2019 City of Gustavus
Hazard Mitigation Plan

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LIST OF ACRONYMS AND ABBREVIATIONS

°F	Degrees Fahrenheit
AECOM	AECOM, Consultant, or Contractor
CFR	US Code of Federal Regulations
City	City of Gustavus
DCCED	Department of Commerce, Community, and Economic Development
DCRA	Division of Community and Regional Affairs
DHS&EM	Division of Homeland Security and Emergency Management
DGGS	Division of Geological and Geophysical Survey
DMA 2000	Disaster Mitigation Act Of 2000
DMVA	Department of Military and Veterans Affairs
DOT/PF	Department of Transportation and Public Facilities
ENSO	El Niño/La Niña Southern Oscillation
FEMA	Federal Emergency Management Agency
GI	Geophysical Institute
MAP	Mitigation Action Plan
LHMP	Local All-Hazard Mitigation Plan
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
PDM	Pre-Disaster Mitigation
PRISM	Parameter-elevation Regressions on Independent Slopes Model
SNAP	Scenarios Network for Alaska and Arctic Planning
Stafford Act	Robert T. Stafford Disaster Relief and Emergency Assistance Act
UAF	University of Alaska Fairbanks
U.S.	United States
USACE	U.S. Army Corps of Engineers
USGS	US Geological Survey

1.0 INTRODUCTION

1.1 HAZARD MITIGATION PLANNING

As defined in Title 44 of the Code of Federal Regulations (CFR), Subpart M, Section 206.401, hazard mitigation is “any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards.” As such, hazard mitigation is any work to minimize the impacts of any type of hazard event before it occurs. Hazard mitigation aims to reduce losses from future disasters. It is a process that identifies and profiles hazards, analyzes the people and facilities at risk, and develops mitigation actions to reduce or eliminate hazard risk. The implementation of the mitigation actions, which include short- and long-term strategies that may involve planning, policy changes, programs, projects, and other activities, is the end result of this process.

In recent years, local hazard mitigation planning has been driven by a federal law, known as the Disaster Mitigation Act of 2000 (DMA 2000). On October 30, 2000, Congress passed the DMA 2000 (Public Law 106-390), which amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (Stafford Act) (Title 42 of the United States Code Section 5121 et seq.) by repealing the act’s previous mitigation planning section and replacing it with a new mitigation planning section. This new section emphasized the need for state, tribal, and local entities to closely coordinate mitigation planning and implementation efforts. This new section also provided the legal basis for the Federal Emergency Management Agency’s (FEMA’s) mitigation plan requirements for the Hazard Mitigation Assistance grant programs.

1.2 2019 ALL-HAZARDS MITIGATION PLAN SYNOPSIS

To meet the requirements of the DMA 2000, the City of Gustavus has prepared an All-Hazards Local Mitigation Plan (LHMP) to assess risks posed by natural hazards and to develop a mitigation action plan for reducing the risks in Gustavus. This is the first hazard mitigation plan created by the City of Gustavus.

The 2019 LHMP is organized to follow FEMA’s Local Mitigation Plan Review Tool, which demonstrates how local LHMPs meet the DMA 2000 regulations. As such, specific planning elements of this review tool are in their appropriate plan sections.

The 2019 LHMP structure includes the following sections:

- **Section 1 Introduction** defines what a hazard mitigation plan is, delineates federal requirements and authorities, and introduces the Hazard Mitigation Assistance program listing the various grant programs and their historical funding levels.
- **Section 2 Planning Process** provides an overview of the planning process, starting with the plan completion timeline. It identifies planning/advisory committee members and describes their involvement with the plan update process. It also details stakeholder outreach, public involvement and continued public involvement. It provides an overview of the existing plans and reports and how they were incorporated into the 2019 LHMP and lastly lays out a plan update method and schedule. Supporting planning process documentation is listed in Appendix A.
- **Section 3 Community Profile** provides a general history and background of the City of Gustavus including historical trends for population and the demographic and economic conditions that have shaped the area. Finally, this section lists the critical facilities identified by the community that are included in this plan.
- **Section 4 Hazard Identification and Risk Assessment** describes each of the five hazards addressed in this plan. Additionally, it includes impact (i.e., risk assessment) tables for the planning area, vulnerable populations and critical facilities in each hazard area. An overall summary description is also provided for each hazard.

- **Section 5 Mitigation Strategy** details Gustavus's capabilities (authorities, policies, programs and resources) available for hazard mitigation. Finally, it describes the mitigation strategy, which is the blueprint for how the city will reduce its risks to hazards. The mitigation strategy is made up of three main components: mitigation goal(s); potential mitigation actions and projects; and a mitigation action plan.
- **Section 6 References** contains the sources cited in this document.
- **Section 7 Plan Adoption** contains a scanned copy of the adoption resolution.

2.0 PLANNING PROCESS

Section 2 – Planning Process addresses Element A of the Local Mitigation Plan Regulation Checklist.

DMA 2000 Requirements
ELEMENT A. Planning Process
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1)) A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2)) A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1)) A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3)) A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii)) A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))
Source: FEMA, March 2015.

2.1 OVERVIEW OF THE LHMP PLANNING PROCESS

The State of Alaska, Division of Homeland Security and Emergency Management (DHS&EM) provided funding and project oversight to AECOM to facilitate and guide planning team development and LHMP development.

The planning process began on January 17, 2018 with an introductory email from AECOM to the Gustavus City Clerk to explain how their community was selected by the Division of Homeland Security and Emergency Management 2016 Pre-Disaster Mitigation Grant award. AECOM staff described the LHMP development requirement to enable the community to qualify for Hazard Mitigation Grant Program grants and the overall LHMP development process. Travis Miller (Fire Chief, Gustavus) was the primary HMP contact for the City of Gustavus.

Mr. Miller was encouraged to develop a community planning team to assist the community's efforts to identify available resources and capabilities for LHMP development. AECOM explained how the LHMP differed from current emergency plans. The planning team would be assisted by AECOM by acting as an advocate for the planning process, assist with gathering information, and provide support during public participation opportunities. AECOM briefly discussed existing hazards that affect the community such as erosion, sediment deposition, and permafrost impacts, which are increasing in intensity due to climate changes. A planning team kick-off meeting was scheduled by conference call for August 6, 2018.

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

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

In summary, the following five-step process took place from July 30, 2018 through August 30, 2019.

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

Table 1 identifies the complete hazard mitigation planning team.

Table 1. Hazard Mitigation Planning Team

Name	Title	Organization	Key Input
Barb Miranda	Mayor	City of Gustavus	Planning team lead, data input and LHMP review.
Travis Miller	Fire Chief, HMP Team Lead	City of Gustavus Fire Department	Planning team member, data input and LHMP review.
Ben Sadler		City of Gustavus	Planning team member, data input and LHMP review.
Mike Taylor		City of Gustavus	Planning team member, data input and LHMP review.
City Council	Entire Membership	City of Gustavus	Planning team member, data input and LHMP review.
Kelly Isham	Emergency Management Planner	AECOM, Alaska	Contract planning team member, data acquisition, LHMP development, plan writing, project coordination.
Scott Simmons	Senior Emergency Management Planner	AECOM, Alaska	Contract planning team member, Responsible for LHMP development, lead writer, project coordination.

2.2 OPPORTUNITIES FOR STAKEHOLDERS

On February 2, 2018, AECOM extended an invitation to all individuals and entities identified on the project mailing list described the planning process and announced the upcoming communities' planning activities. The announcement was emailed to relevant academia, nonprofits, and local, state, and federal agencies. The following agencies were invited to participate and review the LHMP:

- US Bureau of Indian Affairs
- US Bureau of Land Management
- US Department of Housing and Urban Development

- US Fish & Wildlife Service
- University of Alaska Fairbanks (UAF), Geophysical Institute (GI), Alaska Earthquake Information Center
- Alaska Native Tribal Health Consortium-Community Development
- Alaska Volcano Observatory
- Association of Village Council Presidents
- Denali Commission
- Alaska Department of Environmental Conservation
    - Division of Spill Prevention and Response
    - Village Safe Water
- Alaska Department of Transportation and Public Facilities (DOT/PF)
    - Central Region
    - North Region
    - Southcoast Region
- Alaska Department of Community, Commerce, and Economic Development (DCCED)
- DCCED, Division of Community Advocacy (DCRA)
- Alaska Department of Military and Veterans Affairs (DMVA)
- DMVA, Division of Homeland Security and Emergency Management (DHS&EM)
- U.S. Environmental Protection Agency
- National Weather Service (NWS)
    - Northern Region
    - NWS Southeast Region
    - NWS Southcentral Region
- Natural Resources Conservation Service
- U.S. Department of Agriculture
- U.S. Department of Agriculture Division of Rural Development
- US Army Corps of Engineers (USACE)

2.3 PUBLIC INVOLVEMENT

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

Table 2. Public Involvement Mechanisms

Mechanism	Description
Agency Involvement Email (July 30, 2018)	Invited agencies to participate in mitigation planning effort and to review applicable newsletters located on the DHS&EM Local/Tribal All Hazard Mitigation Plan Development website at: http://ready.alaska.gov/plans/localhazmitplans
Newsletter #1 Distribution (August 6, 2018)	The jurisdiction distributed their 1st newsletter introducing the upcoming planning activity. The newsletter encouraged the whole community to provide hazard and critical facility information. It was posted at Gustavus city offices, stores, and bulletin boards, stores centers to enable the widest dissemination.

Table 2. Public Involvement Mechanisms

Mechanism	Description
HMP Reviews Opportunities	The planning team reviewed each section during HMP development and final HMP review.
Public HMP Progress Notifications	Team members engaged their "public" during tribal council meetings to provide update HMP progress and notify them of HMP review opportunities throughout the project.
Public Comment Results	No public comments were received during development or during the draft HMP review period.

The project introductory newsletter was posted throughout the community (post offices, public bulletin boards, etc.) announcing the scope of the project, potential hazard profiles, and meeting agendas.

AECOM described the specific information needed from the planning team to assess critical facility vulnerability and population risk by the location, value, and population within residential properties and critical facilities. The risk assessment was completed after the community asset data was collected by the planning team during 2018, which identified the assets that are exposed and vulnerable to specific hazards. The planning team evaluated these facilities and their associated risks to facilitate creating a viable or realistic risk analysis and subsequent vulnerability assessment for the City of Gustavus.

A planning team meeting was held on October 1, 2018 to review and prioritize the mitigation actions identified based on the results of the risk assessment.

The planning team held a special meeting to review the draft LHMP for accuracy – ensuring it meets city needs.

2.4 REVIEW AND INCORPORATION OF EXISTING PLANS AND REPORTS

The consultant reviewed existing relevant information to include in the 2019 LHMP. Table 3 lists the plans and reports reviewed as well as information to be incorporated into the 2019 LHMP. Data collected included newly available plans, studies, reports, and technical research. The data were reviewed and referenced where applicable for the LHMP's jurisdictional information, hazard profiles, risk analysis, and vulnerability assessment.

Table 3. Documents Reviewed

Existing plans, studies, reports, ordinances, etc.	Contents Summary (How will this information improve mitigation planning?)
Gustavus Strategic Plan, -City of Gustavus, Alaska, 2005	Defined the community's values, goals, and plans for the future
US Army Corps of Engineers, Alaska Baseline Erosion Assessment, 2009	Defined the area's erosion impacts
US Army Corps of Engineers, Floodplain Manager's Reports, Community Specific 2011	Defined the area's historical flood impacts
State of Alaska, Department of Commerce, Community and Economic Development Community Profile	Provided historical and demographic information
State of Alaska Hazard Mitigation Plan (SHMP), 2018, draft	Defined statewide hazards and their potential locational impacts

2.5 INTEGRATING HMP PRECEPTS INTO EXISTING PLANNING MECHANISMS

Each planning team member ensures that the LHMP, in particular each Mitigation Action Plan's (MAP's) project or initiative, is incorporated into existing city planning mechanisms whenever possible. Once the LHMP is community adopted and receives FEMA's final approval, each member of the planning team will undertake the following activities.

- Review community-specific regulatory tools to assess integrating LHMP components. These regulatory tools are identified in the following capability assessment section
- Work with pertinent community departments to increase awareness of the LHMP and provide assistance with integrating the mitigation strategy (including the MAP) into relevant planning mechanisms.

Note: Implementing these requirements may require updating or amending specific planning mechanisms.

2.6 CONTINUED PUBLIC INVOLVEMENT

The entire community is committed to involving the public directly in the continual reshaping and updating the LHMP. A paper copy of the LHMP and any proposed changes will be available at the City Hall; along with an address and phone number of the planning team leader to whom people can direct their comments or concerns.

The City will strive to continue identifying opportunities to raise community awareness about the LHMP and the hazards that affect the area. This effort could include attendance and provision of materials at City-sponsored events, and outreach projects identified in Section 5, Mitigation Strategy, and public meetings. Any public comments received regarding the LHMP will be collected by the planning team leader who will include the information within the annual report for consideration during future LHMP updates.

2.7 PLAN UPDATE AND MONITORING METHOD

This section describes a formal plan maintenance process to ensure that the LHMP remains an active and applicable document. It includes an explanation of how the community's planning team intends to organize their efforts to ensure that improvements and revisions to the LHMP occur in a well-managed, efficient, and coordinated manner. The planning team will:

- Incorporate and integrate LHMP components into existing planning mechanisms
- Continue public involvement
- Monitor, review, evaluate, and update the LHMP annually

The LHMP was prepared as a collaborative effort. To maintain momentum and build upon previous planning efforts and successes; the City of Gustavus will continue to use the planning team to monitor, review, evaluate, and update the LHMP.

The City of Gustavus' planning team intends to organize their efforts to ensure that legacy HMP improvements and revisions occur in a well-managed, efficient, and coordinated manner. The planning team will follow these process steps:

- **Annual Review Worksheets:** Every 12 months from plan adoption, the HMP planning lead will email each member of the planning team an Annual Review Worksheet to complete. As shown in Appendix B, the Annual Review Worksheet reflects the Local Mitigation Plan Review Tool and includes the following: planning process, hazard profile, risk assessment, and mitigation strategy. Each member of the advisory committee will email completed worksheets back to the HMP planning lead to review. The HMP planning lead will summarize these findings and email them out to the committee. If the HMP planning lead believes that the 2019

LHMP needs to be updated based on the findings, then an invitation will be sent to planning team members to attend a formal HMP update meeting.

- **Mitigation Progress Project Reports:** Mitigation actions will be monitored and updated using the Mitigation Project Progress Report. During each annual review, each department or agency currently administering a mitigation project will submit a progress report to the HMP planning lead. For projects that are being funded by a FEMA mitigation grant, FEMA quarterly reports may be used as the preferred reporting tool. As shown in Appendix B, the progress report will discuss the current status of the mitigation project, including any changes made to the project, identify implementation problems, and describe appropriate strategies to overcome them.
- **Planning Team Roundtable:** On the fourth year of the update, the HMP planning lead will lead a tabletop exercise with the advisory committee to: collect the Annual Review Worksheet and any Mitigation Project Progress Reports and FEMA quarterly reports; determine hazards; develop a new work plan; and begin the plan update process.

The City Council will monitor the plan continually, evaluate the plan annually and update the plan every five years, or within 90 days of a presidentially declared disaster (if required), or as necessary to reflect changes in state or federal law.

Each authority identified in the MAP matrix will be responsible for implementing the MAP and determining whether their respective actions were effectively implemented.

The city will appoint the most appropriate planning team leader, who will serve as the primary point-of-contact and will coordinate local efforts to monitor, evaluate, revise, and update LHMP mitigation strategy actions' progress, status, and closure status.

3.0 COMMUNITY PROFILE

3.1 PLANNING AREA

The city of Gustavus and other local entities are collocated and intermingled in the same geographic area with no defined separation between communities. For the purposes of this plan, the area included in the city of Gustavus encompasses the entire community footprint (Figure 1).

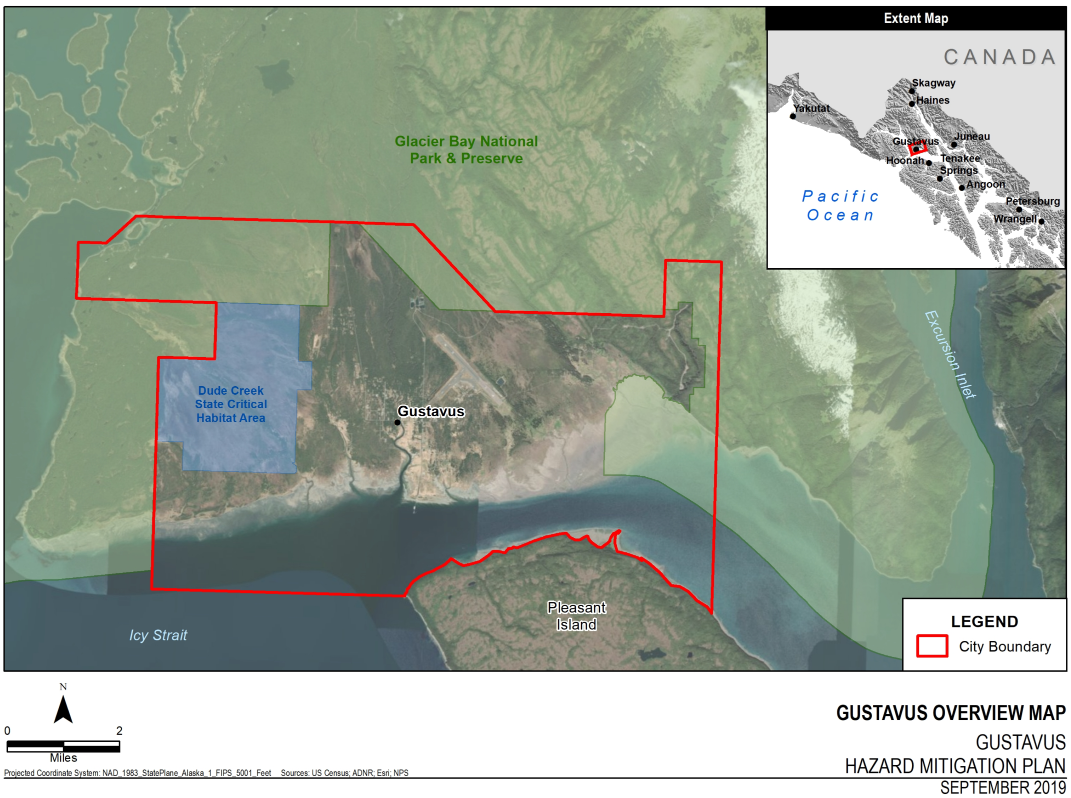


Figure 1. Gustavus Overview Map

The city of Gustavus covers approximately 33.2 square miles of land and approximately 22 square miles of water. Moderate maritime temperature changes occur along Alaska's Southeast "Panhandle." Gustavus's maritime temperatures range from a winter low of 4 degrees Fahrenheit (°F) to a high of 81°F. The area annually receives approximately 74.6 inches of rain and 54 inches of snow. (DCRA 2018; WRCC 2018).

The adjoining Glacier Bay National Park and Preserve, which covers an impressive 3.3 million acres (5,156 square miles) is headquartered in the City of Gustavus.

The Department of Community and Regional Affairs (2018) provides a general community description:

> *Strawberry Point/Gustavus has a year round population of about 450 and up to three times that number in the summer months. Fishing lodges charter daily visitors to the fertile Icy Strait Passage area and beyond for halibut, salmon and whale watching. Many locals are employed in the summer tourism trade and at Glacier Bay National Park. There are a number of churches, a post office, school, gym, library, gas station, several art and gift galleries, a fish smoking business, a restaurant, and 2 grocery stores. Many of the*

> *residents of Strawberry Point/Gustavus choose to live here for the laid-back lifestyle, subsistence activities, the natural resources and beauty of the area and the community.*

The City of Gustavus Strategic Plan (Gustavus 2005) provides some historical background for their community as:

> *Gustavus is a city of 429 people set on the shore of Icy Strait, 36 air miles from Juneau, Alaska's capital city. Originally called Strawberry Point by early settlers, the community was renamed Gustavus in 1925 by the USPS when the first post office was established here. Strawberry point was historically used by the Tlingit people for seasonal harvesting and smoking salmon. The first successful homestead patent was issued in 1923, although settlers were present here as early as 1917. Through "hope and hard work" several families successfully homesteaded here. Their names live on here in their descendants as well as place names. Rink, Parker, Chase, White and Hall were among the families who settled the area.)*

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

1914 First settlers arrive, leaving shortly afterward.

1917 Abraham Lincoln Parker moved his family to Strawberry Point, establishing the first permanent homestead.

1925 U.S. Postal Service establishes new post office and changes the name to Gustavus from Point Gustavus at the mouth of nearby Glacier Bay.

1940 Gustavus appears on U.S. Census as Strawberry Point again, listed as an unincorporated village.

1980 Gustavus became known as a census-designated place.

2004 Gustavus became an incorporated city within the Hoonah-Angoon Census Area.

3.2 DEMOGRAPHICS AND ECONOMY

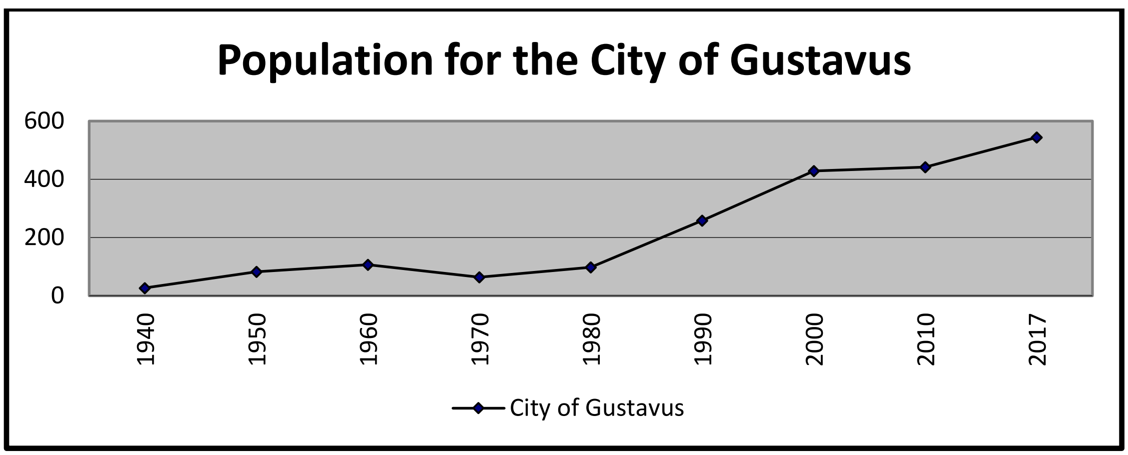


Figure 2. Gustavus Historic Population

The 2010 US Census estimated 442 residents, of which the median age was 51.6 indicating a relatively aging population. The population of Gustavus is expected to remain steady because over half of the population is between 18 and 64 years of age. 90 percent of the population is principally of European heritage. The male and female composition is approximately 50.6 and 49.4 percent respectively. The most recent 2017 Alaska Department of Commerce, Community, and Economic Development (DCCED) certified population is 544. Figure 2 illustrates Gustavus' historic population.

The city of Gustavus's economy is primarily based on subsistence and other general employment opportunities that exist in the community.

According to the 2010 Census estimates, the median household income in Gustavus was $57,019. Approximately 5.5 percent were reported to be living below the poverty level according to the 2016 American Community Survey. The potential work force (those aged 16 years or older) in Gustavus was estimated to be 395, of which 40 percent were actively employed in 2015 according to the DCCED. In 2015 the unemployment rate was 8.7 percent, compared to the U.S. average of 5.2 percent; however, this rate included part-time and seasonal jobs, and practical unemployment or underemployment is likely to be significantly higher.

Figure 3 depicts a photograph from the docks in the City of Gustavus.

Photo Credit: City of Gustavus Planning Team 2018

Figure 3. Photograph from Gustavus docks

3.3 LAND USE AND DEVELOPMENT TRENDS

Land use in the city of Gustavus is predominately residential with limited area for commercial services and community (or institutional) facilities. Suitable developable vacant land is in short supply in city of Gustavus boundaries, and open space and various hydrological bodies surround the community. One area of town is classified as airport land use.

4.0 HAZARD ANALYSIS

This section identifies and profiles the hazards that could affect the city of Gustavus. and addresses Element B of the Local and Tribal Mitigation Plan Regulation Checklist.

DMA 2000 Multi-Jurisdictional Requirements
ELEMENTS. Planning Area and Natural Hazard Profiles
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i)) B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))
Source: FEMA, March 2015

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

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

This is the first step of the hazard analysis. On October 1, 2018 the planning team reviewed seven possible hazards that could affect the community. They then evaluated and screened the comprehensive list of potential hazards based on a range of factors, including prior knowledge or perception of their threat and the relative risk presented by each hazard, the ability to mitigate the hazard, and the known or expected availability of information on the hazard (Table 4). The planning team determined that five hazards pose a great threat to the community: earthquake, flood/erosion, severe weather, tsunami and seiche, and wildland/tundra fire; some of which are influenced by increasing changing climate conditions such as late ice formation, early thaw conditions, increased, lack, or inconsistent rain.

Table 4. Identification and Screening of Hazards

Hazard Type	Should It Be Profiled?	Explanation
Natural Hazards		
Earthquake	Yes	Periodic, unpredictable occurrences. The City of Gustavus area experienced no damage from the 11/2003 Denali earthquake, but experienced minor shaking from the earthquake and its aftershocks, from the 1964 Good Friday Earthquake. The City of Gustavus has experienced 28 earthquakes above M 5.0 with epicenters located from 150 miles from the area since 1972.
Flood and Erosion (Riverine and/or coastal related floods)	Yes	Snowmelt run-off and rainfall flooding occur during spring thaw and the fall rainy season. Events occur from soil saturation. Several minor flood events cause damage. Severe damages occur from major floods. The City experiences storm surge, coastal ice run-up, and coastal wind scour along the shoreline and riverine high water flow scour along the area's rivers, streams, and creek embankments as well as damages from coastal or riverine ice flows, wind, surface runoff, and boat traffic wakes.
Ground Failure	No	The planning team does not recognize this hazard for this location.

Table 4. Identification and Screening of Hazards

Hazard Type	Should It Be Profiled?	Explanation
Severe Weather (Cold, Rain, Snow, etc.)	Yes	Severe weather impacts the community with climate change/global warming and changing El Niño/La Niña Southern Oscillation (ENSO) patterns generating increasingly severe weather events such as winter storms, heavy or freezing rain, thunderstorms and with subsequent secondary hazards such as riverine or coastal storm surge floods, landslides, snow, and wind etc.
Tsunami (Seiche)	Yes, minor	This hazard has had minor historical impact on City infrastructure.
Volcano	No	The planning team does not recognize this hazard for this location.
Wildland Fire	Yes	The community and the surrounding forest area become very dry in summer months with weather (such as drought and lightening) and human caused incidents igniting dry vegetation in the adjacent area.

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

- Nature (Type)
- Location
- History (Previous Occurrences)
- Extent/Impact (breadth, magnitude, and severity)
- Recurrence Probability

Each hazard is assigned a rating based on the following criteria for magnitude/severity (Table 5) and future recurrence probability (Table 6). Potential climate change impacts are primarily discussed in the Severe Weather hazard profile but are also identified where deemed appropriate within each hazard profile.

Estimating magnitude and severity are determined based on historic events using Table 5 identified criteria from narrative descriptions in Section 4.

Table 5. Hazard Magnitude/Severity Criteria

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

Similar to estimating magnitude and severity, Probability is determined based on historic events, using Table 6 identified criteria, to provide estimated future event recurrence likelihood.

Table 6. Hazard Recurrence Probability Criteria

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

The hazards profiled for the City of Gustavus area are presented throughout the remainder of Section 4. The presentation order does not signify their importance or risk level.

4.1 EARTHQUAKE

4.1.1 Nature/Type

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

Ground motion generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. An earthquake causes waves in the earth's interior (i.e., seismic waves) and along the earth's surface (i.e., surface waves). Two kinds of seismic waves occur: P (primary) waves are longitudinal or compressional waves similar in character to sound waves that cause back and forth oscillation along the direction of travel (vertical motion), and S (secondary) waves, also known as shear waves, are slower than P waves and cause structures to vibrate from side to side (horizontal motion). There are also two types of surface waves: Raleigh waves and Love waves. These waves travel more slowly and typically are significantly less damaging than seismic waves.

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

- **Surface Faulting** is the differential movement of two sides of a fault at the earth's surface. Displacement along faults, both in terms of length and width, varies but can be significant (e.g., up to 20 feet), as can the length of the surface rupture (e.g., up to 200 miles). Surface faulting can cause severe damage to linear structures, including railways, highways, pipelines, and tunnels.

- **Liquefaction** occurs when seismic waves pass through saturated granular soil, distorting its granular structure, and causing some of the empty spaces between granules to collapse. Pore water pressure may also increase sufficiently to cause the soil to behave like a fluid for a brief period and cause deformations. Liquefaction causes lateral spreads (horizontal movements of commonly 10 to 15 feet, but up to 100 feet), flow failures (massive flows of soil, typically hundreds of feet, but up to 12 miles), and loss of bearing strength (soil deformations causing structures to settle or tip). Liquefaction can cause severe damage to property.
- **Landslides/Debris Flows** occur as a result of horizontal seismic inertia forces induced in the slopes by the ground shaking. The most common earthquake-induced landslides include shallow, disrupted landslides such as rock falls, rockslides, and soil slides. Debris flows are created when surface soil on steep slopes becomes totally saturated with water. Once the soil liquefies, it loses the ability to hold together and can flow downhill at very high speeds, taking vegetation and/or structures with it. Slide risks increase after an earthquake during a wet winter.

The severity of an earthquake can be expressed in terms of intensity and magnitude. Intensity is based on the damage and observed effects on people and the natural and built environment. It varies from place to place depending on the location with respect to the earthquake epicenter, which is the point on the earth's surface that is directly above where the earthquake occurred. The severity of intensity generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. The scale most often used in the U.S. to measure intensity is the Modified Mercalli Intensity Scale. Peak ground acceleration is also used to measure earthquake intensity by quantifying how hard the earth shakes in a given location.

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

4.1.2 Location

The entire geographic area of Alaska is prone to earthquake effects. The City of Gustavus has experienced 1178 earthquakes since 1973 with an average of approximately 14 earthquakes per day; 834 were less than M2.5.

The City of Gustavus is located approximately 40 miles from the Icy Point earthquake fault as depicted in Figure 4 (DGGS 1994).

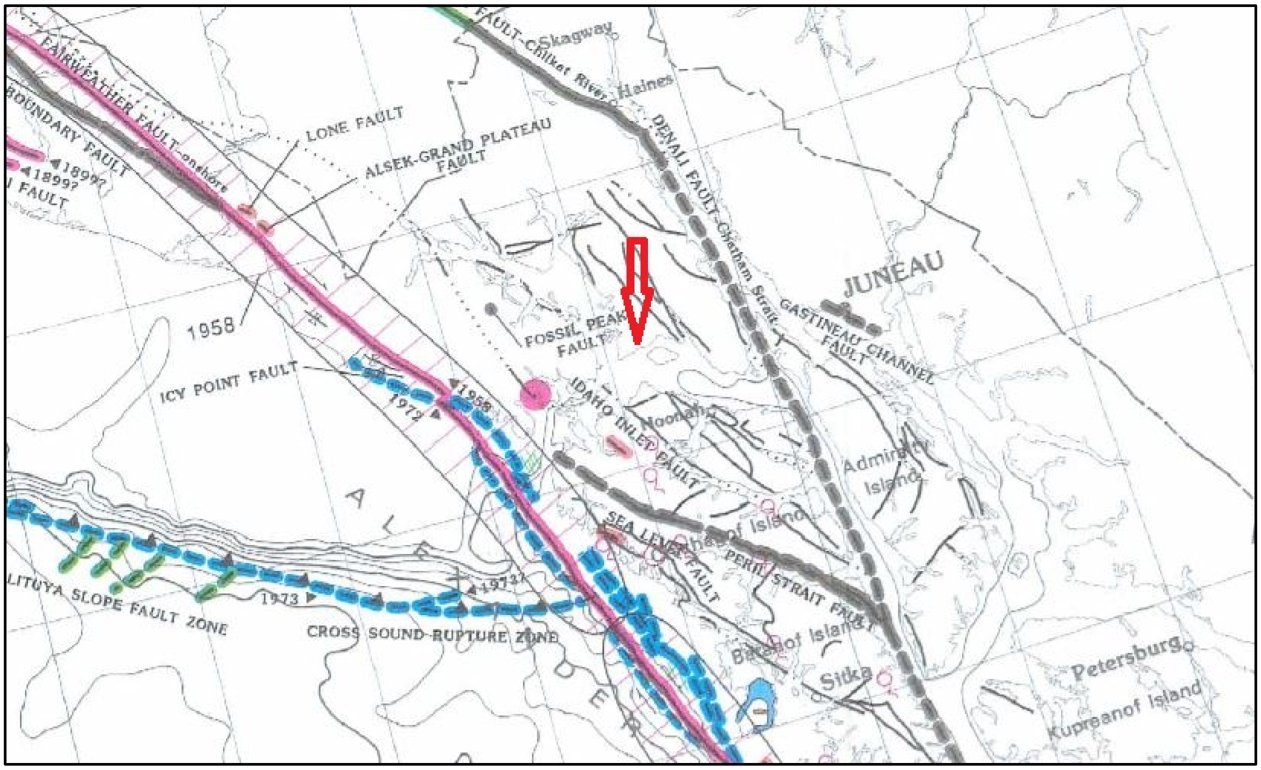


Figure 4. Alaska's Neotechtonic Map of Alaska, Gustavus Area

4.1.3 History

Accurate seismology for Alaska is relatively young with historic data beginning in 1973 for most locations. Therefore, data is limited for acquiring long-term earthquake event data. The LHMP's Alaska earthquake information is based on best available data; obtained from the US Geological Survey (USGS) and the State of Alaska, UAF Geophysical Institute's archives. Research included searching the USGS earthquake database for events spanning from 1973 to present; which exceeded magnitude 2.5 (M2.5) located within 150 miles of City of Gustavus.

Therefore, the planning team determined that based on available recorded data, the City of Gustavus has a minor concern for earthquake damages as they have not experienced damaging impacts from their historical earthquake events and only need to be concerned with earthquakes with a magnitude > M5.0. This is substantiated in Table 7 which lists 34 historical earthquakes greater than M5.0 since 1927 with 28 occurring from 1972 to present.

Table 7. City of Gustavus's Historical Earthquakes

Date	Latitude	Longitude	Magnitude	Date	Latitude	Longitude	Magnitude
1958-07-10	58.23	-136.712	7.8	1991-06-24	58.318	-137.008	5.6
1972-07-30	56.724	-135.853	7.6	1999-05-27	58.652	-137.184	5.6
1927-10-24	57.776	-136.67	7.3	2017-05-01	59.7772	-136.629	5.6
1973-07-01	57.84	-137.33	6.7	1973-07-05	57.905	-137.902	5.4
2017-05-01	59.8295	-136.704	6.3	1958-07-13	57.867	-137.375	5.3
2017-05-01	59.8209	-136.711	6.2	1988-06-06	58.765	-138.032	5.3

Table 7. City of Gustavus's Historical Earthquakes

Date	Latitude	Longitude	Magnitude	Date	Latitude	Longitude	Magnitude
1952-03-09	58.902	-136.942	6.1	1973-07-01	57.78	-137.286	5.2
2000-01-06	58.04	-136.87	6.1	2000-11-04	58.772	-138.988	5.2
2014-07-25	58.3062	-136.87	6.1	1973-07-03	57.993	-137.884	5.1
1957-06-23	57.881	-137.814	6	1973-07-14	58.00	-138.003	5.0
1973-07-03	57.98	-138.021	6	1987-11-14	58.961	-135.241	5.0
1985-09-15	59.102	-136.423	5.9	2009-06-07	58.769	-136.658	5.0
1972-08-15	56.264	-135.604	5.8	2010-06-16	58.0335	-139.75	5.0
2007-01-09	59.42	-137.118	5.7	2017-01-16	58.0622	-136.851	5.0
2014-06-04	59.0268	-136.748	5.7	2017-05-01	59.878	-136.838	5.0
2017-05-01	59.7689	-136.682	5.7	2017-05-01	59.7953	-136.648	5.0
1990-07-11	59.325	-136.47	5.6	2017-09-16	59.8659	-136.794	5.0

Source: USGS 2018

North America's strongest recorded earthquake occurred on March 27, 1964 in Prince William Sound measuring M9.2 and was felt by many residents throughout Alaska. The city of Gustavus experienced minimal ground motion from this historic event. Planning team members further stated that the city of Gustavus has experienced no ground shaking from the November 3, 2002 M7.9 Denali earthquake.

The largest recorded earthquake that has occurred within 150 miles of city of Gustavus measured M7.8, was 42.5 miles distant, occurring on July 10, 1958. This earthquake did not cause any damage to critical facilities, residences, non-residential buildings, or infrastructure.

4.1.4 Extent/Impact

Extent

Based on historic earthquake events and the criteria identified in Table 5, the magnitude and severity of earthquake impacts in the city of Gustavus are considered potentially hazardous with potential injuries and/or illnesses that do not result in permanent disability; critical facilities could expect to be shut-down for more than two weeks; and more than 25 percent of property becomes severely damaged with limited long-term damage to transportation, infrastructure, or the economy.

Impact

Impacts to the community such as significant ground movement that may result in infrastructure damage are/are not expected. Minor shaking may be seen or felt based on past events. Impacts to future populations, residences, critical facilities, and infrastructure are anticipated to remain the same.

The current USGS seismicity model for Alaska was developed in 2007. Figure 5 shows the peak ground acceleration values for a 7.56 percent probability of exceedance in 50 years. Gustavus falls within the very strong perceived shaking, and moderate range for perceived damages.

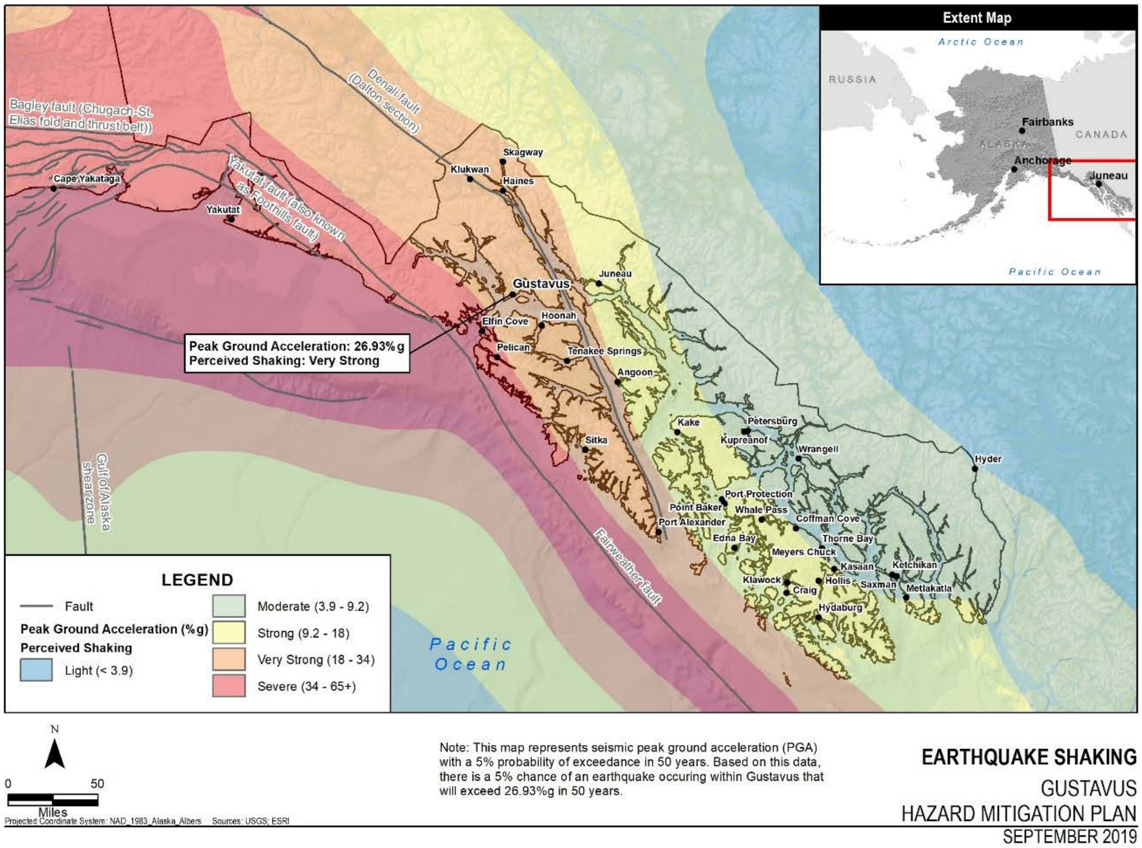


Figure 5. Gustavus Earthquake Perception Map

4.1.5 Recurrence Probability

As indicated, while it is not possible to predict when an earthquake will occur, the Shake Map was generated using the USGS Earthquake Mapping Model to generate the 2018 Shake Map (Figure 6). As indicated, it is not possible to predict when an earthquake will occur. This modelling effort incorporates current seismicity in its development and is the most current map available for this area. Peter Haeussler, USGS, Alaska Region states, it is a viable representation to support probability inquiries.

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

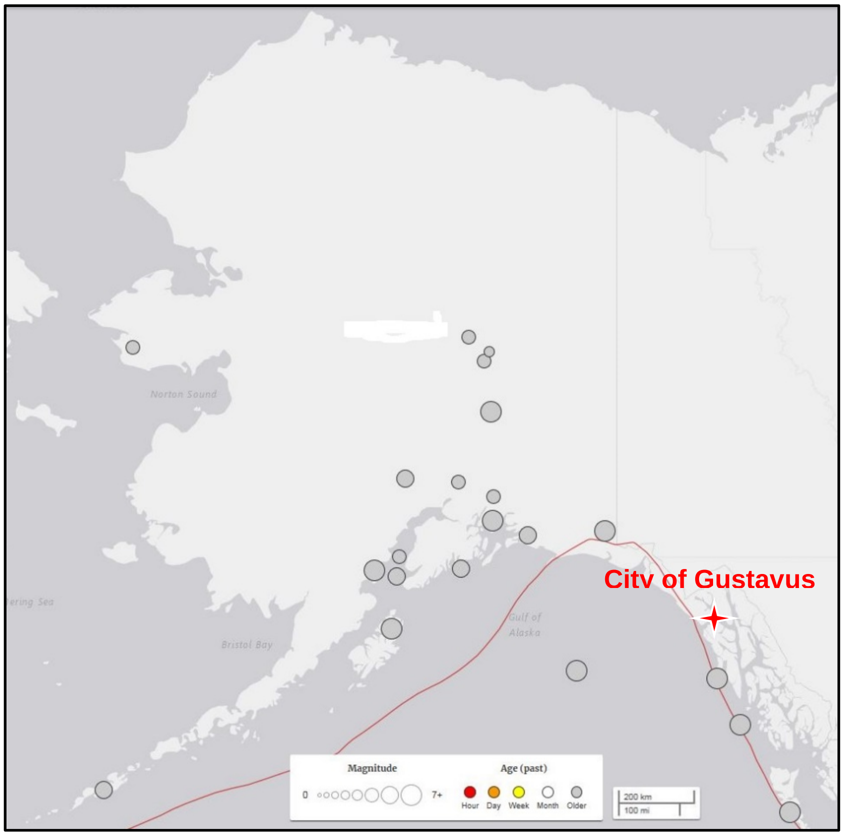


Figure 6. City of Gustavus Earthquake Probability

The Shake Map indicates a M5.0 or greater earthquake occurring within 50 years and 50 miles of the City/Village is "Unlikely" within the next 10 years (1/10=10 percent) chance of occurring; due to an event history that is less than or equal to 10 percent likely per year.

4.2 FLOOD AND EROSION

4.2.1 Nature/Type

Flooding is the accumulation of water where usually none occurs or the overflow of excess water from a stream, river, lake, reservoir, glacier, or coastal body of water onto adjacent floodplains. Floodplains are lowlands adjacent to water bodies that are subject to recurring floods. Floods are natural events that are considered hazards only when people and property are affected.

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

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

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

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

Ice-Jam Floods occur when warming temperatures and rising water flows causes the ice to break-up and disconnect from the embankment. The large ice chunks begin to flow and move down river. The ice does not flow easily, often impacting with adjacent blocks resulting in occasional ice jams. Some ice jams quickly break apart, however, larger jams occur which create small dams causing the water to exert increasing pressure on the jam creating a damming effect. Water subsequently begins to build depth and often overtops adjacent embankments which flood upstream communities.

When the ice-jam breaks the built-up water rushes downstream with great force. Ice blocks scour the embankment, destroying infrastructure such as fuel headers, barge landings, and boat mooring structures. Large house sized ice blocks may even be driven above the embankment destroying any structure in its path. Communities are virtually helpless against such devastation.

Storm Surges, or coastal floods, occur when the sea is driven inland above the high-tide level onto land that is normally dry. Often, heavy surf conditions driven by high winds accompany a storm surge adding to the destructive-flooding water's force. The conditions that cause coastal floods also can cause significant shoreline erosion as the flood waters undercut roads and other structures. Storm surge is a leading cause of property damage in Alaska.

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

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

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

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

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

Coastal Scour (used interchangeably with erosion) rarely causes death or injury. However, erosion causes property destruction, prohibits development, and impacts community infrastructure. Erosion is typically gradual land loss through wind or water scour. However, erosion can occur rapidly as the result of floods, storms or other event or slowly as the result of long-term environmental changes such as melting permafrost. Erosion is a natural process, but its effects can be easily exacerbated by human activity.

Coastal and riverine erosive scour threatens the city of Gustavus area's infrastructure, built environment, and utilities adjacent embankments and shorelines.

Land scour, no matter the source results in lost beach, shoreline, or dune material from natural activity or human influences. Coastal damage occurs throughout the area roughly from the top of the bluff out into the near-shore region to about the 30 feet water depth. It is measured as the rate of change in the position or horizontal displacement of a shoreline over a period of time. Bluff recession is the most visible aspect of coastal erosion because of the dramatic change it causes to the landscape. As a result, this aspect of coastal erosion usually receives the most attention.

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

Scour damages may also be due to multi-year impacts and long-term climatic change such as sea-level rise, lack of sediment supply, subsidence, or long-term human factors such as aquifer depletion or the construction of shore protection structures and dams. Attempts to control erosion using shoreline protective measures such as groins, jetties, seawalls, or revetments can lead to increased erosion.

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

Attempts to control scour using shoreline protective measures such as groins, jetties, levees, or revetments can lead to increased embankment loss or damage.

Land surface loss results from high flowing surface water across roads due to poor or improper drainage. These events typically occur from rain and snowmelt run-off.

Event Recurrence Intervals

Many flood damages are predictable based on rainfall and seasonal thaw patterns. Most of the annual precipitation is received from April through October with August being the wettest. This rainfall leads to flooding in early/late summer and/or fall. Spring snowmelt increases runoff, which can cause excessive surface flooding. It also breaks riverine winter ice cover, exacerbating localized ice-jam flood or coastal ice override damage impacts.

4.2.2 Location

The planning team indicated that the City of Gustavus has minor flooding impacts; most of which occur from rainfall and snowmelt run-off. Water collects in low terrain depressions and may rise to just below a structures first step with no water intrusion on the first floor. The City of Gustavus's typical minor flood locations are taking place in four locations, three of which involve land the City of Gustavus owns or soon will own. One is the meander near the city hall parking lot and city park immediately north of the Salmon River Bridge and the roadway into city hall; one is slightly upstream from the city hall in an area used as a ball diamond and the third is approximately 0.25 miles north of the bridge. The fourth location is approximately 250 yards south of the Salmon River Bridge.

Figure 7 depicts the city of Gustavus's internet-generated aerial photograph and their identified flood or high water flow induced scour impact locations.

Figure 7. City of Gustavus Scour Locations

The City of Gustavus stated they experience erosion along the Salmon and Goode rivers along with moderate road top gravel damage from rain and snow-melt resulting in high water flows throughout the community. High water flow removes riverine embankment and damages the City of Gustavus. Rain and snow melt run-off remove the road topping material, creates severe pot holes, and other damages. The roads become extremely muddy once the topping has been removed.

4.2.3 History

The city experiences surface damages and erosion from heavy rainfall, snowmelt, and spring run-off flooding. Spring run-off causes the most damages to the community.

The U.S. Army Corps of Engineers (USACE) has provided limited flood impact data.

Flood or high water flow induced erosion events

The USACE completed an erosion survey for the city of Gustavus during their 2009 Alaska Baseline Erosion Assessment. The report listed the community as having a minor erosion threat. The Erosion Information Paper – the City of Gustavus, October 30, 2007, reported the following erosion problems or issues associated with the Salmon River (USACE 2007)

> *Gustavus reports periodic erosion caused by riverine processes associated with the Salmon River where it flows through the community. Primary causes of erosion are natural physical processes and daily flows of the river. Water flow can become amplified during in spring and fall. The river is eroding inland at an estimated average of 6 feet per year.* (USACE 2007)

4.2.4 Extent/Impact

Extent

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

The following factors contribute to riverine flooding frequency and severity:

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

The city of Gustavus does experience severe riverine flooding and they experience severe flood-induced high-water flow flood scour impacts. Therefore, based on past high-water flow event history and the criteria identified in Table 5, the extent of flooding and resultant damages to infrastructure and their protective embankments in the city of Gustavus are considered "Limited" where critical facilities would shut-down for more than one week with less than 10 percent of property is severely damaged.

Impact

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

- Structure flood inundation, causing water damage to structural elements and contents
- High water flow storm surge floods scour (erode) coastal embankments, coastal protection barriers, and result in infrastructure and residential property losses. Additional impacts can include roadway embankment collapse, foundations exposure, and damaging impacts
- Damage to structures, roads, bridges, culverts, and other features from high-velocity flow and debris carried by floodwaters. Such debris may also accumulate on bridge piers and in culverts, decreasing water conveyance and increasing loads which may cause feature overtopping or backwater damages
- Sewage, hazardous or toxic materials release, materials transport from wastewater treatment plant or sewage lagoon inundation, storage tank damages, and/or severed pipeline damages can be catastrophic to rural remote communities

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

Impacts and problems also related to flooding are deposition as well as embankment, coastal erosion, and/or wind. Deposition is the accumulation of soil, silt, and other particles on a river bottom or delta. Deposition leads to the destruction of fish habitat, presents a challenge for navigational purposes, and prevents access to historical boat and barge landing areas. Deposition also reduces channel capacity, resulting in increased flooding or bank erosion. Embankment erosion involves material removal from the stream or river banks, coastal bluffs, and dune areas. When bank erosion is excessive, it becomes a concern because it results in loss of embankment vegetation, fish habitat, and land, property, and essential infrastructure (BKP 1988).

4.2.5 Recurrence Probability

Based on previous occurrences, USACE Floodplain Manager's report, and criteria in Table 6, there is a 2 in 5 year (2/5=40 percent) chance of occurring. History of events is greater than 10 percent but less than or equal to 40 percent likely per year. There is no data identifying a 500-year (0.2 percent chance of occurring in a given year) flood threat in the city of Gustavus.

4.3 SEVERE WEATHER

4.3.1 Nature/Type

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

Climate Change influences the environment, particularly historical weather patterns. Climate change and El Niño/La Niña Southern Oscillation (ENSO) determines create increased weather volatility such as hotter summers (drought) and colder winters, intense thunderstorms, lightning, hail, snow storms, freezing rain/ice storms, high winds and even a few tornadoes within and around Alaska.

ENSO is comprised of two weather phenomena known as El Niño and La Niña. While ENSO activities are not a hazard, they can lead to severe weather events and large-scale damage throughout Alaska's varied jurisdictions. Direct correlations were found linking ENSO events to severe weather across the Pacific Northwest, particularly increased flooding (riverine, coastal storm surge) and severe winter storms. Therefore, increased awareness and understanding how ENSO events potentially impact Alaska's vastly differing regional weather.

Climate change is described as a phenomenon of water vapor, carbon dioxide, and other gases in the earth's atmosphere acting like a blanket over the earth, absorbing some of the heat of the sunlight-warmed surfaces instead of allowing it to escape into space. The more gasses, the thicker the blanket, and the warmer the earth. Trees and other plants cannot absorb carbon dioxide through photosynthesis if foliage growth is inhibited. Therefore, carbon dioxide builds up and changes precipitation patterns, increases storms, wildfires, and flooding frequency and intensity; and substantially changes flora, fauna, fish, and wildlife habitats.

The governor's Alaska Interagency Ecosystem Health Work Group is tasked with determining how the changing ecosystems may impact human health and to identify, prioritize, and educate Alaskan's about the connection between their health and changing environmental patterns.

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

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

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

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

Extreme Cold is the definition of extreme cold varies according to the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme." In Alaska, extreme cold usually involves temperatures between -20 to -50°F. Excessive cold may accompany winter storms, be left in their wake, or can occur without storm activity. Extreme cold accompanied by wind exacerbates exposure injuries such as frostbite and hypothermia.

High Winds occur in Alaska when there are winter low-pressure systems in the North Pacific Ocean and the Gulf of Alaska. Alaska's high wind can equal hurricane force but fall under a different classification because they are not cyclonic nor possess other hurricane characteristics. In Alaska, high winds (winds in excess of 45 mph) occur rather frequently over the city of Gustavus's coastal areas. High winds are a moderate threat to the city of Gustavus.

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

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

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

Figure 8 displays Alaska's annual rainfall map based on Parameter-elevation Regressions on Independent Slopes Model (PRISM) that combines climate data from National Oceanic and Atmospheric Administration's (NOAA) and Natural Resources Conservation Service climate stations with a digital elevation model to generate annual, monthly, and event-based climatic element estimates such as precipitation and temperature.

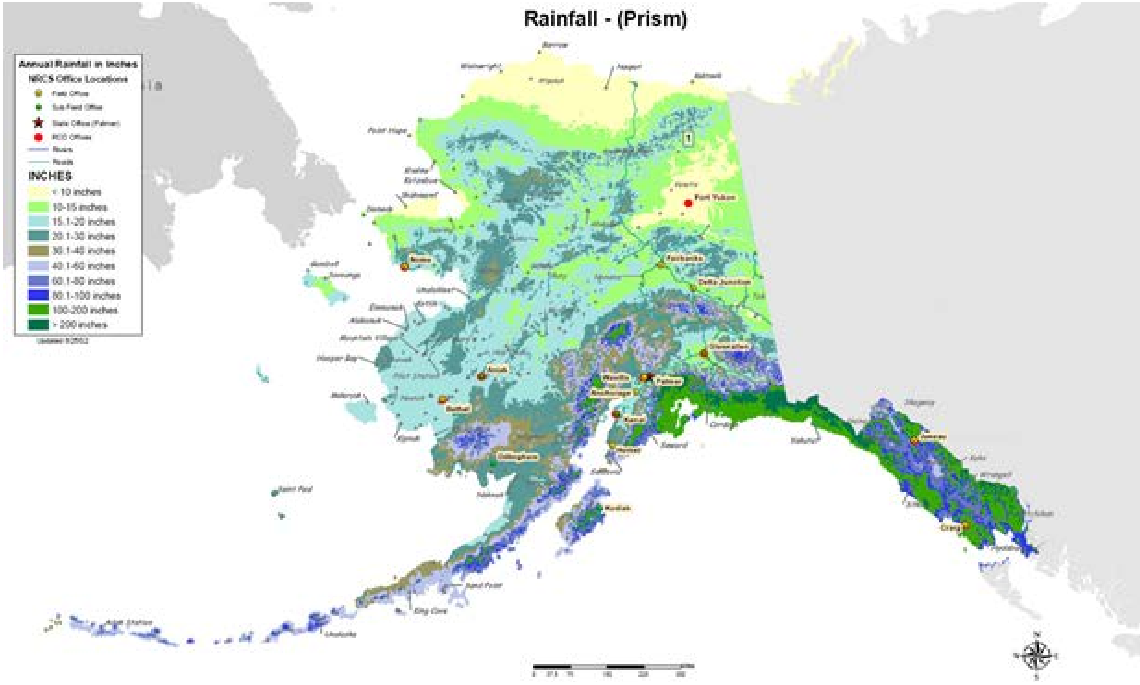


Figure 8. Statewide Rainfall Map

4.3.2 Location

The entire area, which includes the city of Gustavus, experiences periodic severe weather impacts. The most common to the area are high winds and severe winter storms.

4.3.3 History

The city of Gustavus is continually impacted by severe weather events. Hurricane force wind, storm surge, and cold typically have disastrous results.

Climate Change. The UAF Arctic Climate Impact Assessment describes recent weather changes and how they impact Alaska:

> *Alaska experienced an increase in mean annual temperature of about 2 to 3 ºC between 1954 and 2003…Winter temperatures over the same period increased by up to 3 to 4 ºC in Alaska and the western Canadian Arctic, but Chukotka experienced winter cooling of between 1 and 2 ºC…*
>
> *The entire region, but particularly Alaska and the western Canadian Arctic, has undergone a marked change over the last three decades, including a sharp reduction in snow-cover extent and duration, shorter river- and lake ice seasons, melting of mountain glaciers, sea-ice retreat and thinning, permafrost retreat, and increased active layer depth. These changes have caused major ecological and socio-economic impacts, which are likely to continue or worsen under projected future climate change. Thawing permafrost and northward movement of the permafrost boundary are likely to increase slope instabilities, which will lead to costly road replacement and increased maintenance costs for pipelines and other infrastructure. The projected shift in climate is likely to convert some forested areas into bogs when ice-rich permafrost thaws. Other areas of Alaska, such as the North Slope, are expected to continue drying. Reduced sea-ice extent and thickness, rising sea level, and increases in the length of the open-water season in the region will increase the frequency and intensity of storm surges and wave development, which in turn will increase coastal erosion and flooding…*
>
> *Traditional lifestyles are already being threatened by multiple climate-related factors, including reduced or displaced populations of marine mammals, seabirds, and other wildlife, and reductions in the extent and*

thickness of sea ice, making hunting more difficult and dangerous. Indigenous communities depend on fish, marine mammals, and other wildlife, through hunting, trapping, fishing, and caribou/reindeer herding. These activities play social and cultural roles that may be far greater than their contribution to monetary incomes. Also, these foods from the land and sea make significant contributions to the daily diet and nutritional status of many indigenous populations and represent important opportunities for physical activity among populations that are increasingly sedentary… (ACIA 2014)

DHS&EM's Disaster Cost Index records the following severe weather disaster events which may have affected the area:

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

Severe weather events have historically impacted the entire Northwest Arctic Borough area. Rural communities generally lack capacity to track changing climate conditions. It is fortunate the University of Alaska Fairbanks Scenarios Network for Alaska and Arctic Planning (SNAP) is part of the International Arctic Research Center provides this data for planning purposes.

SNAP data tools depict the city of Gustavus's historic and future predicted precipitation and temperatures in Figures 9 and 10 (SNAP 2019).

Note: Both precipitation and temperature are projected to remain fairly consistent throughout the various seasons. However, the warm weather months (July through October) may experience slightly higher temperatures and precipitation due to anticipated climatic changes. Rain and snow variations could dramatically determine wildland fire potential as well as adversely impact future subsistence food source and wildlife habitat support capacity.

How to interpret climate outlooks for your community

You can examine SNAP community outlooks for certain key changes and threshold values—for example, higher mean monthly temperatures in the spring and fall may be of particular interest. This could signify any or all of these conditions:

- a longer growing season
- a loss of ice and/or frozen ground needed for travel or food storage
- a shift in precipitation from snow to rain, which impacts water storage capacity and surface water availability

Precipitation may occur as either rain or snow but is reported for all months in terms of rainwater equivalent. Warmer, drier spring weather may also be an indicator for increased fire risk. In many locations, winter temperatures are projected to increase dramatically. Warmer winters may favor growth of species that are less cold-hardy (including desirable crops and invasive species), or it may decrease snowpack and increase the frequency of rain-on-snow events that impact wildlife. Higher temperatures across all seasons will likely impact permafrost and land-fast ice (SNAP 2019).

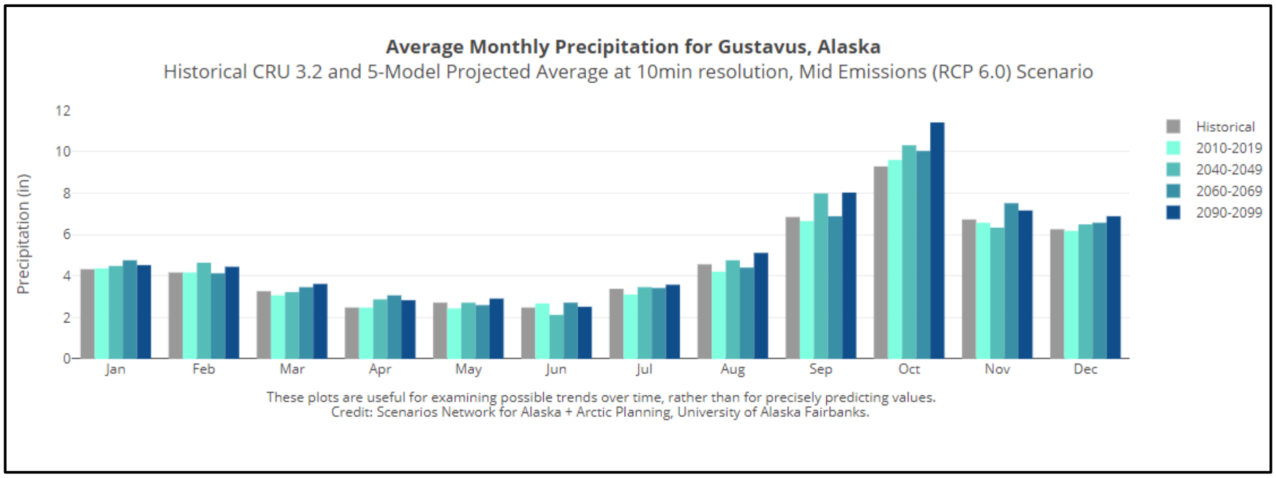


Figure 9. Historic and Predicted Temperatures for Gustavus

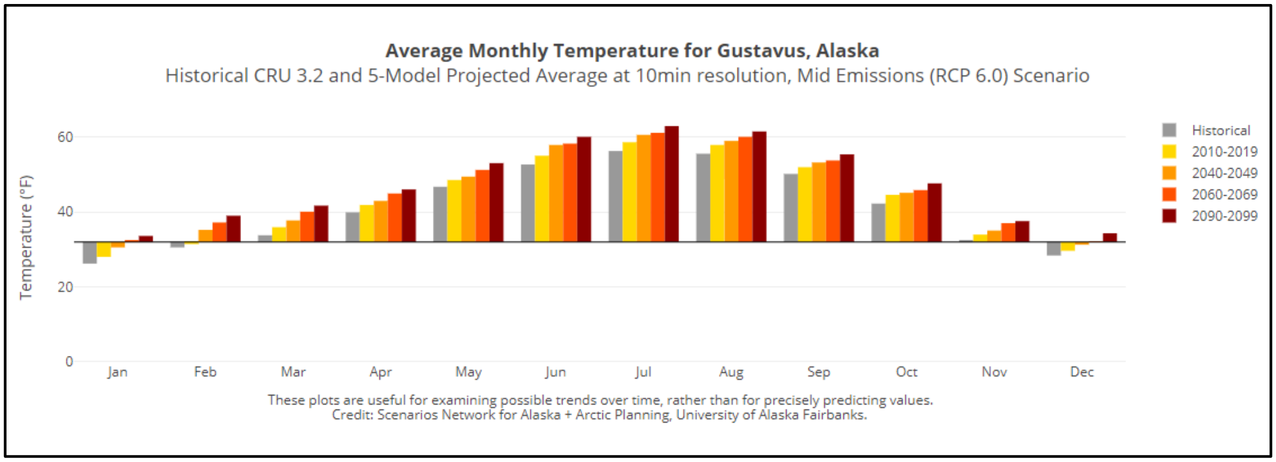


Figure 8. Historic and Predicted Temperatures for Gustavus

4.3.4 Extent/Impact

Extent

The entire city of Gustavus area is equally vulnerable to the severe weather effects. The city of Gustavus experiences severe storm conditions with moderate snow depths and wind speeds exceeding 90 mph.

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

Impact

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

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

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

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

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

4.3.5 Recurrence Probability

Based on previous occurrences and the criteria identified in Table 6, it is likely a severe storm event will occur in the next three years (event has up to 1 in 3 years chance of occurring) as the history of events is greater than 20 percent but less than or equal to 33 percent likely per year.

4.4 TSUNAMI AND SEICHE

4.4.1 Nature/Type

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

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

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

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

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

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

4.4.2 Location

The State of Alaska, the UAF/GI, and the NOAA Pacific Marine Environmental Laboratory indicate that City of Gustavus has a moderate tsunami impact threat. Many believe their relatively protected location on the northern side of the island – away from Aleutian Trench created tsunami sources would protect them from severe impacts. However, the UAF/GI conducted tsunami models that demonstrates the Harbor and airport areas may receive significant water current impacts with whirlpools.

4.4.3 History

City of Gustavus is in close proximity to historic tsunamigenic events that have occurred along the Aleutian Trench. The West Coast/Alaska Tsunami Warning Center lists the following earthquake generated tsunamis with observed or measured tsunami waves in City of Gustavus (Table 8).

Table 8. City of Gustavus’s Historic Aleutian Tsunamis Waves

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

4.4.4 Extent/Impact

Extent

Based on historic earthquake events, UAF/GI, University of Washington, and the Pacific Marine Environmental Laboratory information, and the criteria identified in Table 5, the magnitude and severity of earthquake impacts to Gustavus are considered minimal with injuries and/or illnesses that do not result in permanent disability, and less than 10 percent of property could be severely damaged.

Impact

Based on the lack of available information regarding tsunami inundation in the area and lack of any known historic tsunami events there is a low potential of Gustavus receiving future tsunami impacts associated with a tectonic event. The area is not in the direct path of a tsunami, but could see rising swells.

4.4.5 Recurrence Probability

The city of Gustavus has a minor tsunami impact history. Therefore, following the criteria delineated in Table 6, a distant source tsunami is unlikely to occur, but the recurrence interval is unknown. Too many factors determine when the next event will occur, as supported by known bathymetric conditions adjacent to the city of Gustavus area.

4.5 WILDLAND FIRE

4.5.1 Nature/Type

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

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

Topography describes slope increases, which influences the rate of wildland fire spread increases. South-facing slopes are also subject to more solar radiation, making them drier and thereby intensifying wildland fire behavior. However, ridge tops may mark the end of wildland fire spread since fire spreads more slowly or may even be unable to spread downhill.

Fuel is the type and condition of vegetation plays a significant role in the occurrence and spread of wildland fires. Certain types of plants are more susceptible to burning or will burn with greater intensity. Dense or overgrown vegetation increases the amount of combustible material available to fuel the fire (referred to as the "fuel load"). The ratio of living to dead plant matter is also important. Climate change is deemed to increase wildfire risk significantly during periods of prolonged drought as the moisture content of both living and dead plant matter decreases. The fuel load continuity, both horizontally and vertically, is also an important factor.

Weather is the most variable factor affecting wildland fire behavior is weather. Temperature, humidity, wind, and lightning can affect chances for ignition and spread of fire. Extreme weather, such as high temperatures and low humidity, can lead to extreme wildland fire activity. Climate change increases the susceptibility of vegetation to fire due to longer dry seasons. By contrast, cooling and higher humidity often signal reduced wildland fire occurrence and easier containment.

The frequency and severity of wildland fires is also dependent on other hazards, such as lightning, drought, and infestations (such as the damage caused by spruce-bark beetle infestations). If not promptly controlled, wildland fires may grow into an emergency or disaster. Even small fires can threaten lives and resources and destroy improved properties. In addition to affecting people, wildland fires may severely affect livestock and pets. Such events may require emergency water/food, evacuation, and shelter.

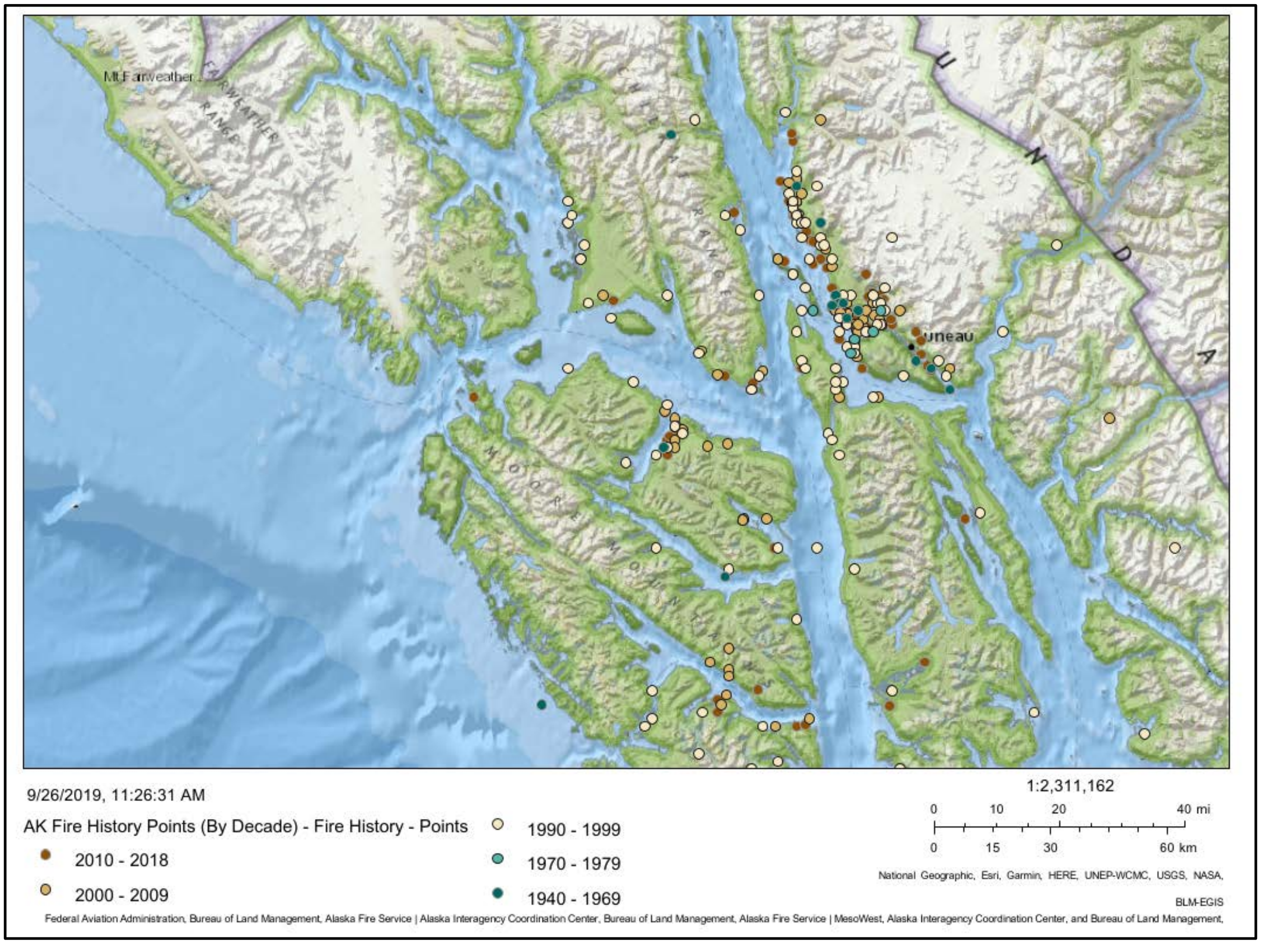
The indirect effects of wildland fires can be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large, intense fires can harm the soil, waterways, and the land itself. Soil exposed to intense heat may lose its capability to absorb moisture and support life.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

4.5.2 Location

Under certain conditions wildland fires may occur near the city of Gustavus when weather, fuel availability, topography, and ignition sources combine. Since fuels data is not readily available, for the purposes of this plan, all areas outside city of Gustavus boundaries are considered to be vulnerable to tundra/wildland fire impacts.

4.5.3 History

Gustavus's historical wildland fire locations are displayed in Figure 9 (AICC 2019).



Location, Figure 9. Gustavus Area Historic Wildfires

4.5.4 Extent, Impact, and Recurrence Probability

Extent

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

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

Based on the limited number of past wildland fire events and the criteria identified in Table 5, the magnitude and severity of impacts in the city of Gustavus are considered likely but limited with minor injuries, there is potential for critical facilities to be shut down for less than 24 hours, less than 10 percent of property.

Impact

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

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

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. 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 firefighters, public safety and welfare; natural and cultural resources threatened; and the other values to be protected dictate the appropriate management response to the fire. In Alaska, and within 50 miles of the city of Gustavus, the natural fire regime is characterized by a return interval of approximately 150 years due to their tundra vegetation, gently rolling topography.

4.5.5 Recurrence Probability

An important issue related to the wildland fire probability is the interface fire is increased development along the community's perimeter, accumulation of hazardous wildfire fuels, and the uncertainty of weather patterns that may accompany climate change. These three combined elements are reason for concern and heightened mitigation management of each community's wildland interface areas, natural areas, and open spaces.

Based on the history of wildland fires in the City of Gustavus area and applying the criteria identified in Table 6, it is highly likely and probable a wildland fire event will occur within in the next ten years. The event has up to 1 in 10 years chance of occurring and the history of events is less than or equal to 10 percent likely each year. Climate change and flammable vegetation species are prolific throughout Alaska's forests and tundra locations. Fire frequency may increase in the future as a result.

4.6 VULNERABILITY ASSESSMENT

This section describes and summarizes the overall vulnerability of the people and critical facilities to the hazards that occur in Gustavus.

4.6.1 Asset Inventory – Critical Facilities

Asset inventory is the first step of a vulnerability analysis. Assets that may be affected by hazard events include population (for community-wide hazards), residential buildings (where data is available), and critical facilities and infrastructure.

A critical facility provides services and functions essential to a community, especially during and after a disaster. Common types of critical facilities include: fire stations, police stations, hospitals, schools, water and waste water systems, and utilities. Critical facilities may also include places that can be used for sheltering or staging purposes, such as community centers and libraries. Critical facilities may also include large public gathering spots.

Critical facility information was queried from the Alaska Critical Facilities database and reviewed and updated by the planning team. Due to many of the remote nature of the community – a long distance from their nearest neighboring community, most all facilities are deemed "critical" to their survival. The critical facilities profiled in this plan include the following:

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

Since approximately 2010, the DCRA is no longer able to collect diverse agency project data for Alaskan communities. Older grants highlight their ongoing efforts toward improving their aging infrastructure. Recent infrastructure improvement projects are still ongoing; however, there is no current information repository for these data.

Table 9 shows critical facilities and infrastructure identified by the planning team. Estimation of structure value is not available; however, the community stated that a single-residence home is valued at approximately $250,000. Paved roads are estimated to cost $5,000,000 per mile to construct, and unpaved roads are estimated at $2,000,000 per mile.

Table 9. Gustavus Critical Facilities and Infrastructure

Type	Occupants	Facilities	Address	Building Type	Earthquake	Flood/Erosion	Tsunami/Seiche	Severe Weather	Wildland Fire
Government	2	U.S. Post Office	Gustavus Rd.	W	X			X	
Government	3	City Hall	Gustavus Rd. at Salmon River Bridge	W	X			X	X
Government	3	Gustavus Library	Gustavus Rd.	W	X			X	X
Government	2	Gustavus Disposal and Recycling Center	Salmon River Boat Harbor area	M	X			X	
Government		Community Chest	Gustavus Rd.	W	X			X	
Government	20	NPS Barco Admin	Barco Inner Lagoon	W	X		X	X	X

Table 9. Gustavus Critical Facilities and Infrastructure

Type	Occupants	Facilities	Address	Building Type	Earthquake	Flood/Erosion	Tsunami/Seiche	Severe Weather	Wildland Fire
Government	8	NPS annex offices	Barco Inner Lagoon	W	X		X	X	X
Government	15	NPS Barco Resources Mgmt/Ranger offices	Barco Inner Lagoon	W	X		X	X	X
Government	6	NPS Barco Visitor Info Station	Barco Dock shoreline	W	X		X	X	X
Government	1	Tlingit Tribal House	Barco shoreline	W	X			X	X
Government	20	NPS maintenance shop	Barco Moraine area	M	X		X	X	X
Government	200	Glacier Bay Lodge (NPS)	Barco shoreline	W	X			X	X
Government	50	Glacier Bay Lodge dorms	Barco shoreline	W	X			X	
Government	50	NPS Housing (multiple)	Barco	W	X			X	
Government	1	NPS Water Treatment Pit	Barco Alder Creek	W	X			X	
Government	2	NPS Water Treatment Pit	Barco Dock area	W	X		X	X	
Government	30	NPS Campground	Barco shoreline	O	X		X	X	
Transportation	0	Gustavus Airport runways	Airport	O	X			X	
Transportation	3	AK Seaplanes terminal	Airport	W	X			X	
Transportation	2	Harris Air terminal	Airport	W	X			X	
Transportation	8	Alaska Airline terminal	Airport	W	X			X	
Transportation	0	Airport hangars (multiple)	Airport	M	X			X	
Transportation	2	DOT&PF shops/garages/sheds	Airport	M/W	X			X	
Transportation	0	DOT&PF lease buildings	Airport	W	X				
Transportation	0	Gustavus Multi-Modal Marine Facility	Icy Passage	W	X				
Transportation	0	Salmon River Boat Launch	Salmon River	W	X			X	
Transportation	0	NPS Barco Dock	Barco	S	X			X	
Transportation	0	NPS Barco fuel dock	Barco	S	X			X	
Transportation	1	Buds Car Rental	Wilson Rd.	W	X			X	
Transportation	1	TLC Taxi	Dungeness Way	W	X			X	
Transportation	2	Strawberry Point Tours	Good River Rd.	W	X			X	X
Transportation	0	Frontier Freight	Chinook Dr.	W	X			X	
Emergency Response	1	Gustavus Volunteer Fire Department	Gustavus Rd.	W	X			X	
Education	80	Gustavus School	Gustavus Rd.	W	X			X	X
Education	10	Gustavus School gym	Gustavus Rd.	M	X			X	X
Education	10	Gustavus Preschool	Gustavus Rd.	W	X			X	
Medical	2	SEARHC Clinic	Gustavus Rd.	W	X			X	
Community	2	Annie May Lodge	Grandpas Farm Rd.	W	X			X	X

Table 9. Gustavus Critical Facilities and Infrastructure

Type	Occupants	Facilities	Address	Building Type	Earthquake	Flood/Erosion	Tsunami/Seiche	Severe Weather	Wildland Fire
Community	2	Beartrack Inn	Rink Creek Rd.	W	X			X	X
Community	2	Gustavus Inn	Gustavus Rd.	W	X			X	
Community	2	Glacier Bay County Inn	Tong Rd.	W	X			X	X
Community	2	Anglers Inn	Dock Rd.	W	X			X	
Community	2	Growly Bear Lodge	Fairweather Rd.	W	X			X	
Community	2	Cottonwood Cabins	Gustavus Rd.	W	X			X	X
Community	2	Aimee's Guest House	Shooting Star Ln	W	X			X	
Community	2	Blue Heron B&B	Dock Rd.	W	X			X	
Community	2	Glacier Bay Puffin Rentals	Wilson Rd.	W	X				X
Community	2	Salmon River Cabins	Wilson Rd.	W	X				X
Community	2	Budget Cabin Rentals	Dock Rd.	W	X				X
Community	2	Spruce Tip Lodge	Wilson Rd.	W	X				X
Community	2	Wild Alaska Charters and Inn	Mountain View Rd.	W	X			X	X
Community	1	Glacier Bay Sea Kayaks	Wilson Rd.	W	X				X
Community	1	Alaska Mountain Guides	Wilson Rd.	W	X				X
Community	1	Spirit Walker Expeditions	Dock Rd.	W	X				X
Community	5	Salmon River Business Center	Gustavus Rd.	W	X				X
Community	1	Salmon River Electric	Gustavus Rd.	W	X				X
Community	1	Steller Botanicals/Fugue Vegetables	Gustavus Rd.	W	X				X
Community	1	Sentinel Coffee	Gustavus Rd.	W	X				X
Community	4	Glacier Bay Construction	Gustavus Rd.	W	X				
Community	2	Fairweather Construction	Bartlett Rd.	W	X				X
Community	2	Berry's Specialty Contracting	Rink Creek Rd.	W	X			X	X
Community	1	Arcadia Custom Carpentry	Same Old Rd.	W	X				X
Community	1	Bob's Garage	Spruce Ln.	W	X				X
Community	1	Crane & Cottonwood Salon	Good River Rd.	W	X				X
Community	0	LDS Church	Dock Rd.	W	X				X
Community	2	Gustavus Chapel	Dock Rd.	W	X				
Community	3	Tosho Grocery/Building Supply	Chinook Rd.	W	X			X	
Community	4	Sunnyside Market	Dock Rd.	W	X			X	
Community	1	Snug Harbor Liquor	Wilson Rd.	W	X				X
Community	4	Clove Hitch Restaurant	Gustavus Rd.	W	X				
Community	2	Fireweed Gallery and Coffee	Gustavus Rd.	W	X				

Table 9. Gustavus Critical Facilities and Infrastructure

Type	Occupants	Facilities	Address	Building Type	Earthquake	Flood/Erosion	Tsunami/Seiche	Severe Weather	Wildland Fire
Community	1	The Outpost Gallery	Humpy Dr.	W	X			X	X
Roads	0	Total road miles: 29.5		HRD 2	X	X	X	X	X
Bridge	0	Salmon River Bridge	Gustavus Rd.	W	X	X		X	
Bridge	0	Good Rive Bridge	Good River Rd.	W	X	X		X	
Bridge	0	Harry Hall Creek	Good River Rd.	W	X	X		X	
Bridge	0	Crane Flats Creek	Dicky Dr.	W	X	X		X	
Bridge	0	Crane Flats Creek	CHA Entry Trail Footbridge	W	X	X		X	
Bridge	0	Mountain View Stream	Spruce Ln.	W	X	X		X	
Bridge	0	Mountain View Stream	Tong Rd.	W	X	X		X	
Bridge	0	Rink Creek	Rink Creek Rd.	W	X	X		X	
Utility	0	City Gravel Pits	Wilson/Rink Creek Rd.	W	X				
Utility	0	NPS Power Plant	Barco	M	X			X	X
Utility	0	NPS Wastewater Plant	Barco	M	X			X	X
Utility	1	Gustavus Dray Gas Station	Gustavus Rd./Dock Rd.	M	X				
Utility	0	Gustavus Propane	Mountain View Rd.	M	X				X
Utility	0	NPS Water Storage Tanks	Barco	M	X			X	X
Utility	0	APT Hydroelectric Facility	Falls Creek	M	X			X	X
Utility	0	APT backup diesel generator	Gustavus Rd.	M	X			X	
Utility	0	ACS phone and tower equipment	Gustavus Rd.	M	X			X	
Utility	0	Falls Creek Hydro Facility	Falls Creek Hydro Rd.	W	X	X		X	
Utility	0	GCI Tower equipment	Gustavus Rd.	M	X			X	

4.6.2 Vulnerability

Table 10 lists Gustavus's infrastructures' hazard vulnerability synopsis.

Table 10. Gustavus Vulnerability Overview

Hazard	Hazard Vulnerability			
	Percent of Jurisdiction's Geographic Area	Percent of Population	Percent of Building Stock	Percent of Critical Facilities and Utilities
Earthquake	100%	100%	100%	100%
Flood and Erosion	10%	20%	20%	10%
Severe Weather	100%	100%	50%	50%
Tsunami and Seiche	10%	5%	5%	5%

Table 10. Gustavus Vulnerability Overview

Hazard	Hazard Vulnerability			
	Percent of Jurisdiction's Geographic Area	Percent of Population	Percent of Building Stock	Percent of Critical Facilities and Utilities
Wildland Fire	40%	45%	30%	25%

Table 11 lists the key issues or overall summary of vulnerability for each hazard profiled in the 2019 Hazard Mitigation Plan.

Table 11. Overall Summary of Vulnerability

Hazard	Vulnerability
Earthquake	Based on earthquake probability maps produced by the USGS, the entire city of Gustavus area is at risk of experiencing moderate to significant earthquake impacts as a result of its close proximity to known earthquake faults. The entire community of Gustavus, including 100% of the geographic area, 100% of the population center, 100% of the critical assets, and 100% of the residential buildings are vulnerable to impacts associated with an earthquake event. While Gustavus will likely experience some moderate shaking during an earthquake event, the expected damage to the built environment would be minimal. Impacts to future populations, residential structures, critical facilities, and infrastructure are anticipated at the same historical impact level.
Erosion/Flood	Typical flood impacts associated include structures and contents water damage, roadbed, embankment, and coastal erosion, boat stranding, standing water in roadways and other areas. Flood events may also damage or displace fuel tanks, power lines, or other infrastructure. Buildings on slab foundations, not located on raised foundations, and/or not constructed with materials designed to withstand flooding events (e.g., cross vents to allow water pass-through an open area under the main floor of a building) are more vulnerable to flood impacts. No detailed 100-year flood analysis has been prepared for the city of Gustavus. The USACE Floodplain Manager does not provide flood information or a 100-year floodplain map for the city of Gustavus. This includes approximately: 10% of the geographic area, 20% of the population, 10% of the critical assets, and 20% of the residential buildings. The city of Gustavus anticipates that impacts to future populations, residential structures, critical facilities, and infrastructure will be at the same historical impact level.

Table 11. Overall Summary of Vulnerability

Hazard	Vulnerability
Severe Weather	Impacts associated with severe weather events includes roof collapse, trees and power lines falling, damage to light aircraft and sinking small boats, injury and death resulting from snow machine or vehicle accidents, overexertion while shoveling all due to heavy snow. A quick thaw after a heavy snow can also cause substantial flooding. Impacts from extreme cold include hypothermia, halting transportation from fog and ice, congealed fuel, frozen pipes, utility disruptions, frozen pipes, and carbon monoxide poisoning. Additional impacts may occur from secondary weather hazards or complex storms such as extreme high winds combined with freezing rain, high seas, and storm surge. Buildings that are older and/or not constructed with materials designed to withstand heavy snow and wind (e.g., hurricane ties on crossbeams) are more vulnerable to the severe weather damage. Based on information provided by City of Gustavus and the National Weather Service; the entire city of Gustavus's existing, transient, and future population, residential structures, and critical facilities are exposed to future severe weather impacts. This includes approximately: 100% of the geographic area, 100% of the population, 50% of the critical assets, and 50% of the residential buildings. Impacts to future populations, residential structures, critical facilities, and infrastructure are anticipated at the same impact level.
Tsunami and Seiche	The UAF/GI, Division of Geological and Geophysical Survey (DGGS), and the National Tsunami Warning Center indicate there are limited distant and local source tsunami threats for City of Gustavus population and infrastructure located within the identified tsunami impact area. Using information provided by the UAF/GI, DGGS, and the West Coast/Alaska Tsunami Warning Center, the city of Gustavus's residential structures and infrastructure located adjacent to the identified tsunami impact area have a limited risk from tsunamigenic impacts. Potentially threatened population and infrastructure includes: 10% of the geographic area, 5% of the population, 5% of the critical assets, and 5% of the residential buildings. The city of Gustavus anticipates that impacts to future populations, residences, critical facilities, and infrastructure are at the same historical impact level.
Wildland Fire	Impacts associated with a wildland fire event include the potential for loss of life and property. It can also impact livestock and pets and destroy forest resources and contaminate water supplies. Buildings closer to the outer edge of town, those with a lot of vegetation surrounding the structure, and those constructed with wood are some of the buildings that are more vulnerable to the impacts of wildland fire. There is moderate potential for wildland fire to interface with the population center of the city. This area includes approximately: 40% of the geographic area, 45% of the population, 25% of the critical assets, and 30% of the residential buildings.

5.0 MITIGATION STRATEGY

Section 5 – Mitigation Strategy addresses Element C of the Local Mitigation Plan Regulation Checklist.

DMA 2000 Requirements
ELEMENT C. Mitigation Strategy
C1. Does the Plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement § 201.6(c)(3)) C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement § 201.6(c)(3)(i)) C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i)) C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii)) C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii)) C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))

5.1 AUTHORITIES, POLICIES, PROGRAMS, AND RESOURCES

The City of Gustavus's existing authorities, policies, programs and resources available for hazard mitigation are listed in Table 12 through Table 14.

Table 12. City of Gustavus's Technical Specialists

Staff/Personnel Resources	Department/Agency and Position
Planner or engineer with knowledge of land development and land management practices	The City contracts for such services as required.
Engineer or professional trained in construction practices related to buildings and/or infrastructure	The City contracts for such services as required.
Planner or engineer with an understanding of natural and/or human-caused hazards	The City contracts for such services as required.
Floodplain Manager	The City consults with the State flood manager.
Surveyors	The City contracts for such services as required.
Staff with education or expertise to assess the jurisdiction's vulnerability to hazards	Mayor, City Manager, City Clerk, Council members have this expertise.
Personnel skilled in Geospatial Information System and/or Hazards Us-Multi Hazard software	The City contracts for such services as required.
Scientists familiar with the hazards of the jurisdiction	The City can work with U.S. Fish and Wildlife Service and Alaska Department of Fish and Game, Alaska Department of Transportation and Public Facilities, or other regulatory agencies.
Emergency Manager	Fire Chief
Finance (Grant writers)	City Treasurer
Public Information Officer	City Clerk

Table 13. City of Gustavus's Financial Resources

Financial Resource	Accessible or Eligible to Use for Mitigation Activities
General funds	Yes, with approval of the City Council

Table 13. City of Gustavus's Financial Resources

Financial Resource	Accessible or Eligible to Use for Mitigation Activities
Payment in Lieu of Taxes	Not available
Municipal Energy Assistance Program	Not available
Indian Community Development Block Grants	Not available
Capital Improvement Project Funding	Yes, with approval of the City Council
Authority to levy taxes for specific purposes	Yes, with approval of the City Council
Incur debt through general obligation bonds	Yes, with approval of the City Council
Incur debt through special tax and revenue bonds	Yes, with approval of the City Council
Incur debt through private activity bonds	Yes, with approval of the City Council
Hazard Mitigation Grant Program	FEMA funding is available to local communities after a Presidentially-declared disaster. It can be used to fund both pre- and post-disaster mitigation plans and projects only.
Pre-Disaster Mitigation grant program	FEMA funding is available on an annual basis. This grant can only be used to fund pre-disaster mitigation plans and projects only.
Flood Mitigation Assistance grant program	FEMA funding is available on an annual basis. This grant can be used to mitigate repetitively flooded structures and infrastructure to protect repetitive flood structures. *Gustavus does not qualify for this funding source, since it does not participate in the NFIP.*
United States Fire Administration Grants	The purpose of these grants is to assist state, regional, national, or local organizations to address fire prevention and safety. The primary goal is to reach high-risk target groups including children, seniors, and firefighters.
Fire Mitigation Fees	Finance future fire protection facilities and fire capital expenditures required because of new development within Special Districts.

Table 14. City of Gustavus's Regulatory Tools

Regulatory Tools (ordinances, codes, plans)	Existing Yes/No?	Comments (Year of most recent update; problems administering it, etc.)
Comprehensive Plan	Yes	Gustavus Strategic Plan, 2005. Used by the City as a road map for community change.
Economic Development Plan	No	None
Flood Map	Yes	Tsunami risk maps have been prepared.
Land Use Plan	No	No land use planning powers.
Emergency Response Plan	No	Currently in development.
Wildland Fire Protection Plan	No	Currently developing with the U.S. Forest Service.
Building code	No	No local building codes at this time.
Zoning ordinances	No	No zoning powers.
Subdivision ordinances or regulations	No	No platting powers.

5.2 NATIONAL FLOOD INSURANCE PROGRAM PARTICIPATION

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

DMA 2000 requirements and implementing City governance regulations for estimating the number and type of structures at risk to repetitive flooding include:

DMA 2000 Requirements
ELEMENT B. NFIP Insured Structures
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))

The city of Gustavus does not participate(s) in the National Flood Insurance Program (NFIP); they do not have a repetitive flood property inventory that meets NFIP criteria.

5.3 MITIGATION GOALS

Mitigation goals are defined as general guidelines that explain what a community wants to achieve in terms of hazard and loss prevention. Goal statements are typically long-range, policy-oriented statements representing community-wide vision. For the 2019 LHMP, the overarching goal is for Gustavus to be a disaster-resilient community. A disaster resilient community is able to prepare for, respond to, and recover from adverse hazards and disasters. According to laresilience.org, "in the resilience framework, less emphasis is placed on traditional, individually focused preparedness efforts… building community resilience is really about making communities stronger."

5.4 IDENTIFYING MITIGATION ACTIONS

Mitigation actions and projects help achieve the goals of the Mitigation Plan. Potential mitigation actions to be considered are listed below in Table 15. This list addresses every hazard profiled in this plan and is based on the plan's risk assessment as well as lessons learned from recent disasters. It was developed using: FEMA success stories and best management practices; FEMA job aids; local and regional plans and reports; and input from subject matter experts and guided by the Gustavus planning team.

The hazard mitigation planning team considered each hazard's history, extent, and recurrence probability to determine each potential action's priority. The planning team defined their project rating categories as high, medium, or low priority:

- High priorities are associated with actions for hazards that impact the community on an annual or near annual basis and generate impacts to critical facilities and/or people.
- Medium priorities are associated with actions for hazards that impact the community less frequently, and do not typically generate impacts to critical facilities and/or people.
- Low priorities are associated with actions for hazards that rarely impact the community and have rarely generated documented impacts to critical facilities and/or people.

The committee determined that high priority activities are essential to remedy or prevent a major health/safety hazard. They meet FEMA HMA grant criteria, including project eligibility, benefit-cost, and performance period. Medium activities are important in building a culture and practice of disaster resilience that will prevent new risks. They do not necessarily require and/or meet FEMA HMA grant criteria (but may qualify for other state and federal funds). Low priority projects still require further investigation toward developing a more comprehensive project idea.

Table 15. Potential Mitigation Actions and Projects

Hazard	Description	Pros	Cons	Priority
Multiple	Develop a public outreach and education programs regarding potential hazard impacts and personal planning preparations.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive	Staff time	High
Multiple	Develop and implement hazard overlay zoning districts. Overlay zoning is used by communities to apply area-specific standards and/or conditions. Some overlay zones (e.g., infill and redevelopment) are drafted to permit exceptions or require a less restrictive set of standards than otherwise provided in the zoning regulations.	Benefit to entire community Risk reduction	Staff time	Medium
Multiple	Develop or refine local emergency announcement procedures and back up plans.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive	Staff time	Medium
Multiple	Join Nixle. Nixle is an electronic network systems provider that proactively manages incident communications over multiple paths including voice, text message, email, and social media before, during, and after an event to keep residents safe and informed..	Life/Safety issue/Risk reduction Benefit to entire community Federal and State assistance available	Staff time, >$50,000	High
Multiple	Develop and install a signage program for hazards posted at key facilities or locations (at the school for emergency shelter designations, e.g.).	Life/Safety issue Risk reduction Benefit to entire community	Staff time, >$5,000	Medium
Earthquake	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	Staff time	High
Earthquake	Contract a structural engineering firm to assess the identified buildings and facilities to determine their structural integrity and devise a strategy to improve their earthquake resistance.	Benefit to entire community Risk reduction	Feasibility and need analysis needed. 1 – 5 years	Medium
Flood and Erosion	Build and/or reinforce revetment walls (i.e., a permanent structure designed to prevent the types of subsidence	Life/Safety issue Risk reduction Benefit to entire community	Expensive, at least $100,000	High

Table 15. Potential Mitigation Actions and Projects

Hazard	Description	Pros	Cons	Priority
	that commonly occur adjacent to waterways) that are affected by erosion.			
Flood and Erosion	Develop a storm Water management plan for sheet flood prone areas of town	Life/Safety issue/Risk reduction Benefit to entire community Federal and State assistance available	Staff time, >$50,000	Low
Severe Weather	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	Staff time	Medium
Severe Weather	Increase back up power generation: Purchase Generators to provide enough back up power to provide essential services and sustain community; Purchase portable generating units for needs for vulnerable populations (elders, medical); Purchase portable generating units for essential services; Explore alternative power sources such as wind and solar for emergency services; Work with Alaska Dept. of Transportation to purchase back-up generator for the airport	Life/Safety Issue Benefit to entire community Federal funding may be available	Expensive, at least $100,000	Medium
Severe Weather	Encourage weather resistant building construction materials and practices.	Risk and damage reduction. Benefit to entire community.	May require ordinance change. Potential for increased staff time. Research into feasibility necessary. Political and public support not determined. 1 – 5 year implementation	Low
Tsunami	Siren and lights at both ends of town for Tsunami and other hazardous warnings	Life/Safety Project	Staff time, >$50,000	Low
Tsunami	Develop Emergency Operations Plan, as needed	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available	Staff time	Medium

Table 15. Potential Mitigation Actions and Projects

Hazard	Description	Pros	Cons	Priority
		1 – 5 years, or as needed.		
Wildland Fire	Develop a local coordinated response and communication channel with the NPS.	Life/Safety issue/Risk reduction Inexpensive	Staff time	Low
Wildland Fire	Develop, adopt, and enforce burn ordinances that control outdoor burning, require burn permits and restricts open campfires during identified weather periods (wind, dry etc)	Life/Safety issue Risk reduction Benefit to entire community Inexpensive	Staff time	High
Wildland Fire	Create and maintain defensible space around critical facility and access to critical facility which is located in a wildfire hazard area. Implement both horizontal and vertical spacing measures between the ground and tree branches, shrubs and tree branches, shrubs to shrubs, and trees to trees.	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available 1 – 5 years, or as needed.	Staff time, >$50,000	Medium

5.5 MITIGATION ACTION PLAN

The Mitigation Action Plan (MAP) represents mitigation projects and programs the City could implement to potentially reduce damaging hazard impacts to both current and future infrastructure and buildings.

The planning team evaluated and prioritized each of the mitigation actions to determine which actions would be included in the Mitigation Action Plan. The Mitigation Action Plan represents mitigation projects and programs to be implemented during this HMP's five-year life cycle. To complete this task, the planning team first prioritized the hazards that were regarded as the most significant within the community (earthquake, flood, ground failure, severe weather, volcano, wildland/tundra fire).

For the city of Gustavus's Mitigation Strategy, grant recipients are restricted to fulfilling grant specific and awarding agency implementation and management processes or requirements. To that end, the LHMP MAP's Responsible Office will be the City Council office. Their respective offices could conceivably receive funding to accomplish similar projects to improve their respective initiatives or owned infrastructure. Table 16 shows the City of Gustavus's MAP.

Table 16. Mitigation Action Plan

Description	Jurisdiction	Potential Funding	Timeframe	Priority
Develop a public outreach and education programs regarding potential hazard impacts and personal planning preparations.	City DCRA DHS&EM	City budget DCRA DHS&EM	<1 year	High
Develop and implement hazard overlay zoning districts. Overlay zoning is used by communities to apply area-specific standards and/or conditions. Some overlay zones (e.g., infill and redevelopment) are drafted to permit exceptions or require a less restrictive set of standards than otherwise provided in the zoning regulations.	City DCRA DHS&EM	City budget DCRA DHS&EM	2-3 years	Medium
Develop or refine local emergency announcement procedures and back up plans.	City DCRA DHS&EM	City budget DCRA DHS&EM	Ongoing	Medium
Join Nixle. Nixle is an electronic network systems provider that proactively manages incident communications over multiple paths including voice, text message, email, and social media before, during, and after an event to keep residents safe and informed..	City DCRA DHS&EM	HMGP grant	2-3 years	High
Develop and install a signage program for hazards posted at key facilities or locations (at the school for emergency shelter designations, e.g.).	City	City budget	>1 year	Medium
Identify buildings and facilities that must be able to remain operable during and following an earthquake event.	City DHS&EM FEMA	State Grants	>1 year	High
Contract a structural engineering firm to assess the identified buildings and facilities to determine their structural integrity and	City DHS&EM	State Grants PDM	1-2 years	Medium

Table 16. Mitigation Action Plan

Description	Jurisdiction	Potential Funding	Timeframe	Priority
devise a strategy to improve their earthquake resistance.				
Build and/or reinforce revetment walls (i.e., a permanent structure designed to prevent the types of subsidence that commonly occur adjacent to waterways) that are affected by erosion.	City USACE DHS&EM	USACE grants FEMA grants	2-3 years	High
Research and consider instituting the National Weather Service program of *"Storm Ready"*.	City NWS	City budget	<1 year	Medium
Increase back up power generation: Purchase Generators to provide enough back up power to provide essential services and sustain community; Purchase portable generating units for needs for vulnerable populations (elders, medical); Purchase portable generating units for essential services; Explore alternative power sources such as wind and solar for emergency services; Work with Alaska Dept. of Transportation to purchase back-up generator for the airport	City DHS&EM	HMGP grant/ Assistance to Firefighters Grant Program grants	2-3 years	Medium
Develop Emergency Operations Plan, as needed	City	City budget, PDM grant	1-2 years	Medium
Develop, adopt, and enforce burn ordinances that control outdoor burning, require burn permits and restricts open campfires during identified weather periods (wind, dry etc)	City	City budget	Ongoing	High
Create and maintain defensible space around critical facility and access to critical facility which is located in a wildfire hazard area. Implement both horizontal and vertical spacing measures between the ground and tree branches, shrubs and tree branches, shrubs to shrubs, and trees to trees.	City DHS&EM	HMGP grant/ Assistance to Firefighters Grant Program grants	<1 year	Medium

5.6 IMPLEMENTING MITIGATION STRATEGY INTO EXISTING PLANNING MECHANISMS

After LHMP adoption, each planning team member will strive to that the LHMP, in particular each mitigation action project, is incorporated into existing planning mechanisms such as their Comprehensive Plan, Economic Development or Business Plan, and BIA Indian Reservation Roads Plan, as well as seeking other integration opportunities where appropriate. The LHMP planning team will achieve this by undertaking the following activities.

- Review city and tribal regulatory tools to determine where to integrate the mitigation philosophy and implementable initiatives within current and future planning mechanisms.
- Work with pertinent community entities to implement LHMP philosophies and mitigation strategy initiatives (including the MAP) into relevant current and future planning mechanisms (e.g., Comprehensive Plan, Economic Development Plan, Capital Improvement Project List, Transportation Improvement Plan).

5.7 MONITORING MITIGATION STRATEGY PROGRESS

DMA 2000 requirements and city governance regulations for determining mitigation action progress include:

DMA 2000 Requirements
ELEMENT E: Plan Updates
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))
Source: FEMA, March 2015
D3. Was the plan revised to reflect changes in priorities? [44 CFR § 201.7(d)(3)]
Source: FEMA, October 2017

The city planning team leader (or designee) will monitor and review their mitigation strategy to determine potential successes or roadblocks to achieving the LHMP's mitigation goals and whether implementing the MAP's activities and projects were successful during the annual review process, throughout the LHMP's 5-year life cycle

The planning team will work together with each agency or authority administering a mitigation project to prepare an Annual Review Progress Report (Appendix B) to the City of Gustavus's planning team leader. The report will include the current status of the mitigation project, including any project changes, a list of identified implementation problems (with appropriate strategies to overcome them), and a statement of whether or not the project has helped achieve their identified goals.

5.8 PROGRESS IN LOCAL MITIGATION EFFORTS

Since approximately 2010, the DCRA is no longer able to collect diverse agency project data for Alaskan communities. Therefore, this plan will only list Gustavus's historically "completed" grant funded resources. The older grants highlight their ongoing efforts toward improving their aging infrastructure.

Note: recent infrastructure improvement projects are still ongoing; however, there is no current information repository for these data.

Table 17. Gustavus Capital Improvement Project List

Project Name	Award Year	Grant Status	Award Amount	End Date
Fire Hall Completion	1986	Closed	$55,000	6/30/1994
Public Library	1994	Closed	$40,000	8/31/1997
Landfill Compliance	1994	Closed	$25,000	
Public Library Replacement	1995	Closed	$25,000	6/30/1997
New Library Completion	1996	Closed	$7,000	6/30/1998
Landfill Activities	1996	Closed	$10,000	
Purchase Medical & Office Equipment for New Clinic	1996	Closed	$8,000	12/31/1996
On-going Projects	1997	Closed	$25,000	12/31/1997
Community Equipment Needs	1998	Closed	$25,000	8/30/1999
Equipment Purchases	1999	Closed	$22,365	12/31/2002
Ongoing Projects	2000	Closed	$28,000	6/30/2004
State Revenue Sharing	2002	Closed	$3,681	3/31/2003

Table 17. Gustavus Capital Improvement Project List

Project Name	Award Year	Grant Status	Award Amount	End Date
State Revenue Sharing	2002	Closed	$596	3/31/2003
State Revenue Sharing	2003	Closed	$3,631	3/31/2004
State Revenue Sharing	2003	Closed	$671	3/31/2004
Gustavus Land Legacy	2003	Closed	$100,000	4/1/2005
Temporary Fiscal Relief Grant	2004	Closed	$3,500	
Temporary Fiscal Relief Grant	2004	Closed	$632	
Community Building and Land Acquisition	2001	Closed	$14,700	7/31/2004
Planning and Design of Dock and Boat Launch	2006	Closed	$150,000	5/31/2010
Boat Harbor/Disposal & Recycle Center Access	2006	Closed	$30,000	9/30/2007
Community Equipment Needs	2001	Closed	$10,300	6/30/2006
Falls Creek Hydroelectric Project Construction	2008	Closed	$0	9/19/2010
Ten Foot Oval Culvert at Wilson Road/State Gravel Pit Crossing	2009	Closed	$61,808	2/28/2011
Community Equipment Purchase	2003	Closed	$25,586	6/30/2006
Ongoing Equipment Purchases	2002	Closed	$24,585	6/30/2006
Purchase Insurance Coverage	2010	Closed	$13,463	9/30/2011
Gustavus - Improvements and Repairs to Fire Hall (HD 5)	2011	Closed	$101,500	6/30/2012
Remodel City Hall	2011	Active	$93,000	6/30/2015
Community Broadband Network	2012	Active	$235,000	6/30/2016
Volunteer Fire Department SCBA Fit Testing and Radio Equipment	2012	Closed	$28,220	9/6/2011
Good River Road Culvert Replacement and Road Safety Improvements	2013	Active	$118,000	6/30/2017
Recycling Center Remodel, Renovation, and Upgrades	2013	Active	$55,000	6/30/2017

6.0 REFERENCES

This section provides a comprehensive reference list used to develop the LHMP

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7.0 JURISDICTIONAL ADOPTION

This section is included to fulfill the City of Gustavus' LHMP adoption requirements.

The of City of Gustavus is represented in this LHMP and meet the requirements of Section 409 of the Stafford Act and Section 322 of DMA 2000, and 44 CFR §201.6(c)(5), and §201.7(c)(5) & (6) respectively.

DMA 2000 requirements and implementing City governance regulations for the LHMP adoption include:

DMA 2000 Requirements
ELEMENT E. Plan Adoption
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))
Source: FEMA, March 2015.

The City of Gustavus City Council adopted the LHMP on date, 201x and submitted the final draft LHMP to FEMA for formal approval.

Adoption Resolutions

APPENDIX A PUBLIC PARTICIPATION AND PLANNING PROCESS DOCUMENTATION

From: Simmons, Scott
To: sally.cox@alaska.gov; jimmy.smith@alaska.gov; twolf@denali.gov; callard@denali.gov; rick.dembroski@alaska.gov; mike.johnson@alaska.gov; scott.nelsen@alaska.gov; eli.ward@alaska.gov; deanne.stevens@alaska.gov; kathryn.pyne@alaska.gov; sheri.gray@alaska.gov; paul.khera@alaska.gov; dan.monteleone@alaska.gov; john.clendenin@alaska.gov; michael.angove@noaa.gov; louise.fode@noaa.gov; aimee.fish@noaa.gov; amy.holman@noaa.gov; kyle.wright@tananachiefs.org; djnicolsky@alaska.edu; naruppert@alaska.edu; Kenneth.J.Eisses@usace.army.mil; scott.crockett@ak.usda.gov; brett.nelson@ak.usda.gov; ann.Y.gravier@hud.gov; jconaway@usgs.gov; adevaris@usgs.gov; janet.schaefer@alaska.gov; robin.bronen@akijp.org; denise.pollock@akijp.org; "essmith@anthc.org"; "kwallace@usgs.gov"; "swhite@avcp.org"; "steve.heppner.bia.ak@gmail.com"; "terri.lomax@alaska.gov"; "Soderlund.Dianne@epamail.epa.gov"; "joel.curtis@noaa.gov"; "sam.albanese@noaa.gov"; "meg.mueller@ak.usda.gov"; "merlaine.kruse@ak.usda.gov"; "patty.burns@alaska.gov"; "margie.goatley1@alaska.gov"; "khoward@blm.gov"; "nicole.kinsman@noaa.gov"; "bruce.r.sexaur@usace.army.mil"; "mtavelton@usace.army.mil"; "steve.mcgroarty@alaska.gov"; "megan.kohler@alaska.gov"; "jade.gamble@alaska.gov"; "essmith@anthc.org"; "kwallace@usgs.gov"; "swhite@avcp.org"; "steve.heppner.bia.ak@gmail.com"; "jimmy.smith@alaska.gov"; "terri.lomax@alaska.gov"; "Soderlund.Dianne@epamail.epa.gov"; "joel.curtis@noaa.gov"; "sam.albanese@noaa.gov"; "meg.mueller@ak.usda.gov"; "merlaine.kruse@ak.usda.gov"; "ak_le@fws.gov"; "eddie.zingone@noaa.gov"; "patty.burns@alaska.gov"; "margie.goatley1@alaska.gov"; "khoward@blm.gov"; "nicole.kinsman@noaa.gov"; "bruce.r.sexaur@usace.army.mil"; "mtavelton@usace.army.mil"; "steve.mcgroarty@alaska.gov"; "megan.kohler@alaska.gov"; "jade.gamble@alaska.gov"
Cc: Evans, Jessica; Rabon, Angel; Cogger, Corinne; Volper, Kaley
Subject: Hazard Mitigation Project Agency Involvement Participant Invitation Letter
Date: Friday, February 02, 2018 11:38:58 AM
Attachments: image003.png

Dear Potential HMP Development Participants,
AECOM (formerly URS) has received a 2014 contract from the State Division of Homeland Security and Emergency Management (DHS&EM) to develop Local/Tribal Multi-Jurisdictional Hazard Mitigation Plans (MJHMPs) for the following communities: Each group defines the HMP type and targeted communities.

The following communities' do not currently have an HMP. These communities will develop plans that meet FEMA's current MJHMP requirements:

New MJHMP and Tribal HMP Development

- ***Organized Cities with Co-Located Villages***
  - Gustavus (2nd Class City)
  - Manokotak (2nd Class City with Tribal Village)
  - Tenakee Springs (2nd Class City)

The following communities' currently have expired HMPs. These communities will have their plans updated from HMP to MJHMPs to meet current FEMA city and tribal requirements:

MJHMP/Tribal HMP Updates Required

- ***Organized Cities with Co-Located Native Villages***
  - Anvik (2nd Class City with Native Village)
  - Seward (2nd Class City with Native Village)

Borough HMPs converted to MJHMP Update Required

  - The City and Borough of Wrangell's (CBW) legacy HMP includes two-collocated villages. CBW's HMP is currently expired. CBW's HMP will be converted to meet FEMA's Multi-Jurisdictional Plan requirements with each Tribe receiving separate Tribal HMPs within CWB's MJHMP to meet current FEMA city and tribal requirements.

- The Aleutians East Borough's (AEB) legacy HMP includes six organized cities and their collocated villages. AEB's HMP is currently expired. AEB's HMP will be converted to meet FEMA's Multi-Jurisdictional Plan requirements with each constituent community and native village receiving separate HMPs within AEB's MJHMP to meet current FEMA requirements:
  - ***AEB Organized Cities with Co-Located Villages***
    - Akutan (2nd Class City with Tribal Village)
    - Cold Bay (2nd Class City only)
    - False Pass (2nd Class City with Tribal Village)
    - King Cove (2nd Class City with 2-Tribal Villages)
    - Nelson Lagoon (2nd Class City with Tribal Village)
    - Sand Point (2nd Class City with 2-Tribal Villages)

We invite you to participate in this important community planning effort during the development process. Community newsletters will be located on the DHS&EM Local/Tribal All Hazard Mitigation Plan Development website at: *https://ready.alaska.gov/plans/localhazmitplans* as the communities finalize them.

Please feel free to contact me and to forward this email to the most appropriate person within your agency involved with hazard assessments, hazard mitigation plan development or community specific hazard information or planning suggestions. (Please cc me so I may update the contact list)

I encourage you to acknowledge receiving this invitation at your earliest convenience to allow me to include your participation (with appropriate acknowledgments) within the Draft and Final HMPs prior to State and FEMA review and subsequent approvals.

Kind Regards
-Scott-

AECOM
R. Scott Simmons, CFM, CPM
Senior Emergency Management Planner

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City of Gustavus Hazard Mitigation Plan (HMP)

February 2018 **Newsletter 1**

This newsletter is for the City of Gustavus Hazard Mitigation Planning project development processes. It explains the planning project to all interested agencies, stakeholders, and the public solicits comments. You can also view it on the State of Alaska Division of Homeland Security and Emergency Management Website at https://ready.alaska.gov/plans/localhazmitplans .

The State of Alaska, Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management (DHS&EM) was awarded a Pre-Disaster Mitigation Program grant from the Federal Emergency Management Agency (FEMA) to prepare a Hazard Mitigation Plan (HMP) for City of Gustavus.

AECOM was contracted to assist the community with preparing a FEMA-approvable HMP.

The Gustavus Hazard Mitigation Plan will identify all natural hazards, such as earthquake, erosion, flood, severe weather, and ground failure, etc. The plan will also identify the people and facilities potentially at risk and ways to mitigate damage from future hazard impacts. We will document the public participation and planning process as part of this project.

What is Hazard Mitigation?

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

Why Do We Need A Hazard Mitigation Plan?

Communities must have a State, FEMA-approved, and community adopted HMP to receive a project grant from FEMA's grant programs. Gustavus's HMP will make you eligible to apply for mitigation funds after the plan is complete.

A FEMA approved and community adopted HMP enables the local and tribal governments to apply for the Hazard Mitigation Grant Program, a disaster related assistance program; the Pre-Disaster Mitigation, and the National Flood Insurance Program Flood Mitigation Assistance grant programs.

The Planning Process

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

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

- Planning Team membership and processes
- HMP participation and plan reviewers
- Identify hazards, and explain hazard impacts
- Identify critical facilities, review their relative location within each hazard's impact area, and determine their estimated replacement costs
- Define the community's population risk and critical facility vulnerabilities
- Develop hazard mitigation goals
- List projects for the Mitigation Strategy and determine priority
- Describe maintenance of the plan
- Provide a copy of the community's HMP Adoption Resolution

FEMA has prepared a Local Multi-Hazard Mitigation Planning Guidance (available at: *http://emilms.fema.gov/is318/assets/local_mtgtn_plan_gdnce_0708.pdf*) that explains how the HMP meets each of the DMA2000 requirements.

We are currently in the very beginning stages of preparing the plan. We will be conducting a Planning Team Meeting to introduce the project and planning team, to gather comments from community residents to update the hazards lists, and collect data to refine the vulnerability assessment.

We Need Your Help

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

Gustavus Hazard Worksheet		
Hazard	Chatham REAA*	City of Gustavus
Earthquake	Yes	
Erosion	Yes	
Flood	Yes	
Ground Failure (Avalanche, Landslide, Permafrost)	Yes	
Severe Weather	Yes	
Tsunami & Seiche	Yes	
Volcano	No	
Wildland Fire	Yes	

*Hazard Matrix from the 2013 State of Alaska Hazard Mitigation Plan for the Chatham REAA.

DHS&EM identified critical facilities within the City of Gustavus as part of the Alaska Critical Facilities Inventory, but the list of critical facilities needs to be updated and the estimated value and location (latitude/longitude) determined.

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

Gustavus's Critical Facilities*	
Facility Name	Facility Type
Post Office	Government
Ruth O. Matson K-12 School	Education
Preschool	Education
Assembly of God Church	Community
Gustavus Inn	Community
Library	Community
Church	Community
Ice Rink	Community
Lodge	Community
NPS Buildings and Lodging	Community
Historic Building	Community
Gustavus Airport	Transportation
Guistavus Multi-Modal Marine Facility	Transportation
Salmon River Boat Launch	Transportation
Public Dock	Transportation
Fuel Dock	Transportation
Gustavus Disposal and Recycling Center	Utility
Water Plant	Utility
Water Storage Tanks	Utility
NPS Water Treatment	Utility
State of Alaska DOT&PF Equipment Shed	Utility
Borrow Pit (by Airport)	Utility
City Gravel Pits	Utility
Power Plant	Utility

* Alaska Dept. of Commerce, Community and Economic Development Maps, 2011

The Planning Team

The Gustavus planning team is being led by Karen Platt. AECOM Corporation has been contracted by DHS&EM to provide assistance and guidance to the planning team throughout the planning process.

Public Participation

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

We encourage you to take an active part in preparing the City of Gustavus's Hazard Mitigation Plan (HMP) development effort. The purpose of this newsletter is to keep you informed and to allow you every opportunity to voice your opinion regarding this important project. Please contact your community HMP Team Leader or Jessica Evans, AECOM directly if you have any questions, comments, or to requests additional information:

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Council Input Requested:

From AECOM:

When I was there, I left a document entitled Mitigation Ideas. Look through that and see if the council may have some ideas in addition to what is in there. (if you see something write it down along with a page number please)

I don't have anything to add at this time.
Cheryl
1/21/19

KETCHIKAN
GATEWAY BOROUGH

LOTS OF GOOD IDEAS IN THIS WE SHOULD CONSIDER PREVENTION OF RISK UP-FRONT FOR ANY INFRASTRUCTURE CONSTRUCTION OR DEVELOPMENT PROJECT. MONITOR SUBDIVISION PLANS TO ASSURE PROPERTIES WON'T BE AT RISK OF NATURAL HAZARDS.

MT.

Gustavus Volunteer Fire Department Sign-In Sheet

Drill: HMP Plan Mitigation Ideas	**Drill Date:** 1/31/19
Instructor: AECOM / Travis Miller	**Place/Room:** City Hall table

Name	Division	Phone	E-Mail
Travis Miller	Fire chief		
Cheryl Cook	City Council		
Mike Taylor	City Council		

APPENDIX B PLAN MAINTENANCE TOOLS

Annual Review Questionnaire

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

Mitigation Action Progress Report

Progress Report Period: ______________________ **To** ______________________
(Date) (Date)

Project Title: ______________________ **Project ID#:** ______________________

Responsible Agency: ______________________

Address: ______________________

: ______________________

Contact Person: ______________________ **Title:** ______________________

Phone #(s): ______________________ **email Address(s):** ______________________

List Supporting Agencies and Contacts: ______________________

Total Project Cost: ______________________

Anticipated Cost Overrun/Underrun: ______________________

Project Approval Date: ______________________ **Project Start Date:** ______________________

Anticipated Completion Date: ______________________

Description of project (describe each phase, if applicable, and the time frame for completing each phase:

Milestones	Complete	Projected Completion Date

Mitigation Action Progress Report *(Continued)*

Plan Goal(s) Addressed:

Goal:

Success Indicators:

Project Status

☐ **On Schedule**

☐ **Completed**

☐ **Delayed***

*** Explain:**

☐ **Canceled**

Project Cost Status

☐ **Cost Unchanged**

☐ **Cost Overrun****

**** Explain:**

☐ **Cost Underrun*****

***** Explain:**

Summary of progress on project for this report:

A. What was accomplished during this reporting period?

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

C. How was each problem resolved?

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

Other Comments: