City of Emmonak, Alaska

Local Hazards Mitigation Plan

Emmonak, July 18, 2006

March 9, 2008

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Acronyms

ADOT/PF	Alaska Department of Transportation and Public Facilities
AEIS	Alaska Earthquake Information System
ANCSA	Alaska Native Claims Settlement Act
AVCP	Association of Village Council Presidents
AVEC	Alaska Village Electric Cooperative
AWCG	Alaska Wildfire Coordinating Group
BFE	Base Flood Elevation (100 year flood)
CDBG	Community Development Block Grant
CDQ	Community Development Quota Program
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMP	Coastal Management Plan
CRS	Community Rating System
CRSA	Coastal Resource Service Area
DCRA	(Alaska) Division of Community and Regional Affairs
DHS&EM	Alaska Division of Homeland Security and Emergency Management
DMA	Disaster Mitigation Act
FBFM	Flood Boundary and Floodway Map
FDIC	Federal Deposit Insurance Corporation
FEMA	Federal Emergency Management Agency
FHBM	Flood Hazard Boundary Map
FHLBB	Federal Home Loan Bank Board
FIRM	Flood Insurance Rate Map
GIS	Geographic Information System
HAZUS	Hazards U.S.
LHMP	Local Hazards Mitigation Plan
LYSD	Lower Yukon School District
MSL	Mean Sea Level
NFIP	National Flood Insurance Program
NOAA	National Oceanographic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
PDMG	Pre-disaster Mitigation Grant
SBA	Small Business Administration
USARC	U.S. Arctic Research Commission
USCOE	United States Army Corps of Engineers
UTM	Universal Transverse Mercator
YDFM	Yukon Delta Fish Marketing Cooperative

Sample Resolution

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

Adoption of the City of Emmonak Local Hazards Mitigation Plan

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

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

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

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

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

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

Passed: _____
Date

_____
Certifying Official

Chapter 1. Planning Process and Methodology

Introduction

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

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

Plan Development

Location

Emmonak is located at the mouth of the Yukon River, 10 miles from the Bering Sea, on the north bank of Kwiguk Pass. It lies 120 air miles northwest of Bethel and 490 air miles from Anchorage, in the Yukon Delta National Wildlife Refuge. It lies at approximately 62.777780° North Latitude and -164.52306° West Longitude. (Sec. 17, T031N, R081W, Seward Meridian.) Emmonak is located in the Bethel Recording District. The area encompasses 7.5 square miles of land and 1.1 square miles of water. A maritime climate predominates in Emmonak. Temperatures range from -25 to 79 degrees Fahrenheit. Precipitation is 19 inches per year, while snowfall is 50 to 60 inches per year. Freeze-up occurs during October; break-up occurs in June.

Project Staff

The Emmonak City Manager Martin Moore and City Planner John Moses were City representatives on the plan. ASCG Incorporated and Eileen R. Bechtol of Bechtol Planning & Development were hired to write the plan.

Scott Simmons and Ervin Petty of the Division of Homeland Security & Emergency Management (DHS&EM) provided technical assistance and reviewed the drafts of this plan.

Plan Research

The plan was developed utilizing existing Emmonak plans and studies as well as outside information and research. Outside sources are credited in parentheses after their inclusion and in the bibliography.

Public Involvement

A site visit was conducted on July 18, 2006; the contractor met with City Manager Martin Moore, the Emmonak Mayor, and city staff.

Emmonak held public meetings on the plan on October 19, 2006 and March 22, 2007 to review the first draft and to add local mitigation projects. The contractor participated by teleconference. See pages 31 and 32 for a list of critical issues brought up by the community. The Village Council and Corporation members were also invited to the meetings, and in several cases are members of the city and native organizations.

The meetings were advertised using usual city council meeting notices, the attendance at these meetings were the Emmonak City Council, Emmonak City Staff, and members of the public. A copy of the draft Plan is available for public perusal at City Hall.

Plan Implementation

The City Council of Emmonak will be responsible for adopting the Emmonak LHMP and all future updates or changes. This governing body has the authority to promote sound public policy regarding hazards. The LHMP will be assimilated into other Emmonak plans and documents as they come up for review according to each plan's review schedule. Please see the following table for plan review schedules.

Table 1. Emmonak Plans

Document	Completed	Next Review
Emmonak Community Plan	Preliminary Plan 1984	Not scheduled
Capital Improvement Projects	Annually	Annually
Comprehensive Economic Development Strategy Plan	1997	Not scheduled
Transportation Plan	2002	To be determined
Ceñaliulriit (Yukon-Kuskokwim) CRSA* Coastal Management Plan	2006	2011
Emergency Operation Plan	Not completed	As needed

* Coastal Resource Service Area

Continuing Review Process

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

Continued Plan Development

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

The plan will be updated every five years or as funded or required by the Division of Homeland Security and Emergency Management.

The City Manager will be responsible for updating and maintaining the plan by adding additional hazards and completing vulnerability assessments for existing hazard chapters.

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

Table 2. Continued Plan Development

Hazard	Status	Hazard Identification Completion Date	Vulnerability Assessment Completion Date
Floods	Completed	2007	2007
Erosion	Completed	2007	2007
Severe Weather	Completed	2007	2007
Wildland Fire	Completed	2007	2007
Earthquake	Completed	2007	2007
Economic	Future Addition	2012	2015
Technological	Future Addition	2012	2016
Public Health Crisis	Future Addition	2009	2011

Continued Public Involvement

The LHMP will be reviewed annually at a regular meeting. Also the plan will be available for review at regular spring break up meetings. The plan is available on the web-based program that DHS&EM has set up. The website for this program can be found online at: www.mitigationplan.com

A copy of the LHMP will be given to the Tribal council for their review and input.

Risk Assessment Methodology

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

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

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

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

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

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

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

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

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

- Transportation systems such as highways, airways and waterways;

- Utilities; water treatment plants, communications systems, power facilities;

- High potential loss facilities such as the levee and bulk fuel storage facilities; and

- Hazardous materials sites.

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

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

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

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

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

Vulnerability Assessment Methodology

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

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

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

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

This hazard plan includes an inventory of critical facilities, if applicable, from the Emmonak City records and land use map.

Federal Requirement for Risk Assessment

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

Table 3. Federal Requirements

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

Section 322 Requirement	How is this addressed?
Assessing Vulnerability: Analyzing Development Trends	The Community Profile Section and Chapter 3 include a description of development in Emmonak and the land use maps lists all the structures and utilities in the community.

Chapter 2: Community Profile

Community Overview

Location:

Emmonak is located at the mouth of the Yukon River, 10 miles from the Bering Sea, on the north bank of Kwiguk Pass. It lies 120 air miles northwest of Bethel and 490 air miles from Anchorage, in the Yukon Delta National Wildlife Refuge. It lies at approximately 62.777780° North Latitude and -164.52306° West Longitude. (Sec. 17, T031N, R081W, Seward Meridian.) Emmonak is located in the Bethel Recording District, and the Wade Hampton Census Area.

Climate:

A maritime climate predominates in Emmonak. Temperatures range from -25 to 79. Precipitation is 19 inches per year, while snowfall is 50 to 60 inches per year. Freeze-up occurs during October; break-up occurs in June.

History and Culture

The village was originally called "Kwiguk", a Yup'ik word meaning "big stream". Villagers call themselves "Kuigpagmuit", or "people from the Yukon River". The Census Bureau has also called it "Emanguk". The original settlement was 1.4 miles south of its present location, and was first reported by the U.S. Coast and Geodetic Survey in 1899.

A post office was established there in 1920. Later, commercial fishing became a major industry in the village and the Northern Commercial Company built a cannery. In 1964, floods washed the cannery away. That same year, the City government was incorporated. Due to increasing flooding and erosion, the village was relocated 1.4 miles north of Kwiguk in 1964-65. The new location was renamed Emmonak, which means "blackfish".

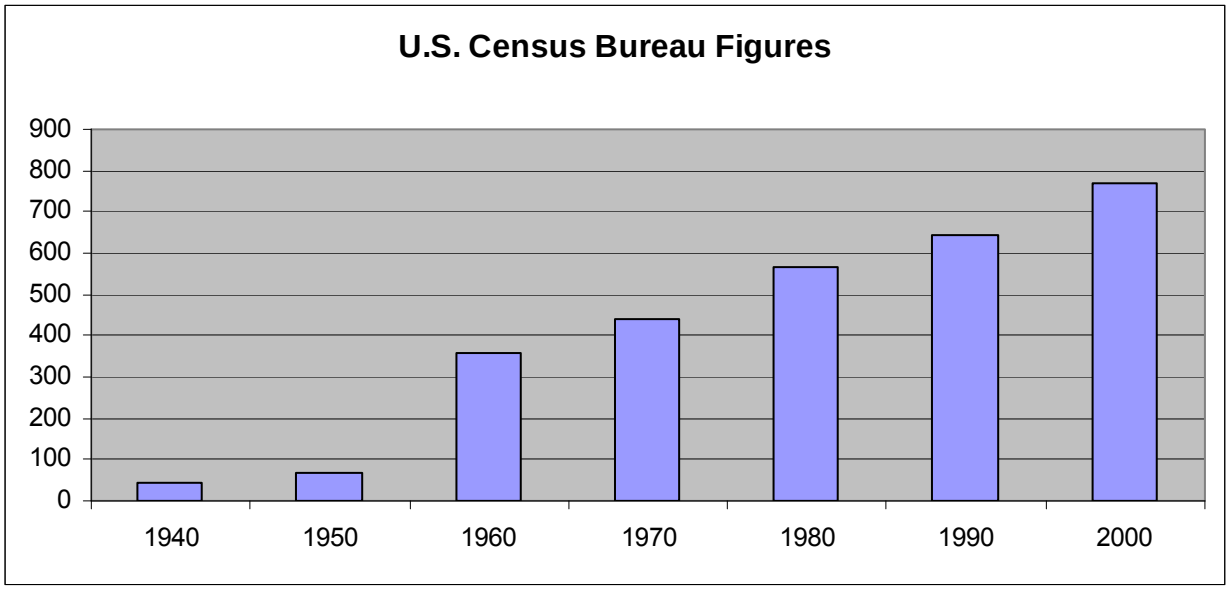
Emmonak is a Yup'ik Eskimo village involved in commercial fishing, processing, and subsistence activities. Residents of Chuloonawick, a nearby fish camp, also live in Emmonak. The sale, importation, and possession of alcohol are banned in the village.

Population

Emmonak is one of the most populous villages in the Yukon Coastal Region. According to the 2000 U. S. Census, Emmonak had a population of 767. Alaska Natives represented 93.9 percent of the population. There were 189 households with an average household size of 4.06. Between 1970 and 2000 the population increased from 439 to 767, an annual growth rate of 1.9 percent. If this trend continues, the population will be 1,113 in 2020. The population can vary widely relative to the seasons

due to fishing activity that contributes to substantial increases in the population during the summer.

Figure 1. Historical Population



Government/Organizations

Emmonak was incorporated as a second-class city within the unorganized borough in 1964. A Traditional Village Council conducts tribal government affairs. Under the Alaska Native Claims Settlement Act (ANCSA) provisions, the community is within the boundaries of Calista Corporation and Emmonak Corporation. The Association of Village Council Presidents (AVCP) also serves the area.

Table 4. Emmonak Community Information

Community Information	Contact Information and Type
Current Population:	740 (2005 State Demographer estimate)
Pronunciation:	ee-MAHN-nuck
Incorporation Type:	2nd Class City

Community Information	Contact Information and Type
City Contact Information:	Martin Moore, City Manager John Moses, City Planner City of Emmonak P.O. Box 9 Emmonak, AK 99581 Phone: (907) 949-1227 Fax: (907) 949-1926 Email: emkcity@unicom-alaska.com
Borough Location:	Unorganized borough
Village Corporation:	Emmonak Corporation P.O. Box 49, Emmonak, AK 99581 Phone: 907-949-1411 Fax: 907-949-1412
Village Council	Emmonak Village P.O. Box 126, Emmonak, AK 99581 Phone: 907-949-1720 Fax: 907-949-1384 Email: Emmonak@aitc.org (BIA-Recognized Traditional Council)
Regional Corporation	Calista Corporation 301 Calista Court, Suite A Anchorage, Alaska 99518-3028 Phone: (907) 279-5516 Fax: (907) 279-5516 Email: calista@calistacorp.com

Community Information	Contact Information and Type
Economic Development. Community Development Quota (CDQ) Program	Yukon Delta Fisheries Development Association 2200 6th Ave., Suite 707, Seattle, WA 98121 Phone: 206-443-1565 Fax: 206-443-1912 (for Wade Hampton/Lower Yukon Communities: Alakanuk, Emmonak, Kotlik, Nunam Iqua, Grayling, Mountain Village)
Regional Native Health Corporation	Yukon-Kuskokwim Health Corporation P.O. Box 528 Emmonak, Alaska 99559 Phone: 907-543-6020 Fax: 907-543-6006 Email: gene_peltola@ykhc.org
Native Housing Authority	Emmonak Village P.O. Box 126, Emmonak, AK 99581 Phone: 907-949-1720 Fax: 907-949-1384 Email: ETCadmin@unicom-alaska.com

Economy/Transportation

Emmonak experiences a seasonal economy as a center for commercial fishing, purchasing and processing on the lower Yukon River. Yukon Delta Fish Marketing Co-op and Bering Sea Fisheries process and export salmon from Emmonak. 101 residents hold commercial fishing permits. Subsistence activities, trapping and public assistance provide additional income. The majority of the community travels to fish camps during the summer months to dry salmon for winter use. Moose, beluga whale, seal, and waterfowl are also utilized.

Emmonak relies on air and water transportation. A State-owned 4,400-foot-long 75-foot-wide gravel airstrip is available. There are no connecting roads, but snow machines use winter trails to Kotlik, Alakanuk, and Nunam Iqua. Skiffs and ATVs are using during the summer for local transportation.

Public Facilities

Water is derived from the Yukon River and is treated. Piped water and sewer services have recently been expanded to the west side—161 homes, businesses, and the school are now served with an aboveground circulating water system and vacuum sewage system. Water storage capacity has been doubled to serve the system expansion and a new washeteria is under construction. The landfill must be relocated.

(Source:
DCRA website information, August 2006 http://www.commerce.state.ak.us/dca/commdb/CIS.cfm)

Community Assets

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

Community Map

The latest land use map is dated 1994. Attached to this plan is a geo-referenced map that used gps readings obtained during the July 18, 2006 site visit.

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

- Emmonak Airport

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

- Designated Shelters
- City Hall Buildings
- Bulk Fuel Storage Tank Farm

Critical Infrastructure: Infrastructure that provides services to Emmonak.

- Telephone lines
- Power lines
- Transportation networks
- Wastewater collection

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

- Schools

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

- Emmonak Community Center

Community Resources

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

Federal Resources

The federal government requires local governments to have a hazard mitigation plan in place to be eligible for funding opportunities through FEMA, such as through the Pre-Disaster Mitigation Assistance Program and the Hazard Mitigation Grant Program. The Mitigation Technical Assistance Programs available to local governments are also a valuable resource. FEMA may also provide temporary housing assistance through rental assistance, mobile homes, furniture rental, mortgage assistance, and emergency home repairs. The Disaster Preparedness Improvement Grant also promotes educational opportunities with respect to hazard awareness and mitigation.

FEMA, through its Emergency Management Institute, offers training in many aspects of emergency management, including hazard mitigation. FEMA has also developed a large number of documents that address implementing hazard mitigation at the local level. Five key resource documents are available from FEMA Publication Warehouse (1-800-480-2520) and are briefly described below:

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

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

- **Mitigation Resources for Success CD.** FEMA 372, September 2001. This CD contains a wealth of information about mitigation and is useful for state and local government planners and other stakeholders in the mitigation process. It provides mitigation case studies, success stories, information about Federal mitigation programs, suggestions for mitigation measures to homes and businesses, appropriate relevant mitigation publications, and contact information.

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

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

Other federal resources include:

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

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

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

- **Department of Housing and Urban Development, Community Development Block Grants.** Administered by the Alaska Department of Commerce, Community and Economic Development (DCRA), Division of Community Advocacy. Provides

grant assistance and technical assistance to aid communities in planning activities that address issues detrimental to the health and safety of local residents, such as housing rehabilitation, public services, community facilities, and infrastructure improvements that would primarily benefit low-and moderate-income persons.

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

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

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

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

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

- **Federal Emergency Management Agency,** http://www.fema.gov – includes links to information, resources, and grants that communities can use in planning and implementation of sustainable measures.

- **American Planning Association,** http://www.planning.org – a non-profit professional association that serves as a resource for planners, elected officials, and citizens concerned with planning and growth initiatives.

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

State Resources

Alaska DHS&EM is responsible for coordinating all aspects of emergency management for the State of Alaska. Improving hazard mitigation technical assistance for local governments is another high priority item for the State of Alaska. Providing hazard mitigation training, current hazard information, and the facilitation of communication with other agencies would encourage local hazard mitigation efforts. DHS&EM provides technical assistance and a web based planning tool: MitigationPlan.com and other resources for mitigation planning on their website at http://www.ak-prepared.com..

DCRA, Division of Community Advocacy: Provides training and technical assistance on all aspects of the National Flood Insurance Program and flood mitigation.

Other state resources include:

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

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

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

Other Funding Sources and Resources

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

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

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

Local Resources

Emmonak has a very limited 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 City, and are summarized in the following tables:

Table 5. Legal and Technical Capability

Regulatory Tools (ordinances, codes, plans)	Local Authority (Y/N)
Building code	Y
Zoning ordinance	Y
Subdivision ordinance or regulations	Y
Special purpose ordinances (floodplain management)	Y
Growth management ordinances (also called "smart growth" or anti-sprawl programs)	N
Site plan review requirements	N
Comprehensive plan	Y
A capital improvements plan	Y
An economic development plan	Y
An emergency response plan	Y

Table 6. Administrative and Technical Capability

Staff/Personnel Resources	Y/N
City Manager	Y
City Clerk	Y
Public Works Director	Y
Librarian	Y
Volunteer Fire Chief and Firefighters	Y
Planner(s) or engineer(s) with knowledge of land development and land management practices	N
Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	N
Planners or Engineer(s) with an understanding of natural and/or human-caused hazards	N
Floodplain manager	Y
Surveyors	N
Staff with education or expertise to assess the community's vulnerability to hazards	N
Personnel skilled in GIS and/or HAZUS	Y
Scientists familiar with the hazards of the community	N
Emergency manager	N
Grant writers	N
Environmental Advisory Council	N

Table 7. Fiscal Capability

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

Chapter 3: Hazards

Hazard Matrix – City of Emmonak

Table 8. Hazard Matrix

Hazard Matrix – City of Emmonak Wade Hampton Census Area					
Flood	**Wildland Fire**	**Earthquake**	**Volcano**	**Avalanche**	**Tsunami & Seiche**
Y-H	Y-L	Y-L	N	N	N
Severe Weather	**Landslides**	**Erosion**	**Drought**	**Technological**	**Economic**
Y-H	N	Y-H	N	Y-M	Y-H

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

Extent:
Z = Zero
L = Limited
T = Total

Previous Occurrence
Y = Yes
N = No

Table 9. Previous Occurrences

Previous Occurrences - City of Emmonak Wade Hampton Census Area					
Flood	**Wildland Fire**	**Earthquake**	**Volcano**	**Avalanche**	**Tsunami & Seiche**
7 - L	None	None	None	None	None
Severe Weather	**Ground Failure**	**Erosion**	**Drought**	**Technological**	**Economic**
3 – L	None	None	None	1 - L	1 - L

Extent
Z - Zero - Used for historical information. An event occurred but may not have caused damage or loss.
L - Limited – Minimal through maximum impact to part of community. *Falls short of the definition for total extent*.
T - Total – Impact encompasses the entire community.
Number: Number of occurrences Source:

Source of Tables 8 and 9: State Hazard Mitigation Plan, 2007

Hazard Vulnerability Assessment Matrix

Identification of Assets

Because Emmonak is a small community of 740 residents, every structure is essential to the sustainability and survivability of Emmonak residents. The Hazard Vulnerability Matrix below includes a list of facilities, utilities and businesses and their vulnerability to natural hazards.

- Essential facilities, which are necessary for the health and welfare of an area and are essential during the response and recovery phase of a disaster such as: city facilities, health clinic and schools.

- Transportation systems such as: the airport and roads.

- Lifeline utility systems such as: potable water and waste water treatment plant, fuel farms, electrical generation facilities and power grid and communications systems.

- Businesses that provides services or commodities.

The following table is from Map 1 Emmonak Land Use Map, 1994.

Table 10. Emmonak Hazard Vulnerability Matrix

Facility	Flood/Erosion	Wildland Fire	Severe Weather	Earthquake
Emmonak Airport	X	X	X	X
City Women's Shelter	X	X	X	X
United Utilities Telephone	X	X	X	X
Church	X	X	X	X
Water Treatment Storage and Fuel Storage	X	X	X	X
AVEC Electric Plant Fuel Storage	X	X	X	X
Lower Yukon School District (LYSD) High School/ Elementary School Complex	X	X	X	X
Health Clinic	X	X	X	X
Washeteria	X	X	X	X
Public Safety	X	X	X	X
Post Office	X	X	X	X
Emmonak Corp. Store	X	X	X	X
YDFM Co-op Fisheries	X	X	X	X
Emmonak Corp. Tank Farm	X	X	X	X
Shorty's Store	X	X	X	X
AC Store Complex and Fuel Storage	X	X	X	X

Facility	Flood/Erosion	Wildland Fire	Severe Weather	Earthquake
City's Women's Shelter	X	X	X	X
United Utilities Telephone	X	X	X	X
Fire Station	X	X	X	X
Water Treatment Storage/Fuel Storage	X	X	X	X
Alascom Telephone	X	X	X	X
Headstart School	X	X	X	X
LYSD Teacher Housing	X	X	X	X
City Manager's House	X	X	X	X
LYSD Fuel Storage	X	X	X	X
Armory	X	X	X	X
City Complex Building and Hotel	X	X	X	X
Health Clinic	X	X	X	X
Larry's Bed and Breakfast	X	X	X	X
Public Safety	X	X	X	X
Yukon Delta Mission Church	X	X	X	X
Kwiguk Trading Co. Store	X	X	X	X
Post Office	X	X	X	X
Emmonak Corp. Store	X	X	X	X
City Shop and Fuel Storage	X	X	X	X
Grant Aviation	X	X	X	X
ADOT/PF* Airport Maintenance	X	X	X	X
FAA Building	X	X	X	X

* Alaska Department of Transportation and Public Facilities

Emmonak's Vulnerability to Identified Hazards:

In summary, Emmonak is a very small village and the identified hazards are area wide. The principal hazards of flood, erosion, wildland fire, severe weather, and earthquake could potentially impact any part of Emmonak.

The FEMA Flood Insurance Rate Maps (FIRM) are included in the appendix of the LHMP. They are dated 1998 and depict which areas in town are designated as flood areas. Descriptions of the flood zones are in the following section on flooding and erosion. Structures shown on Map 1 in the Appendix that are located within 100 feet of the riverbank are most susceptible to direct impacts from erosion and structures within 50 feet are most subject to flooding. In flooding events, even those properties unaffected directly will suffer due to road closures, impacts to public safety (access and response capabilities), limited availability of perishable commodities, and isolation.

During a site visit on July 18, 2006 the City Manager and his staff related the following vulnerabilities or concerns related to flooding and erosion. Public meetings were held

on October 10, 2006 and March 22, 2007. Among other input, the community listed the following critical issues.

- The island across from Emmonak in the channel of the Yukon River is eroding. High winds from the south cause waves to build momentum, and without the island as a buffer, Emmonak's shoreline will erode at an accelerated rate.

- A project to repair and expand the existing revetment is needed to protect the Village from further loss of land.

- The worst flooding occurs during spring and fall, although the community is in year round danger from erosion and flooding.

- During the 2006 spring flood, the entire village was under water except for the clinic.

- The river next to Emmonak continues to rise causing more severe erosion. As erosion worsens the banks of the river continue to erode.

- Ice override causes more damage than flooding.

- Culverts need to be replaced in several areas of the village.

- Melting permafrost has led to more basements being flooded in the village.

- Airport Road flooded in 2006 and needs to be rebuilt with more reliable materials.

- Emmonak Road is the one reliable road into and out of the village to the airport. This road is located directly adjacent to the Yukon River. If it floods the village will be cut off from the airport.

- One of the fuel tanks in the village was pushed over to its side during the 2006 flood.

- The current land use maps and firm maps are over twenty years old and are in need of updating.

- The city is currently involved in a $4,000,000 water and sewer project.

- Arctic boxes (used to collect sewage) are over twenty years, constructed of wood and leaking. A project is needed to replace the boxes with steel at a cost of approximately $50,000.

- Gray water from the septic systems leak into the natural lakes around the community.

- The city dock also is in need of a revetment system. The dock is currently too low and needs to be raised to protect it from flooding.

- Evacuation vehicles, such as four wheelers are needed for during times of flooding.

A severe weather event would create an area-wide impact and could damage structures and potentially isolate Emmonak from the rest of the state.

Earthquake damage would be area-wide with potential damage to critical infrastructure up to and including the complete abandonment of key facilities. Limited building damage assessors are available in Emmonak to determine structural integrity following earthquake damage. Priority would have to be given critical infrastructure to include: public safety facilities, health care facilities, shelters and potential shelters, and finally public utilities.

Wildland fire could impact any area of the village and are therefore an area wide hazard. There is no area of Emmonak that is more in danger from wildland fire than any other area. Please see the section on wildland fire, which describes the vegetative cover of Emmonak.

Section 1. Floods and Erosion

Hazard Description, Characterization and Identification

Types of Flooding in Emmonak

The following hazard description and characterization were, in part, taken from the *Ceñaliulriit CRSA Coastal Management Plan Amendment, 2006* and *Climate change impacts, vulnerabilities, and adaptation in Northwest Alaska (No. 06-11).* Please see the bibliography for complete citations.

The Yukon River is the largest river in Alaska and the fourth longest in North America. It flows more than 2,300 miles from its headwaters in British Columbia to its mouth located on the Bering Sea. The Yukon River watershed encompasses approximately 330,000 square miles, about 35 percent of the State of Alaska. The river is over a mile wide at many points and is frequently braided by sandbars. At its terminus at the Bering Sea there are three main channels and several minor channels, which are collectively referred to as “the passes”. The average winter discharge of the Yukon River is 40,000 cubic feet per second (cfs); during spring break-up the discharge can increase to over 1,000,000 cfs during this major hydrologic event for the year. On an annual basis, the Yukon River flow averages 240,000 cfs and carries over 88 million metric tons of suspended sediment consisting of silt and very fine sand.

Since Emmonak is located ten miles upstream from the Bering Sea the flooding and erosion hazards are river flooding, wave and slough erosion, river ice, and melting permafrost. Permafrost and erosion place constraints on the development of resources, transportation and utility systems, and expansion within the Emmonak community.

The effects of climate change are expected to add to natural hazards including flooding in coastal areas. As sea level rises and the offshore ice pack retreats, more flooding can be expected.

Flooding is also caused by ice jams, snowmelt, and rainfall. The highest flood level recorded in Alaska is 46 feet. In areas of low elevation, such as deltas and flat tundra, a 6-inch rise in the water level can flood a vast area.

Factors that affect the level of coastal flooding include wind conditions, exposure of the site and ice conditions. Due to climate change, some coastal areas of Alaska are freezing later in the season; with the later formation of protective shore ice, shorelines will become increasingly vulnerable to fall storms and associated storm surges.

The entire Village of Emmonak is subject to continuous permafrost, although in some areas the top layer of the land may thaw during summer. All soils are subject to thermal degradation, and ice-rich fine-grained soil is the most problematic. Melting permafrost can result in lakes or depressions.

Over 80 percent of Alaska is covered by permafrost, and permafrost is recognized as a natural hazard in the scientific literature. A number of institutions have developed extensive research on permafrost including the U.S. Army Corps of Engineers' Cold Regions Research and Engineering Laboratory and the Permafrost Laboratory at the University of Alaska Geophysical Institute.

Ice hazards present in the Arctic include strudel scour, ice gouging, shear zone and pressure ridging, and ice over-ride. Ice begins to form during the fall close to shore, moving further out to sea. This ice is known as "shorefast ice". Offshore, multi-year ice becomes grounded, generally at the 66-foot contour in the Chukchi or the 60-foot isobath in the Beaufort Sea (just past the barrier islands). Areas seaward of the 60-foot isobath are covered with pack ice that is continually moving. The ice usually freezes to the bottom when depths are less than 6.5 feet.

Ice Override: Movement of ice to a point more than 33 feet from the high-water mark is known as ice override (movements less than that are called ice pile up). Ice override events are often slowed by ice pile-ups. In the Canadian Arctic, ice pile-ups have reached the height of 98 feet.

Arctic residents have reported ice override events that occurred without warning. Areas more susceptible than others to ice override include areas where the nearshore slope is steep and where there are no offshore bars or shoals to slow the movement of ice. Ice override has implications for offshore drilling platforms, ice and gravel islands and shoreside facilities. Most of the ice override events observed in the Beaufort Sea were on the barrier islands including Cross, Jeannette and Narwahl Islands.

Gravel islands in the shorefast ice zone can accumulate piles of ice. Early in the winter the forces related to the ice pile up are not great, but later in the winter, ice rubble can transfer more significant loads to the island.

Melting Sea Ice: Rising temperatures associated with global warming have affected the thickness, extent, and duration of sea ice. Sea ice plays an important role to protect coastlines from erosion. As a result of later freezing of sea ice, communities are more vulnerable to waves, storm surges, and erosion.

Both temporary and long-term impacts of the current climate shift, which is expected to continue and even accelerate, are already in evidence in many parts of the globe, but particularly in northern latitudes.

Rising global temperatures are expected to trigger impacts to marine and other ecosystems, including many that will affect the resources and uses in the coastal zone of Alaska. Impacts that can be expected to affect Emmonak include a rise in sea level, changing wind and deep-ocean circulation patterns, ocean stratification and resource productivity, shifts in species distributions, outbreaks of disease and harmful algal blooms. The number of variables and unknowns make it impossible to predict the timing, duration, or severity of specific impacts.

Alaska's climate has warmed about 4°F since the 1950s, 7°F in winter, with much of this warming occurring in a sudden regime shift around 1977. The state has grown wetter, with a 30 percent increase in average precipitation between 1968 and 1990. The growing season has lengthened by about 14 days.

Drastic reductions in sea ice and permafrost have occurred along with the warming. Models predict continued warming, including an increase in temperature by 1.5 to 5°F by 2030 and 5 to 18° F by 2100. An increase of precipitation by 20 to 25 percent is expected for the northwestern region of the state, but soils are actually expected to become drier because of the warmer temperatures.

Melting permafrost: A task force commissioned by the U.S. Arctic Research Commission (USARC) in 2002 found that permafrost plays three key roles in the context of climate changes: as a record keeper (temperature archive); as a translator of climatic change (subsidence and related impacts); and as a facilitator of climatic change (impact on the global carbon cycle). The potential for melting of ice-rich permafrost constitutes a significant environmental hazard in high-latitude regions.

Permafrost records temperature changes and other information about environmental changes; it has a memory of past temperatures. Temperature trends spanning a century or more can be recorded in thick permafrost. Analysis of data gathered from boreholes made by the U.S. Geological Survey in northern Alaska show that the temperature of permafrost on the North Slope has generally risen by 2-4°F in the past century.

Thawing of ice-rich permafrost may result in settlement of the ground surface, which often has severe consequences for human infrastructure and natural ecosystems. Melting of glaciers in Alaska and elsewhere will increase the rates of coastal erosion in areas of ice-rich permafrost, already among the highest in the world. Sediment input to the Arctic shelf derived from coastal erosion may exceed that from river discharge. Thawing effects to the active layer of permafrost may alter the activities and functions of the permafrost. Soil moisture content has an important effect on its thermal qualities, soil heat flow and the vegetation is supports.

Permafrost can facilitate further climate change through the release of greenhouse gases. Considerable amounts of carbon are trapped in the upper layers of permafrost; an increase in the thickness of the thawed layer of permafrost could release large quantities of CO 2 and CH 4 to the atmosphere. This could amplify regional and global warming. A further problem in some areas in the Alaskan arctic is the presence of a significant number of sites where contaminants were buried in previous decades. Contaminants are mobile in the active layer of permafrost and some can be mobile within frozen ground. When permafrost thaws, the ground becomes permeable, allowing contaminants to spread laterally and reach other layers.

The thawing of permafrost will cause changes in hydrology. Where it has a high ice content, thawing can result in severe, uneven subsidence of the surface, called thermokarst, which has been observed to exceed 16 feet. Flooding or draining of an area may result from permafrost melt, affecting the uses of the surface.

Shoreline erosion: Storms systems along coasts produce high winds that in turn generate large waves and currents. Storm surges can temporarily raise water levels by as much as 23 feet, increasing the vulnerability of shorelines and floodplains to changes to tidal ranges in rivers and bays, and changes in sediment and nutrient transport which drive beach processes.

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

Floodwaters pose a health hazard by picking up contaminants and disease as they travel. Outhouses, sewers, septic tanks, and dog yards are all potential sources of disease transported by floodwaters. Lack of a water source is a significant concern for flood victims, especially if the flood has been extensive enough to contaminate the public water supply. In such a case, outside bottled water is at times the only source of clean water.

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

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

The Emmonak Land Use Map, dated 1994, contains the following note:

> The U.S. Army Corps of Engineers (USCOE) established flood data for this community. This project located the USCOE flood data on an assumed datum.
>
> The USCOE flood staff #1 is located on the northeast corner of the City Complex Building the USCOE assumed elevations for flood data correlated to surveys made for this map (approximate Mean Sea Level (MSL) from ADOT&PF Airport Plan).

Name	USCOE	Approximate MSL
Flood of Record (1989)	4.2	19.4
Recommended Building Elevation	5.2	20.4

Table 11. Land Use Types in Emmonak

Land Use Type	Number of Uses
Residential	Occupied 189
Residential	Vacant 29
Schools	One, K-12, 223 Students, 16 Teachers

Please see Table 10 earlier in this chapter, which lists facilities and utilities in areas susceptible to flooding and erosion.

Community Participation in the NFIP

The City of Emmonak participates in the NFIP.

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

The table below describes the zones used in Flood Insurance Rate Maps (FIRM), which are in the Appendix of this plan.

Table 12. FIRM Zones

Firm Zone	Explanation
A	Areas of 100-year flood; base flood elevations and flood hazard not determined.
AO	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet, average depths of inundation are shown but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood.
C	Areas of minimal flooding.
D	Areas of undetermined, but possible, flood hazards.

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

Elevation Certificates are used to:

1. Record the elevation of the lowest floor of all newly constructed buildings, or substantial improvement, located in the floodplain.
2. Determine the proper flood insurance rate for floodplain structures
3. Local governments must insure that elevation certificates are filled out correctly for structures built in floodplains. Certificates must include:
   - The location of the structure (tax parcel number, legal description and latitude and longitude) and use of the building.
   - The Flood Insurance Rate Map panel number and date, community name and source of base flood elevation date.
   - Information on the building's elevation.
   - Signature of a licensed surveyor or engineer.

The following table describes how the Emmonak Flood Insurance program relates to the state program.

Flood Hazard Vulnerability

Table 13. Emmonak NFIP Statistics

Emergency Program Date Identified	Regular Program Entry Date	Map Revision Date	NFIP Community Number	CRS Rating Number	Total # of Current Policies (07/31/06)
5/22/1992	9/21/1998	None	020041 A	N/A	15
Total Premiums	**Total Loss Dollars Paid**	**Average Value of Loss**	**AK State # of Current Policies**	**AK State Total Premiums**	**AK Total Loss Dollars Paid**
$10,026	$10,000	$5,000	2,559	$1.6 million	$3.4 million
Emmonak Average Premium	**AK State Average Premium**	**Repetitive Loss Claims**	**Dates of Rep. Losses**	**Total Rep. Loss**	**Average Rep. Loss**
$668	$629	0	0	0	0

Emmonak Floodplain Coordinator	John Moses, Land Planner 907-949-1227 City of Emmonak 907-949-1926 P. O. Box 9 Emmonak, AK 99581
State of AK Floodplain Coordinators	Floodplain Management Programs Coordinator Division of Community Advocacy Department of Commerce, Community & Economic Development Taunnie Boothby, State Floodplain Coordinator 550 W. 7th Avenue, Suite 1640 Anchorage, AK 99501 (907) 269-4567 (907) 269-4563 (fax) Email: christy_miller@commerce.state.ak.us taunnie_boothby@commerce.state.ak.us Website: http://www.commerce.state.ak.us/dca/nfip/nfip.htm

Source: DCRA, Division of Community Advocacy

Please see Table 10, which indicates that all critical facilities are located in areas of flooding and erosion. During a site visit on July 18, 2006 the City Manager and his staff related the following vulnerabilities or concerns related to flooding and erosion. Public meetings were held on October 10, 2006 and March 22, 2007. Among other input, the community listed the following critical issues.

- The island across from Emmonak in the channel of the Yukon River is eroding. High winds from the south cause waves to build momentum, and without the island as a buffer, Emmonak's shoreline will erode at an accelerated rate.

- A project to repair and expand the existing revetment is needed to protect the Village from further loss of land.

- The worst flooding occurs during spring and fall, although the community is in year round danger from erosion and flooding.

- During the 2006 spring flood, the entire village was under water except for the clinic and the tank farm.

- The river next to Emmonak continues to rise causing more severe erosion. As erosion worsens the banks of the river continue to erode.

- Ice override causes more damage than flooding.

- Culverts need to be replaced in several areas of the village.

- Melting permafrost has led to more basements being flooded in the village.

- Airport Road flooded in 2006 and needs to be rebuilt with more reliable materials.

- Emmonak Road is the one reliable road into and out of the village to the airport. This road is located directly adjacent to the Yukon River. If it floods the village will be cut off from the airport.

- One of the fuel tanks in the village was pushed over to its side during the 2006 flood.

- The current land use maps and firm maps are over twenty years old and are in need of updating.

- The city is currently involved in a $4,000,000 water and sewer project.

- Arctic boxes (used to collect sewage) are over twenty years, constructed of wood and leaking. A project is needed to replace the boxes with steel at a cost of approximately $50,000.

- Gray water from the septic systems leak into the natural lakes around the community.

- The city dock also is in need of a revetment system. The dock is currently too low and needs to be raised to protect it from flooding.

- Evacuation vehicles, such as four wheelers are needed for during times of flooding.

Previous Occurrences

The following was obtained from Ervin Petty, Alaska State Division of Homeland Security and Emergency Management.

Emmonak, February 12, 1982 On February 7, 1982, a catastrophic fire destroyed the safe water facility in the community of Emmonak, situated at the mouth of the Yukon River, resulting in a shortage of potable water, causing a health hazard, and forcing the closure of schools. The Governor's Proclamation of a Disaster Emergency enabled DHS&EM to provide the community with the public assistance necessary to replace the destroyed facility.

Emmonak, June 15, 1984 The city requested disaster assistance to repair minor flood damage to a road. The State's categorical grant covered the cost of material to repair the road. The village provided manpower and equipment.

Emmonak, June 11, 1985 The Governor declared a Disaster Emergency after flooding caused damage to city roads. A categorical grant provided funds to assist in repairing the roads.

Spring Floods, FEMA declared (DR-0832) on June 10, 1989 Presidential Declaration of Major Disaster, incorporated sixteen local declarations and applied to all communities on Yukon, Kuskokwim and Kobuk rivers and their tributaries. Provided public and individual assistance to repair damage.

Fairbanks/North Star Borough, Emmonak, McGrath, Red Devil, Anvik, Grayling, Emmonak, Holy Cross, Alakanuk, Shageluk, Galena. the Governor declared on May 3-23, 1991 FEMA declared May 30, 1991 Flooding. Record snowfalls in the interior combined with sudden spring melt caused flooding all along the Yukon and Kuskokwim River systems. Numerous State Declarations were combined into a single Presidential Declaration of Major Disaster (FEMA-0909-AK) that authorized assistance for repair of public property only. State Disaster Relief Funds were used to implement the Individual and Family Grant Program in all of the communities included in the federal declaration.

Yukon Kuskokwim Delta On June 5, 1995, the Governor declared a condition of disaster emergency exist in the Cities of Akiak, Kwethluk, Napaskiak, Emmonak, and

Alakanuk, as a result of inundation. As a result of this disaster, roads, boardwalks, and other public works essential to vital community services were damaged.

02 Interior Floods (AK-DR-1423) Declared May 29, 2002 by Gov Knowles then FEMA Declared (DR-1423) on June 26 2002: Flooding occurred in various interior and western Alaska river drainages, including the Tanana, Kuskokwim, Nushagak, Susitna and Yukon River drainages beginning on April 27, 2002 and continuing. The floods caused widespread damage to and loss of property in the Fairbanks North Star Borough (Tanana River drainage); in McGrath, Lime Village, Sleetmute, Red Devil, Crooked Creek, Emmonak and Kwethluk (Kuskokwim River drainage); Ekwok and New Stuyahok (Nushagak River drainage); in the Susitna River drainage from Chase to Montana Creek; and in Emmonak (Yukon River drainage). The following conditions exist as a result of this disaster: widespread damage to public facilities and infrastructure, including damage to public airports, roads, and buildings; to public utilities, including water , sewer, and electrical utilities; to personal residences, in some areas requiring evacuation and sheltering of residents; to commercial operations; and to other public and private real and personal property.

2005 Spring Floods (AK-05-213) declared July 20, 2005 by Governor Murkowski
Beginning May 13, 2005, a large ice jam blocked the mouth of the Lower Yukon River and caused widespread flooding to the cities of Emmonak and Alakanuk. In both cities, several roads were inundated and eroded by the floodwaters. Floodwaters also inundated city infrastructure to include the above-ground circulating water and vacuum sewage systems which were displaced and/or knocked off their mounting supports. Both cities have submitted local disaster declarations requesting State assistance. There were no life safety issues during this event. Floodwaters subsequently subsided to normal levels within the river banks on or about May 18, 2005.

2005 West Coast Storm declared October 24, 2005 by Governor Murkowski then FEMA declared (DR-1618) on December 9, 2005: Beginning on September 22, 2005 and continuing through September 26, 2005, a powerful fall sea storm produced high winds combined with wind-driven tidal surges resulting in severe and widespread coastal flooding and a threat to life and property in the Northwest Arctic Borough, and numerous communities within the Bering Strait (REAA 7), the Kashunamiut (REAA 55), the Lower Yukon (REAA 32) and the Lower Kuskokwim (REAA 31) Rural Education Attendance Areas including the cities of Nome, Kivalina, Unalakleet, Golovin, Tununak, Hooper Bay, Chevak, Mekoryuk and Napakiak. The following conditions existed as a result of this disaster: severe damage to personal residences requiring evacuation and sheltering of the residents; to businesses; to drinking water systems, electrical distribution systems, local road systems, airports, seawalls, and other public infrastructure; and to individual personal and real property; necessitating emergency protective measures and temporary and permanent repairs.

2006 Spring Floods (AK-06-218) declared June 27,2006 by Governor Murkowski then FEMA declared (DR-1657) on August 04, 2006
Beginning May 5, 2006 continuing through May 30, 2006, the National Weather Service

(NWS) issued flooding warnings and watches across the state as excessive snowmelt and ice jams caused flooding along the Yukon, Kuskokwim, and Koyukuk river drainages. The most serious impacts were reported in the communities of Hughes, Koyukuk, Kwethluk, Alakanuk, and Emmonak, along with substantial damage to State-maintained airports, roads, and highways. In each community, large portions of the village, city infrastructure, and several roads were inundated and eroded by the floodwaters.

Flood and Erosion Mitigation Goals, Objectives and Projects

Goals and Objectives

Goal 1. Reduce flood damage.

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

Goal 2. Prevent future flood damage.

Objective 2.1: Continue to enforce the requirements of the National Flood Insurance Program.

Goal 3: Increase public awareness

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

Flood Projects

After receiving public input, it is the recommendation of this plan that the City of Emmonak, along with other local, state and federal entities look at the following projects for flood and erosion control.

Structure Elevation and/or Relocation

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

Emmonak Maps

Accurate flood maps should be prepared that delineate areas of flooding and upland areas.

Public Education

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

Revetment Repair and Expansion

The revetment along Emmonak Road and the Yukon River is in disrepair in places and should be expanded to protect against flooding and further erosion.

Culvert Repairs

Culverts in Emmonak need to be resized and replaced to be large enough to handle increased water levels during floods.

Airport Road Improvements

Airport Road flooded during the 2006 flood and should be repaired with upgraded materials.

Section 2. Severe Weather

Hazard Description and Characterization

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

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

Winter Storms

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

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

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

- Lift – A mechanism to raise the moist air to form the clouds and cause precipitation. Lift may be provided by any or all of the following:

  - The flow of air up a mountainside.

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

  - Upper-level low pressure troughs.

Heavy Snow

Heavy snow, generally more than 12 inches of accumulation in less than 24 hours, can immobilize a community by bringing transportation to a halt. Until the snow can be removed, airports and major roadways are impacted, even closed completely, stopping the flow of supplies and disrupting emergency and medical services. Accumulations of snow can cause roofs to collapse and can knock down trees and power lines. Heavy snow can also damage light aircraft and sink small boats. A quick thaw after a heavy snow can cause substantial flooding. The cost of snow removal, repairing damages, and the loss of business can have severe economic impacts on cities and towns. Injuries and deaths related to heavy snow usually occur as a result of vehicle accidents. Casualties also occur due to overexertion while shoveling snow and hypothermia caused by overexposure to the cold weather.

Extreme cold

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

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

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

The greatest danger from extreme cold is its effect on people. Prolonged exposure to the cold can cause frostbite or hypothermia and become life-threatening. Infants and elderly people are most susceptible. The risk of hypothermia due to exposure greatly

increases during episodes of extreme cold, and carbon monoxide poisoning is possible as people use supplemental heating devices.

Ice Storms

The term “ice storm” is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. They can be the most devastating of winter weather phenomena and are often the cause of automobile accidents, power outages and personal injury. Ice storms result from the accumulation of freezing rain, which is rain that becomes super cooled and freezes upon impact with cold surfaces. Freezing rain most commonly occurs in a narrow band within a winter storm that is also producing heavy snow and sleet in other locations.

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

Local Severe Weather Hazard Identification

Table 14. Emmonak Weather Summary

EMMONAK, ALASKA
Period of Record General Climate Summary - Temperature

Station:(502825) EMMONAK															
From Year=1977 To Year=1994															
	Monthly Averages			Daily Extremes				Monthly Extremes				Max. Temp.		Min. Temp.	
	Max.	Min.	Mean	High	Date	Low	Date	Highest Mean	Year	Lowest Mean	Year	>= 90 F	<= 32 F	<= 32 F	<= 0 F
	F	F	F	F	dd/yyyy or yyyymmdd	F	dd/yyyy or yyyymmdd	F	-	F	-	# Days	# Days	# Days	# Days
January	14.9	0.5	7.6	39	29/1985	-50	17/1980	22.9	1985	-10.5	1989	0.0	26.8	30.0	14.0
February	14.3	-1.7	6.3	46	12/1986	-41	01/1993	24.4	1989	-14.4	1990	0.0	22.1	26.7	15.7
March	22.9	4.3	13.6	44	22/1990	-40	15/1991	22.0	1981	4.8	1988	0.0	22.1	29.6	11.2
April	28.9	11.0	20.1	54	28/1978	-19	02/1985	27.9	1978	2.6	1985	0.0	16.1	28.7	7.2
May	44.3	29.7	36.7	73	28/1990	-7	04/1992	42.4	1983	29.3	1992	0.0	2.2	19.8	0.4
June	58.5	41.2	50.3	75	20/1982	21	13/1987	53.4	1991	44.7	1985	0.0	0.0	2.3	0.0
July	60.7	47.0	53.8	80	19/1985	34	01/1981	57.7	1993	51.2	1981	0.0	0.0	0.0	0.0
August	59.3	45.4	52.0	80	11/1978	28	27/1984	57.3	1990	47.9	1984	0.0	0.0	0.8	0.0
September	50.7	37.4	44.1	67	11/1979	19	25/1983	45.9	1984	41.2	1983	0.0	0.0	6.9	0.0
October	36.0	24.9	30.3	57	01/1979	-5	27/1985	35.9	1991	26.5	1982	0.0	9.5	24.6	0.2
November	24.5	12.2	18.1	43	29/1983	-29	30/1987	24.7	1979	8.6	1977	0.0	23.1	29.1	5.4
December	17.2	4.7	11.3	40	26/1985	-30	18/1977	25.7	1985	-4.4	1979	0.0	25.0	30.1	12.5
Annual	36.0	21.4	28.7	80	19780811	-50	19800117	29.8	1983	26.6	1984	0.0	146.9	228.7	66.7

Winter	15.5	1.2	8.4	46	19860212	-50	19800117	14.8	1986	-0.1	1990	0.0	73.9	86.8	42.2
Spring	32.0	15.0	23.5	73	19900528	-40	19910315	30.1	1981	14.6	1985	0.0	40.4	78.2	18.8
Summer	59.5	44.5	52.0	80	19780811	21	19870613	53.0	1982	50.7	1984	0.0	0.0	3.1	0.0
Fall	37.0	24.8	30.8	67	19790911	-29	19871130	34.6	1979	26.8	1977	0.0	32.6	60.6	5.7

Table updated on Nov 2, 2006
For monthly and annual means, thresholds, and sums:
Months with 5 or more missing days are not considered
Years with 1 or more missing months are not considered
Seasons are climatological not calendar seasons

Winter = Dec., Jan., and Feb. Spring = Mar., Apr., and May

Summer = Jun., Jul., and Aug. Fall = Sep., Oct., and Nov.

Source: Western Regional Climate Center, wrcc@dri.edu

Previous Occurrences

As indicated in table above Emmonak is at most danger from extreme cold. The following severe weather event for the entire state was declared in 1989.

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

Severe Weather Hazard Vulnerability

See Table 10 and description on page 21.

Severe Weather Mitigation

Severe Weather Goals

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

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

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

Projects

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

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

To be officially Storm Ready, a community must:

1. Establish a 24-hour warning point and emergency operations center.

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

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

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

Expand public awareness about National Oceanographic and Atmospheric Administration (NOAA) Weather Radio for continuous weather broadcasts and warning tone alert capability.

Encourage weather resistant building construction materials and practices.

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

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

Section 3. Tundra/Wildland Fire

Hazard Description and Characterization

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

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

Fires can be divided into the following categories:

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

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

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

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

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

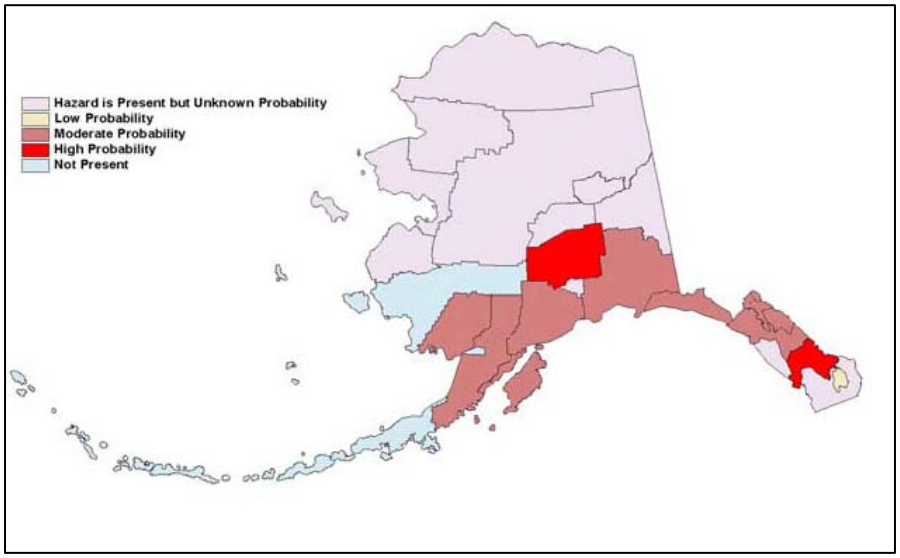
Fuel, weather, and topography influence wildland fire behavior. Wildland fire behavior can be erratic and extreme causing firewhirls and firestorms that can endanger the lives of the firefighters trying to suppress the blaze. Fuel determines how much energy the fire releases, how quickly the fire spreads and how much effort is needed to contain the fire. Weather is the most variable factor. Temperature and humidity also affect fire behavior. High temperatures and low humidity encourage fire activity while low temperatures and high humidity help retard fire behavior. Wind affects the speed and direction of a fire. Topography directs the movement of air, which can also affect fire behavior. When the terrain funnels air, like what happens in a canyon, it can lead to faster spreading. Fire can also travel up slope quicker than it goes down.

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

Local Tundra/Wildland Fire Hazard Identification

The following map from the Alaska State Hazard Plan depicts Emmonak as being in a low-probability area of the state, indicating a low risk factor for Emmonak.

Figure 2. Alaska Hazard Plan - Fire Risk Map



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

The vegetation of the Ceñaliulriit coastal district is dominated by subarctic wet, moist, and alpine tundra underlain by permafrost. Vegetation communities on the mainland are adapted to permafrost, periodic flooding by tidal or riverine waters, and wind. The periodic flooding favors graminoid-dominated plant communities. Within the Yukon-Kuskokwim Delta National Wildlife Refuge, 38 percent of the vegetation cover is comprised of grass or sedge communities. Other significant vegetation classes in this area include dwarf scrub and peatland complexes; these communities are mixes of dwarf scrub, sphagnum mosses, and tussock-forming grasses. (Ceñaliulriit Coastal Management Plan)

In 1984, the U.S. Fish and Wildlife Service and the U.S. Geological Survey cooperatively surveyed and mapped cover types in the Yukon Delta National Wildlife Refuge using satellite (LANDSAT) imagery. High-altitude photo imagery was used to produce maps on a 1:250,000 scale depicting eighteen vegetation types and six classes of waters. Within the Yukon Delta refuge, the dominant land cover types are graminoid tussock/dwarf shrub/peatland (19.2 percent), graminoid marsh (18.7 percent), and lichen-dwarf shrub/peatland (12.7 percent).

Forested areas are represented by few tree species, and they generally occur in small stands that are interspersed with low-growth shrubs or areas of bog vegetation. Black

spruce (*Picea mariana*), white spruce (*Picea glauca*), white birch (*Betula papyrifera*), and poplar (*Populus balsamifera*) are the most common tree species. Due to the variations in topography, forested stands are generally not extensive. Along the lower portions of the Kuskokwim and Yukon Rivers, riparian woodlands adjoining the watercourses and tributaries are comprised primarily of willow and poplar.

Previous Occurrences

There have been no documented occurrences of tundra/wildland fire in Emmonak.

Tundra/Wildland Fire Hazard Vulnerability

See Hazard Vulnerability Assessment Matrix and description beginning on page 21.

Tundra/Wildland Fire Mitigation

Wildland Fire Goals and Projects

Goal 1: Make buildings safer

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

Goal 3: Encourage the creation of firebreaks.

Goal 4: Encourage the evaluation of emergency plans with respect to wildland fire assessment.

Goal 5: Information acquisition

Projects

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

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

Ensure compliance with fire regulations and requirements.

Encourage revision or development of building codes and requirements.

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

Develop or evaluate emergency plans to ensure consistency with wildland fire assessments.

Section 4. Earthquake

Hazard Description and Characterization

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

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

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

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

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

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

Intensity is usually reported using the Modified Mercalli Intensity Scale. This scale has 12 categories ranging from not felt to total destruction. Different values can be recorded at different locations for the same event depending on local circumstances such as

distance from the epicenter or building construction practices. Soil conditions are a major factor in determining an earthquake's intensity, as unconsolidated fill areas will have more damage than an area with shallow bedrock. Surface faulting is the differential movement of the two sides of a fault. There are three general types of faulting.

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

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

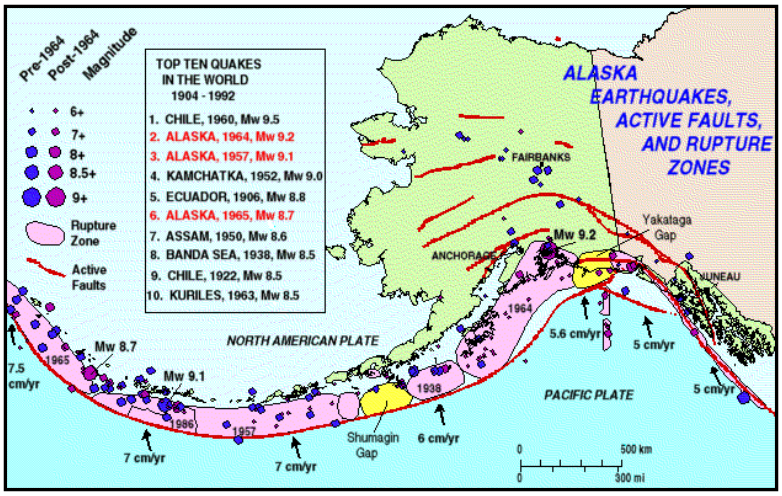
Liquefaction causes three types of ground failures: lateral spreads, flow failures, and loss of bearing strength. In the 1964 earthquake, over 200 bridges were destroyed or damaged due to lateral spreads. Flow failures damaged the port facilities in Seward, Valdez and Whittier.

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

Local Earthquake Hazard Identification

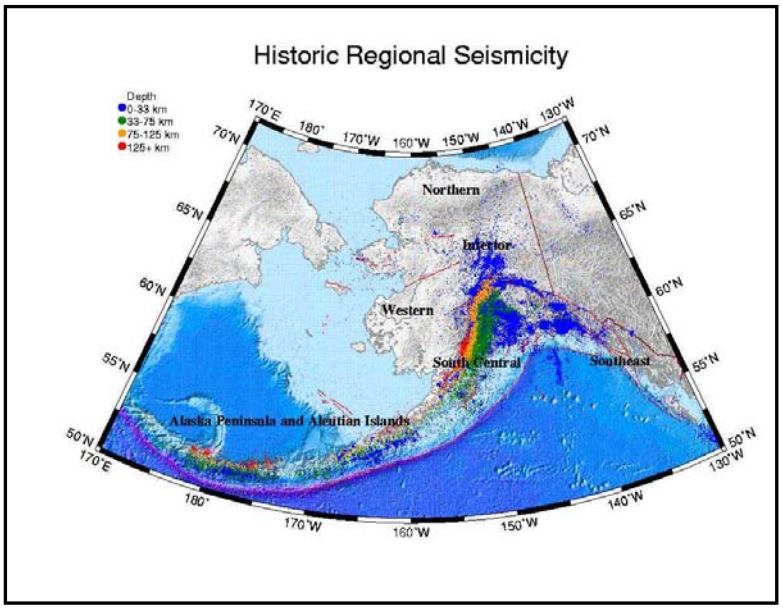
The following figures were obtained from the University of Alaska, Fairbanks, and Alaska Earthquake Information Center website at: http://www.giseis.alaska.edu/Seis/

Figure 3. Alaska Earthquake Information System (AEIS) Earthquake Active Faults



The tables and other information at the website list the Emmonak area as having a low probability of an earthquake. However, since all of Alaska is at risk for an earthquake event Emmonak could be at risk for an earthquake or have secondary impact from an earthquake in the region.

Figure 4. AEIS Historic Regional Seismicity



Previous Occurrences of Earthquake Damage

The City of Emmonak staff and elders have stated that to their knowledge an earthquake has not caused any damage in the Emmonak area, however, the danger always exists in Alaska.

Earthquake Hazard Vulnerability

See Table 10 and description at the beginning of this chapter.

Earthquake Mitigation

Earthquake Goals

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

Projects

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

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

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

Section 5. Description of Hazards Not Present in Emmonak

Avalanche, Landslides and Volcanoes

Emmonak is located on a flat floodplain with a gentle topographic relief in the city estimated to be 10 to 12 feet. There is no danger from avalanches, landslides or volcanoes because there are no mountains or steep slopes in the city.

Tsunamis and Seiches

There is no danger of tsunamis and seiches since Emmonak is located ten miles inland from the Bering Sea.

Chapter 4: Mitigation Strategy

Benefit - Cost Review

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

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

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

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

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

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

3. Project protects critical facilities or critical city functionality.

    A. Hazard probability.

    B. Hazard severity.

Other criteria that was used to developing the benefits – costs listing depicted on the Cost Benefit Review Listing table:

1. Vulnerability before and after Mitigation

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

Loss of life (number of people)
Injury (number of people)

1. List of Benefits

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

2. Costs

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

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

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

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

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

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

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

Benefit-Cost Analysis

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

Facilitating BCA

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

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

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

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

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

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

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

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

Benefit Cost Review Listing Table

Table 15. Benefit Cost Review Listing

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

** PDMG Pre-Disaster Mitigation Grant

*** HMGP Hazard Mitigation Grant Program

****FMA Flood Mitigation Assistance (Program)

Mitigation Projects	Benefits (pros)	Costs (cons)	High
Flood/Erosion (FLD)			
FLD-1. Structure Elevation and/or Relocation	Life/Safety project Benefit to government facilities and private properties. Potential PDMG**, HMGP***, FMA****	Dollar cost unknown, >$50k 1 – 5 year implementation	Medium
FLD-2. Updated FIRM Emmonak Maps	FEMA, PDMG**, HMGP*** and State DCRA funding available. USCOE facilitated project. Can be started immediately.	Expensive, at least $100,000	High
FLD-3. Public Education	DCRA funding may be available. Could be done yearly. Inexpensive <$1,000City	Not clear if there would be community interest or participation.	Medium
FLD-4. Install upgraded streamflow and rainfall measuring gauges	Life/Safety project Benefit to government facilities and private properties. Potential PDMG**, HMGP***, FMA****	Dollar cost unknown, >$50k 1 – 5 year implementation	Medium
FLD-5. Apply for grants/funds to implement riverbank protection methods.	Life/Safety project Benefit to government facilities and private properties. Potential PDMG**, HMGP***, FMA****	Dollar cost unknown, >$50k 1 – 5 year implementation	Medium
FLD-6. Pursue obtaining a CRS rating to lower flood insurance rates.	High capability by city to do on an annual basis Will reduce NFIP insurance for entire community. <$1,000/year	Staff time.	High

Mitigation Projects	Benefits (pros)	Costs (cons)	High
FLD-7. Obtain flood insurance for all City structures, and continue compliance with NFIP.	High capability by city to do on an annual basis. Public benefit to have public buildings insured through NFIP. Inexpensive, approx.$3,000/year.	Staff time	High
FLD-8. Culvert Repairs	Property Damage Reduction during flooding. State DOT responsibility. Benefit to public and private properties. Ongoing project. No expense to community	Plan needed. Cost is not determined, could be up to $100,000	Medium
FLD-9. Airport Road Improvements	Benefit to entire community. Life/Safety issue Funding potential from PDMG or HMGP. Could be implemented within 1 year.	Cost and funding not secured.	High
FLD-10. Revetment Repair and Expansion	Benefit to entire community. Life/Safety issue Funding potential from PDMG or HMGP.	Engineering needed. Cost and funding not secured. 1 – 5 years for implementation.	Medium
FLD-11. Develop a method to protect the landfill from further flooding.	Benefit to entire community. Life/Safety issue Health issue Funding potential from PDMG or HMGP. Needs to be implemented immediately.	Feasibility and cost study needed.	High
FLD-12. Research a strategy to deal with beaver dams which cause water flow obstruction and more flood damage.	Property damage reduction. State Fish and Game Responsibility. No cost to community. Benefit to specific properties.	Political and public support not determined. 1 – 5 year timeframe.	Medium

Mitigation Projects	Benefits (pros)	Costs (cons)	High
Severe Weather (SW)			
SW-1. Research and consider instituting the National Weather Service program of *"Storm Ready"*.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be implemented annually	Staff time	High
SW-2. Conduct special awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High
SW-3. Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High
SW-4. Encourage weather resistant building construction materials and practices.	Risk and damage reduction. Benefit to entire community.	Would require ordinance change. Potential for increased staff time. Research into feasibility necessary. Political and public support not determined. 1 – 5 year implementation	Medium
SW-5. Install a siren to warn people of a severe weather event.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be implemented immediately.	Less than $5,000	High
SW-6. Installation of automated weather sensors.	Life/Safety issue Risk reduction Benefit to entire community	Expensive. Need to secure funding. 1 – 5 years implementation	Medium

Mitigation Projects	Benefits (pros)	Costs (cons)	High
Tundra/Wildland Fire (WF)			
WF-1. Continue to support the local fire department with adequate firefighting equipment and training.	Life/Safety issue Risk reduction Benefit to entire community State assistance available Annual project.	Dollar cost not determined. Staff time to research grants	High
Project WF-2. Promote Fire Wise building design, siting, and materials for construction.	Life/Safety issue Risk reduction Benefit to entire community, Annual project. State assistance available	Dollar cost not determined. Staff time to research grants	High
WF-3: Continue to enforce development of building codes and requirements for new construction.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be implemented annually	Staff time	High
WF-4: Enhance public awareness of potential risk to life and personal property. Encourage mitigation measures in the immediate vicinity of their property.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be implemented annually	Staff time	High
WF-5. Purchase additional fire fighting equipment and vehicle, such as a fire truck and fire extinguishers.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be implemented immediately.	Need to secure funding.	High
Earthquake (E)			
E-1. If funding is available, perform an engineering assessment of the earthquake vulnerability of each identified critical infrastructure owned by the City of Emmonak.	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High

E-2. Identify buildings and facilities that must be able to remain operable during and following an earthquake event.	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High
E-3. Contract a structural engineering firm to assess the identified bldgs and facilities.	Benefit to entire community Risk reduction	Feasibility and need analysis needed. 1 – 5 years	Medium

Mitigation Project Plan Table

Table 16. Mitigation Strategy Plan Table

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

** PDMG Pre-Disaster Mitigation Grant

*** HMGP Hazard Mitigation Grant Program

****FMA Flood Mitigation Assistance (Program)

Mitigation Projects	Responsible Agency	Cost	Funding Sources Possible	Priority*
Flood and Erosion Projects				
Project FLD 1. Structure Elevation and/or Relocation	City DCRA, DHS&EM FEMA	To be Determined	PDMG** HMGP*** FMA****	Medium
Project FLD 2. Emmonak Maps	FEMA USCOE	>$10,000	PDMG** HMGP*** FMA****	High
Project FLD 3. Public Education	City DCRA	Staff Time	DCRA	Medium
Project FLD 4. Install new streamflow and rainfall measuring gauges	City DHS&EM	$10,000	PDMG HMGP	Medium
Project FLD 5. Apply for grants/funds to implement riverbank protection methods.	City	Staff Time	PDMG HMGP	Medium
Project FLD 6. Pursue obtaining a CRS ranking to lower flood insurance rates.	City DCRA	Staff Time	City	High

Mitigation Projects	Responsible Agency	Cost	Funding Sources Possible	Priority*
Project FLD 7. Obtain flood insurance for all City structures, and continue compliance with NFIP.	City	$1,500	City	High
Project FLD 8. Culvert Repairs	ADOT/PF	>$100,000	PDMG ADOPT/PF	Medium
Project FLD 9. Airport Road Improvements	City ADOT/PF FEMA	>$100,000	PDMG ADOT/PF	High
Project FLD 10. Revetment Repair and Expansion	USCOE ADOT/PF FEMA	>$100,000	PDMG HMGP	Medium
Project FLD-11. Develop a method to protect the landfill from further flooding	USCOE City	>$100,000	USCOE PDMG	High
Project FLD 12. Research a strategy to deal with beaver dams which cause water flow obstruction and more flood damage	ADF&G	Unknown	ADF&G	Medium
Project FLD 13. Require that all new structures be constructed according to NFIP requirements and set back from the river shoreline to lessen future erosion concerns and costs.	City	Staff Time	City Budget	High
Severe Weather Projects				
Project SW 1: Research and consider instituting the National Weather Service program of *"Storm Ready"*.	City	Staff Time	DCRA	High
Project SW 2: Conduct special awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.	City DCRA DHS&EM	Staff Time	DCRA DHS&EM FEMA	High
Project SW 3: Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability.	City	Staff Time	NOAA	High

Mitigation Projects	Responsible Agency	Cost	Funding Sources Possible	Priority*
Project SW 4: Encourage weather resistant building construction materials and practices.	City	Staff Time	City	Medium
Project SW 5: Install a siren to warn people of a severe weather or disaster event.	City DCRA DHS&EM	>$5,000	DCRA DHS&EM FEMA	High
Project SW 6: Installation of automated weather sensors. Automated weather sensors are the chief method by which the National Weather Service detects the occurrence of incoming severe weather.	DHS&EM	>$20,000	PDMG	Medium
Tundra/Wildland Fire Projects				
Project FIRE 1. Acquire additional firefighting equipment and training for personnel.	City DHS&EM	>$20,000	State Grant	High
Project FIRE 2. Promote Fire Wise building design, siting, and materials for construction.	State Div of Forestry	NA	State Grants	High
Project FIRE 3. Establish additional fire regulation and requirements.	City	Staff Time	State Grants	High
Project FIRE 4. Purchase additional fire fighting equipment and vehicles, such as a Fire Truck and fire extinguishers.	City State Div of Forestry	>$150,000	State Grants	High
Earthquake Hazard Projects				
Project EQ 1: Encourage development of earthquake resistance building codes and requirements.	City	Staff Time	State Grants	High

Mitigation Projects	Responsible Agency	Cost	Funding Sources Possible	Priority*
Project EQ 2: Enhance public awareness of potential risk to life and personal property from earthquakes. Encourage mitigation measures in the immediate vicinity of their property.	City DHS&EM DCRA	Staff Time	State Grants	High
Project EQ 3: If funding is available, perform an engineering assessment of the earthquake vulnerability of each identified critical infrastructure owned by the City of Emmonak.	City DHS&EM	Staff Time	PDMG	Medium
Project EQ 4: Identify buildings and facilities that must be able to remain operable during and following an earthquake event.	City DHS&EM	Combine with Project EQ-3	PDMG	Medium
Project EQ 5: Contract a structural engineering firm to assess the identified buildings and facilities to determine their structural integrity and strategy to improve their earthquake resistance.	City DHS&EM	Combine with Project EQ-3	PDMG	Medium

Glossary of Terms

A-Zones

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

Acquisition

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

Asset

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

Base Flood

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

Base Flood Elevation (BFE)

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

Base Floodplain

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

Building

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

Building Code

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

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

Community

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

Community Rating System (CRS)

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

Critical Facility

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

Designated Floodway

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

Development

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

Digitize

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

Disaster Mitigation Act (DMA)

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

Earthquake

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

Elevation

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

Emergency Operations Plan

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

Erosion

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

Federal Disaster Declaration

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

Federal Emergency Management Agency (FEMA)

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

Flood

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

Flood Disaster Assistance

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

Flood Elevation

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

Flood Hazard

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

Flood Insurance Rate Map

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

Flood Insurance Study

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

Floodplain

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

Floodplain Management

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

Floodplain Management Regulations

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

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

Flood Zones

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

Flood Zone Symbols

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

Geographic Information System

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

Governing Body

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

Hazard

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

Hazard Event

A specific occurrence of a particular type of hazard.

Hazard Identification

The process of identifying hazards that threaten an area.

Hazard Mitigation

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

Hazard Mitigation Grant Program

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

Hazard Profile

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

Hazard and Vulnerability Analysis

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

Mitigate

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

Mitigation Plan

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

National Flood Insurance

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

One Hundred (100)-Year

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

Planning

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

Repetitive Loss Property

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

Risk

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

Riverine

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

Riverine Flooding

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

Runoff

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

Seiche

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

Seismicity

Describes the likelihood of an area being subject to earthquakes.

State Disaster Declaration

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

Along with other provisions, this declaration allows the governor to utilize all available resources of the State as reasonably necessary, direct and compel the evacuation of all or part of the population from any stricken or threatened area if necessary, prescribe routes, modes of transportation and destinations in connection with evacuation and control ingress and egress to and from disaster areas. It is required before a Presidential Disaster Declaration can be requested.

Topography

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

Tribal Government

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

Tsunami

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

Vulnerability

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

Vulnerability Assessment

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

Watercourse

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

Watershed

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

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

5. *Emmonak Transportation Plan, 2002*. ASCG, Inc., Emmonak Native Village.

6. *FEMA Benefit-Cost Analysis Website:* http://www.fema.gov/government/grant/bca.

7. FEMA How to Guides

   Getting Started: Building Support For Mitigation Planning (FEMA 386-1)

   Understanding Your Risks: Identifying Hazards And Estimating Losses (FEMA 386-2)

   Developing The Mitigation Plan: Identifying Mitigation Actions And Implementing Strategies (FEMA 386-3)

   Bringing the Plan to Life: Implementing the Hazard Mitigation Plan (FEMA 386-4)

   Using Benefit-Cost Review in Mitigation Planning (FEMA 386-5)

8. *Potential Consequences of Climate Variability and Change for Alaska.* Parson, Edward A., et al. (1999) A Report of the Alaska Regional Assessment Group for the U.S. Global Change Program. Prepared for the Center for Global Change and Arctic Research. Fairbanks.

Web Sites

American Planning Association:	http://www.planning.org
Association of State Floodplain Managers:	http://www.floods.org

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

Appendix

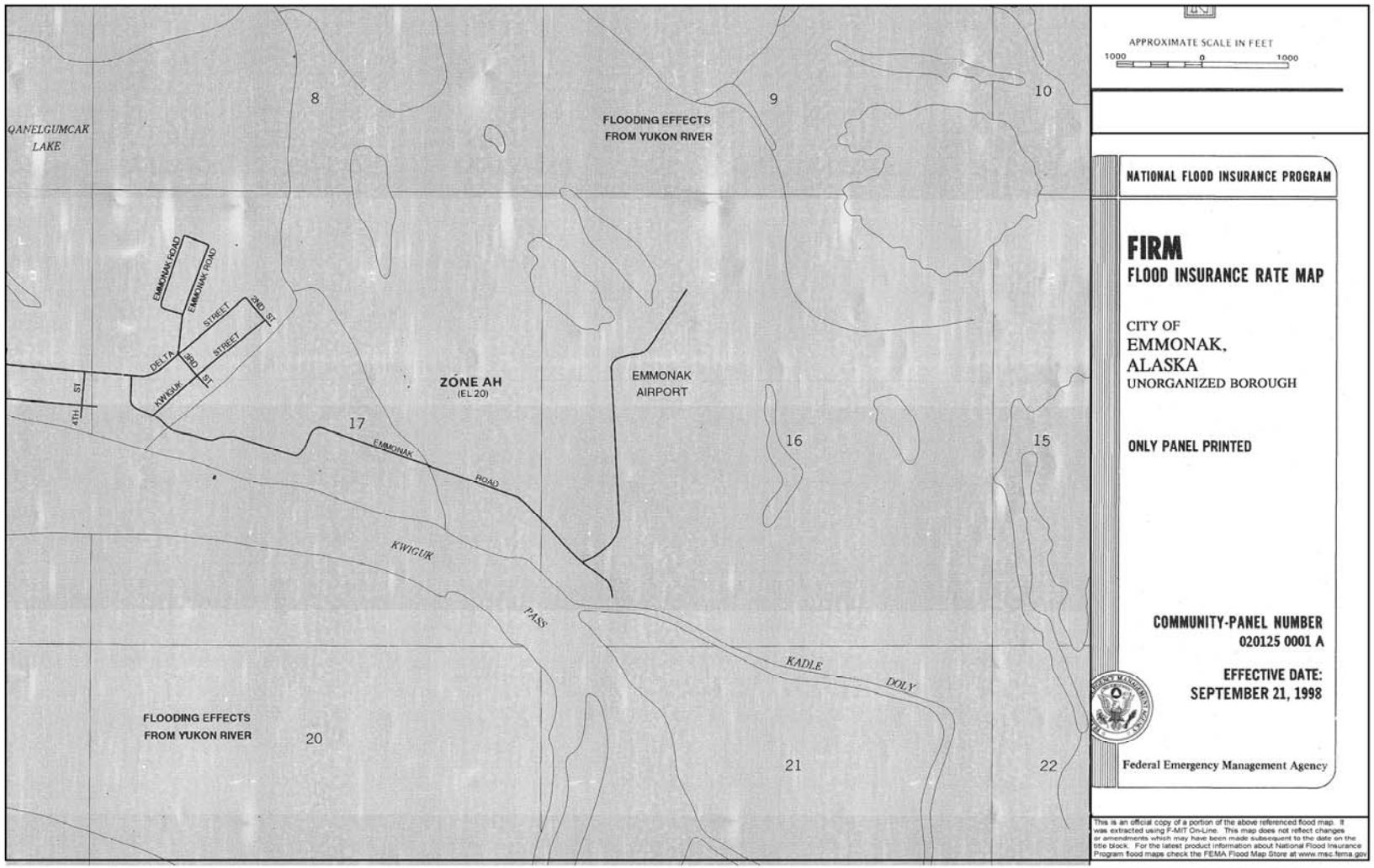
List of Maps – Pages 71 - 75

1. Land Use Map, Georeferenced photo
2. FIRM maps

Group of Pictures – Pages 76 - 78

July 18, 2006 Site Visit Pictures


Emmonak
N
W
E
S
Land Use
1. City Women's Shelter
2. Church
3. United Utilities Telephone
4. Fire Station
5. Church
6. Water Treatment Storage And Fuel Storage
7. AVEC Electric Plant Fuel Storage
8. LYSD High School/Elementary School Complex
9. LYSD School
10. Health Clinic
11. Washeteria
12. Public Safety
13. Post Office
14. Emmoneck Corp. Store
15. YDFM Co-op Fisheries
16. Emmonak Corp. Tank Farm
0
0.125
0.25
0.5
Miles


APPROXIMATE SCALE IN FEET
1000 0 1000
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
CITY OF
EMMONAK,
ALASKA
UNORGANIZED BOROUGH
ONLY PANEL PRINTED
COMMUNITY-PANEL NUMBER
020125 0001 A
EFFECTIVE DATE:
SEPTEMBER 21, 1998
Federal Emergency Management Agency
QANELGUMCAK LAKE
FLOODING EFFECTS FROM YUKON RIVER
ZONE AH
(EL 20)
EMMONAK AIRPORT
EMMONAK ROAD
EMMONAK ROAD
2ND ST
STREET
DELTA
3RD
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KWIGUK
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4TH ST
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ROAD
KWIGUK
PASS
KADLE
DOLY
FLOODING EFFECTS FROM YUKON RIVER
8
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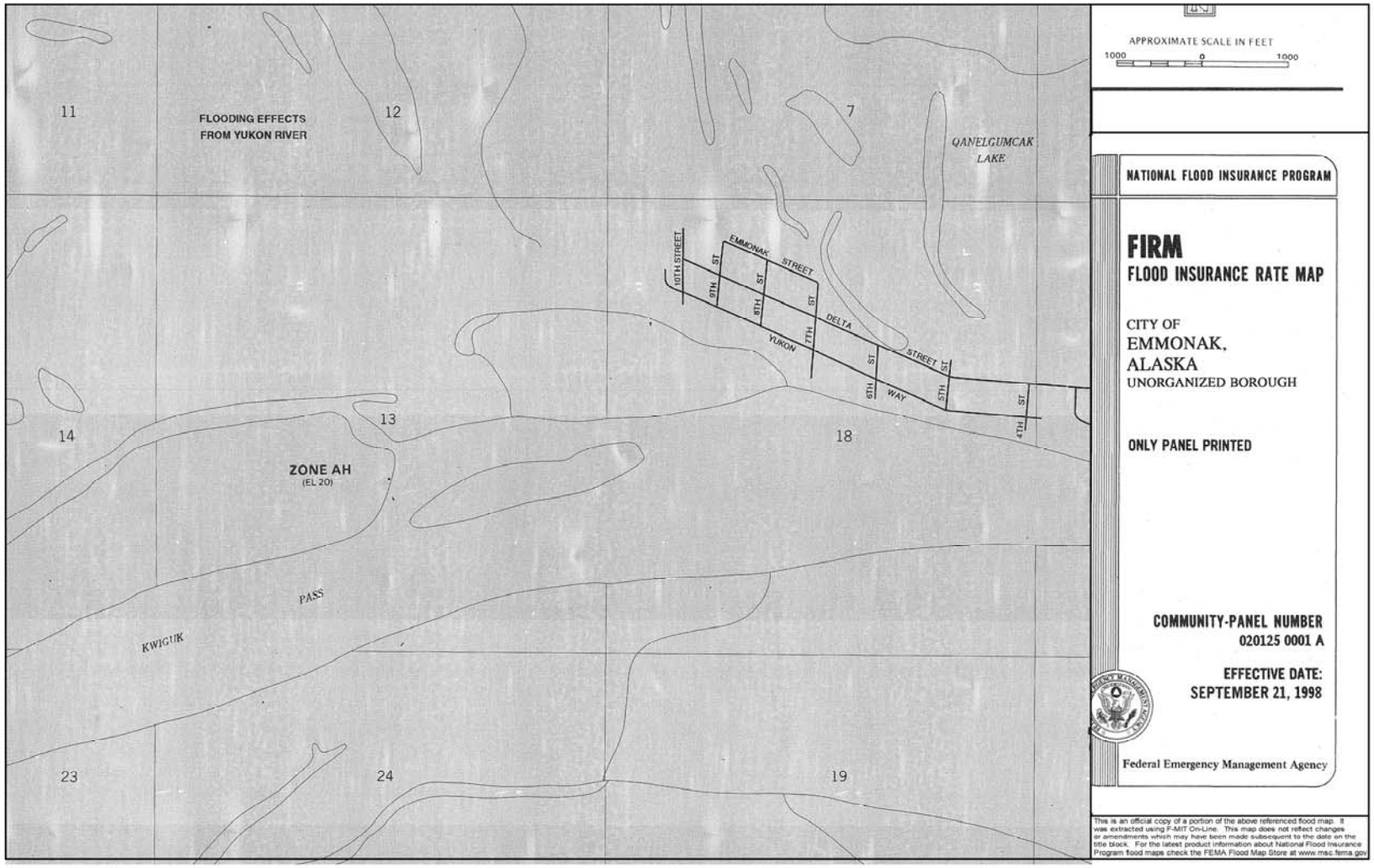
11
FLOODING EFFECTS
FROM YUKON RIVER
12
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QANELGUMCAK
LAKE
EMMONAK STREET
10TH STREET
9TH ST
8TH ST
7TH ST
DELTA
YUKON
6TH WAY
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18
ZONE AH
(EL 20)
PASS
KWIGUK
23
24
19
APPROXIMATE SCALE IN FEET
1000 0 1000
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
CITY OF
EMMONAK,
ALASKA
UNORGANIZED BOROUGH
ONLY PANEL PRINTED
COMMUNITY-PANEL NUMBER
020125 0001 A
EFFECTIVE DATE:
SEPTEMBER 21, 1998
Federal Emergency Management Agency
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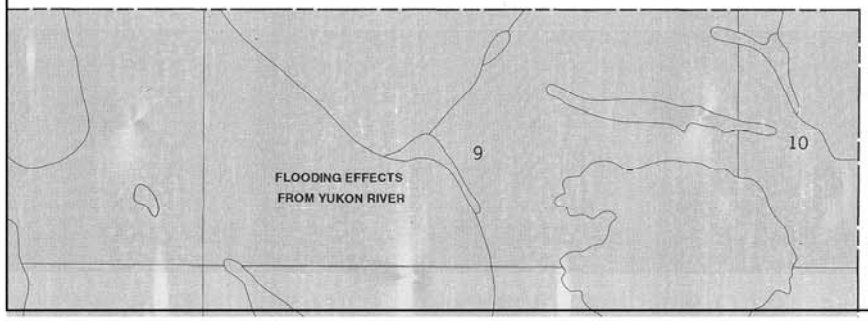

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** No base flood elevations determined
- **ZONE AE** Base flood elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding; velocities also determined.
- **ZONE A99** To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.
- **ZONE V** Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside 500-year floodplain.
- **ZONE D** Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS†

Identified 1983 | Identified 1990 | Otherwise Protected Areas

†Coastal barrier areas are normally located within or adjacent to special flood hazard areas.

- Floodplain Boundary
- Floodway Boundary
- Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
- 513 — Base Flood Elevation Line; Elevation in Feet*
- D — D — Cross Section Line
- (EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone
- RM7x — Elevation Reference Mark
- •M1.5 — River Mile

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be consulted for more detailed data on BFEs, and for any information on floodway delineations, prior to use of this map for property purchase or construction purposes.

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, A1-A30, AH, AO, A99, V, VE and V1-V30.

Certain areas not in Special Flood Hazard Areas may be protected by flood

APPROXIMATE SCALE IN FEET
1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

CITY OF
EMMONAK,
ALASKA
UNORGANIZED BOROUGH

ONLY PANEL PRINTED

COMMUNITY-PANEL NUMBER
020125 0001 A

EFFECTIVE DATE:
SEPTEMBER 21, 1998

Federal Emergency Management Agency

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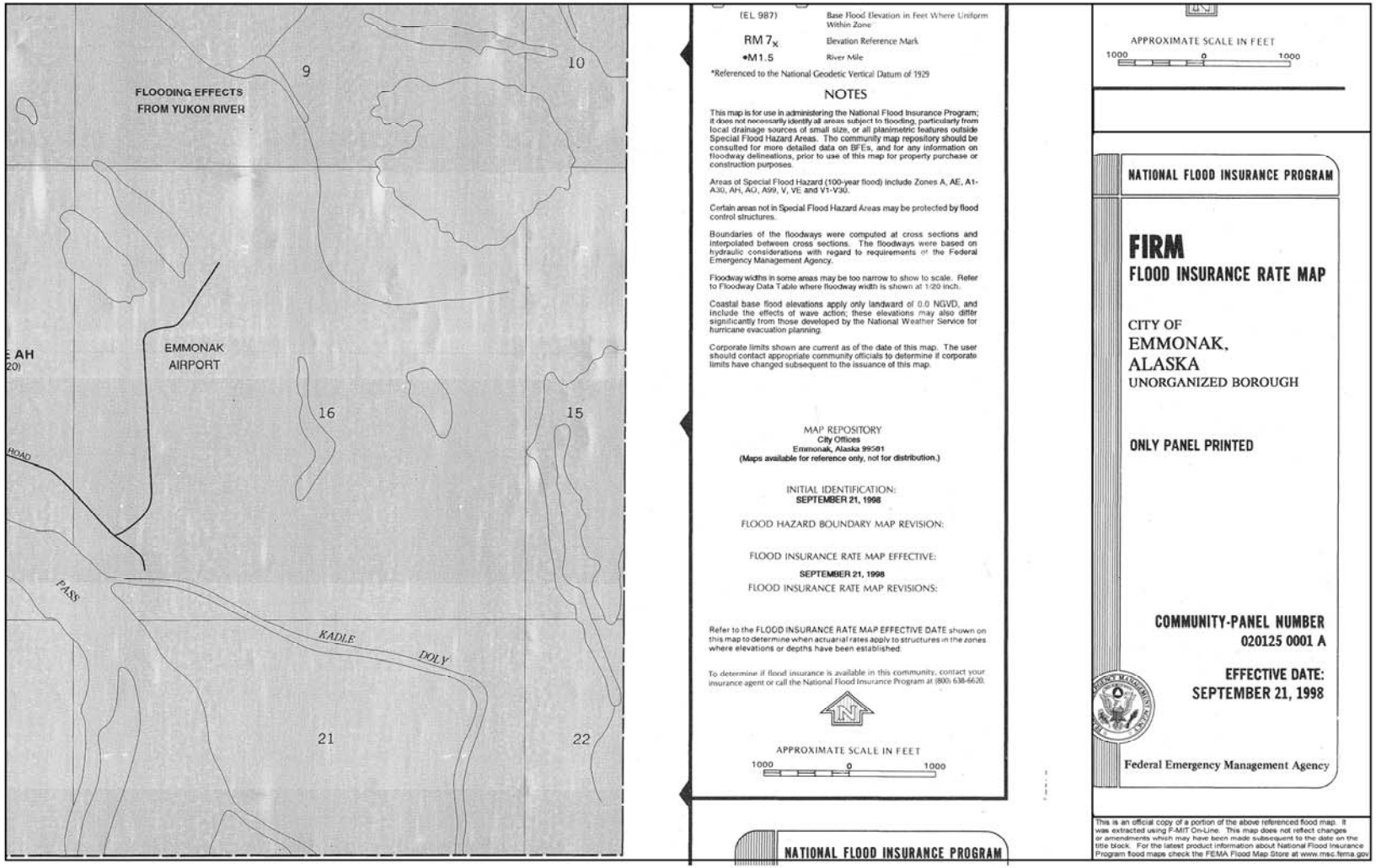
FLOODING EFFECTS
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(EL 987) Base Flood Elevation in Feet Where Uniform Within Zone
RM 7x Elevation Reference Mark
•M1.5 River Mile
*Referenced to the National Geodetic Vertical Datum of 1929
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Areas of Special Flood Hazard (100-year flood) include Zones A, AE, A1-A30, AH, AO, A99, V, VE and V1-V30.
Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.
Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.
Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 1/20 inch.
Coastal base flood elevations apply only landward of 0.0 NGVD, and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.
Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.
MAP REPOSITORY
City Offices
Emmonak, Alaska 99581
(Maps available for reference only, not for distribution.)
INITIAL IDENTIFICATION:
SEPTEMBER 21, 1998
FLOOD HAZARD BOUNDARY MAP REVISION:
FLOOD INSURANCE RATE MAP EFFECTIVE:
SEPTEMBER 21, 1998
FLOOD INSURANCE RATE MAP REVISIONS:
Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE DATE shown on this map to determine when actuarial rates apply to structures in the zones where elevations or depths have been established.
To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at (800) 638-6620.
APPROXIMATE SCALE IN FEET
1000 0 1000
NATIONAL FLOOD INSURANCE PROGRAM
APPROXIMATE SCALE IN FEET
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Emmonak Picture File

July 18, 2006 Site Visit

Airport Access Road Damaged from Flooding 2.JPG

Airport Access Road Damaged from Flooding 3.JPG

Yukon Rv Shoreline Erosion 2.JPG

City Hall Water Mark 1.JPG

Yukon Rv Shoreline Erosion 1.JPG

Yukon Rv Shoreline Erosion 3.JPG

Flooded Landfill.JPG

Damaged Revetment.JPG