City of Saint Paul, Alaska
Hazard Mitigation Plan

Prepared by
The City of St. Paul
Hazard Mitigation Planning Team
February 2016

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Front Cover Photo Acknowledgment:

1. Top of page: 2008 Legacy HMP photo)

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Acronyms/Abbreviations

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

Acronyms/Abbreviations

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

Acronyms/Abbreviations

RD	Rural Development
RL	Repetitive Loss
RurALCAP	Rural Alaska Community Action Program Incorporated
SAFER	Staffing for Adequate Fire and Emergency Response
SBA	U.S. Small Business Administration
SHMP	Alaska State Hazard Mitigation Plan
SHSP	State Homeland Security Program
SOA	State Of Alaska
Sq.	Square
Stafford Act	Robert T. Stafford Disaster Relief and Emergency Assistance Act
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic, and Environmental
US or U.S.	United States
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VFA-RFA	Volunteer Fire Assistance and Rural Fire Assistance Grant
VSW	Village Safe Water
WARN	Warning, Alert, and Response Network
WHIP	Wildlife Habitat Incentives Program
WX	Weather

1. Introduction

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

1.1 Hazard Mitigation Planning

In recent years, a new Federal law has driven local hazard mitigation planning. On October 30, 2000, Congress passed the Disaster Mitigation Act of 2000 (DMA 2000) (P.L. 106-390), which amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) (Title 42 of the United States Code [USC] 5121 et seq.) by repealing the act's previous mitigation planning section (409) and replacing it with a new mitigation planning section (322). This new section emphasized the need for State, Tribal, and local entities to closely coordinate mitigation planning and implementation efforts. In addition, it provided the legal basis for the Federal Emergency Management Agency's (FEMA) mitigation plan requirements for mitigation grant assistance.

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

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

This HMP complies with Title 44 CFR current as of January 1, 2014 and applicable guidance documents.

1.2 Grant Programs with Mitigation Plan Requirements

FEMA HMA grant programs provide funding to States, Tribes, and local entities that have a FEMA-approved State, Tribal, or Local Mitigation Plan. Two of the grants are authorized under the Stafford Act and DMA 2000, while the remaining three are authorized under the National Flood Insurance Act and the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act. Excerpts from FEMA's 2015 HMA Guidance, Part I are as follows:

> *"The U.S. Department of Homeland Security (DHS) FEMA HMA programs present a critical opportunity to reduce the risk to individuals and property from natural hazards, while simultaneously reducing reliance on Federal disaster funds. On March 30, 2011, the President signed Presidential Policy Directive 8 (PPD-8): National Preparedness and the National Mitigation Framework were finalized in May 2013. The National Mitigation Framework comprises seven core capabilities, including:*
>
> - *Threats and Hazard Identification*
> - *Risk and Disaster Resilience Assessment*
> - *Planning*
> - *Community Resilience*

- *Public Information and Warning*
- *Long-Term Vulnerability Reduction*
- *Operational Coordination*

HMA programs provide funding for eligible activities that are consistent with the National Mitigation Framework's Long-Term Vulnerability Reduction capability. HMA programs reduce community vulnerability to disasters and their effects, promote individual and community safety and resilience, and promote community vitality after an incident. Furthermore, HMA programs reduce response and recovery resource requirements in the wake of a disaster or incident, which results in a safer community that is less reliant on external financial assistance.

Hazard mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to people and property from natural hazards and their effects. This definition distinguishes actions that have a long-term impact from those that are more closely associated with immediate preparedness, response, and recovery activities. Hazard mitigation is the only phase of emergency management specifically dedicated to breaking the cycle of damage, reconstruction, and repeated damage. Accordingly, States, territories, federally-recognized tribes, and local communities are encouraged to take advantage of funding that HMA programs provide in both the pre- and post-disaster timelines.

In addition to hazard mitigation, FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) Program provides communities with education, risk communication, and outreach to better protect its citizens. The Risk MAP project lifecycle places a strong emphasis on community engagement and partnerships to ensure a whole community approach that reduces flood risk and builds more resilient communities. Risk MAP risk assessment information strengthens a local community's ability to make better and more informed decisions. Risk MAP allows communities to better invest and determine priorities for projects funded under HMA. These investments support mitigation efforts under HMA that protect life and property and build more resilient communities.

The whole community includes children, individuals with disabilities, and others with access and functional needs; those from religious, racial, and ethnically diverse backgrounds; and people with limited English proficiency. Their contributions must be integrated into mitigation/resilience efforts, and their needs must be incorporated as the whole community plans and executes its core capabilities.

A. HMA Commitment to Resilience and Climate Change Adaptation

FEMA is committed to promoting resilience as expressed in PPD-8: National Preparedness; the President's State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience; the Administrator's 2011 FEMA Climate Change Adaptation Policy Statement (Administrator Policy 2011-OPPA-01); and the 2014–2018 FEMA Strategic Plan. Resilience refers to the ability to adapt to changing conditions and withstand and rapidly recover from disruption due to emergencies. The concept of resilience is closely related to the concept of hazard mitigation, which reduces or eliminates potential losses by breaking the cycle of damage, reconstruction, and repeated damage. Mitigation capabilities include, but are not limited to, community-wide risk reduction projects, efforts to improve the resilience of critical infrastructure and key resource lifelines, risk reduction for specific vulnerabilities from natural hazards and climate change, and initiatives to reduce future risks after a disaster has occurred.

FEMA is supporting efforts to streamline the HMA programs so that these programs can better respond to the needs of communities nationwide that are addressing the impacts of climate change. FEMA, through its HMA programs:

- *Develops and encourages adoption of resilience standards in the siting and design of buildings and infrastructure*
- *Modernizes and elevates the importance of hazard mitigation*

FEMA has issued several policies that facilitate the mitigation of adverse effects from climate change on the built environment, structures and infrastructure. Consistent with the 2014–2018 FEMA Strategic Plan, steps are being taken by communities through engagement of individuals, households, local leaders, representatives of local organizations, and private sector employers and through existing community networks to protect themselves and the environment by updating building codes, encouraging the conservation of natural and beneficial functions of the floodplain, investing in more resilient infrastructure, and engaging in mitigation planning. FEMA plays an important role in supporting community-based resilience efforts, establishing policies, and providing guidance to promote mitigation options that protect critical infrastructure and public resources.

FEMA encourages better integration of Sections 404 and 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended (Stafford Act), Title 42 of the United States Code (U.S.C.) 5121 et seq., to promote more resilience during the recovery and mitigation process. FEMA regulations that implement Sections 404 and 406 of the Stafford Act allow funding to incorporate mitigation measures during recovery activities. Program guidance and practice limits Section 406 mitigation to the damaged elements of a structure. This limitation to Section 406 mitigation may not allow for a comprehensive mitigation solution for the damaged facility; however, Section 404 funds may be used to mitigate the undamaged portions of a facility.

Recognizing that the risk of disaster is increasing as a result of multiple factors, including the growth of population in and near high-risk areas, aging infrastructure, and climate change, FEMA promotes climate change adaptation by:

- *Incorporating sea level rise in the calculation of Benefit-Cost Analysis (BCA)*
- *Publishing a new HMA Job Aid on pre-calculated benefits for hurricane wind retrofit measures, see HMA Job Aid (Cost Effectiveness Determination for Residential Hurricane Wind Retrofit Measures Funded by FEMA)*
- *Encouraging floodplain and wetland conservation associated with the acquisition of properties in green open space and riparian areas*
- *Reducing wildfire risks*
- *Preparing for evolving flood risk*
- *Encouraging mitigation planning and developing mitigation strategies that encourage community resilience and smart growth*
- *Encouraging the use of building codes and standards (the American Society of Civil Engineers/Structural Engineering Institute [ASCE/SEI] 24-14, Flood Resistant Design and Construction) wherever possible.*

For additional information, see http://www.fema.gov/climate-change" (FEMA 2015).

1.2.1 Hazard Mitigation Assistance (HMA) Grant Programs

HMA grant program activities include the following.

Table 1-1 HMA Eligible Activities

Activities	HMGP	PDM	FMA
1. Mitigation Projects	✓	✓	✓
Property Acquisition and Structure Demolition	✓	✓	✓
Property Acquisition and Structure Relocation	✓	✓	✓
Structure Elevation	✓	✓	✓
Mitigation Reconstruction	✓	✓	✓

Table 1-1 HMA Eligible Activities

Activities	HMGP	PDM	FMA
Dry Floodproofing of Historic Residential Structures	✓	✓	✓
Dry Floodproofing of Non-residential Structures	✓	✓	✓
Generators	✓	✓	
Localized Flood Risk Reduction Projects	✓	✓	✓
Non-localized Flood Risk Reduction Projects	✓	✓	
Structural Retrofitting of Existing Buildings	✓	✓	✓
Non-structural Retrofitting of Existing Buildings and Facilities	✓	✓	✓
Safe Room Construction	✓	✓	
Wind Retrofit for One- and Two-Family Residences	✓	✓	
Infrastructure Retrofit	✓	✓	✓
Soil Stabilization	✓	✓	✓
Wildfire Mitigation	✓	✓	
Post-Disaster Code Enforcement	✓		
Advance Assistance	✓		
5 Percent Initiative Projects	✓		
Miscellaneous/Other[(1)]	✓	✓	✓
2. Hazard Mitigation Planning	✓	✓	✓
Planning Related Activities	✓		
3. Technical Assistance			✓
4. Management Cost	✓	✓	✓

[(1)] Miscellaneous/Other indicates that any proposed action will be evaluated on its own merit against program requirements. Eligible projects will be approved provided funding is available.

(FEMA 2012)

The Hazard Mitigation Grant Program (HMGP) is a competitive, disaster funded, grant program. Whereas the other Unified Mitigation Assistance Programs: Pre-Disaster Mitigation (PDM) and Flood Mitigation Assistance (FMA) programs although competitive, rely on specific pre-disaster grant funding sources, sharing several common elements. The 2015 HMA Guidance provides the following programmatic information:

> *"HMGP is authorized by Section 404 of the Stafford Act, 42 U.S.C. 5170c. The key purpose of HMGP is to ensure that the opportunity to take critical mitigation measures to reduce the risk of loss of life and property from future disasters is not lost during the reconstruction process following a disaster.*
>
> *HMGP funding is available, when authorized under a Presidential major disaster declaration, in the areas of the State requested by the Governor. Federally-recognized tribes may also submit a request for a Presidential major disaster declaration within their impacted areas (see http://www.fema.gov/media-library/assets/documents/85146). The amount of HMGP funding available to the Applicant is based on the estimated total Federal assistance, subject to the sliding scale formula outlined in Title 44 of the Code of Federal Regulations (CFR) Section 206.432(b) that FEMA provides for disaster recovery under Presidential major disaster declarations. The formula provides for up to 15 percent of the first $2 billion of estimated aggregate amounts of*

disaster assistance, up to 10 percent for amounts between $2 billion and $10 billion, and up to 7.5 percent for amounts between $10 billion and $35.333 billion. For States with enhanced plans, the eligible assistance is up to 20 percent for estimated aggregate amounts of disaster assistance not to exceed $35.333 billion.

The Period of Performance (POP) for HMGP begins with the opening of the application period and ends no later than 36 months from the close of the application period.

PDM is designed to assist States, territories, federally-recognized tribes, and local communities to implement a sustained pre-disaster natural hazard mitigation program to reduce overall risk to the population and structures from future hazard events, while also reducing reliance on Federal funding in future disasters. Congressional appropriations provide the funding for PDM.

The total amount of funds distributed for PDM is determined once the appropriation is provided for a given fiscal year. It can be used for mitigation projects and planning activities.

The POP for PDM begins with the opening of the application period and ends no later than 36 months from the date of subapplication selection.

FMA is authorized by Section 1366 of the National Flood Insurance Act of 1968, as amended (NFIA), 42 U.S.C. 4104c, with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FMA was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994. The Biggert-Waters Flood Insurance Reform Act of 2012 (Public Law 112-141) consolidated the Repetitive Flood Claims and Severe Repetitive Loss grant programs into FMA. FMA funding is available through the National Flood Insurance Fund (NFIF) for flood hazard mitigation projects as well as plans development and is appropriated by Congress. States, territories, and federally-recognized tribes are eligible to apply for FMA funds. Local governments are considered subapplicants and must apply to their Applicant State, territory, or federally-recognized tribe.

The POP for FMA begins with the opening of the application period and ends no later than 36 months from the date of subapplication selection" (FEMA 2015).

As the State Hazard Mitigation plan states:

"The [FMA] provides pre-disaster grants to State and Local Governments for planning and flood mitigation projects. Created by the National Flood Insurance Reform Act of 1994, its goal is to reduce or eliminate NFIP claims. It is an annual nationally competitive program. Residential and non-residential properties may apply for FMA grants through their NFIP community and are required to have NFIP insurance to be eligible. FMA grant funds may be used to develop the flood portions of hazard mitigation plans or to do flood mitigation projects. FMA grants are funded 75% Federal and 25% applicant.

The Biggert-Waters Flood Insurance Reform Act of 2012 eliminated the Repetitive Flood Claims (RFC) and Severe Repetitive Loss (SRL) grant programs. Elements of these flood programs have been incorporated into FMA. The FMA program now allows for additional cost share flexibility:

- *Up to 100-percent Federal cost share for severe repetitive loss properties.*
- *Up to 90-percent Federal cost share for repetitive loss properties.*
- *Up to 75-percent Federal cost share for NFIP insured properties.*

The FMA program is available only to communities participating in the NFIP. In the State of Alaska, the Department of Commerce, Community, and Economic Development (DCCED) manage this program" (SHMP 2013).

HMP Layout Description

The HMP consists of the following sections and appendices:

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 Community Description

Provides a general history and background of the City of Saint Paul (City), including historical trends for population and the demographic and economic conditions that have shaped the area.

Section 3 Planning Process

Describes the HMP update's planning process, identifies the Planning Team Members, the meetings held as part of the planning process, and the key stakeholders within Saint Paul and the surrounding area. This section documents public outreach activities (support documents are located in Appendix D); the review and incorporation of relevant plans, reports, and other appropriate information; actions the City plans to implement to assure continued public participation; and their methods and schedule for keeping the plan current.

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

Section 4 HMP Adoption

Describes the community's HMP adoption process (support documents are located in Appendix C).

Section 5 Hazard Profile Analysis

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

Section 6 Vulnerability Analysis

Identifies the City's potentially vulnerable assets—people, residential and nonresidential buildings (where available), critical facilities, and critical infrastructure. The resulting information identifies the full range of hazards that the City could face and potential social impacts, damages, and economic losses. Land use and development trends are also discussed.

Section 7 Mitigation Strategy

Defines the mitigation strategy, which provides a blueprint for reducing the potential losses identified in the vulnerability analysis. This section lists the community's governmental authorities, policies, programs and resources.

The Planning Team developed a list of mitigation goals and potential actions to address the risks facing the Saint Paul. Mitigation actions include preventive actions, property protection techniques, natural resource protection strategies, structural projects, emergency services, and public information and awareness activities. Mitigation strategies were developed to address NFIP insured properties (if

applicable) while encouraging participation with the NFIP and the reduction of flood damage to flood-prone structures.

Section 8 References

Lists reference materials and resources used to prepare this HMP.

Appendices

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

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

Appendix C: Provides the adoption resolution for participating jurisdictions.

Appendix D: Provides public outreach information, including newsletters.

Appendix E: Contains a Benefit-Cost Analysis Fact Sheet used to prioritize mitigation actions.

Appendix F: Provides the HMP maintenance documents, such as an annual review sheet and progress report forms.

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2. Community Description

Section Two provides a description of the location, geography, history, demographic information and economy of the City of Saint Paul.

2.1 Location, Geography, and History

Location

The City of Saint Paul is located on a narrow peninsula on the southern tip of Saint Paul Island, the largest of five islands in the Pribilof Islands. It lies 240 miles north of the Aleutian Island chain, 300 miles west of the Alaska mainland, and 750 air miles west of Anchorage. Its coordinates are approximately 57.122220° north latitude and -170.275000° west longitude. Saint Paul is located in the Aleutian Islands recording district. The area encompasses 40.3 square miles of land and 255.2 square miles of water.

Figure 2-1 Saint Paul Vicinity Map

Geography

Saint Paul Island is approximately 16 miles long and 9 miles wide and has a maximum land surface elevation of about 665 feet above sea level. The bulk of the island is a series of gently dipping olivine-basalt lava flows and scoriacious volcanic debris. The Island's surface topography is composed of volcanic features such as individual flow boundaries and volcanic cones; volcanic rocks are discontinuously overlain by coastal dunes and marine deposits. The volcanic rocks and scoriacious deposits are highly permeable and allow rapid infiltration of precipitation and snowmelt.

Climate

Saint Paul is located in an arctic maritime climate, characterized by a narrow range of mean temperatures. The year round temperatures range from 19° Fahrenheit (F) to 51°F. Average precipitation is 25 inches, with snowfall of 56 inches. During the summer heavy fog is common.

History

In 1786, Russian fur traders discovered the Pribilof Islands. Aleuts enslaved by the Russian American Company, were relocated from Siberia, Atka and Unalaska to the Pribilof Islands in 1788, to hunt fur seals. In exchange for housing, food and medical care the Aleut population harvested seals; this 20-year sealing lease was established between the Alaska Commercial Company and the U.S. Government; however, severe over harvesting resulted in poverty. Food and clothing were scarce, working conditions were poor and social and racial segregation were practiced. The Fur Seal Act of 1910 ended private leasing on the Islands and placed the community and fur seals under the U.S. Bureau of Fisheries. During World War II, the Pribilof Aleuts were moved to Funter Bay on Admiralty Island where they were confined to an abandoned cannery and mine camp, in Southeast Alaska as part of the emergency evacuation of residents from the Bering Sea. In 1979, the Aleut Islanders received $8.5 million in partial compensation for the unfair and unjust treatment they were subject to under federal administration between 1870 and 1946.

In 1983, Congress amended the Fur Seal Act, which ended government control of the commercial seal harvest and the federal presence on the island. Twenty million dollars were provided to help develop and diversify the Island economy - $12 million to Saint Paul and $8 million to Saint George. In 1985, commercial harvesting of fur seal ended; ownership of pelts is now prohibited except for Native arts and crafts purposes.

Culture

Saint Paul's population is predominantly Aleut; many are descendants of the enslaved Aleuts. The subsistence lifestyle has increasingly become the focus of local culture. Halibut and seal are shared and exchanged for salmon and meat from relatives living off the islands. A total of 1,645 fur seals may be taken for subsistence purposes each year. Halibut, reindeer, marine invertebrates, plants and berries are also harvested for subsistence purposes. The Russian Orthodox Church plays a strong role in community cohesiveness.

Transportation

Saint Paul is accessible by sea and air. The State-owned asphalt runway is 6,500 feet long by 150 feet wide and provides a base for regularly-scheduled flights. Most supplies and freight are shipped by air; however, very large supplies and equipment arrive by barge. There is a 1200' breakwater, small boat harbor and ramp, dock space, barge off-loading area. Saint Paul is not connected by road or State Ferry to the rest of the state" (DCRA 2015).

2.2 Demographics

The most recent 2014 DCCED certified population is 479. According to the 2010 U.S. Census, nearly 82 percent of Saint Paul residents are Alaska Native and 18 percent non-Native. The community has a total of 190 housing units and 162 units are occupied households; 28 units are vacant and 3 are vacant due to seasonal use. Note: these statistics indicate an overall decrease in population and in percent Native plus a decrease in housing between 2000 to 2010 Census. According to the 2010 Census, the population is expected to remain steady because over half of the population is between 1 and 34 years of age. The City's population is principally of Alaska Native heritage. The male and female composition is approximately 53 and 47 % respectively.

Figure 2-1 illustrates the City's historic population.

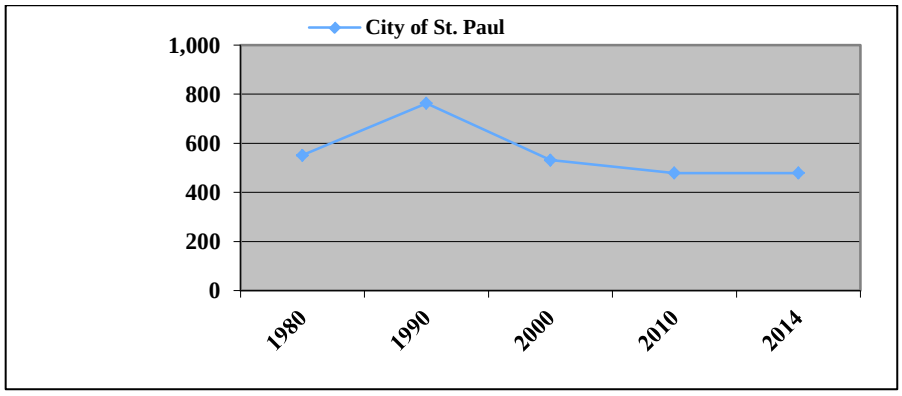

Figure 2-2 City of Saint Paul Historic Population (DCCED 2015)

2.3 Economy

Saint Paul is a port for the Central Bering Sea fishing fleet, and major harbor improvements have fueled economic growth. Trident and Icicle Seafood process cod, crab, halibut and other seafood.

Since the 2008 Legacy Plan, the number of Saint Paul residents holding commercial halibut fishing permits has dropped from thirty to twenty-five.

The City of Saint Paul reports that the total potential work force (age 16 and over) is 324 and of those, 149 were employed (DCCED 2013 data). The per capita income 2009-2013 was $20,901 (DCCED) with a margin of error +/-$5,000. The median household income for the same reporting period was $38,750 (DCCED) with a margin of error +/- $6,000. Nearly 12 percent of residents live below the poverty line. The Island's natural resources attract nearly 700 tourists annually.

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3. Planning Process

Section Three provides an overview of the planning process; identifies the Planning Team Members and key stakeholders; documents public outreach efforts; and summarizes the review and incorporation of existing plans, studies, and reports used to develop this HMP. Outreach support documents and meeting information regarding the Planning Team and public outreach efforts are provided in Appendix F.

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

DMA 2000 Requirements
Local Planning Process §201.6(b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: Element §201.6(b)(1): An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval; §201.6(b)(2): An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and nonprofit interests to be involved in the planning process; and §201.6(b)(3): Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information. §201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved. §201.6(c)(4)(i): The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle. §201.6(c)(4)(iii): The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.
1. REGULATION CHECKLIST
ELEMENT A. Planning Process
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1)) A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2)) A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1)) A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3)) A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii)) A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle?) (Requirement §201.6(c)(4)(i))
Does the updated plan document how the planning team reviewed and analyzed each section of the plan and whether each section was revised as part of the update process? (Not applicable until 2013 update).
Source: FEMA, March 2015.

3.1 Planning Process Overview

The State of Alaska (SOA), Division of Homeland Security and Emergency Management (DHS&EM) provided funding and project oversight to AECOM to facilitate and guide Planning Team with updating their legacy 2008 HMP to comply with FEMA regulatory requirements.

The planning process began with submittal of the first newsletter to the community on February 14, 2015. An email describing the HMP update process was also sent on that date. The City was encouraged to

develop a community Planning Team to assist the community's efforts to identify available resources and capabilities for updating their legacy HMP.

The Planning Team held a teleconference on February 18, 2015 and the draft plan update was reviewed at subsequent Planning Team meetings.

3.2 Hazard Mitigation Planning Team

Table 3-1 lists the 2015 HMP Update Planning Team.

Table 3-1 Planning Team Members

Team Member	Title	Involvement
Phillip A. Zavadil	Director for Department of Community Safety and Peace	Team Leader, plan review and assistance with data gathering
Nick Hunnicutt	Director of Public Safety	Initial HMP development Team Leader, plan review and assistance with data gathering
Bill Mathews	City Manager	Plan review
Richard Warren	Firefighter/Tribal	Plan review
Membership	Local Emergency Planning Committee	Plan review and assistance with data gathering
Scott Simmons	AECOM, Project Manager	HMP update project manager, lead writer, and HMP coordination.
Eileen Bechtol	BP&D/Community Planner	HMP update, initial project sub-contract planner

3.3 Public Involvement & Opportunity for Interested Parties to participate

AECOM extended an invitation to all individuals and entities identified on the project mailing list described the HMP update process and announced the upcoming communities' planning activities. The announcement was emailed to relevant academia, nonprofits, and local, state, and federal agencies on November 20, 2014. The following agencies were invited to participate and review the updated HMP:

- University of Alaska Fairbanks, Geophysical Institute, Alaska Earthquake Information Center (UAF/GI/AEIC)
- Alaska Native Tribal Health Consortium-Community Development (ANTHC)
- Alaska Volcano Observatory (AVO)
- Association of Village Council Presidents (AVCP)
- Denali Commission
- Alaska Department of Environmental Conservation (DEC)
- DEC Division of Spill Prevention and Response (DSPR)
- DEC Village Safe Water (VSW)
- Alaska Department of Transportation and Public Facilities (DOT&PF)
- Alaska Department of Community, Commerce, and Economic Development (DCCED)
- DCCED, Division of Community Advocacy (DCRA)
- Alaska Department of Military and Veterans Affairs (DMVA)
- DMVA – DHS&EM
- US Environmental Protection Agency (EPA)
- National Weather Service (NWS) Northern Region

- NWS Southeast Region
- NWS Southcentral Region
- Natural Resources Conservation Service (NRCS)
- US Department of Agriculture (USDA)
- USDA Division of Rural Development (RD)
- US Army Corps Of Engineers (USACE)
- US Bureau of Indian Affairs (BIA)
- US Bureau of Land Management (BLM)
- US Department of Housing and Urban Development (HUD)
- US Fish & Wildlife Service (USFWS)

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

Table 3-2 Public Involvement Mechanisms

Mechanism	Description
Agency Involvement eMail (November 20, 2014)	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.htm
Newsletter #1 Distribution (February 2015)	In February 2015, the jurisdiction distributed a newsletter introducing the upcoming planning activity. The newsletter encouraged the City to provide hazard and critical facility information. It was posted at City offices, bulletin boards, local stores, and on the City's website to enable the widest dissemination.
Public Meeting Notice (February 2015)	Notice of the February 18, 2015 Planning Team meeting was added to Newsletter #1.
Newsletter #2 Distribution (May 2015)	In May 2015, the jurisdiction distributed Newsletter #2 that described the availability of the HMP and presented potential HMP projects for review. The newsletter encouraged comments and input. It was posted at City offices, bulletin boards, local stores, and on the City's website to enable the widest dissemination.
Public Meeting Notice (August 2015)	Notice of the August 28, 2015 Planning Team meeting was added to Newsletter #2.

The newsletters were placed on the DSH&EM website and posted throughout the community. The Planning Team identified natural hazards: earthquake, flood, severe weather, and tsunami/seiche, which periodically impact the City. A few of the legacy HMP's hazards have been combined within broader categories to better reflect their impacts and relationships.

The risk assessment was completed after the community asset data was collected by the Planning Team during 2015, 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.

3.4 Review and Analysis of the Legacy 2008 HMP.

The Legacy 2008 HMP document was revised as described below.

Section 1. ***Introduction***: added entire new section explaining the plan process.

Section 2. ***Community Description***: updated and expanded community information, including new census and State data.

Section 3. ***Planning Process***: updated this section to reflect 2015 public process including newsletters, public meetings and 2015 Planning Team.

Section 4. ***Plan Adoption***: 2015 resolutions and dates.

Section 5. ***Hazard Profile Analysis***: reviewed hazard identification and risk assessment for earthquake, flooding, ground failure, tsunami and severe weather, adding 2008 to 2015 descriptions and data.

Section 6. ***Vulnerability Analysis***: added a new section to analyze vulnerability with 2015 critical facilities and infrastructure tables.

Section 7. ***Mitigation Strategy***: reviewed 2008 mitigation goals and actions and added new goals and action for the 2015 Mitigation Action Plan.

Section 8. ***References***: revised to reflect 2015 Update.

The Planning Team did not complete their designated annual HMP reviews or plan maintenance activities. Therefore it became a primary consideration o update the existing Legacy 2008 HMP to include all hazards that have, or could potentially have, impacted the community during the legacy HMP's 5-year lifecycle.

The 2015 HMP Update process included inviting new and existing stakeholders to review the existing HMP to determine what was accomplished versus what was intended to accomplish.

Pertinent section data are identified within Table 3-3, which provided the foundation for completing the 2015 HMP Update.

Table 3-3 HMP Review and Update Needs Determination

Legacy 2008 HMP Section	Legacy HMP Items to be Updated	Status: F: Fulfilled NF: Not Fulfilled	2015 HMP Identified items for Deletion	Newly Identified Items to be Added for HMP Compliance	New Action Commitment
Planning Process	Planning process • Planning team membership • Mitigation resource list • Public outreach initiatives • Plan Maintenance Activities • Plan Review Obligations	• NF: Did not meet or complete annual HMP review • NF: Adding Manmade/ Technological Hazards • NF: Continued Plan Development	• None	• Refine plan maintenance processes and responsibilities	• Planning Team will begin to hold annual review meetings and • Strive to integrate HMP initiatives into other plans, ordinances, and resolutions. • Planning Team will continue meetings and strive to integrate HMP initiatives into other plans,

Table 3-3 HMP Review and Update Needs Determination

Legacy 2008 HMP Section	Legacy HMP Items to be Updated	Status: F: Fulfilled NF: Not Fulfilled	2015 HMP Identified items for Deletion	Newly Identified Items to be Added for HMP Compliance	New Action Commitment
					ordinances, and resolutions.
Hazard Profile Update	• Update hazard profile and new event history • Profile newly identified hazard risks	• NF: Update hazard profile and new event history	• Mitigation projects that were completed, deleted, or combined due to similarity	• Identify new hazards • Develop new Mitigation Action Plan (MAP) • Update existing hazards' impacts	• Delineate new actions within the MAP
Risk Analysis and Vulnerability Assessment	• Asset inventory • Vulnerability analysis & summaries	• NF: Identify development and land use changes	• None	• Develop asset inventory • Determine infrastructure vulnerabilities • Determine residential structure vulnerabilities • Identify repetitive loss properties as appropriate	• Fill data gaps • Locate scientific information to augment these data. • Delineate climate change scenario future development analysis
Mitigation Strategy	• Determine existing mitigation actions status • Define mitigation action, implementation successes or barriers	• NF: Did not track project implementation process	• Delete completed, combined, or deleted actions • Implemented & non-relevant mitigation actions	• Identify existing 2008 mitigation plan actions' status • Identify new mitigation actions for newly identified hazard implementation • Develop community specific capability assessment(s)	• Annually review action's status and feasibility

3.5 Incorporation of Existing Plans and Other Relevant Information

During the planning process, the Planning Team reviewed and incorporated information from existing plans, studies, reports, and technical reports into the HMP.

Table 3-4 lists existing plans and other documents that were available regarding the City and were reviewed and used as references for the jurisdiction information and hazard profiles in the risk assessment of the HMP for the City.

Table 3-4 Existing Plans and Other Relevant Information

Existing Plans, Studies, Reports, Ordinances, Etc.	Contents Summary (How Will This Information Improve Mitigation Planning?)
Tribal Gov't of Saint Paul Island CEDS, 2002	Implementation of mitigation measures
University of Alaska, Fairbanks, and Alaska Earthquake Information Center	Spatial information for mitigation planning, reports, historical information.
USGS Earthquake Probability Mapping	Spatial information for mitigation planning.
West Coast and Alaska Tsunami Warning Center	Historical data and reports for mitigation measures.
Alaska All-Hazard Risk Mitigation Plan. Prepared by and for DHS&EM, October 2013	Mitigation measures development.
ATAQAN AKUN Community Plan, Prepared by the City of Saint Paul, March 1995	Goals and objectives and land use measures for incorporation in mitigation measures.
US Army Corps of Engineers (USACE), Alaska Baseline Erosion Assessment, 2009	US Army Corps of Engineers, Alaska Baseline Erosion Assessment, 2009
USACE, St. Paul Island, Alaska Erosion Assessment, 2009	Defined local erosion impacts
USACE, Storm-Induced Water Level Prediction Study for the Western Coast of Alaska	Provided general area impacts and future storm impacts

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

3.6 Plan Maintenance

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

The following three process steps are addressed in detail here:

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

3.6.1 Implementation into Existing Planning Mechanisms

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

DMA 2000 Requirements
Incorporation into Existing Planning Mechanisms §201.6(b)(3): Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.
1. REGULATION CHECKLIST
ELEMENT A Planning Process (Continued)
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information?
Source: FEMA, March 2015.

Once the HMP is community adopted and receives FEMA's final approval, each Planning Team Member ensures that the HMP, in particular each Mitigation Action Project, is incorporated into existing planning

mechanisms whenever possible. Each member of the Planning Team has responsibility to undertake the following activities.

- Conduct a review of the community-specific regulatory tools to assess the integration of the mitigation strategy. These regulatory tools are identified in the following capability assessment section
- Work with pertinent community departments to increase awareness of the HMP and provide assistance in integrating the mitigation strategy (including the Mitigation Action Plan) into relevant planning mechanisms. Implementation of these requirements may require updating or amending specific planning mechanisms

3.6.2 Continued Public Involvement

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

DMA 2000 Requirements
1. REGULATION CHECKLIST
Continued Public Involvement §201.6(c)(4)(iii): The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.
1. REGULATION CHECKLIST
ELEMENT A Planning Process (Continued)
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))
Source: FEMA, March 2015.

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

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

3.6.3 Monitoring, Reviewing, Evaluating, and Updating the HMP

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

DMA 2000 Requirements
Monitoring, Evaluating and Updating the Plan §201.6(c)(4)(i): The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.
1. REGULATION CHECKLIST
ELEMENT A. Planning Process (Continued)
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle?)
Source: FEMA, March 2015.

This section provides an explanation of how the City's Planning Team intends to organize their efforts to ensure that improvements and revisions to the HMP occur in a well-managed, efficient, and coordinated manner.

The following three process steps are addressed in detail here:

1. Review and revise the HMP to reflect development changes, project implementation progress, project priority changes, and resubmit
2. Resubmit HMP at the end of the plan's five year life cycle for State and FEMA review and approval
3. Continued mitigation initiative implementation

3.6.3.1 Monitoring the HMP

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

3.6.3.2 Reviewing the HMP

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

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

3.6.3.3 Evaluating the HMP

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

The Planning Team Leader will initiate the annual review two months prior to the scheduled planning meeting date to ensure that all data is assembled for discussion with the Planning Team. The findings from these reviews will be presented at the annual Planning Team Meeting. Each review, as shown on the Annual Review Worksheet, will include an evaluation of the following:

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

3.6.3.4 Updating the HMP

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

DMA 2000 Requirements
Reviewing, Evaluating, and Implementing the Plan §201.6(d)(3): A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit if for approval within 5 years in order to continue to be eligible for mitigation project grant funding.
1. REGULATION CHECKLIST
ELEMENT D. Planning Process (Continued) *Update activities not applicable to the plan version*
D1. Was the Plan revised to reflect changes in development? (Requirement §201.6(d)(3))
D2. Was the Plan revised to reflect progress in local mitigation effort? (Requirement §201.6(d)(3))
D3. Was the Plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))
Source: FEMA, March 2015.

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

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

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

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

  - Prepare a "new" MAP matrix for the City.
- Prepare a new updated HMP
- Submit the updated HMP to the DHS&EM and FEMA for review and approval

3.6.3.5 Formal State and FEMA HMP Review

Completed HMPs do not automatically qualify the City or Tribal Council for mitigation grant program eligibility until they have been reviewed and adopted by the City and Tribal councils and received State and FEMA final approval.

Upon completion, the City (or its contractor) will submit the updated HMP to the DHS&EM for initial review and preliminary approval. Once any corrections are made, DHS&EM will forward the HMP to FEMA for their review and conditional approval.

The City of Saint Paul and the Aleut Community of Saint Paul Island are represented in this HMP 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.

The Aleut Community of Saint Paul Island has participated with this HMP's development and it intends to follow and implement applicable tribal activities to qualify the Village Tribal Council for tribal grant opportunities. The Aleut Community of Saint Paul Island's Traditional Council supports 44 CFR 201 and assures compliance with all applicable Federal statutes and regulations.

The City and Aleut Community councils, with assistance from the City, State Hazard Mitigation Officer (SHMO), and the State Hazard Mitigation Advisory Committee (SHMAC), is responsible for monitoring, evaluating, and updating their portion of the Saint Paul Hazard Mitigation Plan in accordance with 44 CFR §201.7. Their respective councils will monitor the plan to evaluate progress and update the plan every five years, or within 90 days of a Presidential Declared Disaster (as required), to reflect changes in State or Federal law. The Hazard Mitigation Plan Annual Progress Report and Hazard Mitigation Plan Annual Evaluation Forms are plan review tools.

The City and Tribal councils, with assistance from the SHMO and FEMA to determine when significant changes warrant an update prior to the scheduled date.

Once the plan has fulfilled all FEMA criteria, the City and Aleut Community will pass an HMP Adoption Resolution and forward to the State and FEMA for final approval. FEMA's final approval assures the City is eligible for applying for appropriate mitigation grant program funding.

4. Plan Adoption

Section Four is included to fulfill the City HMP adoption requirements.

4.1 Adoption by Local Governing Bodies and Supporting Documentation

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

DMA 2000 Requirements
Local Plan Adoption §201.6(c)(5): [The plan shall include…] Documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County commissioner, Tribal Council). For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.
1. REGULATION CHECKLIST
ELEMENT E. Plan Adoption
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval?) (Requirement §201.6(c)(5))
Source: FEMA, March 2015.

The City of St. Paul and the Aleut Community of Saint Paul Island are represented in this HMP; they meet the requirements of Section 409 of the Stafford Act, Section 322 of DMA 2000, and 44 CFR §201.6(c)(5) and §201.7 respectively.

The St. Paul City Council adopted the HMP on , 2015 and submitted the final draft HMP to FEMA for formal approval.

The Aleut Community of Saint Paul Island's Tribal Council adopted the HMP on , 2015.

Scanned copies of their formal adoptions are included in Appendix C as they become available.

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5. Hazard Profile Analysis

Section Five profiles and analyzes the four hazards the Planning Team determined pose a great threat to the Saint Paul. These hazards are: earthquake, flood, severe weather, and tsunami/seiche.

5.1 Overview of a Hazard Analysis

A hazard analysis includes the identification, screening, and profiling of each hazard. Hazard identification is the process of recognizing the natural events that threaten an area. Natural hazards result from unexpected or uncontrollable natural events of sufficient magnitude. Human, 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.

5.2 Hazard Identification and Screening

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

DMA 2000 Requirements
Identifying Hazards §201.6(c)(2)(i): The risk assessment shall include a] description of the type, location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events. §201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.
1. REGULATION CHECKLIST
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods?
Source: FEMA, March 2015.

For the first step of the hazard analysis, the City's Planning Team reviewed the Legacy 2008 HMP February 14, 2015, which listed four hazards that could affect the City. They evaluated and screened the comprehensive list of potential hazards based on a range of factors, including prior knowledge or perception of their threat and the relative risk presented by each hazard, the ability

to mitigate the hazard, and the known or expected availability of information on the hazard (Table 5-1).

The Planning Team reviewed their internal Threat Vulnerability Assessment Worksheet and determined that seven natural hazards pose a threat to the City and the island: earthquake, flood, ground failure, severe weather, tsunami, and volcanic ash, and wildland "tundra" fire.

It is beyond the scope of this planning effort to address the LEPC led Planning Team's September 2015 identified manmade and technological hazards. They may make this a focus during this HMP's planning life cycle for inclusion in future HMP updates as funding becomes available.

Table 5-1 Hazard Identification and Screening

Hazard Type	Should It Be Profiled?	Explanation
Natural Hazards		
Earthquake	Yes	Periodic, unpredictable occurrences. The City area experienced no damage from the 11/2003 Denali EQ, but experienced minor shaking from the earthquake and its aftershocks, from the 1964 Good Friday Earthquake.
Flood (Riverine and/or coastal related floods and resultant erosion)	Yes	Snowmelt run-off and rainfall flooding occurs during spring thaw and the fall rainy season. Events occur from soil saturation. Several minor flood events cause damage. Severe damages occur from ground water flooding. The City experiences storm surge, coastal ice run-up, and coastal wind erosion along the shoreline and riverine erosion along the area's rivers, streams, and creek embankments from high water flow, riverine high water ice flows, wind, surface runoff, and boat traffic wakes.
Ground Failure (Avalanche, Landslide/Debris Flow, Permafrost, Subsidence)	Yes	Ground Failure is sporadic around the community. There are cliffs, bluffs, and other areas that are deteriorating from storm surge, wind, and wave impacts. The City hall is approximately 100 yards, with adjacent water tanks (1.2M gals) that are within 50 yards.
Severe Weather (Cold, Drought, Rain, Snow, Wind, etc.)	Yes	Severe weather impacts the City 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. Severe weather events cause fuel price increases and frozen pipes. Heavy snow loads potentially damage house roofs. Winds potentially remove or damage roofs and moved houses off their foundations.
Tsunami (Seiche)	Yes	Tsunamis pose a threat to portions of the City from local and/or distant events.
Volcano	Yes	Volcano-generated ash poses a transportation minor threat to the City.
Wildland/Tundra Fire	Yes	Tundra fire poses a minor threat to the City.
Manmade/Technological		
Manmade	No	Not within the scope of this planning effort and may be pursued as funding becomes available.
Technological	No	

5.3 Hazard Profile and Risk Assessment

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

DMA 2000 Requirements
Profiling Hazards Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
1. REGULATION CHECKLIST
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? (Requirement §201.6(c)(2)(i)) B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction?
Source: FEMA, March 2015.

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

- Nature (Type)
  - Potential climate change impacts are primarily discussed in the Severe Weather hazard profile but are also identified where deemed appropriate within each hazard profile.
- History (Previous Occurrences)
- Location
- Extent (to include magnitude and severity)
- Impact (Section 5 provides general impacts associated with each hazard. Section 6 provides detailed impacts to City's residents and critical facilities)
- Recurrence Probability

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

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

Estimating magnitude and severity are determined based on historic events using the criteria identified in the introductory narrative description of Section 5.3.

Table 5-2 Hazard Identification and Screening

Magnitude / Severity	Criteria
4 - Catastrophic	• Multiple deaths. • Complete shutdown of facilities for 30 or more days. • More than 50 percent of property is severely damaged.
3 - Critical	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least two weeks. • More than 25 percent of property is severely damaged.

2 - Limited	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than one week. • More than 10 percent of property is severely damaged.
1 - Negligible	• Less than 10 percent of property is severely damaged.

Similar to estimating magnitude and severity, probability is determined based on historic events, using the criteria identified above, to provide the likelihood of a future event (Table 5-3).

Table 5-3 Hazard Probability Criteria

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

The hazards profiled for the City are presented in the remainder of Section 5.3.

Note: *The hazard presentation order DOES NOT signify their importance or risk level.*

5.3.1 Earthquake

5.3.1.1 Nature

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

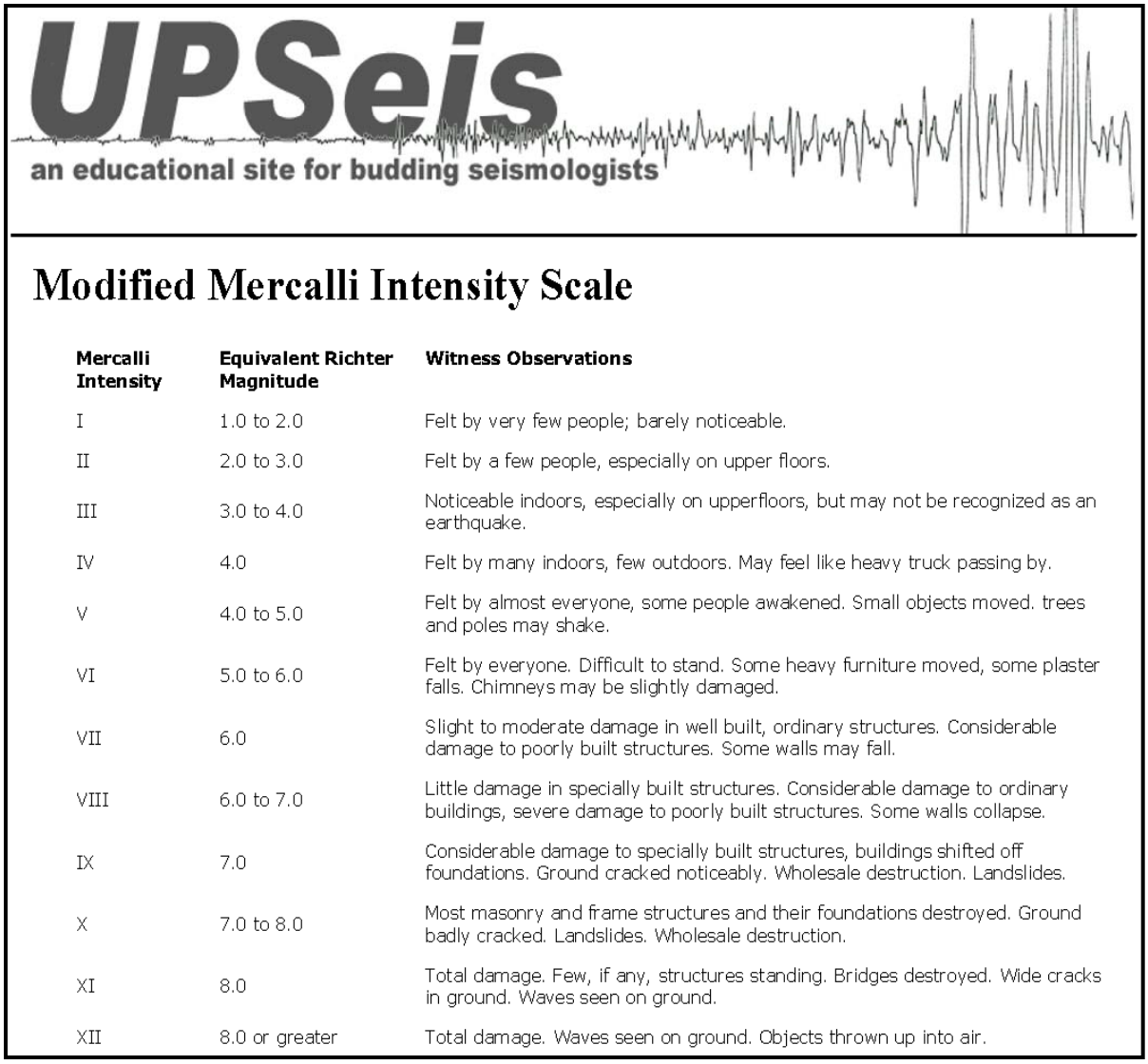
Ground motion generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. An earthquake causes waves in the earth's interior (i.e., seismic waves) and along the earth's surface (i.e., surface waves). Two kinds of seismic waves occur: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

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

- **Surface Faulting** is the differential movement of two sides of a fault at the earth's surface. Displacement along faults, both in terms of length and width, varies but can be significant (e.g., up to 20 feet [ft.]), as can the length of the surface rupture (e.g., up to 200 miles). Surface faulting can cause severe damage to linear structures, including railways, highways, pipelines, and tunnels.
- **Liquefaction** occurs when seismic waves pass through saturated granular soil, distorting its granular structure, and causing some of the empty spaces between granules to collapse. Pore water pressure may also increase sufficiently to cause the soil to behave like a fluid for a brief period and cause deformations. Liquefaction causes lateral spreads (horizontal movements of commonly 10 to 15 ft., but up to 100 ft.), flow failures (massive flows of soil, typically hundreds of ft., but up to 12 miles), and loss of bearing strength (soil deformations causing structures to settle or tip). Liquefaction can cause severe damage to property.
- **Landslides/Debris Flows** occur as a result of horizontal seismic inertia forces induced in the slopes by the ground shaking. The most common earthquake-induced landslides include shallow, disrupted landslides such as rock falls, rockslides, and soil slides. Debris flows are created when surface soil on steep slopes becomes totally saturated with water. Once the soil liquefies, it loses the ability to hold together and can flow downhill at very high speeds, taking vegetation and/or structures with it. Slide risks increase after an earthquake during a wet winter.

The severity of an earthquake can be expressed in terms of intensity and magnitude. Intensity is based on the damage and observed effects on people and the natural and built environment. It varies from place to place depending on the location with respect to the earthquake epicenter, which is the point on the earth's surface that is directly above where the earthquake occurred. The severity of intensity generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. The scale most often used in the U.S. to measure intensity is the Modified Mercalli Intensity (MMI) Scale. As shown in, the MMI Scale consists of 12 increasing levels of intensity that range from imperceptible to catastrophic destruction. Peak ground acceleration (PGA) is also used to measure earthquake intensity by quantifying how hard the earth shakes in a given location. PGA can be measured as acceleration due to gravity (g) (MMI 2015).

Magnitude (M) is the measure of the earthquake strength. It is related to the amount of seismic energy released at the earthquake's hypocenter, the actual location of the energy released inside the earth. It is based on the amplitude of the earthquake waves recorded on instruments, known as the Richter magnitude test scales, which have a common calibration (see Figure 5-1).



Modified Mercalli Intensity Scale

Mercalli Intensity	Equivalent Richter Magnitude	Witness Observations
I	1.0 to 2.0	Felt by very few people; barely noticeable.
II	2.0 to 3.0	Felt by a few people, especially on upper floors.
III	3.0 to 4.0	Noticeable indoors, especially on upperfloors, but may not be recognized as an earthquake.
IV	4.0	Felt by many indoors, few outdoors. May feel like heavy truck passing by.
V	4.0 to 5.0	Felt by almost everyone, some people awakened. Small objects moved. trees and poles may shake.
VI	5.0 to 6.0	Felt by everyone. Difficult to stand. Some heavy furniture moved, some plaster falls. Chimneys may be slightly damaged.
VII	6.0	Slight to moderate damage in well built, ordinary structures. Considerable damage to poorly built structures. Some walls may fall.
VIII	6.0 to 7.0	Little damage in specially built structures. Considerable damage to ordinary buildings, severe damage to poorly built structures. Some walls collapse.
IX	7.0	Considerable damage to specially built structures, buildings shifted off foundations. Ground cracked noticeably. Wholesale destruction. Landslides.
X	7.0 to 8.0	Most masonry and frame structures and their foundations destroyed. Ground badly cracked. Landslides. Wholesale destruction.
XI	8.0	Total damage. Few, if any, structures standing. Bridges destroyed. Wide cracks in ground. Waves seen on ground.
XII	8.0 or greater	Total damage. Waves seen on ground. Objects thrown up into air.

Figure 5-1 Modified Mercalli Intensity (MMI 2015)

5.3.1.2 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 HMP's Alaska earthquake data is based on best available data; obtained from the 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; none of which exceeded M4.8 located within 100 miles of the City.

Therefore the Planning Team determined that based on available recorded data, the City of Saint George has a moderate concern for earthquake damages as they have not yet 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 5-4 which lists 19 historical earthquakes with the largest one (M4.8) occurring on June 10, 2013.

Table 5-4 Historical Earthquakes for St George

Date	Latitude	Longitude	Depth	Magnitude	Location
4/26/2014	55.9874	-169.3483	18.41	3	142km SSE of City of Saint Paul, Alaska
6/10/2013	56.7577	-167.2018	25.1	3.5	190km ESE of City of Saint Paul, Alaska
6/10/2013	56.403	-167.828	40.3	4.8	170km ESE of City of Saint Paul, Alaska
9/1/2012	56.562	-168.223	25	3.2	Pribilof Islands, Alaska region
6/12/2012	56.506	-168.326	10	4.4	Pribilof Islands, Alaska region
3/29/2012	56.708	-169.616	25.7	3.5	Pribilof Islands, Alaska region
10/17/2011	56.334	-167.808	12.9	4.5	Pribilof Islands, Alaska region
9/1/2010	56.554	-170.835	27.1	3.2	Pribilof Islands, Alaska region
8/23/2010	56.201	-168.478	22.4	3.2	Pribilof Islands, Alaska region
7/13/2008	56.311	-168.324	19.4	3.6	Pribilof Islands, Alaska region
5/22/2008	56.257	-168.555	8.1	3.2	Pribilof Islands, Alaska region
5/26/2007	56.343	-167.394	6.6	3.5	Pribilof Islands, Alaska region
6/13/2004	56.275	-170.554	17.2	3.2	Pribilof Islands, Alaska region
6/13/2004	56.284	-170.443	16.4	3.2	Pribilof Islands, Alaska region
1/23/2002	56.724	-169.106	21.7	4.3	Pribilof Islands, Alaska region
7/4/1997	56.559	-168.157	33	4.2	Pribilof Islands, Alaska region
1/5/1989	56.302	-167.94	33	4.3	Pribilof Islands, Alaska region
6/26/1978	57.615	-169.925	33	4.2	Pribilof Islands, Alaska region
3/27/1977	57.571	-169.94	33	4.2	Pribilof Islands, Alaska region

(USGS 2014)

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. Saint Paul experienced minimal ground motion from this historic event. Planning Team members further stated they believe the Island has a very minor earthquake threat based on their limited historical activity.

5.3.1.3 Location, Extent, Impact, and Recurrence Probability

Location

An earthquake hazard event could potentially impact any part of Saint Paul Island. Earthquake damage would be area-wide with potential damage to critical infrastructure up to and including the complete abandonment of key facilities. Limited building damage assessors are available in the City to determine structural integrity following earthquake damage. Priority would have to be given critical infrastructure to include: public safety facilities, health care facilities, shelters and potential shelters, and finally public utilities.

Figure 5-2, prepared by the Alaska Earthquake Information Center (AEIC), shows Alaska's regional earthquakes, active faults, and rupture zones.

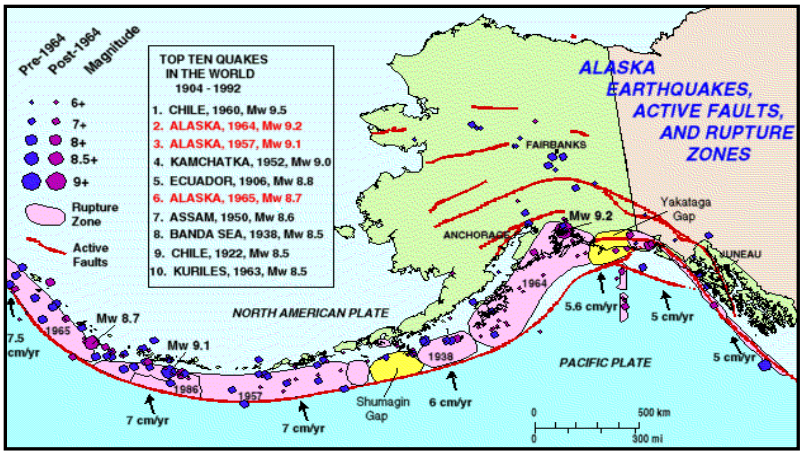


Figure 5-2 Historical Earthquakes (AEIC 2015)

Figure 5-3 depicts UAF Geophysical Institute's listed historical earthquakes in Alaska.

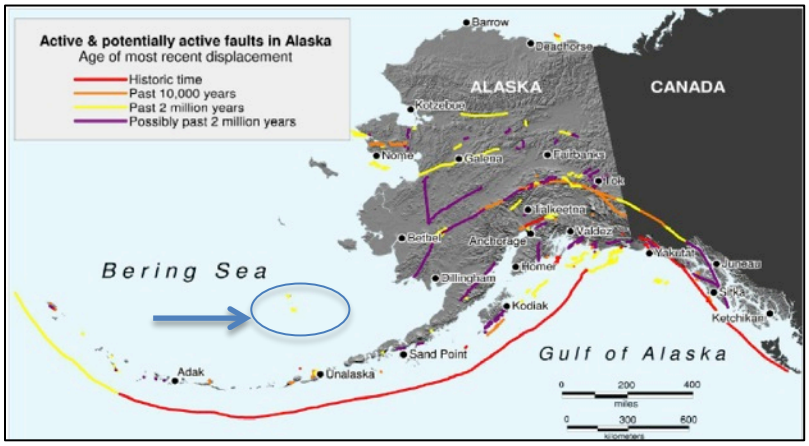


Figure 5-3 Historical Earthquakes in Alaska (AEIC 2015)

Figure 5-4 depicts The Division of Geological and Geophysical Survey identified earthquake faults within close proximity (50 to 80 miles) of Saint Paul.

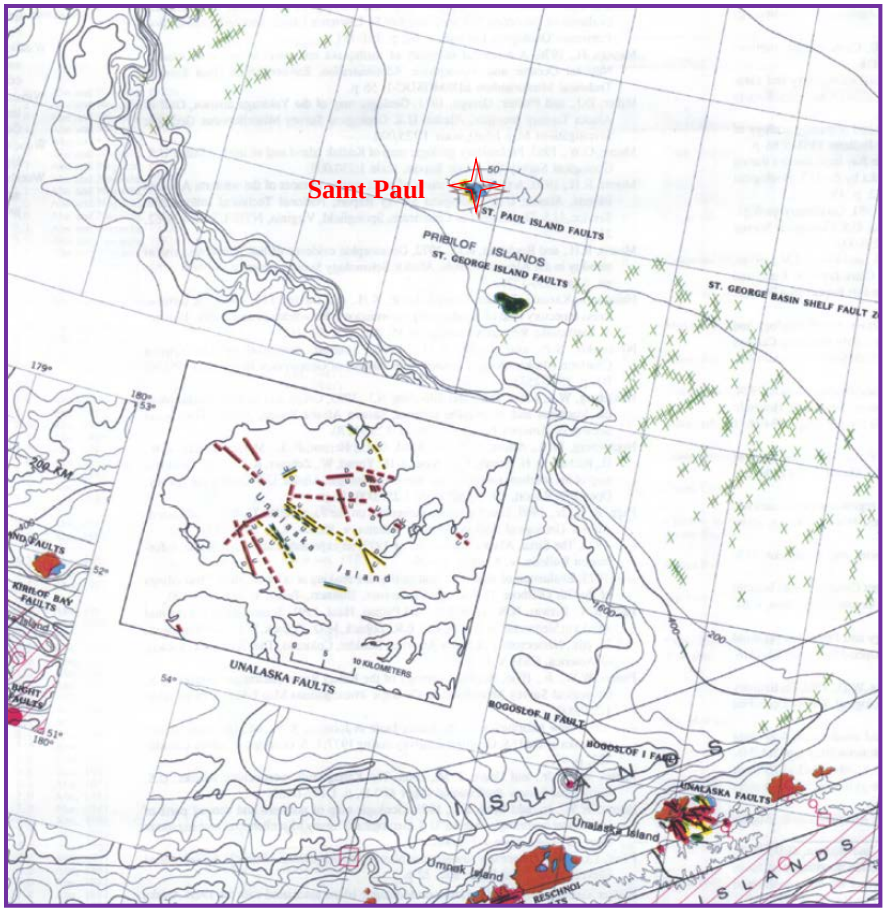


Figure 5-4 Neotectonic Map of Alaska-Cropped-St. Paul (DGGS 1994a)

The 1988 St. George Comprehensive Plan provides a description of Saint Paul's Island neighbor's relative fault proximity:

> "*Today, the Island lies well north of the violent earthquake and volcanic zone known as the Aleutian Arc. Volcanoes are extinct, seismic activity is minimal and there are no recorded tsunamis…*
>
> *Major fault escarpments form large topographic breaks at the northwestern end of the Island along Esogemunga escarpment and through the west central part of the Island extending from South Hill, north of Ulakaia and Sealion Hills, to Tolstoi Point. Lower escarpments north of Ulakaia Fault and in the vicinity of the village have also been mapped as fault traces." (DCRA 2014).*

Extent

The average distance of the Saint Paul's recorded earthquakes ranged from 50 to 200 miles distant.

Based on Saint Paul's location on the Continental Shelf, historic earthquake events, and the criteria identified in Table 5-2, the magnitude and severity of earthquake impacts in the Saint Paul area are considered "Critical" 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 is severely damaged.

Figure 5-6 depicts Alaska regional seismicity with Figure 5-7 displaying historical Aleutian Chain specific earthquake locations.

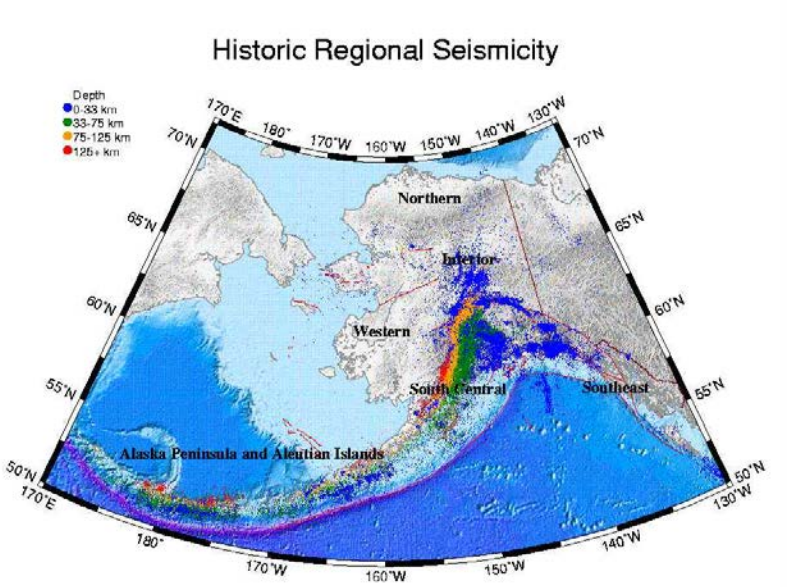


Figure 5-5 AEIS Historic Regional Seismicity (AEIC 2015)

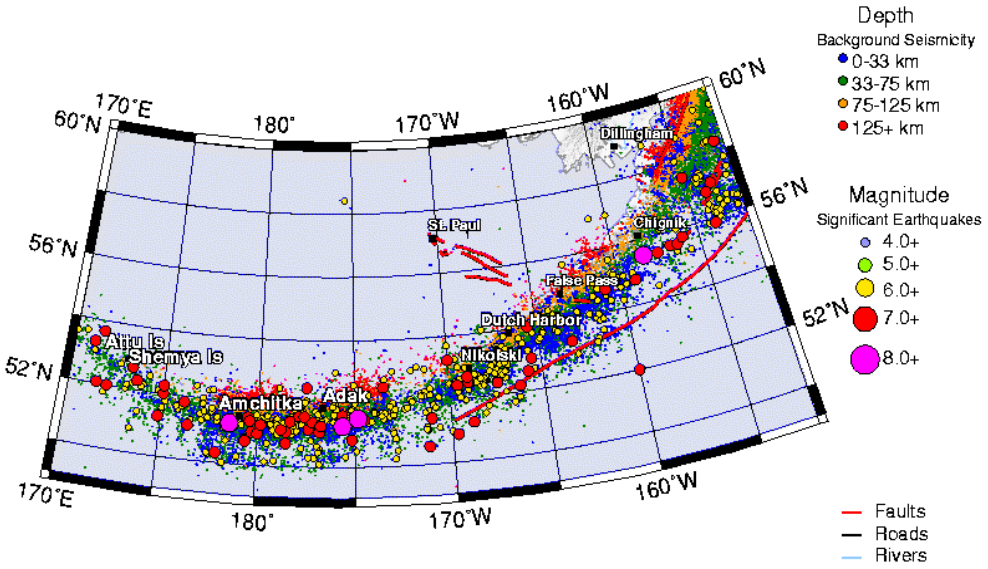


Figure 5-6 Aleutian Islands and Alaska Peninsula Seismicity (AEIC 2015)

Impact

The impact on the community of Saint Paul of a severe earthquake could be extensive. Depending on the location of underground lava tubes, not currently mapped, an earthquake could cause damage or destruction of critical facilities. Portions of the community could be cut off from critical facilities and infrastructure and services could be disrupted for an extended period.

Earthquake damage would be area-wide with potential damage to critical infrastructure up to and including the complete abandonment of key facilities. Limited building damage assessors are available in Saint Paul to determine structures integrity following earthquake damage. Priority

would have to be given critical infrastructure to include: public safety facilities, health care facilities, shelters and potential shelters, and finally public utilities.

Recurrence Probability

The SOA All-Hazards Mitigation Plan designates Saint Paul as in a Zone 5 of potential earthquake danger (on a scale of 0-10 being the lowest and 31-100 the highest). Saint Paul is considered an area of low seismic probability.

While it is not possible to predict an earthquake, the USGS has developed Earthquake Probability Maps that use the most recent earthquake rate and probability models. These models are derived from earthquake rate, location and magnitude data from the USGS National Seismic Hazard Mapping Project.

Figure 5-7 indicates that the USGS earthquake probability model places the City's earthquake occurrence probability with an intensity of 5.0 or greater occurring within the next 100 years within 50 kilometers (32 miles) of Saint Paul is 12 to 15 percent.

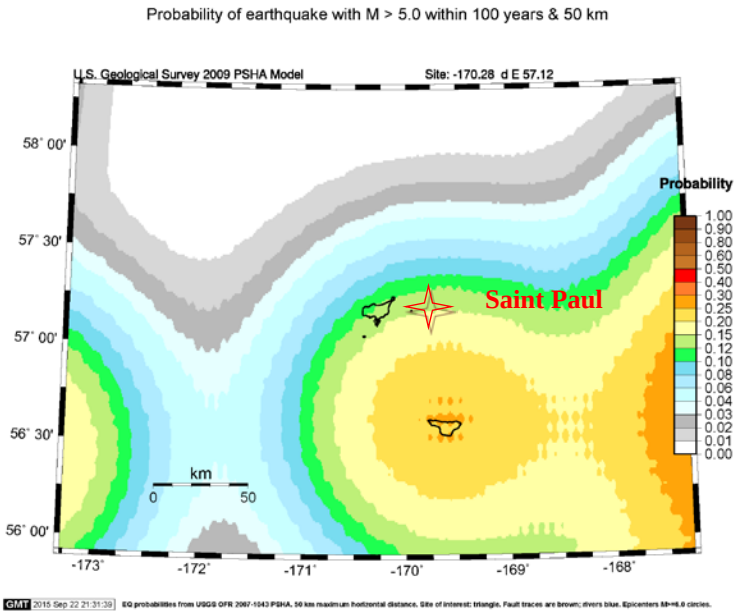


Figure 5-7 USGS Saint Paul Earthquake Probability Map (USGS 2015)

Therefore according to USGS estimates portrayed in Figure 5-7, criteria established in Table 5-3 and the history of earthquakes in the Saint Paul area an earthquake event is "Possible" within the next five years, an event has up to 1 in 5 year's chance of occurring (1/5=20 percent). History of events is greater than 10 percent but less than or equal to 20 percent likely per year. Event could "Possibly" occur.

5.3.2 Flood

5.3.2.1 Nature

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

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

The primary flooding and erosion hazard in the Saint Paul is storm surge flooding. Saint Paul is located on the coast and therefore susceptible to significant storm surge flooding. The effects of climate change are expected to add to natural hazards including flooding in coastal areas. As sea level rises and the offshore ice pack retreats, more coastal flooding can be expected.

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

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

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

Coastal Scour (used interchangeably with erosion) rarely causes death or injury. However, erosive scour 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 Saint Paul's infrastructure, built environment, and utilities adjacent embankments and shorelines.

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.

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. Further information on coastal erosion can be found in Coastal Construction Manual (FEMA 2011a), FEMA's Multi-hazard Identification and Risk Assessment (FEMA 1997), Evaluation of Erosion Hazards published by The Heinz Center (Heinze 2000), and Coastal Erosion Mapping and Management, a special edition of the Journal of Coastal Research. (FEMA 2002)

5.3.2.2 History

The USACE Floodplain manager's October 2011 Saint Paul report states<

> *"December 1966 was the flood of record. Floodwaters reached the foundation of Harold Thayers' house next to the current Assembly of God Parsonage" (USACE 2011).*

The DHS&EM Disaster Cost Index delineates historical flood events affecting the City (2015).

> *"**12-236 2011 West Coast Storm declared by Governor Parnell on December 5, 2011 then FEMA declared December 22, 2011 (DR-4050).** On November 7, 2011 the National Weather Service (NWS) issued the first of several coastal flood warnings for the western coastline of Alaska from Hooper Bay to the North Slope. The NWS warned of "a rapidly intensifying storm…expected to be an extremely powerful and dangerous storm…one of the worst on record." Over the next three days additional warnings in response to the 942 millibar low pressure system were issued for coastal villages as the storm moved northerly from the Aleutian Islands into the Bering and Chukchi Seas. The west coast was impacted with hurricane force winds exceeding 85 mph, high tidal ranges, and strong sea surges up to 10-ft above mean sea level (msl). Before the first storm had passed, a second equally-low pressure system (e.g., 942 millibar) impacted the western coastline from the Yukon-Kuskokwim Delta south to Bristol Bay. This combined weather extended the incident period for the state to November 13, 2011. The FEMA declaration was limited to the incident period from November 8 – 10, 2011" (DHS&EM 2014).*

The USACE, Alaska Baseline Erosion Assessment, Erosion Information Paper – Saint Paul, Alaska, October 2007 classified the Island's erosion threat as "Minimal."

> *"**Description of Erosion Problem***
>
> *The community survey reports that Saint Paul is periodically eroded by high tides, storm surges, wind, and waves. The city identified 2 areas impacted by coastal erosion. The area of greatest concern is 1 of their 2 cemeteries. The cemetery is in the southeast area of the community, along a 20-to-40-foot-high bluff. As the toe of the bluff erodes in this area, the upland portion slides and drops to the beach.*
>
> *The other erosion area identified by the community is along the Northeast Point Road, about 12 miles northeast of the presently-developed area of the community. Access to the location is along Northeast Point Road.*
>
> *In the community survey the city did not identify any major erosion events, but estimated the rate of erosion at 2.5 feet per year" (USACE 2007).*

The City of Saint Paul prepared a Memorandum explaining their most recent flooding damages extending from December 2015 to January 2016. The following is an excerpt from the Memorandum:

> *"I am writing this memorandum to document the events that led up to the localized flooding in the town pond on St. Paul Island, Alaska, as well as the actions taken in response to the flooding.*
>
> *On December 13-14, 2015 we experienced a storm from the southeasterly direction with gusts up to 54 knots per hour (see attached St. Paul Island National Weather Service data). This storm was of enough intensity that sea water breached the rocky shoreline on the east side of the island south of East Landing area bringing a large amount of water across the road into the town pond (Figures 1, 2, 3). Additionally, there were significant observed water levels from the Village Cove tidal gauge (see attached NOAA Observed Water Levels chart)*
>
> *On December 19, 2015 we experienced a storm from the southwesterly/westerly direction with gusts up to 54 knots per hour (see attached St. Paul Island National Weather Service data).*
>
> *On January 06-07, 2016 we experienced a storm from the southeasterly direction with gusts up to 56 knots per hour (see attached St. Paul Island National Weather Service data). This storm was of enough intensity that sea water breached the rocky shoreline once again bringing a large amount of water across the road into the town pond (Figures 4, 5, 6). The wave heights during this storm were 27 feet (see attached National Weather Service 24-Hour Wind & Wave Forcast for this storm).*
>
> *In all three storm incidents there were significant observed water levels from the Village Cove tidal gauge (see attached NOAA Observed Water Levels chart)" (Memo 2016)*

The Hans Hanner National Weather Service Meteorological Technician, WSO St. Paul, AK provided data from a 1966 Saint Paul WSO report which best describes the December 18th and 19th winter storm conditions that resulted in their 2015 flooding event (Figure 5-8).

> *"This form is from 1966 Climatic report, and should give you a good idea of what occurred. On the 18th and 19th there were winds from 120° at 46 and 45 mph max. A couple days after that, we see a sudden drop in temperature (as well as pressure), so that would indicate a front passed over on the 19th, with very similar fashion to our last [D]ecember…*
>
> *R/S*
>
> *Hans*

LOCAL CLIMATOLOGICAL DATA

U. S. DEPARTMENT OF COMMERCE -- JOHN T. CONNOR, Secretary

ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION -- ENVIRONMENTAL DATA SERVICE

ST. PAUL ISLAND, ALASKA
AIRPORT
DECEMBER 1966

Latitude 57° 09 'N Longitude 170° 13' W Elevation (ground) 22 ft. Standard time used: BERING

Date	Temperature (°F) Maximum	Minimum	Average	Departure from normal	Average dew point	Degree days (Base 65°)	Weather types shown by code 1-9 on dates of occurrence (1 Fog, 2 Heavy Fog, 3 Thunderstorm, 4 X, 5 Sleet, 6 Hail, 7 Glaze, 8 Duststorm, Sandstorm, Haze, 9 Blowing Snow)	Snow, Sleet, or Ice on ground at 07AM (In.)	Precipitation Total (Water equivalent) (In.)	Snow, sleet (In.)	Avg. station pressure (In.) - - - Elev. 28 feet m.s.l.	Wind Resultant direction	Resultant speed (m.p.h.)	Average speed (m.p.h.)	Fastest mile Speed (m.p.h.)	Fastest mile Direction	Sunshine Total (Hours and tenths)	Sunshine Percent of possible	Sky cover (Tenths) Sunrise to sunset	Sky cover (Tenths) Midnight to midnight	Date
1	35	25	30	1	25	35		T	0	0	30.85	05	19.7	20.0	28	06			5	5	1
2	37	21	29	0	26	36	2	T	0	0	30.66	31	3.5	8.2	14	30			1	2	2
3	35	31	33	5	29	32		T	0	0	30.51	01	8.2	8.9	13	04			10	10	3
4	32	28	30	2	29	35	1	T	T	0	30.38	04	8.0	8.6	14	05			7	7	4
5	35	25	30	2	29	35	1	T	T	0	30.11	12	7.5	9.8	16	08			8	6	5
6	36	32	34	7	31	31	1 6	0	T	0	29.92	15	7.9	8.2	12	14			10	9	6
7	38*	34	36	9	35	29	1 6	0	.13	0	29.68	12	16.2	16.4	25	11			10	10	7
8	34	27	31	4	23	34	1	T	T	T	29.62	09	26.7	27.7	31	08			10	10	8
9	32	21	27	0	21	38	1 6	T	.01	.2	29.55	06	31.5	31.9	38	05			10	10	9
10	36	19	28	1	22	37	2	T	.03	.4	29.48	05	20.8	23.3	32	04			10	10	10
11	35	21	28	2	28	37		1	T	T	29.44	13	10.4	12.4	17	12			8	6	11
12	29	15	22	-4	19	43		1	0	0	29.49	04	6.1	6.5	14	02			8	6	12
13	27	17	22	-4	17	43		1	T	T	29.51	35	12.8	13.1	21	34			10	8	13
14	27	21	24	-2	14	41		1	T	T	29.60	33	9.7	11.2	20	32			8	8	14
15	25	16	21	-5	12	44	9	1	.05	.5	29.24	05	31.5	32.9	40	04			9	9	15
16	24	14	19	-7	14	46	9	2	.05	.5	29.24	01	29.0	29.3	45	36			8	9	16
17	26	19	23	-3	14	42	9	2	.03	.3	29.68	32	16.6	17.1	29	35			7	6	17
18	34	20	27	1	22	38		2	T	T	29.58	14	24.8	27.9	46	12			10	9	18
19	35	31	33	7	28	32	1	2	T	T	29.24	12	36.0	36.7	45	12			10	10	19
20	32	24	28	2	18	37		1	0	0	29.65	03	24.8	27.5	33	02			4	5	20
21	25	16	21	-5	14	44		1	T	T	30.04	04	22.5	23.1	29	05			9	9	21
22	18	16	17	-9	11	48		1	T	T	29.71	06	27.0	27.2	32	05			10	10	22
23	27	15	21	-5	12	44	1	1	T	T	29.41	04	20.3	20.7	31	05			10	10	23
24	37	27	32	6	31	33	1	1	.08	.2	29.07	08	30.0	31.5	59	08			10	10	24
25	37	34	36	10	31	29	1	0	.25	.5	28.75	12	33.8	40.5	59	08			10	10	25
26	36	33	35	9	29	30		T	.09	.9	29.07	11	19.9	22.3	32	08			8	8	26
27	34	29	32	6	30	33	1	T	.04	.3	28.90	03	12.8	18.0	32	07			10	10	27
28	35	22	29	3	28	36	1	1	.06	.6	28.97	06	17.4	19.4	36	06			10	9	28
29	37	32	35	9	33	30	1	1	.15	.8	28.71	16	13.1	13.4	21	16			10	9	29
30	36	26	31	5	30	34	1	1	.05	.4	28.94	33	9.1	14.2	29	33			10	9	30
31	28	12*	20	-6	14	45		1	.03	.3	29.64	32	7.2	10.2	25	33			4	6	31
	Sum 994	Sum 723				Total 1151	Dep. -46	Temperature: Number of days	Total 1.05	Total 5.9	For the month: 29.57	07	12.0	19.9	59	08	Total for	%	Sum 264	Sum 255	
	Avg. 32.1	Avg. 23.3	Avg. 27.7	Dep. 1.3	Avg. 23	Season to date Total 4755	Dep. -23	Max. < 32° 13	Max. > 90°‡ 0	Min. < 32° 28	Min. < 0° 0	Dep. -0.78					Date: 25+	Possible month	8.5	Avg. 8.2	

* Extreme for the month. May be the last of more than one occurrence.
– Below zero temperatures or negative departure from normal.
T In columns 9, 10, and 11 and in the Hourly Precipitation table indicates an amount too small to measure.
X Heavy fog — visibility ¼ mile or less.

Greatest in 24 hours and dates		Greatest depth on ground of	
Precipitation	Snow, Sleet	snow, sleet or ice and date	
.25	25	1.0	28-29	2	19+

‡ ≥ 70° at Alaskan stations. + Also on an earlier date, or dates.

HOURLY PRECIPITATION (Liquid in Inches)

Date	A. M. Hour ending at 1	2	3	4	5	6	7	8	9	10	11	12	P. M. Hour ending at 1	2	3	4	5	6	7	8	9	10	11	12	Date
1																									1
2																									2
3									T	T			T	T											3
4																	T	T	T	T	T	T			4
5																									5
6	T	T	T	T	T																				6
7					T	T	T	.01	.01	.02	.02	.02	T	.02	T	T	.02	T	T	.01	T	T	T	T	7
8			T	T	T	T	T														T	T	T	T	8
9					T	T	T	T	T		T	T	T	T	T	T	T	T	T	.01	T	T	T	T	9
10	T	T	T	T	T	T	T	T	T	T	T	T	T	.01	T	T	T	T		.02				T	10
11	T				T	T								T	T	T									11
12																									12
13												T	T	T	T			T	T	T	T	T	T		13
14			T	T	T	T	T	T		T	T	T	T	T		T	T	T	T	T	T	T	T	T	14
15	T	T	T	T	T	T	T	T	T	T	T	T	T	T	.01	.01	.01	.01	T	T	T	.01	T	T	15
16	T	T	.01	.01	.01	T	T	T	T	T							T	T	T	T	.01	.01	T		16
17	T	T	T	T		T		T	T					.01	.01	T	T	.01	T						17
18														T	T			T	T	T	T			T	18
19	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T						19
20																									20
21															T	T	T	T	T	T	T	T	T	T	21
22	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	22
23	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	23
24	T	T	T		.03	.01	.02	.01	.01											T	T	T	T	T	24
25	T	T	T	T	T	.01	.02	.04	.06	.03	.03	.01		.04	T						.01			T	25
26	T						T	T	.03	.01								T	T	.01	.01	.02	.01	T	26
27	.01	T	T	T	T	T	T	T	T	T	T	.01	.01	.01	T	T	T	T	T	T	T	T	T	T	27
28	T	T								T	T		T	T	T	.01	.01	.01	T	.01	.01	.01	T		28
29				.03	T	.01	.01	.03	.01	T	T		T	T		T	T		T	T	.03	.03			29
30								T	T	T	.01	T	T	T	.01	.01	T	T	T	T	.01	.01	T	T	30
31	T	T	.01	T	T		T	T		.01	.01	T													31

Data in columns 6, 12, 13, 14, and 15 are based on 8 observations per day at 3-hour intervals. Wind directions are those from which the wind blows. Resultant wind is the vector sum of wind directions and speeds divided by the number of observations. Figures for directions are tens of degrees from true North; i.e., 09 = East, 18 = South, 27 = West, 36 = North, and 00 = Calm. When directions are in tens of degrees in Col. 17, entries in Col. 16 are fastest observed 1-minute speeds. If the / appears in Col. 17, speeds are gusts. Any errors detected will be corrected and changes in summary data will be annotated in the annual Summary if published.

AVERAGES BY HOURS

Hour (Local time)	Sky cover (In tenths)	Station press. (In.)	Dry bulb (°F)	Wet bulb (°F)	Rel. hum. %	Dew point (°F)	Wind speed (m.p.h.)	Resultant wind Direction	Resultant wind Speed (m.p.h.)
01	8	29.59	28	27	82	23	20.6	06	12.6
04	8	29.58	28	27	80	23	19.7	07	12.3
07	8	29.57	28	27	81	23	21.0	06	13.1
10	9	29.58	29	27	81	23	19.8	07	9.9
13	8	29.57	29	28	80	24	19.1	07	10.2
16	8	29.56	29	27	81	23	19.6	06	12.0
19	8	29.56	28	27	80	23	19.4	07	12.5
22	8	29.55	28	27	80	23	20.3	06	13.4

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I certify that this is an official publication of the Environmental Science Services Administration, and is compiled from records on file at the National Weather Records Center, Asheville, North Carolina. 28801.

Director, National Weather Records Center

USCOMM—ESSA—ASHEVILLE 150

(NWS 2015)

5.3.2.3 Location, Extent, Impact, and Recurrence Probability

Location

Historically, flooding in Saint Paul resulted from storm surges from the north wind-driven waves entering the harbor; being pushed across the low-lying central town and harbor area. The USACE constructed breakwaters in the harbor that have done much to mitigate this hazard. However, elevation and reinforcement of the roads along the harbor and on the East Landing side of the island will provide additional protection.

The flood event memorandum described associated emergency measures taken to protect critical infrastructure:

> *January 08. 2016*
>
> *The City, TDX, and TGSPI began assessing potential damage from the flooding to critical infrastructure (i.e. utilities such as electric, water, sewer, internet, cable television).*
>
> *The City installed a berm to prevent more water from entering the east side of East Landing road towards cemetery hill (Figure 7).*
>
> *The City dug a three foot wide, 250 foot long trench from the south end of the pond to the rocky bank on the north side of Gorbatch Bay (Figures 9-15)*
>
> **Note:** Figure 11 depicts their trenching effort… (Memo 2016)

The City does not participate in the NFIP and there is no community floodplain maps depicting their flood hazard areas.

Figure 11 - Photograph digging of trench to help drain water on January 8, 2016

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

Much of the community is built on uplands that are not in danger of flooding or erosion. However, their road system, playground, and utilities are impacted are among their infrastructure being impacted by water run-off flooding.

The City's 2016 flood memorandum provided additional photos of their most recent flood extent.

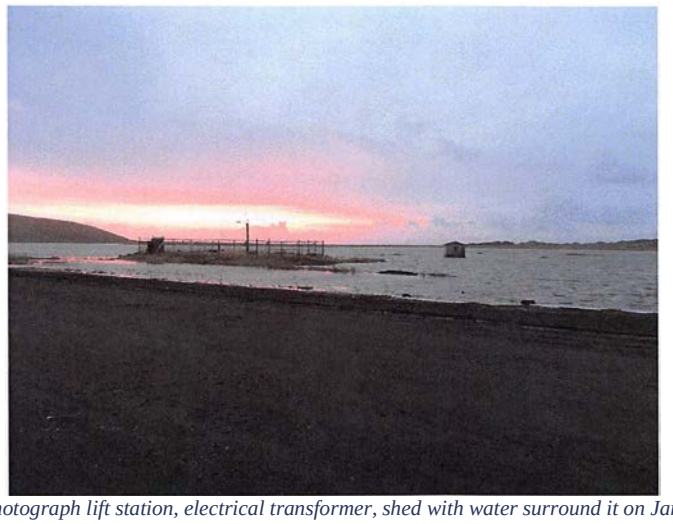

Figure 26 - Photograph lift station, electrical transformer, shed with water surround it on January 7, 2016

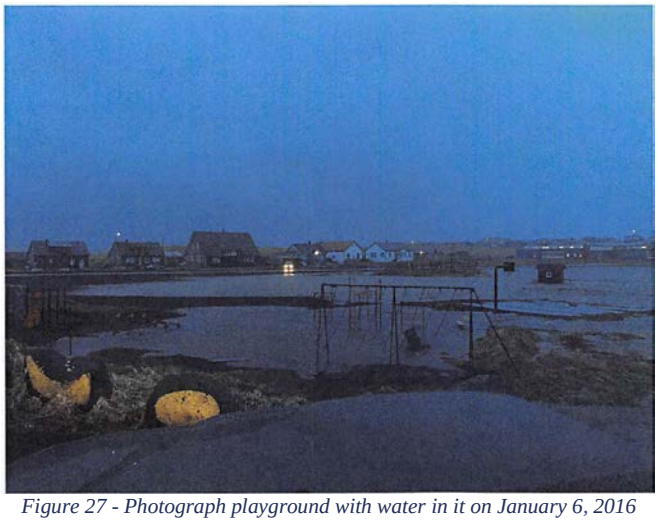

Figure 27 - Photograph playground with water in it on January 6, 2016

Figure 31 - Photograph of town pond from cemetery on January 11, 2016

Based on past limited high water flow event history and impacts and the criteria identified in Table 5-2, the flooding extent and resultant damages to infrastructure and their protective embankments in the St. Paul are considered "Limited" where critical facilities would shut-down for 24 hours or less with more than 10 percent of property being severely damaged.

The 2007 USACE Saint Paul Island Erosion Information Paper depicts its erosion extent (Figure 5-8):

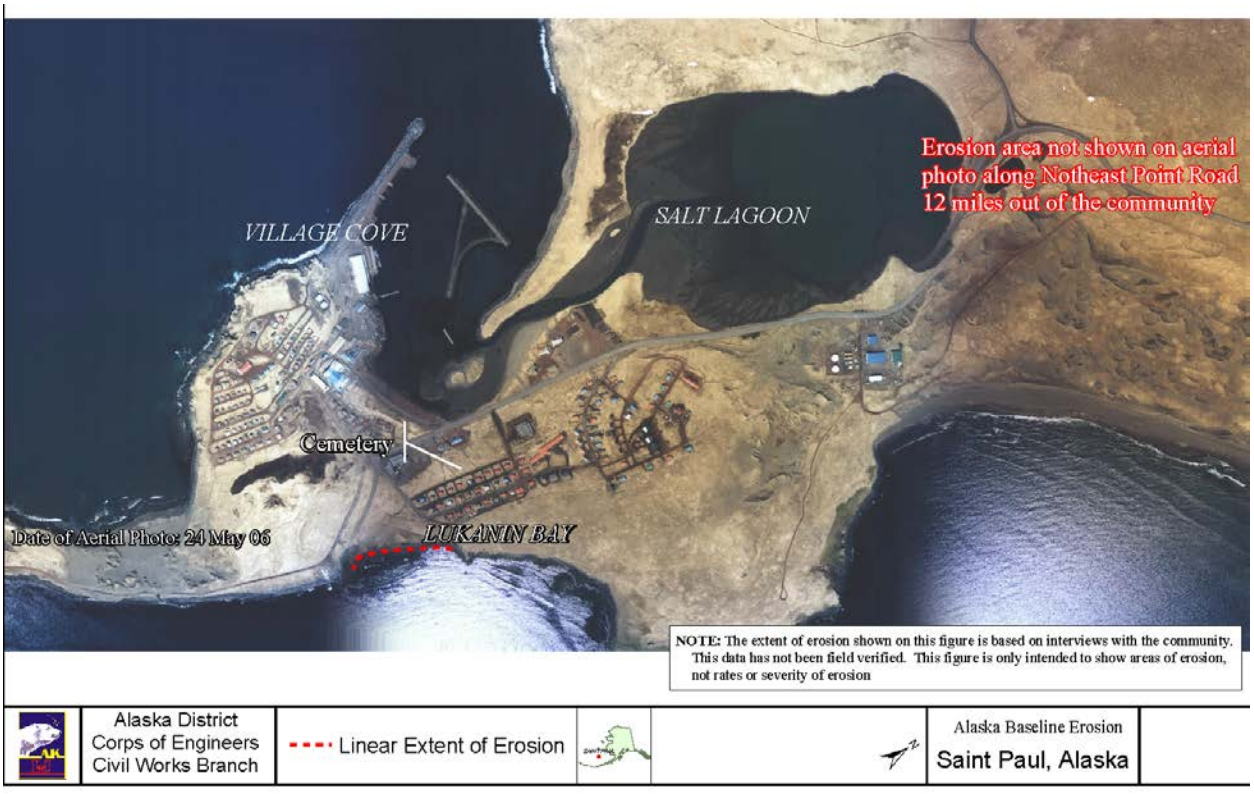

Figure 5-8 St. Paul Island Erosion extent (USACE 2007)

Impact

Flooding in the low-lying central portion of Saint Paul could prevent portions of the community from accessing critical services located on the other side. For example, the clinic and Public Works facilities are on one side of the community, while the store and Public Safety offices are on the other. There are residences located on both hillsides. Because of this, while the actual area subject to flooding is limited, the impact of the flooding could affect the entire community.

The USACE, Alaska Baseline Erosion Assessment, Erosion Information Paper – Saint Paul, Alaska, October 2007 described Saint Paul Island's impacts as:

> *"As the coastal erosion advances, the community cemetery in the southeast portion of the community could be lost or damaged. The community estimates that the southeast corner of the cemetery is less than 100 feet from the eroding bluff area. A section of Northeast Point Road is threatened by the advancing coastal erosion at Northeast Point. The community reported that the cemetery and road will likely have to be relocated. The only erosion protective measure used so far in the community is the posting of signs warning that the eroding bluffs are dangerous and off limits" (USACE 2007).*

Flooding events, even for those properties unaffected directly, will suffer due to road closures, impacts to public safety (access and response capabilities), limited availability of perishable commodities, and isolation.

Recurrence Probability

Based on the City records and past historical events, it is "Possible" Saint Paul could experience periodic flooding even though the community is partially protected by the USACE installed and maintained breakwaters. However, the City's outlying infrastructure is much more vulnerable to ground water flooding.

Therefore following Table 5-3 probability criteria, the Island's recurrence probability for experiencing flood impacts is best described as "Possible." Flooding is probable annually due to the nature of their terrain. Event has up to 1 in 1 year's (1/1=100 percent) chance of occurring with a history of greater than 33 percent likely per year.

5.3.3 Ground Failure

5.3.3.1 Nature

Ground failure describes gravitational soil movement. Soil movement influences can include rain, snow, and/or water saturation induced avalanches or landslides; as well as being influenced by seismic activity, melting permafrost, river or coastal embankment undercutting, or a combination of steep slope conditions.

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

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

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

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

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

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

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

Seasonal freezing can cause frost heaves and frost jacking. Frost heaves occur when ice forms in the ground and separates sediment pores, causing ground displacement. Frost jacking causes

unheated structures to move upwards. Permafrost is frozen ground in which a naturally occurring temperature below 32ºF has existed for two or more years. (DHS&EM 2013).

Indicators of a possible ground failure include:

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

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

5.3.3.2 History

There are few written records defining ground failure impacts. However, DGGS soil and geological studies indicate that nearly all of the Pribilof Islands were formed from volcanic activity. The islands are underlain by very dense volcanic materials, impervious to water absorption except through fissure formations. The following excerpt from the DGGS Investigation of Alaskan Volcanoes, Geology and Petrology of the Pribilof Islands, Alaska, 1956. GEOLOGICAL SURVE Y BULLETIN 1 028-F describes the Islands' geophysical characterics:

"By large fissure eruptions the Pribilof area was built up during the late Pleistocene. The area may have maintained a high average elevation in early Pleistocene. But, later a general foundering of the area, in combination with fissuring, faulting, and outpouring of lava, reduced the area to a low position, oscillating around sea level, where it remained during the subsequent volcanic history…

Sample 14. Apophysis of limburgite at the seashore (fig. 30) 1 mile south of Garden Cove, St . George Island. [Depicts D: sediment layers, E: Lava flow with incorporated sedimentary material…]

Lava flows of basaltic habit make up the bulk of the island. The flows are analogous to those found in St. Paul Island. Many· flows show the similar differences in vesiculation from top to bottom as those described on p. 104.

[Note: the 60 ft. lava flow thickness within this graphic.]

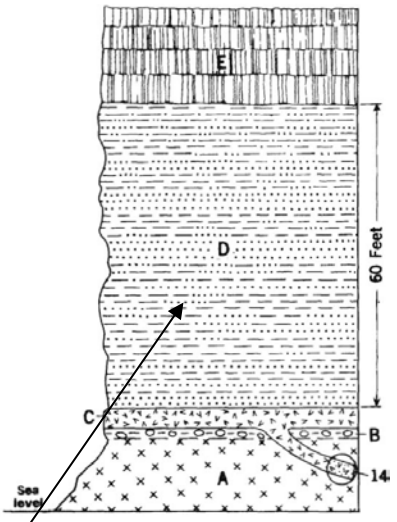

FIGURE 30.—Section at the seashore 1 mile south of Garden Cove, St. George Island. A, peridotite, B, thin layer of clay with boulders of peridotite; C, sill of hyalobasanite sending an apophysis down into the peridotite; at 14 the basanite has become limburgitic (analysis 14); D, sediments, 50 feet thick, consisting of clay, sand, and tuff with fragments of peridotite; crossbedding is conspicuous; E, lava flow with incorporated sedimentary material. At the top of this lava another series of sediment is deposited and again overridden by lava flows. Total height of the cliff is about 200 feet.

A remarkable sediment is deposited two-thirds of a mile south of Garden Cove, directly on the glaciated surface of the peridotite. Almost 1 mile consolidated, it is made up of well-rounded pebbles, ranging from 2 inches to 6 feet in diameter, inbedded in sand (Envio-glacial moraine?). Farther to the southwest, the moraine gives place o other types of sediment,: clay and sand, usually crossbedded. Southward, these sediments become very thick, and at intercalated with basaltic flows" (USGS 1956).

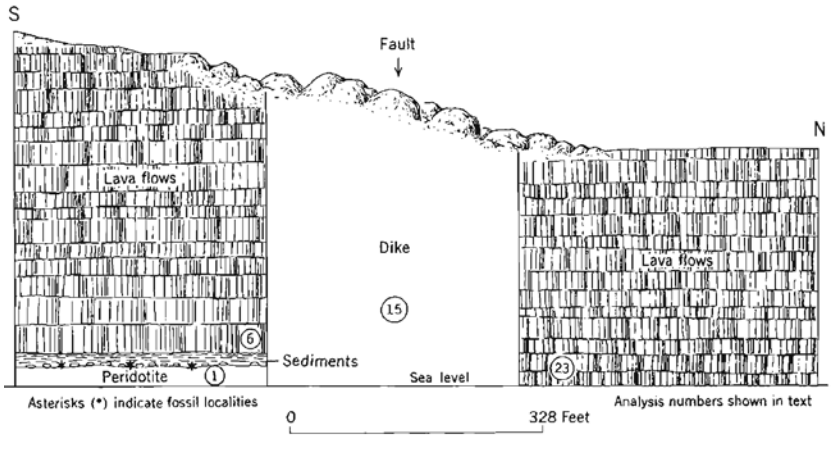

FIGURE 36.—Section about two-thirds of a mile south of Tolstoi Point, St. George Island. Numbers correspond to those of the analyzed rocks. No. 23 is described on page 115.

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

Location

There are various ground failure locations throughout Saint Paul Island. Potential resources for future data gathering include USACE, NRCS, USGS, as well as other agencies' developed plans and studies.

The Planning Team states that "land subsidence and ground water run-off due to the terrain's inability to absorb excess water are the most common ground failure impacts along with locations where cliff failure occurs from storm surge and wind erosion" (St. George 2016)

The DGGS's 1994 Analysis of an Aquifer Test at Saint Paul Island, Pribilof Islands, Alaska describes St. Paul Island's geological composition:

> *"The City of Saint Paul is located on the southwest tip of Saint Paul lsland of the Pribilof Islands in the Bering Sea off the southwest coast of mainland Alaska. Saint Paul lsland is approximately 16 miles long and 9 miles wide and has a maximum land surface elevation of about 665 ft above sea level. The bulk of the island is comprised of a series of gently dipping olivine-basalt lava flows and scoriacious volcanic debris of Late Pleistocene age (Barth, 1956). The thickness of individual lava flows generally ranges from a foot to several tens of feet. Surface topography of Saint Paul lsland exhibits volcanic features such as individual flow boundaries and volcanic cones in some areas. Volcanic rocks are discontinuously overlain by coastal dunes and marine deposits. Volcanic rocks are generally quite permeable as a result of fracturing of the volcanic rocks during transport and cooling. The scoriacious deposits are also highly permeable as a result of the coarse clast size. No integrated stream drainage network exists on the island. The high permeability of soils and rocks allow rapid infiltration of precipitation and snowmelt. Water resources of Saint Paul lsland are generally described by Feulner (1 980)."*
> (DGGS 1994).

Saint Paul specific geologic data can be obtained from the Montana State University (MSU) link located within Section 8, References.

The Planning Team stated that a few buildings are located within close proximity (within 100 yards) of the coast line embankment such as the City Hall. The cliffs located about 100 yards away experiences severe ground water soil saturation. During winter months, the water freezes, the soil expands and cracks. This condition weakens the soil's cohesiveness. The soil then separates as it thaws and topples away from the bluff edge.

According to the permafrost and ice conditions map (Figure 5-9) developed for the National Snow and Ice Data Center/World Data Center for Glaciology located in the State Hazard Mitigation Plan (SHMP) (DHS&EM 2010), The Pribilof Islands are located within the defined permafrost "Absent" zone. This zone is classified as having "zero percent" permafrost.

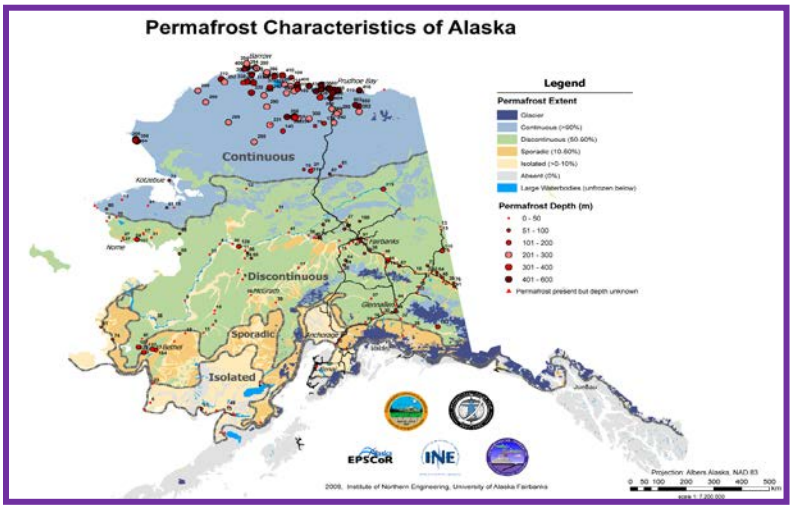

Figure 5-9 Permafrost and Ground Ice Map of Alaska (Jorgenson et al 2008)

Extent

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

Based on research and the Planning Team's knowledge of past ground failure and various degradation events and the criteria identified in Table 5-2, the extent of ground failure impacts in the City are considered "Negligible". Impacts would not occur quickly but over time with warning signs. Therefore this hazard would not likely cause "immediate" injuries or death, neither would it shutdown critical facilities and services for more than 24 hours with less than 10 percent of property is severely damaged as long as cliff failure or other ground failure events do not occur to threatening identified facilities.

Impact

Impacts associated with ground failure include surface subsidence, infrastructure, building, and/or road damage. Ground failure does not typically pose a sudden and catastrophic hazard. Ground failure damages occur from improperly designed and constructed buildings. It may also impact buildings, communities, pipelines, airfields, as well as road design costs and location. To avoid costly damage to these facilities, careful planning, location, and facility construction design is warranted.

Probability of Future Events

Even though there are few written records defining ground failure impacts for the City, the Planning Team has solid evidence of their annually recurring ground failure damages throughout the community – to structures, roads, and the airport from ground water saturation and subsequent subsidence. Water permeates the soil, freezes, the soil expands, and ultimately fails. This condition accelerates land mass separation on steep slopes.

The Planning Team stated the probability for ground failure follows the criteria in Table 5-3, the future damage probability resulting from ground failure is 'Possible' in the next ten years (event has up to 1 in 10 years chance of occurring) as the history of events is less than 10 percent likely per year.

5.3.4 Severe Weather

5.3.4.1 Nature

Severe weather occurs throughout Alaska with extremes experienced by the City which includes heavy and drifting snow, freezing rain/ice storm, extreme cold, and high winds. The City 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) influences 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 increased winter storm activity. Therefore, increased awareness and

understanding how ENSO events potentially impact Alaska's vastly differing regional weather patterns.

Climatic changes are 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 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's Climate, Ecosystems & Human 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 frequently over the coastal areas along the Bering Sea and the Gulf of Alaska. Heavy rain is a severe threat to the City**.**

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, overhead utility wires and support 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 -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. 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 or open ocean islands.

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.

The combination of heavy snowfall, high winds, and cold temperatures pose potential danger by causing prolonged power outages, automobile accidents and transportation delays, creating direct damage to buildings, pipes, roads, and walkways.

Figure 5-10 displays Alaska's annual rainfall map based on Parameter-elevation Regressions on Independent Slopes Model (PRISM) that combines climate data from NOAA and Natural Resources Conservation Service (NRCS) climate stations with a digital elevation model to generate annual, monthly, and event-based climatic element estimates such as precipitation and temperature.

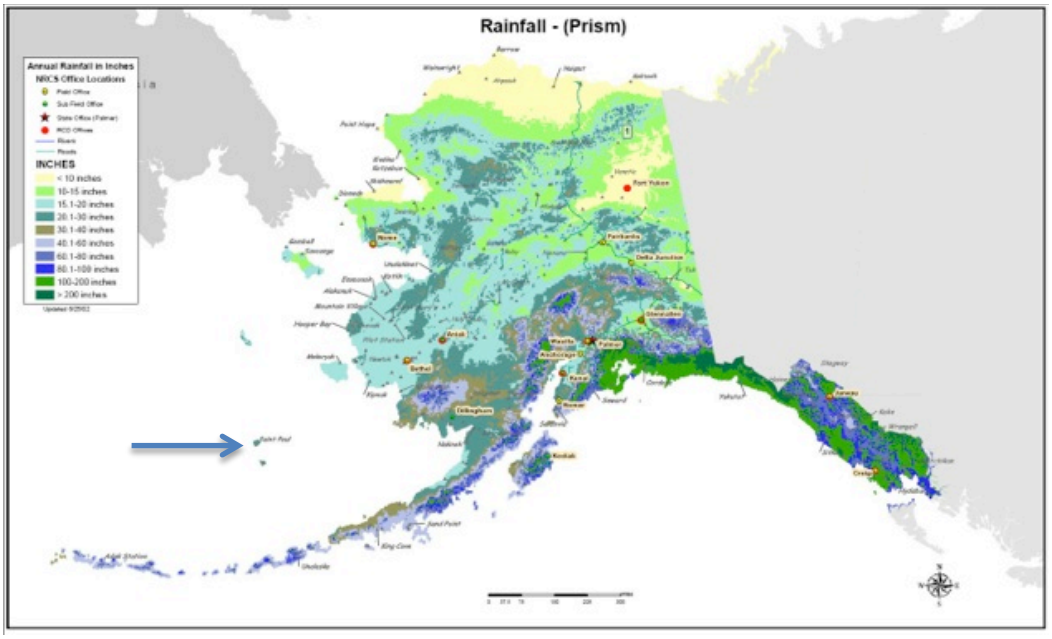

Figure 5-10 Statewide Rainfall Map (NRCS PRISM 2012)

5.3.4.2 History

The St. Paul is continually impacted by severe weather events. Hurricane force wind, storm surge, and cold occur throughout the year. The City of Saint George's 1988 Comprehensive Plan provides information that may be pertinent to Saint Paul Island:

> *"The St. George climate is typically maritime, resulting in considerable cloudiness, heavy fog, high humidity and restricted daily temperature ranges. Humidity remains uniformly high from May to late September, and during the summer there is almost continuous low cloudiness and occasional heavy fog. The differences between average maximum and minimum temperatures for the entire year are only slightly above 7' F, with the greatest monthly variation (March) slightly less than 12' F. Temperatures remain on the cool side even during the summer, with the highest recorded temperature 64' in August. Extreme highs in the summertime usually range around the mid-fifties. Record low readings fall well below zero; however, such extremely cold days are rather rare. on the average, there are only five days each winter season when temperatures fall below zero.*
>
> *Despite the prevalent humidity, precipitation on St. George is surprisingly light. The average annual precipitation is about 23 inches, slightly below the average for the State as a whole. Average annual snowfall is 57 inches. April is generally the driest month, with a gradual increase of precipitation until a mean monthly*

total of over three inches is reached in August to October, followed by a gradual decrease during the succeeding months until April.

St. George is characterized by windy periods throughout the year. Frequent storms occur from October to April, often accompanied by gale force winds producing general blizzard conditions. The average wind speed is 14 to 16 knots, with highs ranging from 50 to 60 knots" (DCRA 2014).

Climate Change. The University of Alaska Fairbanks (UAF) Arctic Climate Impact Assessment describes recent weather changes and how they impact Alaska:

*"**18.3.3.1. Changes in climate***

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…

18.3.3.4. Impacts on people's lives

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)

Figure 5-11 delineates Saint Paul Island's Weather Service Office's [WSO's]) weather data. This figure summarizes the Saint Paul Island precipitation and snowfall trends; providing a representation of the typical weather events which may have impacted the Islands.

ST PAUL ISLAND WSO AP, ALASKA

NCDC 1981-2010 Monthly Normals

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Max. Temperature (F)	29.1	28.5	29.3	33.4	40.4	46.8	50.8	52.1	49.6	42.8	36.9	33.0	39.4
Highest Mean Max. Temperature (F)													
Year Highest Occurred													
Lowest Mean Max. Temperature (F)													
Year Lowest Occurred													
Mean Temperature (F)	25.1	24.4	24.8	29.2	36.2	42.4	47.2	48.8	45.3	38.6	33.0	28.9	35.4
Highest Mean Temperature (F)													
Year Highest Occurred													
Lowest Mean Temperature (F)													
Year Lowest Occurred													
Mean Min. Temperature (F)	21.1	20.2	20.4	25.1	31.9	38.0	43.6	45.6	41.1	34.4	29.1	24.7	31.3
Highest Mean Min. Temperature (F)													
Year Highest Occurred													
Lowest Mean Min. Temperature (F)													
Year Lowest Occurred													
Mean Precipitation (in.)	1.58	1.30	1.07	1.08	1.13	1.35	1.85	3.07	2.99	3.11	2.89	2.25	23.67
Highest Precipitation (in.)													
Year Highest Occurred													
Lowest Precipitation (in.)													
Year Lowest Occurred													
Heating Degree Days (F)	1237.	1138.	1245.	1073.	894.	678.	552.	501.	590.	818.	960.	1121.	10806.
Cooling Degree Days (F)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

Figure 5-11 Saint Paul Island Weather Data (WRCC 2014)

DHS&EM's Disaster Cost Index records the following severe weather disaster events which may not have impacted Saint Paul but are listed due to their location:

> *"**6. West Coast Storm, November 23, 1979.** A major sea storm on the west coast of Alaska caused extensive damage in 14 villages in the area. The Governor proclaimed a Disaster Emergency effective from Sheldon Point [Nunam Iqua] to Togiak. At the request of the Governor, the SBA authorized disaster loans to affected individuals and businesses, and the State provided grants to individuals and families as well as some public assistance related to a fuel spill at Togiak.*
>
> ***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.*
>
> ***85. St. George, February 9, 1989.** A severe windstorm caused sinking of a landing barge used as a dock by the City of St. George. The incident resulted in a blockage of the port and a loss of the capability to off-load essential supplies. The Governor declared a disaster to provide State assistance in recovering the barge.*
>
> ***04-209 2003 Fall Sea Storm (AK-04-209) Declared January 29, 2004 by Governor Murkowski.** - A series of sea storms with high winds and tidal surge during the period of November 1 to November 24, 2003 caused damages in the communities of Unalakleet, Diomede, and Port Heiden. Damage was also reported by the Department of*

Transportation. The City of Unalakleet and Port Heiden declared local emergencies and Diomede requested assistance in a letter to the Division of Homeland Security and Emergency Management. The Department of Transportation reported damages in Nome on the Nome-Counsel Road (MP 22 and 23.8) and at the Unalakleet airport. The City of Unalakleet had a large quantity of debris deposited throughout the road system. Damages to a gabion protection wall, roads and exposure of a water line were also experienced. Port Heiden experienced tidal erosion that exposed two grave sites, a power line and endangered a road. The US Air Force, under the coordination of the Division of Homeland Security and Emergency Management, addressed the issue of the two grave sites. Disaster Assistance for Emergency Protective Measures and Permanent Work category C for the City of Port Heiden, the Department of Transportation and Unalakleet, category F for Port Heiden and debris removal for Unalakleet were approved under the State Public Assistance Program. No Federal Disaster Assistance was requested. No Hazard Mitigation was applicable. The total for this disaster is approximately $654K. This is for Public Assistance for 4 potential applicants with 5 PW's.

05-211 2004 Bering Strait Sea Storm declared October 28, 2004 by Governor Murkowski then FEMA declared (DR-1571) on November 15, 2004. Amended declaration to extend incident to October 24, 2004. *Between October 18 and 20, 2004, a* ***severe winter storm with strong winds and extreme tidal surges*** *occurred along the Western Alaska coastline, which resulted in severe damage and threat to life and property, specifically in the Bering Strait Regional Educational Attendance Area (REAA), including Elim, Nome, Koyuk, Shaktoolik, Unalakleet, and other communities; in the Northwest Artic Borough, including Kivalina, Kotzebue, and other communities; and in the City of Mekoryuk; with* ***potentially unidentified damages in adjacent areas, and additional storm surges likely from continuing weather patterns in this area****… Conditions that exist in the coastal communities of the Northwest Artic Borough as a result of this disaster: severe damage to roadways, power distribution systems, and drain fields. Conditions that exist in the coastal communities of the Bering Strait REAA as a result of this disaster: severe damage to gabions (used to protect shoreline), major damage to coastal highways and roads, damage to water and septic systems, damage to a bridge, damage to power distribution systems, damage to fuel storage tanks, fuel spills, and property damage. Conditions that exist in the City of Mekoryuk as a result of this disaster: major damage to sea wall and damage to roadways. On November 16, 2004, the declaration was amended to reflect a more accurate timeframe of the disaster. The City of St. George appealed the denial of funding decision for the breakwater. The appeal was granted, which increased the original estimate for total funding of this disaster by more than $3 million. The dates of the severe storm were changed to October 18 through October 24, 2004. Individual assistance totaled $1 million for 271 applicants. Public Assistance total $13 million for 60 potential applicants with 125 PW's. Hazard Mitigation totaled $800K. The total for this disaster is $17 million.*

The St. Paul area is historically impacted by severe weather events. The UAF's Scenarios Network for Alaska and Arctic Planning depict St. Paul's historic and future predicted precipitation and temperatures. (Figures 5-12 and 5-13) Note that both precipitation and temperature are projected to increase 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.

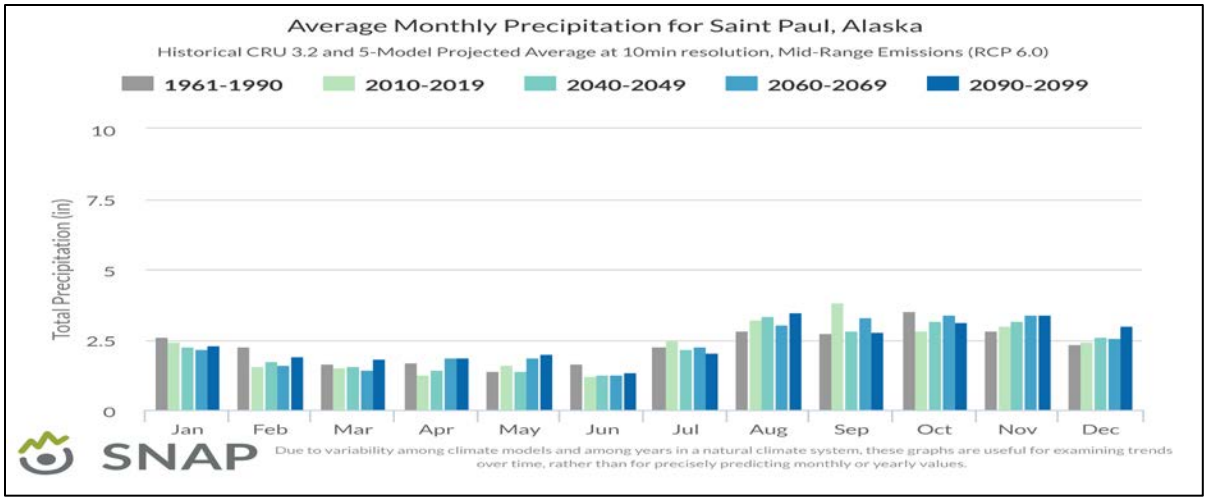

Figure 5-12 St. Paul's Historic and Predicted Precipitation (SNAP 2015)

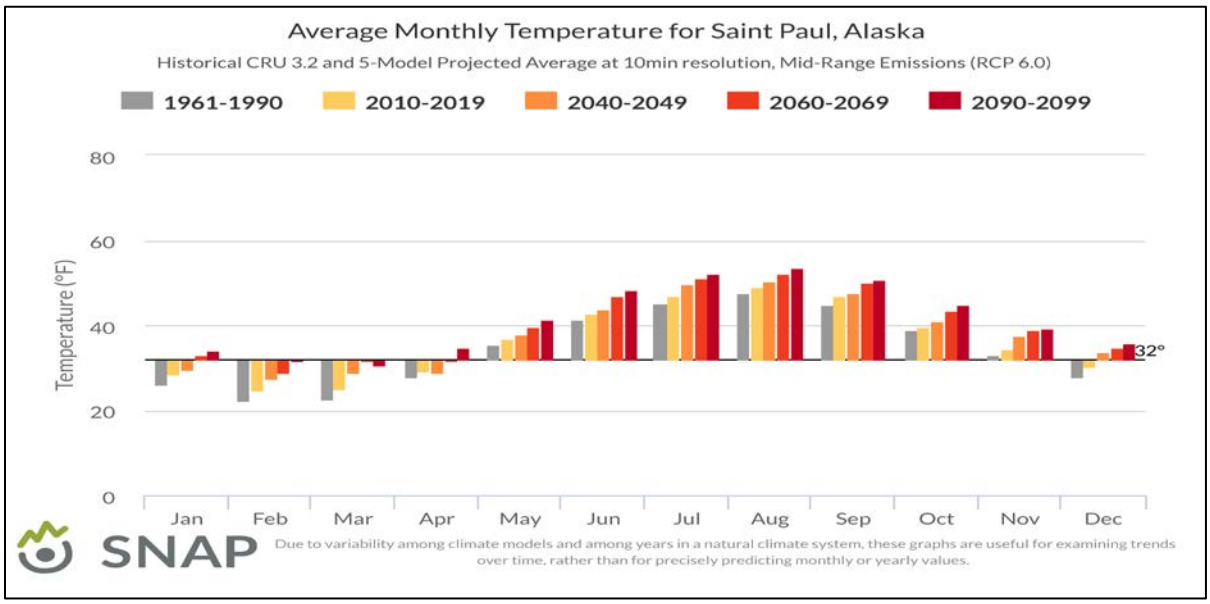

Figure 5-13 St. Paul's Historic and Predicted Temperatures (SNAP 2015)

Table 5-5 summarizes the Western Region Climate Center's weather summaries for the Saint Paul area. Data is inclusive from 1892-2015, including monthly temperature averages, and daily and monthly temperature extremes.

Table 5-5 Saint Paul Island Historical Weather Data

ST PAUL ISLAND AP, ALASKA (508118)													
Period of Record Monthly Climate Summary													
Period of Record : 09/01/1892 to 01/20/2015													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average Max. Temperature (F)	29.7	27.5	28.7	32.7	39.4	45.9	50	51.5	48.9	42.3	37	32.6	38.9
Average Min. Temperature (F)	21.6	18.8	19.4	24.2	31.3	37.4	42.7	44.8	40.7	34	29.2	24.4	30.7
Average Total Precipitation (in.)	1.74	1.28	1.17	1.17	1.17	1.29	2.01	3.05	2.82	3.01	2.71	2.05	23.48
Average Total Snow Fall (in.)	10.8	9.8	9.3	5.8	1.9	0.1	0	0	0	2.5	7.2	10	57.5
Average Snow Depth (in.)	4	6	7	6	1	0	0	0	0	0	1	2	2
Percent of possible observations for period of record.													
Max. Temp.: 99.6% Min. Temp.: 99.6% Precipitation: 99.6% Snowfall: 96.4% Snow Depth: 96.5%													
Check Station Metadata or Metadata graphics for more detail about data completeness.													

(WRCC 2015)

Table 5-6 provides a representative sample of the Saint Paul Island's major storm events the NWS identified for the Saint Paul Island WSO's Weather Zone. Each weather event may not have specifically impacted St. Paul.

These storm events are listed due to how close they are to a listed community or within the identified zone.

Table 5-6 Severe Weather Events

Location	Date	Type	Magnitude
Pribilof Islands (Zone)	3/26/2013	Blizzard	Widespread blizzard conditions across both St Paul and St George Island. The peak of this event on St Paul Island had ¼ mile visibility with winds gusting to 44 miles per hour (mph).
Pribilof Islands (Zone)	3/1/2013	Blizzard	Paul Island entered Blizzard conditions a little before midnight and peaked around 3 AM AKST when visibility continued to be ¼ mile in blowing snow driven by Easterly winds gusting to 45 mph.
Pribilof Islands (Zone)	2/22/2013	Blizzard	The most severe conditions for St Paul were at 10:53 PM February 22 when visibility was 1/4 mile in blowing snow driven by Northeast winds sustained at 39 and gusting to 47 mph. Neither the Village Public Safety Officer for St Paul or for St George reported any damage or injuries
Pribilof Islands (Zone)	2/6/2013	Blizzard	Visibility was 1/8 mile in heavy snow and blowing snow that was produced by Northeast winds that were 59 mph gusting to 72 mph
Pribilof Islands (Zone)	1/29/2012	Blizzard	Strong wind and spread snow across the central Aleutian Island to the Pribilof Islands
Pribilof Islands (Zone)	01/02/2010	Blizzard	Hurricane force gusts to 75 mph (86 knots [kts.]) were observed at Adak. This storm produced strong wind and snow in the Pribilof Islands resulting in a blizzard
Pribilof Islands (Zone)	3/2/2010	Blizzard	Strong wind and snow in the Pribilof Islands resulting in a blizzard
Pribilof Islands (Zone)	2/17/2009	Blizzard	Strong northeast wind and snow in advance of the front produced blizzard conditions in the Pribilof Islands and along the Bering Sea coast from Nunivak Island north
Pribilof Islands (Zone)	2/5/2008	Blizzard	Strong wind and snow across the Eastern Aleutians an Pribilof Island resulting in a blizzard
Pribilof Islands (Zone)	1/13/2008	Blizzard	Hurricane force wind blew through the Aleutian Islands.

Table 5-6 Severe Weather Events

Location	Date	Type	Magnitude
			Snow combined with the strong wind created blizzard conditions in the eastern Aleutians and Pribilof Islands
Pribilof Islands (Zone)	12/19/2007	Blizzard	Storm produced strong east wind, snow, and blizzard conditions across the Pribilof Islands
Pribilof Islands (Zone)	2/3/2006	Blizzard	Blizzard conditions in the Pribilof Islands
Pribilof Islands (Zone)	3/31/2005	Blizzard	Blizzard conditions in the Pribilof Islands
Alaska Peninsula (Zone)	11/2/2004	High Wind	87.5 mph (76 kts.)
Pribilof Islands (Zone)	1/27/2001	Blizzard	53 mph with visibilities briefly dropping to 1/4 mile in snow and blowing snow
Pribilof Islands (Zone)	12/12/2000	High Wind	60 mph (52 kts.)
Pribilof Islands (Zone)	11/20/2000	High Wind	74.8 mph (53 kts)
Pribilof Islands (Zone)	11/3/2000	High Wind	74.8 mph (65 kts)
Pribilof Islands (Zone)	11/12/1999	High Wind	85 mph (74 kts)
Pribilof Islands (Zone)	3/29/1999	High Wind	69 mph (60 kts)
Pribilof Islands (Zone)	11/27/1997	High Wind	Gusts between 55 – 69 mph (48 – 60 kts) were recorded both along the Aleutians and in the central Bering Sea

(NWS 2014, WRCC 2014)

The Saint Paul area may experience a relatively new weather phenomenon; "Waterspouts," that may become a future concern (See Section 3 Flood). Waterspouts are open ocean cyclonic winds, much like a land tornado. Waterspouts activity occurs sporadically off the coast; in the open ocean. These water laden winds look threatening. Residents should be alert to these events and keep watch to determine their potential to move inland where it would wreak havoc, damaging infrastructure and homes, as well as potentially injuring residents.

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

Location

The entire area, which includes St. Paul, experiences periodic severe weather impacts. The most common to the area are high winds and severe winter storms. Table 5-6 provided a representative sample of severe weather events that have impacted the area since 1996.

Extent

The entire Saint Paul Island is equally vulnerable to severe weather effects. The City experiences severe storm conditions with moderate snow depths; wind speeds exceeding 100 mph; and extreme low temperatures that reach -16ºF. The Planning Team states they may experience five days a year when they experience temperatures below zero degrees.

Based on past severe weather events and the criteria identified in Table 5-2, the extent of severe weather in the City are considered limited where injuries do not result in permanent disability, complete shutdown of critical facilities occurs for more than one week, and more than 10 percent of property is severely damaged.

Impact

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

The 1988 Comprehensive Development Plan describes potential impacts: "Heavy rain and snow characteristic of the Bering Sea climate cause serious drainage problems on St. Paul. Storm drainage systems must be installed in conjunction with roads through the industrial park to minimize maintenance costs and assure year-round access to the harbor area.

Probability of Future Events

Based on previous occurrences and the criteria identified in Table 5-3, it is likely a severe storm event will occur in the next calendar year; an event has up to 1 in 1 years (1/1=100%) chance of occurring as the history of events is greater than 33 % likely per year.

5.3.5 Tsunami

5.3.5.1 Nature

Tsunamis are ocean waves that are generally triggered by vertical motion of the sea floor during major earthquakes. Most seismically generated local tsunamis in Alaska have occurred along the Aleutian arc, which includes part of the Pribilof Islands.

The Alaska coastline facing the Bering Sea has a very low tsunami threat. However, evidence exists of a volcanically induced tsunami in Bristol Bay about 3,500 years ago. Near ocean or undersea landslides or volcanic eruptions can also generate tsunamis. They can be generated

locally or a great distance from where they landfall. Warning time can be limited when the tsunami is triggered close to the impacted coastline. Many tsunamis are small and are only detected by instruments, but damaging tsunamis create concern for the City's coastal areas.

The portion of Alaska bordering the North Pacific Ocean can be hit by tsunamis generated by above and underwater landslides, crustal plate movement, or volcanic activity. The Aleutian Islands could receive a tsunami generated by remote source earthquakes while areas of the Gulf of Alaska could experience a tsunami from several possible sources.

The fact that tsunamis are rare does not reduce their potential for causing devastating damage to communities. Actual tsunami damage is a direct result of three factors: inundation, wave impact, and coastal erosion. Even a relatively small damaging tsunami is likely to cause significant disruption to rural, isolated communities.

Tele-tsunami is the term for a tsunami observed at places 1,000 kilometers from their source. In many cases, tele-tsunamis can allow for sufficient warning time and evacuation. There is a slight risk in the western Aleutians and some parts of Southeast Alaska.

Most tele-tsunamis that reached Alaska have not caused damage. In fact, Massacre Bay on Attu Island has historically received tele-tsunamis with less than one foot recorded amplitudes.

Only one tele-tsunami has caused damage in Alaska; the 1960 Chilean tsunami. Damage occurred to pilings at MacLeod Harbor, Montague Island and on Cape Pole, Kosciusko Island where a log boom broke free.

Volcanic tsunamis occur when severe eruptions create severe water forces propagating into either a local or distant driven tsunami wave. For example, in 1883, a debris flow from the Saint Augustine volcano triggered a local-tsunami that inundated Port Graham with waves 30 feet high. Other volcanic events may have caused tsunamis but there is not enough evidence to report that conclusively. Many volcanoes have the potential to generate tsunamis.

Seismically-generated local tsunamis generally occur along the Aleutian Arc. Other locations include the back arc area in the Bering Sea and the eastern boundary of the Aleutian Arc plate. They generally reach land within 20 to 45 minutes.

Landslide-generated (submarine landslides or sub-aerial landslides can generate large tsunamis. Sub-aerial landslides have more kinetic energy associated with them so they trigger larger tsunamis. An earthquake usually, but not always, triggers this type of landslide and they are usually confined to the originating bay or lake location.

Seiches are waves that oscillates in partially or totally enclosed bodies of water. They are caused by earthquakes, underwater landslides, atmospheric disturbances or avalanches and can last from a few minutes to a few hours. The first wave can occur within a few minutes, giving virtually no time for warning. The resulting effect is similar to bathtub water sloshing repeatedly from side to side. The reverberating water continually causes damage until the activity subsides. The factors for effective warning are similar to a local tsunami. Communities near large lakes may be vulnerable to seiche activity following an earthquake.

5.3.5.2 History

The City has not been hit by a damaging tsunami in recent history, but this does not reduce the potential for a tsunami. Tsunamis are unpredictable and can occur with little warning.

The City of St. Paul is in close proximity to historic tsunamigenic events that have occurred along the Aleutian-Alaska Subduction Zone as well as from the nearby Bering Sea Continental Shelf. This is supported by Dmitry Nicolski, University of Alaska, Fairbanks/Geophysical Institute (UAF/GI) who states,

> *"In my opinion, the substantial tsunami threat to the islands exists from the tsunami generated by potential submarine landslides in Bering Sea, as well as from local tectonic tsunamis triggered along the Aleutian-Alaska subduction zone. There are some very crude estimations of the potential tsunami due to a submarine landslide at the Umnak Plateau, but they need further examinations, e.g. local high-res[olution] modeling is not yet completed" (UAF/GI 2014)*

The West Coast/Alaska Tsunami Warning Center (WC/ATWC) lists the following earthquake generated tsunamis within the Bering Sean and the Alaska Aleutian Subduction Zone (Table 5-7).

Table 5-7 Historic Aleutian Bering Sea Tsunamis

Date	Location	Earthquake Magnitude (M)	Wave Height	Source	
			Ft./Meters	Latitude	Longitude
June 10, 1996	Central Aleutian Islands, AK	M7.9	0.6	51.56	-177.63
February 21, 1991	Bering Sea	M6.7	0.15	58.43	-175.45
May 7, 1986	Central Aleutian Islands, AK	M8.0	0.15	51.52	-166.54
February 4, 1965	Rat Islands, Western Aleutian Islands, AK	M8.7	<0.1	51.29	-178.49
March 27, 1964	Prince William Sound	M9.2	/0.35	61.05	-147.48
March 9, 1957	South of Andreanof Islands, Central Aleutian Islands, AK	M8.3	Unknown	51.5	-175.7
April 1, 1946	Near Unimak Island, Eastern Aleutian Islands, AK	M8.6	Unknown	25.8	-163.5

The Tsunamis Affecting Alaska 1737-1996; NGDC Key to Geophysical Research, Documentation No. 31, September 1996, by James F. Lander, University of Colorado, Cooperative Institute for Research in Environmental Sciences (CIRES) describes various tsunami identification, tide gauge locations, and community impacts:

> *"The first tide station was located at Iliuliuk, Unalaska. It operated during 1871 and in 1872 for four months. A second station was installed at Saint Paul Island in the Pribilof Islands in 1872 and operated until December when ice flows destroyed it. It recorded the August 23, 1872, Fox Island tsunami which had been recorded in Hawaii and on the United States west coast. The event had not been firmly identified and located before the Alaskan marigram record was found…*
>
> *Today, the population is concentrated in several larger cities-Anchorage, Fairbanks, and Juneau-which do not have a tsunami hazard. In the highly seismic Aleutian Island chain the population is quite small and the communities are usually located on the north shore as protection from Pacific storms and tsunamis…*
>
> *The source for Alaskan tsunamis that can effect the Pacific Basin is the Aleutian Islands arc from Attu Island on the west to the Prince William Sound on the east (Figure 10). It is*

marked by an oceanic trench, volcanic islands (including approximately 40 with active volcanoes extending into Cook Inlet) and an active zone of earthquakes extending from the trench to behind the island arc, ranging from shallow depth of focus to depths of 170 km…

At least one tsunami was generated behind the arc but it was minor. However, the history is short and the risk is not fully known. The recent destructive Sea of Japan earthquakes and tsunamis also arose in the back arc area without much of a history of prior occurrence…

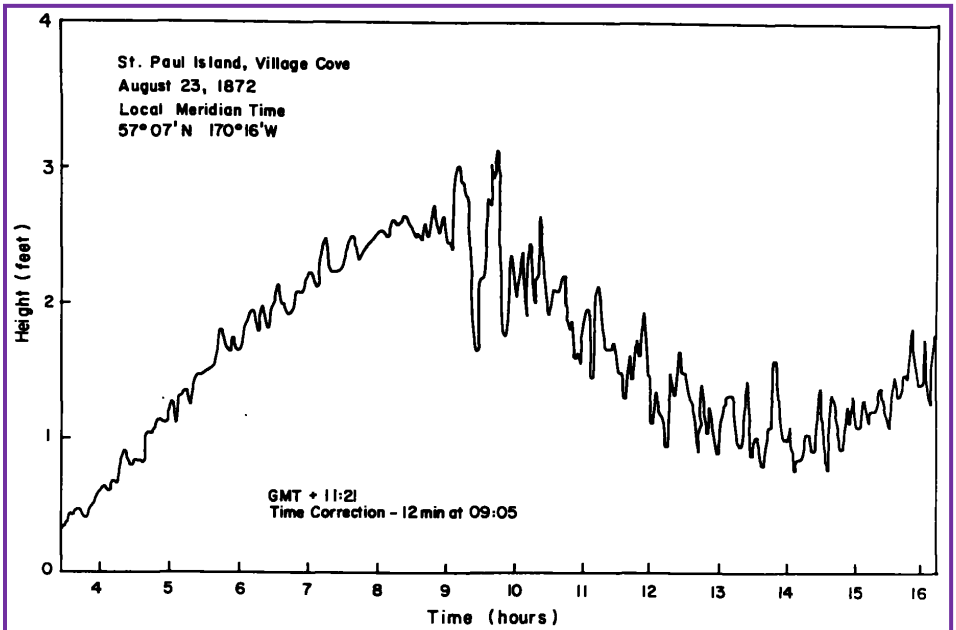

Figure 14. Marigram from Village Cove, St. Paul Island (Pribilof Islands) for August 23, 1872.

1872, August 23, 18:OO GMT. *On August* ***23,*** *1872, a tsunami was recorded on the marigrams at Astoria, San Francisco, San Diego, and Honolulu. The Honolulu marigram showed an arrival time of 12:25 local time (reported in the* ***Pacific Cotiitnercial Advertiser,*** *October 6, 1872). It was observed at Hanalei, Nawiliwili, Honolulu, and Hilo. Cox (1984) calculated the source of this event as being in the Fox Islands. This calculation was not fully convincing since th Hawaiian marigram could not be located and its critical control depended on newspaper accounts…*

…Lander found a marigram from Saint Paul Island, in the Pribolof Islands, Bering Sea, which recorded this event (Figure 14). It shows an initial rise of 0.5 feet at 20:14 GMT and a period of 33 or 34 minutes. The new data essentially confirms Cox' solution and puts to rest a 120-year search (Cox and Lander, 1995). The marigram is the earliest of an Alaskan tsunami, and the location is the first instrumentally-located tsunami source in the world. It is also the first instrumentally-located earthquake source as well and a new entry for the earthquake catalogs. It fills a seismic gap as identified in Davies et al., 1981. The earthquake and tsunami were not reported as directly observed in Alaska…

1991, February 21, 02:36 GMT. *A rare earthquake in the Bering Sea, with a magnitude of only 6.5, generated a small tsunami that was recorded at Dutch Harbor, Unalaska, with an amplitude of 1 foot and at Sweeper Cove, Adak, an amplitude of 9 inches. It had been felt as an earthquake at Saint Paul Island and Adak. It was not recorded by U.S.*

west coast tide stations of Alameda, Port San Luis, or Monterey. The Fort Point, California, recording could not be located" (UAF/GI 2014).

5.3.5.3 Location, Extent, Impact and Recurrence Probability

Location

The State of Alaska, the University of Alaska Fairbanks, Geophysical Institute (UAF/GI), and the National Oceanic and Atmospheric Administration's (NOAA) Pacific Marine Environmental Laboratory (PMEL) and the National Geophysical Data Center (NGDC) indicate that Saint Paul Island has a minor tsunami impact threat (Red star in Figure 5-14 and 5-15).

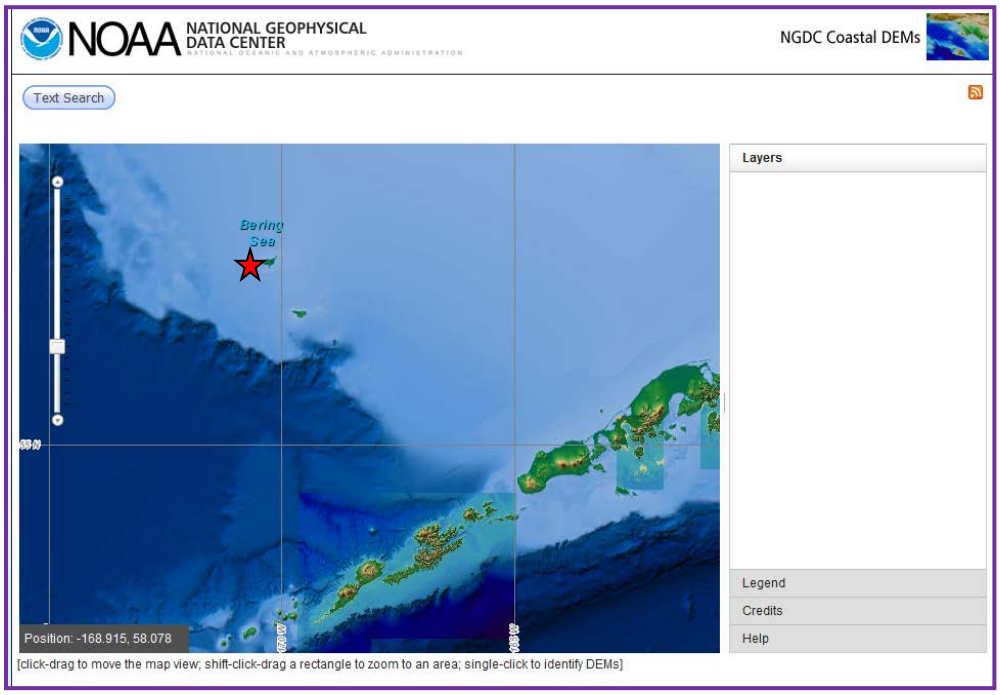

Figure 5-14 NGCD Coastal DEM Map-St. Paul Island (NGDC 2014)

The National Geophysical Data Center (NGDC) provides the following image (Figure 5-15) to depict tsunami wave propagation and travel times to distant locations. As the image demonstrates, it is possible for a tsunami wave to propagate to Saint Paul Island from an Aleutian-Alaska Fault location.

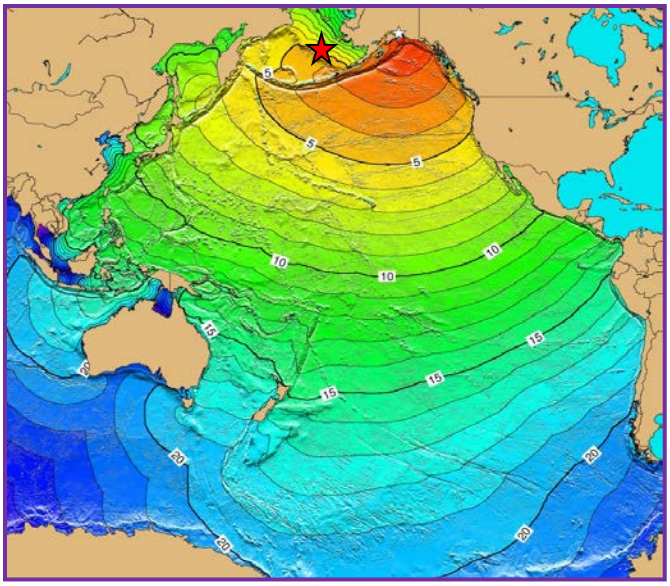

Figure 5-15 NGDC Calculated Tsunami Travel Times (UAF/GI 2012)

No mapping has been completed that indicate which portions of the community of Saint Paul would be at risk for tsunami. Two emergency shelters have been designated at higher elevations

- The City Hall on the west side of the community and
- The senior housing center on the east side.

Evacuation routes to these facilities have been mapped from all areas of the community. It is anticipated that the entire City could be impacted by a tsunami event.

Extent

Based on historic earthquake events, UAF/GI analysis, Saint Paul Island's steep coastal terrain, and the criteria identified in Table 5-3, the magnitude and severity of tsunami impacts to Saint Paul are considered "Limited" with injuries and/or illnesses that do not result in permanent disability; complete critical facility shutdown for more than one week, and more than 10 percent of property could be severely damaged.

Besides the tsunami's originating location, the following factors could determine a tsunami's impact and severity:

- **Earthquake characteristics:** An earthquake that generates a tsunami contributes to the tsunami's intensity, extent, and shape of the rupture zone.
- **Fault movement:** vertical movements along a fault on the seafloor displace water and create a tsunami hazard. However, strike-slip movements that occur under the ocean create little or no tsunami hazard.
- **Magnitude and depth:** Earthquakes with greater magnitude cause more intense tsunamis. Shallow-focus earthquakes also have greater capacity to cause tsunamis.
- **Coral reefs:** Reefs surrounding islands in the western North Pacific generally cause waves to break; providing some protection to the islands.
- **Coastline configuration:** Tsunamis impact long, low-lying stretches of linear coastlines, usually extending inland for relatively short distances. Concave shorelines, bays, sounds,

inlets, rivers, streams, offshore canyons, and flood control channels may create effects that result in greater damage.

- Offshore canyons can focus tsunami wave energy, and islands can filter the energy. The orientation of the coastline determines whether the waves strike head-on or are refracted away from other parts of the coastline. Tsunami waves entering flood control channels could reach a mile or more inland; especially if it enters at high tide.
- **Human activity:** Land development potentially increases where structures are close to the water; multiplying the amount of debris available to damage or destroy other structures.

While the State All-Hazard Risk Mitigation Plan describes the Pribilof Island threat as "Negligible", subsequent modeling has indicated that Saint Paul's proximity to the edge of the continental shelf may make a threat more likely.

Therefore based on Planning Team, UAF, and the Alaska Tsunami Warning Center's estimated a tsunami impact extent could be "Critical" to the community with property damage, possible life losses, and injuries and/or illnesses resulting in permanent disability. Critical facilities could shut-down for at least two weeks with more than 25 percent of property being severely damaged.

Impact

UAF GI's Dmitry Nicolsky indicates it is possible that Saint Paul Island could receive future tsunami impacts, most likely from locally generated tsunamis created from close proximity undersea canyons and plateaus.

Mr. Nicolsky states:

> *"Tsunamis are most commonly triggered by earthquakes and/or generated by submarine landslides. Subduction of the Pacific plate under the North American plate has resulted in numerous great earthquakes and still has the greatest potential to generate tsunamis along the Aleutian trench. The Aleutian megathrust, where the Pacific plate is being subducted, is the most seismically active tsunamigenic fault zone in the U.S. The latest sequence of great earthquakes along the Aleutian megathrust started in 1938 with a Mw 8.3 earthquake west of Kodiak Island. Four subsequent events, the 1946 Mw 8.6 Aleutian, the 1957 Mw 8.6 Andreanof Island, the 1964 Mw 9.2 Alaska, and the 1965 Mw 8.7 Rat Island earthquakes, ruptured almost the entire length of the megathrust. Tsunamis triggered by these great earthquakes traveled across the Pacific Ocean and impacted exposed shorelines.*
>
> *In Alaska, these tsunamis reached coastal communities within minutes of the earthquake and resulted in widespread damage and loss of life. Earthquakes occurring elsewhere in the Pacific rim can cause tsunami waves to reach the Pribilof Islands of Saint Paul and Saint George. However, since these communities are somewhat protected by the Aleutian chain there is little probability that a tsunami generated along the Kuril–Kamchatka Trench, or along the western or eastern segments of the Aleutian Trench can trigger a substantial tsunami of rapid and destructive force in Pribilof Islands.*
>
> *The major consideration for the Pribilof Islands with respect to the tsunami hazard are the locally generated tsunamis near Fox Islands in the so-called Unalaska Seismic Gap - a segment of the active fault that has not slipped in a long time compared to nearby areas.*
>
> *A local run-up in the Pribilof Islands due to an earthquake near the Fox Islands could be substantial and some dangerous tsunami currents may be expected. An additional*

tsunami threat to the Pribilof Islands' communities may occur from submarine landslides.

Potential locations for submarine landslide (slump failures) include the continental shelf in Bering Canyon, Zhemchug Canyon, and Umnak Plateau. Unfortunately, little is known about the extent, volume, and locations of these potential landslides and even less about the slope stability in these areas. However, it is known that massive landslides along continental slopes can cause great tsunamis. Accurate high-resolution modeling of the tsunami inundation zone in the Pribilof Islands has not been yet completed" (UAF/GI 2014).

Future Event Probability

Based on the history of tsunamis in the Saint Paul Island area and applying the criteria identified in Table 5-3, it is "Possible" a tsunami event could occur within in the next five years. The event has up to 1 in 5 years (1/5=20 percent) chance of occurring with a history of events equal to or over 10 percent but less than or equal to 20 percent likely each year.

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

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

The Saint Paul Island has a limited tsunami impact history. While it is not possible to predict when a tsunami will occur, Dmitry Nicolsky, University of Alaska Fairbanks' tsunami threat assessment analysis, combined with the criteria delineated in Table 5-2, a distant source tsunami is "Possible" to occur, but is more "Probable" a near source submarine landslide event would be more likely to occur.

Neither the distant source nor the near source events have known recurrence intervals. Too many factors determine when the next event will occur that could potentially threaten Saint Paul Island.

5.3.6 Volcano

5.3.6.1 Nature

Saint Paul Island is not directly impacted from very distant volcano activity; however this hazard is profiled because air and sea transportation is vital to Pribilof Island communities' survival.

Alaska is home to 41 historically active volcanoes stretching across the entire southern portion of the state from the Wrangell Mountains to the far western Aleutian Islands. "Historically active" refers to actual eruptions that have occurred during Alaskan historic time, in general the time-period in which written records have been kept; from about 1760. Alaska averages 1-2 eruptions per year. In 1912, the largest eruption of the 20th century occurred at Novarupta and Mount

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

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

There are four general volcano types:

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

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

- Volcanic gases are made up of water vapor (steam), carbon dioxide, ammonia, as well as sulfur, chlorine, fluorine, and boron compounds, and several other compounds. Wind is the primary source of dispersion for volcanic gases. Life, health, and property can be endangered from volcanic gases within about 6 miles of a volcano. Acids, ammonia, and other compounds present in volcanic gases can damage eyes and respiratory systems of people and animals, and heavier-than-air gases, such as carbon dioxide, can accumulate in closed depressions and suffocate people or animals.
- Lahars are usually created by shield volcanoes and stratovolcanoes and can easily grow to more than 10 times their initial size. They are formed when loose masses of unconsolidated, wet debris become mobilized. Eruptions may trigger one or more lahars directly by quickly melting snow and ice on a volcano or ejecting water from a crater lake. More often, lahars are formed by intense rainfall during or after an eruption since rainwater can easily erode loose volcanic rock and soil on hillsides and in river valleys. As a lahar moves farther away from a volcano, it will eventually begin to lose its heavy load of sediment and decrease in size.
- Landslides are common on stratovolcanoes because their massive cones typically rise thousands of feet above the surrounding terrain, and are often weakened by the very process that created the mountain – the rise and eruption of molten rock (magma). If the moving rock debris is large enough and contains a large content of water and soil material, the landslide may transform into a lahar and flow down valley more than 50 miles from the volcano.

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

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

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

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

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

> *"From Miller and others (1998): "Makushin volcano is a broad, truncated stratovolcano, 1800 m high and 16 km in basal diameter, which occupies most of the triangular northwest extension of Unalaska Island. A breached summit caldera, about 3 km across, contains a small cinder cone, eroded remnants of other cones, and several fumaroles. The volcano is capped by an icefield of about 40 square km; subsidiary glaciers descend the larger flanking valleys to elevations as low as 305 m.*

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

The Preliminary Volcano-Hazard Assessment for Makushin Volcano (see Figure 5-16), Alaska, Summary of Hazards states,

"Makushin Volcano is a 2,036-meter-high stratovolcano on Unalaska Island. The volcano is located 28 kilometers west of the towns of Dutch Harbor and Unalaska, the largest population centers in the Aleutian Islands and the principal fishing, shipping, and air-transportation hub for westernmost Alaska. Explosive eruptions of Makushin Volcano have occurred at least 17 times since the late 1700s, when written records began. These historic eruptions have been relatively small, sending ash 3 to 10 kilometers above the volcano summit and depositing ash mainly on the flanks of the volcano …

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

Figure 5-16 Makushin Volcano (AVO 2012b)

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

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

Table 5-8 Volcanoes in Alaska

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

(AVO 2012)

5.3.6.2 History

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

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

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

> ***103. Mt. Redoubt Volcano, December 20, 1989*** *When Mt. Redoubt erupted in December 1989, posing a threat to the Kenai Peninsula Borough, Mat-Su Borough, and the Municipality of Anchorage, and interrupting air travel, the Governor declared a Disaster Emergency. The Declaration provided funding to upgrade and operate a 24-hr. monitoring and warning capability.*
>
> ***104. KPB-Mt. Redoubt, January 11, 1990*** *The Kenai Peninsula Borough, most directly affected by Mt. Redoubt, experienced extraordinary costs in upgrading air quality in schools and other public facilities throughout successive volcanic eruptions. The Borough also sustained costs of maintaining 24-hr. operations during critical periods. The Governor's declaration of Disaster Emergency supported these activities.*
>
> ***161. Mt. Spurr, September 21, 1992*** *Frequent eruptions and the possibility of further eruptions has caused health hazards and property damage within the local governments of the Municipality of Anchorage, Kenai Peninsula Borough and Mat-Su Borough. These eruptions caused physical damage to observation and warning equipment. Funds to replace equipment for AVO.*

The AVO's Service Review, Mount Redoubt Volcanic Eruptions, March – April 2009 (Figure 5-17) states,

Figure 5-17 2009 Eruption Cloud-15,000 ft. (AVO 2009b)

Photo Credit: Kristi Wallace, AVO…

> *"Mount Redoubt volcano in continuous eruption on March 31, 2009. Plume height is no more than 15,000 feet above sea level. The small amount of ash in the plume is creating a haze layer downwind of the volcano and dustings of fine ash are falling out of the plume. View is from the northwest…*
>
> *On March 22, 2009, Mount Redoubt volcano, 106 miles southwest of Anchorage, Alaska, began a series of eruptions after persisting in Orange or "Watch" status since late January 2009. Plume heights were observed at or above 60,000 feet during two of the six significant eruptions. Ashfall occurred over south central Alaska, including in Anchorage, with amounts ranging from a trace to one-half inch in depth.*
> *The Redoubt eruptions also disrupted air traffic in the region. Hundreds of commercial flights were cancelled and cargo companies were significantly impacted. This resulted in employees being placed on unpaid leave during periods when airport operations were shut down. Anchorage is Alaska's major population center; its airport serves as a critical strategic transportation hub as the third busiest cargo airport in the world" (AVO 2009b).*

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

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

Table 5-9 Aleutian Volcano Eruption Events

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

(AVO 2012)

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

Location

Figure 5-18 depicts the AVO monitoring program's active and inactive volcanoes.

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

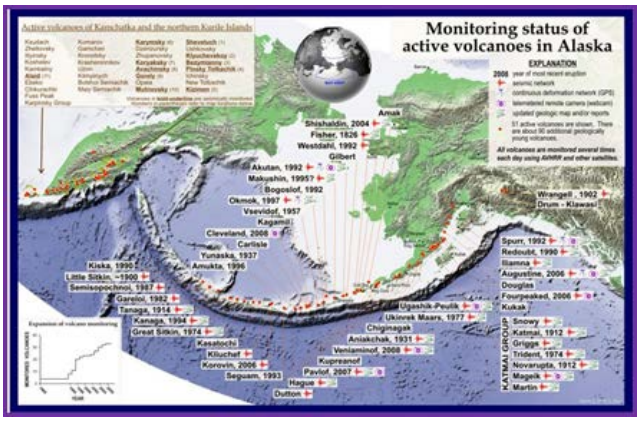

Figure 5-18 AVO's Volcano Monitoring Status Map (AVO 2008)

Table 5-10 List of Published Aleutian Volcano Hazard Assessments

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

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

Figure 5-19 indicates the Aleutian Chain portion of the Ring-of-Fire volcanoes to potentially impact Saint Paul Island area.

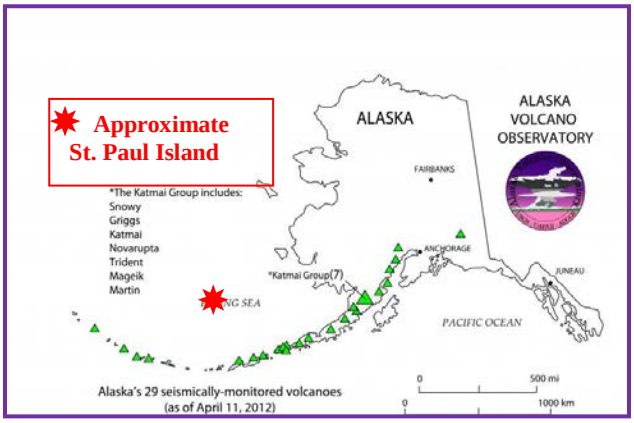

Figure 5-19 Alaska's Seismically Monitored Volcanoes (AVO 2012)

Alaska contains approximately 80 volcanic centers and is at continual risk for volcanic eruptions. Most of Alaska's volcanoes are far from settlements that could be affected by lahars, pyroclastic

flows and clouds, and lava flows; however ash clouds and ash fall have historically caused significant impact to human populations.

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

Many of the volcanoes in Alaska are capable of producing eruptions that can affect Saint Paul. City residents are concerned that significant volcanic ash falls could impact the City. A large ash plume has the capability of shutting down air, and potentially, shipping and commercial fishing operations because tephra damages all engine types.

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

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

Figure 5-20 shows the extent of four ash cloud impact areas. The 1912 Katmai ash cloud is gray; the Augustine (blue plume), Redoubt (orange plume), and Spurr (yellow plume) were each dwarfed by the Katmai event. "Volcanologist's discovered that [this] 1912 [Katmai] eruption was actually from Novarupta, not Mount Katmai" (USGS 1998).

- Archaeological evidence suggests that an eruption of Aniakchak volcano 3,500 years ago spread ash over much of Bristol Bay and generated a tsunami which washed up onto the tundra around Nushagak Bay. Within the past 10,000 years, Aniakchak volcano has significantly erupted on at least 40 occasions.

Figure 5-20 1912 Katmai Volcano Impact (USGS 1998)

- The 1989-90 eruption of Mt. Redoubt seriously affected the population commerce, and oil production and transportation throughout the Cook Inlet region.

> *"Redoubt Volcano is a strato-volcano located within a few hundred kilometers of more than half of the population of Alaska. This volcano has erupted explosively at least six times since historical observations began in 1778. The most recent eruption occurred in 1989-90 and similar eruptions can be expected in the future. The early part of the 1989-90 eruption was characterized by explosive emission of substantial volumes of volcanic ash to altitudes greater than 12 kilometers above sea level and widespread flooding of the Drift River valley. Later, the eruption became less violent, as developing lava domes collapsed, forming short-lived pyroclastic flows associated with low-level ash emission. Clouds of volcanic ash had significant effects on air travel as they drifted across Alaska, over Canada, and over parts of the conterminous United States causing damage to jet aircraft, as far away as Texas. Total estimated economic costs are $160 million, making the eruption of Redoubt the second most costly in U.S. history" (USGS 1998).*

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

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

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

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

Figure 5-21 displays the air travel routes in the North Pacific, Russia, and Alaska and the active volcanoes which could easily disrupt air travel during significant volcanic eruptions with ash fall events. The "red" circle designates Saint Paul Island's approximate location in relation to major airline flight paths.

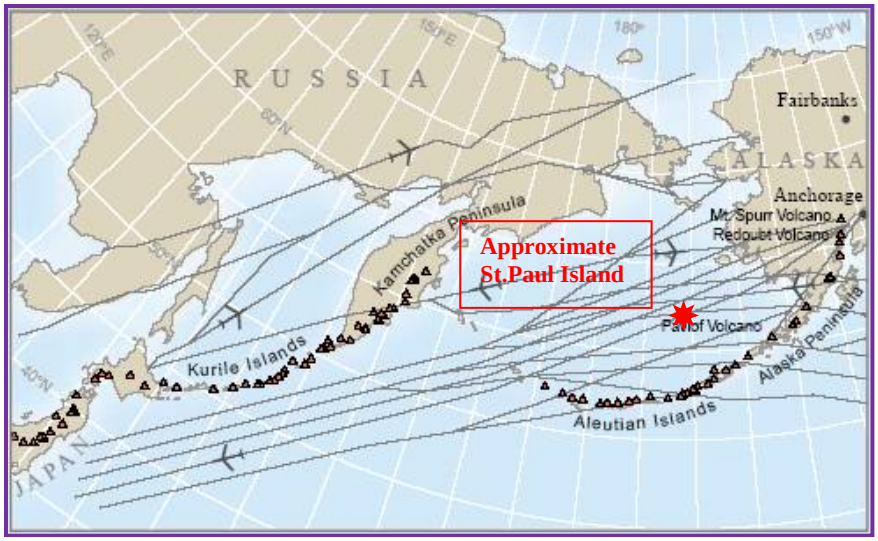

Figure 5-21 North Pacific Air Travel Routes (USGS 2001)

Figure 5-22, DGGS Makushin Hazard Assessment (Report of Investigation 200-4, Figure 8), explains how an explosive Makushin Volcano eruption's plumes could impact airline flight routes:

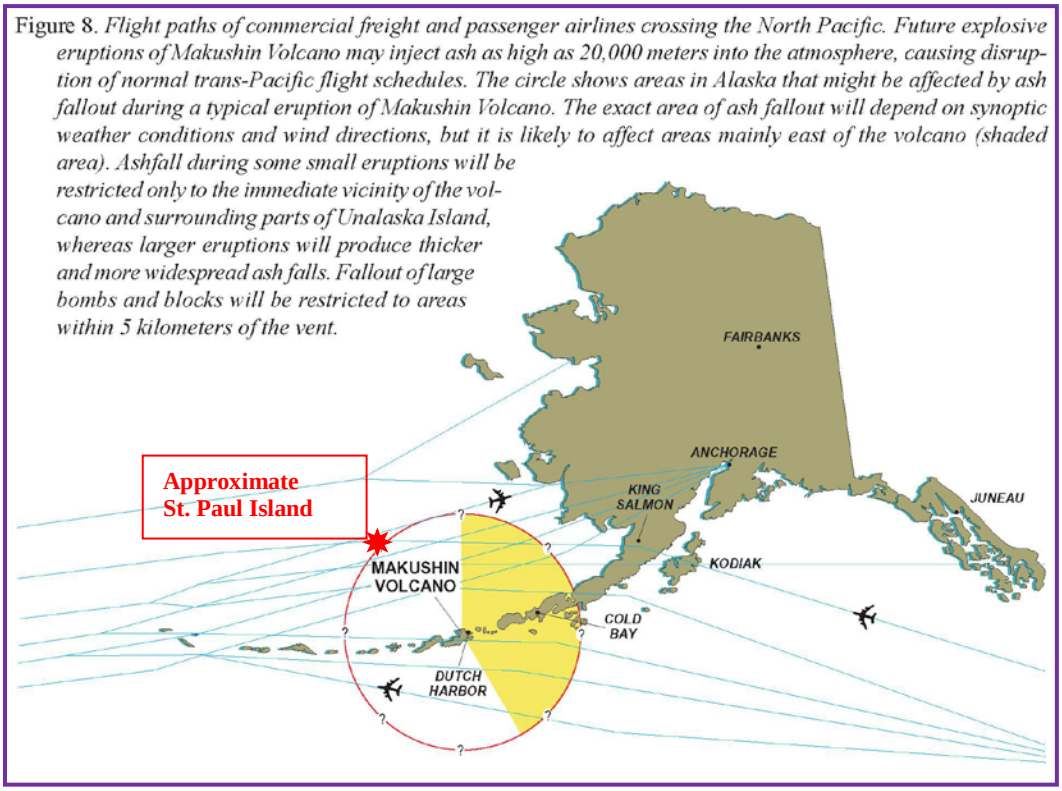

Figure 5-22 Unalaska's Makushin Volcano Flight Proximity (DGGS 2000)

Extent

Volcanic effects include severe blast, turbulent ash and gas clouds, lightning discharge, volcanic mudflows, pyroclastic flows, corrosive rain, flash flood, outburst floods, earthquakes, and

tsunamis. Some of these activities include ash fallout in various communities, air traffic, road transportation, and maritime activity disruptions.

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

A massive eruption anywhere on earth, as depicted in Figure 5-23, could severely affect the global climate; radically changing Pribilof Island communities' (and everyone else's) risk from weather events for weeks, months, or years.

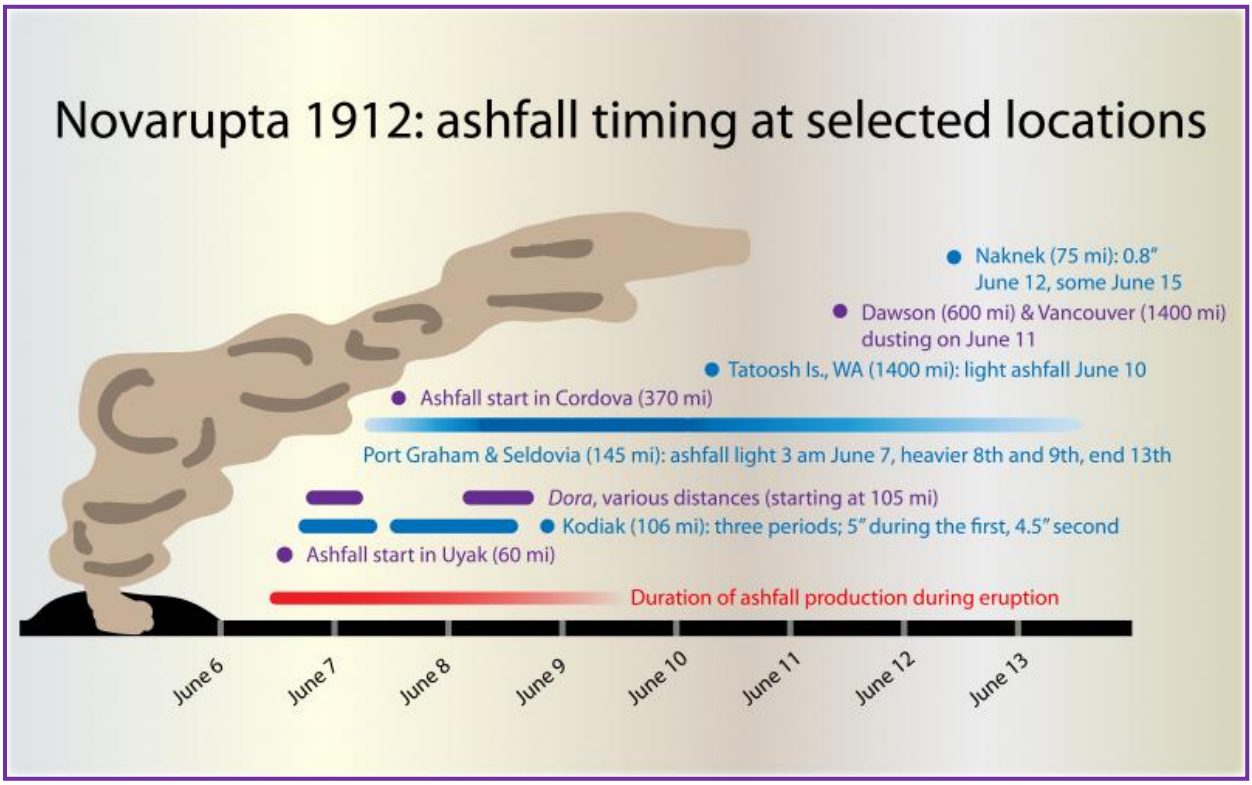

Figure 5-23 Novarupta's Historic Ashfall Timeline (AVO 2012)

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

Impact

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

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

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

Probability of Future Events

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

The Planning Team has determined that volcanic impacts do not directly threaten Saint Paul Island. However, the City has experienced intense or long-term volcanic ash discharges events that created a critical "economic" hardship on the island's inhabitants. Saint Paul residents rely heavily on air and ocean shipping and transportation; all transportation to and from the island stops during severe volcanic activity. This stoppage could adversely impact their sustainability if they were unable to receive critical supplies and medical assistance during such an event.

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

5.3.7 Wildland Fire

5.3.7.1 Nature

A wildland fire is a type of wildfire that spreads through consumption of vegetation. It often begins unnoticed, spreads quickly, and is usually signaled by dense smoke that may be visible from miles around. Wildland fires can be caused by human activities (such as arson 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 urban fires, interface or intermix fires, and prescribed fires.

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. The risk of fire is increased 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. 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.

5.3.7.2 History

The Alaska Interagency Coordination Center (AICC) lists does not list any tundra/ wildland fires for Saint Paul Island that would have potentially occurred within 50 miles of the City the since 1939 as depicted in Figure 5-24. However, the community reports that numerous tundra fires occur in the more sparsely populated areas outside the City limits due to natural tundra growth in close proximity to homes and other structures.

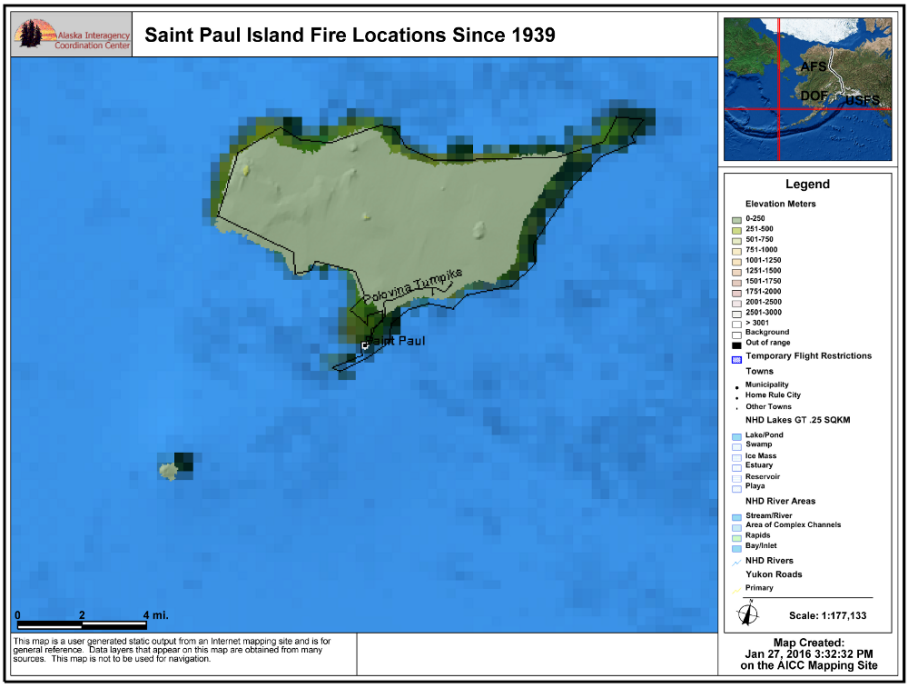

Figure 5-24 Saint Paul's Historical Wildfire Locations (AICC 2015)

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

Location

Under certain conditions wildland fires may occur in any area with fuel surrounding the City of Saint Paul. Since fuels data is not readily available, for the purposes of this plan, all areas outside City limits are considered to be vulnerable to tundra/wildland fire impacts. Since 1939, the Division of Forestry has not recorded any tundra/wildland fire events on Saint Paul Island.

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 tundra/wildland fire events and the criteria identified in Table 5-3, the magnitude and severity of impacts in Saint Paul are considered negligible with minor injuries, there is potential for critical facilities to be shut down for less than 24 hours, less than 10 percent of property or critical infrastructure being severely damaged, and little to no permanent damage to transportation or infrastructure or the economy.

Impact

Impacts of a wildland fire that interfaces with the population center of the City 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.

Probability of Future Events

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. Alaska’s natural fire regime is influenced by weather and characterized by a return

interval of approximately 150 years due to their tundra vegetation, gently rolling topography, and coastal location.

Based on AICC's identified history tundra/wildland fires in the Saint Paul area and applying the criteria identified in Table 5-2, it is "Unlikely" but possible 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.

6. Vulnerability Analysis

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

1. Vulnerability Overview of Each Hazard
2. Land Use and Development Trends
3. Assessing Vulnerability
4. Repetitive Loss (RL) Properties

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

DMA 2000 Recommendations
Assessing Risk and Vulnerability, and Analyzing Development Trends §201.6(c)(2)(ii): The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. *All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods.* The plan should describe vulnerability in terms of: §201.6(c)(2)(ii)(A): The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas; §201.6(c)(2)(ii)(B): An estimate of the potential dollar losses to vulnerable structures identified in … this section and a description of the methodology used to prepare the estimate. §201.6(c)(2)(ii)(C): Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions. §201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.
1. REGULATION CHECKLIST
ELEMENT B. Risk Assessment, Assessing Vulnerability, Analyzing Development Trends
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))
B4. Does the Plan address NFIP insured structures within each jurisdiction that have been repetitively damaged by floods?
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))
Source: FEMA, March 2015.

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

- A summary of the community's vulnerability to each natural hazard that addresses the impact of each hazard on the community.
- Identification of the types and numbers of repetitive loss (RL) properties in the identified hazard areas.
- An identification of the types and numbers of existing vulnerable buildings, infrastructure, and critical facilities and, if possible, the types and numbers of vulnerable future development.

- Estimate of potential dollar losses to vulnerable structures and the methodology used to prepare the estimate.

6.1 Vulnerability Overview to Each Hazard

Table 6-1 provides an overview of the City's infrastructures' natural hazard vulnerability.

Table 6-1 Vulnerability Overview to Each Hazard

Hazard	Area's Hazard Vulnerability			
	Percent of Jurisdiction's Geographic Area	Percent of Population	Percent of Building Stock	Percent of Critical Facilities and Utilities
Earthquake	100	100	100	100
Flood	100	100	100	100
Ground Failure	100	100	100	100
Weather	100	100	100	100
Tsunami	100	100	100	100

Figure 6-1 depicts the LEPC's determination for all hazards and that pose a potential threat to Saint Paul Island.

St. Paul Island, Alaska Hazards/Threats Vulerabilty Assessment Worksheet

(see instructions below)

Done By:	Saint Paul Island LEPC
Date:	9/15/2015

Hazard/Threat	Frequency of Occurrence		Potential Magnitude		Preparedness		Warning		Risk (H/TVA)
	Past Occurrence	Projected Occurrence	Impact to Residents	Impact to Responders	Preparedness	Availability of Resources	Onset	Existing Warning Systems	
Natural									
Disease Outbreak	6	3	2	2	1	1	1	1	2.13
Earthquake	6	3	2	2	3	3	4	3	3.25
Epidemic	3	2	3	2	2	2	4	2	2.50
Flood	2	2	4	3	3	3	2	1	2.50
Tsunami	1	1	4	4	3	3	4	1	2.63
Volcanic Eruption	1	1	4	4	3	3	4	3	2.88
Winter Storm	6	4	4	4	3	2	1	1	3.13
Erosion	6	4	4	4	3	3	4	3	3.88
Contaimination of Food Supply	1	3	4	1	2	3	4	1	2.38
Technological									
Airplane Crash	6	3	4	3	2	2	4	1	3.13
Dock Failure	1	1	4	3	2	2	1	1	1.88
Breakwater Failure	1	1	4	2	2	2	1	1	1.75
HazMat (Facility)	6	3	4	3	2	4	4	1	3.38
HazMat (Community)	3	3	4	2	2	2	4	1	2.63
Power Failure	6	4	4	2	2	2	4	1	3.13
Complete Loss of Communications	1	2	4	1	1	1	4	1	1.88
Intruption of Supply Chain	6	3	4	1	3	3	1	1	2.75
									0.00
Man-Made									
Protest / Civil Unrest	3	3	2	2	3	3	1	1	2.25
Missing/Lost Person	6	4	1	2	2	2	4	1	2.75
Terrorist Acts	1	1	1	1	2	2	4	1	1.63
School Violence	4	2	4	2	2	2	4	1	2.63
Multiple Structure Fire	1	2	3	3	2	1	4	1	2.13
Large Industrial Fire	6	3	4	4	2	2	4	1	3.25
Wildfire	6	3	3	3	2	2	4	1	3.00
									0.00
Planned Events									
Annual Meetings	6	4	1	1	1	1	1	1	2.00
School Fundrasising Events	6	4	1	1	1	1	1	1	2.00
Health Fairs	6	4	1	1	1	1	1	1	2.00
June-July	6	4	1	1	1	1	1	1	2.00
Labor Day BBQ	6	4	1	1	1	1	1	1	2.00
Christmas Program	6	4	1	1	1	1	1	1	2.00
Graduations	6	4	1	1	1	1	1	1	2.00
Dances	6	4	1	1	1	1	1	1	2.00
									0.00
Sample:	*3*	*3*	*2*	*2*	*2*	*2*	*2*	*2*	*2.25*

Instructions: For each relevant row, rate each of the eight items "1" through "6" leveraging the below descriptions; in unknown, enter "2" the basic H/TVA for each row will be shown in the right-hand column. The basic H/TVA for each row will be shown on the right. (See the "Sample" at the bottom of the main table.)

Past Occurrence:	
	6, one or more cases in the past 1 to 5 years
	5, one or more cases in the past 5 to 10 years
	4, one or more cases in the past 10 to 25 years
	3, one or more cases in the past 25 to 50 years
	2, on or more cases in the past 50 to 100 years
	1, no cases reported
Projected Occurrence:	
	4, Highly Likely: Near 100% probability in the next year
	3, Likely: Between 10 and 100% probability in the next year, or at least one chance in the next 10 years
	2, Possible: Between 1 and 10% probability in next year, or at least one chance in the next 100 years
	1, Unlikely: Less than 1% probabilty in the next 100 years
Impact to Residents:	
	4, Catastrophic: More than 50% residents can be affected
	3, Crtitical: 25 to 50% residents can be affected
	2, Limited:10 to 25% of residents can be affected
	1, Negligible: Less than 10% of residents that can be affected
Impact to Responders:	
	4, if death or serious injury ishighly likely
	3, if death or serious injury is likely
	2, if death or serious injury is possible
	1, if death or serious injury is unlikely
Preparedness:	
	3, not trained, not equipped, inadequate facilities
	2, some training, reasonable equipment, reasonable facilities
	1, trained, well equipped, adequate facilities
Availability of Resources:	
	3, if field and management resources are insufficient
	2, if field or management resources are insufficient
	1, if field and management resources are sufficient
Onset:	
	4, Minimal or no warning
	3, 6 to 12 hours warning
	2, 12 to 24 hours warning
	1, More than 24 hours warning
Existing Warning System:	
	3, no warning systems exist
	2, some warning systems exist
	1, adquet warning systems exist
Risk:	
	High Risk: If greater than 2.88
	Medium Risk: If greater than 2.38
	Lower Risk: If less than 1.88

NOTE: *Manmade and technological hazard profiling is beyond the scope of this planning effort. St. Paul Island may strive to compile essential data during the life cycle of this HMP update for inclusion during their 2020 HMP update process.*

6.2 Land Use and Development Trends

6.2.1 Land Use

Land use in the City is predominately residential with limited area for commercial services and community (or institutional) facilities.

Figure 6-2 depicts the community's water resource and transmission methods as well as ponds, waste disposal, and other area features.

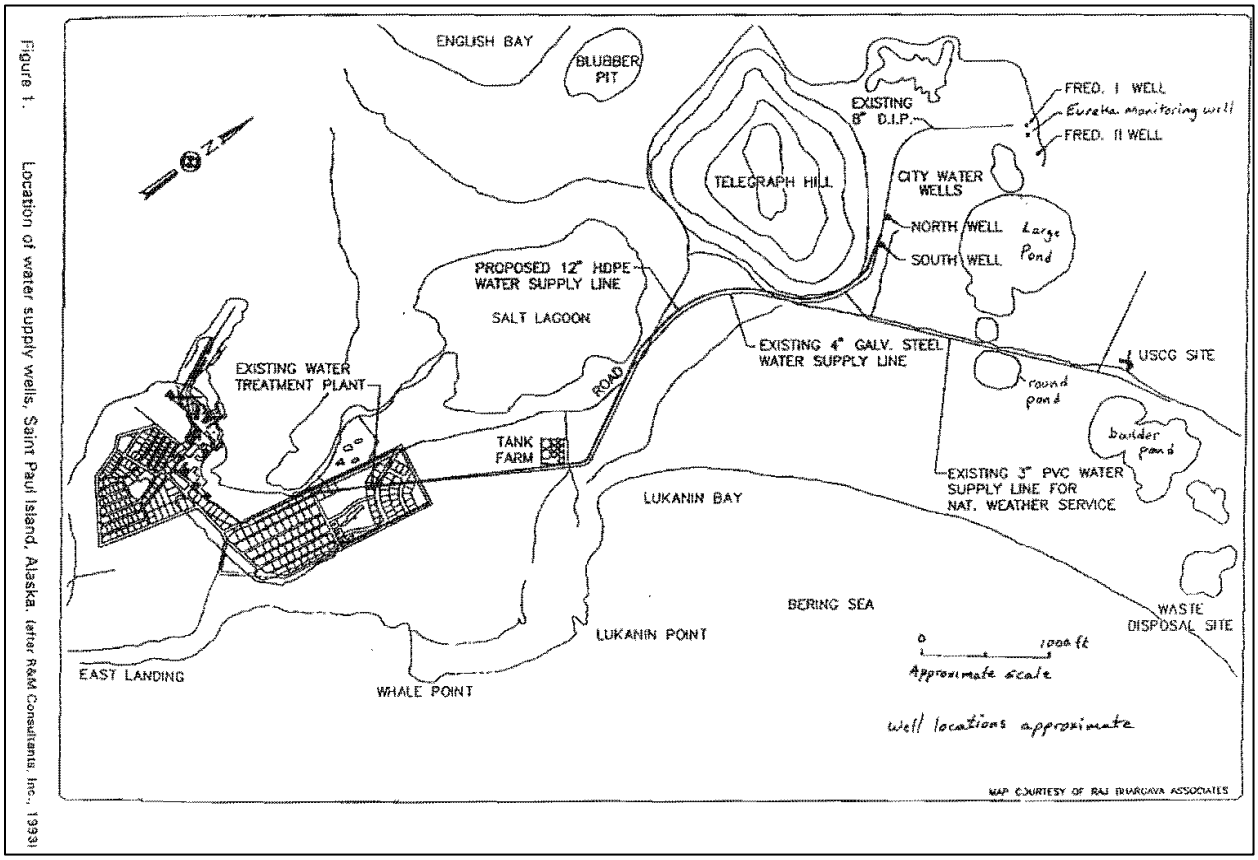

Figure 6-2 Saint Paul Infrastructure Locations (DGGS 1994)

6.3 Assessing Vulnerability

6.3.1 Overview

The vulnerability overview section is a summary of Saint Paul's vulnerability to the hazards identified in Section 5. The summary includes, type of hazard, the types of structures, infrastructures and critical facilities affected by the hazards.

The Hazard Vulnerability Matrix below includes a list of facilities, utilities and businesses and their vulnerability to identified natural hazards.

6.3.2 Population and Building Stock

Population data for the City was obtained from the 2010 U.S. Census and the DCRA. The US Census reports the City's total population for 2010 as 479 and DCRA 2014 data reported an estimated population of 436 (Table 6-2).

Table 6-2 Population and Housing Replacement Costs

Population		Residential Buildings	
2010 Census	DCCED 2014 Data	Total Building Count	Total Value of Buildings[1]
479	436	162	$56,700,000

The Planning Team stated that residential replacement values are generally understated because replacement costs exceed Census structure estimates due to material purchasing, barge or airplane delivery, and construction in rural Alaska. The Planning Team estimates an average 30ft by 40 ft. (1,200 sq. ft.) residential structure costs $350,000.

6.3.3 Infrastructure Improvements

Table 6-3 list the City's identified "completed" infrastructure improvement projects. They provide a depiction of the community's ongoing development trends and focus toward improving aging infrastructure.

Table 6-3 Infrastructure improvements

Grant Recipient	Project Name	Award Year	Grant Status	Award Amount	End Date
City of Saint Paul					
City of Saint Paul	Purchase of Worker's Compensation and General Liability Insurance	2010	Closed	$13,523	12/31/09
City of Saint Paul	Municipal Fire Station	2009	Closed	$200,000	2/28/09
City of Saint Paul	Public Safety Vehicles	2007	Closed	$100,000	12/31/07
City of Saint Paul	Saint Paul Police and Fire Station Design and Engineering	2006	Closed	$300,000	12/31/07
Saint Paul Island	Hybrid wind diesel power plan	2006	Closed	1,000,000	N/A
City of Saint Paul	Airport Water, Phase 7	2000	Closed	$25,271	9/30/00
City of Saint Paul	Lukanin Street Lights, East	2001	Closed	$25,014	6/30/04
City of Saint Paul	South Ellerman Electric Installation	2002	Closed	$25,000	6/30/05
TDX Foundation	Bering Sea.Com Economic Diversification St. Paul (TDX)	2001	Closed	$317,782	6/30/03
TDX Foundation	St. Paul Government House Diversification (TDX)	2001	Closed	$411,907	11/30/03
City of Saint Paul	St. Paul Comprehensive Community Water System	2002	Closed	$1,123,159	6/30/04
City of Saint Paul	Payment in Lieu of Taxes	2002	Closed	$41,725	6/30/02
City of Saint Paul	Shared Fisheries Business Tax	2002	Closed	$3,009	6/30/02
City of Saint Paul	Fisheries Landing Tax	2002	Closed	$1,433	6/30/02
City of Saint Paul	State Revenue Sharing	2002	Closed	$29,472	3/31/03
City of Saint Paul	Safe Communities	2002	Closed	$10,457	3/31/03
City of Saint Paul	State Revenue Sharing	2003	Closed	$29,503	3/31/04
City of Saint Paul	Safe Communities	2003	Closed	$9,597	3/31/04
City of Saint Paul	Payment in Lieu of Taxes	2003	Closed	$39,233	6/30/03

Table 6-3 Infrastructure improvements

Grant Recipient	Project Name	Award Year	Grant Status	Award Amount	End Date
City of Saint Paul	Alaska Coastal Management Plan 306 Grant	2002	Closed	$3,200	6/30/02
City of Saint Paul	Alaska Coastal Management Plan 306 Grant	2003	Closed	$3,200	6/30/03
City of Saint Paul	Temporary Fiscal Relief Grant	2004	Closed	$40,000	
City of Saint Paul	Water and Sewer Upgrades	2003	Closed	$25,000	5/31/05
Tribal Government of Saint Paul					
Tribal Government of St. Paul	Tribal Gov't & Business Development Center	2002	Closed	$1,018,503	3/31/03
Tribal Government of St. Paul	Pribilof Islands: Marine Debris Removal and Monitoring	2003	Closed	$30,000	3/1/05
Tribal Government of St. Paul	Tribal Government & Business Development Center Restaurant Project	2001	Closed	$7,767	12/31/03
Tribal Government of St. Paul	St. Paul Tribal Government and Business Development Center	2002	Closed	$471,157	3/31/04
Pribilof Islands School District	Carpet Replacement	2008	Closed	$172,261	3/31/09

(DCRA)

North America's largest high penetration wind-diesel hybrid power plant has been in operation since in 1999 when the first turbine was installed. Shortly after two additional turbines installed in 2006; have saved the community approximately $150,000 per year in fuel costs. The Alaska Energy Wiki website powered by the Alaska Center for Energy and power provided Saint Paul Island data wind resource data (Figure 6-3).

Figure 6-3 Saint Paul Wind Turbines (AKWiki 2016)

"Project Overview

In 1999 a high-penetration, no-storage, wind-diesel power system was installed by TDX Power and Northern Power Systems to run an industrial facility and airport complex on the island of St. Paul in the Bering Sea. The project was largely privately funded and initially included a 225 kW Vestas V27 wind turbine. This project was later expanded and now includes three V27 turbines, two 150 kW Volvo diesel engine generators, a synchronous condenser, a 27,000 liter insulated hot water tank, approximately 305 m (1,000 feet) of hot water piping, and a microprocessor-based control system capable of providing fully automatic plant operation.

The electrical load for this industrial facility averages about 70 kW, but the system also supplies the primary space heating for the facility, using excess power from the wind generators and thermal energy from the diesel plant. When the wind generation exceeds demand by a specific margin, the engines automatically shut off, and the wind turbine meets the electrical demand with excess power diverted to the hot water tank.

When wind power is insufficient to meet the load, the engines are engaged to provide continuous electric supply as well as energy to the hot water system as needed. The total 500 kW wind-diesel co-generation system cost approximately $1.2 million. According to TDX, the system has eliminated $200,000 per year in utility electric charges and $50,000 per year in diesel heating fuel" (AKWiki 2016)

6.3.4 Identification of Assets

Because Saint Paul is a small community of 436 residents, every structure is essential to the sustainability and survivability of Saint Paul residents. Table 6-3 includes a list of facilities, utilities and businesses that are critical to the community. They are all at equal risk to the natural hazards.

Table 6-4 Saint Paul Critical Infrastructures

Facility Type	Occupants	Facilities	Street Name with Number	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood	Severe Weather	Tsunami	Volcanic Ash	Wildland/Tundra FireFire
Government	4	City Hall/Public Safety Complex	Pribilofs Street	57.1213	-170.28	$22,000,000	W1	X		X		X	
	5	Post Office	Undefined	57.12431	-170.27224	$250,000	W1	X		X		X	
	2	City Civic Center	Bartlett Blvd.	Undefined	Undefined	$196,000	W1	X		X		X	
		Volunteer Fire Station	Diamond Hill										
Education	88	Saint Paul Island School, P-12	Tolston Blvd.	57.1217	-170.277	$10,000,000	W2	X		X		X	

Table 6-4 Saint Paul Critical Infrastructures

Facility Type	Occupants	Facilities	Street Name with Number	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood	Severe Weather	Tsunami	Volcanic Ash	Wildland/Tundra FireFire
Medical	3	Health Center	Undefined	57.12173	-170.2779	$2,000,000	W1	X		X		X	
Community	20	Church	Church-north	57.1235	-170.27329	$40,000	W1	X		X		X	
	20	Church	Church Street	57.12177	-170.27856	$40,000	W1	X		X		X	
		Polarstar Building	Undefined	Undefined	Undefined	$1,075,000	W1	X		X		X	
	0	Cemetery	Cemetery Street	57.12289	-170.26924	$20,000		X		X		X	
	0	Cemetery	Church Street	57.12134	-170.27841	$20,000		X		X		X	
Transportation	2	Harbor Master Office	Harbor	Undefined	Undefined	$80,000	W1	X		X		X	
	0	North Dock	Harbor	57.12756	-170.28278	$2,000,000	S	X		X		X	
	0	South Dock	Harbor	Undefined	Undefined	$3,500,000	S	X		X		X	
	0	East Dock	Harbor	57.12016	-170.26817	$2,000,000	S	X		X		X	
	5	Airport	SNP	57.12221	-170.27501	$10,000,000	G	X		X		X	
Utilities	0	Radio Transmitter	KUHB-FM CH 220	57.12152	-170.27681	$20,000	C	X		X		X	
	2	Public Works/Trades Building	Diamond Hill Road	57.13568	-170.26453	$2,050,000	S1	X		X		X	
	2	Service/Maintenance Shop	Diamond Hill Road	57.13538	-170.2639	$2,100,000	S1	X		X		X	
	2	City Diesel and Tank Farm	Diamond Hill Road	Undefined	Undefined	$10,200,000	OTF	X		X		X	
	2	Tank Farm Pump House	Undefined	Undefined	Undefined	$30,000	OTF	X		X		X	
	0	Satellite	Undefined	57.12104	-170.28061	$20,000	C	X		X		X	
	0	Water Storage Tanks	850,000 gallons	Undefined	Undefined	1,000,000	PSTW	X		X		X	
	0	Fresh Water Wells/Well Houses (Seven)	Undefined	Undefined	Undefined	$150,000	PWE	X		X		X	
	2	City Power Plant	Undefined	57.13519	-170.26294	$3,641,152	S2	X		X		X	
	3	Wind Turbines				$1,200,000							
	1	Landfill Buildings	Undefined	57.18184	-170.20298	$64,892	N/A	X		X		X	
	160	**Estimated Occupants**			**Estimated Total Damages**	**$50,497,044**							

(Saint Paul Planning Team 2015, DCRA 2015)

6.4 Repetitive Loss Properties

This section estimates the number and type of structures at risk to repetitive flooding such as properties, which have experienced RL, the extent of flood depth, and damage potential. The DMA 2000 requirements for RL from the CFR are described below:

DMA 2000 Requirements
Repetitive Loss Strategy (Optional)
§201.7(c)(3)(vi): An Indian Tribal government applying to FEMA as a grantee may request the reduced cost share authorized under 79.4(c)(2) of this chapter of the FMA and SRL programs if they have an approved Tribal Mitigation Plan meeting the requirements of this section that also identifies actions the Indian Tribal government has taken to reduce the number of repetitive loss properties (which must include severe repetitive loss properties), and specifies how the Indian Tribal government intends to reduce the number of such repetitive loss properties. [Note: While submittal of a Repetitive Loss Strategy is optional, if the Indian Tribal government wants to request the reduced cost share authorized under 44 CFR 79.4(c)(2) for the FMA and SRL programs as a grantee, then all of the following requirements must be met.]
1. REGULATION CHECKLIST
ELEMENTS
A. Does the new or updated plan address repetitive loss properties in its risk assessment (see 201.7(c)(2))?
B. Does the new or updated plan describe the Indian Tribal government's mitigation goals that support the selection of mitigation activities for repetitive loss properties (see 201.7(c)(3)(i))?
C. Does the new or updated plan identify mitigation actions for repetitive loss properties (see 201.7(c)(3)(iii))?
D. Does the new or updated plan describe specific actions that have been implemented to mitigate repetitive loss properties, including actions taken to reduce the number of severe repetitive loss properties?
E. Does the new or updated plan consider repetitive loss properties in its evaluation of the Indian Tribal government's hazard management laws, regulations, policies, programs, and capabilities and its general description of mitigation capabilities (see 201.7(c)(3)(iv))?
F. Does the new or updated plan identify current and potential sources of Federal, tribal, or private funding to implement mitigation activities for repetitive loss properties (see 201.7(c)(3)(v))?
Source: FEMA, March 2015.

6.4.1 NFIP Participation

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

6.5 Vulnerability Analysis Methodology

The Community Planning Team determined their facility locations within identified hazard impact zones. This data was used to develop a vulnerability assessment for those hazards.

Combined replacement structure and contents values were determined by the community for their physical assets. The community's aggregate exposure was calculated by assuming the worst-case scenario (that is, the asset would be completely destroyed and would have to be replaced) for each physical asset located within a hazard area. A similar analysis was used to evaluate the proportion of the population at risk. However, the analysis simply represents the number of people at risk; no estimate of the number of potential injuries or deaths was prepared.

6.6 Data Limitations

The vulnerability estimates provided herein use the best data currently available, and the methodologies applied result in a risk approximation. These estimates may be used to understand

relative risk from hazards and potential losses. However, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning hazards and their effects on the built environment as well as the use of approximations and simplifications that are necessary for a comprehensive analysis.

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

6.7 Vulnerability Exposure Analysis

There is limited GIS data available for Saint Paul Island. The following discussion contains data obtained from the Project Team and their subsequent analysis. The results of the exposure analysis for loss estimations are summarized in Tables 6-5 and 6-6 followed by narrative descriptions for each identified hazard.

Table 6-5 Potential Hazard Exposure Analysis – Critical Facilities

		Government and Emergency Response		Educational		Medical		Community	
Hazard Type	Methodology	* # Bldgs/ # Occ	Value ($)	* # Bldgs/ # Occ	Value ($)	* # Bldgs/ # Occ	Value ($)	* # Bldgs/ # Occ	Value ($)
Earthquake	Descriptive								
Flood/ Erosion	Descriptive								
Ground Failure	Descriptive								
Severe Weather	Descriptive								
Tsunami	Descriptive								
Volcanic Ash	Descriptive								
Wildland/ Tundra Fire	Descriptive								

Table 6-6 Potential Hazard Exposure Analysis – Critical Infrastructure

		Highway		Bridges		Transportation Facilities		Utilities	
Hazard Type	Methodology	Miles	Value ($)	No.	Value ($)	# Bldgs/ # Occ	Value ($)	# Bldgs/ # Occ	Value ($)
Earthquake	Descriptive								
Flood/ Erosion	Descriptive								
Ground Failure	Descriptive								
Severe Weather	Descriptive								
Tsunami	Descriptive								
Volcanic Ash	Descriptive								
Wildland Fire	Descriptive								

6.7.1 Exposure Analysis – Hazard Narrative Summaries

Earthquake

The City and surrounding area can expect to experience moderate to severe, earthquake ground movement that may damage infrastructure.

Based on earthquake probability (PGA) maps (Shake Maps) produced by the USGS, It is "Possible" the City of Saint Paul would experience moderate earthquake impacts.

The probability is rated at 15 percent chance (see Section 5.3.1.3) that impacts to the community such as "moderate" ground movement may result in minor infrastructure damage or personal injury.

The City of Saint Paul's entire existing, transient, and future population, residential structures and critical facilities are exposed to potential "moderate" earthquake events because the City is located in close proximity to the Aleutian subduction zone. The following would potentially experience moderate damage:

- people in residences (approximate value $)
- people in government and emergency response facilities (approximate value $)
- people in educational facilities (approximate value $)
- people in medical facility (approximate value $)
- people in community facilities (approximate value $)
- road system miles (approximate value $)
- bridge (approximate value $)
- people in transportation facilities (approximate value $)
- people in utility facilities (approximate value $)

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

Flood

No detailed 100 year flood analysis has been prepared for the Pribilof Island communities. Neither does the USACE Floodplain Manager provide flood information or a 100 year floodplain map. (see Section 5.3.2.3)

Potential damages could include approximately:

- people in residences (approximate value $)
- people in government and emergency response facilities (approximate value $)
- people in educational facilities (approximate value $)
- people in medical facility (approximate value $)
- people in community facilities (approximate value $)
- road system miles (approximate value $)

- bridge (approximate value $)
- people in transportation facilities (approximate value $)
- people in utility facilities (approximate value $)

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

Ground Failure

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

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

Ground Failure hazards periodically cause structure and infrastructure displacement due to ground shifting, sinking, and upheaval. According to mapping completed by the DGGS, the Pribilof Islands has no permafrost (see Section 5.3.3.3).

Ground Failure hazards periodically cause structure and infrastructure displacement due to ground shifting, sinking, and upheaval.

There have been periodic ground failure incidents in Saint Paul.

Threatened facilities include:

- people in residences (approximate value $)
- people in government and emergency response facilities (approximate value $)
- people in educational facilities (approximate value $)
- people in medical facility (approximate value $)
- people in community facilities (approximate value $)
- road system miles (approximate value $)
- bridge (approximate value $)
- people in transportation facilities (approximate value $)
- people in utility facilities (approximate value $)

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

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. Section 5.3.4.3 provides additional detail regarding severe weather impacts. Buildings that are older and/or not constructed with materials designed to withstand heavy snow and wind (e.g., hurricane ties on crossbeams) are more vulnerable to the severe weather damage.

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

This includes approximately:

- people in residences (approximate value $)
- people in government and emergency response facilities (approximate value $)
- people in educational facilities (approximate value $)
- people in medical facility (approximate value $)
- people in community facilities (approximate value $)
- road system miles (approximate value $)
- bridge (approximate value $)
- people in transportation facilities (approximate value $)
- people in utility facilities (approximate value $)

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

Tsunami and Seiche

The UAF/GI indicates there is a minimal threat from distant source tsunamis; however they indicated community has a low tsunami threat. (see Section 5.3.5.3) However, the following infrastructure located along the Island's lower coastal elevations could potentially be impacted if such an event were to occur:

- people in residences (approximate value $)
- people in government and emergency response facilities (approximate value $)
- people in educational facilities (approximate value $)
- people in medical facility (approximate value $)

- people in community facilities (approximate value $)
- road system miles (approximate value $)
- bridge (approximate value $)
- people in transportation facilities (approximate value $)
- people in utility facilities (approximate value $)

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

Volcano

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

Using information provided by the Alaska Volcano Observatory, the entire existing and future Saint Paul Island population, residences, and critical facilities are equally at risk from the volcanic ash impacts (see Section 5.4.6.3).

This includes approximately:

- people in residences (approximate value $)
- people in government and emergency response facilities (approximate value $)
- people in educational facilities (approximate value $)
- people in medical facility (approximate value $)
- people in community facilities (approximate value $)
- road system miles (approximate value $)
- bridge (approximate value $)
- people in transportation facilities (approximate value $)
- people in utility facilities (approximate value $)

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

According to the AICC, there were no wildland fires reported for Saint Paul Island (see Section 5.3.7.3). There is a slight potential for tundra fires to interface with the population from outside the City limits due to undergrowth near residential structures. These areas could affect approximately:

- people in residences (approximate value $)
- people in government and emergency response facilities (approximate value $)
- people in educational facilities (approximate value $)
- people in medical facility (approximate value $)
- people in community facilities (approximate value $)
- road system miles (approximate value $)
- bridge (approximate value $)
- people in transportation facilities (approximate value $)
- people in utility facilities (approximate value $)

6.8 Future Development

Table 6-7 lists the active DCRA grants for Saint Paul.

Table 6-7 DCRA Future Grants

Grant Recipient	Project Name	Award Year	Grant Status	Award Amount	End Date
City of Saint Paul	Ataqan Landfill Burn Box	2013	Active	$382,337	6/30/17
Pribilof Islands School District	Nutritional Alaskan Foods for Schools	2013	Active	$31,166	7/1/12

7. Mitigation Strategy

Section Seven outlines the six-step process for preparing a mitigation strategy including:

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

DMA requirements for developing a comprehensive mitigation strategy include:

DMA 2000 Requirements
Identification and Analysis of Mitigation Actions §201.6(c)(3): [The plan shall include the following:] A *mitigation strategy* that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools. §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards. §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. §201.6(c)(3)(iii): [The hazard mitigation strategy shall include an] action plan, describing how the action identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs. §201.6(c)(3)(iv): [For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan. Requirement §201.6(c)(4): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvements, when appropriate.
ELEMENT C. Mitigation Strategy
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs?
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? *(Addressed in Section 6.4)*
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards?
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure?
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction?
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate?
Source: FEMA, March 2015.

7.1 City of Saint Paul Capability Assessment

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

DMA 2000 Requirements
Incorporation into Existing Planning Mechanisms §201.6(c)(3): [The plan shall include the following:] A *mitigation strategy* that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools.
ELEMENT C. Incorporate into Other Planning Mechanisms
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs?
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate?
Source: FEMA, March 2015.

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

Table 7-1 City of Saint Paul Regulatory Tools

Regulatory Tools (ordinances, codes, plans)	Existing Yes/No?	Comments (Year of most recent update; problems administering it, etc.)
Comprehensive Plan	Yes	Explains the City's land use initiatives and natural hazard impacts.
Land Use Plan	Yes	Explains the City's land use goals and initiatives.
Tribal Land Use Plan	Yes	Community Economic Development Strategy, 2002. Describes the Tribal Council development goals and initiatives for their lands.
Emergency Response Plan	No	
Wildland Fire Protection Plan	No	
Building code	No	The City can exercise this authority.
Zoning ordinances	No	The City can exercise this authority.
Subdivision ordinances or regulations	No	The City can exercise this authority.
Special purpose ordinances	No	The City can exercise this authority.

Local Resources

The Community's Local Emergency Management Committed works with the city and village to identify hazard areas. Their joint knowledge allows them to identify and implement hazard mitigation initiatives. The resources available in these areas have been assessed by the hazard mitigation Planning Team, and are summarized below.

Table 7-2 Technical Specialists for Hazard Mitigation

Staff/Personnel Resources	Yes / No	Department/Agency and Position
Development and land management practices	Yes	Community Development Planner
Planner or engineer with an understanding of natural and/or human-caused hazards.	Yes	Community Development Planner
Floodplain Manager	Yes	Community Development Planner
Surveyors	Yes	The City hires consultants when they need a surveyor.
Staff with education or expertise to assess the jurisdiction's vulnerability to hazards.	Yes	Community Development Planner
Personnel skilled in Geospatial Information System (GIS) and/or Hazards Us-Multi Hazard (Hazus-MH) software	Yes	Community Development Planner
Scientists familiar with the hazards of the jurisdiction	No	The City works with U.S. Fish & Wildlife Service (USFWS) and Fish & Game (ADF&G), and the Alaska Department of Transportation and Public Facilities
Emergency Manager	Yes	Community Development Planner
Finance (Grant writers)	Yes	Community Development Planner and community representatives
Public Information Officer	Yes	The City Mayor and Tribal President

Table 7-3 City of Saint Paul Financial Resources.

Financial Resource	Accessible or Eligible to Use for Mitigation Activities
General funds	Can exercise this authority with voter approval
Payment in Lieu of Taxes (PILT)	Provides operating support funding
Municipal Energy Assistance Program (MEAP)	Provides operating support funding
Community Development Block Grants (CDBG)	Can exercise this authority with voter approval
Capital Improvement Project Funding	Can exercise this authority with voter approval
Authority to levy taxes for specific purposes	Can exercise this authority with voter approval
Incur debt through general obligation bonds	Can exercise this authority with voter approval
Incur debt through special tax and revenue bonds	Can exercise this authority with voter approval
Incur debt through private activity bonds	Can exercise this authority with voter approval
Hazard Mitigation Grant Program (HMGP)	FEMA funding which is available to local communities after a Presidentially-declared disaster. It can be used to fund both pre- and post-disaster mitigation plans and projects.
Pre-Disaster Mitigation (PDM) grant program	FEMA funding which available on an annual basis. This grant can only be used to fund pre-disaster mitigation plans and projects only
Flood Mitigation Assistance (FMA) grant program	FEMA funding which is available on an annual basis. This grant can be used to mitigate repetitively flooded structures and infrastructure to protect repetitive flood structures. *(The City of Saint Paul does not participate in the NFIP so is not eligible for FMA project funding.)*
United State Fire Administration (USFA) Grants	The purpose of these grants is to assist state, regional, national or local organizations to address fire prevention and safety. The primary goal is to reach high-risk target groups including children, seniors and firefighters.

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

7.2 Developing Mitigation Goals

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

DMA 2000 Requirements
Local Hazard Mitigation Goals §201.6(c)(3)(i): The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.
ELEMENT C. Mitigation Goals
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards?
Source: FEMA, March 2015.

The exposure analysis results were used as a basis for developing the mitigation goals and actions. Mitigation goals are defined as general guidelines that describe what a community wants to achieve in terms of hazard and loss prevention. Goal statements are typically long-range, policy-oriented statements representing community-wide visions. As such, eight goals were developed to reduce or avoid long-term vulnerabilities to the identified hazards (Table 7-4).

Table 7-4 Mitigation Goals

No.	Goal Description
Multi-Hazards (MH)	
MH 1	Provide **outreach** activities to educate and promote recognizing and mitigating all natural and manmade hazards that affect the City of Saint Paul (City) and the Aleut Community of Saint Paul Island (Tribe).
MH 2	**Cross-reference** mitigation goals and actions with other City and Tribal planning mechanisms and projects.
MH 3	Develop **construction** activities that reduce possibility of losses from all natural and manmade hazards that affect the City and Tribe.
Natural Hazards	
EQ 4	Reduce structural vulnerability to earthquake (EQ) damage.
FL 5	Reduce flood and erosion (FL) damage and loss possibility.
SW 6	Reduce structural vulnerability to severe weather (SW) damage.
TS 7	Reduce vulnerability, damage, or loss of structures from tsunami or seiche (TS)

7.3 Identifying Mitigation Actions

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

DMA 2000 Requirements
Identification and Analysis of Mitigation Actions §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.
ELEMENT C. Mitigation Actions

DMA 2000 Requirements
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure?
Source: FEMA, March 2015.

The Planning Team assessed the potential mitigation actions to carry forward into the mitigation strategy. Mitigation actions are activities, measures, or projects that help achieve the goals of a mitigation plan. Mitigation actions are usually grouped into three broad categories: property protection, public education and awareness, and structural projects.

During the planning process, November 2014 through January 2016. The Planning Team did not delete any of the Legacy 2008 HMP actions, but reports their current status as well as editing to reworded or clarified legacy actions, as deemed appropriate.

Table 7-5 lists each project's status for clarification (completed, deferred, deleted, or ongoing) with a short explanatory statement to support their status. The Planning Team identified numerous mitigation actions that were reported in other City planning documents. They also considered new projects or activities from a comprehensive list for each hazard type. Newly selected projects are included to reflect additional community mitigation action needs for implementation during the five-year life cycle of this HMP.

Table 7-5 Mitigation Plan and Potential Actions

(Blue text reflects legacy HMP action status, updates, or changes)

Goals		Status		Actions
No.	**Description**	**New** *Considered, Selected* **Brought Forward** *Complete, Deferred, Deleted, or Ongoing*	**Explain Status**	**Description**
MH 1	Provide **outreach** activities to educate and promote recognizing and mitigating all natural and manmade hazards that affect the City of Saint Paul (City) and the Aleut Community of Saint Paul Island (Tribe).	Newly selected project		Identify and pursue funding opportunities to implement mitigation actions.
		Newly selected project		Enhance public awareness of potential risk to life and personal property from identified natural hazard events (EQ, flood, ground failure, severe weather, tsunami, volcanic ash, and tundra fire)
		Newly selected project		Encourage individuals to apply mitigation measures in their properties immediate vicinity to avoid potential fire, flooding, snow loading, and other damages.
		Deferred / Ongoing	*Awaiting Funding*	*Research and consider instituting the National Weather Service program of "Storm Ready".*
		Deferred / Ongoing	*Awaiting Funding*	*Conduct special awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.*

Table 7-5 Mitigation Plan and Potential Actions

(Blue text reflects legacy HMP action status, updates, or changes)

Goals		Status		Actions
No.	**Description**	**New** *Considered, Selected* **Brought Forward** *Complete, Deferred, Deleted, or Ongoing*	**Explain Status**	**Description**
		Deferred / Ongoing	*Awaiting Funding*	*Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability.*
		Deferred / Ongoing	• *Edited to better reflect community needs.* • *Awaiting community decision to participate* *Moved from TS 7*	*Saint Paul Island has received NOAA funded emergency notifications and alert sirens.* *The City seeks to participate in DHS&EM's and NOAA's Tsunami Awareness Program.*
MH 2	**Cross-reference** mitigation goals and actions with other City and Tribal planning mechanisms and projects.	Newly selected project		Implement and coordinate regularly community discussions to identify best ways to assist mitigation efforts within the community, and add mitigation actions to existing City documents and plans.
		Edited to reflect community need *Deferred / Ongoing*	*Seeking Coordination Opportunity*	*Prepare and implement a Saint Paul Emergency Response Plan (ERP) in coordination with Alaska DHS&EM.*
		Deferred / Ongoing	*Awaiting Funding, Reworded to include all hazards*	*Identify critical buildings and facilities that must be able to remain operable during and following hazard impact events.*
MH 3	Identify and develop **construction** activities that reduce possibility of losses from all natural and manmade hazards that affect the City and Tribe.	*Deferred / Ongoing*	*Awaiting Funding, Reworded to include all hazards*	*Saint Paul road improvement projects are essential. Community will seek funding for designing and constructing road improvement as well as protective barriers in coastal areas to reduce storm surge, flooding, and other natural hazard impacts.*
		Deferred / Ongoing	*Awaiting Funding*	*Encourage effective building construction methods, materials, and practices to reduce potential damage impacts.*
EQ 4	Reduce vulnerability of structures to earthquake damage.	*Deferred / Ongoing*	*Awaiting Funding*	*If funding is available, perform an engineering assessment of the earthquake vulnerability of each identified critical infrastructure.*
		Deferred / Ongoing	*Awaiting Funding*	*Identify buildings and facilities that must be able to remain operable during and following an earthquake event.*
		Deferred / Ongoing	*Awaiting Funding*	*Contract a structural engineering firm to assess vulnerability to identified buildings and facilities.*
FL 5	Reduce vulnerability, damage, or loss of structures from	*Deferred / Ongoing*	*Awaiting City and Tribal Council Decision*	*NFIP - Consider the feasibility of joining NFIP.*

Table 7-5 Mitigation Plan and Potential Actions

(Blue text reflects legacy HMP action status, updates, or changes)

Goals		Status		Actions
No.	**Description**	**New** *Considered, Selected* **Brought Forward** *Complete, Deferred, Deleted, or Ongoing*	**Explain Status**	**Description**
	flooding and erosion.	*Deferred / Ongoing*	• *Reworded to better reflect community needs.* • *Awaiting community joining NFIP*	*Develop map of Saint Paul's floodplain to enable accurately assessing the flood threat.*
SW 6	Reduce structural vulnerability to severe weather (SW) damage.	Newly selected project		Install a siren to warn people of a severe weather or disaster event.
TS 7	Reduce vulnerability, damage, or loss of structures from tsunami or seiche	*Deferred / Ongoing*	• *Edited to better reflect community needs.* • *Awaiting community decision to participate* • *Moved to MH1*	*Saint Paul Island has received NOAA funded emergency tsunami notifications and alert sirens.* *The City seeks to participate in DHS&EM's and NOAA's Tsunami Awareness Program.*
		Delete	Duplicate Action	*Participation in the Tsunami Ready Program.*
		Deferred / Ongoing	Awaiting Funding	*Develop tsunami inundation maps in conjunction with state agencies.*
		Deferred / Ongoing	Awaiting Funding	*Repair or replace current non-functional city-wide alarm system to provide emergency warnings.*

7.4 Evaluating and Prioritizing Mitigation Actions

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

DMA 2000 Requirements: Mitigation Strategy - Implementation of Mitigation Actions
Implementation of Mitigation Actions §201.6(c)(3)(iii): [The hazard mitigation strategy shall include an] action plan, describing how the action identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.
1. REGULATION CHECKLIST
ELEMENT C. MITIGATION STRATEGY

DMA 2000 Requirements: Mitigation Strategy - Implementation of Mitigation Actions
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))
Source: FEMA, March 2015.

The Planning Team reviewed the simplified social, technical, administrative, political, legal, economic, and environmental (STAPLEE) evaluation criteria (Table 7-6) and the Benefit-Cost Analysis Fact Sheet (Appendix G) to consider the opportunities and constraints of implementing each particular mitigation action. For each action considered for implementation, a qualitative statement is provided regarding the benefits and costs and, where available, the technical feasibility. A detailed cost-benefit analysis is anticipated as part of the application process for those projects the City chooses to implement.

Table 7-6 Evaluation Criteria for Mitigation Actions

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

The Planning Team considered each hazard's history, extent, and probability to determine each potential actions priority. A rating system based on high, medium, or low was used.

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

7.5 Mitigation Action Plan

Table 7-7 delineates the acronyms used in the Mitigation Action Plan (MAP). Mitigation actions are prioritized within the MAP matrix to provide the City with an implementation approach.

Appendix A summarizes agency funding source responsible agencies, titles, and applicable acronyms.

Table 7-7 Potential Funding Source Acronym List

(See complete funding resource description in Appendix A)

City of Saint Paul (City Manager's Office)

Aleut Community of Saint Paul Island Tribal Council (Tribal Council Office)

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

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

US Department of Commerce (DOC)/
Remote Community Alert Systems Program (RCASP)
National Oceanic and Atmospheric Administration (NOAA)
Economic Development Administration (EDP)
Public Works and Development Facilities Program (PWDFP)
US Environmental Protection Agency (EPA)/
Indian Environmental General Assistance Program (IGAP)

US Department of Agriculture (USDA)/
USDA, Farm Service Agency
Emergency Conservation Program (ECF)
Rural Development (RD)

USDA, Natural Resources Conservation Service (NRCS)
Conservation Technical Assistance Program (DCT)
Conservation Innovation Grants (CIG)
Environmental Quality Incentives Program (EQIP)
Emergency Watershed Protection Program (EWP)
Watershed Planning (WSP)

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

Assistance to Native Americans (ANA)
*Native American Housing Assistance and Self Determination Act (NA*FSMA),

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

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

Alaska Department of Community, Commerce, and Economic Development (DCCED)

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

Alaska Department of Transportation
State road repair funding

Table 7-7 Potential Funding Source Acronym List

(See complete funding resource description in Appendix A)

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

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

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

Denali Commission (Denali)
Energy Program (EP
Solid Waste Program (SWP)

Lindbergh Foundation Grant Programs (LFGP)

Rasmuson Foundation Grants (RFG)

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

Table 7-8 Saint Paul Mitigation Action Plan (MAP)

Goal / Action ID	Description	Priority (High, Medium, Low)	Department	Potential Funding Source(s)	Timeframe (1-3 Years 2-4 Years 3-5 Years)	Benefit-Costs (BC) / Technical Feasibility (T/F)
MH 1.1	Identify and pursue funding opportunities to implement mitigation actions.	High	St. Paul Mayor's or City Manager's Office Aleut Community of Saint Paul Island's Tribal Council Office *(The Native Council is included as a viable responsible entity in order to obtain Administration for Native Americans (ANA) funding, the Tribe would need to be the applicant for those projects)*	City, Tribe, (See Appendix A)	Ongoing	B/C: City and Village life requires this as an ongoing activity; it is essential for rural communities as there are limited funds available to accomplish effective mitigation actions. TF: This activity is ongoing demonstrating its feasibility.
MH 1.2	Enhance public awareness of potential risk to life and personal property from **all** natural hazard events (EQ, Flood, Severe Weather, Tundra Fire)	Medium	City Manager's Office	City, DCRA, DHS&EM	0 – 5 years	B/C: An evacuation center is a long-range action which depends on funding. T/F: This high cost action can be accomplished through the City's proven record of successful grants.
MH 1.3	*Identify buildings and facilities that must be able to remain operable during natural hazard events.*	*High*	*City Manager's or Public Works Director's Office as applicable*	*City, HMA, NRCS, ANA, USACE, US USDA, Lindbergh*	*Ongoing*	*B/C: This project would ensure threatened infrastructures are available for use – their loss would exacerbate potential damages and further threaten survivability.* *T/F: This project is feasible using existing staff skills, equipment, and materials.*

Table 7-8 Saint Paul Mitigation Action Plan (MAP)

Goal / Action ID	Description	Priority (High, Medium, Low)	Department	Potential Funding Source(s)	Timeframe (1-3 Years 2-4 Years 3-5 Years)	Benefit-Costs (BC) / Technical Feasibility (T/F)
MH 1.4	Encourage individuals to apply mitigation measures in their properties immediate vicinity to avoid potential fire, flooding, snow loading, and other damages.	High	City Manager's Office	City	1-3 years	B/C: Sustained mitigation outreach program has minimal cost and will help build and support area-wide capacity. This type activity enables the public to prepare for, respond to, and recover from disasters. TF: This low cost activity can be combined with recurring community meetings where hazard specific information can be presented in small increments. This activity is ongoing demonstrating its feasibility.
MH 1.5	*Research and consider instituting the National Weather Service program of "Storm Ready".*	*High*	*City Manager's Office*	*City, NWS, NOAA*	*Ongoing*	*B/C: Sustained emergency warning, communication, and response activity capabilities enable communities to warn and protect their hazard threatened populations.* *This project will help build and support community capacity enabling the public to prepare for, respond to, and recover from disasters.* *TF: This project is technically feasible using existing City staff*
MH 1.6	*The City seeks to participate in DHS&EM's and NOAA's Tsunami Awareness Program.*	*Low*	*City Manager's Office*	*CITY, ADOT, HMA, NRCS, USACE, USDA/EWP, USDA/ECP, DCRA/ ACCIMP*	*Ongoing*	*Saint Paul Island has received NOAA funded emergency tsunami notifications and alert sirens.* *B/C: Sustained emergency response planning, notification, and mitigation outreach programs have minimal cost and will help build and support community capacity enabling the public to prepare for, respond to, and recover from disasters.* *TF: This project is technically feasible using existing City staff*

Table 7-8 Saint Paul Mitigation Action Plan (MAP)

Goal / Action ID	Description	Priority (High, Medium, Low)	Department	Potential Funding Source(s)	Timeframe (1-3 Years 2-4 Years 3-5 Years)	Benefit-Costs (BC) / Technical Feasibility (T/F)
MH 1.7	*Conduct special awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.*	*High*	*City Manager's Office*	*City, NWS, DCRA, DHS&EM*	*Ongoing*	*B/C: Sustained mitigation outreach program has minimal cost and will help build and support area-wide capacity. This type activity enables the public to prepare for, respond to, and recover from disasters.* *TF: This low cost activity can be combined with recurring community meetings where hazard specific information can be presented in small increments. This activity is ongoing demonstrating its feasibility.*
MH 1.8	*Prepare and implement a Saint Paul Emergency Response Plan (ERP) in coordination with Alaska DHS&EM.*	*High*	*City Manager's Office*	*City, DCRA, DHS&EM*	*Ongoing*	*B/C: Sustained emergency response planning, notification, and mitigation outreach programs have minimal cost and will help build and support community capacity enabling the public to prepare for, respond to, and recover from disasters.* *TF: This project is technically feasible using existing City staff*
MH 1.9	*Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability.*	*High*	*City Manager's Office*	*City, DCRA, DHS&EM*	*Ongoing*	*B/C: Sustained mitigation outreach program has minimal cost and will help build and support area-wide capacity. This type activity enables the public to prepare for, respond to, and recover from disasters.* *TF: This low cost activity can be combined with recurring community meetings where hazard specific information can be presented in small increments. This activity is ongoing demonstrating its feasibility.*
MH 2.1	Implement and coordinate regularly community discussions to identify best ways to assist mitigation efforts within the community, and add mitigation actions to existing City documents and plans.	Medium	City Manager's Office	City, FEMA HMA programs, AFG, FP&S, and SAFER	2-4 years	B/C: Sustained mitigation outreach programs have minimal cost and will help build and support area-wide capacity. This type activity enables the public to prepare for, respond to, and recover from disasters. T/F: This low cost activity can be combined with recurring community meetings where hazard specific information can be presented in small increments. This activity is ongoing

Table 7-8 Saint Paul Mitigation Action Plan (MAP)

Goal / Action ID	Description	Priority (High, Medium, Low)	Department	Potential Funding Source(s)	Timeframe (1-3 Years 2-4 Years 3-5 Years)	Benefit-Costs (BC) / Technical Feasibility (T/F)
						demonstrating its feasibility.
MH 2.2	*Identify critical buildings and facilities that must be able to remain operable during and following hazard impact events.*	*Medium*	*City Manager's Office*	*City, FEMA HMA programs, AFG, FP&S, and SAFER*	*Ongoing*	*B/C: Coordinated planning ensures effective damage abatement and ensures proper attention is assigned to reduce losses and damage to structures and residents.* *TF: This is feasible to accomplish as cost can be associated with plan reviews and updates. The action relies on staff and review committee availability and willingness to serve their community.*
MH 3.1	*Saint Paul all hazard mitigation road improvements. Design and construct to provide barrier to storm surge and other flooding.*	*Medium*	*City Manager's Office*	*City, FEMA HMA programs, AFG, FP&S, and SAFER*	*Ongoing*	*B/C: This project would ensure threatened infrastructures are available for use – there loss would exacerbate potential damages and further threaten survivability.* *TF: This project is feasible using existing staff skills, equipment, and materials.*
MH 3.2	*Encourage effective building construction methods, materials, and practices to reduce potential damage impacts.*	*Medium*	*City Manager's Office*	*City, FEMA HMA programs, AFG, FP&S, and SAFER*	*Ongoing*	*B/C: Sustained mitigation programs combined with ordinance development, implementation, and enforcement can effectively reduce future losses to damaging hazard impacts.* *TF: This project is technically feasible and enforceable.*
EQ 4.1	*If funding is available, perform an engineering assessment of the earthquake vulnerability of each identified critical infrastructure.*	*High*	*City Manager's or Public Works Director's Office as applicable*	*City, HMA, NRCS, ANA, USACE, US USDA, Lindbergh*	*Ongoing*	*B/C: This project would ensure threatened infrastructures are available for use – their loss would exacerbate potential damages and further threaten survivability.* *T/F: This project is feasible using existing staff skills, equipment, and materials.*
EQ 4.3	*Contract a structural engineering firm to assess vulnerability to identified buildings and facilities.*	*High*	*City Manager's or Public Works Director's Office as applicable*	*City, HMA, NRCS, ANA, USACE, US USDA, Lindbergh*	*Ongoing*	*B/C: This project would ensure threatened infrastructures are available for use – their loss would exacerbate potential damages and further threaten survivability.* *T/F: This project is feasible using existing staff skills, equipment, and materials.*

Table 7-8 Saint Paul Mitigation Action Plan (MAP)

Goal / Action ID	Description	Priority (High, Medium, Low)	Department	Potential Funding Source(s)	Timeframe (1-3 Years 2-4 Years 3-5 Years)	Benefit-Costs (BC) / Technical Feasibility (T/F)
FL 5.1	*NFIP - Consider the feasibility of joining NFIP.*	*Medium*	*City Manager's Office*	*City, DCRA, FEMA*	*Ongoing*	*B/C: Flood hazard mitigation is among FEMA's highest national priorities. Proactive mitigation activities have a high/cost benefit ratio and result in less costly construction before a problem develops. T/F: The City would be assisted and supported by DCRA and FEMA in the decision making process.*
FL 5.2	*Develop map of Saint Paul's floodplain to enable accurately assessing the flood threat.*	*Medium*	*City Manager's Office*	*City, ADOT, HMA, NRCS, USACE, USDA/EWP, USDA/ECP, DCRA/ ACCIMP*	*Ongoing*	*B/C: Flood hazard mitigation is among FEMA's highest national priorities. Proactive mitigation activities have a high/cost benefit ratio and result in less costly construction before a problem develops.* *T/F: The City would be assisted and supported by DCRA and FEMA in the decision making process.*
SW 6.1	Install a siren to warn people of a severe weather or disaster event.	Medium	City Manager's Office	CITY, HMA, NRCS, ANA, USACE, US USDA, Lindbergh	1-3 years	B/C: This project would ensure threatened infrastructures are available for use – their loss would exacerbate potential damages and further threaten survivability. T/F: This project is feasible using existing staff skills, equipment, and materials.
TS 7.2	*Develop tsunami inundation maps.*	*Low*	*City Manager's Office*	*CITY, ADOT, HMA, NRCS, USACE, USDA/EWP, USDA/ECP, DCRA/ ACCIMP*	*Ongoing*	*B/C: This action has a high/cost benefit ratio and result in less costly construction before a problem develops.* *T/F: The action depends on the action above.*
TS 7.3	*Repair or replace current non-functional city-wide alarm system to provide emergency warnings.*	*High*	*City Manager's Office*	*CITY, ADOT, HMA, NRCS, USACE, USDA/EWP, USDA/ECP, DCRA/ ACCIMP*	*Ongoing*	*B/C: This action has a high/cost benefit ratio and result in less costly construction before a problem develops.* *T/F: The CITY has the skill to implement this action. Specialized skills may need to be contracted-out with materials and equipment barged in depending on the method selected.*

7.6 Implementing Mitigation Strategy into Existing Planning Mechanisms

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

DMA 2000 Requirements
Incorporation into Existing Planning Mechanisms §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.
ELEMENT C. Incorporate into Other Planning Mechanisms
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate?
Source: FEMA, March 2015.

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

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

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Section Eight provides a comprehensive reference list used to develop the HMP.

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Appendix A
Funding Resources

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Appendix A
Funding Resources

The Federal government requires local governments to have a HMP in place to be eligible for mitigation funding opportunities through FEMA such as the UHMA Programs and the HMGP.

The Mitigation Technical Assistance Programs available to local governments are also a valuable resource. FEMA may also provide temporary housing assistance through rental assistance, mobile homes, furniture rental, mortgage assistance, and emergency home repairs.

The Disaster Preparedness Improvement Grant also promotes educational opportunities with respect to hazard awareness and mitigation.

- FEMA, through its Emergency Management Institute, offers training in many aspects of emergency management, including hazard mitigation. FEMA has also developed a large number of documents that address implementing hazard mitigation at the local level. Five key resource documents are available from FEMA Publication Warehouse (1-800-480-2520) and are briefly described here:
    - How-to Guides. FEMA has developed a series of how-to guides to assist states, communities, and tribes in enhancing their hazard mitigation planning capabilities. The first four guides describe the four major phases of hazard mitigation planning. The last five how-to guides address special topics that arise in hazard mitigation planning such as conducting cost-benefit analysis and preparing multi-jurisdictional plans. The use of worksheets, checklists, and tables make these guides a practical source of guidance to address all stages of the hazard mitigation planning process. They also include special tips on meeting DMA 2000 requirements (http://www.fema.gov/hazard-mitigation-planning-resources#1).
    - Local Mitigation Planning Handbook, March 2013. This handbook explains the basic concepts of hazard mitigation and provides guidance to local governments on developing or updating hazard mitigation plans to meet the requirements of Title 44 Code of Federal Regulations (CFR) §201.6 for FEMA approval and eligibility to apply for FEMA Hazard Mitigation Assistance grant programs. (http://www.fema.gov/library/viewRecord.do?id=7209)
    - A Guide to Recovery Programs FEMA 229(4), September 2005. The programs described in this guide may all be of assistance during disaster incident recovery. Some are available only after a Presidential declaration of disaster, but others are available without a declaration. Please see the individual program descriptions for details. (http://www.fema.gov/txt/rebuild/ltrc/recoveryprograms229.txt)
    - The Emergency Management Guide for Business and Industry. FEMA 141, October 1993. This guide provides a step-by-step approach to emergency management planning, response, and recovery. It also details a planning process that businesses can follow to better prepare for a wide range of hazards and emergency events. This effort can enhance a business's ability to recover from financial losses, loss of market share, damages to equipment, and product or business interruptions. This guide could be of great assistance to a community's industries and businesses located in hazard prone areas. (https://www.fema.gov/media-library/assets/documents/3412)
    - The 2015 Hazard Mitigation Assistance (HMA) Guidance and Addendum, February 27 and March 3, 2015 respectively. Part I of the Hazard Mitigation Assistance (HMA) Guidance introduces the three HMA programs, identifies roles and responsibilities, and

outlines the organization of the document. This guidance applies to Hazard Mitigation Grant Program (HMGP) disasters declared on or after the date of publication unless indicated otherwise. This guidance is also applicable to the Pre-Disaster Mitigation (PDM) and Flood Mitigation Assistance (FMA) Programs; the application cycles are announced via http://www.grants.gov/. The guidance in this document is subject to change based on new laws or regulations enacted after publication.

- FEMA (http://www.fema.gov), includes links to information, resources, and grants that communities can use in planning and implementing community resilience and sustainability measures.
- FEMA also administers emergency management grants (http://www.fema.gov/help/site.shtm) and various firefighter grant programs (http://www.firegrantsupport.com/) such as
  - Emergency Management Performance Grant (EMPG). This is a pass through grant. The amount is determined by the State. The grant is intended to support critical assistance to sustain and enhance State and local emergency management capabilities at the State and local levels for all-hazard mitigation, preparedness, response, and recovery including coordination of inter-governmental (Federal, State, regional, local, and tribal) resources, joint operations, and mutual aid compacts state-to-state and nationwide. Sub-recipients must be compliant with National Incident Management System (NIMS) implementation as a condition for receiving funds. Requires 50% match. (https://www.fema.gov/fiscal-year-2015-emergency-management-performance-grant-program)
  - National Earthquake Hazards Reduction Program (NEHRP). The National Earthquake Hazards Reduction Program (NEHRP) seeks to mitigate earthquake losses in the United States through both basic and directed research and implementation activities in the fields of earthquake science and engineering. (https://www.fema.gov/national-earthquake-hazards-reduction-program)

    The NEHRP agencies pursue the goals of the program through collaboration with each other and numerous partners. In addition to other federal agencies, program partners include state and local governments, universities, research centers, professional societies, trade associations and businesses, as well as associated councils, commissions and consortia.

    NEHRP's work encompasses research, development and implementation activities. Program research helps to advance our understanding of why and how earthquakes occur and impact the natural and built environments. The program develops strategies, tools, techniques and other measures that can reduce the adverse effects of earthquakes and facilitates and promotes implementation of these measures, thereby strengthening earthquake resilience among at-risk communities.

    Detailed information about the program is available at NEHRP.gov, which is maintained by NIST, the lead agency for NEHRP. For additional agency-specific information, visit FEMA Earthquake, the USGS Earthquake Hazards Program, the NIST NEHRP Office and the National Science Foundation.
  - Assistance to Fire Fighters Grant (AFG), Fire Prevention and Safety (FP&S), Staffing for Adequate Fire and Emergency Response Grants (SAFER), and

Assistance to Firefighters Station Construction Grant programs. Information can be found at: (http://forestry.alaska.gov/fire/vfa.htm).

- Department of Homeland Security (DHS) provides the following grants:
  - Homeland Security Grant Program (HSGP), State Homeland Security Program (SHSP) are 80% pass through grants. SHSP supports implementing the State Homeland Security Strategies to address identified planning, organization, equipment, training, and exercise needs for acts of terrorism and other catastrophic events. In addition, SHSP supports implementing the National Preparedness Guidelines, the NIMS, and the National Response Framework (NRF). Must ensure at least 25% of funds are dedicated towards law enforcement terrorism prevention-oriented activities. (https://www.dhs.gov/homeland-security-grant-program-hsgp)
  - Citizen Corps Program (CCP). The Citizen Corps mission is to bring community and government leaders together to coordinate involving community members in emergency preparedness, planning, mitigation, response, and recovery activities. (http://www.dhs.gov/citizen-corps)
  - Emergency Operations Center (EOC) Guidance. This program is intended to improve emergency management and preparedness capabilities by supporting flexible, sustainable, secure, strategically located, and fully interoperable Emergency Operations Centers (EOCs) with a focus on addressing identified deficiencies and needs. Fully capable emergency operations facilities at the State and local levels are an essential element of a comprehensive national emergency management system and are necessary to ensure continuity of operations and continuity of government in major disasters or emergencies caused by any hazard. Requires 25% match. (https://www.fema.gov/media-library/assets/documents/20622)
  - Emergency Alert System (EAS). Resilient public alert and warning tools are essential to save lives and protect property during times of national, state, regional, and local emergencies. The Emergency Alert System (EAS) is used by alerting authorities to send warnings via broadcast, cable, satellite, and wireline communications pathways. Emergency Alert System participants, who consist of broadcast, cable, satellite, and wireline providers, are the stewards of this important public service in close partnership with alerting officials at all levels of government. The EAS is also used when all other means of alerting the public are unavailable, providing an added layer of resiliency to the suite of available emergency communication tools. The EAS is in a constant state of improvement to ensure seamless integration of CAP-based and emerging technologies. (https://www.fema.gov/emergency-alert-system)
- U.S. Department of Commerce's grant programs include:
  - National Oceanic and Atmospheric Administration (NOAA), provides funds to the SOA due to Alaska's high threat for tsunami. The allocation supports the promotion of local, regional, and state level tsunami mitigation and preparedness; installation of warning communications systems; installation of warning communications systems; installation of tsunami signage; promotion of the Tsunami Ready Program in Alaska; development of inundation models; and delivery of inundation maps and decision-support tools to communities in Alaska. (http://www.tsunami.noaa.gov/warning_system_works.html)

  - Remote Community Alert Systems (RCASP) grant for outdoor alerting technologies in remote communities effectively underserved by commercial mobile service for the purpose of enabling residents of those communities to receive emergency messages. (http://www.federalgrants.com/Remote-Community-Alert-Systems-Program-11966.html) This program is a contributing element of the Warning, Alert, and Response Network (WARN) Act.

- Department of Agriculture (USDA). Provides diverse funding opportunities; providing a wide benefit range. Their grants and loans website provides a brief programmatic overview with links to specific programs and services. (http://www.rd.usda.gov/programs-services)
  - Farm Service Agency: Emergency Conservation Program, Non-Insured Assistance, Emergency Forest Restoration Program, Emergency Watershed Protection, Rural Housing Service, Rural Utilities Service, and Rural Business and Cooperative Service. (http://www.fsa.usda.gov/FSA/stateoffapp?mystate=ak&area=home&subject=landing&topic=landing)
  - Natural Resources Conservation Service (NRCS) has several funding sources to fulfill mitigation needs. (http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/cig/)
    - The Emergency Watershed Protection Program (EWP). This funding source is designed is to undertake emergency measures, including the purchase of flood plain easements, for runoff retardation and soil erosion prevention to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood or any other natural occurrence is causing or has caused a sudden impairment of the watershed. (http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/)
    - Watershed Surveys and Planning. NRCS watershed activities in Alaska are voluntary efforts requested through conservation districts and units of government and/or tribes. The purpose of the program is to assist Federal, State, and local agencies and tribal governments to protect watersheds from damage caused by erosion, floodwater, and sediment and to conserve and develop water and land resources. Resource concerns addressed by the program include water quality, opportunities for water conservation, wetland and water storage capacity, agricultural drought problems, rural development, municipal and industrial water needs, upstream flood damages, and water needs for fish, wildlife, and forest-based industries. (http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wsp/)

- Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy, Weatherization Assistance Program. This program minimizes the adverse effects of high energy costs on low-income, elderly, and handicapped citizens through client education activities and weatherization services such as an all-around safety check of major energy systems, including heating system modifications and insulation checks. (http://www1.eere.energy.gov/wip/wap.html)

  - The Tribal Energy Program offers financial and technical assistance to Indian tribes to help them create sustainable renewable energy installations on their lands. This program promotes tribal energy self-sufficiency and fosters employment and economic development on America's tribal lands. (http://energy.gov/eere/wipo/tribal-energy-program)

- US Environmental Protection Agency (EPA). Under EPA's Clean Water State Revolving Fund (CWSRF) program, each state maintains a revolving loan fund to provide independent and permanent sources of low-cost financing for a wide range of water quality infrastructure projects, including: municipal wastewater treatment projects; non-point source projects; watershed protection or restoration projects; and estuary management projects. (http://dec.alaska.gov/water/MuniGrantsLoans/index.htm)
  - Public Works and Development Facilities Program. This program provides assistance to help distressed communities attract new industry, encourage business expansion, diversify local economies, and generate long-term, private sector jobs. Among the types of projects funded are water and sewer facilities, primarily serving industry and commerce; access roads to industrial parks or sites; port improvements; business incubator facilities; technology infrastructure; sustainable development activities; export programs; brownfields redevelopment; aquaculture facilities; and other infrastructure projects. Specific activities may include demolition, renovation, and construction of public facilities; provision of water or sewer infrastructure; or the development of stormwater control mechanisms (e.g., a retention pond) as part of an industrial park or other eligible project. (https://ofmpub.epa.gov/apex/watershedfunding/f?p=109:2:0::NO::P2_X_PROG_NUM,P2_X_YEAR:51,2015)
  - Indian Environmental General Assistance Program (IGAP). In 1992, Congress passed the Indian Environmental General Assistance Program Act (42 U.S.C. 4368b) which authorizes EPA to provide General Assistance Program (GAP) grants to federally-recognized tribes and tribal consortia for planning, developing, and establishing environmental protection programs in Indian country, as well as for developing and implementing solid and hazardous waste programs on tribal lands. (http://www.epa.gov/tribal/gap/)

- Department of Health and Human Services, Administration of Children & Families, Administration for Native Americans (ANA). The ANA awards funds through grants to American Indians, Native Americans, Native Alaskans, Native Hawaiians, and Pacific Islanders. These grants are awarded to individual organizations that successfully apply for discretionary funds. ANA publishes in the Federal Register an announcement of funds available, the primary areas of focus, review criteria, and application information. (http://www.acf.hhs.gov/grants/open/foa/)
- Department of Housing and Urban Development (HUD) provides a variety of disaster resources. They also partner with Federal and state agencies to help implement disaster recovery assistance. Under the *National Response Framework* the FEMA and the Small Business Administration (SBA) offer initial recovery assistance. (http://www.hud.gov/info/disasterresources_dev.cfm)

- HUD, Office of Homes and Communities, Section 108 Loan Guarantee Programs. This program provides loan guarantees as security for Federal loans for acquisition, rehabilitation, relocation, clearance, site preparation, special economic development activities, and construction of certain public facilities and housing. (http://www.hud.gov/offices/cpd/communitydevelopment/programs/108/index.cfm)
- HUD, Office of Homes and Communities, Section 184 Indian Home Loan Guarantee Programs (IHLGP). The Section 184 Indian Home Loan Guarantee Program is a home mortgage specifically designed for American Indian and Alaska Native families, Alaska Villages, Tribes, or Tribally Designated Housing Entities. Section 184 loans can be used, both on and off native lands, for new construction, rehabilitation, purchase of an existing home, or refinance.
- Because of the unique status of Indian lands being held in Trust, Native American homeownership has historically been an underserved market. Working with an expanding network of private sector and tribal partners, the Section 184 Program endeavors to increase access to capital for Native Americans and provide private funding opportunities for tribal housing agencies with the Section 184 Program. (http://www.hud.gov/offices/pih/ih/homeownership/184/)
- Indian Housing Block Grant / Native American Housing Assistance and Self Determination Act (IHBG/NAHASDA) administration, operating & construction funds. The act is separated into seven sections:

  The Indian Housing Block Grant Program (IHBG) is a formula grant that provides a range of affordable housing activities on Indian reservations and Indian areas. The block grant approach to housing for Native Americans was enabled by the Native American Housing Assistance and Self Determination Act of 1996 (NAHASDA).

  Eligible IHBG recipients are Federally recognized Indian tribes or their tribally designated housing entity (TDHE), and a limited number of state recognized tribes who were funded under the Indian Housing Program authorized by the United States Housing Act of 1937 (USHA). With the enactment of NAHASDA, Indian tribes are no longer eligible for assistance under the USHA.

  An eligible recipient must submit to HUD an Indian Housing Plan (IHP) each year to receive funding. At the end of each year, recipients must submit to HUD an Annual Performance Report (APR) reporting on their progress in meeting the goals and objectives included in their IHPs.

  Eligible activities include housing development, assistance to housing developed under the Indian Housing Program, housing services to eligible families and individuals, crime prevention and safety, and model activities that provide creative approaches to solving affordable housing problems. (http://portal.hud.gov/hudportal/HUD?src=/program_offices/public_indian_housing/ih/grants/ihbg)
- HUD/CDBG provides grant assistance and technical assistance to aid communities in planning activities that address issues detrimental to the health and safety of local residents, such as housing rehabilitation, public services, community facilities, and infrastructure improvements that would primarily benefit low-and moderate-income. persons (http://www.hud.gov/offices/cpd/communitydevelopment/programs/)

  - HUD/Indian Community Development Block Grants (ICDBG) provide grant assistance and technical assistance to aid communities or Indian tribes in planning activities that address issues detrimental to the health and safety of local residents, such as housing rehabilitation, public services, community facilities, and infrastructure improvements that would primarily benefit low-and moderate-income. persons (http://portal.hud.gov/hudportal/HUD?src=/program_offices/public_indian_housing/ih/grants/icdbg)

- Department of Labor (DOL), Employment and Training Administration, Disaster Unemployment Assistance (DUA). Provides weekly unemployment subsistence grants for those who become unemployed because of a major disaster or emergency. Applicants must have exhausted all benefits for which they would normally be eligible. (http://www.workforcesecurity.doleta.gov/unemploy/disaster.asp)
  - The Workforce Investment Act contains provisions aimed at supporting employment and training activities for Indian, Alaska Native, and Native Hawaiian individuals. The Department of Labor's Indian and Native American Programs (INAP) funds grant programs that provide training opportunities at the local level for this target population. (http://www.dol.gov/dol/topic/training/indianprograms.htm)
- U.S. Department of Transportation (DOT), Hazardous Materials Emergency Preparedness (HMEP) Grant. The Hazardous Materials Transportation Safety and Security Reauthorization Act of 2005 authorizes the U.S. DOT to provide assistance to public sector employees through training and planning grants to States, Territories, and Native American tribes for emergency response. The purpose of this grant program is to increase State, Territorial, Tribal, and local effectiveness in safely and efficiently handling hazardous materials accidents and incidents, enhance implementation of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA), and encourage a comprehensive approach to emergency training and planning by incorporating the unique challenges of responses to transportation situations. (http://www.phmsa.dot.gov/hazmat/grants)
- Federal Financial Institutions. Member banks of Federal Deposit Insurance Corporation, Financial Reporting Standards or Federal Home Loan Bank Board may be permitted to waive early withdrawal penalties for Certificates of Deposit and Individual Retirement Accounts.
- Internal Revenue Service (IRS), Disaster Tax Relief. Provides extensions to current year's tax return, allows deductions for disaster losses, and allows amendment of previous year’s tax returns (http://www.irs.gov/Businesses/Small-Businesses-%26-Self-Employed/Disaster-Assistance-and-Emergency-Relief-for-Individuals-and-Businesses-1).
- U.S. Small Business Administration (SBA) Disaster Assistance Loans and Grants program provides information concerning disaster assistance, preparedness, planning, cleanup, and recovery planning. (https://www.sba.gov/category/navigation-structure/loans-grants)
  - May provide low-interest disaster loans to individuals and businesses that have suffered a loss due to a disaster. (https://www.sba.gov/category/navigation-structure/loans-grants/small-business-loans/disaster-loans). Requests for SBA loan assistance should be submitted to DHS&EM.

- United States Army Corps of Engineers (USACE) Alaska District's Civil Works Branch studies potential water resource projects in Alaska. These studies analyze and solve water resource issues of concern to the local communities. These issues may involve navigational improvements, flood control or ecosystem restoration. The agency also tracks flood hazard data for over 300 Alaskan communities on floodplains or the sea coast. These data help local communities assess the risk of floods to their communities and prepare for potential future floods. The USACE is a member and co-chair of the Alaska Climate Change Sub-Cabinet.
  - Civil Works and Planning (http://www.poa.usace.army.mil/Missions/CivilWorksandPlanning.aspx)
  - Environmental Resources Section (http://www.poa.usace.army.mil/About/Offices/Engineering/EnvironmentalResources.aspx)
  - USACE Alaska District Grants (http://search.usa.gov/search?affiliate=alaska_district&query=grants)
- The Grants.gov program management office was established, in 2002, as a part of the President's Management Agenda. Managed by the Department of Health and Human Services, Grants.gov is an E-Government initiative operating under the governance of the Office of Management and Budget.

  Under the President's Management Agenda, the office was chartered to deliver a system that provides a centralized location for grant seekers to find and apply for federal funding opportunities. Today, the Grants.gov system houses information on over 1,000 grant programs and vets grant applications for 26 federal grant-making agencies.

State Funding Resources

- Department of Military and Veterans Affairs (DMVA): Provides damage appraisals and settlements for VA-insured homes, and assists with filing of survivor benefits. (http://veterans.alaska.gov/links.htm)
  - DHS&EM within DMVA is responsible for improving hazard mitigation technical assistance for local governments for the SOA. Providing hazard mitigation training, current hazard information and communication facilitation with other agencies will enhance local hazard mitigation efforts. DHS&EM administers FEMA mitigation grants to mitigate future disaster damages such as those that may affect infrastructure including elevating, relocating, or acquiring hazard-prone properties. (http://ready.alaska.gov/plans/mitigation.htm) DHS&EM also provides mitigation funding resources for mitigation planning on their Web site at http://ready.alaska.gov/grants .
- Division of Health and Social Services (DHSS): On this site you will find information intended to assist all who are interested in DHSS grants and services they support. (http://dhss.alaska.gov/fms/grants/Pages/grants.aspx and http://dhss.alaska.gov/fms/Documents/FY15GrantBook.pdf)

- Division of Health and Social Services (DSS): Provides special outreach services for seniors, including food, shelter and clothing. (http://dhss.alaska.gov/dsds/Pages/hcb/hcb.aspx)
- Division of Insurance (DOI): Provides assistance in obtaining copies of policies and provides information regarding filing claims. (http://commerce.state.ak.us/dnn/ins/Consumers/AlaskaConsumerGuide.aspx)
- DCRA within the DCCED administers the HUD/CDBG, FMA Program, and the Climate Change Sub-Cabinet's Interagency Working Group's program funds and administers various flood and erosion mitigation projects, including the elevation, relocation, or acquisition of flood-prone homes and businesses throughout the State. This division also administers programs for State's" distressed" and "targeted" communities. (http://www.commerce.state.ak.us/dca/)
    - DCRA Planning and Land Management staff provide Alaska Climate Change Impact Mitigation Program (ACCIMP) funding to Alaskan communities that meet one or more of the following criteria related to flooding, erosion, melting permafrost, or other climate change-related phenomena: Life/safety risk during storm/flood events; loss of critical infrastructure; public health threats; and loss of 10% of residential dwellings. (http://commerce.state.ak.us/dnn/dcra/PlanningLandManagement/ACCIMP.aspx)

      The Hazard Impact Assessment is the first step in the ACCIMP process. The HIA identifies and defines the climate change-related hazards in the community, establishes current and predicted impacts, and provides recommendations to the community on alternatives to mitigate the impact. (http://commerce.alaska.gov/dca/planning/accimp/hazard_impact.html)
- Department of Environmental Conservation (DEC). DEC's primary roles and responsibilities concerning hazards mitigation are ensuring safe food and safe water, and pollution prevention and pollution response. DEC ensures water treatment plants, landfills, and bulk fuel storage tank farms are safely constructed and operated in communities. Agency and facility response plans include hazards identification and pollution prevention and response strategies. (http://dec.alaska.gov/)
    - The Division of Water's Village Safe Water (VSW) Program works with rural communities to develop sustainable sanitation facilities. Communities apply each year to VSW for grants for sanitation projects. Federal and state funding for this program is administered and managed by the VSW program. VSW provides technical and financial support to Alaska's smallest communities to design and construct water and wastewater systems. In some cases, funding is awarded by VSW through the Alaska Native Tribal Health Consortium (ANTHC), who in turn assist communities in design and construct of sanitation projects.
    - Municipal Grants and Loans (MGL) Program. The Department of Environmental Conservation / Division of Water administer the Alaska Clean Water Fund (ACWF) and the Alaska Drinking Water Fund (ADWF). The division is fiscally responsible to the Environmental Protection Agency (EPA) to administer the loan funds as the EPA provides capitalization grants to the division for each of the loan funds. In addition, it is prudent upon the division to administer the funds in a manner that ensures their

continued viability.
(http://dec.alaska.gov/water/MuniGrantsLoans/loanoverview.html)

- Under EPA's Clean Water State Revolving Fund (CWSRF) program, each state maintains a revolving loan fund to provide independent and permanent sources of low-cost financing for a wide range of water quality infrastructure projects, including: municipal wastewater treatment projects; non-point source projects; watershed protection or restoration projects; and estuary management, [and stormwater management] projects.
(http://yosemite.epa.gov/R10/ecocomm.nsf/6da048b9966d22518825662d00729a35/7b68c420b668ada5882569ab00720988!OpenDocument)

  Alaska's Revolving Loan Fund Program, prescribed by Title VI of the Clean Water Act as amended by the Water Quality Act of 1987, Public Law 100-4. DEC will use the ACWF account to administer the loan fund. This Agreement will continue from year-to-year and will be incorporated by reference into the annual capitalization grant agreement between EPA and the DEC. DEC will use a fiscal year of July 1 to June 30 for reporting purposes.
  (http://www.epa.gov/region10/pdf/water/srf/cwsrf_alaska_operating_agreement.pdf)

- Department of Transportation and Public Facilities (DOT/PF) personnel provide technical assistance to the various emergency management programs, to include mitigation. This assistance is addressed in the DHS&EM-DOT/PF Memorandum of Agreement and includes but is not limited to: environmental reviews, archaeological surveys, and historic preservation reviews.
  - DOT/PF and DHS&EM coordinate buy-out projects to ensure that there are no potential right-of-way conflicts with future use of land for bridge and highway projects, and collaborate on earthquake mitigation.
  - Additionally, DOT/PF provides the safe, efficient, economical, and effective State highway, harbor, and airport operation. DOT/PF uses its Planning, Design and Engineering, Maintenance and Operations, and Intelligent Transportation Systems resources to identify hazards, plan and initiate mitigation activities to meet the transportation needs of Alaskans, and make Alaska a better place to live and work. DOT/PF budgets for temporary bridge replacements and materials necessary to make the multi-modal transportation system operational following natural disaster events.
  - DNR administers various projects designed to reduce stream bank erosion, reduce localized flooding, improve drainage, and improve discharge water quality through the stormwater grant program funds. Within DNR, the Division of Geological and Geophysical Survey (DGGS) is responsible for Alaska's mineral, land, and water resources use and development and earthquake mitigation collaboration. Their geologists and support staff are leaders in researching Alaska's geology and implementing technological tools to most efficiently collect, interpret, publish, archive, and disseminate information to the public.
    (http://dggs.alaska.gov/pubs/advanced-search)
  - The DNR’s Division of Forestry (DOF) participates in a statewide wildfire control program in cooperation with the forest industry, rural fire departments and other agencies. Prescribed burning may increase the risks of fire hazards; however,

prescribed burning reduces the availability of fire fuels and therefore the potential for future, more serious fires. (http://forestry.alaska.gov/pdfs/08FireSuppressionMediaGuide.pdf)

- DOF also manages various wildland fire programs, activities, and grant programs such as the FireWise Program (http://forestry.alaska.gov/fire/firewise.htm), Community Forestry Program (CFP) (http://forestry.alaska.gov/community/), Assistance to Fire Fighters Grant (AFG), Fire Prevention and Safety (FP&S), Staffing for Adequate Fire and Emergency Response Grants (SAFER), and Volunteer Fire Assistance and Rural Fire Assistance Grant (VFA-RFA) programs (http://forestry.alaska.gov/fire/vfarfa.htm). Information can be found at http://forestry.alaska.gov/fire/current.htm.
- The Alaska Interagency Coordination Center (AICC) is the Geographic Area Coordination Center for Alaska. AICC serves as the focal point for initial attack resource coordination, logistics support, and predictive services for all state and federal agencies involved in wildland fire management and suppression in Alaska.

  Fire management planning, preparedness, suppression operations, prescribed burning, and related activities are coordinated on an interagency basis. DOF has cooperative agreements with the Departments of Agriculture and Interior, and numerous local government and volunteer fire departments to respond to wildland fires, reduce duplication of efforts, and share resources.

  In 1984 the SOA adopted the National Interagency Incident Management System Incident Command System concept for managing fire suppression. The Incident Command System (ICS) guiding principles are followed in all wildland fire management operations. All SOA Departments adopted ICS in 1996 through the Governor's administrative order.

Other Funding Resources

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

- Rural Alaska Community Action Program Inc. (RurAL CAP). In the nearly 50 years since it began, it is difficult to imagine any aspect of rural Alaskan lives which has not been touched in some way by the people and programs of RurAL CAP. From Head Start, parent education, adult basic education, and elder-youth programs, to Native land claims and subsistence rights, energy and weatherization programs, and alcohol and substance abuse prevention, RurAL CAP has left a lasting mark on the history and development of Alaska and its rural Peoples. (http://ruralcap.com/?page_id=334)
  - Weatherization Assistance Program assists low to moderate income households in weatherization needs. The program is available to homeowners as well as renters and includes; single family homes, cabins, mobile homes, condominiums and multifamily dwellings. (http://ruralcap.com/?page_id=794)
  - Solid Waste Management. RurAL CAP continues to host an expert solid waste liaison, Ted Jacobson, through funding provided by the Environmental Protection Agency (EPA) and Senior Services America, Inc. The liaison provides solid waste management technical assistance to rural communities through training, site visits, hands-on demonstrations, and remote contact. Resources are provided for dump

management activities, collaborating with funders for funding and technical assistance on solid waste management, recycling, and backhaul. (http://ruralcap.com/?page_id=198

- American Planning Association (APA), http://www.planning.org - a non-profit professional association that serves as a resource for planners, elected officials, and citizens concerned with planning and growth initiatives.
- Institute for Business and Home Safety (IBHS), an initiative of the insurance industry to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters. (http://www.disastersafety.org/)
- American Red Cross (ARC). Provides for the critical needs of individuals such as food, clothing, shelter, and supplemental medical needs. Provides recovery needs such as furniture, home repair, home purchasing, essential tools, and some bill payment may be provided. (http://www.redcross.org/find-help)
- Catalog of Federal Domestic Assistance (DFDA) Crisis Counseling Program (CCP). Provides grants to State and Borough Mental Health Departments, which in turn provide training for screening, diagnosing and counseling techniques. Also provides funds for counseling, outreach, and consultation for those affected by disaster. (http://dialoguemakers.org/Resourses4states+Nonprofits.htm)
- Denali Commission. Introduced by Congress in 1998, the Denali Commission is an independent federal agency designed to provide critical utilities, infrastructure, and economic support throughout Alaska. With the creation of the Denali Commission, Congress acknowledged the need for increased inter-agency cooperation and focus on Alaska's remote communities. Since its first meeting in April 1999, the Commission is credited with providing numerous cost-shared infrastructure projects across the State that exemplifies effective and efficient partnership between federal and state agencies, and the private sector. (http://www.denali.gov/grants)
    - The Energy Program primarily funds design and construction of replacement bulk fuel storage facilities, upgrades to community power generation and distribution systems, alternative-renewable energy projects, and some energy cost reduction projects. The Commission works with the Alaska Energy Authority (AEA), Alaska Village Electric Cooperative (AVEC), Alaska Power and Telephone and other partners to meet rural communities' fuel storage and power generation needs.
    - The goal of the solid waste program at the Denali Commission is to provide funding to address deficiencies in solid waste disposal sites, which threaten to contaminate rural drinking water supplies.
- Lindbergh Foundation Grants. Each year, The Charles A. and Anne Morrow Lindbergh Foundation provides grants of up to $10,580 (a symbolic amount representing the cost of the Spirit of St. Louis) to men and women whose individual initiative and work in a wide spectrum of disciplines furthers the Lindbergh's' vision of a balance between the advance of technology and the preservation of the natural/human environment. (http://www.thelindberghfoundation.org/awards)

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

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

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

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

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Appendix B
FEMA Hazard Mitigation Plan (HMP) Review Tool

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Appendix C
Community HMP Adoption Resolutions

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Appendix D
Public Outreach Activities

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Subject: Hazard Mitigation Plan Development Project Initial Notice

Date: Thursday, November 20, 2014 at 12:18:13 PM Alaska Standard Time

From: Simmons, Scott

To: 'mewest@alaska.edu', 'hdenny@anthc.org', 'tneal@usgs.gov', 'swhite@avcp.org', 'steve.heppner.bia.ak@gmail.com', 'kato_howard@ak.blm.gov', 'jneimeyer@denali.gov', 'leslie.pearson@alaska.gov', 'ryan.anderson@alaska.gov', 'Alice.Edwards@alaska.gov', 'taunnie.boothby@alaska.gov', 'scott.nelsen@alaska.gov', 'alan.wien@alaska.gov', 'terri.lomax@alaska.gov', 'Soderlund.Dianne@epamail.epa.gov', 'john.lingaas@noaa.gov', 'joel.curtis@noaa.gov', 'sam.albanese@noaa.gov', 'meg.mueller@ak.usda.gov', 'merlaine.kruse@ak.usda.gov', 'greg.magee@alaska.gov', 'Anna_Plager@dnr.state.ak.us', 'kerry_walsh@dnr.state.ak.us', 'John_Dunker@dnr.state.ak.us', 'Steve_Clautice@dnr.state.ak.us', 'patricia_burns@dnr.state.ak.us', 'Steve_McGroarty@dnr.state.ak.us', 'Mac_McLean@dnr.state.ak.us', 'Margie_Goatley@dnr.state.ak.us', 'Bruce.R.Sexauer@poa02.usace.army.mil', 'colleen.bickford@hud.gov', 'ak_le@fws.gov'

CC: Eileen Bechtol (erbechtol@gmail.com), DHSEM Scott Nelsen, Evans, Jessica, Appleby, Elizabeth, Wasserman, Evan

Dear Potential HMP Development Participants,
URS Corporation has received a 2014 contract from the State Division of Homeland Security and Emergency Management (DHS&EM) to develop 21 Local/Tribal All-Hazard Mitigation Plans for the following communities:

New HMP Development

- Atmautlauk (Unorganized)
- Chitina (Unorganized)
- Copper Center (Unorganized)
- Grayling (Unorganized)
- Kongiganak (Unorganized)
- Kwigillingok (Unorganized)
- City of Merkoryuk (2nd Class City)
- City of Nightmute (2nd Class City)
- Tuntutuliak (Unorganized)
- Tununak (Unorganized)
- City of Wales (2nd Class city)

HMP Update Required

- Newtok (Unorganized)
- City of Aniak (2nd Class City)
- City of Dillingham (1st Class City)
- City of Golovin (2nd Class City)
- Lake and Peninsula Borough, MJHMP
- City of Hooper Bay (2nd Class City)
- City of Kivalina (2nd Class City)
- City of Saint Paul (2nd Class City)
- City of Unalakleet (2nd Class City)
- City and Borough of Yakutat

The Lake and Peninsula Borough (L&PB) Multi-Jurisdictional HMP (MJHMP) consists of six organized cities and 12 unorganized communities:

The Lake and Peninsula Borough, MJHMP

Organized Cities	*Unorganized Communities*
City of Chignik (2nd Class City)	Chignik Lagoon
City of Egegik (2nd Class City)	Chignik Lake
City of Newhalen (2nd Class City)	Igiugig
City of Nondalton (2nd Class City)	Iliamna
City of Pilot Point (2nd Class City)	Ivanof Bay
City of Port Heiden (2nd Class City)	Kokhanok

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: http://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-

R. Scott Simmons, CFM, CPM
AECOM + URS
700 G Street, Suite 500 | Anchorage, AK 99501
Ph: 907.261.9706 | 800.909.6787 | Personal Mobile: 841.1832 | Fax: 907.562.1297
eMail Address: scott.simmons@urs.com

Subject: Saint Paul HMP Update

Date: Saturday, February 14, 2015 at 9:51:29 PM Alaska Standard Time

From: Eileen Bechtol

To: Ken Weaver

CC: Simmons, Scott

Hello Mr. Weaver:

I am writing to introduce myself, Eileen Bechtol, a subcontractor for Scott Simmons, AECOM (formerly known as URS Corporation). AECOM was contracted by the Division of Homeland Security and Emergency Management (DHS&EM) to develop a Hazard Mitigation Plan Update for 21 Alaska jurisdictions. The City of Saint Paul is one of the selected jurisdictions.

I got your name as the City Manager of Saint Paul from DHS&EM; if there is someone else I should contact about the Saint Paul HMP Update please forward this email. Thank you.

It is important to note that the City of Saint Paul does not have to pay anything for this project. This is an important project for your community funded by FEMA through the DHS&EM. URS worked with rural communities to assist them with their hazard mitigation plan development needs. In fact, URS has been developing HMPs nationwide since 2000. Our Alaska office has completed approximately 90 State, Borough and local community, State reviewed, and FEMA approved Hazard Mitigation Plans to-date.

HMP updates require reviewing current plans to identify how conditions have changed since the plan was last approved. For example, the current plan's plan development activities may change such as planning team membership; new plans, reports, and studies reviewed, new hazards identified and newly disaster impacts annotated. These changes could directly change identified planning community vulnerabilities and risks. This requires that the current Mitigation Strategy be reviewed and updated to identify current project's status. Were any project completed or do they need to be modified, merged with similar initiatives for the same impact or location; deleted because they are no longer deemed the most appropriate mitigation initiative, or changed to reflect new jurisdictional needs?

AECOM role in this project is to ensure that the Updated HMP meets state and federal requirements -- part of this requirement is to describe the process in which the community was involved. We are at the beginning stages of this project.

Our task is to write the plan while guiding you through the HMP Update process, maximizing your Planning Team's talent and local knowledge. AECOM will write the plan. The Planning Team will assist the process by working with us to identify changes since 2008 implementation:

Describe how the HMP has changed:

- New Planning Team membership and processes
- HMP update participation and plan reviewers,
- Identify new hazards not formerly addressed,
- Help us explain your hazard impacts since 2009,
- Identify changes to new and existing participating community's critical facilities and their relative location within each identified hazard's impact area,
- Determine their "estimated" replacement costs,
- Define the community's population risk and critical facility vulnerabilities,
- Review current and update the existing hazard mitigation goals if applicable,
- Determine the current status of each project within the Mitigation Strategy; was it completed, deleted, delayed, combined/changed, or is it still viable and ongoing? We will need to provide a brief explanation for any changes.
- Update the HMP Maintenance section to reflect how the City completed HMP annual review

commitments and identify whether it was effective or not, then update the process to make it more effective for future use.

There will be opportunities for the entire community to review the team's work during various public involvement processes because FEMA requires at least two public involvement activities. We will provide planning team meeting minutes and two newsletters for distribution or posting to enable community wide knowledge, providing information during Borough Planning Commission Meetings or other public meetings, and working with us over the phone as we capture needed information.

AECOM will provide two (2) newsletters. The first newsletter will introduce the project and explain the planning process, encourage public involvement; ask the community to identify known hazards, and to confirm their critical infrastructure as identified by DHS&EM's statewide small community Critical Facility Database. The second will introduce the updated draft HMP and encourage the community to review and provide comments to make the plan better or more usable to mitigate your hazards.

Please write me back with the names of whom you want on the Planning Team.

I would like to schedule an introductory teleconference meeting with yourself and other members of the Planning Team to introduce the project and the process letting you know what information we will need to allow us to proceed. I can call you on your speakerphone if that works. Please let me know when a good time is to call you.

I look forward to working with you and your Team. Thank you for your time.

Eileen Bechtol

Make no little plans; they have no magic to stir men's blood and probably themselves will not be realized. Make big plans; aim high in hope and work."
— Daniel Hudson Burnham (1846-1912)

Bechtol Planning & Development
Eileen R. Bechtol, AICP
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Homer, Alaska 99603
Phone: 907.399.1624
Email: erbechtol@gmail.com

SAINT PAUL ISLAND HAZARD MITIGATION PLAN UPDATE

This newsletter describes the Saint Paul Island's Hazard Mitigation Planning project development processes to all interested agencies, stakeholders, and the public and to solicit comments. It can also be viewed on the State of Alaska Division of Homeland Security and Emergency Management Website at http://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 update your 2008 Hazard Mitigation Plan (HMP.

URS was contracted to assist Saint Paul with preparing a 2015 FEMA approvable HMP update.

The HMP will identify all natural hazards, such as earthquake, flood/erosion, severe weather, and wildland/tundra fire hazards, 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 these 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, and education.

Why Do We Need A Hazard Mitigation Plan?

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

A FEMA approved and community adopted HMP enables the Local government to apply for the Hazard Mitigation Grant Program (HMGP), a disaster related assistance program; the Pre-Disaster Mitigation (PDM), and the National Flood Insurance Program (NFIP) Flood Mitigation Assistance (FMA) grant programs.

The Planning Process

There are very specific federal requirements that must be met when preparing a FEMA approvable HMP. 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:

- New Planning Team membership and processes
- HMP update participation and plan reviewers,
- Identify new hazards not formerly addressed,
- Help us explain your hazard impacts since 2008,
- Identify changes to new and existing participating community's critical facilities and their relative location within each identified hazard's impact area,
- Determine their "estimated" replacement costs,
- Define the community's population risk and critical facility vulnerabilities,
- Review current and update the existing hazard mitigation goals if applicable,
- Determine the current status of each project within the Mitigation Strategy; was it completed, deleted, delayed, combined/changed, or is it still viable and ongoing? We will need to provide a brief explanation for any changes.
- Update the HMP Maintenance section to reflect how the (City, Village, or Borough) completed HMP annual review commitments and identify whether it was effective or not, then update the process to make it more effective for future use.
- Provide a copy of the community's HMP Adoption Resolution

FEMA has prepared Local (available at: http://emilms.fema.gov/is318/assets/local_mtgtn_plan_gdnce_0708.pdf that explains how the HMP Update meets each of the DMA2000 requirements.

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

We Need Your Help

Please use the following table to confirm the hazards AND identify new hazards not formerly addressed.

Saint Paul Island's Hazard Worksheet		
Hazard	2008 HMP	Still Valid? Yes/No?
Earthquake (EQ)	Yes	
Flood (Erosion) (FL)	Yes	
Ground Failure (GF) Avalanche, Landslide, Melting Permafrost, and/or Subsidence	Yes	
Severe Weather (SW)	Yes	
Tsunami & Seiche (TS)	Yes	
Volcano (VO)	No	
Wildland "Tundra" Fire	No	

The 2008 HMP identified your critical facilities, but the list needs to be reviewed and 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 on Saint Paul Island. Please review and update the facilities list to assist us with better defining your vulnerabilities and potential losses.

Critical Facility	Current Natural Hazards				
	EQ	FL	GF	SW	TS
City Hall	X			X	X
Police Station					
Public Works	X			X	X
South Dock	X			X	X
East Dock	X			X	X
North Dock	X			X	X
TDK Dock					
SNP Airport	X			X	X
St. Paul Island School	X			X	X
Hospital/Clinic/ER	X			X	X
Cemetery Street Cemetery	X			X	X
Church Street Cemetery	X			X	X
Church-north	X			X	X
KUHB-FM CH 220 Radio					

Critical Facility	Current Natural Hazards				
	EQ	FL	GF	SW	TS
Transmitter	X			X	X
Church	X			X	X
Church	X			X	X
Post Office	X			X	X
Senior Center	X			X	X
Store	X			X	X
Public Works Machine Shop	X			X	X
Saint Paul Water System-1	X			X	X
Saint Paul Water System-2	X			X	X
Saint Paul Water System-3	X			X	X
Saint Paul Water System-4	X			X	X
Saint Paul Water System-5	X			X	X
Saint Paul Water System-6	X			X	X
Saint Paul Water System-7	X			X	X
Septic Tank and Drainfield-1	X			X	X
Septic Tank and Drainfield-2	X			X	X
Septic Tank and Drainfield-3	X			X	X
Septic Tank and Drainfield-4	X			X	X
Water Treatment Plant	X			X	X
Wind Generator	X			X	X
St. Paul Landfill Class II	X			X	X
Polovina Hill Class II Landfill	X			X	X
Satellite	X			X	X
Oil or Natural Gas Pipeline--Start	X			X	X
Oil or Natural Gas Pipeline--End	X			X	X
Delta Western Fuel Tanks (>500 gal)	X			X	X
City Power Plant					

Please email or fax updated hazard and critical facility information directly to Eileen Bechtol or provide it to your community Planning Team Leader.

The Planning Team

The Planning Team is being led by Chief of Police Michael Roever with assistance from Phillip Zavadil, the LEPC, and the City and Village Councils; with AECOM (contracted by DHS&EM) providing 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 mitigation ideas and to guide the community.

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

City of Saint Paul
Planning Team Leader
Chief of Police Michael Roever
PO Box 901
Saint Paul, AK 99660
Phone: 907.546.3131
eMail: mroever@stpaulak.com

AECOM Corporation
Scott Simmons, HMP Planner
700 G Street, Suite 500
Anchorage, Alaska 99501
800.909.6787
scott.simmons@aecom.com

BP&D
Eileen R. Bechtol, AIVP
Change Planner
P.O. Box 3426
Homer, AK 99603
907.399.1624
erbechtol@gmail.com

Subject: Re: what happened?
Date: Friday, August 28, 2015 at 2:37:08 PM Alaska Daylight Time
From: Nicholas Hunnicutt
To: Eileen Bechtol

We are so very remote that our phone service is on satellite and sometimes drops calls due to weather and things going on around the island.
I had to leave for a call, but I hope they were able to help you with everything you needed. Thank you for being patient with us out here and please
don't hesitate to call or email me for any thing.

Thanks again,

Below are those who attended call:

Public Safety Director Nick Hunnicutt

Director Peach and Safety Phil Zavadil

City Manager Bill Mathews

Firefighter/Tribal Richard Warren

On Fri, Aug 28, 2015 at 2:00 PM, Eileen Bechtol <erbechtol@gmail.com> wrote:

> Telephone call dropped and your line rings busy.
>
> *Make no little plans; they have no magic to stir men's blood and probably themselves will not be realized. Make big plans; aim high in hope and work.*"
> — Daniel Hudson Burnham (1846-1912)
>
> ***Bechtol Planning & Development***
> Eileen R. Bechtol, AICP
> P.O. Box 3426
> Homer, Alaska 99603
> Phone: 907.399.1624
> Email: erbechtol@gmail.com

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Chief Nick Hunnicutt
Saint Paul Public Safety
907-546-3130
nhunnicutt@stpaulak.com

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SAINT PAUL ISLAND'S HAZARD MITIGATION PLAN (HMP)

May 2015 **Newsletter 2**

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

HMP Development

Saint Paul was one of 21 communities selected by the State of Alaska, Division of Homeland Security and Emergency Management (DHS&EM) for a Hazard Mitigation Planning (HMP) development project. The plan identifies natural hazards that affect the community including earthquake, flood, ground failure, severe weather, and tsunami. The HMP also identifies the people and facilities potentially at risk and potential actions to mitigate community hazards. The public participation and planning process is documented as part of the project.

What is Hazard Mitigation?

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

People and property throughout Alaska are at risk from a variety of hazards that have the potential for causing human injury, property damage, or environmental harm.

The purpose of hazard mitigation is to implement projects that reduce the risk severity of hazards on people and property. Mitigation programs may include short-term and long-term activities to reduce hazard impacts or exposure to hazards. Mitigation could include education, construction or planning projects. Hazard mitigation activity examples include relocating buildings, developing or strengthening building codes, and educating residents and building owners.

Why Do We Need A Hazard Mitigation Plan?

A community is only eligible to receive grant money for mitigation programs by preparing and adopting a hazard mitigation plan. Communities must have an approved mitigation plan to receive grant funding from the Federal Emergency Management Agency (FEMA) for eligible mitigation projects.

The Planning Process

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

The DMA2000 requires the plan to document the following topics:

- Planning process
- Community Involvement and HMP review
- Hazard identification
- Risk assessment
- Mitigation Goals
- Mitigation programs, actions, and projects
- A resolution from the community adopting the plan

FEMA has prepared a Local Planning Review Guide) and (available at: http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=4859). It explains how the HMP meets each of the DMA2000 requirements. FEMA has prepared and "Mitigation Planning Guidance" and "How to Guides" (available at: http://www.fema.gov/hazard-mitigation-planning-resources). The City's Hazard Mitigation Plan will follow those guidelines.

The planning process kicked-off on February 14, 2014 by establishing a local planning committee and holding a public meeting. The planning committee examined the full spectrum of hazards listed in the State Hazard Mitigation Plan and identified six natural and three manmade/technological hazards the HMP would address.

After the first public meeting, City staff and AECOM began identifying critical facilities, compiling the hazard profiles, assessing capabilities, and conducting the risk assessment for the identified hazards. Critical facilities are facilities that are critical to the recovery of a community in the event of a disaster. After collection of this information, AECOM helped to determine which critical facilities and estimated populations are vulnerable to the identified hazards in Dillingham.

A mitigation strategy was the next component of the plan to be developed. Understanding the community's local capabilities and using information gathered from the public and the local planning committee and the expertise of the consultants and agency staff, a mitigation strategy was developed. The mitigation strategy is based on an evaluation of the hazards, and the assets at risk from those hazards. Mitigation goals and a list of potential actions/projects were developed as the foundation of the mitigation strategy.

Mitigation goals are defined as general guidelines that explain what a community wants to achieve in terms of hazard and loss prevention. Goals are positively stated future situations that are typically long-range, policy-oriented statements representing community-wide visions. Mitigation actions and projects are undertaken in order to achieve your stated objectives.

The local planning committee identified projects and/or actions for each hazard that focus on six categories: prevention, property protection, public education and awareness, natural resource protection, emergency services, and structural projects. A representative sample of the mitigation actions identified as a priority by the planning team are listed below, and explained in more detail in the HMP.

The selected projects and/or actions will potentially be implemented over the next five years as funding becomes available. A maintenance plan was also been developed for the hazard mitigation plan. It outlines how the community will monitor progress on achieving the projects and actions that will help meet the stated goals and objectives, as well as an outline for continued public involvement.

The draft plan is available in the City and Tribal offices for public review and comment. Comments should be made via email, fax, or phone to Scott Simmons (listed below) and be received no later than September 30, 2015. The plan will be provided to DHS&EM and FEMA for their preliminary approval and returned to Saint Paul's City and Tribal Council's for formal adoption.

The Planning Committee

The plan was developed with the assistance from the community's planning committee consisting of a cross section from the community. Planning Team members who helped with developing the plan include Team Leaders Public Safety Director Hunnicutt and Phillip Zavadil, with assistance from the LEPC, the City and Tribal Councils, and AECOM.

Sample of Saint Paul Island's Mitigation Actions. Review the draft HMP for a complete list.		
Identify and pursue funding opportunities to implement mitigation actions.	Install a siren to warn people of a severe weather or disaster event.	Develop tsunami inundation maps in conjunction with state agencies.
Enhance public awareness of potential risk to life and personal property from identified natural hazard events (EQ, flood, ground failure, severe weather, tsunami, volcanic ash, and tundra fire)	Implement and coordinate regularly community discussions to identify best ways to assist mitigation efforts within the community, and add mitigation actions to existing City documents and plans.	Repair or replace current non-functional city-wide alarm system to provide emergency warnings.
Install non-structural seismic restraints for large furniture such as bookcases, filing cabinets, heavy televisions, and appliances to prevent toppling damage and resultant injuries to small children, elderly, and pets.	In erosion-prone areas, install stakes at regular intervals perpendicular to eroding riverbanks and/or coastlines and provide long-term monitoring of the rate at which erosion occurs.	Implement and coordinate regularly community discussions to identify best ways to assist mitigation efforts within the community, and add mitigation actions to existing City documents and plans.
Coordinate with the SOA Department Transportation to improve City roads improving the drainage on the existing road and replacing many culverts where needed to prevent additional erosion.	Encourage individuals to apply mitigation measures in their properties immediate vicinity to avoid potential fire, flooding, snow loading, and other damages.	Contract a structural engineering firm to assess vulnerability to identified buildings and facilities.

We encourage you to learn more about Saint Paul Island's Hazard Mitigation Plan. The purpose of this newsletter is to keep you informed and to allow you every opportunity to voice your opinion regarding this important project. If you have any questions, comments, or requests for more information, please contact:

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Appendix E
Benefit–Cost Analysis Fact Sheet

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Benefit Cost Analysis Process

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

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

All Benefit-Costs must be:

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

General Data Requirements:

- All data entries (other than Federal Emergency Management Agency [FEMA] standard or default values) MUST be documented in the application.
- Data MUST be from a credible source.
- Provide complete copies of reports and engineering analyses.
- Detailed cost estimate.
- Identify the hazard (flood, wind, seismic, etc.).
- Discuss how the proposed measure will mitigate against future damages.
- Document the Project Useful Life.
- Document the proposed Level of Protection.
- The Very Limited Data (VLD) BCA module cannot be used to support cost-effectiveness (screening purposes only).
- Alternative BCA software MUST be approved in writing by FEMA HQ and the Region prior to submittal of the application.

Damage and Benefit Data

- Well documented for each damage event.
- Include estimated frequency and method of determination per damage event.
- Data used in place of FEMA standard or default values MUST be documented and justified.

- The Level of Protection MUST be documented and readily apparent.
- When using the Limited Data (LD) BCA module, users cannot extrapolate data for higher frequency events for unknown lower frequency events.

Building Data

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

Use Correct Occupancy Data

- Design occupancy for Hurricane shelter portion of Tornado module.
- Average occupancy per hour for the Tornado shelter portion of the Tornado module.
- Average occupancy for Seismic modules.

Questions to Be Answered

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

Common Shortcomings

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

Appendix F
Plan Maintenance Documents

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Annual Review Questionnaire

PLAN SECTION	QUESTIONS	YES	NO	COMMENTS
PLANNING PROCESS	Are there internal or external organizations and agencies that have been invaluable to the planning process or to mitigation action			
	Are there procedures (e.g. meeting announcements, plan updates) that can be done more efficiently?			
	Has the 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: _____

City: _____

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

Plan Goal(s) Addressed:

Goal:

Success Indicators:

Project Status

- ☐ **Project on schedule**
- ☐ **Project completed**
- ☐ **Project delayed***

*** explain:**

- ☐ **Project canceled**

Project Cost Status

- ☐ **Cost unchanged**
- ☐ **Cost overrun****

**** explain:**

Cost underrun***

***** explain:**

Summary of progress on project for this report:

A. What was accomplished during this reporting period?

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

C. How was each problem resolved?

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

Other Comments: