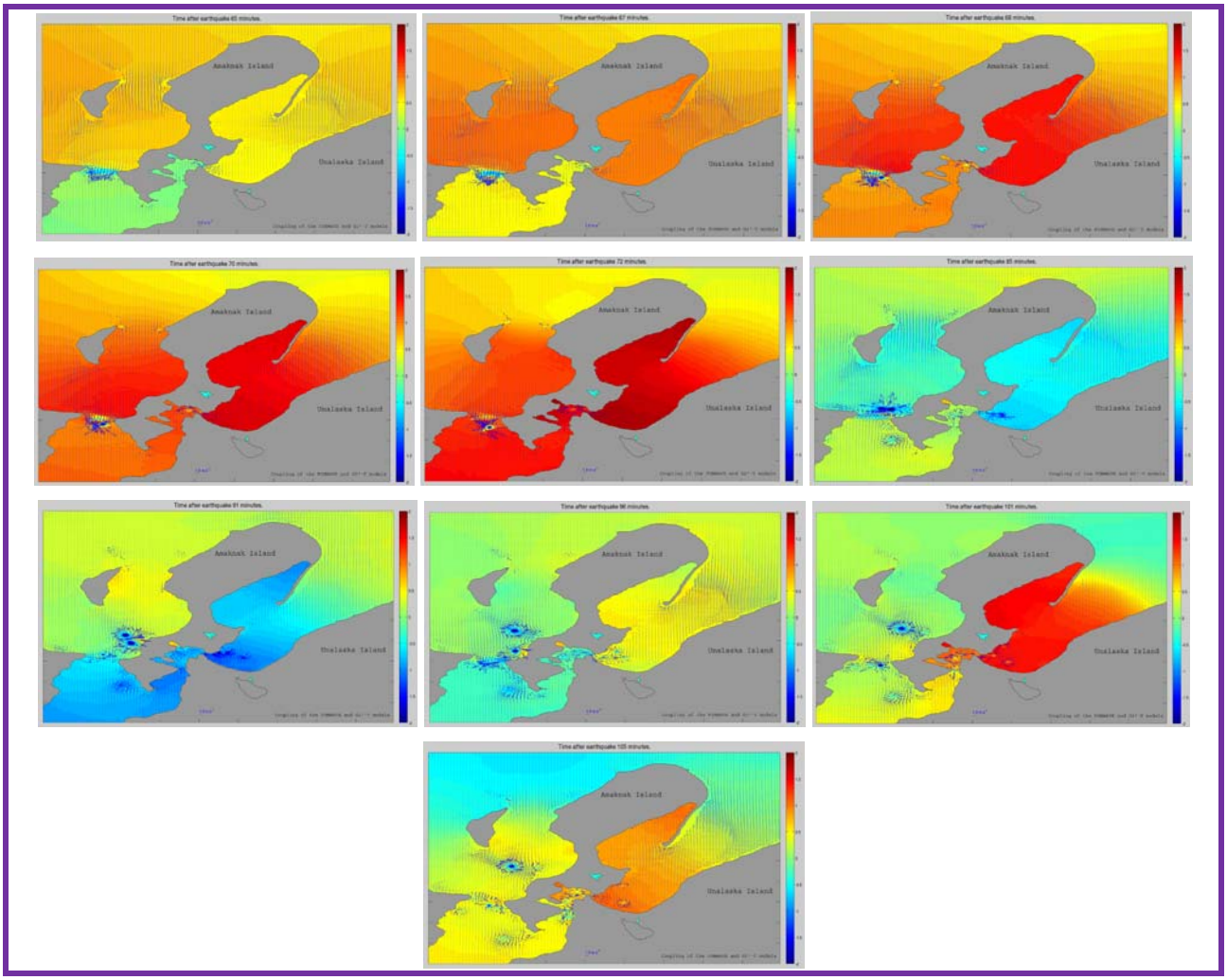


Figure 5-9 UAF/GI Impact Model Sequence Photos (UAF/GI 2012)

The photos provide a relative scale for this particular model where blue indicates a water level at -2 meters, and red depicts a +2 meter water level. These photos do not depict a worst case

scenario for Unalaska. However, they do depict potential whirlpools developing adjacent to the narrow passages between Amaknak and Unalaska Islands.

Extent

Based on historic earthquake events, UAF/GI, University of Washington, and the Pacific Marine Environmental Laboratory (PMEL) information, and the criteria identified in Table 5-3, the magnitude and severity of earthquake impacts to Unalaska are considered "Limited" with Injuries and/or illnesses that do not result in permanent disability; complete critical facility shutdown for more than one week, and more than 10 percent of property could be severely damaged.

Impact

UAF GI's Dr. Elena Sulemani and Dmitry Nicolski indicate there is a high potential of Unalaska receiving future tsunami impacts.

Dr. Elena Sulemani states:

> *"I think that the NOAA's SIFT modeling summary gives a [sound] estimate of the tsunami threat to Unalaska. Based on our recent modeling results, there could be a wave of about 2 meter high coming into the Unalaska [B]ay from a tsunami source located along the Aleutian trench" (UAF/GI 2012).*

Dmitry Nicolski further postulates:

> *"Some local landslide-generated tsunamis might produce higher runup values, but there is little known about them in this region.*
>
> *The tsunami currents could be extremely dangerous especially in passages between Amaknak and Unalaska Islands. Here is a small very preliminary visualization of the tsunami currents around Amaknak Island: http://atom.giseis.alaska.edu/misc/DutchHarbor.wmv*
>
> *Please notice lots of whirlpools forming in and around the passages. The blue arrows show the water velocity. The water level changes between -2 and +2 meters, but this is only for this particular scenario and this is not the so-called worst case scenario" (UAF/GI 2012).*

Yong Wei, (Joint Institute for the Study of Atmosphere and Ocean (JISAO), University of Washington and NOAA Center for Tsunami Research (NCTR), NOAA/PMEL presentation at the American Society of Civil Engineers "Solutions to Coastal Disasters 2008: Tsunamis" conference. Yong postulated that Unalaska could have a substantial tsunami impact.

> *"Being the most populous area in the Aleutians, Unalaska is considered as one of Alaskan coastal communities with high potential for tsunamis. As part of NOAA's Short-term Inundation Forecast for Tsunami (SIFT), a Stand-by Inundation Model (SIM) based on the MOST model is applied in this study to assess the tsunami impact for Unalaska. The model validation using historical tsunami events show excellent agreement between the model computation and observations, which gives rise to the accuracy of the inundation model. This study provides inclusive tsunami impact assessment for Unalaska, AK subject to a total of 2681 distant and local tsunamis scenarios in the Pacific at different level of earthquake magnitude Mw 7.5, 7.8, 8.2, 8.7 and 9.3. This study also investigates the impact caused by the hypothetical scenarios initiated in Unalaska gap*

and Shumagin gap at different level of earthquake magnitude Mw 7.5, 8.0, 8.5, and 9.0. The computational maximum tsunami runup suggests the current definition of Tsunami Safe Zone in Unalaska, areas above 50ft (~15m), is conservative" (UW 2011).

Probability of Future Events

The City's 1977 Community Development Plan states:

> *"Tsunamis, seismic sea waves, are sometimes generated by earthquake activity and crustal movements. These are often generated along the Aleutian Chain and can have disastrous effects throughout the Pacific Basin. Earthquakes occurring elsewhere in the Pacific [R]im can cause tsunami waves to reach Unalaska Island also. However, since the community is located on the north, or Bering Sea, side of the chain there is very little, if any, probability that a substantial tsunami wave of rapid and destructive force could affect Unalaska. The major consideration in Unalaska with respect to the tsunami problem is the rapid rising of ocean waters sometimes associated with tsunami activity rather than the destructive tidal wave of rapid movement and great height as occurred in 1964 in Valdez and Kodiak. In low lying areas at or adjacent to sea level elevation even a two or three foot increase in sea level could cause flooding. The tsunami watch station at Unalaska is part of the Alaska Regional Warning System, which monitors tsunamic activity throughout the state." (UCDP 1977).*

The DGGS Makushin Volcano Assessment, Report of Investigation, 2000-4 states that it is unlikely the volcano will generate a tsunami:

> *"No tsunamis have been produced at Makushin Volcano during the relatively small eruptions of the last few hundred years, and tsunamis are very unlikely to be produced by typical eruptions of Makushin Volcano in the future. However, if an unusually large eruption, similar to the caldera-forming eruptions of about 8,000 years ago, were to occur again, tsunami waves might be produced. During the prehistoric eruptions, pyroclastic flows and surges traveled from the volcano to the sea, especially on the north flank, where the sea is closest (McConnell and others, 1997). Slightly older debris avalanches also reached the sea on the north flank of Makushin Volcano (Bean, 1999). No geologic deposits of tsunamis produced by eruptions of Makushin were identified during field studies (Bean, 1999)" (DGGS 2000).*

The City of Unalaska has a minor tsunami impact history. While it is not possible to predict when a tsunami will occur, Dr. Elena Sulemani, University of Alaska Fairbanks' tsunami threat assessment supports, NOAA's Short-Term Inundation Forecast for Tsunami (SIFT) model. Therefore, following the criteria delineated in Table 5-2, a distant source tsunami is "Possible" to occur, but the recurrence interval is unknown. Too many factors determine when the next event will occur, as supported by known bathymetric conditions surrounding Unalaska Island.

5.4.6 Volcanic Hazards

5.4.6.1 Nature

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 Aleutian Islands. "Historically active" refers to actual eruptions that have occurred during Alaskan historic time, in general the time-period in which written records have been kept; from about 1760. Alaska averages 1-2 eruptions per year. In 1912, the largest eruption of the 20th century occurred at Novarupta and Mount

Katmai, located in what is now Katmai National Park and Preserve on the Alaska Peninsula (AVO 2011, USGS 2002).

A volcano is a vent or opening in the earth's crust from which molten lava (magma), pyroclastic materials, and volcanic gases are expelled onto the surface. Volcanoes and other volcanic phenomena can unleash cataclysmic destructive power greater than nuclear bombs, and can pose serious hazards if they occur in populated and/or cultivated regions.

There are four general volcano types:

- Lava domes are formed when lava erupts and accumulates near the vent
- Cinder cones are shaped and formed by cinders, ash, and other fragmented material accumulations that originate from an eruption
- Shield volcanoes are broad, gently sloping volcanic cones with a flat dome shape that usually encompass several tens or hundreds of square miles, built from overlapping and inter-fingering basaltic lava flows
- Composite or stratovolcanoes are typically steep-sided, large dimensional symmetrical cones built from alternating lava, volcanic ash, cinder, and block layers. Most composite volcanoes have a crater at the summit containing a central vent or a clustered group of vents.

Along with the different volcano types there are different eruption classifications. Eruption types are a major determinant of the physical impacts an event will create, and the particular hazards it poses. Six main types of volcano hazards exist including:

- Volcanic gases are made up of water vapor (steam), carbon dioxide, ammonia, as well as sulfur, chlorine, fluorine, and boron compounds, and several other compounds. Wind is the primary source of dispersion for volcanic gases. Life, health, and property can be endangered from volcanic gases within about 6 miles of a volcano. Acids, ammonia, and other compounds present in volcanic gases can damage eyes and respiratory systems of people and animals, and heavier-than-air gases, such as carbon dioxide, can accumulate in closed depressions and suffocate people or animals.
- Lahars are usually created by shield volcanoes and stratovolcanoes and can easily grow to more than 10 times their initial size. They are formed when loose masses of unconsolidated, wet debris become mobilized. Eruptions may trigger one or more lahars directly by quickly melting snow and ice on a volcano or ejecting water from a crater lake. More often, lahars are formed by intense rainfall during or after an eruption since rainwater can easily erode loose volcanic rock and soil on hillsides and in river valleys. As a lahar moves farther away from a volcano, it will eventually begin to lose its heavy load of sediment and decrease in size.
- Landslides are common on stratovolcanoes because their massive cones typically rise thousands of feet above the surrounding terrain, and are often weakened by the very process that created the mountain – the rise and eruption of molten rock (magma). If the moving rock debris is large enough and contains a large content of water and soil

material, the landslide may transform into a lahar and flow down valley more than 50 miles from the volcano.

- Lava flows are streams of molten rock that erupt from a vent and move downslope. Lava flows destroy everything in their path; however, deaths caused directly by lava flows are uncommon because most move slowly enough that people can move out of way easily, and flows usually do not travel far from the source vent. Lava flows can bury homes and agricultural land under tens of feet of hardened rock, obscuring landmarks and property lines in a vast, new, hummocky landscape.
- Pyroclastic flows are dense mixtures of hot, dry rock fragments and gases that can reach 50 mph. Most pyroclastic flows include a ground flow composed of coarse fragments and an ash cloud that can travel by wind. Escape from a pyroclastic flow is unlikely because of the speed at which they can move.
- Tephra is a term describing any size of volcanic rock or lava that is expelled from a volcano during an eruption. Large fragments generally fall back close to the erupting vent, while smaller fragment particles can be carried hundreds to thousands of miles away from the source by wind. Ash clouds are common adaptations of tephra.

Ash fall poses a significant volcanic hazard to the City of Unalaska because, unlike other secondary eruption effects such as lahars and lava flows, ash fall can travel thousands of miles from the eruption site.

Volcanic ash consists of tiny jagged particles of rock and natural glass blasted into the air by a volcano. Ash can threaten the health of people, livestock, and wildlife. Ash imparts catastrophic damage to flying jet aircraft, operating electronics and machinery, and interrupts power generation and telecommunications. Wind can carry ash thousands of miles, affecting far greater areas and many more people than other volcano hazards. Even after a series of ash-producing eruptions has ended, wind and human activity can stir up fallen ash for months or years, presenting a long-term health and economic risk. Special concern is extended to aircraft because volcanic ash completely destroys aircraft engines.

Ash clouds have caused catastrophic aircraft engine failure, most notably in 1989 when KLM Flight 867, a 747 jetliner, flew into an ash cloud from Mt. Redoubt's eruption and subsequently experienced flameout of all four engines. The jetliner fell 13,000 feet before the flight crew was able to restart the engines and land the plane safely in Anchorage. The significant trans-Pacific and intrastate air traffic traveling directly over or near Alaska's volcanoes, has necessitated developing strong communication and warning links between the Alaska Volcano Observatory (AVO), other government agencies with responsibility for aviation management, and the airline and air cargo industry (AVO 2012a, USGS 2002).

The AVO states, The Aleutian Islands consist of a volcanic chain (14 large and 55 smaller volcanic islands). Makushin Volcano is on Unalaska Island and visible from the City of Unalaska. AVO provides information about Makushin Volcano (Figure 5-10):

> *"From Miller and others (1998): "Makushin volcano is a broad, truncated stratovolcano, 1800 m high and 16 km in basal diameter, which occupies most of the triangular northwest extension of Unalaska Island. A breached summit caldera, about 3 km across,*

contains a small cinder cone, eroded remnants of other cones, and several fumaroles. The volcano is capped by an icefield of about 40 square km; subsidiary glaciers descend the larger flanking valleys to elevations as low as 305 m.

... Based on geomorphic analysis, Arce (1983) infers that the sequence of Holocene events... as follows: construction of Sugarloaf cone, activity at Tabletop Mountain, construction of Makushin cone, and lastly, construction of the Wide Bay cone and activity on the Pt. Kadin vents" (AVO 2012b).

The Preliminary Volcano-Hazard Assessment for Makushin Volcano, Alaska, Summary of Hazards states,

"Makushin Volcano is a 2,036-meter-high stratovolcano on Unalaska Island. The volcano is located 28 kilometers west of the towns of Dutch Harbor and Unalaska, the largest population centers in the Aleutian Islands and the principal fishing, shipping, and air-transportation hub for westernmost Alaska. Explosive eruptions of Makushin Volcano have occurred at least 17 times since the late 1700s, when written records began. These historic eruptions have been relatively small, sending ash 3 to 10 kilometers above the volcano summit and depositing ash mainly on the flanks of the volcano. Geologic studies show that larger explosive eruptions occurred more than two dozen times during the last several thousand years, generating more widespread ash layers. In addition, a series of very large eruptions about 8,800 to 8,000 years ago produced a 4-kilometer-diameter crater at the summit of the volcano and generated not only numerous pyroclastic flows and surges that traveled down valleys to the sea on the east, west, and north flanks of the volcano, but a debris avalanche and lateral blast that entered the sea on the north flank of Makushin Volcano.

Figure 5-10 Makushin Volcano
(AVO 2012b)

If future eruptions are similar in size to those of the last few hundred to few thousand years, the most likely volcanic hazard would be plumes of volcanic ash that could extend several kilometers to 10 kilometers or more into the atmosphere. Such ash plumes would constitute a hazard both to aircraft landing at the Dutch Harbor airport and to passenger and cargo jets that fly over the eastern Aleutian Islands and northern Pacific Ocean on long-distance international air routes. Currently, as many as a hundred flights a day cross above or near Makushin Volcano. Ashfall from future eruptions could also disrupt airport operations, shipping, fishing, and other commercial activities at Dutch Harbor. Such eruptions might be accompanied by floods, mudflows, and small pyroclastic flows and surges that would be dangerous for humans and property within about 10 kilometers of the volcano, particularly in low-lying areas.

If eruptions as large as those of 8,000 years ago were to occur, volcanic ash falls would be much thicker and more extensive than any seen in the area in historic time, and highly mobile pyroclastic flows, surges, or lateral blasts might affect areas tens of kilometers from the volcano, including the towns of Dutch Harbor and Unalaska. Such huge eruptions could also significantly disrupt air travel over the north Pacific area for days

and perhaps weeks. However, based on the volcano's pattern of past behavior, eruptions of this magnitude are very rare, and therefore unlikely to recur in the near future. (DGGS 2000)

The AVO's identified volcanos in Alaska. Table 5-8 lists those located along the Aleutian Chain.

Table 5-8 Volcanos in Alaska

Volcano Names			
Akutan Volcano	Davidof Volcano	Kiska Volcano	Semisopochnoi Volcano
Amak Volcano	Dutton Volcano	Koniuji Volcano	Shishaldin Volcano
Amukta Volcano	Fisher Volcano	Korovin Volcano	Tanaga Volcano
Aniakchak Volcano	Gareloi Volcano	Little Sitkin Volcano	Ugashik-Peulik Volcano
Bobrof Volcano	Great Sitkin Volcano	Makushin Volcano	Ukinrek-Maars Volcano
Bogoslof Volcano	Herbert Volcano	Okmok Volcano	Uliaga Volcano Volcano
Buldir Volcano	Isanotski Volcano	Pavlov Volcano	Veniaminof Volcano
Carlisle Volcano	Kagamil Volcano	Pogromni Volcano	Vsevidof Volcano
Chagulak Volcano	Kanaga Volcano	Seguam Volcano	Westdahl Volcano
Cleveland Volcano	Kasatochi Volcano	Segula Volcano	Yunaska Volcano

(AVO 2012)

5.4.6.2 History

The City's 1977 Comprehensive Development Plan states, "Makushin Volcano has erupted 14 times since 1700 A.D., the last major eruption occurring in 1938. Ash eruptions have occurred as recently as 1951. Makushin and other nearby volcanoes are still engaged in the island-building process" (Unalaska 1977).

The AVO, and its constituent organizations (USGS, DNR, and UAF), has volcano hazard identification and assessment responsibility for Alaska's active volcanic centers. The AVO monitors active volcanoes several times each day using Advanced Very High Resolution Radiometers (AVHRR) and satellite imagery.

DHS&EM's Disaster Cost Index records the following volcanic eruption disaster events:

103. Mt. Redoubt Volcano, December 20, 1989 *When Mt. Redoubt erupted in December 1989, posing a threat to the Kenai Peninsula Borough, Mat-Su Borough, and the Municipality of Anchorage, and interrupting air travel, the Governor declared a Disaster Emergency. The Declaration provided funding to upgrade and operate a 24-hr. monitoring and warning capability.*

104. KPB-Mt. Redoubt, January 11, 1990 *The Kenai Peninsula Borough, most directly affected by Mt. Redoubt, experienced extraordinary costs in upgrading air quality in schools and other public facilities throughout successive volcanic eruptions. The Borough also sustained costs of maintaining 24-hr. operations during critical periods. The Governor's declaration of Disaster Emergency supported these activities.*

161. Mt. Spurr, September 21, 1992 *Frequent eruptions and the possibility of further eruptions has caused health hazards and property damage within the local governments*

of the Municipality of Anchorage, Kenai Peninsula Borough and Mat-Su Borough. These eruptions caused physical damage to observation and warning equipment. Funds to replace equipment for AVO.

The AVO's Service Review, Mount Redoubt Volcanic Eruptions, March – April 2009 (Figure 5-11) states,

"Mount Redoubt volcano in continuous eruption on March 31, 2009. Plume height is no more than 15,000 feet above sea level. The small amount of ash in the plume is creating a haze layer downwind of the volcano and dustings of fine ash are falling out of the plume. View is from the northwest…

[Figure 5-10] Photo Credit: Kristi Wallace, AVO…

Figure 5-11 2009 Eruption Cloud- 15,000 ft. (AVO 2009b)

On March 22, 2009, Mount Redoubt volcano, 106 miles southwest of Anchorage, Alaska, began a series of eruptions after persisting in Orange or "Watch" status since late January 2009. Plume heights were observed at or above 60,000 feet during two of the six significant eruptions. Ashfall occurred over south central Alaska, including in Anchorage, with amounts ranging from a trace to one-half inch in depth.

The Redoubt eruptions also disrupted air traffic in the region. Hundreds of commercial flights were cancelled and cargo companies were significantly impacted. This resulted in employees being placed on unpaid leave during periods when airport operations were shut down. Anchorage is Alaska's major population center; its airport serves as a critical strategic transportation hub as the third busiest cargo airport in the world.

The impacts of the unrest at Mount Redoubt volcano continued through spring and into the summer. The threat of continuing eruptions and lahars (volcanic mud flows composed of water, ash, mud, and debris) necessitated the removal of millions of gallons of oil from Chevron's nearby Drift River Terminal. Residents, emergency management, and health officials remained on alert until Mount Redoubt volcano was downgraded to Yellow or "Advisory" status on June 30, 2009, and finally to Green or "Normal" status on September 29, 2009. " (AVO 2009b)

Recent volcano eruption impacts demonstrate modern community vulnerability to volcanic ash dispersal and travel distance.

Alaska's volcanoes have very diverse eruption histories spanning thousands of years. Activity spanning such an extensive timeline is nearly impossible to define. However modern science has enabled the AVO with determining fairly recent historical eruption dates. Table 5-9 lists the AVO's identified Aleutian Chain volcano's historical eruption dates with explanatory symbols to designate the data's accuracy.

Table 5-9 Aleutian Volcano Eruption Events

Aleutian Volcanoes and Their Respective Eruption Dates				
Akutan	**Gareloi**	**Korovin**	**Semisopochnoi**	**Westdahl**
10: ✱ 1765-1953	6: ✱ 1760-1996	8: ✱ 1829-2005	4: ✱ 1772-1830	3: ✱ 1820-1979
30: ! 1848-1992	10: ! 1791-1989	3: ! 1973-1998	2: !1873-1987	7: ! 1795-1991
Amak	**Great Sitkin**	**Little Sitkin**	**Shishaldin**	**Wrangell**
2: ✱ 1700-1796	7: ✱ 1760 -1987	3: ✱ 1776-1900	28: ✱ 1775-2008	3: ✱1820-1979
Amukta	8: ! 1767-1974	**Makushin**	23: ! 1824 2004	2: ! 1795-1991
1: ✱ 1770	**Kagamil**	14: ✱ 1790-1993	**Tanaga**	**Yunaska**
Aniachak	1: ✱ 1929	10: ! 1769-1995	3: ✱ 1763-1829	3: ✱1817-1929
1: ! 1931	**Kanaga**	**Okmok**	1: !1914	2: ! 1824-1937
Bogoslof	5: ✱ 1763-1996	3: ✱ 1878-1936	**Ugashik-Peulik**	
4: ✱ 1908-1951	6: ! 1786-2012	14: ! 1817-2008	2: ✱1814-1852	
8: ! 1796-1992	**Kasatochi**	**Pavlof**	**Ukinrek-Maars**	
Carlisle	4: ✱ 1760-1899	7: ✱ 1762-1903	1: !1977	
1: ✱ 1987	1: ! 2008	31: ! 1817-2007	**Veniaminof**	
Cleveland	**Kiska**	**Pavlof Sister**	4: ✱ 18572-1987	
7: ✱ 1774-2010	3: ✱ 1907-1987	1: ✱ 1762	2: !1830-2008	
19: ! 1828-2011	4: ! 1962-1990	**Seguam**	**Vsevidof**	
Fisher		3: ✱ 1827-1927	5: ✱ 1784-1957	
3: ✱ 1795-1830		6: !1786-1993		

Key:
! Eruption
✱ Questionable eruption
i Non-eruptive activity

(AVO 2012)

5.4.6.3 Location, Extent, Impact, and Probability of Future Events

Location

Figure 5-12 depicts the AVO monitoring program's active and inactive volcanoes.

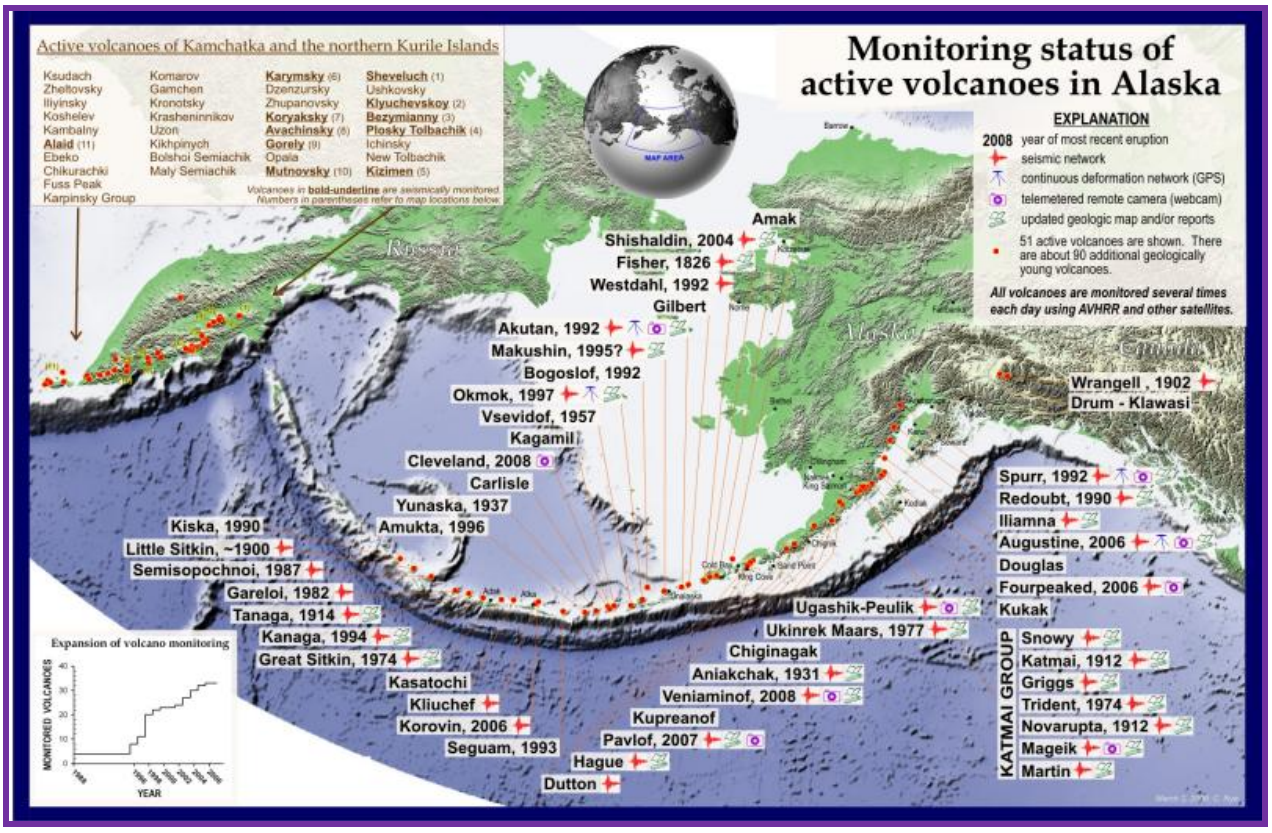


Figure 5-12 AVO's Volcano Monitoring Status Map (AVO 2008)

The AVO publishes individual hazard assessments for each active volcano in Alaska. Table 5-10 lists a representative sample of their preliminary reports and hazard assessments.

Table 5-10 List of Published Aleutian Volcano Hazard Assessments

Volcano Names			
Akutan Volcano	Great Sitkin Volcano	Makushin Volcano	Shishaldin Volcano
Aniakcahak Volcano	Hayes Volcano	Okmok Volcano	Tanaga Island Volcanic Cluster
Gareloi Volcano	Kanaga Volcano	Pavlof Volcano	

Each report contains a description of the eruptive history of the volcano, the hazards they pose, and the likely effects of future eruptions to populations, facilities, and ecosystems.

Figure 5-13 indicates the most likely volcanoes to impact Unalaska.

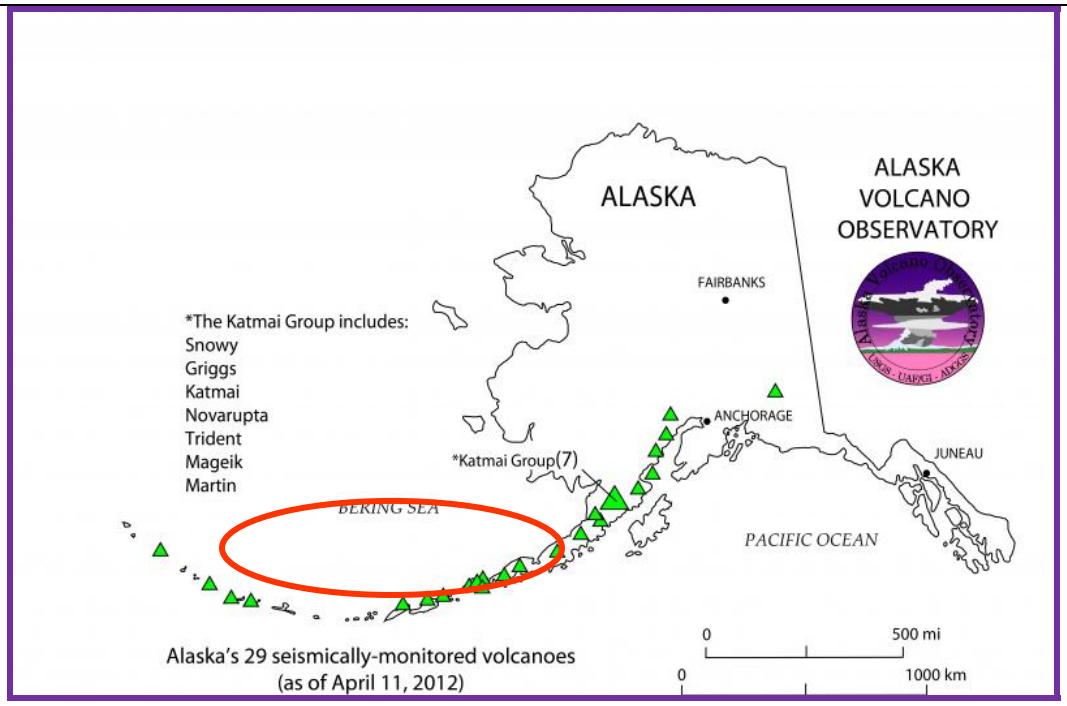


Figure 5-13 Alaska's Seismically Monitored Volcanoes (AVO 2012)

Alaska contains 80+ volcanic centers and is at continual risk for volcanic eruptions. Most of Alaska's volcanoes are far from settlements that could be affected by lahars, pyroclastic flows and clouds, and lava flows; however ash clouds and ash fall have historically caused significant impact to human populations.

> *"When volcanoes erupt explosively, high-speed flows of hot ash (pyroclastic flows) and landslides can devastate areas 10 or more miles away, and huge mudflows of volcanic ash and debris (lahars) can inundate valleys more than 50 miles downstream. . . Explosive eruptions can also produce large earthquakes. . . the greatest hazard posed by eruptions of most Alaskan volcanoes is airborne dust and ash; even minor amounts of ash can cause the engines of jet aircraft to suddenly fail in flight" (USGS 1998)*

Many of the volcanoes in Alaska are capable of producing eruptions that can affect Unalaska. The City of Unalaska is concerned that significant volcanic ash falls and even large tephra particles could impact the City. A large ash plume has the capability of shutting down air, and potentially, ferry and barge operations because tephra is damaging to all engine types. Large tephra could cause further damage from direct impact damages.

USGS Bulletin 1028-N explains that Mount Katmai's eruption on June 5, 1912 was up to that point "the greatest volcanic catastrophe in the recorded history of Alaska. More than six cubic miles of ash and pumice were blown into the air from Mount Katmai and the adjacent vents in the Valley of Ten Thousand Smokes." The eruption lasted for 3 days. The USGS Fact Sheet 075-98, Version 1.0 states,

"The ash cloud, now thousands of miles across, shrouded southern Alaska and western Canada, and sulfurous ash was falling on Vancouver, British Columbia; and Seattle, Washington. The next day the cloud passed over Virginia, and by June 17th it reached Algeria in Africa."

Figure 5-14 shows the extent of four ash cloud impact areas. The 1912 Katmai ash cloud is gray; the Augustine (blue plume), Redoubt (orange plume), and Spurr (yellow plume) were each dwarfed by the Katmai event. "Volcanologist's discovered that [this] 1912 [Katmai] eruption was actually from Novarupta, not Mount Katmai" (USGS 1998).

Figure 5-14 1912 Katmai Volcano Impact (USGS 1998)

- Archaeological evidence suggests that an eruption of Aniakchak volcano 3,500 years ago spread ash over much of Bristol Bay and generated a tsunami which washed up onto the tundra around Nushagak Bay. Within the past 10,000 years, Aniakchak volcano has significantly erupted on at least 40 occasions.
- The 1989-90 eruption of Mt. Redoubt seriously affected the population commerce, and oil production and transportation throughout the Cook Inlet region.

"Redoubt Volcano is a strato-volcano located within a few hundred kilometers of more than half of the population of Alaska. This volcano has erupted explosively at least six times since historical observations began in 1778. The most recent eruption occurred in 1989-90 and similar eruptions can be expected in the future. The early part of the 1989-90 eruption was characterized by explosive emission of substantial volumes of volcanic ash to altitudes greater than 12 kilometers above sea level and widespread flooding of the Drift River valley. Later, the eruption became less violent, as developing lava domes collapsed, forming short-lived pyroclastic flows associated

with low-level ash emission. Clouds of volcanic ash had significant effects on air travel as they drifted across Alaska, over Canada, and over parts of the conterminous United States causing damage to jet aircraft, as far away as Texas. Total estimated economic costs are $160 million, making the eruption of Redoubt the second most costly in U.S. history" (USGS 1998).

- Mt. Spurr's 1992 eruption brought business to a halt and forced a 20 hour Anchorage International Airport closure. Communities 400 miles away reported light ash dustings.

  "Eruptions from Crater Peak on June 27, August 18, and September 16–17, 1992, produced ash clouds (fig. 11) that reached altitudes of 13 to 15 kilometers [8-9 miles] above sea level. These ash clouds drifted in a variety of directions and were tracked in satellite images for thousands of kilometers beyond the volcano (Schneider and others, 1995). One ash cloud that drifted southeastward over western Canada and over parts of the conterminous United States and eventually out across the Atlantic Ocean (fig. 12) significantly disrupted air travel over these regions but caused no direct damage to flying aircraft" (USGS 2002)

  In 1992, another eruption series occurred, resulting in three separate eruption events. The first, in June, dusted Denali National Park and Manley Hot Springs with 2 mm of ash – a relatively minor event. In August, the mountain again erupted, covering Anchorage with ash, bringing business to a halt and forcing officials to close Anchorage International Airport for 20 hours. St. Augustine's 1986 eruption caused similar air traffic disruption.

- Small ash clouds from the 2001 eruption of Mt. Cleveland were noted by USGS to have reached Fairbanks. These clouds dissipated somewhere along the line between Cleveland and Fairbanks. A full plume, visible on satellite imagery, was noted in a line from Cleveland to Nunivak Island.

Figure 5-15 displays the air travel routes in the North Pacific, Russia, and Alaska and the active volcanoes which could easily disrupt air travel during significant volcanic eruptions with ash fall events.

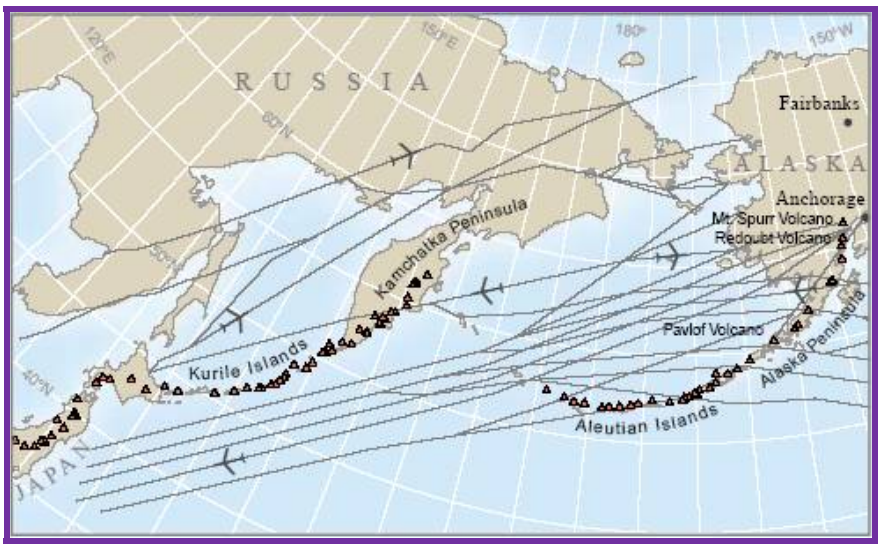


Figure 5-15 North Pacific Air Travel Routes (USGS 2001)

Figure 5-16, DGGS Makushin Hazard Assessment (Report of Investigation 200-4, Figure 8), explains how an explosive Makushin Volcano eruption's plumes could impact airline flight routes:

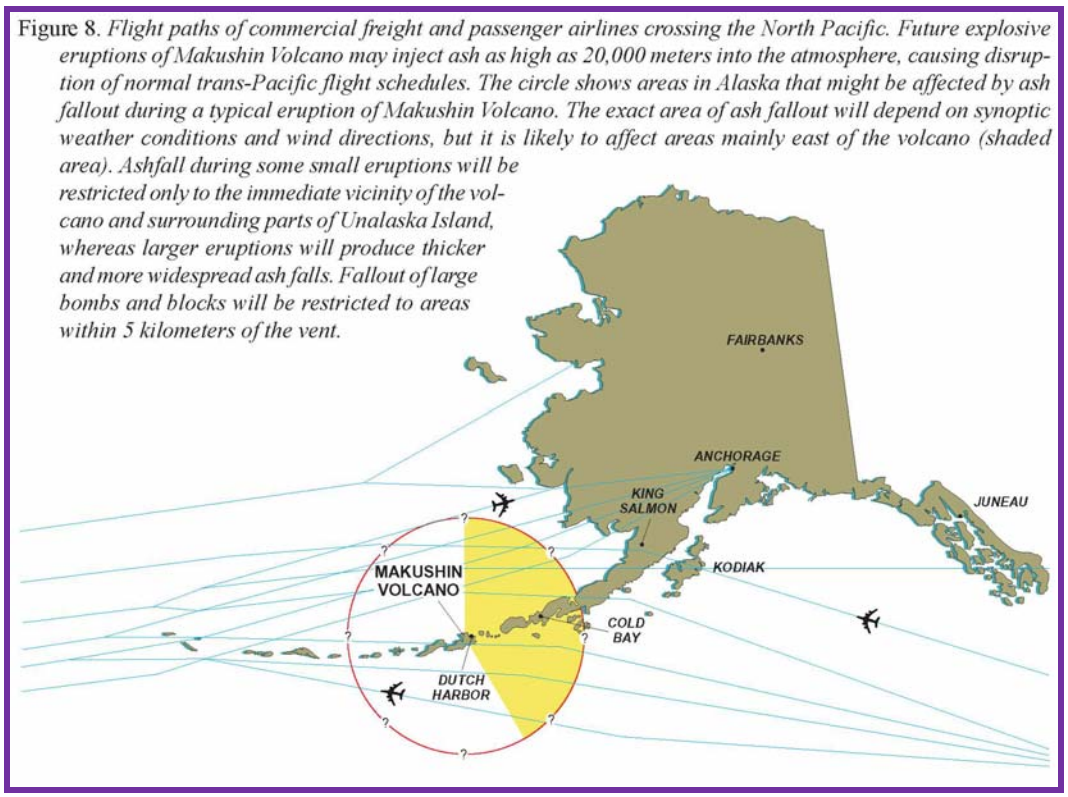


Figure 5-16 Unalaska/Makushin Volcano Flight Proximity (DGGS 2000)

Extent

Volcanic effects include severe blast, turbulent ash and gas clouds, lightning discharge, volcanic mudflows, pyroclastic flows, corrosive rain, flash flood, outburst floods, earthquakes, and tsunamis. Some of these activities include ash fallout in various communities, air traffic, road transportation, and maritime activity disruptions.

Unalaska might receive some ash fall during a massive volcanic eruption. A tsunami is possible if the eruption included a massive, high speed pyroclastic flow into the Bering Sea; however, Unalaska has only a minimal tsunami impact threat from volcanic activity. A much more likely impact would be prolonged traffic disruptions (air, land, or rail) preventing essential community resupply e.g. food and medicine delivery, and medical evacuation service capabilities to full service hospitals.

A massive eruption anywhere on earth, as depicted in Figure 5-17, could severely affect the global climate; radically changing Unalaska's (and everyone else's) risk from weather events for weeks, months, or years.

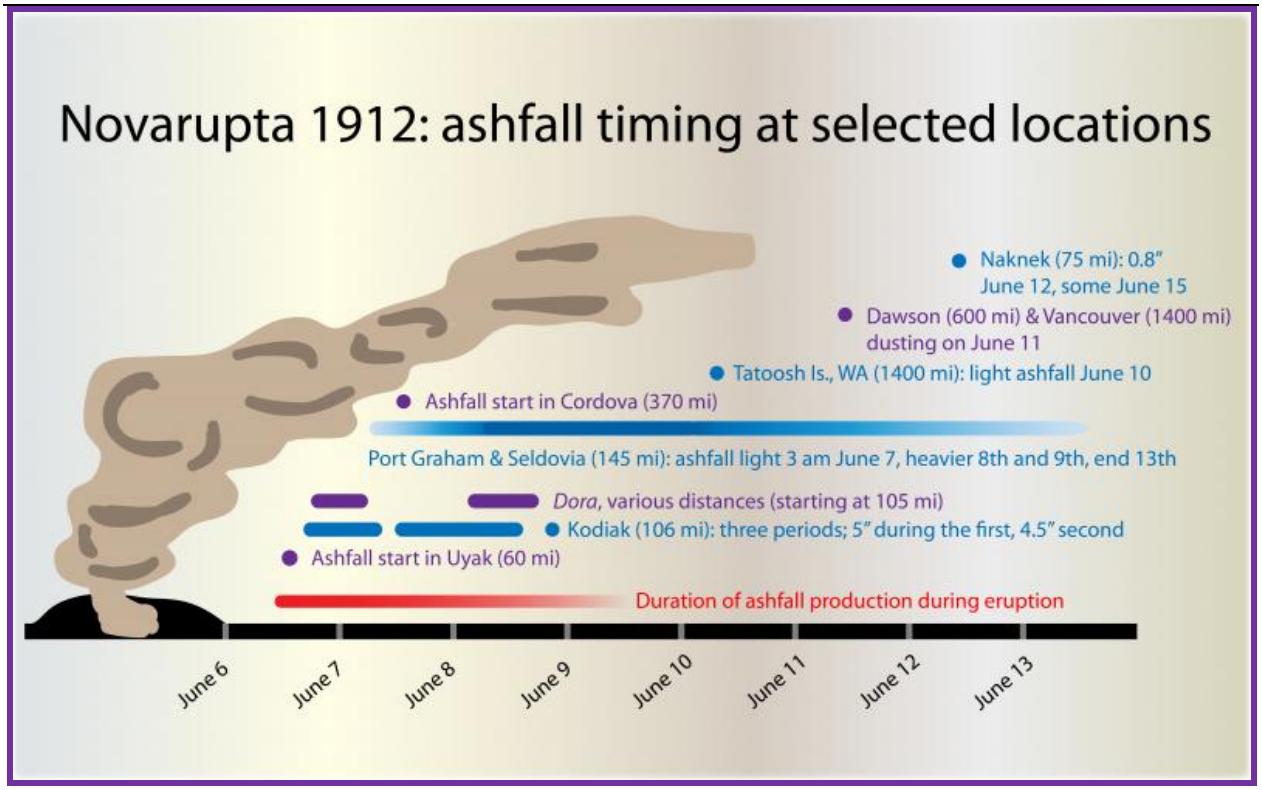


Figure 5-17 Novarupta's Historic Ashfall Timeline (AVO 2012)

Based on historic volcanic activity impacts and the criteria identified in Table 5-3, the magnitude and severity of impacts in Unalaska are considered "limited" with minor injuries, the potential for critical facilities to be shut down for more than a week, more than 10% of property or critical infrastructure being severely damaged, and limited permanent damage to transportation, infrastructure, or the economy.

Impact

As the Preliminary Volcano-Hazard Assessment for Makushin Volcano, Alaska, Summary of Hazards states,

> *"If eruptions as large as those of 8,000 years ago were to occur, volcanic ash falls would be much thicker and more extensive than any seen in the area in historic time, and highly mobile pyroclastic flows, surges, or lateral blasts might affect areas tens of kilometers from the volcano, including the towns of Dutch Harbor and Unalaska. Such huge eruptions could also significantly disrupt air travel over the north Pacific area for days and perhaps weeks. However, based on the volcano's pattern of past behavior, eruptions of this magnitude are very rare, and therefore unlikely to recur in the near future. (DGGS 2000)*

Such an ash fall event would undoubtedly be devastating to Unalaska by straining its resources as well as transportation (air, ocean, land, and rail routes); especially if other hub communities are also significantly affected by a volcanic eruption. Residents would likely experience respiratory problems from airborne ash, personal injury, and potential residential displacement or lack of shelter with general property damage (electronics and unprotected machinery), structural

damage from ash loading, state/regional transportation interruptions, loss of commerce, as well as water supply contamination.

These impacts can range from inconvenience – a few days with no transportation capability; to disastrous – heavy, debilitating ash fall throughout the state, forcing Unalaska to be completely self-sufficient.

Probability of Future Events

Geologists can make general forecasts of long-term activity associated with individual volcanoes by carefully analyzing past activity, but these are on the order of trends and likelihood, rather than specific events or timelines. Short-range forecasts are often possible with greater accuracy. Several signs of increasing activity can indicate that an eruption will follow within weeks or months. Magma moving upward into a volcano often causes a significant increase in small, localized earthquakes, and measurable carbon dioxide and compounds of sulfur and chlorine emissions increases. Shifts in magma depth and location can cause ground level elevation changes that can be detected through ground instrumentation or remote sensing.

Based on the criteria identified in Table 5-2 and information presented in the SHMP, it is "Likely" for a volcanic eruption to occur within the next three years. Event has up to 1 in 3 years chance of occurring (1/3=33 percent). History of events is greater than 20percent but less than or equal to 33 percent likely per year. Vulnerability depends on the type of activity and current weather, especially wind patterns.

5.4.7 Weather (Severe)

5.4.7.1 Nature

Severe weather occur throughout Alaska with extremes experienced by the City of Unalaska that includes thunderstorms, lightning, hail, heavy and drifting snow, freezing rain/ice storm, extreme cold, and high winds. The City experiences periodic severe weather events such as the following:

Heavy Rain occurs rather frequently over the coastal areas along the Bering Sea and the Gulf of Alaska. Heavy rain is a severe threat to Unalaska**.**

Heavy Snow generally means snowfall accumulating to four inches or more in depth in 12 hours or less or six inches or more in depth in 24 hours or less.

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

Freezing Rain and Ice Storms occur when rain or drizzle freezes on surfaces, accumulating 12 inches in less than 24 hours. Ice accumulations can damage trees, utility poles, and communication towers which disrupts transportation, power, and communications.

Extreme Cold is 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 between -20 to -50°F. Excessive cold may accompany winter storms, be left in their wake, or can occur without storm activity. Extreme cold accompanied by wind exacerbates exposure injuries such as frostbite and hypothermia.

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 wind can equal hurricane force but fall under a different classification because they are not cyclonic nor possess other hurricane characteristics. In Alaska, high winds (winds in excess of 60 mph) occur rather frequently over the coastal areas along the Bering Sea and the Gulf of Alaska. High winds are a severe threat to Unalaska.

Strong winds occasionally occur over the interior due to strong pressure differences, especially where influenced by mountainous terrain, but the windiest places in Alaska are generally along the coastlines.

Winter Storms include a variety of phenomena described above and as previously stated may include several components; wind, snow, and ice storms. Ice storms, which include freezing rain, sleet, and hail, can be the most devastating of winter weather phenomena and are often the cause of automobile accidents, power outages, and personal injury. Ice storms result in the accumulation of ice from freezing rain, which coats every surface it falls on with a glaze of ice. Freezing rain is most commonly found in a narrow band on the cold side of a warm front, where surface temperatures are at or just below freezing temperatures. Typically, ice crystals high in the atmosphere grow by collecting water vapor molecules, which are sometimes supplied by evaporating cloud droplets. As the crystals fall, they encounter a layer of warm air where they 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. However, since the cold layer is so shallow, the drops themselves do not freeze, but rather, are supercooled, that is, in liquid state at below-freezing temperature. These supercooled raindrops freeze on contact when they strike the ground or other cold surfaces.

Snowstorms happen when a mass of very cold air moves away from the polar region. As the mass collides with a warm air mass, the warm air rises quickly and the cold air cuts underneath it. This causes a huge cloud bank to form and as the ice crystals within the cloud collide, snow is formed. Snow will only fall from the cloud if the temperature of the air between the bottom of the cloud and the ground is below 40 degrees Fahrenheit. A higher temperature will cause the snowflakes to melt as they fall through the air, turning them into rain or sleet. Similar to ice storms, the effects from a snowstorm can disturb a community for weeks or even months. The combination of heavy snowfall, high winds and cold temperatures pose potential danger by causing prolonged power outages, automobile accidents and transportation delays, creating dangerous walkways, and through direct damage to buildings, pipes, livestock, crops and other vegetation. Buildings and trees can also collapse under the weight of heavy snow.

Winter storm floods are discussed in Section 5.3.3.

(NWS 2011)

5.4.7.2 History

The City of Unalaka is continually impacted by severe weather events. Hurricane force wind, storm surge, and cold typically have disastrous results. For example, *The Village*, A Rural Blog posted an Anchorage Daily News entry on December 5, 2009, stating that a 125 mph wind event toppled a 110-foot gantry crane at an American President Lines, LTD shipping facility in Dutch

Harbor (ADN 2009). DHS&EM's Disaster Cost Index records the following severe weather disaster events which affected the area:

49. Unalaska, December 13, 1985: *A severe windstorm caused mudslides, road and port damage, and damage to public buildings. Public disaster assistance supplemented insurance settlements to assist in recovery.*

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

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

(New numbering system began in 1995 to begin with event year)

07-221, 2006 October Southern Alaska Storm (AK-07-221) declared October 14, 2006 by Governor Murkowski FEMA declared (DR-1669) on December 8, 2006. *Beginning on October 8, 2006 and continuing through October 13, 2006, a strong large area of low pressure that developed in the Northern Pacific and moved into the Southwest area of the state, produced hurricane force winds throughout much of the state and heavy rains in the Southcentral and Northern Gulf coast areas, which resulted in severe flooding and wind damage and threats to life in the Southern part of the state… Federal declaration was made December 2006 including assistance for Public Assistance and Hazard Mitigation but not including Individual Assistance.*

00-191, Central Gulf Coast Storm declared February 4, 2000 by Governor Murkowski Murkowski then FEMA declared (DR-1316) on February 17, 2000: *On Feb 4 2000, the Governor declared a disaster due to high impact weather events throughout an extensive area of the state. The State began responding to the incident since the beginning of December 21, 1999. The declaration was expanded on February 8 to include City of Whittier, City of Valdez, Kenai Peninsula Borough, Matanuska-Susitna Borough and the Municipality of Anchorage. On February 17, 2000, President Bill Clinton determined the event disaster warranted a major disaster declaration under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, P.L. 93-288 as amended ("the Stafford Act). On March 17, 2000, the Governor again expanded the disaster area and declared that a condition of disaster exists in Aleutians East, Bristol Bay, Denali, Fairbanks North Star, Kodiak Island, and Lake and Peninsula Boroughs and the census areas of Dillingham, Bethel, Wade Hampton, and Southeast Fairbanks, which is of sufficient severity and magnitude to warrant a disaster declaration. Effective on April 4, 2000, Amendment No. 2 to the Notice of a Major Disaster Declaration, the Director of FEMA included the expanded area in the presidential declaration. Public Assistance, for 64 applicants with 251 PW's, totaled $12.8 million. Hazard Mitigation totaled $2 million. The total for this disaster is $15.66 million.*

12-236, 2011 West Coast Storm declared by Governor Parnell on December 5, 2011 then FEMA declared December 22, 2011 (DR-4050). *On November 7, 2011 the National Weather Service (NWS) issued the first of several coastal flood warnings for the western coastline of Alaska from Hooper Bay to the North Slope. The NWS warned of "a rapidly intensifying storm…expected to be an extremely powerful and dangerous storm…one of the worst on record." Over the next three days additional warnings in response to the 942 millibar low pressure system were issued for coastal villages as the storm moved northerly from the Aleutian Islands into the Bering and Chukchi Seas. The west coast was impacted with hurricane force winds exceeding 85 mph, high tidal ranges, and strong sea surges up to 10-ft above mean sea level (msl). Before the first storm had passed, a second equally-low pressure system (e.g., 942 millibar) impacted the western coastline from the Yukon-Kuskokwim Delta south to Bristol Bay. This combined weather extended the incident period for the state to November 13, 2011. The FEMA declaration was limited to the incident period from November 8 – 10, 2011.*

The Western Regional Climate Center (WRCC) provides weather data throughout the Pacific Northwest. The WRCC's SBCFSA's daily comparative average and extreme data are as follows:

Figure 5-18 provides average and extreme temperature data for the closest community to Unalaska – Cold Bay. As indicated on the graph, October 1986 had a maximum rainfall event with 15.05 inches. Other high accumulation year information for 2006, 2009, and 2012 were not available.

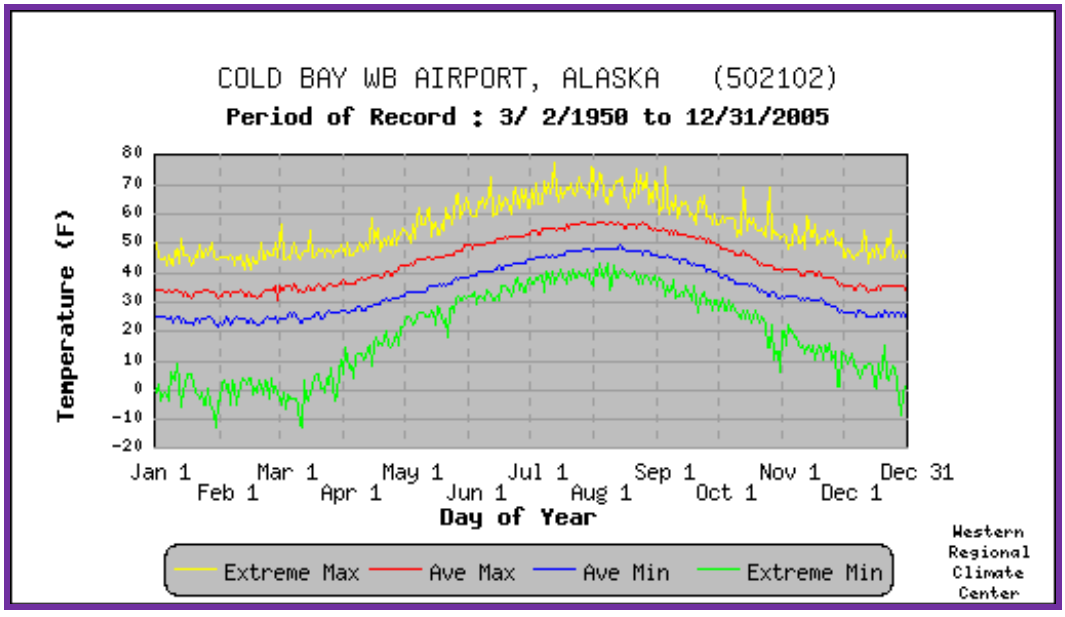


Figure 5-18 Cold Bay's Temperature Extremes (WRCC 2012)

Figure 5-19 displays the areas daily precipitation extremes.

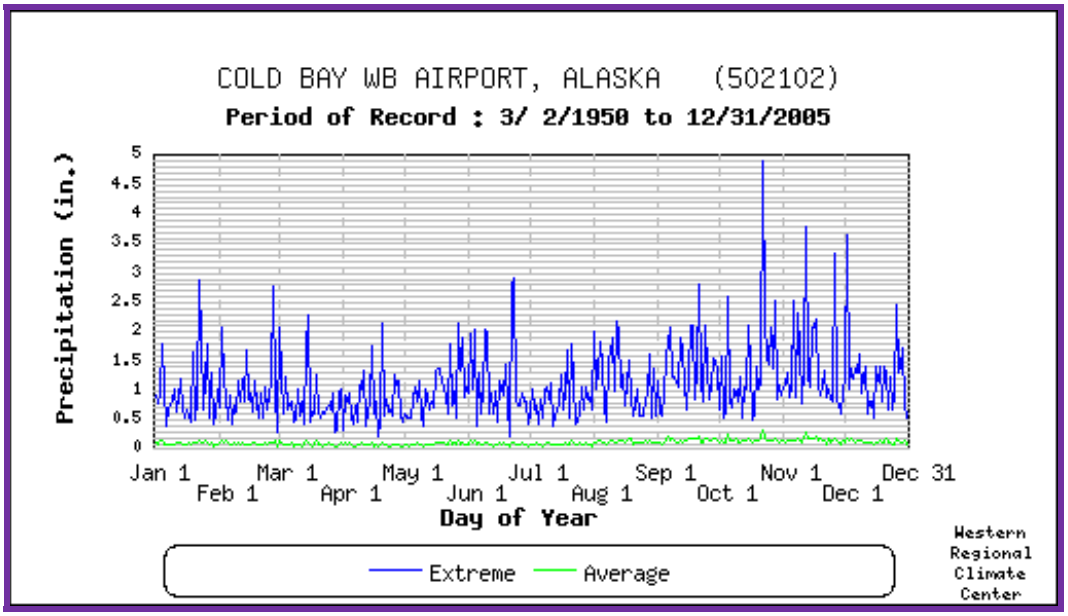


Figure 5-19 Cold Bay's Precipitation Extremes (NWS 2012)

Figure 5-20 displays the areas daily snowfall extremes.

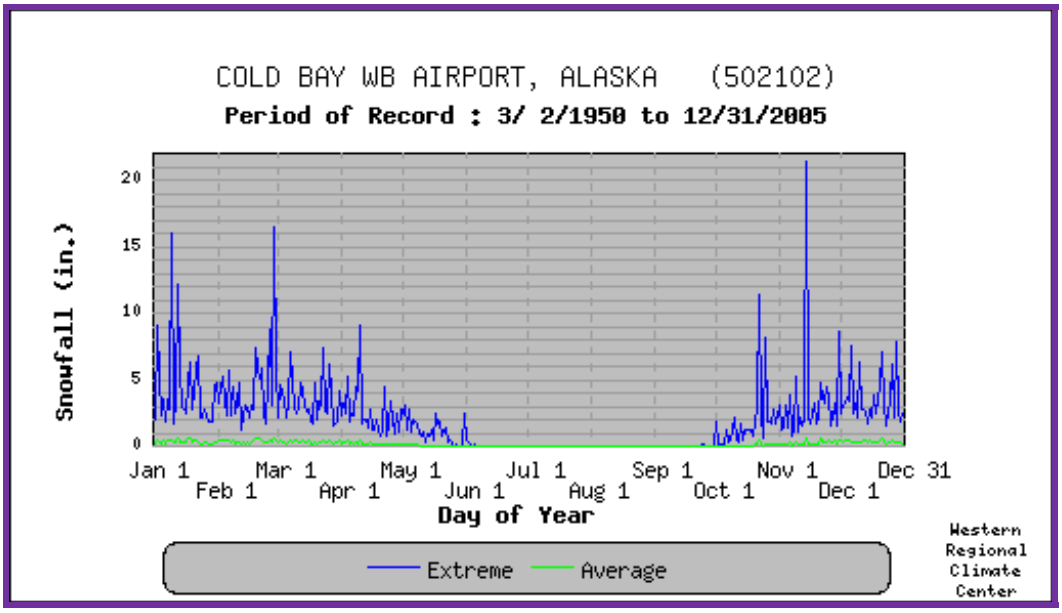


Figure 5-20 Cold Bay's Snowfall Extremes (WRCC 2012)

The City of Unalaska is continually impacted by severe weather as depicted in Table 5-11 which lists 29 major storm events the National Weather Service identified for Unalaska's Weather Zone. Each weather event may not have specifically impacted the area around Unalaska. These storm events are listed due to their close proximity to listed communities or by location within the identified zone.

Table 5-11 Severe Weather Events

Location	Date	Event Type	Magnitude
Central Aleutians	10/14/2006	High Wind	October 14th, storm produced strong southeast wind 75 mph. (65 kts.) across the central and eastern Aleutians with strong west wind across the western Aleutians.
Central Aleutians	10/27/2006	High Wind	Strong system crossed the Western Aleutian Islands Oct 27th with wind gusts measured to 86 mph. (75 kts.) near Adak.
Central Aleutians	12/1/2006	High Wind	Strong north Pacific storm crossed the central Aleutians with strong wind 77 mph. (67 kts.) and winter storm.
Central Aleutians	12/26/2006	Blizzard	Blizzard conditions across most of the central and eastern Bering Sea and over the south central region of Alaska.
Central Aleutians	1/3/2007	Blizzard	Storm produced snow and strong wind across most of the western Aleutian islands.
Central Aleutians	1/29/2007	Blizzard	Snow over the central Aleutians combined with the wind resulted in a Blizzard for that region.
Central Aleutians	9/17/2007	High Wind	Storm crossed the Aleutians, mariners reported wind gusts to 90 mph. (78 kts.).
Central Aleutians	12/27/2007	Blizzard	Strong wind and snow that resulted in a blizzard across portions of the central Aleutians.
Central Aleutians	1/12/2008	High Wind	Hurricane force wind blew through the Aleutian Islands. Snow combined with the strong wind 69 mph. (60 kts.) created blizzard conditions in the eastern Aleutians
Central Aleutians	12/17/2008	Blizzard	Strong north to northwest wind around the west side of the low coupled with snow resulted in a blizzard in Adak.
Central Aleutians	1/12/2009	Blizzard	Strong wind and snow in advance of the front produced blizzard conditions.
Central Aleutians	2/20/2009	High Wind	Storm produced high wind 74 mph. (65 kts.) over the central Aleutians on the 20th.
Central Aleutians	2/24/2009	High Wind	Storm produced hurricane force wind 78 mph. (68 kts.) as it moved through the region.
Central Aleutians	11/29/2009	High Wind	Gulf of Alaska produced high winds across the Aleutians and blizzard conditions from the Pribilof Islands to the Bering Sea coast and high wind 76 mph. (66 kts.) heavy snow and blizzard conditions across south central Alaska and Prince William Sound.
Central Aleutians	2/7/2010	Blizzard	Blizzards across the central Aleutians to the Pribilof Islands and along the Bering Sea coast of the Kuskokwim Delta.
Central Aleutians	3/1/2010	High Wind	Central Aleutians, hurricane force gusts to 65 mph. (75 kts.) at Adak. Strong north wind and snow
Central Aleutians	3/4/2010	Blizzard	High wind and blizzard conditions from the Central Aleutians across the Alaska Peninsula to the Pribilof Islands and across South Central Alaska and Prince William Sound.
Central Aleutians	3/11/2010	Blizzard	Blizzard conditions over the western and central Aleutians.
Central Aleutians	3/30/2010	Blizzard	Strong wind and snow resulting in blizzard conditions from the central Aleutians to the Alaska Peninsula, north to the Pribilof Islands.
Central Aleutians	1/8/2011	High Wind	Strong wind across Adak. The peak gust during this event was 77 mph. (67 kts.).
Central Aleutians	1/17/2011	High Wind	High wind 74 mph. (65 kts.) as it moved south of the Aleutians and blizzard conditions over southwest Alaska.
Central Aleutians	1/26/2011	Blizzard	High wind and blizzard conditions in the Central Aleutians and high wind in the eastern Aleutians. The peak winds in the Eastern Aleutians was 78 mph. (68 Kts.)
Central Aleutians	4/6/2011	High Wind	Storm impacted Alaska from the Aleutian Islands to south

Table 5-11 Severe Weather Events

Location	Date	Event Type	Magnitude
			central Alaska. Wind gust ranged from 72 - 78 mph (63 - 68 kts.) along the Aleutian Islands,
Central Aleutians	10/28/2011	High Wind	Moderately strong storm moved across the eastern Aleutians producing strong gusty northwest wind 70 mph. (61 kts.) over the western to west central Aleutians.
Central Aleutians	11/18/2011	High Wind	High wind 76 mph.(66 kts.) along with blizzard conditions and a storm surge that resulted in minor coastal flooding.
Central Aleutians	12/13/2011	High Wind	Strong wind across the central and eastern Aleutians. The peak wind was 81 mph. (70 kts.) in Dutch Harbor.
Central Aleutians	1/27/2012	Blizzard	Strong wind and spread snow across the central Aleutian Island to the Pribilof Islands.
Central Aleutians	1/31/2012	Blizzard	Strong northwest wind and snow resulted in blizzard conditions.
Central Aleutians	4/3/2012	Blizzard	Strong storm moved across the central Aleutian Islands. Snow and strong wind produced blizzard conditions

(WRCC 2012)

5.4.7.3 Location, Extent, Impact, and Probability of Future Events

Location

The entire area, which includes the City of Unalaska and Dutch Harbor, experiences periodic severe weather impacts. The most common to the area are high winds and severe winter storms. Table 5-11 depicts weather events that have impacted the area since 2006 and are provided as a representative sample.

Extent

The entire City is equally vulnerable to the severe weather effects. The City experiences severe storm conditions with moderate snow depths; wind speeds exceeding 90 mph; and extreme low temperatures that reach -34ºF.

Based on past severe weather events and the criteria identified in Table 5-3, the extent of severe weather in the City are considered limited where injuries do not result in permanent disability, complete shutdown of critical facilities occurs for more than one week, and more than 10 percent of property is severely damaged.

Impact

The intensity, location, and the land's topography influence a severe weather event's impact within a community. Hurricane force winds, rain, snow, and storm surge can be expected to impact the entire Unalaska Island.

Heavy snow can immobilize a community by bringing transportation to a halt. Until the snow can be removed, airports and roadways are impacted, even closed completely, stopping the flow of supplies and disrupting emergency and medical services. Accumulations of snow can cause roofs to collapse and knock down trees and power lines. Heavy snow can also damage light aircraft and sink small boats. A quick thaw after a heavy snow can cause substantial flooding.

The cost of snow removal, repairing damages, and the loss of business can have severe economic impacts on cities and towns.

Injuries and deaths related to heavy snow usually occur as a result of vehicle and or snow machine accidents. Casualties also occur due to overexertion while shoveling snow and hypothermia caused by overexposure to the cold weather.

Extreme cold can also bring transportation to a halt. Aircraft may be grounded due to extreme cold and ice fog conditions, cutting off access as well as the flow of supplies to communities. Long cold spells can cause rivers to freeze, disrupting shipping and increasing the likelihood of ice jams and associated flooding.

Extreme cold also interferes with the proper functioning of a community's infrastructure by causing fuel to congeal in storage tanks and supply lines, stopping electric generation. 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.

Probability of Future Events

Based on previous occurrences and the criteria identified in Table 5-2, it is likely a severe storm event will occur in the next three years (event has up to 1 in 3 years chance of occurring) as the history of events is greater than 20 percent but less than or equal to 33 percent likely per year.

5.5 TECHNOLOGICAL AND MANMADE HAZARDS

The City of Unalaska decided to identify technological and manmade hazards that could potentially impact the City. However, they determined that only Transportation and Utility System Disruptions need to be profiled within the HMP.

5.5.1 Transportation System Disruptions

Transportation and utility system disruptions are a potential or subsequent impact of each of the identified natural hazards; their ramifications are far-reaching and much broader than direct damage and direct service loss.

It is important to remember, in considering any of the other hazards profiled in this plan, that transportation and utility system disruptions should be viewed in addition to other impacts. The probability, duration, extent, and risk associated with system disruptions are described below, and in some cases quantified. Electric power outages are dealt with in more detail than other disruptions because loss of electric power has the most widespread effects on other utilities.

5.5.1.1 Nature

Road, airport, and harbor closures are the most significant disruptive events to Unalaska. All are subject to disruption from the various hazards profiled in this plan: earthquake, flood, ground failure, (avalanche and landslide), volcano, severe weather, and hazardous materials incidents.

The ramifications of transportation system disruption range from effects on life, health, and safety (emergency vehicle mobility, access to hospitals, evacuation routes, and vital supplies if transport is unavailable for extended time periods); to the economic effects of delays, lost commerce, and lost time.

Utility System Disruptions

Similarly, utility system disruptions can affect the City at the commerce and recreation levels as well as at the impacting fundamental health and safety. Analyzing potential utilities disruptions is complicated because utilities like electric power, potable water, wastewater, natural gas, and telecommunications are all networks, consisting of nodes (centers where something happens) and links (connections between nodes). Networks typically have various built-in redundancy levels, and the amount and nature of alternate pathways determines the robustness of the system and their sustainability to a particular disturbance. (Goettel 2005)

The City's water treatment plant is by nature located in flood-prone areas. Floodwater inundation can cause raw water to circumvent and contaminate source wells and filtration and treatment systems. Earthquakes can damage water storage, treatment, and transport systems. Water systems are also extremely vulnerable to power outages. Storage tanks are usually located 60 to 200 feet above the water source network, and water is pumped into these tanks using electricity. Storage tanks typically contain one to two days' water supply. Long duration power outages can result in a drinking and cooking water shortage –a basic public health requirement. (Goettel 2005)

Wastewater management is also crucial for public health, and wastewater systems are similarly vulnerable to floods, earthquake damages, and power outages. Floods may cause collection pipes to overflow that in-turn could cause inflow that exceeds treatment plant capacity, resulting in untreated or partially treated wastewater releases. Treatment plants are often located in low-lying areas, which facilitate collected wastewater gravity flow to the plant. However, this means that treatment plants are often found in flood zones. Wastewater pipes and plants are subject to earthquake damage, and loss of power can result in plant shutdown with subsequent releases of untreated or partially treated water. (Goettel 2005) Public health hazards can be posed by wastewater and sewage backed-up, as well as by untreated or incompletely treated wastewater releases.

Natural Gas Systems

Natural and propane gas systems (compression stations and distribution pipes) are vulnerable to seismic events, and compression stations are vulnerable to flood damage and power loss. Landslides, too, can affect these gas systems. (Goettel 2005) Where it is used for cooking or heating, natural or propane gas distribution disruption will create difficulties. Leaks in enclosed areas present a health hazard, and both are highly flammable and explosive.

Telecommunication Systems

Telecommunications systems (including telephone, broadcast radio, and satellite systems) are generally somewhat less vulnerable to hazards than other services, given that few nodes (stations) are located in flood zones or landslide areas. Buried lines have more ability to stretch than do gas and water lines, and can usually accommodate several feet of ground movement before failing. Above-ground lines are vulnerable to utility pole failure, but disruptions are about

10 times less common than electrical line failures – partly because the much lower communications line voltage makes them much less vulnerable to arcing or shorting out if lines come very close to one another. (Goettel 2005) Telecommunications failures can have devastating impacts to Unalaska due to its isolated location. Routine emergency response (fire, police, and ambulance) as well as disaster-response rely on immediate, electricity for timely communications.

Electrical power plants and transmission lines are vulnerable to most of the hazards covered in this Plan. Earthquake, flood, volcano, and severe weather events are all power, transmission, and distribution line threats. Unalaska has only one small generating plant. Electric power is pivotal to modern life. Residential, commercial, and public facilities all rely heavily on electricity. Emergency facilities such as hospitals and emergency response centers typically are equipped with backup generators for critical life-support and communications functions. Nonetheless, there significant consequences to long-term and widespread electrical power outages. Other utility systems, discussed above, also depend on electricity for normal operations, subsequently, electric power loss can have serious secondary effects. (Goettel 2005)

5.5.1.2 History

System disruptions typically result from a primary hazard event and are treated as a secondary hazard.

5.5.1.3 Location, Extent, Impact, and Probability of Future Events

Location

Unalaska has and relies upon modern infrastructure. Transportation and utility systems are the basis of everyday life in rural areas of Alaska.

The City has identified critical system networks and links which may experience critical failure from these technological hazards. To that end, the City has stated that they have or are working to acquire emergency generators, bury utility lines where appropriate, and ensure fuel availability for their critical infrastructure's sustainability. The City owns the electric utility who considers mitigating power line failure projects, developing plans for fuel distribution, and water-waste treatment alternatives.

Extent

The extent of transportation or utility service disruptions directly depends on the nature and magnitude of a hazard's impacts. Minor hazard events may cause minor disruptions, while significant hazard events may cause long-term transportation and utility failures.

Impact

The intensity, location, topography, and the age of an infrastructure all influence damages experienced. For example, earthquakes, floods, hurricane force winds, rain, and snow in and of themselves may not adversely affect a critical facility. However, combine any of these events in any combination could create catastrophic impacts. Compounded hazard impacts would potentially cripple the City's response capabilities.

These impacts can range from inconvenience – a few days with no transportation capability; to disastrous – heavy, debilitating damages with no capability to communicate their plight beyond Unalaska Island.

Utility functionality would directly determine the rapidity for response, construction, and repairs because communication and computer systems, and emergency response equipment is essential for modern operational capability.

The City's transportation or utility system malfunctions would be hamper, even close down operations completely, stopping the flow of supplies and disrupting emergency and medical services. Accumulations of snow or ash can cause roof collapse and other hazard impacts could further impact recovery processes.

Probability of Future Events

Inclement weather, topography, and human influence are the usual cause for transportation and utility system failure events. Increased usage (portrayed by heavy traffic periods or increased utility needs such as winter heating) can exacerbate or accelerate these systems' failure rate. Consequently, Unalaska may periodically experience episodic utility failure.

This section outlines the vulnerability process for determining potential losses for the community from various hazard impacts.

6.1 VULNERABILITY ANALYSIS OVERVIEW

A vulnerability analysis predicts the extent of exposure that may result from a hazard event of a given intensity in a given area. The analysis provides quantitative data that may be used to identify and prioritize potential mitigation measures by allowing communities to focus attention on areas with the greatest risk of damage. A vulnerability analysis is divided into eight steps:

1. Asset Inventory
2. Exposure Analysis For Current Assets
3. Repetitive Loss Properties
4. Land Use and Development Trends
5. Vulnerability Analysis Methodology
6. Data Limitations
7. Vulnerability Exposure Analysis
8. Future Development

This section provides an overview of the vulnerability analysis for current assets, and area future development initiatives.

DMA 2000 Recommendations
Assessing Risk and Vulnerability, and Analyzing Development Trends §201.6(c)(2)(ii): The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. *All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods.* 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 … 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. §201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.
1. REGULATION CHECKLIST
ELEMENT B. Risk Assessment, Assessing Vulnerability, Analyzing Development Trends
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))
B4. Does the Plan address NFIP insured structures within each jurisdiction that have been repetitively damaged by floods?
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))
Source: FEMA, October 2011.

The requirements for a vulnerability analysis as stipulated in DMA 2000 and its implementing regulations are described here.

- A summary of the community's vulnerability to each hazard that addresses the impact of each hazard on the community.
- Identification of the types and numbers of RL properties in the identified hazard areas.
- An identification of the types and numbers of existing vulnerable buildings, infrastructure, and critical facilities and, if possible, the types and numbers of vulnerable future development.
- Estimate of potential dollar losses to vulnerable structures and the methodology used to prepare the estimate.

Table 6-1 lists the City of Unalaska infrastructures' hazard vulnerability.

Table 6-1 Vulnerability Overview

Hazard	Area's Hazard Vulnerability			
	Percent of Jurisdiction's Geographic Area	Percent of Population	Percent of Building Stock	Percent of Critical Facilities and Utilities
Earthquake	100	100	100	100
Erosion	< 10	~ 10	< 10	< 5
Flood	< 10	~ 10	< 10	< 5
Ground Failure	< 5	< 5	< 5	< 5
Tsunami/Seiche	< 5	< 5	< 5	< 5
Volcano	100	100	100	100
Weather	100	100	100	100

6.2 LAND USE AND DEVELOPMENT TRENDS

6.2.1 Land Use

The Unalaska Comprehensive Plan 2020 describers their land use capability as:

> *"Since most of the available land area in Unalaska suitable for the development of business and industry is owned by the Ounalashka Corporation, it will always be essential to involve that organization in striving to meet the growing demand for appropriate land area to accommodate the needs of local businesses and industries…*
>
> *Owners of appropriate land area in Unalaska, including OC and others, should be supported and encouraged in their efforts to make available land for the future development needs of businesses and industry." (UCP 2020a).*

The City of Unalaska has completed several plans to ensure the adequate maintenance and supply of the City's drinking water. These plans as listed in their Comprehensive Plan 2020 include:

The Unalaska Water System Master Plan was prepared in 2004 by HDR Alaska, Inc. which describes the City's future goals and accomplishments;

- City of Unalaska National Pollutant Discharge Elimination System
    - Quality Assurance Plan, prepared in 2004 by CH2MHILL, and updated in 2009 by City staff;
    - City of Unalaska Water Treatment Public Water System PWS Wellhead Protection Management Plan, prepared in 2005 by City staff, and updated in 2009;
    - City of Unalaska Icy Creek Reservoir Dam Emergency Action Plan Standard Operating Procedures, prepared in 2005 by City staff, and updated in 2008;
- City of Unalaska Water Treatment Plant Phase I Analysis Design
    - Recommendations Report, prepared by HDR in 2008; and Cost of Service/Rate Design Study Water Utility, City of Unalaska, prepared in 2009 by the Financial Engineering Company.
    - (HDR

Their UCP 2020 further defines existing land use as:

> ***Description of Existing Land Uses***
>
> *As noted by the existing Land Use Maps presented on the following … pages, land in Unalaska is currently used for a multitude of purposes. Please note that the first Land Use Map presents land uses for the entire City. The second Land Use Map presents an enlarged view of land uses in the most developed parts of the City to enable better viewing within this Comprehensive Plan.*
>
> *The classifications of land uses include the following. The classifications are the same as those used in the City's Zoning Ordinance in order to present consistent definitions for both land uses and zoning classifications.*
>
> - *Communication & Utility Towers Overlay District (CUTOD) – The Communication and Utility Towers Overlay District is a special land use classification area that contains communication towers and public utility towers that enhance the safety and welfare of the community.*
> - *General Commercial – General Commercial land uses include, primarily, general retail sales, service, and repair activities. This land use classification also includes professional offices, certain commercial/lighter industrial and warehousing offices, and structures that are not dependent on direct access to a waterbody.*
> - *Single-Family/Duplex Residential – Single-Family/Duplex Residential land uses include one- and two-family residential dwellings, served with public sewer and water.*
> - *Moderate Density Residential – Moderate-Density Residential land uses include intermediate density multi-family residential dwellings with up to four residential dwelling units per lot, served with public sewer and water.*

- *<u>High-Density Residential</u> – High-Density Residential land uses include single-, two-, and multiple-family dwelling units, served with public sewer and water.*
- *<u>Marine-Dependent Industrial</u> – Marine-Dependent/Industrial land uses include those land uses and structures whose primary purposes require direct access to a water body and/or can be carried out on, in, or adjacent to a water body only.*

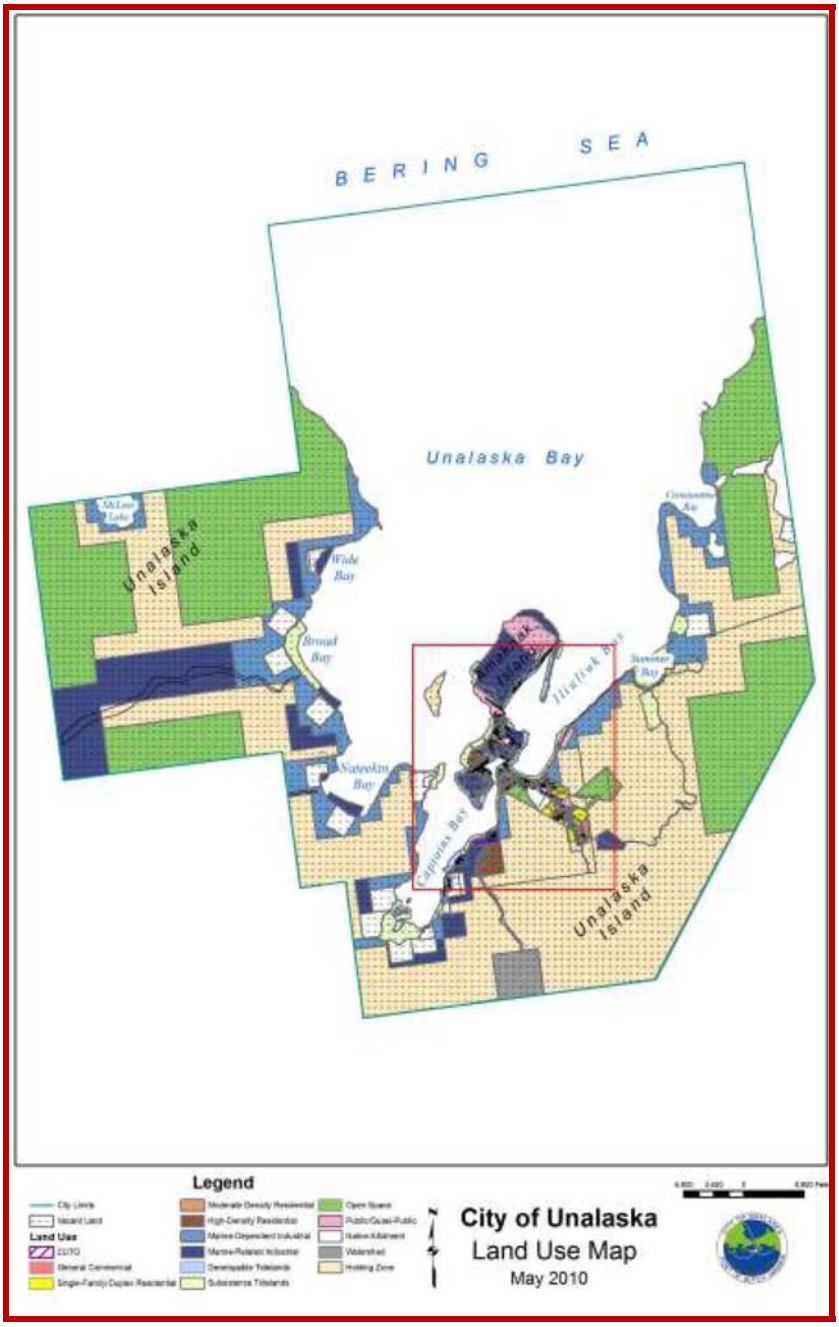


Figure 6-1 **Unalaska Area Land Use Map 1** (UCP 2020a)

- *Marine-Related Industrial – Marine-Related/Industrial land uses include those industrial land uses and structures that are not dependent on direct access to a water body.*
- *Developable Tidelands – Developable Tidelands land uses include tide and submerged lands that have been identified as developable subject to guidelines and restrictions.*
- *Subsistence Tidelands – Subsistence, as defined in Title 8, Section 803, of the 1980 Alaska National Interest Lands Conservation Act, "is the customary and traditional uses by rural Alaska residents of wild renewable resources for direct personal or family consumption, as food, shelter, fuel, clothing, tools, or transportation…for barter or sharing for personal or family consumption and for customary trade."*

  The Subsistence Tidelands land uses include tide and submerged lands that have been identified as important to fish and wildlife habitats, recreation and personal use subsistence activities, and water quality and circulation characteristics
- *Open Space – Open-Space land uses include the community's scenic resources, parks, recreation, and subsistence activities.*
- *Public/Quasi-Public – Public/Quasi-Public land uses include public and quasi-public educational, recreational, health, utility, administrative, and institutional land uses and structures.*
- *Native Allotment – Native Allotment land uses include land that has been conveyed to individual Alaskan Natives under the Native Allotment Act of 1906, 34 Stat. 197, as amended.*
- *Watershed – Watershed land uses include potable water reserves available to the city.*
- *Holding – Land uses classified as Holding are those lands within the City of Unalaska that are suitable and intended for future development but for which the landowner has no proposed land use plans. The Holding areas are not intended to prohibit future development, but to provide both the City and the landowner flexibility in determining the future use of those lands.*

The UCP describes the Ounalashka Corporate land holdings throughout Unalaska Island,

> *"Since most of the available land area in Unalaska suitable for the development of business and industry is owned by the Ounalashka Corporation, it will always be essential to involve that organization in striving to meet the growing demand for appropriate land area to accommodate the needs of local businesses and industries.*
>
> *Formed in 1973 under the Alaska Native Claims Settlement Act, the Ounalashka Corporation (OC) is the Native village corporation of Unalaska, Alaska.*

As noted on OC"s Web site, OC was incorporated with an original 269 Unangan shareholders, OC's shareholder base now represents about 400 original shareholders and original shareholders' descendants. Under ANCSA, OC is entitled to 115,000 acres of land on Unalaska, Amaknak, and Sedanka Islands. To date, the US Bureau of Land Management has conveyed approximately 112,000 acres. Selection and conveyance of remaining land depends on development plans. Much of the land OC owns is undevelopable given the terrain of the islands (and current development standard), but the land within the City limits was well chosen by early leadership. Site work done during World War II set the stage for development in later years.

Ounalashka Corporation is a for-profit corporation. Its business is land leasing and development. OC is the major land owner in Unalaska. OC leases land to commercial and residential interests – some short-term and some long-term. Commercial tenants include firms in the fishing industry and firms that support it, as well as firms in international shipping, sand and gravel extraction, retail, etc. It is the Board of Directors' policy to lease only. Lease terms range from month-to-month rentals for apartments and units in Kashega Ministorage to very long-term leases of 50+ years."

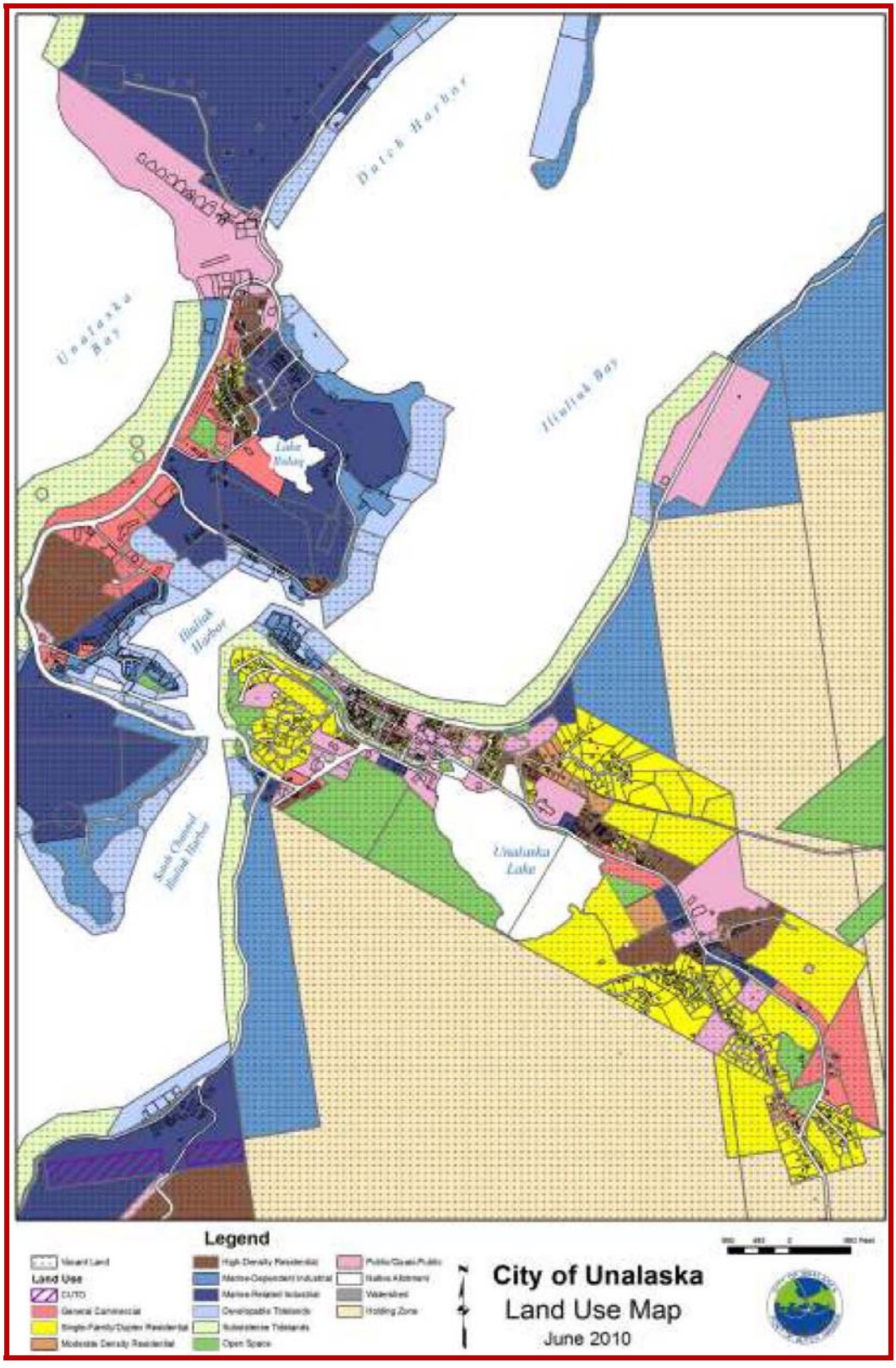


Figure 6-2 Unalaska Area Land Use Map 2 (UCP 2020a)

The UCP provides detailed "Existing Land Use Calculations" presented below in Table 6-2..

> *"The most significant finding presented in the chart is that the City of Unalaska has sufficient land area to accommodate any anticipated growth in the community for the foreseeable future, assuming that an adequate amount of the undeveloped land area is made available for development and is developable given contemporary construction limitations" (UCP 2020a).*

The Planning Team explained, *"this table includes the entire land area within the corporate boundary, only a small fraction of which is developed."*

Table 6-2 provides a general land-use breakout:

Table 6-2 Existing Land Use Break-Out

Percentage Used	Land Use Description
0.50	*Developable Tidelands*
2.13	*Subsistence Tidelands*
0.19	*General Commercial*
1.01	*Residential areas include single or duplex, moderate-density, or high-density housing*
43.47	*Holding Zone (cannot be developed unless planned and approved for specific use)*
17.58	*Marine Industrial areas include Marine – Dependent or Marine – Related Industrial*
0.99	*Watershed*
30.00	*Open Space*
1.03	*Public and Quasi Public lands*
3.11	*Restricted Deeds and Native Allotments*
100%	***Total***

(UCP 2020a)

The largest land use in the City (90.95%) is predominately classified as either a "Holding Zone" (43.47%) or as "Open Space" (30.00%) followed by industrial classifications. This leaves very little space for residential, commercial, or future development (0.5%).

6.3 VULNERABILITY EXPOSURE ANALYSIS FOR CURRENT ASSETS

6.3.1 Asset Inventory

Asset inventory is the first step of a vulnerability analysis. Assets that may be affected by hazard events include population (for community-wide hazards), residential buildings (where data is available), and critical facilities and infrastructure. The critical facility and infrastructure assets and associated values throughout the City of Unalaska are addressed in Section 6.3.1.3. and Appendices E and F.

6.3.1.1 Population and Building Stock

Population data for the City were obtained from the 2010 U.S. Census and the DCRA. The US Census reports the City's total population for 2010 as 4,376 and 2012 Unalaska data reported a population of 4,768 (Table 6-3).

Table 6-3 Estimated Population and Building Inventory

Population		Residential Buildings	
2010 Census	DCCED 2011 Data	Total Building Count	Total Value of Buildings[1]
4,376	4,768	1,847	$567,213,700

Sources: U.S. Census 2010, and 2012 Unalaska population data. US Census listed housing value at $307,100.
[1] US Census listed housing value at $307,100.

Estimated replacement values for those structures, as shown in Table 6-2, were obtained from the 2010 U.S. Census, and 2012 DCCED/DCRA certified estimate. The City stated that a total of 1,847 single-family residential buildings were considered in this analysis along with the US Census estimated structure values.

6.3.1.2 Existing Infrastructure

The City of Unalaska has benefited from numerous funding opportunities to assist them with upgrading their infrastructure. The 1990's brought several housing construction and upgrade projects; several airport, dock, and harbor facility improvements; a new Airport Highway Channel Bridge along with landfill and baler upgrades, and the Iliuliuk Family & Health Services Clinic construction.

The years 2000 to 2010 brought a new hydro-electric project to Pyramid Creek, wastewater treatment plan upgrades, an Airport Master Plan Study, landfill leachate analysis, landfill cell development, roads rehabilitation, and a new chemical storage building,

The City's Comprehensive Development Plan states,

> *"**Electrical Production***
>
> *The City of Unalaska has been very proactive in planning and upgrading their electrical power needs for current and future requirements. In 2002 the City started design on a new 16,000 square foot Powerhouse. The New Powerhouse Project consisted of two phases. Phase I consisted of installing two new Wartsila 12V32 Generator Sets in Bay One with a total capacity of 10.4 MW. On December 17, 2010 Phase I was put into service increasing the City's electrical capacity from 7.5 MW to 13.2 MW. Phase II consists of adding 10.4 MW or more capacity in Bay 2. In 2007 the City bought a new C280 Caterpillar Generator Set with a capacity of 4.4 MW. In March of 2011, the City will proceed with the installation of the C280 Generator Set. Once this unit is installed, the City will reevaluate its electrical needs for future growth.*
>
> ***Electrical Distribution***
>
> *The City of Unalaska has also been proactive in upgrading their Electrical Distribution System. From 2007 – 2010, the City has spent approximately $250,000 per year for Electrical Distribution System upgrades. These upgrades consisted of replacing damaged or aging transformers, section cans, switch gear and underground primary and secondary lines. The City has also developed an electrical line testing procedure where six foot sections of our underground electrical lines are removed and sent in for testing and analysis which evaluates its life expectancy. This information is used by the City for planning future line replacement" (UCP 2011.)*

Table 6-4 list the City's identified "completed" infrastructure improvement projects. They provide a depiction of the community's ongoing development trends and focus toward improving aging infrastructure.

Table 6-4 Completed Projects

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
Department of Transportation and Public Facilities (DOT/PF)	2008	Funded	Chemical Storage Building - Comments: Legislative Grant	Completed	$800,000
DOT/PF	2008	Funded	Airport Environmental Analysis - Comments: Legislative Grant	Completed	$1,500,000
Division of Community and Regional Affairs (DCRA)	2007	Funded	New Landfill Cell Development - Comments: Legislative Grant	Completed	$2,000,000
Housing and Urban Development (HUD)	2006	Funded	Indian Housing Block Grant (IHBG) – Native American Housing Assistance and Self Determination Act (NAHASDA) Comments: administration, operating & construction funds: Aleutian Corporation	Completed	$2,476,319
DCRA	2006	Funded	Boat Harbor - Comments: Legislative Grant Boat Harbor	Completed	$4,000,000
HUD	2006	Funded	Indian Housing Block Grant (IHBG) - Native American Housing Assistance and Self Determination Act (NAHASDA) administration, operating & construction funds - Qawalangin	Completed	$113,006
HUD	2005	Funded	IHBG/NAHASDA: administration, operating & construction funds – Qawalangin	Completed	$125,934
HUD	2005	Funded	IHBG/NAHASDA: administration, operating & construction funds – Aleut Corporation	Completed	$2,533,416
HUD	2004	Funded	IHBG/NAHASDA: administration, operating & construction funds – Aleut Corporation	Completed	$2,351,582
HUD	2004	Funded	IHBG/NAHASDA: administration, operating & construction funds	Completed	$137,728
DOT/PF	2004	Funded	Captains Bay Road Rehabilitation - Comments: Rehabilitate 2.7 miles of Captains Bay Road between its intersection with Airport Beach Road and the entrance to the Offshore Systems, Inc. Facility. Improvements consist of rehabilitation of the road foundation and surfacing with asphalt pavement.	Completed	$200,000
Denali Commission	2004	Funded	Construction - Clinic Renovation - Comments: Local Match $611484	Project Close-out Complete	$711,484
Department of Health and Social Services (DHSS)	2004	Funded	Iliukiuk Family and Health Services Renovation and Construction - Comments: Other Funding: Denali Commission	Completed	$711,484

Table 6-4 Completed Projects

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
DCRA	2003	Funded	Economic Development Plan - Comments: Mini-Grant. Denali Commission Funding	Completed	$30,000
Department of Environmental Conservation/ Municipal Grants and Loans (DEC/MGL)	2003	Funded	*Unidentified project*	Completed	$445,042
Federal Aviation Administration (FAA)	2003	Funded	Airport Rescue & Fire Fighting Vehicle - Comments: OTHER FUNDING: DOT/PF	Completed	$679,650
DCRA	2003	Funded	Community Park Development - Comments: Capital Matching	Completed	$143,125
Department of Environmental Conservation/Municipal Grants and Loans (DEC/MGL)	2003	Funded	Leachate Collection and Treatment Analysis - Comments: DEC/MGL $49,000. The analysis of the City's leachate collection and treatment will enable the City to determine how to best collect and treat the leachate generated from the City landfill.	Completed	$49,000
FAA	2003	Funded	Conduct Environmental Study - Comments: OTHER FUNDING: DOT/PF	Completed	$751,870
HUD	2003	Funded	IHBG/NAHASDA: administration, operating & construction funds	Completed	$73,439
DCRA	2003	Funded	Operation of Emergency Shelter	Completed	$344,593
DCRA	2002	Funded	Iliuliuk Family Clinic Facility Repairs - Comments: Opilio Crab Disaster	Completed	$113,838
DCRA	2002	Funded	Visitor Center Exhibits - Comments: Opilio Crab Disaster	Completed	$52,555
HUD	2002	Funded	IHBG/NAHASDA: administration, operating & construction funds: For communities in the Region	Completed	$2,196,673
HUD	2002	Funded	IHBG/NAHASDA: administration, operating & construction funds	Completed	$59,441
DCRA	2002	Funded	Power Integration - Comments: Opilio Crab Disaster	Completed	$250,000
United States Army Corps of Engineers (USACE)	2002	Funded	Harbor & Navigation Improvements/Construction Ph 1 - Comments: Expand Marine Center dock by 500 feet	Completed	$7,500,000
DCRA	2002	Funded	Community Park Development - Comments: Capital Matching	Completed	$140,283
DCRA	2002	Funded	UMC City Dock Facility/Fill-Bridge - Comments: Opilio Crab Disaster	Completed	$200,000
FAA	2001	Funded	Expand Apron - Comments: OTHER FUNDING: DOT/PF	Completed	$1,147,500
DOT/PF	2001	Funded	Airport Safety Improvements	Completed	$3,700,000
HUD	2001	Funded	IHBG/NAHASDA: administration, operating & construction funds: For communities in the Region – (not yet allocated) -	Completed	$2,675,460

Table 6-4 Completed Projects

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
DOT/PF	2001	Funded	Airport Snow Removal Equipment	Completed	$170,000
FAA	2001	Funded	Improve Runway Safety Area - Comments: OTHER FUNDING: DOT/PF.	Completed	$2,235,870
DCRA	2001	Funded	Community Park - Comments: Capital Matching Community Park	Completed	$141,267
FAA	2000	Funded	Conduct Airport Master Plan Study - Comments: OTHER FUNDING: DOT/PF	Completed	$331,890
HUD	2000	Funded	IHBG/NAHASDA: administration, operating & construction funds – Qawalangin	Completed	$58,649
HUD	2000	Funded	IHBG/NAHASDA: administration, operating & construction funds – Aleut Corporation	Completed	$2,248,398
Alaska Energy Authority / Alternative Energy and Energy Efficiency (AEA/AEEE)	2000	Funded	Hydroelectric project (Pyramid Creek) - Comments: OTHER FUNDING: US DOE $1 million. Initiate permitting and engineering activities for the proposed Pyramid Creek Hydroelectric Project near Unalaska; authorize construction of the project. Federal and state grant agreements are in place. The City of Unalaska will issue a request for proposals (RFP) for the work. Permitting is underway. FERC recently issued an order finding that the project did not require a license. Environmental assessment is on-going.	Construction	$11,822,026
AEA/AEEE	2000	Funded	Unalaska Fish Oil-Assessment of fish and other bio-waste - Comments: OTHER FUNDING: Other funding sources are federal grants. Test of performance and air emissions from various blends of fish oil and diesel in a 2.2 MW Fairbanks Morse diesel generator at Unisea Inc. in Unalaska. Successful air emissions tests were performed 10/01. Over 50,000 gallons of fish oil used with no apparent engine impact and decreased air emissions. Follow-up work planned for CAT or other more common engine generator sets.	Completed	$25,395
DEC/MGL	2000	Funded	Wastewater Treatment Plant Upgrade - East Broadway Sewer - Comments: OTHER FUNDING: AHFC $63,400. Design, construction and inspection of 3,350lf of DIP, 10-manholes, 10-sewer service connections.	Completed	$695,100
DCRA	2000	Funded	Pathway Development, Phase VI - Comments: Capital Matching	Completed	$147,149
Alaska Housing Finance Corporation (AHFC)	1999	Funded	Tradewinds Apartments - Comments: Construction Dept. - 16 Units Funded with Home and Tax Credits	Completed	$3,296,515
HUD	1999	Funded	IHBG/NAHASDA: administration, operating & construction funds – Aleut Corporation	Completed	$2,248,398

Table 6-4 Completed Projects

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
HUD	1999	Funded	IHBG/NAHASDA: administration, operating & construction funds – Qawalangin	Completed	$58,649
DCRA	1999	Funded	Pathway Development, Phase IV - Comments: Capital Matching Pathway Development, Phase IV	Completed	$138,431
USACE	1999	Funded	Harbor & Navigation Improvements/Feasibility - Comments: Feasibility to be complete in March 2004	Completed	$300,000
DEC/MGL	1999	Funded	Wastewater Treatment Plant Upgrade - Comments: Design & construct ultraviolet treatment in new sewage plant. Local priority, from 1997 United States Department Of Agriculture/Rural Development (USDA/RD) survey of villages	Completed	$3,412,000
Bureau of Indian Affairs (BIA)	1999	Funded	Grade & Drain Ulatka Drive - Comments: 2.13 km	Completed	$2,500,000
HUD/AHFC	1998	Funded	Construct 15 Mutual Help Units, Tradewinds Project - Comments: HUD 1937 Act (Indian Housing)	Completed	$2,707,813
HUD	1998	Funded	IHBG/NAHASDA: administration, operating & construction funds – Aleut Corporation	Completed	$2,046,749
HUD	1998	Funded	IHBG/NAHASDA: administration, operating & construction funds – Qawalangin	Completed	$66,058
DEC/MGL	1998	Funded	Landfill & Baler, Ph IV - Comments: Complete landfill cells to extend life of landfill by 10 years, connect leachate collection system. Balefill now being used. Local priority, from 1997 USDA/RD survey of villages	Completed	$7,074,536
DCRA	1998	Funded	Community Facilities and Equipment - Comments: Capital Matching	Completed	$63,832
DCRA	1998	Funded	Pathway Development, Phase III - Comments: Capital Matching	Completed	$138,535
DOT/PF	1997	Funded	*Unidentified project*	Completed	$1,100,000
FAA	1997	Funded	Rehabilitate Apron - Comments: OTHER FUNDING: DOT/PF	Completed	$1,010,932
HUD/Comprehensive Grant Program (CGP)	1997	Funded	Housing Modernization - Comments: Entry doors, repair roofs	Completed	$51,500
FAA	1997	Funded	Improve Snow Removal Equipment Building - Comments: OTHER FUNDING: DOT/PF	Completed	$1,174,860
FAA	1997	Funded	Rehabilitate Taxiway - Comments: OTHER FUNDING: DOT/PF	Completed	$53,125
DEC/MGL	1997	Funded	Landfill & Baler, Ph III - Comments: Est. completion 10/98	Completed	$7,350,000
DCRA	1997	Funded	Pedestrian Trail, Ph IV - Comments: Capital Matching	Completed	$139,099
FAA	1997	Funded	Expand Apron - Comments: OTHER	Completed	$106,250

Table 6-4 Completed Projects

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
			FUNDING: DOT/PF		
DEC/MGL	1996	Funded	Landfill & Baler, Ph II - Comments: Construct baler and 6-acre landfill within existing Summer Bay landfill tract	Completed	$7,350,000
DCRA	1996	Funded	Pedestrian Trail, Ph III - Comments: Capital Matching	Completed	$220,034
DOT/PF	1995	Funded	*Unidentified project*	Completed	$70,000
HUD/CGP	1995	Funded	Housing Modernization - Comments: Chimney caps, entry doors	Completed	$17,501
DEC/MGL	1995	Funded	Landfill & Baler, Ph I - Comments: Construct baler and 6-acre landfill within existing Sumner Bay landfill tract	Completed	$7,350,000
DCRA	1995	Funded	Pedestrian Trail, Ph II Design - Comments: Capital Matching	Completed	$214,952
FAA	1995	Funded	Rehabilitate Runway - Comments: OTHER FUNDING: DOT/PF	Completed	$637,500
FAA	1995	Funded	Improve Runway Safety Area - Comments: OTHER FUNDING: DOT/PF	Completed	$5,435,802
USACE	1995	Funded	Harbor & Navigation Improvements/Reconnaissance	Completed	$620,000
HUD/CGP	1994	Funded	Housing Modernization - Comments: Flooring, electrical, sub. rehab., handicapped retrofit	Completed	$79,090
DOT/PF	1994	Funded	Airport Contaminated Site Assessment	Completed	$92,000
AEA	1994	Funded	Waste Heat Finance	Completed	$179,712
DCRA	1994	Funded	Trails Development Ph I - Comments: Capital Matching Trails Development Ph I	Completed	$197,445
HUD/CGP	1994	Funded	Housing Modernization - Comments: Heating systems	Completed	$112,916
HUD/AHFC	1994	Funded	Construct 7 Low Rent Housing Units	Completed	$680,615
DOT/PF	1994	Funded	Airport Storm Armor Replacement Ph I	Completed	$2,226,000
DOT/PF	1994	Funded	Airport Storm Armor Replacement Ph II	Completed	$3,264,668
DEC/MGL	1994	Funded	Icy Creek Dam Design & Construction	Completed	$2,850,000
DOT/PF	1994	Funded	South Channel Bridge Pedestrian Walkway Construction	Completed	$341,100
DOT/PF	1994	Funded	Airport Highway Channel Bridge	Completed	$379,042
DOT/PF	1994	Funded	New Small Boat Harbor - Comments: Moorage for 150 small vessels. Project was converted to a Corps of Engineers Program. Final project report due 12/31/2001. Federal share is $9,140,000.	Completed	$19,140,000
DCRA	1993	Funded	Historical Building Improvements - Comments: Legislative Grant	Completed	$80,000
DOT/PF	1993	Funded	Historical Building Improvements - Comments: Legislative Grant	Completed	$100,000

Table 6-4 Completed Projects

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
AEA	1993	Funded	Geothermal Project - Comments: A $558,000 feasibility study analysis and finance plan has been completed. OESI is selling their geothermal leases to Oremat Nevada, which has slowed the progress on the project	Completed	$19,200
DOT/PF	1993	Funded	Small Boat Harbor	Completed	$60,000
Alaska Industrial Development and Export Authority (AIDEA)	1993	Funded	Ballyhoo Dock - Comments: Private investment by Sea Land Services and Petro Marine Services. Extend the public dock by 730 ft and install a crane rail system. The City operates the facility as a public dock, leased from AIDEA, and will obtain title to it once AIDEA is repaid	Completed	$14,500,000
DCRA	1993	Funded	Iliuliuk Medical Center Construction - Comments: Legislative Grant	Completed	$1,000,000
DOT/PF	1993	Funded	Airport Highway Reconstruction - Comments: Rehabilitate and repair including pedestrian facilities on south Channel Bridge. Construction Summer 94 and 95	Completed	$428,330
FAA	1992	Funded	Extend Runway - Comments: OTHER FUNDING: DOT/PF	Completed	$3,048,582
FAA	1992	Funded	Improve Airport Drainage - Comments: OTHER FUNDING: DOT/PF	Completed	$85,431
FAA	1992	Funded	Install Guidance Signs - Comments: OTHER FUNDING: DOT/PF	Completed	$58,438
FAA	1992	Funded	Acquire Security Equipment - Comments: OTHER FUNDING: DOT/PF	Completed	$638,456
AEA	1992	Funded	Geothermal Project/Financing Negotiations - Comments: Negotiate contractual agreements, financing agreements and construction of a geothermal power plant on Makushin volcano to serve fish processors. RSA to AIDEA Geothermal Project/Financing Negotiations	Completed	$247,200
DOT/PF	1992	Funded	Small Boat Harbor	Completed	$180,000
DEC/MGL	1992	Funded	Water Improvements	Completed	$3,500,000
HUD/AHFC	1992	Funded	Construct 15 Low Rent Housing Units	Completed	$2,227,244

(DCRA 2012)

6.3.1.3 Existing Critical Facilities

A critical facility is defined as a facility that provides essential products and services to the general public, such as preserving the quality of life in the City and fulfilling important public safety, emergency response, and disaster recovery functions. The critical facilities profiled in this plan include the following:

- Government facilities, such as city and tribal administrative offices, departments, or agencies
- Emergency response facilities, including police department and firefighting equipment
- Educational facilities, including K-12
- Care facilities, such as medical clinics, congregate living health, residential and continuing care, and retirement facilities
- Community gathering places, such as community and youth centers
- Utilities, such as electric generation, communications, water and waste water treatment, sewage lagoons, landfills.

Note: *The Critical Facilities list is provided as Appendix D, Table D-1. However, this information is not available to the general public. Contact the City of Unalaska, Director of Public Safety if you have a valid need to access this information.*

Figures 6-3, 6-4, and 6-5 depict the City's road system and infrastructure locations.

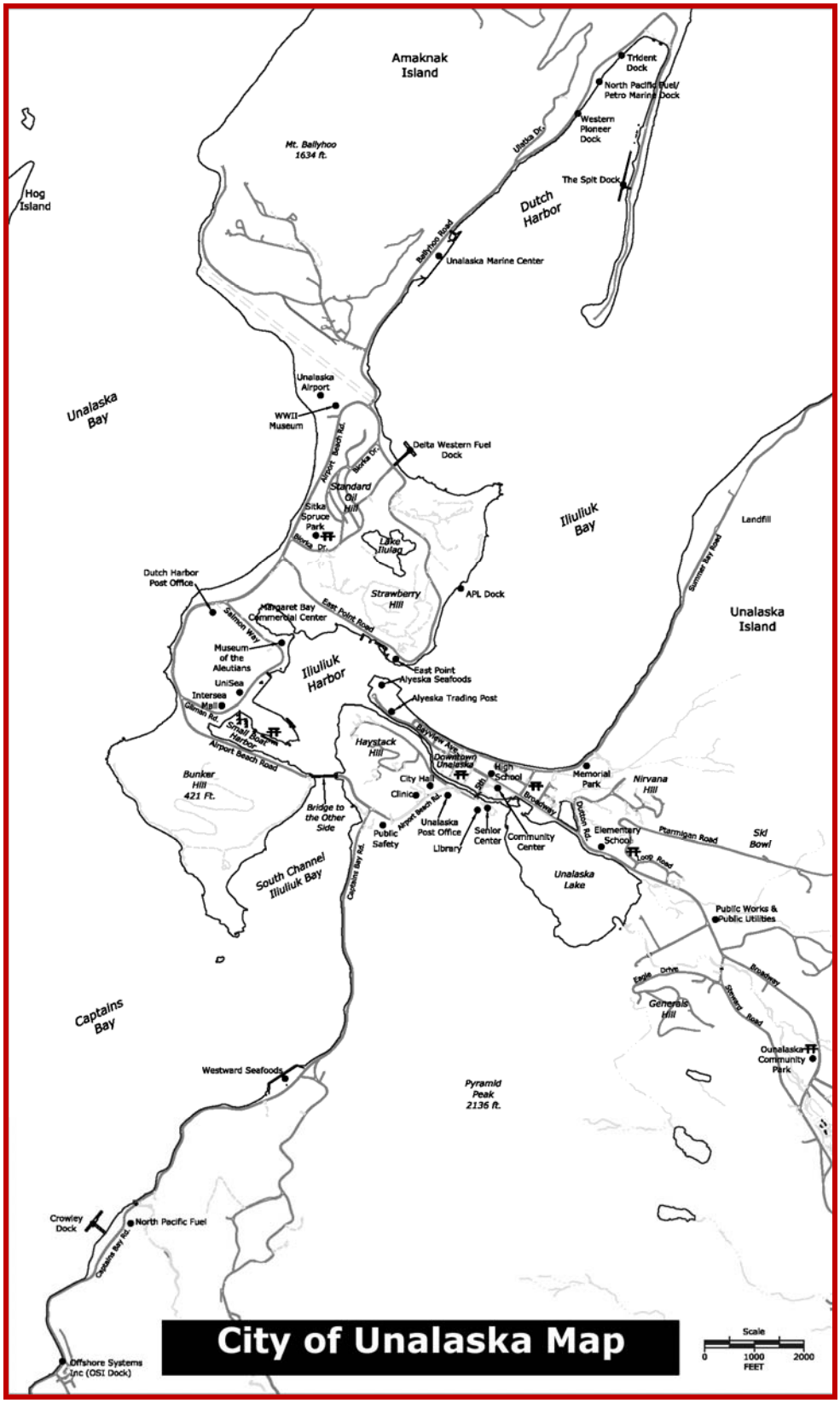

Amaknak Island
Trident Dock
North Pacific Fuel/ Petro Marine Dock
Western Pioneer Dock
The Spit Dock
Mt. Ballyhoo 1634 ft.
Hog Island
Dutch Harbor
Ballyhoo Road
Unalaska Marine Center
Unalaska Airport
WWII Museum
Unalaska Bay
Delta Western Fuel Dock
Standard Oil Hill
Sitka Spruce Park
Iliuliuk Bay
Landfill
Lake Iliuliuk
Dutch Harbor Post Office
Strawberry Hill
APL Dock
Margaret Bay Memorial Center
East Point Road
Unalaska Island
Museum of the Aleutians
Iliuliuk Harbor
East Point Alyeska Seafoods
UniSea
Intersea Mall
Alyeska Trading Post
Small Boat Harbor
Airport Beach Road
Haystack Hill
Bayview Ave.
Downtown Unalaska
High School
Memorial Park
Nirvana Hill
Bunker Hill 421 Ft.
City Hall
Clinics
Bridge to the Other Side
Airport Beach Rd.
Broadway
Public Safety
Unalaska Post Office
Library
Senior Center
Community Center
Elementary School
Ptarmigan Road
Ski Bowl
South Channel Iliuliuk Bay
Captains Bay Rd.
Unalaska Lake
Public Works & Public Utilities
Eagle Drive
Generals Hill
Captains Bay
Westward Seafoods
Pyramid Peak 2136 ft.
Unalaska Community Park
Crowley Dock
North Pacific Fuel
Offshore Systems Inc (OSI Dock)
City of Unalaska Map
Scale
0
1000
2000
FEET

Figure 6-3 City of Unalaska Map 1 (Unalaska 2009)

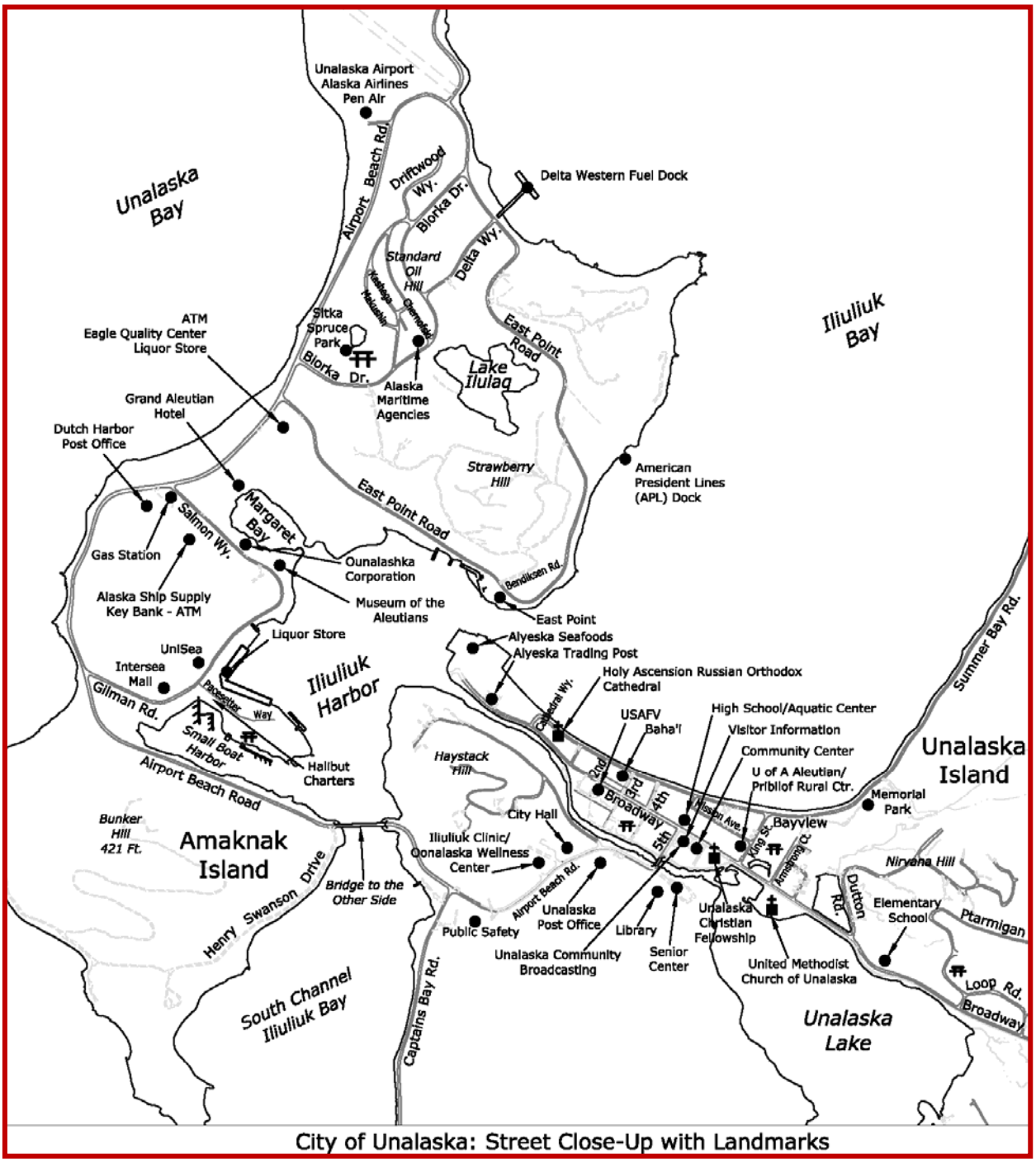


Figure 6-4 City of Unalaska Map 2 (Unalaska 2009)

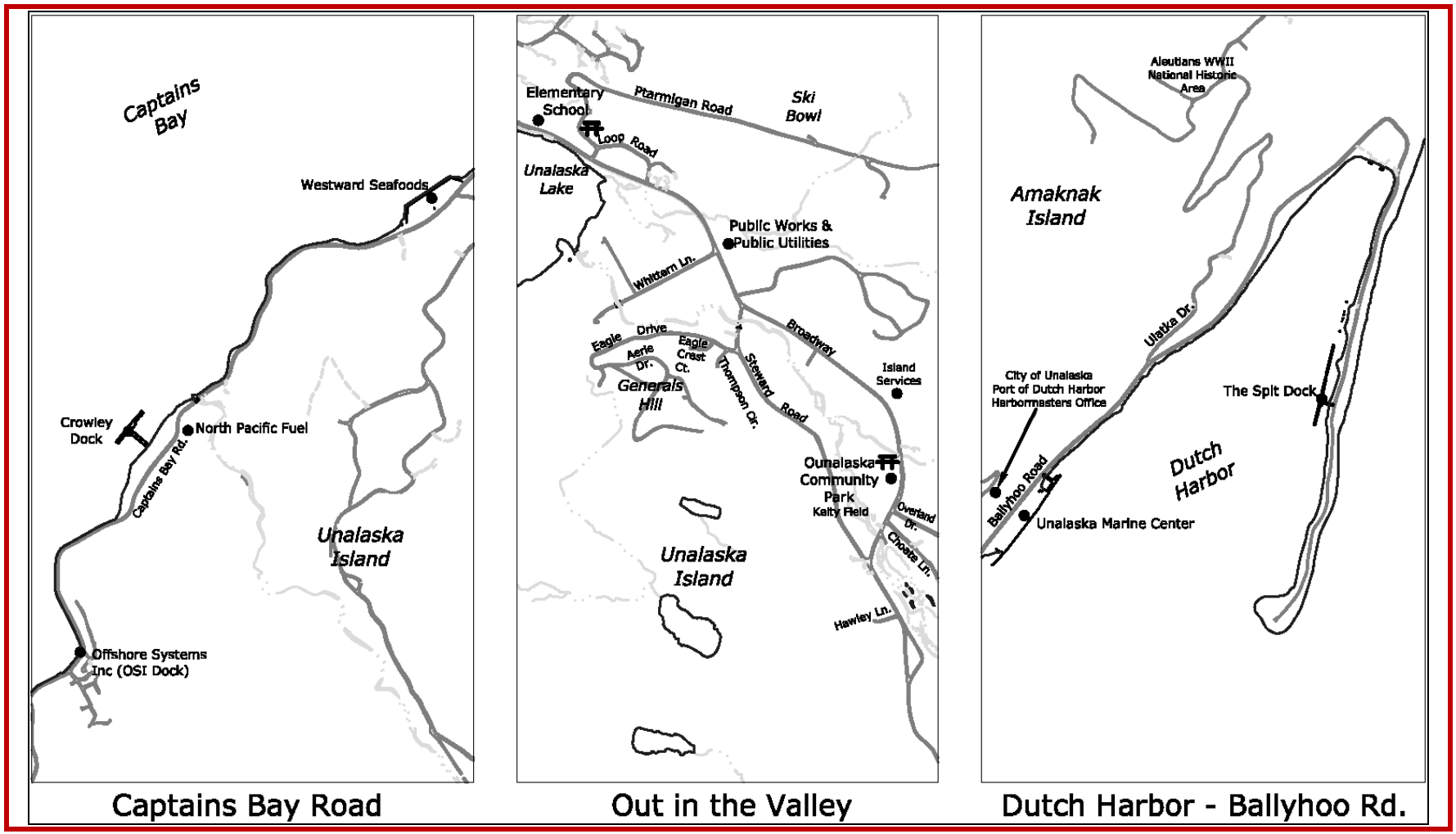


Figure 6-5 **City of Unalaska Map 3** (Unalaska 2009)

6.4 REPETITIVE LOSS PROPERTIES

This section estimates the number and type of structures at risk to repetitive flooding. (Properties which have experienced RL and the extent of flood depth and damage potential.)

DMA 2000 Requirements
Addressing Risk and Vulnerability to NFIP Insured Structures §201.6(c)(2)(ii): The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. *All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods.* The plan should describe vulnerability in terms of: §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of] the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas; §201.6(c)(2)(ii)(B): The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate; §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. §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.
1. REGULATION CHECKLIST
ELEMENT B. NFIP Insured Structures
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods?
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate?
Source: FEMA, October 2011.

6.4.1 NFIP Participation

The City of Unalaska does not participate in the NFIP neither do they have a repetitive flood property inventory that meets NFIP criteria as the loss thresholds are substantially below FEMA values.

6.5 VULNERABILITY ANALYSIS METHODOLOGY

A conservative exposure-level analysis was conducted to assess the risks of the identified hazards. This analysis is a simplified assessment of the potential effects of the hazards on values at risk without considering probability or damage levels.

The methodology used a two pronged effort. First, The City of Unalaska provided a copy of their extensive GIS database and raster images. This information allowed the Planning Team to identify and locate critical facilities and infrastructure relevant to each facility's hazard threat exposure and vulnerability. Second this data was used to develop a vulnerability assessment for those hazards where GIS based hazard mapping information was available.

Replacement structure values were developed for physical assets. These value estimates were provided by the Planning Team. For each physical asset located within a hazard area, exposure

was calculated by assuming the worst-case scenario (that is, the asset would be completely destroyed and would have to be replaced). Finally, the aggregate exposure, in terms of replacement value, for each category of structure or facility was estimated. A similar analysis was used to evaluate the proportion of the population at risk. However, the analysis simply represents the number of people at risk; no estimate of the number of potential injuries or deaths was prepared.

6.6 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, critical facilities, and infrastructure to the identified hazards. It was beyond the scope of this HMP to develop a more detailed or comprehensive risk assessment (including annualized losses, people injured or killed, shelter requirements, loss of facility/system function, and economic losses). Such impacts may be addressed with future HMP updates.

6.7 VULNERABILITY EXPOSURE ANALYSIS

The City of Unalaska provided extensive area wide GIS data which formed the basis for the City's critical facility hazard exposure analysis. Tables 6-5 and Table 6-6 tabulates potential loss estimation data. Section 6.7.1 Exposure Analysis – Hazard Narrative Summaries provides an explanatory description of the tabulated exposure analysis.

Appendix D contains a detailed critical facility list that was used to develop the City's Vulnerability Exposure Analysis as summarized in Tables 6-5 and 6-6.

Appendix E provides figures (maps) that depict colored hazard impact areas. The various color codes define the extent of the impact area. Critical facilities are depicted as point locations within the City; and subsequently indicate their relative location within an identified potential hazard impacted area.

Table 6-5 Potential Hazard Exposure Analysis – Critical Facilities

			Government		Emergency Response		Educational		Medical		Community	
Hazard Type	**Hazard Area**	**Methodology**	*** #Bldgs/ # Occ**	**Value ($)**	*** #Bldgs/ # Occ**	**Value ($)**	*** #Bldgs / # Occ**	**Value ($)**	*** #Bldgs / # Occ**	**Value ($)**	*** #Bldgs/ # Occ**	**Value ($)**
Earthquake	Severe	>40-60% (g)	6/125	9,398,090	4/25	15,622,599	6/504	29,144,500	3/80	7,016,000	19/>560	>89,491,995
Erosion	--	Within 300 ft of erosion areas	3/95	6,759,180	--	--	--	--	--	--	--	--
Flood	--	Descriptive	3/65	1,739,080	--	--	--	--	--	--	--	--
Ground Failure	Moderate	>14-32 degrees	--	--	--	--	--	--	--	--	--	--
	High	>32-56 degrees	2/45	1,259,780	--	--	--	--	--	--	6/Unknown	> 1,547,100
Tsunami	Inundation Elevation	Low (100 ft)	6/120	9,398,090	3/25	4,822,599	6/482	28,579,600	3/80	7,016,000	14/380	70,431,575
		Moderate (50 ft)	6/120	9,398,090	2/10	668,669	6/482	28,579,600	1/40	1,709,400	14/380	70,431,575
		High (30 ft)	5/70	3,898,690	2/10	668,669	6/482	28,579,600	1/40	1,709,400	14/380	70,431,575
Volcanic	--	Descriptive	6/125	9,398,090	4/25	15,622,599	6/504	29,144,500	3/80	7,016,000	19/>560	>89,491,995
Weather, Severe	--	Descriptive	6/125	9,398,090	4/25	15,622,599	6/504	29,144,500	3/80	7,016,000	19/>560	>89,491,995

Table 6-6 Potential Hazard Exposure Analysis – Critical Infrastructure

			Highway		Bridges		Transportation Facilities		Utilities	
Hazard Type	**Hazard Area**	**Methodology**	**Miles**	**Value ($)**	**No.**	**Value ($)**	*** #Bldgs/ # Occ**	**Value ($)**	*** #Bldgs/ # Occ**	**Value ($)**
Earthquake	Severe	>40-60% (g)	41	3,813,330	4	41,846,933	10/450	$158,237,321	11/26	100,085,000
Erosion	--	Within 300 ft of erosion areas	--	--	--	--	--	--	--	--
Flood	--	Descriptive	--	--	--	--	--	--	--	--
Ground Failure	Moderate	>14-32 degrees	--	--	--	--	--	---	--	-
	High	>32-56 degrees	.5	Unknown	--	--	--	--	--	--
Tsunami	Inundation Elevation	Low (100 ft)	Unknown	Unknown	2	30,024,907	9/410	143,737,321	3/12	7,979,807
		Moderate (50 ft)	Unknown	Unknown	2	30,024,907	9/410	143,737,321	3/12	7,979,807
		High (30 ft)	Unknown	Unknown	4	41,846,933	10/450	158,237,321	--	--
Volcanic	--	Descriptive	41	3,813,330	4	41,846,933	10/450	$158,237,321	11/26	100,085,000
Weather, Severe	--	Descriptive	41	3,813,330	4	41,846,933	10/450	$158,237,321	11/26	100,085,000

6.7.1 Exposure Analysis – Hazard Narrative Summaries

Earthquake

The City and surrounding area can expect to experience significant earthquake ground movement that may result in infrastructure damage. Intense shaking may be seen or felt based on past events. Although all structures are exposed to earthquakes, buildings within the City constructed with wood have slightly less vulnerability to the effects of earthquakes than those with masonry.

Based on earthquake probability (PGA) maps produced by the USGS, the entire City area is at risk of experiencing moderate to significant earthquake impacts as a result of its proximity along the Aleutian section of the Ring of Fire which possesses numerous volcanoes and a seismically active location.

The probability is high (see Section 5.3.1.3) that impacts to the community such as ”severe” ground movement may result in infrastructure damage and personal injury.

The entire existing, transient, and future Unalaska population, residential structures, and critical facilities are exposed to the effects of “severe” earthquake events. This includes approximately:

- 4,768 people in 1,847 residences (approximate value: $567,213,700)
- 125 people in six government facilities (approximate value: $9,398,090)
- 25 people in four emergency response facility (approximate value: $15,622,599)
- 504 people in six educational facilities (approximate value: $29,144,500)
- 80 people in three care facilities (approximate value: $7,016,000)
- >560 people in 19 community facilities (approximate value: >$89,491,995)
- 41 asphalt and gravel miles (approximate value: $3,813,330)
- four bridges (approximate value: $41,846,933)
- 450 people in ten transportation facilities (approximate value: $158,237,321)
- 26 people in 11 utilities (approximate value: $100,085,000)

Impacts to future populations, residential structures, critical facilities, and infrastructure are anticipated at the same historical impact level.

Erosion

Impacts from erosion include loss of land and any development on that land. Erosion can cause increased sedimentation of harbors and river deltas and hinder channel navigation, reduction in water quality due to high sediment loads, loss of native aquatic habitats, damage to public utilities (beaches, docks, harbors, and electric and water/wastewater utilities), and economic impacts associated with costs trying to prevent or control erosion sites. Only a building’s or facility’s location can lessen its vulnerability to erosion on Unalaska Island.

Based on local knowledge, areas within the City affected by erosion are located adjacent to the Illiuliuk River, stormwater run-off, and beach areas from storm surge damage (Section 5.3.2.3).

This includes approximately:

- 3,814 people in 185 residences (approximate value: $56,813,500)
- 95 people in three government facilities (approximate value: $6,759,180)

Impacts to future populations, residential structures, critical facilities, and infrastructure are anticipated at the same impact level.

Flood

Typical flood impacts associated with flooding is water damage to structures and contents, roadbed erosion and damage, boat strandings, areas of standing water in roadways, and damage or displacement of fuel tanks, power lines, or other infrastructure. Buildings on slab foundations, not located on raised foundations, and/or not constructed with materials designed to withstand flooding events (e.g., cross vents to allow water to pass through an open area under the main floor of a building) are more vulnerable to the impacts of flooding (see Section 5.3.3.3).

No detailed 100 year flood analysis has been prepared for the City. The USACE Floodplain Manager does not provide flood information or a 100 year floodplain map for Unalaska.

This includes approximately:

- 477 people in 1,478 residences (approximate value: $453,893,800)
- 65 people in three government facilities (approximate value: $1,739,080)

The City anticipates that impacts to future populations, residential structures, critical facilities, and infrastructure will be at the same historical impact level.

Ground Failure

Impacts associated with ground failure include surface subsidence, infrastructure, structure, and/or road damage. Buildings that are built on slab foundations and/or not constructed with materials designed to accommodate the ground movement associated with building on permafrost and other land subsidence and impacts are more vulnerable damage.

The potential ground failure impacts from avalanches, landslides, and subsidence can be widespread. Potential debris flows and landslides can impact transportation, utility systems, and water and waste treatment infrastructure along with public, private, and business structures located adjacent to steep slopes, along riverine embankments, or within alluvial fans or natural drainages. Response and recovery efforts will likely vary from minor cleanup to more extensive utility system rebuilding. Utility disruptions are usually local and terrain dependent. Damages may require reestablishing electrical, communication, and gas pipeline connections occurring from specific breakage points. Initial debris clearing from emergency routes and high traffic areas may be required. Water and wastewater utilities may need treatment to quickly improve water quality by reducing excessive water turbidity and reestablishing waste disposal capability.

USGS elevation datasets were used to determine the ground failure hazard areas within Unalaska. Risk was assigned based on slope angle. A slope angle less than 14 degrees was assigned a low risk, a slope angle between 14 and 32 degrees was assigned a medium risk, and a slope angle greater than 32 degrees was assigned a high risk.

Ground Failure hazards periodically cause structure and infrastructure displacement due to ground shifting, sinking, and upheaval. According to mapping completed by the DGGS, Unalaska has no permafrost (see Section 5.3.4.3).

There have been periodic landslides and other ground failure incidents in Unalaska.

Threatened facilities include:

- 45 people in two government facilities (approximate value: $1,259,780)
- Six community facilities (approximate value: >$1,547,100)
- 0.5 highway miles (approximate value: Unknown)

Impacts to future populations, residential structures, critical facilities, and infrastructure are anticipated at the same impact level.

Tsunami and Seiche

The UAF/GI indicates there is a minimal threat from distant source tsunamis; however they indicated there could be a two meter high tsunami coming into Unalaska Bay from an Aleutian Trench generated tsunami. UAF/GI 2012).

Potentially threatened facilities located within the **30 ft elevation**:

- 70 people in five government facilities (approximate value: $3,898,690)
- Ten people in two emergency response facilities (approximate value: $668,669)
- 482 people in six educational facilities (approximate value: $28,579,600)
- 40 people in one medical facilities (approximate value: $1,709,400)
- 380 people in 14 community facilities (approximate value: $70,431,575)
- Unknown highway facilities (approximate value: Unknown)
- Two bridges (approximate value: $30,024,907)
- 410 people in nine transportation facilities (approximate value: $143,737,321)
- 12 people in three utility facilities (approximate value: $7,979,807)

Impacts to future populations, residential structures, critical facilities, and infrastructure are unpredictable due to several complex factors, such as tsunami generating source, distance from community and originating direction of source wave.

Volcano

Impacts associated with a volcanic eruption include strain on resources should other hub communities be significantly affected by volcanic eruption. An eruption of significant size in southcentral Alaska will certainly affect air routes, which in turn affects the entire state. Other impacts include respiratory problems from airborne ash, displaced persons/ lack of shelter, and personal injury. Other potential impacts include general property damage (electronics and unprotected machinery), structural damage from ash loading, state/regional transportation interruption, loss of commerce, and contamination of water supply.

Using information provided by the Alaska Volcano Observatory, the entire existing and future Unalaska population, residences, and critical facilities are equally at risk from the effects of a volcanic eruption (see Section 5.4.5.3).

This includes approximately:

- 4,768 people in 1,847 residences (approximate value: $567,213,700)
- 125 people in six government facilities (approximate value: $9,398,090)
- 25 people in four emergency response facility (approximate value: $15,622,599)
- 504 people in six educational facilities (approximate value: $29,144,500)
- 80 people in three care facilities (approximate value: $7,016,000)
- >560 people in 19 community facilities (approximate value: >$89,491,995)
- 41 asphalt and gravel miles (approximate value: $3,813,330)
- four bridges (approximate value: $41,846,933)
- 450 people in ten transportation facilities (approximate value: $158,237,321)
- 26 people in 11 utilities (approximate value: $100,085,000)

Impacts to future populations, residential structures, critical facilities, and infrastructure are anticipated at the same impact level.

Weather (Severe)

Impacts associated with severe weather events includes roof collapse, trees and power lines falling, damage to light aircraft and sinking small boats, injury and death resulting from snow machine or vehicle accidents, 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, utility disruptions, frozen pipes, and carbon monoxide poisoning. Additional impacts may occur from secondary weather hazards or complex storms such as extreme high winds combined with freezing rain, high seas, and storm surge. Section 5.3.5.3 provides additional detail regarding severe weather impacts. 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 severe weather damage.

Based on information provided by the City of Unalaska and the National Weather Service, the entire existing, transient, and future Unalaska population, residential structures, and critical facilities are exposed to future severe weather impacts.

This includes approximately:

- 4,768 people in 1,847 residences (approximate value: $567,213,700)
- 125 people in six government facilities (approximate value: $9,398,090)
- 25 people in four emergency response facility (approximate value: $15,622,599)
- 504 people in six educational facilities (approximate value: $29,144,500)

- 80 people in three care facilities (approximate value: $7,016,000)
- >560 people in 19 community facilities (approximate value: >$89,491,995)
- 41 asphalt and gravel miles (approximate value: $3,813,330)
- four bridges (approximate value: $41,846,933)
- 450 people in ten transportation facilities (approximate value: $158,237,321)
- 26 people in 11 utilities (approximate value: $100,085,000)

Impacts to future populations, residential structures, critical facilities, and infrastructure are anticipated at the same impact level.

6.8 FUTURE DEVELOPMENT

The City's Comprehensive plan describes their Future Land Use goals as:

> ***"Future Land Uses***
>
> *As noted by the previous sections of this chapter of the Comprehensive Plan:*
>
> - *The City of Unalaska has a tremendous amount of developable, undeveloped land, as noted by the map on the following page;*
> - *An abundance of land is being held for future planning and development, land currently classified in a Holding Zone by the City's Zoning Ordinance;*
> - *The City has an established utility system, roadway system, and all other significant infrastructure to support continued growth and development of industry, general commercial, and housing;*
> - *The City has substantial plans for the continued expansion of infrastructure, and is working purposively to establish cost-effective and timely maintenance of all public facilities;*
> - *With expectations that the fishing industry will continue to grow and prosper, it appears that adequate land area is available for the continued development of needed facilities; and*
> - *While Unalaska is not without issues such as conflicting land uses, code violations, and the start of revitalization talks throughout the community, most land uses have been segregated and future development has been planned for by zoning an adequate amount of land area to reasonably accommodate the growth needs of Unalaska, without over-zoning prematurely.*
>
> *The good news from a future planning perspective is that the community has a good existing planning foundation and, rather than wholesale planning and land use changes, the community should work to correct current land use conflicts, avoid similar conflicts in the future, and work to require compliance with all local growth and development codes.*
>
> *And, as previously noted, the City of Unalaska has sufficient land area to accommodate any anticipated growth in the community for the foreseeable future, assuming that an adequate amount of the undeveloped land area is made available for development and is developable given contemporary construction limitations" (UCP 2011).*

Table 6-7 delineates Unalaska's future, planned, and funded projects and their tentative completion status.

Table 6-7 Planned and Funded Projects

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
Division of Community and Regional Affairs (DCRA)	2012	Funded	Wastewater Treatment Plant Improvements	WSSW	$4,000,000
DCRA	2011	funded	Unalaska Powerhouse Expansion Project - Comments: Legislative - Installation of a new 4.4 Mega-Watt C280 CAT engine; previous funding $40,000,000	Preliminary	$50,000,000
Department of Transportation and Public Facilities (DOT/PF)	2011	Funded	Unalaska Marine Center Berth 1 Upgrades - Comments: Berth enhancements at the Unalaska Marine Center Berth 1	Design	$7,007,800
Alaska Energy Authority / Alternative Energy and Energy Efficiency (AEA/AEEE)	2010	Funded	Unalaska Heat Recovery Construction - Comments: OTHER FUNDING: Federal	Preliminary	$1,919,807
DOT/PF	2009	Funded	Airport Environmental Analysis - Comments: Legislative Grant	Preliminary	$1,500,000
DOT/PF	2009	Funded	Unalaska Little South America (LSA) Harbor Construction - Comments: Legislative Grant	Preliminary	$1,500,000
DOT/PF	2009	Funded	Chemical Storage Building - Comments: Airport Improvement Program: Construction	Preliminary	$925,000
Department of Environmental Conservation / Village Safe Water (DEC/VSW)	2009	Funded	Wastewater Treatment Plant Upgrade and Leachate Treatment - Comments: Renewal and Replacement	Preliminary	$2,060,000
Housing and Urban Development (HUD)	2009	Funded	Indian Housing Block Grant (IHBG) - Native American Housing Assistance and Self Determination Act (NAHASDA) administration, operating & construction funds - Qawalangin	Contract	$106,460
HUD	2009	Funded	IHBG/NAHASDA: administration, operating & construction funds – Aleut Corporation	Contract	$2,291,792
Alaska Energy Authority / AEA/AEEE and AEA/ Legislative Energy Grant (LEG)	2009	Funded	Power Generation Expansion. (LEG funding source undefined)	Construction	$1,500,000
HUD	2008	Funded	IHBG/NAHASDA: administration, operating & construction funds – Qawalangin	Design	$95,505
HUD	2008	Funded	IHBG/NAHASDA: administration, operating & construction funds – Aleut Corporation	Design	$2,774,150

Table 6-7 Planned and Funded Projects

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
DCRA	2008	Funded	Unalaska Landfill Cell Design and Construction - Comments: Legislative Grant - Grants to Municipalities	Construction	$2,000,000
HUD	2007	Funded	IHBG/NAHASDA: administration, operating & construction funds – Aleut Corporation	Construction	$2,480,678
HUD	2007	Funded	IHBG/NAHASDA: administration, operating & construction funds – Qawalangin	Construction	$111,868
EDA	2006	Funded	Little South America Harbor Improvements (Utilities, Road)	Preliminary	$2,649,000
Federal Aviation Administration (FAA)	2006	Funded	Snow Removal Equipment - Comments: OTHER FUNDING: DOT/PF	Contract	$292,465
FAA	2006	Funded	Conduct Environmental Study - Comments: OTHER FUNDING: DOT/PF	Contract	$1,511,948
DOT/PF	2006	Funded	South Channel Bridge Construction	Construction	$30,024,907
FAA	2005	Funded	Conduct Airport Master Plan Study - Comments: OTHER FUNDING: DOT/PF	Contract	$526,316
US Army Corps of Engineers (USACE)	2003	Funded	Harbor & Navigation Improvements/Construction Phase 2	Preliminary	$7,500,000
DOT/PF	2002	Funded	East Point/Ballyhoo Road Rehabilitation, Phase I - Comments: Rehabilitate and pave East Point Road from Airport Beach Road to Ballyhoo Road, Ballyhoo Road from East Point Road to the Alaska Ship Supply Store, and Airport Beach Road from Ballyhoo Road to Airport Drive. Project includes foundation and drainage improvements, and a new pathway.	Design	$3,185,000
DOT/PF	2001	Funded	Airport Beach Road Pedestrian/Bicycle Pathway - Comments: Construct 2.4 miles of pathway along Airport Beach Road, between Captains Bay Rd. and Ballyhoo Road	Design	$285,000

(DCRA 2012)

This section outlines the six-step process for preparing a mitigation strategy including:

1. Identifying each jurisdiction's existing authorities for implementing mitigation action initiatives
2. NFIP Participation
3. Developing Mitigation Goals
4. Identifying Mitigation Actions
5. Evaluating Mitigation Actions
6. Implementing the Mitigation Action Plan (MAP)

DMA requirements for developing a comprehensive mitigation strategy include:

DMA 2000 Requirements
Identification and Analysis of Mitigation Actions §201.6(c)(3): [The plan shall include the following:] A *mitigation strategy* that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools. §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. §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. §201.6(c)(3)(iii): [The hazard mitigation strategy shall include an] action plan, describing how the action identified in paragraph (c)(3)(ii) of this section 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. §201.6(c)(3)(iv): [For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan. Requirement §201.6(c)(4): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvements, when appropriate.
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?
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? *(Addressed in Section 6.4)*
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards?
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?
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?
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?
Source: FEMA, October 2011.

7.1 CITY OF UNALAKSA'S CAPABILITY ASSESSMENT

The City's capability assessment reviews the technical and fiscal resources available to the community.

DMA 2000 Requirements
Incorporation into Existing Planning Mechanisms §201.6(c)(3): [The plan shall include the following:] A *mitigation strategy* that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools.
ELEMENT C. Incorporate into Other Planning Mechanisms
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?
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?
Source: FEMA, October 2011.

This section outlines the resources available to the City of Unalaska for mitigation and mitigation related funding and training. Tables 7-1, 7-2, and 7-3 delineate the City's regulatory tools, technical specialists, and financial resource available for project management. Additional funding resources are identified in Appendix A.

Table 7-1 Unalaska's Regulatory Tools

Regulatory Tools (ordinances, codes, plans)	Existing?	Comments (Year of most recent update; problems administering it, etc.)
Comprehensive Plan	Yes	Comprehensive Plan, 2020. Explains the City's land use initiatives and natural hazard impacts.
Land Use Plan	Yes	The City's Land Use plan explains the City's land use goals and initiatives.
Tribal Corporation Land Use Plan	Yes	Qawalangin Tribe of Unalaska Land Use Plan, 1999, Describes the Village's community development goals and initiatives.
Emergency Response Plan	Yes	
Wildland Fire Protection Plan	No	This hazard is not present within the surrounding area.
Building code	Yes	Title 17 Unalaska Municipal Code of Ordinances (UCO). They currently follow the International Building Code (IBC)
Zoning ordinances	Yes	Title 8.12 UCO. City Council Ordinance 2012-07 effective October 1, 2012
Subdivision ordinances or regulations	Yes	Title 8.08 UCO. City Council Ordinance 2012-07 effective October 1, 2012
Special purpose ordinances	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 have been assessed by the hazard mitigation Planning Team, and are summarized below.

Table 7-2 Unalaska's Technical Specialists for Hazard Mitigation

Staff/Personnel Resources	Y/N	Department/Agency and Position
Planner or engineer with knowledge of land development and land management practices	Yes	The City has staff with land development and land management knowledge
Engineer or professional trained in construction practices related to buildings and/or infrastructure	Yes	The City has staff with construction and building and/or infrastructure knowledge
Planner or engineer with an understanding of natural and/or human-caused hazards	Yes	Director of Planning and the Planning Administrator
Floodplain Manager	No	The City has staff with land development and land management knowledge
Surveyors	Yes	City uses consultants when a surveyor is needed. City possesses survey-grade equipment including a Total Station and two survey-grade GPS units Staff trained in use these tools are the City Engineer and Roads Chief
Staff with education or expertise to assess the jurisdiction's vulnerability to hazards	Yes	The City has staff with this knowledge
Personnel skilled in Geospatial Information System (GIS) and/or Hazards Us-Multi Hazard (Hazus-MH) software	Yes	The City has staff with this knowledge
Scientists familiar with the hazards of the jurisdiction	No	City can work with U.S. Fish & Wildlife Service (USFWS) and Fish & Game (ADF&G), the West Coast/Alaska Tsunami Warning Center (WC/ATWC), and the Alaska Volcano Observatory (AVO).
Emergency Manager	Yes	Director of Public Safety
Finance (Grant writers)	Yes	City Finance Officer
Public Information Officer	Yes	Director of Public Safety

Table 7-3 Financial Resources Available for Hazard Mitigation

Financial Resource	Accessible or Eligible to Use for Mitigation Activities
General funds	Can exercise this authority with voter approval
Community Development Block Grants	Can exercise this authority with voter approval
Capital Improvement Project Funding	Can exercise this authority with voter approval
Authority to levy taxes for specific purposes	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 available on an annual basis. This grant can only be used to fund pre-disaster mitigation

Table 7-3 Financial Resources Available for Hazard Mitigation

Financial Resource	Accessible or Eligible to Use for Mitigation Activities
	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. ***Unalaska does not qualify for this funding source because they do not participate in the NFIP.***
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 because of new development within Special Districts.

The Planning Team developed the mitigation goals and potential mitigation actions to address identified potential hazard impacts for the City of Unalaska within Section 5.3.

7.2 DEVELOPING MITIGATION GOALS

The requirements for the local hazard mitigation goals, as stipulated in DMA 2000 and its implementing regulations are described below.

DMA 2000 Requirements
Local Hazard Mitigation Goals §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 C. Mitigation Goals
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards?
Source: FEMA, October 2011.

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, eleven goals were developed to reduce or avoid long-term vulnerabilities to the identified hazards (Table 7-4).

Table 7-4 Mitigation Goals

No.	Goal Description
Multi-Hazards	
1	Promote recognition and mitigation of all natural and manmade hazards that affect the City of Unalaska (City) and Qawalangin Tribe of Unalaska (Tribe).
2	Promote cross-referencing mitigation goals and actions with other City and Tribal planning mechanisms and projects.
3	Reduce possibility of losses from all natural and manmade hazards that affect the City, Tribe, and Native Corporation.
Natural Hazards	
4	Reduce structural vulnerability to earthquake damage.
5	Reduce erosion damage and loss possibility.
6	Reduce flood damage and loss possibility.
7	Reduce ground failure damage and loss possibility.
8	Reduce tsunami impact vulnerability to population and infrastructure.
9	Reduce structural and population vulnerability to volcanic ashfall impacts.
10	Reduce structural vulnerability to severe weather damage.
Technological/Manmade Hazards	
11	Reduce population vulnerability to Utility and Transportation Disruptions.

7.3 IDENTIFYING MITIGATION ACTIONS

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

DMA 2000 Requirements
Identification and Analysis of Mitigation Actions §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.
ELEMENT C. Mitigation Actions
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?
Source: FEMA, October 2011.

After developing mitigation goals, the Planning Team reviewed a comprehensive list of potential mitigation actions that were identified during this HMP development process.

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 a mitigation plan. Mitigation actions are usually grouped into three broad categories: property protection, public education and awareness, and structural projects.

On January 18, 2013, the Planning Team selected 42 natural hazard, and one manmade / technological mitigation action for potential Mitigation Action Plan (MAP) implementation during the five-year life cycle of this HMP. The Planning Team placed particular emphasis on projects and programs that reduce the effects of hazards on both new and existing buildings and infrastructure as well as facilities located in potential flood zones to comply with NFIP requirements should the City join the NFIP.

The table breaks out the project criteria as considered, selected, ongoing, and completed. The Planning Team considered projects from a comprehensive list for each hazard type. They identified numerous "ongoing" mitigation actions currently in-process or those that were listed in other City planning documents. The Planning Team then selected "newly identified" actions identified through this plan development activity that would most benefit the community.

These 'Considered" projects are listed in Table 7-5 below.

Table 7-5 Potential Mitigation Actions

(Ongoing and newly selected items were identified for MAP implementation)

Supports Goal No.	Hazard	Criteria *Considered Selected Ongoing Completed*	Action Description
Multi- Hazards			
MH 1	Promote recognition and mitigation of all natural hazards that affect the City of Unalaska (City), Qawalangin Tribe of Unalaska (Tribe), and Ounalashka Corporation (Tribal Corp).	S High	Identify and pursue funding opportunities to implement mitigation actions.
		C	Establish a formal role for the jurisdictional Hazard Mitigation Planning Committees to develop a sustainable process to implement, monitor, and evaluate community wide mitigation actions.
		O Low	Develop, produce, and distribute information materials concerning mitigation, preparedness, and safety procedures for all identified natural hazards.
		O Med	Based on known high-risk hazard areas, identify hazard-specific signage needs and purchase and install hazard warning signs near these areas to notify and educate the public of potential hazards
		O High	Identify evacuation routes away from high hazard areas and develop outreach program to educate the public concerning warnings and evacuation procedures.
		S High	Develop public outreach program to train proper response to each natural hazard type, i.e. Earthquake: drop, cover, and hold-on; Structure fire: Drop and Roll, and Drop and Crawl…
		O High	Develop outreach program to educate and encourage residents to maintain several days of emergency supplies for power outages or road closures
MH 2	Cross reference Mitigation goals and actions with other City, Tribe, and Corp planning mechanisms and projects.	O High	Develop Stormwater Management Plan and coordinate within other City and Tribal planning mechanisms (20/20 Plan)
		S Med	The City will aggressively manage their existing plans to ensure they incorporate mitigation planning provisions into all community planning processes such as comprehensive, capital improvement, and land use plans, etc. to demonstrate multi-benefit considerations and facilitate using multiple funding source consideration.
		C	Integrate the Mitigation Plan findings for enhanced emergency planning.

Table 7-5 Potential Mitigation Actions

(Ongoing and newly selected items were identified for MAP implementation)

Supports Goal No.	Hazard	Criteria *Considered Selected Ongoing Completed*	Action Description
Multi- Hazards			
		C	Prohibit new construction in identified mitigatable hazard impact areas (avalanche, flood, erosion, etc.) or require building to applicable building codes for other hazard impacts (earthquake, volcanic ash, weather, etc.).
MH 3	Reduce possibility of losses from all natural hazards that affect the City, Tribe, and Corp.	O	Improve riparian cover along Unalaska's waterways (20/20 Plan)
		O	Install flood and erosion mitigation actions to reduce stormwater related erosion, mudslides, landslides, debris flows, and avalanches by extending pavement and ditching along gravel roads and installing catchment basins, sediment traps, and retention ponds to control sediment entry into community waterways. (20/20 Plan)
		S Med	Purchase and install generators with main power distribution disconnect switches for identified and prioritized critical facilities susceptible to short term power disruption. (i.e. first responder and medical facilities, schools, correctional facilities, and water and sewage treatment plants, etc.)
		S Med	Identify and harden utility headers located along river embankments to mitigate potential flood, debris, and erosion damages.
		S Low	Perform hydrologic and hydraulic engineering, and drainage studies and analyses. Use information obtained for feasibility determination and project design. This information should be a key component, directly related to a proposed project.
Natural- Hazards			
EQ 4	Reduce vulnerability of structures to earthquake damage.	S Med	Evaluate critical public facility seismic performance for fire stations, public works buildings, potable water systems, wastewater systems, electric power systems, and bridges within the jurisdiction.
		O Med	City utilities to evaluate and harden vulnerable infrastructure elements for sustainability.
ER 5	Reduce possibility of damage and losses from erosion.	O	Develop erosion control measures along Iliuliuk River from Unalaska Lake to Iliuliuk Harbor. (20/20 Plan)
		O	Manage Iliuliuk River access to reduce sedimentation, trampling, and erosion by restricting access through fencing and constructing access walkways or elevated boardwalks at designated riverine entry locations. (20/20 Plan)
		O	Conduct areawide coastal engineering evaluation to identify the most effective embankment stabilization techniques for revegetation and controlled access for subsistence and recreational uses. (20/20 Plan)
		O	Determine most effective erosion protective measure for the Tanaxtagax, Amaknak Spit Site to protect from continued damage to this historical site. Artifacts found during erosion measure implementation would need to be cataloged and curated. (20/20 Plan)
		O	Implement appropriate erosion control and revegetate impact areas. (20/20 Plan)
		O	Install bank protection such as rip-rap (large rocks), sheet pilings, gabion baskets, articulated matting, concrete, asphalt, vegetation, or other armoring or protective materials to provide river bank protection.
		O	Install embankment protection such as vegetation, riprap,

Table 7-5 Potential Mitigation Actions

(Ongoing and newly selected items were identified for MAP implementation)

Supports Goal No.	Hazard	Criteria *Considered Selected Ongoing Completed*	Action Description
Multi- Hazards			
			gabion baskets, sheet piling, and walls to reduce or eliminate erosion.
		S High	Install embankment protection along Icy Dam reservoir.
FL 6	Reduce the possibility of damage and losses from flooding.	O	Improve water circulation along two sections of Unalaska Lake. (20/20 Plan)
		O	Develop repetitive flood impacted structures to track damages and for future NFIP requirements. (20/20 Plan)
		S Med	Develop, vise, adopt, and enforce storm water ordinances and regulations to manage run-off from new development, including buffers and retention ponds.
		O	Create detention storage basins, ponds, reservoirs etc. to allow water to temporarily accumulate to reduce pressure on culverts and low water crossings allowing water to ultimately return to its watercourse at a reduced flow rate.
GF 7	Reduce possibility of damage and losses from ground failure.	S	Complete a landslide location inventory; identify threatened critical facilities and other buildings and infrastructure.
		S	Update the Stormwater Management Plan to include regulations to control runoff, both for flood reduction and to minimize saturated soils on steep slopes that can cause landslides.
TS 8	Reduce vulnerability of population and infrastructure to tsunami impacts.	O	Increase available number of warning systems in high risk areas
		O	Develop a public education effort to reduce the public health and safety risks for this hazard
		O	Provide customers in the hazard area with information about what to do if there is a tsunami including the best evacuation route to avoid a tsunami.
		O	Install tsunami warning and evacuation route signs in hazard areas
VOL 9	Reduce vulnerability of population and infrastructure to Volcanic eruption impacts.	O	Update public emergency notification procedures and develop an outreach program for ash fall events.
		O	Evaluate capability of water treatment plants to deal with high turbidity from ash fall events
		O	Develop water plant protection or sustainability plan.
		O	Evaluate ash impact on storm water drainage systems and develop mitigation actions.
		O	Evaluate electric utility air intake filter quality and inspection processes within the facilities maintenance plan
WX 10	Reduce vulnerability of structures to severe weather damage.	S high	Develop critical facility list needing emergency back-up power systems, prioritize, seek funding, and implement mitigation actions.
		Complete	Develop, implement, and maintain partnership program with electrical utilities to use underground utility placement methods where possible to reduce or eliminate power outages from severe winter storms. Consider developing incentive programs.
		O	Develop early warning test program partnering with NOAA, City Police, Fire Departments, and Volunteer Fire Department to coordinate tests.
		O	Review critical facilities and public facility energy efficiency, winter readiness, and electrical protection capability. Identify, prioritize and implement infrastructure upgrade or

Table 7-5 Potential Mitigation Actions

(Ongoing and newly selected items were identified for MAP implementation)

Supports Goal No.	Hazard	Criteria *Considered Selected Ongoing Completed*	Action Description
Multi- Hazards			
			rehabilitation project prioritization and development.
		Complete	Revise requirements to place utilities underground to reduce power disruption from wind storm/tree blow down damage
Manmade / Technological Hazards			
UTD 11	Reduce vulnerability to Utility and Transportation Disruptions	S	Develop redundant communications capability for all critical facilities

7.4 EVALUATING AND PRIORITIZING MITIGATION ACTIONS

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 §201.6(c)(3)(iii): [The hazard mitigation strategy shall include an] action plan, describing how the action identified in paragraph (c)(3)(ii) of this section 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 C. MITIGATION STRATEGY
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))
Source: FEMA, October 2011.

The Planning Team evaluated and prioritized each of the mitigation actions on January 30, 2013 to determine which actions would be included in the Mitigation Action Plan. The Mitigation Action Plan represents mitigation projects and programs to be implemented through the cooperation of multiple entities in the City. To complete this task, the Planning Team first prioritized the hazards that were regarded as the most significant within the community (earthquake, erosion, flood, ground failure, tsunami, volcano, and severe weather).

The Planning Team reviewed the simplified social, technical, administrative, political, legal, economic, and environmental (STAPLEE) evaluation criteria (Table 7-6) and the Benefit-Cost Analysis Fact Sheet (Appendix G) 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 7-6 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
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, 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 Federal Emergency Management Agency (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, state, and Federal laws

On January 30, 2012, the hazard mitigation Planning Team prioritized 42 natural hazard and one manmade/technological mitigation actions that were selected to carry forward into the Mitigation Action Plan (MAP).

The hazard mitigation Planning Team considered each hazard's history, extent, and probability to determine each potential actions 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.
- Medium priorities are associated with actions for hazards that impact the community less frequently, and do not typically generate impacts to critical facilities and/or people.
- Low priorities are associated with actions for hazards that rarely impact the community and have rarely generated documented impacts to critical facilities and/or people.

Prioritizing the mitigation actions within the MAP matrix (Table 7-8) was completed to provide the City with an implementation approach.

7.5 MITIGATION ACTION PLAN

Table 7-7 delineates the acronyms used in the Mitigation Action Plan (Table 7-8). See Appendix A for summarized agency funding source descriptions.

The City's Mitigation Action Plan, Table 7-8, depicts how each mitigation action will be implemented and administered by the Planning Team. The MAP delineates each selected mitigation action, its priorities, the responsible entity, the anticipated implementation timeline, and provides a brief explanation as to how the overall benefit/costs and technical feasibility were taken into consideration.

Table 7-7 Potential Funding Source Acronym List

City of Unalaska (City)

Qawalangin Tribal Council (Tribe)

Federal Management Agency (FEMA)/
Hazard Mitigation Assistance (HMA) Grant Programs,
Emergency Management Program Grant (EMPG)
Debris Management Grant
Flood Mitigation Assistance Grants
National Earthquake Hazards Reduction Program (NEHRP)
National Dam Safety Program (NDS)

US Department of Homeland Security (DHS)
Citizens Corp Program (CCP)
Emergency Operations Center (EOC)
Homeland Security Grant Program (HSGP)
Emergency Management Performance Grant (EMPG)
State Homeland Security Program (SHSP)

US Department of Commerce (DOC)/
Remote Community Alert Systems Program (RCASP)
National Oceanic and Atmospheric Administration (NOAA)

Denali Commission (Denali)
Energy Program,
Solid Waste Program,

Alaska Department of Military and Veterans Affairs (DMVA), Division of Homeland Security and Emergency Management (DHSEM)
Mitigation Section (for PDM & HMGP projects and plan development)
Preparedness Section (for community planning)
State Emergency Operations Center (SEOC for emergency response)

Alaska Department of Community, Commerce, and Economic Development (DCCED) Division of Community and Regional Affairs (DCRA)/
Community Development Block Grant (CDBG)
Alaska Climate Change Impact Mitigation Program (ACCIMP)
Flood Mitigation Assistance Grants (FMA)

Alaska Department of Transportation
State road repair funding

Alaska Energy Authority (AEA)
AEA/Bulk Fuel (ABF)
AEA/Alternative Energy and Energy Efficiency (AEEE)

Alaska Department of Environmental Conservation (DEC)/
Village Safe Water (VSW),
DEC/Alaska Drinking Water Fund (ADWF),
DEC/Alaska Clean Water Fund [ACWF],
DEC/Clean Water State Revolving Fund (CWSRF)

US Army Corp of Engineers (USACE)/
Planning Assistance
Capital Projects: Erosion, Flood, Ports & Harbors,

Alaska Division of Forestry (DOF)/
Volunteer Fire Assistance and Rural Fire Assistance Grant (VFAG/RFAG),
Assistance to Firefighters Grant (AFG),
Fire Prevention and Safety (FP&S),
Staffing for Adequate Fire and Emergency Response Grants (SAFER)
Emergency Food and Shelter (EF&S)

US Department of Agriculture (USDA)/
Emergency Watershed Protection Program (EWP])
Emergency Conservation Fund (ECF),
Rural Development (RD)

US Geological Survey (USGS)
Alaska Volcano Observatory (AVO)

Assistance to Native Americans (ANA)
(NAFSMA),

Natural Resources Conservation Service (NRCS)/
Emergency Watershed Protection Program (EWP)
Wildlife Habitat Incentives Program (WHIP)
Watershed Planning

US Army Corps of Engineers (USACE)/
Planning Assistance Program

Lindbergh Foundation Grant Programs (LFGP)

Rasmuson Foundation Grants (LFG)

Table 7-8 City of Unalaska's Mitigation Action Plan (MAP)

(Italicized Projects were brought forward from cross referenced – Identified Plans)

(See acronym and abbreviations list for complete titles)

Goal/ Action ID	Description	Priority (High, Medium, Low)	Responsible Department	Potential Funding Source(s)	Timeframe (1-3 Years 2-4 Years 3-5 Years)	Benefit-Costs (BC) / Technical Feasibility (T/F)
MH 1.1	Identify and pursue funding opportunities to implement mitigation actions.	High	City of Unalaska (City), Qawalangin Tribal Council (Tribe)	City, Tribe	Ongoing	B/C: This ongoing activity is essential for the City as there are limited funds available to accomplish effective mitigation actions. TF: This is an ongoing activity demonstrating its feasibility.
MH 1.2	Develop, produce, and distribute information materials concerning mitigation, preparedness, and safety procedures for all identified natural hazards.	Low	City, Tribe	City, Tribe, FEMA HMA, DHSEM HMGP, DOF	Ongoing	B/C: FEMA provides free publications for community education purposes. TF: This activity is an ongoing LEPC supported activity demonstrating its feasibility. Low to no cost outreach efforts makes this a very feasible project to successfully educate large populations.
MH 1.3	Based on known high-risk hazard areas, identify hazard-specific signage needs and purchase and install hazard warning signs near these areas to notify and educate the public of potential hazards	Medium	City, Tribe	City, Tribe, Denali Commission, DCRA, DOF, DHS&EM Mitigation & Preparedness Sections	Ongoing	B/C: This project will ensure the community looks closely at their identified hazard areas to ensure they can safely evacuate their residents and visitors during a natural hazard event. TF: This is an ongoing technically feasible activity using existing city resources.
MH 1.4	Identify evacuation routes away from high hazard areas and develop outreach program to	High	City, Tribe	City, Tribe, Denali Commission, DCRA, DOF, DHS&EM Preparedness	Ongoing	B/C: This project will ensure the community looks closely at their hazard areas to ensure they can

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(See acronym and abbreviations list for complete titles)

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	educate the public concerning warnings and evacuation procedures.					safely evacuate their residents and visitors during a natural hazard event. TF: This is technically feasible using existing city and tribal resources.
MH 1.5	Develop public outreach program to train proper response to each natural hazard type, i.e. Earthquake: drop, cover, and hold-on; Structure fire: Drop and Roll, and Drop and Crawl.	High	City, Tribe	City, Tribe, DHS&EM, NEHRP, DOF, AFG, FP&S, SAFER	2-4 years	B/C: Sustained emergency response, preparedness, and mitigation planning and outreach programs have minimal cost and will help build and support community capacity enabling the public to prepare for, respond to, and recover from disaster events. TF: This project is technically feasible using existing City staff.
MH 1.6	Develop outreach program to educate and encourage residents to maintain several days of emergency supplies for power outages or road closures	Medium	City, Tribe	City, Tribe, DHS&EM, DOF, AFG, FP&S, SAFER	Ongoing	B/C: Sustained emergency response, preparedness, and mitigation planning and outreach programs have minimal cost and will help build and support community capacity enabling the public to prepare for, respond to, and recover from disaster events. TF: This project is technically feasible using existing City staff.
MH 2.1	*Develop Stormwater Management Plan and*	High	City, Tribe	City, Tribe, HMA, ANA, EPA, DEC/CWSRF	Ongoing	B/C: Stormwater Management plans are an essential disaster

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	coordinate within other City and Tribal planning mechanisms (20/20 Plan)					management tool. Focused and coordinated planning enables effective damage abatement and ensures proper attention is assigned to reduce losses, damage, and materials management. TF: This action is feasible with limited fund expenditures. **This project is identified in the City's 20/20 Plan*
MH 2.	The City and Tribe will aggressively manage their existing plans to ensure they incorporate mitigation planning provisions into all community planning processes such as comprehensive, capital improvement, and land use plans, etc. to demonstrate multi-benefit considerations and facilitate using multiple funding sources.	Medium	City, Tribe	City, Tribe, Denali Commission, DCCED/DCRA, ANA	1-3 years	B/C: Coordinated planning ensures effective damage abatement and ensures proper attention is assigned to reduce losses and damage to structures and residents. TF: This is feasible to accomplish as cost can be associated with plan reviews and updates. The action relies on staff and review committee availability and willingness to serve their community.
MH 3.1	*Improve riparian cover along Unalaska's waterways (20/20 Plan)*	Medium	City, Tribe	City, Tribe, HMA, ANA, NRCS, USACE	Ongoing	B/C: Improving slope stability and ground cover will greatly reduce potential material losses. Improving ground cover would reduce erosion and natural vegetation would help reduce foreign material intrusion

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						within the waterways. TF: Technically feasible as the community has the skill to implement this action using existing equipment and native materials. *This project is identified in the City's 20/20 Plan
MH 3.2	*Install flood and erosion mitigation actions to reduce stormwater related erosion, mudslides, landslides, debris flows, and avalanches by extending pavement and ditching along gravel roads and installing catchment basins, sediment traps, and retention ponds to control sediment entry into community waterways. (20/20 Plan)*	Low	City, USACE, NRCS	City, Tribe, FEMA, FHWA, DOT/PF, USACE, NRCS	Ongoing	B/C: Improving water flow capability will greatly reduce potential infrastructure and residential losses. Project costs would outweigh replacement costs of lost facilities. TF: The community has the skill to implement this action. Specialized skills may need to be contracted-out with materials and equipment barged in depending on the method selected. **This project is identified in the City's 20/20 Plan*
MH 3.3	Purchase and install generators with main power distribution disconnect switches for identified and prioritized critical facilities susceptible to short term power disruption. (i.e. first responder and medical facilities, schools, correctional facilities, and water	Medium	City,	City, Tribe, Lindbergh, HMA, FP&S, SAFER, ANA, DHS/HSGP, CCP, EMPG, EOC	1-5 years	B/C: Emergency power generation is a minor cost to ensure their availability for use after a hazard strikes. TF: Installing emergency generators is technically feasible for this community as they already have staff to maintain existing community

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	and sewage treatment plants, etc.)					power generation facilities. ** This project typically needs to be associated with essential facility upgrades for FEMA funding*
MH 3.4	Identify and harden utility headers located along river embankments to mitigate potential flood, debris, and erosion damages.	Medium	City, Tribe	City, Tribe, HMA, ANA, DOT/PF, Denali Commission, NRCS, USACE, USDA/EWP, USDA/ECP, DCRA/ ACCIMP	3-5 years	B/C: Hardening infrastructure to reduce erosion and flood damages reduces potential future damages and replacement costs. TF: The City has the technical capability to manage and conduct this project.
MH 3.5	Perform hydrologic and hydraulic engineering, and drainage studies and analyses. Use information obtained for feasibility determination and project design. This information should be a key component, directly related to implementing a proposed project identified from the study.	Low	City, Tribe	City, Tribe, HMA, NRCS, USACE, USDA/EWP, USDA/ECP, DCRA/ ACCIMP	1-3 years	B/C: Flood hazard mitigation is among FEMA's highest national priorities. FEMA desires communities focus on repetitive flood loss properties. This activity will ensure the City and Tribal Councils focus on priority flood locations and projects. TF: The City has the technical capability to manage and conduct this project. Hiring contractors to accomplish specialized studies is expected in rural/remote Alaska.
EQ 4.1	Evaluate critical public facility seismic performance for fire stations, public works buildings, potable water systems, wastewater systems, electric	Medium	City, Tribe	City, Tribe, HMA, ANA, EFSP, DOT/PF	2-4 years	B/C: Retrofit projects can be very cost effective methods for bush communities as materials and shipping costs are very high.

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	power systems, and bridges within the jurisdiction.					Project viability is depending on the cost and extent of modifications. A comprehensive BCA will need to be conducted for each facility to validate this activity. TF: The community has the skill to implement this action. Specialized skills may need to be contracted-out with materials and equipment barged in depending on the method selected.
EQ 4.2	City Utilities to evaluate and harden vulnerable infrastructure elements for sustainability.	Medium	City, Tribe	City, Tribe, HMA, ANA, EFSP, DOT/PF	Ongoing	B/C: This project would ensure threatened infrastructures are available for use – their loss would exacerbate potential damages and further threaten survivability. F: This project is feasible using existing staff skills, equipment, and materials.
ER 5.1	*Develop erosion control measures along Iliuliuk River from Unalaska Lake to Iliuliuk Harbor. (20/20 Plan)*	Medium	City, Tribe	City, Tribe, HMA, ANA, NRCS, USACE, USDA/EWP, USDA/ECP, DCRA/ACCIMP	Ongoing	B/C: Improving embankment and slope stability will greatly reduce potential infrastructure and residential losses. Project costs would outweigh replacement costs of lost facilities. TF: The community has the skill to implement this action. Specialized

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						skills may need to be contracted-out with materials and equipment barged in depending on the method selected. **This project is identified in the City's 20/20 Plan*
ER 5.2	*Manage Iliuliuk River access to reduce sedimentation, trampling, and erosion by restricting access through fencing and constructing access walkways or elevated boardwalks at designated riverine entry locations. (20/20 Plan)*	Medium	City, Tribe	City, Tribe, HMA, ANA, NRCS, USACE, USDA/EWP, USDA/ECP, DCRA/ACCIMP	Ongoing	B/C: Pre-planning and implementing appropriate access controls will greatly reduce or delay potential damage and reduce sedimentation accumulation. Project costs would outweigh replacement costs of lost facilities. TF: The community has the skill and resources to implement this action. **This project is identified in the City's 20/20 Plan*
ER 5.3	*Conduct area-wide coastal engineering evaluation to identify the most effective embankment stabilization techniques for revegetation and controlled access for subsistence and recreational uses. (20/20 Plan)*	Medium	City, Tribe	City, Tribe, HMA, ANA, NRCS, USACE, USDA/EWP, USDA/ECP, DCRA/ACCIMP	Ongoing	B/C: Pre-planning and implementing appropriate embankment stability actions will greatly reduce or delay potential infrastructure and residential losses. Project costs would outweigh replacement costs of lost facilities. TF: Technically feasible as the community has the skill to implement this action using native materials and equipment.

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						**This project is identified in the City's 20/20 Plan*
ER 5.4	*Determine most effective erosion protective measure for the Tanaxtagax, Amaknak Spit Site to protect from continued damage to this historical site. Artifacts found during erosion measure implementation would need to be cataloged and curated. (20/20 Plan)*	Medium	City, Tribe, USACE,	City, Tribe, HMA, ANA, NRCS, USACE	Ongoing	B/C: Improving embankment and slope stability will greatly reduce potential infrastructure and residential losses. Project costs would outweigh replacement costs of lost facilities. TF: Technically feasible as the community has the skill to implement this action using native materials and equipment. **This project is identified in the City's 20/20 Plan*
ER 5.5	*Implement appropriate erosion control, to revegetate impact areas. (20/20 Plan)*	Medium	City, Tribe	City, Tribe, HMA, ANA, NRCS, USACE	Ongoing	B/C: Improving slope stability will greatly reduce potential infrastructure and residential losses. Project costs would outweigh replacement costs of lost facilities. TF: Technically feasible as the community has the skill to implement this action using native materials and equipment. **This project is identified in the City's 20/20 Plan*
ER 5.6	Install bank protection such as rip-rap (large rocks), sheet	Medium	City, Tribe	City, Tribe, HMA, ANA, NRCS, USACE,	Ongoing	B/C: Improving embankment and slope stability will greatly reduce

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	pilings, gabion baskets, articulated matting, concrete, asphalt, vegetation, or other armoring or protective materials to provide river bank protection.			USDA/EWP, USDA/ECP, DCRA/ACCIMP		potential infrastructure and residential losses. Project costs would outweigh replacement costs of lost facilities. TF: The community has the skill and resources to implement this action.
ER 5.7	Install embankment protection along Icy Dam reservoir.	High	City, Tribe	City, Tribe, HMA, NRCS, USACE, USDA/EWP, USDA/ECP, DCRA/ ACCIMP	1-3 years	B/C: Improving embankment and slope stability will greatly reduce potential infrastructure and residential losses. Project costs would outweigh replacement costs of lost facilities. TF: The community has the skill and resources to implement this action.
FL 6.1	Develop, revise, adopt, and enforce storm water ordinances and regulations to manage run-off from new development, including buffers and retention ponds.	Medium	City, Tribe	City, Tribe, HMA, ANA, DEC)/WSRF	2-4 years	B/C: Stormwater Management plans are an essential disaster management tool. Focused and coordinated planning enables effective damage abatement and ensures proper attention is assigned to reduce losses, damage, and materials management. TF: This action is feasible with limited fund expenditures.
FL 6.2	Create detention storage basins, ponds, reservoirs etc. to allow water to temporarily accumulate to reduce pressure on culverts	Medium	City, Tribe	City, Tribe, HMA, ANA, Denali Commission, NRCS, USACE,	Ongoing	B/C: Improving water flow capability will greatly reduce potential infrastructure and residential losses. Project costs would outweigh

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	and low water crossings allowing water to ultimately return to its watercourse at a reduced flow rate.			USDA/EWP, USDA/ECP, DCRA/ ACCIMP		replacement costs of lost facilities. TF: The community has the skills and resources to implement this action.
GF 7.1	Complete a landslide location inventory; identify threatened critical facilities and other buildings and infrastructure.	Low	City, Tribe	City, Tribe, ANA, NRCS, Denali Commission, DCRA, USACE	3-5 years	B/C: Identifying ground failure locations is a minimal cost project which would decrease damage to facilities if they were sited appropriately. Project must be associated with an eligible relocation or construction project. TF: Technically feasible as the community is currently aware of landslide locations but they have not created a formal locational inventory.
GF 7.2	*Update the Stormwater Management Plan to include regulations to control runoff, both for flood reduction and to minimize saturated soils on steep slopes that can cause landslides. (2020 Plan)*	Low	City, Tribe	City, Tribe, HMA, ANA, EPA, DEC/CWSRF	Ongoing	B/C: Stormwater Management plans are an essential disaster management tool. Focused and coordinated planning enables effective damage abatement and ensures proper attention is assigned to reduce losses, damage, and materials management. TF: This action is feasible with limited fund expenditures. **This project is identified in the City's 20/20 Plan*

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TS 8.1	Increase available number of warning systems in high risk areas.	High	City, Tribe	City, Tribe, DHS/SHSP, EOP, DOF/AFG, FP&S, SAFER	Ongoing	B/C: Sustained emergency warning, response planning, and mitigation outreach programs enable communities to plan for, warn, and protect their hazard threatened populations. Each project type is cost dependent, but for the most part are cost effective and will help build and support community capacity enabling the public to prepare for, respond to, and recover from disasters. TF: This project is technically feasible using existing City staff
TS 8.2	Develop a public education effort to reduce the public health and safety risks for this hazard	High	City, Tribe	City, Tribe, Lindbergh Grants Program, HMA, HMGP, NOAA, AFG, FP&S, SAFER, ANA, EF&S Program	Ongoing	B/C: Sustained mitigation outreach programs have minimal cost and will help build and support community capacity enabling the public to appropriately prepare for, respond to, and recover from disasters. TF: This project is technically feasible using existing City and Tribal staff.
TS 8.3	Provide customers in the hazard area with information about what to do if there is a tsunami including the best evacuation route to avoid a tsunami.	High	City, Tribe	City, Tribe, DHS&EM, NOAA, NWS, Denali Commission	Ongoing	B/C: This project will ensure the community looks closely at their hazard areas to ensure they can safely evacuate their residents and visitors to safety during a natural hazard event. TF: This is technically feasible using

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						existing city and tribal resources.
TS 8.4	Install tsunami warning and evacuation route signs in hazard areas	High	City, Tribe	City, Tribe, DHS&EM, DOC/NOAA, RCASP, NWS, Denali Commission	Ongoing	B/C: Sustained emergency warning, response planning, and mitigation outreach programs enable communities to plan for, warn, and protect their hazard threatened populations. Each project type is cost dependent, but for the most part are cost effective and will help build and support community capacity enabling the public to prepare for, respond to, and recover from disasters. TF: This project is technically feasible using existing City staff
VOL 9.1	Update public emergency notification procedures and develop an outreach program for ash fall events.	High	City, Tribe	City, Tribe, DHS&EM, USGS, AVO, DOC/NOAA, RCASP, NWS, Denali Commission	Ongoing	B/C: Sustained emergency warning, response planning, and mitigation outreach programs enable communities to plan for, warn, and protect their hazard threatened populations. Each project type is cost dependent, but for the most part are cost effective and will help build and support community capacity enabling the public to prepare for, respond to, and recover from disasters. TF: This project is technically feasible using existing City staff

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VOL 9.2	Evaluate capability of water treatment plants to deal with high turbidity from ash fall events	High	City, Tribe	City, Tribe, HMA, ANA, EPA, DEC/CWSRF	Ongoing	B/C: Water Plant Protection plans are an essential disaster management tool. Focused and coordinated planning enables effective damage abatement and ensures proper attention is assigned to reduce losses, damage, and materials management. TF: This action is feasible with limited fund expenditures.
VOL 9.3	Develop water plant protection or sustainability plan.	Medium	City, Tribe	City, Tribe, HMA, ANA, EPA, DEC/CWSRF	Ongoing	B/C: Water Plant Protection plans are an essential disaster management tool. Focused and coordinated planning enables effective damage abatement and ensures proper attention is assigned to reduce losses, damage, and materials management. TF: This action is feasible with limited fund expenditures.
VOL 9.4	Evaluate ash impact on storm water drainage systems and develop mitigation actions.	Low	City, Tribe	City, Tribe, HMA, ANA, EPA, DEC/CWSRF	Ongoing	B/C: Stormwater Management plans are an essential disaster management tool. Focused and coordinated planning enables effective damage abatement and ensures proper attention is assigned to reduce losses, damage, and materials management.

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						TF: This action is feasible with limited fund expenditures. **This project is associated with an identified City's 20/20 Plan project*
VOL 9.5	Evaluate electric utility air intake filter quality and inspection processes within the facilities maintenance plan	Low	City, Tribe	City, Tribe, HMA, ANA, EPA, DEC/CWSRF	Ongoing	B/C: Critical Facility Maintenance plans are an essential disaster management tool. Focused and coordinated planning enables effective damage abatement and ensures proper attention is assigned to reduce losses, damage, and materials management. TF: This action is feasible with limited fund expenditures. **This project is associated with identified projects in the City's 20/20 Plan*
WX 10.1	Develop critical facility list needing emergency back-up power systems, prioritize, seek funding, and implement mitigation actions.	High	City, Tribe	City, Tribe, Lindbergh Grants Program, HMA, FP&S, SAFER, ANA, DHS, HSGP, EMPG, EOC	3-5 Years	B/C: Emergency power generation is a relatively minor cost to ensure facilities' availability for use after a hazard strikes. TF: Installing emergency generators is technically feasible for this community as they already have staff to maintain existing community power generation facilities. This

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						project typically needs to be associated with essential facility upgrades for FEMA funding
WX 10.2	Develop, implement, and maintain partnership program with electrical utilities to use underground utility placement methods where possible to reduce or eliminate power outages from severe winter storms.	Medium	City, Tribe	City, Tribe, HMA, NNRCS, ANA, USACE, USDA, LFGP, RFG	Complete	B/C: This project would ensure threatened infrastructures are available for use – there loss would exacerbate potential damages and further threaten survivability. F: This project is feasible using existing staff skills, equipment, and materials.
WX 10.3	Develop early warning test program partnering with NOAA, City Police, Fire Departments, and local industries to coordinate tests.	Medium	City, Tribe	City, Tribe, Lindbergh Grants Program, HMA, FP&S, SAFER, ANA, DHS, HSGP, EMPG, EOC	Ongoing	B/C: Sustained emergency warning and response planning programs enable communities to plan for, warn, and protect their hazard threatened populations. Each project type is cost dependent, but for the most part are cost effective and will help build and support community capacity enabling the public to prepare for, respond to, and recover from disasters. TF: This project is technically feasible using existing City staff
WX 10.4	Review critical facilities and public facility energy efficiency, winter readiness, and electrical protection capability. Identify,	Low	City, Tribe	City, Tribe, HMA, NRCS, USACE, USDA/EWP, USDA/ECP, DCRA/ ACCIMP	Ongoing	B/C: Identifying threatened infrastructure proximity to natural hazards is vital to their sustainability. There are currently few mapped

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	prioritize and implement infrastructure upgrade or rehabilitation project prioritization and development.					hazard areas. This is a vital first step. This knowledge will help the community focus on activities to protect their vital infrastructure. Emergency power sustainability is essential to ensure facilities' availability for use after a hazard strikes. TF: This project is technically feasible for this community as they already have staff to inspect and maintain existing community infrastructure.
WX 10.5	Revise requirements to place utilities underground to reduce power disruption from wind storm/tree blow down damage	Low	City, Tribe	City, Tribe, HMA, NRCS, USACE, USDA/EWP, USDA/ECP, DCRA/ ACCIMP	Complete	B/C: This project would ensure threatened infrastructures are available for use – there loss would exacerbate potential damages and further threaten survivability. F: This project is feasible using existing staff skills, equipment, and materials.
Manmade / Technological Hazards						
UTD 11.1	Develop redundant communications capability for the City to the outside world as well as all critical facilities	Medium	City	City, Tribe, Lindbergh Grants Program, HMA, FP&S, SAFER, ANA, DHS, HSGP, EMPG, EOC	Ongoing	B/C: Sustained emergency warning, communication, and response activity capabilities enable communities to warn and protect their hazard threatened populations. This project is dependent on

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						emerging technology. The City is researching options to replace satellite communications (such as fiber optic undersea cabling) and their viability for development and implementation. This project will help build and support community capacity enabling the public to prepare for, respond to, and recover from disasters. TF: This project is technically feasible using existing City staff

7.6 IMPLEMENTING MITIGATION STRATEGY INTO EXISTING PLANNING MECHANISMS

The requirements for implementation through existing planning mechanisms, as stipulated in the DMA 2000 and its implementing regulations, are described here.

DMA 2000 Requirements
Incorporation into Existing Planning Mechanisms §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.
ELEMENT C. Incorporate into Other Planning Mechanisms
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?
Source: FEMA, October 2011.

After the adoption of the HMP, each Planning Team Member will ensure that the HMP, in particular each Mitigation Action Project, is incorporated into existing planning mechanisms. Each member of the Planning Team will achieve this incorporation by undertaking the following activities.

- Review the community-specific regulatory tools to determine where to integrate the mitigation philosophy and implementable initiatives. These regulatory tools are identified in Section 7.1 capability assessment.
- Work with pertinent community departments to increase awareness for implementing HMP philosophies and identified initiatives. Provide assistance with integrating the mitigation strategy (including the Mitigation Action Plan) into relevant planning mechanisms (i.e. Comprehensive Plan, Capital Improvement Project List, Transportation Improvement Plan, etc.).
- Implementing this philosophy and activities may require updating or amending specific planning mechanisms.

8

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Appendix A
Funding Resources

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Funding Resources

Federal Funding Resources

The Federal government requires local governments to have a 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. Five key resource documents are available from 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 (http://www.fema.gov/plan/mitplanning/resources.shtm#1).
    - Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments. FEMA DAP-12, September 1990. This handbook explains the basic concepts of hazard mitigation and shows state and local governments how they can develop and achieve mitigation goals within the context of FEMA's post-disaster hazard mitigation planning requirements. The handbook focuses on approaches to mitigation, with an emphasis on multi-objective planning.
    - A Guide to Recovery Programs FEMA 229(4), September 2005. The programs described in this guide may all be of assistance during disaster incident recovery. Some are available only after a Presidential declaration of disaster, but others are available without a declaration. Please see the individual program descriptions for details. (http://www.fema.gov/txt/rebuild/ltrc/recoveryprograms229.txt)
    - 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 (HMA Unified Guidance, June 1, 2010. 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 2009).

- FEMA also administers emergency management grants (http://www.fema.gov/help/site.shtm) and various firefighter grant programs (http://www.firegrantsupport.com/) such as
  - Emergency Management Performance Grant (EMPG). This is a pass through grant. The amount is determined by the State. The grant is intended to support critical assistance to sustain and enhance State and local emergency management capabilities at the State and local levels for all-hazard mitigation, preparedness, response, and recovery including coordination of inter-governmental (Federal, State, regional, local, and tribal) resources, joint operations, and mutual aid compacts state-to-state and nationwide. Sub-recipients must be compliant with National Incident Management System (NIMS) implementation as a condition for receiving funds. Requires 50% match.
  - Assistance to Fire Fighters Grant (AFG), Fire Prevention and Safety (FP&S), Staffing for Adequate Fire and Emergency Response Grants (SAFER), and Assistance to Firefighters Station Construction Grant programs. Information can be found at: (http://forestry.alaska.gov/fire/vfarfa.htm).
- Department of Homeland Security (DHS) provides the following grants:
  - Homeland Security Grant Program (HSGP), State Homeland Security Program (SHSP) are 80% pass through grants. SHSP supports implementing the State Homeland Security Strategies to address identified planning, organization, equipment, training, and exercise needs for acts of terrorism and other catastrophic events. In addition, SHSP supports implementing the National Preparedness Guidelines, the NIMS, and the National Response Framework (NRF). Must ensure at least 25% of funds are dedicated towards law enforcement terrorism prevention-oriented activities.
  - Citizen Corps Program (CCP). The Citizen Corps mission is to bring community and government leaders together to coordinate involving community members in emergency preparedness, planning, mitigation, response, and recovery activities.
  - Emergency Operations Center (EOC) This program is intended to improve emergency management and preparedness capabilities by supporting flexible, sustainable, secure, strategically located, and fully interoperable Emergency Operations Centers (EOCs) with a focus on addressing identified deficiencies and needs. Fully capable emergency operations facilities at the State and local levels are an essential element of a comprehensive national emergency management system and are necessary to ensure continuity of operations and continuity of government in major disasters or emergencies caused by any hazard. Requires 25% match.
- U.S. Department of Commerce's grant programs include:

- Remote Community Alert Systems (RCASP) grant for outdoor alerting technologies in remote communities effectively underserved by commercial mobile service for the purpose of enabling residents of those communities to receive emergency messages. This program is a contributing element of the Warning, Alert, and Response Network (WARN) Act.
- National Oceanic and Atmospheric Administration (NOAA), provides funds to the State of Alaska due to Alaska's high threat for tsunami. The allocation supports the promotion of local, regional, and state level tsunami mitigation and preparedness; installation of warning communications systems; installation of warning communications systems; installation of tsunami signage; promotion of the Tsunami Ready Program in Alaska; development of inundation models; and delivery of inundation maps and decision-support tools to communities in Alaska.

- Department of Agriculture (USDA). Disaster assistance provided includes: Emergency Conservation Program, Non-Insured Assistance, Emergency Forest Restoration Program, Emergency Watershed Protection, Rural Housing Service, Rural Utilities Service, and Rural Business and Cooperative Service. (http://www.fsa.usda.gov/FSA/webapp?area=home&subject=diap&topic=landing)
- Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy, Weatherization Assistance Program (http://www1.eere.energy.gov/wip/wap.html). 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.
  - The Tribal Energy Program offers financial and technical assistance to Indian tribes to help them create sustainable renewable energy installations on their lands. This program promotes tribal energy self-sufficiency and fosters employment and economic development on America's tribal lands. (http://www1.eere.energy.gov/wip/tribal.html)
- US Environmental Protection Agency (EPA). Under EPA's Clean Water State Revolving Fund (CWSRF) program, each state maintains a revolving loan fund to provide independent and permanent sources of low-cost financing for a wide range of water quality infrastructure projects, including: municipal wastewater treatment projects; non-point source projects; watershed protection or restoration projects; and estuary management projects. (http://yosemite.epa.gov/R10/ecocomm.nsf/6da048b9966d22518825662d00729a35/7b68c420b668ada5882569ab00720988!OpenDocument)
  - Public Works and Development Facilities Program. This program provides assistance to help distressed communities attract new industry, encourage business expansion, diversify local economies, and generate long-term, private sector jobs. Among the types of projects funded are water and sewer facilities, primarily serving industry and commerce; access roads to industrial parks or sites; port improvements; business incubator facilities; technology infrastructure; sustainable development activities; export programs; brownfields redevelopment; aquaculture facilities; and other infrastructure projects. Specific activities may include demolition, renovation, and

construction of public facilities; provision of water or sewer infrastructure; or the development of stormwater control mechanisms (e.g., a retention pond) as part of an industrial park or other eligible project. (http://cfpub.epa.gov/fedfund/program.cfm?prog_num=51)

- 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. (http://www.acf.hhs.gov/programs/ana/programs/program_information.html)
- Department of Housing and Urban Development (HUD) provides a variety of disaster resources. They also partner with Federal and state agencies to help implement disaster recovery assistance. Under the *National Response Framework* the FEMA and the Small Business Administration (SBA) offer initial recovery assistance. (http://www.hud.gov/info/disasterresources_dev.cfm)
    - 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. (http://www.hud.gov/offices/cpd/communitydevelopment/programs/108/index.cfm)
    - HUD, Office of Homes and Communities, Section 184 Indian Home Loan Guarantee Programs (IHLGP). The Section 184 Indian Home Loan Guarantee Program is a home mortgage specifically designed for American Indian and Alaska Native families, Alaska Villages, Tribes, or Tribally Designated Housing Entities. Section 184 loans can be used, both on and off native lands, for new construction, rehabilitation, purchase of an existing home, or refinance.
    - Because of the unique status of Indian lands being held in Trust, Native American homeownership has historically been an underserved market. Working with an expanding network of private sector and tribal partners, the Section 184 Program endeavors to increase access to capital for Native Americans and provide private funding opportunities for tribal housing agencies with the Section 184 Program. (http://www.hud.gov/offices/pih/ih/homeownership/184/)
    - 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 (http://www.hud.gov/offices/cpd/communitydevelopment/programs/)
- 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. (http://www.workforcesecurity.doleta.gov/unemploy/disaster.asp)

- The Workforce Investment Act contains provisions aimed at supporting employment and training activities for Indian, Alaska Native, and Native Hawaiian individuals. The Department of Labor's Indian and Native American Programs (INAP) funds grant programs that provide training opportunities at the local level for this target population. (http://www.dol.gov/dol/topic/training/indianprograms.htm)

- U.S. Department of Transportation (DOT), Hazardous Materials Emergency Preparedness Grant. DOT increases State, Territorial, Tribal and local effectiveness in safely and efficiently handling hazardous materials accidents and incidents, enhances implementation of the Emergency Planning and Community Right-to-Know Act of 1986, and encourages a comprehensive approach to emergency training and planning by incorporating the unique challenges of responses to transportation situations, through planning and training. Requires a 20% local match.
- 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), Disaster Tax Relief. Provides extensions to current year's tax return, allows deductions for disaster losses, and allows amendment of previous year's tax returns (http://www.irs.gov/newsroom/article/0,,id=108362,00.html).
- Natural Resources Conservation Service (NRCS) has several funding sources to fulfill mitigation needs. Further information is located at: http://www.ak.nrcs.usda.gov/sitemap.html
  - The Emergency Watershed Protection Program (EWP). This funding source is designed is to undertake emergency measures, including the purchase of flood plain easements, for runoff retardation and soil erosion prevention to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood or any other natural occurrence is causing or has caused a sudden impairment of the watershed.
  - Wildlife Habitat Incentives Program (WHIP). This is a voluntary program for conservation-minded landowners who want to develop and improve wildlife habitat on agricultural land, nonindustrial private forest land, and Indian land.
  - Watershed Planning. NRCS watershed activities in Alaska are voluntary efforts requested through conservation districts and units of government and/or tribes. The watershed activities are lead locally by a "watershed management committee" that is comprised of local interest groups, local units of government, local tribal representatives and any organization that has a vested interest in the watershed planning activity. This committee provides direction to the process as well as provides the decision-making necessary to implement the process. Technical assistance is provided to the watershed management committee through a "technical advisory committee" comprised of local, state and federal technical specialist. These specialists provide information to the watershed management committee as needed to make sound decisions. NRCS also provides training on watershed planning organization and process.

- U.S. Small Business Administration (SBA) Disaster Assistance provides information concerning disaster assistance, preparedness, planning, cleanup, and recovery planning. (http://www.sba.gov/category/navigation-structure/starting-managing-business/managing-business/running-business/emergency-preparedness-and-disaster-)
    - May provide low-interest disaster loans to individuals and businesses that have suffered a loss due to a disaster. (http://www.sba.gov/category/navigation-structure/loans-grants/small-business-loans/disaster-loans). Requests for SBA loan assistance should be submitted to DHS&EM.
- United States Army Corps of Engineers (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 (http://www.poa.usace.army.mil/en/cw/index.htm). The USACE is a member and co-chair of the Alaska Climate Change Sub-Cabinet.

State Funding Resources

- Department of Military and Veterans Affairs (DMVA): Provides damage appraisals and settlements for VA-insured homes, and assists with filing of survivor benefits. (http://veterans.alaska.gov/links.htm)
    - DHS&EM within DMVA is responsible for improving hazard mitigation technical assistance for 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 elevating, relocating, or acquiring hazard-prone properties. (http://ready.alaska.gov/plans/mitigation.htm)

      DHS&EM also provides mitigation funding resources for mitigation planning on their Web site at http://www.ak-prepared.com/plans/mitigation/localhazmitplan.htm.
- Division of Senior Services (DSS): Provides special outreach services for seniors, including food, shelter and clothing. (http://www.hss.state.ak.us/dsds/seniorInfoResources.htm)
- Division of Insurance (DOI): Provides assistance in obtaining copies of policies and provides information regarding filing claims. (http://www.dced.state.ak.us/insurance/)
- DCRA within the DCCED 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 division also administers programs for State's" distressed" and "targeted" communities. (http://www.commerce.state.ak.us/dca/)
    - DCRA Planning and Land Management staff provide Alaska Climate Change Impact Mitigation Program (ACCIMP) funding to Alaskan communities that meet one or

more of the following criteria related to flooding, erosion, melting permafrost, or other climate change-related phenomena: Life/safety risk during storm/flood events; loss of critical infrastructure; public health threats; and loss of 10% of residential dwellings.

The Hazard Impact Assessment is the first step in the ACCIMP process. The HIA identifies and defines the climate change-related hazards in the community, establishes current and predicted impacts, and provides recommendations to the community on alternatives to mitigate the impact. The community may then pursue these recommendations through an ACCIMP Community Planning Grant. (http://commerce.alaska.gov/dca/planning/accimp/hazard_impact.html)

- Department of Environmental Conservation (DEC). 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. (http://dec.alaska.gov/)
  - The Division of Water's Village Safe Water Program works with rural communities to develop sustainable sanitation facilities. Communities apply each year to VSW for grants for sanitation projects. Federal and state funding for this program is administered and managed by the State of Alaska's Village Safe Water (VSW) program. VSW provides technical and financial support to Alaska's smallest communities to design and construct water and wastewater systems. In some cases, funding is awarded by VSW through the Alaska Native Tribal Health Consortium, who in turn assist communities in design and construct of sanitation projects.
  - Municipal Grants and Loans Program. The Department of Environmental Conservation / Division of Water administer the Alaska Clean Water Fund (ACWF) and the Alaska Drinking Water Fund (ADWF). The division is fiscally responsible to the Environmental Protection Agency (EPA) to administer the loan funds as the EPA provides capitalization grants to the division for each of the loan funds. In addition, it is prudent upon the division to administer the funds in a manner that ensures their continued viability.
  - Under EPA's Clean Water State Revolving Fund (CWSRF) program, each state maintains a revolving loan fund to provide independent and permanent sources of low-cost financing for a wide range of water quality infrastructure projects, including: municipal wastewater treatment projects; non-point source projects; watershed protection or restoration projects; and estuary management, [and stormwater management] projects. (http://yosemite.epa.gov/R10/ecocomm.nsf/6da048b9966d22518825662d00729a35/7b68c420b668ada5882569ab00720988!OpenDocument)

    Alaska's Revolving Loan Fund Program, prescribed by Title VI of the Clean Water Act as amended by the Water Quality Act of 1987, Public Law 100-4. DEC will use the ACWF account to administer the loan fund. This Agreement will continue from year-to-year and will be incorporated by reference into the annual capitalization grant agreement between EPA and the DEC. DEC will use a fiscal year of July 1 to June 30

for reporting purposes.
(http://www.epa.gov/region10/pdf/water/srf/cwsrf_alaska_operating_agreement.pdf)

- 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.
  - 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 the safe, efficient, economical, and effective State highway, harbor, and airport operation. DOT/PF uses it's Planning, Design and Engineering, Maintenance and Operations, and Intelligent Transportation Systems resources to identify hazards, 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 temporary bridge replacements and materials necessary to make the multi-modal transportation system operational following natural disaster events.
- 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 Alaska's mineral, land, and water resources use, development, and earthquake mitigation collaboration.

    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 information to the public. Information is available at: (http://www.dggs.dnr.state.ak.us/index.php?menu_link=publications&link=publications_search#)
  - 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.
    (http://forestry.alaska.gov/pdfs/08FireSuppressionMediaGuide.pdf)
  - DOF also manages various wildland fire programs, activities, and grant programs such as the FireWise Program (http://forestry.alaska.gov/fire/firewise.htm), Community Forestry Program (CFP) (http://forestry.alaska.gov/community/), Assistance to Fire Fighters Grant (AFG), Fire Prevention and Safety (FP&S), Staffing for Adequate Fire and Emergency Response Grants (SAFER), and Volunteer Fire Assistance and Rural Fire Assistance Grant (VFA-RFA) programs (http://forestry.alaska.gov/fire/vfarfa.htm). Information can be found at http://forestry.alaska.gov/fire/current.htm.

Other Funding 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. (http://dialoguemakers.org/Resourses4states+Nonprofits.htm)
- Denali Commission. Introduced by Congress in 1998, the Denali Commission is an independent federal agency designed to provide critical utilities, infrastructure, and economic support throughout Alaska. With the creation of the Denali Commission, Congress acknowledged the need for increased inter-agency cooperation and focus on Alaska's remote communities. Since its first meeting in April 1999, the Commission is credited with providing numerous cost-shared infrastructure projects across the State that exemplifies effective and efficient partnership between federal and state agencies, and the private sector. (http://www.denali.gov/index.php?option=com_content&view=section&id=1&Itemid=3)
    - The Energy Program primarily funds design and construction of replacement bulk fuel storage facilities, upgrades to community power generation and distribution systems, alternative-renewable energy projects, and some energy cost reduction projects. The Commission works with the Alaska Energy Authority (AEA), Alaska Village Electric Cooperative (AVEC), Alaska Power and Telephone and other partners to meet rural communities' fuel storage and power generation needs.
    - The goal of the solid waste program at the Denali Commission is to provide funding to address deficiencies in solid waste disposal sites which threaten to contaminate rural drinking water supplies.
- Lindbergh Foundation Grants. Each year, The Charles A. and Anne Morrow Lindbergh Foundation provides grants of up to $10,580 (a symbolic amount representing the cost of the Spirit of St. Louis) to men and women whose individual initiative and work in a wide spectrum of disciplines furthers the Lindberghs' vision of a balance between the advance

of technology and the preservation of the natural/human environment. (http://www.lindberghfoundation.org/docs/index.php/our-grants)

- Rasmuson Foundation Grants. The Rasmuson foundation invests both in individuals and well-managed 501(c)(3) organizations dedicated to improving the quality of life for Alaskans.

  Rasmuson Foundation awards grants both to organizations serving Alaskans through a base of operations in Alaska, and to individuals for projects, fellowships and sabbaticals. To be considered for a grant award, grant seekers must meet specific criteria and complete and submit the required application according to the specific guidelines of each program. (http://www.rasmuson.org/index.php?switch=viewpage&pageid=5)

  - Tier 1 Awards: Grants of up to $25,000 for capital projects, technology updates, capacity building, program expansion, and creative works.
  - Tier 2 Awards: Grants over $25,000 for projects of demonstrable strategic importance or innovative nature.
  - Pre-Development Program: Guidance and technical resources for planning new, sustainable capital projects.

  The Foundation seeks to support not-for-profit organizations that are focused and effective in the pursuit of their goals, with special consideration for those organizations that demonstrate strong leadership, clarity of purpose and cautious use of resources.

  The Foundation trustees believe successful organizations can sustain their basic operations through other means of support and prefer to assist organizations with specific needs, focusing on requests which allow the organizations to become more efficient and effective. The trustees look favorably on organizations which demonstrate broad community support, superior fiscal management and matching project support. (http://www.rasmuson.org/index.php)

Appendix B
FEMA Hazard Mitigation Plan (HMP) 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 the 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: **Unalaska**	**Title of Plan:** **Hazard Mitigation Plan**	**Date of Plan:** **April 2013**
Local Point of Contact: **Jamie Sunderland**		**Address:** **PO Box 370** **Unalaska, Alaska 99685**
Title: **Director of Public Safety**		
Agency: **City of Unalaska**		
Phone Number: **907-581-1233**		**E-Mail:** **jsunderland@ci.unalaska.ak.us**

State Reviewer: **Scott Nelsen**	**Title: Mitigation Planner**	**Date: 4/30/2013**

FEMA Reviewer: Brett Holt	**Title:** Mitigation Planner	**Date:** July 2, 2013
Date Received in FEMA Region X	May 23, 2013	
Plan Not Approved		
Plan Approvable Pending Adoption	August 23, 2013	
Plan Approved	December 5, 2013	

SECTION 1:
REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan (section and/or page number)**	**Met**	**Not Met**
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))	3-1 to 3-3, Appendix F	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))	3-3 & 3-4	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	3-3 & 3-4, Appendix F	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	3-4 & 3-5	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))	3-5 to 3-7	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))	3-6 to 3-10, Appendix H	X	
ELEMENT A: REQUIRED REVISIONS:			

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
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))	5-5 to 5-62	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))	5-5 to 5-62	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))	5-5 to 5-62 6-2 to 6-9 6-22 to 6-28	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))	6-20	X	
ELEMENT B: REQUIRED REVISIONS			
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))	7-2 to 7-4	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))	6-20	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	7-5	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))	7-13 to 7-30	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))	7-9 to 7-30	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))	7-31	X	
ELEMENT C: REQUIRED REVISIONS			

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
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		
ELEMENT D: REQUIRED REVISIONS			
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))	4-1 Appendix C	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		
ELEMENT E: REQUIRED REVISIONS			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
F1.			
F2.			
ELEMENT F: REQUIRED REVISIONS			

SECTION 2:

PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

Element A: Planning Process

Plan Strengths:

- The plan includes a brief summary of the steps taken during plan development and further documents the plan update process by including meeting agendas in the plan appendix.
- The public involvement strategy included the following methods: hard copies of the plan were available at City offices, flyers were posted at the City Offices, and notices that the plan was out for public review were emailed to interested parties.
- The plan includes a list of future tasks for continued plan development.

Opportunities for Improvement:

- Further document the plan update process by including all meeting minutes, sign-in sheets, flyers, and email notices or by describing the steps taken in more detail.
- Include members on the planning team that represent additional interests such as business, academia, and other private and non-profit groups.
- In addition to holding public meetings and making copies of the draft plan available for review and comment, consider using more diverse methods of participation, such as surveys, questionnaires, and workshops to solicit feedback.
- Use footnotes or citations to further document how the relevant information from existing plans, studies, reports, and technical information was incorporated into the plan.

Element B: Hazard Identification and Risk Assessment

Plan Strengths:

- The community profile includes a description of land uses, coastal development, and community assets.
- The plan includes a hazard matrix that identifies which hazards are present in the City as well as their probability of occurrence and the extent of their impact.
- The plan describes the potential impact of each hazard by identifying the extent of the City that will be impacted and it summarizes the City's vulnerability by identifying key issues that describe the greatest vulnerabilities to each hazard.
- The plan describes the general hazard characteristics as well as the local hazard for each identified hazard.

Opportunities for Improvement:

- Better define the descriptors that are used for extent (e.g., "Limited" could mean less than 50% of the community will be impacted by an event).
- Describe the location of specific areas that are most vulnerable to each of the identified hazards.
- Use maps to more clearly illustrate the areas that are affected by flood, erosion, tsunami, and severe weather.
- In addition to providing state-level maps to identify the location of areas affected by different hazards, include maps that are specific to the City and provide local-level detail. Also identify where Unalaska is located on the state-level maps.

Element C: Mitigation Strategy

Plan Strengths:

- The plan includes a capability assessment that identifies Federal and state resources available for mitigation and mitigation-related funding and training as well as evaluates local resources, including legal and technical, administrative, and fiscal capability.
- The plan links the mitigation strategy to the hazard vulnerability assessment by including hazard-specific goals, objectives, and mitigation projects within each hazard profile. The plan also explicitly links each mitigation project to the hazard it will mitigate.
- The mitigation strategy includes a comprehensive range of mitigation projects, including prevention measures, property protection measures, natural resource protection measures, structural projects, and education and awareness actions.
- The responsible agency, cost, potential funding sources, and estimated timeframe are identified for each proposed mitigation project.
- The plan identifies the existing plans and documents in which the Hazard Mitigation Plan has been and will be assimilated and indicates when the last update was completed as well as the next scheduled review.

Opportunities for Improvement:

- Make additional linkages between the vulnerability assessment, hazard risk, and mitigation strategy. For example, target mitigation actions at specific locations/areas that have been identified as vulnerable to a hazard.
- Identify a specific position, office, or department who will be responsible for implementing the mitigation projects with "City" designated as the responsible agency.

B. Resources for Implementing Your Approved Plan

- 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
- The **Local Mitigation Planning Handbook** is available. While the requirements under §201.6 have not changed, the *Handbook* provides guidance to local governments on developing or updating hazard mitigation plans to meet the requirements and is available through the FEMA Library website. http://www.fema.gov/library/viewRecord.do?id=7209

- 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. http://www.fema.gov/library/viewRecord.do?id=6938

- The **Integrating Hazard Mitigation into Local Planning: Case Studies and Tools for Community Officials** resource provides practice 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 practice. http://www.fema.gov/library/viewRecord.do?id=7130

- The FEMA Region X Risk Mapping, Analysis, and Planning program (RiskMAP) 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.
- The mitigation strategy includes projects that are eligible for FEMA's grant programs. Contact the State Hazard Mitigation Officer, Ann Gravier, ann.gravier@alaska.gov for application information.

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Appendix C
Community HMP Adoption Resolution

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CITY OF UNALASKA
UNALASKA, ALASKA

RESOLUTION 2013-72

A RESOLUTION OF THE UNALASKA CITY COUNCIL ADOPTING THE CITY OF UNALASKA HAZARD MITIGATION PLAN.

WHEREAS the City of Unalaska 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;

WHEREAS a Hazard Mitigation Plan (the Plan) has been developed through the work of the Planning Team, and interested parties within the City of Unalaska;

WHEREAS the Plan recommends hazard mitigation actions that will protect people and property affected by natural hazards that face the City of Unalaska, that will reduce future public, private, community, and personal costs of disaster response and recovery; and that will reinforce the City of Unalaska's leadership in emergency preparedness efforts;

WHEREAS the Disaster Mitigation Act of 2000 (P.L. 106-390) (DMA 2000) and associated Federal regulations published under 44 CFR Part 201 require the City of Unalaska to formally adopt a Hazard Mitigation Plan subject to the approval of the Federal Emergency Management Agency to be eligible for federal hazard mitigation projects and activities funds;

WHEREAS public meetings were held to receive comment on the Plan as required by DMA 2000;

NOW THEREFORE BE IT RESOLVED by the City Council of the City of Unalaska that:

1. The Plan is hereby adopted as an official plan of the City of Unalaska.

2. The City of Unalaska's Planning Team, will complete periodic updates of the Plan as indicated in the Plan Maintenance Section (Section 8), but no less frequently than every five years.

NOW THEREFORE, BE IT RESOLVED by City Council that the City of Unalaska adopts the City of Unalaska Hazard Mitigation Plan.

PASSED AND APPROVED BY A DULY CONSTITUTED QUORUM OF THE UNALASKA CITY COUNCIL THIS 26TH DAY OF NOVEMBER, 2013.

MAYOR

ATTEST:

CITY CLERK, Acting

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Appendix D
Critical Facility and Infrastructure List

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Critical Facilities and Infrastructure

Table D-1 provides an extensive list of the City of Unalaska's critical facilities and infrastructure, their physical address, GPS coordinates, estimated value, Hazus building types, and the natural hazards that may impact each facility. This data provides input to determine listed facilities' vulnerability to each identified hazard type. This enabled the Planning Team to estimate potential property losses defined in Section Six, Vulnerability Assessment.

Table D-1 Critical Facilities and Infrastructure

Facilities	Number of Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Erosion	Flood	Ground Failure	Tsunami	Volcano	Weather (Severe)
Government	50	Unalaska City Hall	43 Raven Way	53.873	-166.5377	$5,499,400	W2	X	X				X	X
	20	Court Building	196 West Broadway Ave	53.8746	-166.5356	$497,800	W1	X	X	X	X	X	X	X
	20	Qawalangin Tribal Office	205 West Broadway Ave	53.8749	-166.5353	$479,300	W1	X		X		X	X	X
	25	Ounalashka Corporation Office	400 Salmon Way	53.8826	-166.5506	$761,980	W1	X	X	X	X	X	X	X
	5	Dutch Harbor Post Office	1745 Airport Beach Road	53.8841	-166.5547	$2,159,610	S1L	X				X	X	X
	5	Unalaska Post Office	82 Airport Beach Road	53.8725	-166.5351	Unknown	S1L	X					X	X
Transportation	70	Unalaska Airport (3,900' long by 100' wide paved runway)	105 Terminal Drive	53.8948	-166.5425	$6,430,000	W1	X				X	X	X
	0	Seaplane Base	Henry Swanson Drive	53.8964	-166.5377	Unknown	N/A	X				X	X	X
	70	City of Unalaska Carl E. Moses Small Boat Harbor at Little South America Harbor	570 Henry Swanson Drive	53.8704	-166.5546	$72,000,000	W2	X				X	X	X
	0	C&M Breakwater	Henry Swanson Drive	53.8672	-166.5549	$18,000,000	655 FT	X				X	X	X
	75	Unalaska Marine Center	731 Ballyhoo Road (UMC Dock)	53.9019	-166.53011	$28,515,631	Unknown	X				X	X	X

Table D-1 Critical Facilities and Infrastructure

Facilities	Number of Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Erosion	Flood	Ground Failure	Tsunami	Volcano	Weather (Severe)
	150	US Coast Guard Dock	939 Ballyhoo Rd	53.9039	-166.5261	$300,000	Unknown	X				X	X	X
	10	Unalaska Light Cargo Dock (Pot Dock) at the Spit	2633 Ballyhoo Rd	53.9072	-166.5097	$12,220,300	Unknown	X				X	X	X
	40	Ballyhoo Dock (Tustumena Dock, Positions 3 & 4)	731 Ballyhoo Road	53.9021	-166.5291	$14,500,000	Unknown	X				X	X	X
	0	International Port of Dutch Harbor (5,200' moorage, 1,232' floating dock)	731 Ballyhoo Road	53.9057	-166.5158	$4,000,000	Unknown	X				X	X	X
	35	Robert Storrs Int'l. Small Boat Harbor	22 Pacesetter Way	53.8778	-166.5536	$2,271,390	Unknown	X				X	X	X
Emergency Response	15	Unalaska Police Department (Public Safety Building)	29 Safety Way	53.8713	-166.5419	$4,153,930	S1L	X				X	X	X
	5	State Troopers Post	2315 Airport Beach Road (located within the "FTS Building"	53.8894	-166.5442	$600,000	S1L	X				X	X	X
	0	Emergency Mooring Buoy	Broad Bay	54.1092	-166.7742	$10,200,000		X				X	X	X
	5	Amaknak Fire Station	2713 Airport Beach Road	53.89404	-166.5399	$668,669	S1L	X				X	X	X
Educational	15	Unalaska Pre-School (Head Start)	77 W. Broadway Ave.	53.8737	-166.5329	Unknown	W1	X				X	X	X
	20	Walkabout (Alternative School)	55 E Broadway Avenue	53.8728	-166.5302	$564,900	MH	X				X	X	X
	229	Eagles View Elementary Achigaalux	501 E. Broadway Ave.	53.869	-166.5225	$9,177,800	W2	X				X	X	X
	218	Unalaska City School (High School)	55 E. Broadway Ave.	53.8728	-166.5302	$18,627,600	S1L/W2	X					X	X

Table D-1 Critical Facilities and Infrastructure

Facilities	Number of Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Erosion	Flood	Ground Failure	Tsunami	Volcano	Weather (Severe)
	7	Unalaska School District Office	55 E. Broadway Ave.	53.8728	-166.5302	$774,200	W2	X					X	X
	15	University of Alaska (UAF)	14 Mission Avenue	53.87222	-166.5286	Unknown	W1	X					X	X
Medical	15	Oonalaska Wellness Center	34 Lavelle Court	53.8721	-166.5393	Unknown	W1	X					X	X
	25	Iliuliuk Medical Center (Family & Health Services, Inc.)	34 Lavelle Court	53.8724	-166.5393	$5,306,600	W2	X					X	X
	40	Father Ishmail Gromoff Senior Center	79 Eleanor Drive	53.87106	-166.53058	$1,709,400	W2	X					X	X
Community	80	Church, Russian Orthodox, Church of the Holy Ascension	265 West Broadway Avenue	53.8756	-166.5363	$433,210	W1/W2	X				X	X	X
	5	Museum of the Aleutians Aleutian World War II National Park	Ulatka Head, Mt. Ballyhoo	53.9159	-166.5149	$2,889,370	W2/W1	X				X	X	X
	250	The Grand Aleutian	498 Salmon Way	53.8841	-166.5511	$9,141,000	W2	X				X	X	X
	50	Carl's Bayview Inn	404 W Broadway Avenue	53.8771	-166.5388	Unknown	S1L	X					X	X
	100	Unisea Inn	188 Gilman Rd	53.8784	-166.5547	$3,640,800	W2	X				X	X	X
	25	Unalaska Senior Center	Same as Father Ishmail Gromoff Senior Center	53.8711	-166.5307	Unknown	W2	X					X	X
	50	Public Library	64 Eleanor Drive	53.8711	-166.5319	$3,404,665	W2	X					X	X
	Unknown	Alyeska Seafoods, LLC	551 W. Broadway Ave	53.8791	-166.5409	Unknown	S1L	X					X	X
	Unknown	North Pacific Fuel	1654 Ballyhoo Rd	53.9121	-166.5103	Unknown	S1L	X			X		X	X

Table D-1 Critical Facilities and Infrastructure

Facilities	Number of Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Erosion	Flood	Ground Failure	Tsunami	Volcano	Weather (Severe)
	Unknown	Off Shore Systems Inc.	Mile 4 Captains Bay Rd	53.8435	-166.5788	Unknown	S1L	X			X		X	X
	Unknown	Radiant Heating Fuel Service	717 E. Broadway Ave.	53.8666	-166.5179	Unknown	W1	X					X	X
	Unknown	Westward Seafoods	1200 Captains Bay Rd	53.8579	-166.5542	$24,888,040	S1L	X				X	X	X
	Unknown	Unisea Seafoods	88 Salmon Way	53.8788	-166.5531	$27,376,760	S1L	X				X	X	X
	Unknown	Alyeska Seafoods, LLC	Listed above on line 41	Unknown	Unknown	$16,171,050	S1L	X				X	X	X
	Unknown	Icicle Seafoods	1829 Ballyhoo Rd	53.9119	-166.5069	$1,547,100	W2	X			X	X	X	X
	Unknown	Trident Seafoods	1787 Ballyhoo Rd	53.9124	-166.5085	Unknown	W2	X			X	X	X	X
	Unknown	Trident Bunkhouse	1836 Ballyhoo Road	53.9131	-166.5078	Unknown	W2	X			X		X	X
	Unknown	Trident Warehouse	1712 Ballyhoo Road	53.9124	-166.5097	Unknown	S1L	X			X		X	X
	Unknown	Royal Aleutian Seafoods	441 East Point Road	53.8815	-166.5422	Unknown	S1L	X				X	X	X
Roads	0	2nd Street	~41 miles (61 Km)	N/A	N/A	$3,813,330	HRD1	X					X	X
	0	3rd Street						X					X	X
	0	4th Street						X					X	X
	0	5th Street						X					X	X
	0	Aerie Drive						X					X	X
	0	Airport Beach Road						X					X	X
	0	Armstrong Court						X					X	X
	0	Ballyhoo Road						X					X	X

Table D-1 Critical Facilities and Infrastructure

Facilities	Number of Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Erosion	Flood	Ground Failure	Tsunami	Volcano	Weather (Severe)
	0	Bayview Avenue						X					X	X
	0	Bendiksen Road						X					X	X
	0	Biorka Drive						X					X	X
	0	Captains Bay Road						X				X	X	X
	0	Chernofski Drive						X					X	X
	0	Choate Lane						X					X	X
	0	Dutton Road						X					X	X
	0	Eagle Crest Court						X					X	X
	0	Eagle Drive						X					X	X
	0	East Broadway						X					X	X
	0	East Point Road						X					X	X
	0	Gilman Road						X					X	X
	0	Gromoff Lane						X					X	X
	0	Haystack Drive						X					X	X
	0	Henry Swanson Drive						X					X	X
	0	Jack London Drive						X					X	X
	0	Kashega Drive						X					X	X
	0	Lake Drive						X					X	X
	0	Lavelle Court						X					X	X
	0	Lear Road						X					X	X
	0	Loop Road						X					X	X
	0	Makushin Drive						X					X	X
	0	Nirvana Drive						X					X	X
	0	Overland Drive						X					X	X
	0	Pacesetter Way						X					X	X
	0	Ptarmigan Road						X					X	X

Table D-1 Critical Facilities and Infrastructure

Facilities	Number of Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Erosion	Flood	Ground Failure	Tsunami	Volcano	Weather (Severe)
	0	Pyramid Creek Road						X					X	X
	0	Raven way						X					X	X
	0	Riverside Drive						X					X	X
	0	Safety Way						X					X	X
	0	Salmon Way						X					X	X
	0	Stewart Road						X					X	X
	0	Summer Bay Road						X					X	X
	0	Thompson Circle						X					X	X
	0	Trapper Drive						X					X	X
	0	Tundra Drive						X					X	X
	0	Ulatka Drive						X					X	X
	0	West Broadway						X					X	X
	0	Willow Drive						X					X	X
	0	Wittern Lane						X					X	X
Bridges	0	South Channel Bridge	Airport Beach Road (S310)	53.8739	-166.5465	$30,024,907	Unknown	X				X	X	X
	0	UMC City Dock Facility Fill Bridge	Ballyhoo Road	53.9028	-166.5281	$11,822,026	Unknown	X				X	X	X
	0	Summer Bay Bridge	Summer Bay Road	53.8965	-166.4595	Unknown	Unknown	X				X	X	X
	0	Captains Bay Road Bridge	Captains Bay Road	Unknown	Unknown	Unknown	Unknown	X				X	X	X
Utilities	0	Bulk Fuel Storage Tank Farm: Delta Western North Pacific Offshore Systems	Fuel tank farms are not addressed in our system	Unknown	Unknown	Unknown	OTF	X					X	X
	0	Icy Creek Reservoir	2500 Pyramid Creek Road	53.8305	-166.5534	Unknown	Unknown	X					X	X

Table D-1 Critical Facilities and Infrastructure

Facilities	Number of Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Erosion	Flood	Ground Failure	Tsunami	Volcano	Weather (Severe)
	0	Icy Lake Reservoir	3175 Pyramid Creek Rd	53.8081	-166.5504	Unknown	Unknown	X					X	X
	0	Water Storage Tanks	410 Lear Road	53.8601	-166.5045	Unknown	PWST	X					X	X
	8	Wastewater Treatment Facility	19 Gilman Rd	53.8797	-166.5582	$6,060,000	WWTS	X					X	X
	5	Water Treatment Facility	1400 Pyramid Creek Rd	53.8504	-166.5607	$23,800,000	PWTS	X					X	X
	0	City-wide piped water	Citywide	N/A	N/A	$17,800,000	PWP	X					X	
	0	City-wide piped wastewater	Citywide	N/A	N/A	Unknown	WWP	X					X	X
	7	Unalaska Electric Utility	Citywide	N/A	N/A	$51,500,000	EPPS	X					X	X
	4	Unalaska Community Broadcasting Inc.	28 East Broadway Ave (same building as Burma Road Chapel)	53.8727	-166.5313	Unknown	CBO	X					X	X
	2	Chemical Storage Building	2486 E. Broadway Ave.	53.8455	-166.5045	$925,000	Unknown	X					X	X
Total Occ.	1770				**Total Damages:**	$454,655,768								

(Unalaska 2012, DHS&EM 2009a)

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Appendix E
Figures
Section Six, Vulnerability Analysis Support

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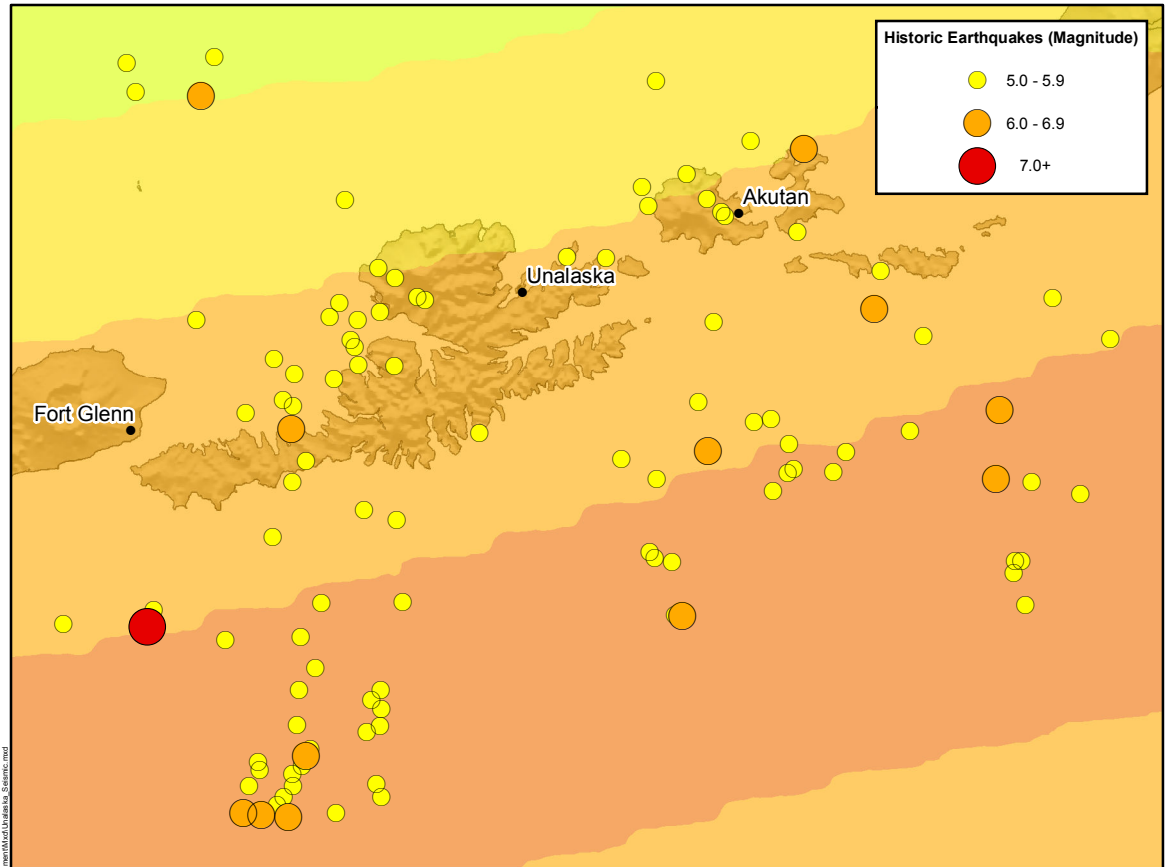

Miles
0 15 30

N

Seismic Hazard and Historic Events

Seismic Ground Motion (USGS, 2007)

165	78	37	17	8	4
129	61	29	13	6	3
100	47	22	10	5	

URS

Source:
Earthquakes by USGS, Critical Facilities and 2010 Imagery provided by Unalaska.

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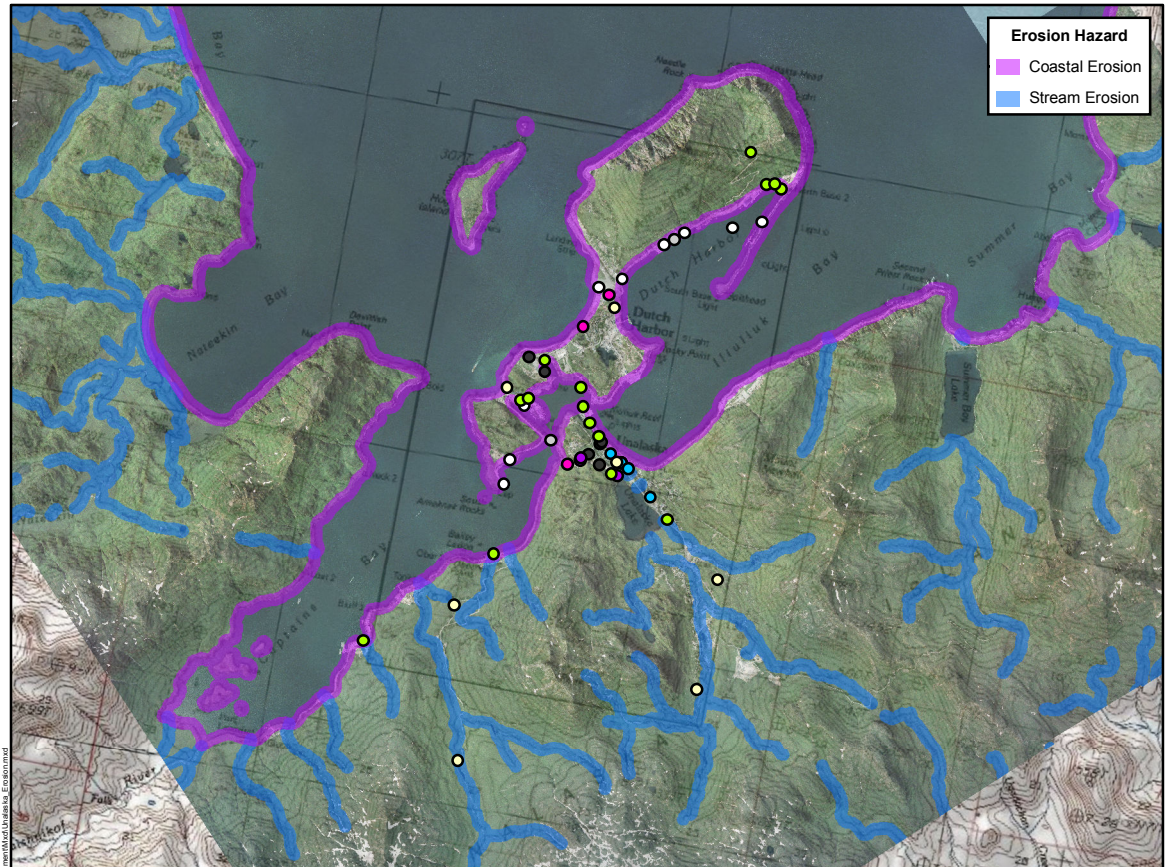

Miles
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Source:
Erosion Hazards developed with USGS NHD by URS.
Critical Facilities and 2010 Imagery provided by Unalaska.
Topography by 2011 National Geographic Society, i-cubed

Erosion Hazard

Unalaska Critical Facility Type

- Bridge
- Community
- Education
- Emergency Response
- Government
- Medical Care
- Transportation
- Utilities

URS

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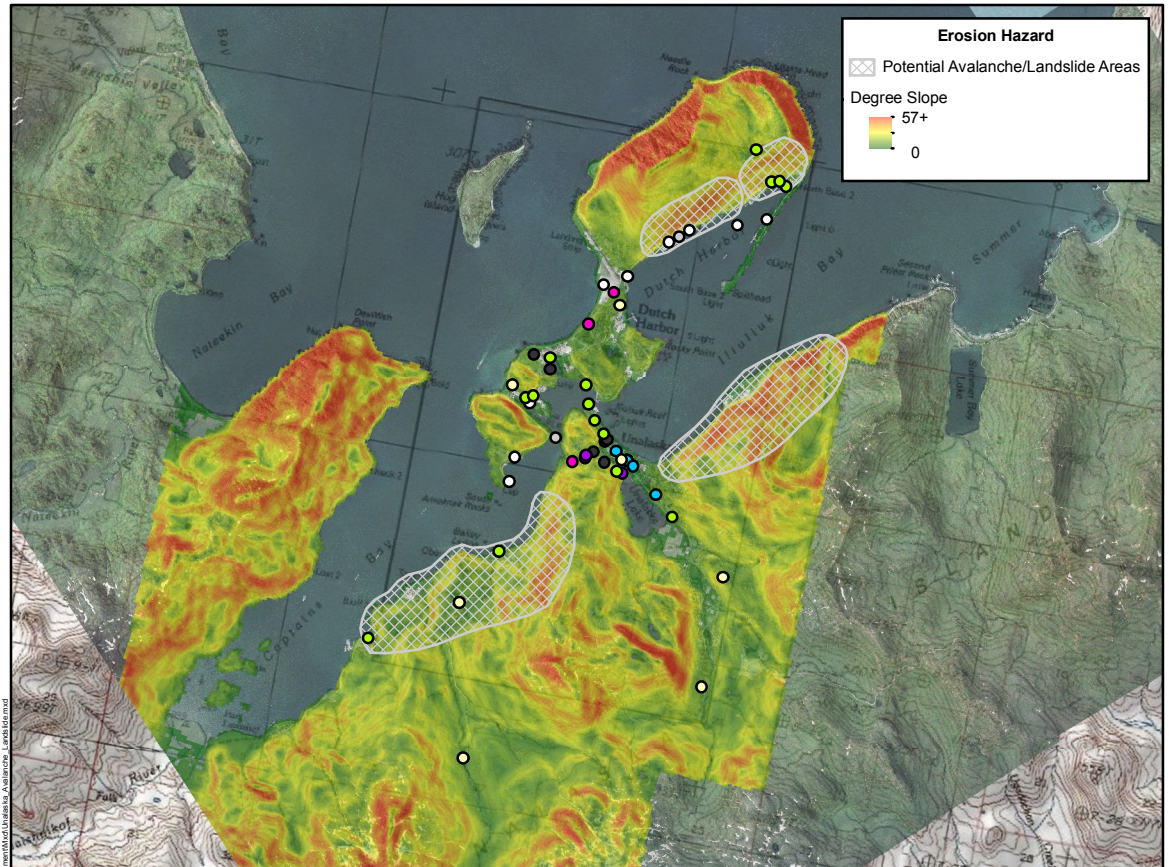

Avalanche/Landslide Hazard

Unalaska Critical Facility Type

- Bridge
- Community
- Education
- Emergency Response
- Government
- Medical Care
- Transportation
- Utilities

Source:
Slope by URS. Critical Facilities and 2010 Imagery provided by Unalaska. Topography by 2011 National Geographic Society, i-cubed

URS

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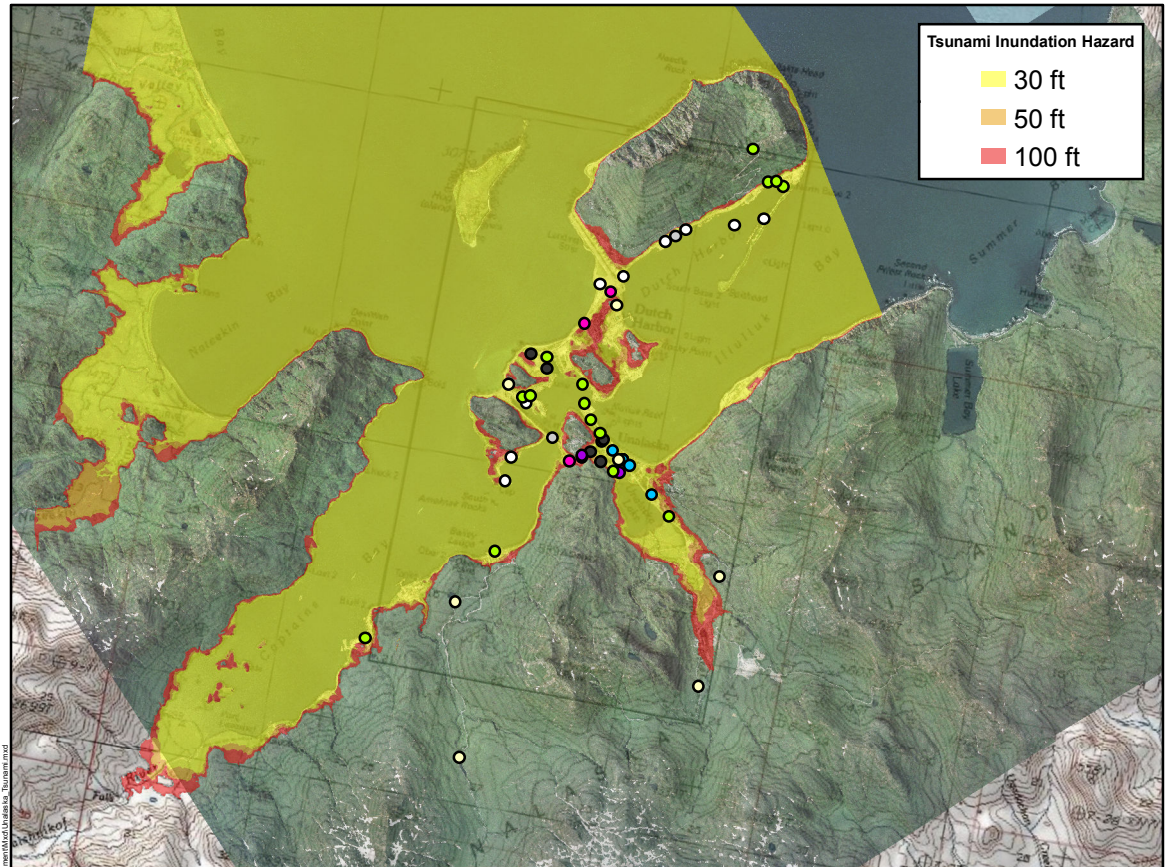

Miles
0 1 2

N

Source:
Tsunami Inundation Hazard, Critical Facilities and 2010 Imagery provided by Unalaska. Topography by 2011 National Geographic Society, i-cubed.

Tsunami Inundation Hazard

Unalaska Critical Facility Type

- Bridge
- Community
- Education
- Emergency Response
- Government
- Medical Care
- Transportation
- Utilities

URS

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Appendix F
Public Outreach

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CITY OF UNALASKA HAZARD MITIGATION PLAN

Newsletter 1 **November 2012**

This newsletter discusses the preparation of the Unalaska Hazard Mitigation Plan. It has been prepared to inform interested agencies, stakeholders, and the public about the project and to solicit comments. This newsletter can also be viewed on the State of Alaska Division of Homeland Security and Emergency Management Website at http://www.ready.alaska.gov/plans/localhazmitplans.htm.

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 prepare Hazard Mitigation Plans (HMP) for fifteen Alaskan Communities. Unalaska was selected for participation in this effort.

URS was contracted to assist the community with preparing a FEMA approvable hazard mitigation plan and subsequent hazard mitigation grant program application during 2012 and 2013.

The Unalaska Hazard Mitigation Plan will identify all natural hazards, such as earthquake, erosion, flood, severe weather, and wildland fire hazards and others. The plan will also identify the people and facilities potentially at risk and ways to mitigate damage from future hazard impacts. The public participation and planning process is documented as part of these projects.

What is Hazard Mitigation?

Across the United States, natural and human-caused disasters have increasingly caused injury, death, property damage, and business and government service interruptions. The toll on individuals, families, and businesses can be very high. The time, money, and emotional effort required to respond to and recover from these disasters takes public resources and attention away from other important programs and problems.

The people and property in the State of Alaska are at risk from a variety of natural hazards that can potentially cause human injury, property damage, or environmental harm.

Hazard mitigation projects eliminate the risk or reduce the hazard impact severity to people and property. Projects may include short- or long-term activities to reduce exposure to or the effects of known hazards. Hazard mitigation activities include relocating or elevating buildings, replacing insufficiently sized culverts, using alternative construction techniques, or developing, implementing, or enforcing building codes, and developing educational outreach initiatives to educate residents and visitors of known hazards.

Why Do We Need A Hazard Mitigation Plan?

Communities must have a State, FEMA approved, and community adopted mitigation plan to receive a project grant from FEMA's pre- and post-disaster grants identified in their Hazard Mitigation Assistance and other agency's mitigation grant programs. The City of Unalaska plans to apply for mitigation funds after our plan is complete.

A FEMA approved and community adopted HMP enables the Local government to apply for the Hazard Mitigation Grant Program (HMGP), a disaster related assistance program. Applicants typically compete on a statewide basis.

The Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), Repetitive Flood Loss (RL), Severe Repetitive Flood Loss (SRL) grant programs are nationally competitive funding programs. These grans use the same application process and eligibility requirements.

The Planning Process

There are very specific federal requirements that must be met when preparing a hazard mitigation plan. These requirements are commonly referred to as the Disaster Mitigation Act of 2000, or DMA2000 criteria. Information about the criteria and other applicable laws and regulations may be found at: http://www.fema.gov/plan/mitplanning/guidance.shtm

The DMA2000 requires the plan to include and document the following topics:

- Plan development process
- Identify hazards specific to the community
- Identify the population's and structures' risks
- Define the jurisdiction's mitigation goals
- List the community's mitigation strategy, selected actions, and implemented projects
- Provide a copy of the community's HMP Adoption Resolution

FEMA has prepared Planning Guidance which is available at: http://www.fema.gov/library/viewRecord.do?id=4225; and "How to" Guides that explain in detail how each of the DMA2000 requirements are met. These guides are available at

http://www.fema.gov/plan/mitplanning/resources.shtm. The City's Hazard Mitigation Plan will follow those guidelines.

We are currently in the very beginning stages of preparing the plan. We will be conducting a public meeting to introduce the project and planning team, and to gather comments from our community residents. Specifically we will complete the hazard identification task, and collect data to conduct the risk assessment.

DHS&EM has previously identified natural hazards that occur in the Aleutians West Census Area that may also occur specifically in Unalaska.

The Planning Team

The planning team is being led by Director of Public Safety Jamie Sunderland, with assistance from Director of Planning Erin Reinders, AICP; Planning Administrator Rosio Glorso, and the Planning Commission. URS Corporation has been contracted by DHS&EM to provide assistance and guidance to the planning team throughout the planning process.

Public Participation

Public involvement will continue throughout the project. The goal is to receive comments, identify key issues or concerns, and improve ideas for mitigation. When the Draft Unalaska Hazard Mitigation Plan is complete, the results will be presented to the community before DHS&EM and FEMA approval, and community adoption.

We Need Your Help

Please use the following table to identify any hazards you have observed in your area that DHS&EM is not aware of AND any additional natural hazards that may not be on the list.

Unalaska Identified Hazards		
Hazard	Aleutians West Census Area	Unalaska
Earthquake	Yes (Medium)	Yes
Erosion	Yes	Yes
Flood	Yes (High)	Yes (Low)
Ground Failure (Avalanche, Landslide, Subsidence, Permafrost)	No	Yes (Landslide, subsidence)
Tsunami & Seiche	No	Yes
Volcano	No	Yes
Weather (Severe)	Yes	Yes
Wildland (Tundra) Fire	No	No

*Hazard Matrix from the 2010 State of Alaska Hazard Mitigation Plan for the Aleutians West Census Area

Critical Facility Listing

Our list of critical facilities within the City of Unalaska needs to be updated and the estimated value and location (latitude/longitude) determined.

In addition, the number and value of structures, and the number of people living in each structure will need to be documented. Once this information is collected we will determine which critical facilities, residences, and populations are vulnerable to specific hazards in Unalaska. Please add additional facilities if needed.

Please email or fax updated hazard and critical facility information directly to URS or provide it to your community planning & project team leader.

Unalaska Critical Facilities		
Facility	Facility	Sample List of the Roads
Unalaska City Hall	Radiant Heating Fuel Service	2nd Street
Unalaska Port of Dutch Harbor Convention and Visitors Bureau	Westward Seafoods	3rd Street
Qawalangin Tribe of Unalaska Office	Unisea Seafoods	4th Street
Unalaska Airport (3,900' long by 100' wide paved runway)	Alyeska Seafoods, LLC	5th Street
Seaplane Base	Icicle Seafoods	Aerie Drive
Unalaska Little South America Harbor	Trident Seafoods	Airport Beach Road
Unalaska Marine Center	Royal Aleutians Seafoods	Armstrong Court
US Coast Guard Dock	Little South America Harbor Road	Ballyhoo Road
Unlaska City Dock	East Point	Bayview Avenue
Ballyhoo Dock (City)	Ballyhoo Road	Bendiksen Road
International Port of Dutch Harbor (5,200' moorage, 1,232' floating dock)	Airport Beach Road	Biorka Drive

Unalaska Critical Facilities		
Facility	**Facility**	**Sample List of the Roads**
Small Boar Harbor (238 slips)	Airport Drive	Captains Bay Road
Unalaska Police Department	Airport Highway	Chernofski Drive
State Troopers Post	Captains Bay Rd	Choate Lane
Village Publid Safety Officer (VPSO)	East Broadway	Dutton Road
Unalaska Volunteer Fire Department	Ulatka Drive	Eagle Crest Court
Eagle's View Elementary School	South Channel Bridge	Eagle Drive
Unalaska Jr./Sr. High School	UMC City Dock Facility Fill Bridge	East Broadway
Oonalaska Wellness Center	Airport Highway Channel Bridge	East Point Road
Iliuliuk Medical Center (Family & Health Services, Inc.)	South Channel Bridge	Gilman Road
Church, Russian Orthodox, Church of the Holy Ascension	UMC City Dock Facility Fill Bridge	Gromoff Lane
Museum of the Aleutians Aleutian World War II National Park	Airport Highway Channel Bridge	Haystack Drive
Waverider Encouragement Ministries	Icy Creek Reservoir	Henry Swanson Drive
The Grand Aleutian	Water Storage Tanks	Jack London Drive
Carl's Bayview Inn	Wastewater Treatment Facility	Kashega Drive
Unisea Inn	Water Treatment Facility	Lake Drive
Eagles Inn	City-wide piped water and wastewater	Lavelle Court
Unalaska Senior Center	Bulk Fuel Storage Tank Farm: Delta Western North Pacific Offshore Systems	Lear Road
Father Ishmail Gromoff Senior Center	Unalaska Electric Utility	Loop Road
Public Library	Unalaska Community Broadcasting Inc.	Makushin Drive
Alyeska Seafoods, LLC	Chemical Storage Building	Nirvana Drive
North Pacific Fuel	Unalaska Heat Recovery	Overland Drive

We encourage you to take an active part in preparing the City of Unalaska's Hazard Mitigation Plan development effort. The purpose of this newsletter is to keep you informed and to allow you every opportunity to voice your opinion regarding these important projects. Please contact your community representative or Scott Simmons, URS directly if you have any questions, comments, or requests for more information:

Unalaska's Planning Team Leader

Jamie Sunderland, Director of Public Safety
City of Unalaska
P.O. Box 610
Unalaska, AK 99685.0610
907.581.1251
jsunderland@ci.unalaska.ak.us

URS Corporation

Scott Simmons, Hazard Mitigation, Emergency Management, and Climate Change Planner
560 E 34th Avenue, Suite 200
Anchorage, Alaska 99503
907.261.9706 OR 800.909.6787
scott_Simmons@urscorp.com

Division of Homeland Security & Emergency Management

Scott Nelsen, Emergency Management Specialist
PO Box 5750
Anchorage, AK 99505-5750
907.428.7010 or 800.478.2337
Scott.Nelsen@alaska.gov

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eMail Message extracted from City eMail string.-ss

From: Jamie Sunderland [mailto:jsunderland@ci.unalaska.ak.us]
Sent: Thursday, December 13, 2012 2:41 PM
To: Abner Hoage; Alvin Merculief; City of St. Paul; D. Kompkoff; Dan Winters; Dave Gregory; Erin Reinders; Ferdinand Lopez; Gabriel Rukovishnikoff (gabe@stpaulak.com); Gary Sandness; Gregg Bishop; Hank Anelon; Jacob Merculief; Jamie Sunderland; Jeff Hawley; John Conwell (jconwell@UCSD.net); Jon Droska; KC Alberg (kcalberg@stpaulak.com); Leonty Lokanin; Louis Nevzoroff; M. Lynn Crane; Michael Holman; Mike Barber; Millie Prokopeuff; Ramona Thompson; Rosie Glorso; Ruth Marquez; Sonia Handforth-Kome (bohako@yahoo.com); Stephen Senisch; Steve Milligan; Victor Golodoff; William Dushkin
Cc: Simmons, Scott
Subject: LEPC mtg on [December] 19th[, 2012]

LEPC members and guests,

There will be an LEPC meeting at Public Safety on **Wednesday the 19th of December at 1pm**.

If you are out of town, you can call in at the number below.

Agenda:

USA Toll-Free: (877)322-9654

HOST CODE: 309508 **PARTICIPANT CODE:** 724281

- Discuss the draft Unalaska Hazard Mitigation Plan, led by Scott Simmons (telephonic)
- Review draft sheltering plan, Jeff Hawley
- Upcoming Alaska Shield 2014 planning meeting
- Position specific training in March, ANC
- Promotional items mailed out to St. Paul and Atka
- Future plans to review?
- ICS training in Unalaska in 2013

Thanks and hope to see you there,

Jamie Sunderland
Director
Unalaska Dept. of Public Safety
P.O. Box 370
Unalaska, AK 99685
(907)581-1233

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CITY OF UNALASKA
UNALASKA, ALASKA
PLANNING COMMISSION MINUTES
Thursday, January 17, 2013
CITY COUNCIL CHAMBERS, CITY HALL
7:00 P.M.

Call to Order: Chair Chris Bobbitt called the meeting to order at 7:04 P.M.

Staff Present:
Erin Reinders, AICP, Planning Director
Rosie Glorso, Planning Administrator
Jamie Sunderland, Director of Public Safety
Abner Hoage, Fire Chief
Michael Holman, Deputy Chief of Public Safety

Consultants Present:
Scott Simmons, Consultant with URS Corporation
Scott Nelsen, Alaska DHS&EM

Public Present:
Bill Shaisnikoff
Diane Shaishnikoff

Roll Call:
Commissioners present:
Chris Bobbitt, Chair
Chris Spengler
Steven Gregory

Commissioners excused:
Vicki Williams
John Laskowski

Additions to the Agenda: None

Appearance Requests: None

Minutes: Mr. Spengler motioned to approve the minutes from the November 8, 2012 meeting. There was a second. Chair Bobbitt inquired if there were any questions about the minutes. There being no questions, Chair Bobbitt called for vote on the minutes and the motion passed by unanimous consensus (3-0). The minutes from the November 8, 2012 meeting were adopted.

Announcements/Public Input: Ms. Reinders announced the quarterly e-newsletter and thank the people who have already signed up for the e-newsletter. It will start out as a quarterly newsletter but once more materials are available it will expand into a monthly e-newsletter. People can sign up through the Planning Department page of the City website and asked everyone to spread the word and expect the first issue by February.

Chair Bobbitt reminded the Commissioners that the Financial Disclosure forms are available. Mr. Gregory inquired when the deadline for submission and was told that the deadline was sometime in March and was available from the City Clerk.

Planning Commission Public Hearings:

1. **Public Hearing to review the preliminary plat of Unalaska Tideland Survey (UTS) 103, a replat of Alaska Tideland Survey No. 1452, Plat No. 95-12, Aleutian Islands Recording District, located in Captains Bay.**

Chair Bobbitt opened the public hearing and called for any ex parte contact or conflicts of interest to be disclosed. Hearing none, the Chair called for staff presentation.

Staff Presentation: Staff stated that the proposed preliminary plat consists of a portion of ATS 1452 at the head of Captains Bay adjacent to Bill Shaishnikoff's native allotment. The platting action of UTS 103 is one of the steps in a tideland lease application process. All of ATS 1452 is owned by the City of Unalaska and must be subdivided to allow for Mr. Shaishnikoff to lease a portion according to Title 7 and Title 8 requirements.

Staff recommended approval of the plat with conditions as follows:

1. Show and label existing improvements, such as the barge loading ramp.
2. Show a tie from one monument within the subdivision to one of the existing City control monuments with bearing and distance.
3. Set one new primary monument and provide coordinates in NAD 83 Alaska Statute Plane Zone 10, U.S. foot.
4. Submit a closure report.

Chair Bobbitt asked if there were any questions from the Commissioners.

Mr. Gregory asked how the boundary lines were drawn. Staff explained that the surveyor extended the lot lines from upland parcels to create the new tracts or they were created for specific purposes, specifically to encompass the barge loading ramp.

Chair Bobbitt asked if there were any more questions. Hearing none, he asked Mr. Bill Shaishnikoff if he would like to testify.

Applicant Testimony: Mr. Shaishnikoff stated that he believes the best use of the property is for industrial purposes. He stated that for the past 4-5 years, his rock export business has taken off and a large part of his business is providing coarse bed rock for applications such as erosion control. Mr. Shaishnikoff explained that he will need larger barges for future projects that require a parallel side load and a larger barge loading ramp.

Chair Bobbitt asked the Commissioners if they have any questions for Mr. Shaishnikoff. Mr. Gregory inquired if Mr. Shaishnikoff ever stopped moving barges due to the weather. Mr. Shaishnikoff said that they have never experienced any interruptions once the barge was safely landed due to weather. He explained that Captains Bay is largely protected due to its configuration, and his barges have lower risk because the bay is protected and has a gravel bottom beach. He explained that at times he has been unable to land the barge due to weather, at which point his crew has to moor the barge and wait for the weather to clear. He explained that the larger barges with a parallel side load will mean fewer weather delays than with the current equipment he is using.

Chair Bobbitt asked if there were any other questions from the Commissioners. Hearing none, Chair Bobbitt called for a vote by consensus on Resolution 2013-01.

Motion: Mr. Spengler moved to approve Resolution 2013-01. There was a second.

Vote: The vote was unanimous (3-0). The motion carried.

Mr. Spengler motioned to move to a Regular Meeting. There was a second, and all were in favor (3-0).

Regular Meeting:

2. Review the Planning Commission/Platting Board Annual Report for 2012.

Staff Presentation: Ms. Reinders explained that every year the Planning Department is required to present an Annual Report to the City Council. The Staff has put together the Annual Report for the Planning Commission to review and approve and then present to the City Council. The report contains the overview of projects that the Planning Commission has taken action on, including general statistics as well as details of the activities, the recommendations to City Council and the Platting Actions that were approved throughout the year. Ms. Reinders explained that the Planning Commission would present this report as amended at the February 26, 2013 Council Meeting. She also thanked the Commissioners for their hard work in 2012, especially with large projects such as the changes in Title 8 of the UCO.

There being no other questions from the Commissioners, Chair Bobbitt called for a vote by consensus on Resolution 2013-02.

Motion: Mr. Spengler moved to approve Resolution 2013-02. There was a second.

Vote: The vote was unanimous (3-0). The motion carried.

3. Receipt of Resolution 2012-17 giving preliminary plat approval to Parkside Estates Subdivision Revision 1, a resubdivision of Parkside Estates Subdivision Plat No. 2011-17, Aleutian Islands Recording District, located in the Valley on East Broadway Avenue.

Staff Presentation: Staff reminded the Commissioners that per UCO 8.08.040(B), the Planning Director is the Platting Authority for abbreviated plat review and approval. The Parkside Estates Subdivision Revision No. 1 is a short plat subdividing one lot into two smaller lots. Staff informed the Board that Ms. Glorso approved the plat as the Acting Planning Director in this case, in lieu of Ms. Reinders who was out of town.

Chair Bobbitt asked the Commissioners if they have any questions for the Staff. Hearing none, he moved on to the presentation of the Local Hazard Mitigation Plan (LHMP).

Work Session:

4. Presentation on Local Hazard Mitigation Plan (LHMP) by Mr. Scott Simmons of URS Corporation and Mr. Scott Nelsen of the State of Alaska Division of Homeland Security & Emergency Management (DHS&EM), along with the Aleutians Pribilof Local Emergency Planning Committee (LEPC) and the Unalaska Department of Safety.

Presentation: Mr. Scott Simmons introduced himself and explained that URS Corporation was contracted by the State of Alaska to come up with a LHMP for 14 rural communities in Alaska and Unalaska was one of the 14 that was chosen. Unalaska is one of the largest rural

communities that have yet to have a LHMP. Mr. Scott Nelsen of the State of Alaska DHS&EM is the approval authority for Hazard Mitigation Planning.

Mr. Simmons explained that hazard mitigation is identifying all the natural and human-caused disasters that cause injury, death, property damage and business and government services interruptions, and creating projects to reduce or eliminate those hazards. Mr. Simmons explained the need for an LHMP is primarily to qualify for Federal funding for projects. The FEMA approved Hazard Mitigation Plan adopted by a community enables that community to apply for the Hazard Mitigation Grant Program. Mr. Simmons said that the city should not adopt a plan until FEMA has approved it, otherwise no funding for projects will be granted.

Mr. Simmons said there are specific requirements that must be met when preparing a HMP. He told the audience that there are available resources such as a Planning Guidance by FEMA. They are currently in the beginning stage of preparing the HMP plan for Unalaska. The Planning Team is being led by Police Chief Jamie Sunderland. Public involvement will continue throughout the planning process and once it has been completed it will be presented to the community before seeking FEMA approval. Once he has everything in the report it will be for review at the end of the month.

Chair Bobbitt thanked Mr. Simmons for the presentation. There were no questions from the Commissioners for Mr. Simmons.

Commission Discussion: Chair Bobbitt informed the Planning Commissioners that February is the time to re-apply for those with terms that are about to expire. Ms. Reinders told the Board that Mr. John Laskowski, the current Vice-Chair, would not be re-applying when his term expires this coming February 2013. Chair Bobbitt told fellow Commissioners that they will be voting for officer positions soon and encouraged other Commissioners to consider serving as Chair or Vice-Chair.

Meeting Review: The next regularly-scheduled Planning Commission meeting will be on February 21st. Ms. Reinders added that she is hoping to show the draft CMMP to the Planning Commissioners.

Adjournment. Chair Bobbitt adjourned the meeting at 7:45 PM.

PASSED AND APPROVED THIS _____ DAY OF _____ 2013 BY THE CITY OF UNALASKA, ALASKA PLANNING COMMISSION.

_____ _____
Chris Bobbitt Date
Chair

_____ _____
Erin Reinders, AICP Date
Recording Secretary

Prepared by Rosie Glorso and Veronica De Castro, Planning Department

CITY OF UNALASKA HAZARD MITIGATION PLAN (HMP)

February 2013 **Newsletter 2**

This newsletter discusses the preparation of the City of Unalaska Hazard Mitigation Plan. It has been prepared to inform interested agencies, stakeholders, and the public about the project and to solicit comments. This newsletter can also be viewed on the State of Alaska Division of Homeland Security and Emergency Management Website at http://www.ready.alaska.gov/plans/localhazmitplans.htm.

HMP Development

The City of Unalaska was one of fifteen communities selected by the State of Alaska, Division of Homeland Security and Emergency Management (DHS&EM) for a Hazard Mitigation Planning (HMP) development project. The plan identifies natural hazards that affect the community including earthquake, erosion, flood, ground failure, severe weather, and wildland (tundra) fire. The HMP also identifies the people and facilities potentially at risk and ways to mitigate hazards. The public participation and planning process has been documented as part of the project.

What is Hazard Mitigation?

Across the United States, natural disasters have increasingly caused injury, death, property damage, and business and government service interruptions. The toll on individuals, families, and businesses can be very high. The time, money, and emotional effort required to respond to and recover from these disasters take public resources and attention away from other important programs and problems.

The people and property in the State of Alaska are at risk from a variety of hazards that have the potential for causing human injury, property damage, or environmental harm.

The purpose of hazard mitigation is to implement projects that eliminate the risk or reduce the severity of hazards on people and property. Mitigation programs may include short-term and long-term activities to reduce the hazards, reduce exposure to hazards, or reduce the effects of hazards. Mitigation could include education, and construction projects. Hazard mitigation activity examples include relocating buildings, developing or strengthening building codes, and educating residents and building owners.

Why Do We Need A Hazard Mitigation Plan?

A community is only eligible to receive grant money for mitigation programs by preparing and adopting a hazard mitigation plan. Communities must have an approved mitigation plan to receive grant funding from the Federal Emergency Management Agency (FEMA) for eligible mitigation projects.

The Planning Process

There are very specific federal requirements that must be met when preparing a hazard mitigation plan. These requirements are commonly referred to as the Disaster Mitigation Act of 2000, or DMA2000 criteria. Information about the criteria may be found on the Internet at: http://www.fema.gov/plan/mitplanning/guidance.shtm

The DMA2000 requires the plan to document the following topics:

- Planning process
- Hazard identification
- Risk assessment
- Goals
- Mitigation programs, actions, and projects
- A resolution from the community adopting the plan

FEMA has prepared Planning Guidance which is available at: http://www.fema.gov/library/viewRecord.do?id=4225; and "How to" Guides that explain in detail how each of the DMA2000 requirements is met. These guides are available at http://www.fema.gov/plan/mitplanning/resources.shtm. The Unalaska Hazard Mitigation Plan will follow those guidelines.

The planning process kicked-off in April 2012 by establishing a local planning committee and holding a public meeting. The planning committee examined the full spectrum of hazards listed in the State Hazard Mitigation Plan and identified six hazards the HMP would address.

After the first public meeting, City staff and URS began identifying critical facilities, compiling the hazard profiles, assessing capabilities, and conducting the risk assessment for the identified hazards. Critical facilities are facilities that are critical to the recovery of a community in the event of a disaster. After collection of this information, URS helped to determine which critical facilities and estimated populations are vulnerable to the identified hazards in Unalaska.

A mitigation strategy was the next component of the plan to be developed. Understanding the community's local capabilities and using information gathered from the public and the local planning committee and the expertise of the consultants and agency staff, a mitigation strategy was developed. The mitigation strategy is based on an

evaluation of the hazards, and the assets at risk from those hazards. Mitigation goals and a list of potential actions/projects were developed as the foundation of the mitigation strategy. Mitigation goals are defined as general guidelines that explain what a community wants to achieve in terms of hazard and loss prevention. Goals are positively stated future situations that are typically long-range, policy-oriented statements representing community-wide visions. Mitigation actions/projects are undertaken in order to achieve your stated objectives. On January 18, 2013, the local planning committee identified projects/actions for each hazard that focus on six categories: prevention, property protection, public education and awareness, natural resource protection, emergency services, and structural projects. A representative sample of the mitigation actions identified as a priority by the planning team are listed below, and explained in more detail in the plan.

The selected projects and actions will potentially be implemented over the next five years as funding becomes available. A maintenance plan has also been developed for the hazard mitigation plan. It outlines how the community will monitor progress on achieving the projects/actions that will help meet the stated goals and objectives, as well as an outline for continued public involvement.

The draft plan is available in the City and Tribal offices for public review and comment. Comments should be made via email, fax, or phone to the contact person below and be received no later than March 1, 2013. The plan will be provided to DHS&EM and FEMA for their approval prior to formal adoption by Unalaska's City and Tribal Councils.

The Planning Committee

The plan was developed with the assistance from a planning committee consisting of a cross section of the community. Planning committee members who helped with development of the plan include Director of Public Safety and Team Leader, Jamie Sunderland, with assistance from Planning Director Erin Reinders, Planning Administrator Rosie Glorso, and Qawalangin Tribal President Denise Rankin, Tribal CEO Rick Miller, Tribal Administrator Robin Waldron, and URS Corporation.

Sample of the City of Unalaska's Mitigation Actions. Review the draft HMP for a complete list.

Unalaska Comprehensive Plan, 20/20 identified projects are included within the HMP's Mitigation Strategy.	Identify and pursue funding opportunities to implement mitigation actions.	Install embankment protection along Icy Dam reservoir.
Develop, produce, and distribute information materials concerning mitigation, preparedness, and safety procedures for all identified natural hazards.	Complete a landslide location inventory; identify threatened critical facilities and other buildings and infrastructure.	Identify and harden utility headers located along river embankments to mitigate potential flood, debris, and erosion damages.
Develop public outreach program to train proper response to each natural hazard type, i.e. Earthquake: drop, cover, and hold-on; Structure fire: Drop and Roll, and Drop and Crawl.	Develop critical facility list needing emergency back-up power systems, prioritize, seek funding, and implement mitigation actions.	Evaluate critical public facility seismic performance for fire stations, public works buildings, potable water systems, wastewater systems, electric power systems, and bridges within the jurisdiction.
The City and Tribe will aggressively manage their existing plans to ensure they incorporate mitigation planning provisions into all community planning processes such as comprehensive, capital improvement, and land use plans, etc. to demonstrate multi-benefit considerations and facilitate using multiple funding sources.	Purchase and install generators with main power distribution disconnect switches for identified and prioritized critical facilities susceptible to short term power disruption. (i.e. first responder and medical facilities, schools, correctional facilities, and water and sewage treatment plants, etc.)	Perform hydrologic and hydraulic engineering, and drainage studies and analyses. Use information obtained for feasibility determination and project design. This information should be a key component, directly related to implementing a proposed project identified from the study.
Develop, revise, adopt, and enforce storm water ordinances and regulations to manage run-off from new development, including buffers and retention ponds.		

We encourage you to learn more about the City of Unalaska's Hazard Mitigation Plan. The purpose of this newsletter is to keep you informed and to allow you every opportunity to voice your opinion regarding this important project. If you have any questions, comments, or requests for more information, please contact:

Scott Simmons, Hazard Mitigation, Emergency Management, and Climate Change Planner
URS Corporation
700 G Street, Suite 500
Anchorage, Alaska 99501
907.261.9706 or 800.909.6787
scott_simmons@urscorp.com

Scott Nelsen, Emergency Management Specialist
DHS&EM
P.O. Box 5750
Fort Richardson, Alaska 99506
907.428.7010 or 800.478.2337
Scott.Nelsen@alaska.gov

Simmons, Scott

From: Erin Reinders <ereinders@ci.unalaska.ak.us>
Sent: Friday, March 29, 2013 9:22 AM
To: Simmons, Scott
Cc: Jamie Sunderland
Subject: Hazard Plan

Good Morning!

We received no public comments during the review period. Looks like the plan can keep moving forward.

I will be back in the office on Monday, so please let me know if you need anything else at this point.

Thanks!

Erin Reinders
Sent from my iPhone

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Appendix G
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. Benefits, however, must be estimated probabilistically because they depend on the improved performance of the building or facility in future hazard events, the timing and severity of which must be estimated probabilistically.

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 Federal Emergency Management Agency [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 (flood, wind, seismic, etc.).
- Discuss how the proposed measure will mitigate against future damages.
- Document the Project 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 the Region 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.
- 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 (FFEs).
- 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 (i.e., 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 FFEs.
- Use of incorrect Project Useful Life (not every mitigation measure = 100 years).

Appendix H

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?			

Mitigation Action Progress Report

Progress Report Period: _____ (date) to _____ (date)

Project Title: _____ Project ID# _____

Responsible Agency: _____

Address: _____

City: _____

Contact Person: _____ Title: _____

Phone #(s): _____ email address: _____

List Supporting Agencies and Contacts:

_____

_____

Total Project Cost: _____

Anticipated Cost Overrun/Underrun: _____

Date of Project Approval: _____ Start date of the project: _____

Anticipated completion date: _____

Description of the Project (include a description of each phase, if applicable, and the time frame for completing each phase): _____

_____

_____

_____

Milestones	Complete	Projected Date of Completion

Plan Goal (s) Addressed:

Goal: _____

Indicator of Success: _____

_____

_____

_____

Project Status

☐ Project on schedule

☐ Project completed

☐ Project delayed*

*explain: _____

_____

☐ Project canceled

Project Cost Status

☐ Cost unchanged

☐ Cost overrun*

*explain: _____

_____

☐ Cost underrun*

*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: