Draft

Seldovia Village Tribe

TRIBAL HAZARD MITIGATION PLAN

August 13, 2019

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Acronyms/Abbreviations

°F	Degrees Fahrenheit
% g	Percent of the Acceleration of Gravity
ACS	American Community Service
AEC	Alaska Earthquake Center
AFG	Assistance to Firefighters Grant
AICC	Alaska Interagency Coordination Center
AKST	Alaska Standard Time
ANA	Administration for Native Americans
ANSCA	Alaska Native Claims Settlement Act
APA	American Planning Association
ARC	American Red Cross
ATV	All-Terrain Vehicle
AVO	Alaska Volcano Observatory
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
CC	Cryosphere
CDBG	Community Development Block Grant
CDP	Census Designated Place
CEO	Chief Executive Officer
CFP	Community Forestry Program
CHEMS	Community Health and Emergency Medical Services
CFR	Code of Federal Regulations
City	City of Seldovia
DCCED	Department of Commerce, Community, and Economic Development
DCRA	Division of Community and Regional Affairs
DGGS	Division of Geological and Geophysical Survey
DEC	Department of Environmental Conservation

DHSS	Department of Health and Social Services
DHS&EM	Division of Homeland Security and Emergency Management
DMA 2000	Disaster Mitigation Act of 2000
DMVA	Department of Military and Veterans Affairs
DNR	Department of Natural Resources
DOE	Department of Energy
DOF	Division of Forestry
DOI	Division of Insurance
DOL	Department of Labor
DOT&PF	Department of Transportation and Public Facilities
EQ	Earthquake
F	Fire
FEMA	Federal Emergency Management Agency
FL	Flood
FMA	Flood Mitigation Assistance
FP&S	Fire Prevention and Safety
FY	Fiscal Year
g	gravity as a measure of peak ground acceleration
HAZUS	Multi-Hazard Software
HEA	Homer Electric Association
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HUD	Housing and Urban Development
HVAC	Heating, Ventilation, and Air Conditioning
HWE	High Water Elevation
ICDBG	Indian Community Development Block Grant
IFG	Individual Family Grant Program
IGAP	Indian General Assistance Program
IRA	Indian Reorganization Act
IRS	Internal Revenue Service
M	Magnitude
Mb	Millibars
MAP	Mitigation Action Plan
MHHW	Mean Higher High Water
MLLW	Mean Lower Low Water

MMI	Modified Mercalli Intensity
MP	Mile Post
mph	miles per hour
msl	mean sea level
NOAA	National Oceanic and Atmospheric Administration
NFIP	National Flood Insurance Program
NWS	National Weather Service
PDM	Pre-Disaster Mitigation
PGA	peak ground acceleration
PSHAs	Probabilistic Seismic Hazard Analyses
RD	U.S. Division of Rural Development
REAA	Rural Education Attendance Area
RFC	Repetitive Flood Claim
RPSU	Rural Power System Upgrade
SAFER	Staffing for Adequate Fire and Emergency Response
SBA	U.S. Small Business Administration
Stafford Act	Robert T. Stafford Disaster Relief and Emergency Assistance Act
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic, and Environmental
SW	Severe Weather
SVT	Seldovia Village Tribe
SNA	Seldovia Native Association
T	Tsunami
TF	Technical Feasibility
UHMA	United Hazard Mitigation Assistance
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFA	U.S. Fire Administration
U.S.	United States
USC	United States Code
USGS	United States Geological Survey
V	Volcanic Ash
VA	Veterans Assistance
VFA-RFAG	Volunteer Fire Assistance and Rural Fire Assistance Grant
VFD	Volunteer Fire Department
WUI	Wildland Urban Interface

This section provides a brief introduction to hazard mitigation planning, the grants associated with these requirements, and a description of this Hazard Mitigation Plan (HMP). This HMP was developed in 2019 for Seldovia Village Tribe (SVT). This HMP is a single jurisdiction plan with non-contiguous tribal facilities and land in Seldovia Village and in the Cities of Seldovia, Homer, and Anchor Point, Alaska. This HMP addresses all Seldovia Village and the facilities SVT owns in the above-mentioned communities. As a Tribal Government, SVT is entirely community-based; SVT defines their public as everyone (Native and non-Native) in the Kachemak Bay area and provides services to all people, regardless of race, ethnicity, age, or residency.

1.1 HAZARD MITIGATION PLANNING

Hazard mitigation, as defined in Title 44 of the Code of Federal Regulations (CFR), Section §201.4, is "any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards." Many areas have expanded this definition to also include human-caused hazards. As such, hazard mitigation is any work done to minimize the impacts of any type of hazard event before it occurs and aims to reduce losses from future disasters. Hazard mitigation is a process in which hazards are identified and profiled, people and facilities at risk are analyzed, and mitigation actions are developed. Implementation of the mitigation actions, which include long-term strategies such as planning, policy changes, programs, projects, and other activities, is the end result of this process. Hazard mitigation is the only phase of emergency management specifically dedicated to breaking the cycle of damage reconstruction and repeated damage. As such, State, Local, and Tribal governments are encouraged to take advantage of funding provided by Federal Hazard Mitigation Assistance (HMA) grant programs.

1.2 PLANNING REQUIREMENTS

1.2.1 Tribal Mitigation Plans

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

On October 2, 2015, FEMA published the Mitigation Planning Final Rule in the Federal Register, [Docket ID: FEMA-2015-0012], 44 CFR Part 201, effective November 2, 2015. Planning requirements for Tribal entities are described in detail in Section §201.7. Tribally-adopted and FEMA-approved HMPs qualify jurisdictions for several HMA grant programs. This Tribal HMP for SVT complies with Title 44 CFR §201.7 and applicable FEMA guidance documents as well as the 2018 State of Alaska HMP.

Section 322 of the Stafford Act (42 USC 5165) as amended by P.L. 106-390 provides for Tribal governments to undertake a risk-based approach to reducing risks from natural hazards through mitigation planning. The National Flood Insurance Act of 1968 (42 USC 4001 et seq.) as amended, further reinforces the need and requirement for HMPs, linking Flood Mitigation Assistance (FMA) programs to Tribal HMPs. This change also requires participating National

Flood Insurance Program (NFIP) communities' risk assessments and mitigation strategies to identify and address repetitively flood-damaged properties.

1.3 GRANT PROGRAMS WITH MITIGATION PLAN REQUIREMENTS

FEMA HMA grant programs provide funding to Tribal entities that have a FEMA-approved Tribal HMP. Two of the grants are authorized under the Stafford Act and DMA 2000, while the remaining three are authorized under the National Flood Insurance Act and the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act. As of June 19, 2008, the grant programs were segregated. The Hazard Mitigation Grant Program (HMGP) is a competitive, disaster-funded grant program whereas the other Unified Mitigation Assistance Programs (Pre-Disaster Mitigation [PDM] and FMA, although competitive) rely on specific pre-disaster grant funding sources, sharing several common elements.

> *"The Department of Homeland Security and Emergency Management (DHS&EM) FEMA HMA grant programs present a critical opportunity to protect individuals and property from natural hazards while simultaneously* ***reducing reliance on Federal disaster funds****. The HMA programs provide PDM grants annually to States, Local, and Tribal communities. The statutory origins of the programs differ, but all share the common goal of reducing the loss of life and property due to natural hazards.*
>
> *The PDM program is authorized by the Stafford Act and focuses on mitigation project and planning activities that address multiple natural hazards, although these activities may also address hazards caused by manmade events. The FMA program is authorized by the National Flood Insurance Act and focuses on reducing claims against the NFIP"* (FEMA, 2019h).

1.3.1 Hazard Mitigation Assistance (HMA) Unified Programs

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

The PDM grant program provides funds to Tribal entities for hazard mitigation planning and mitigation project implementation prior to a disaster event. PDM grants are awarded on a nationally-competitive basis. Like HMGP funding, a PDM project's potential savings must be more than the cost of implementing the project. In addition, funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage. The total amount of PDM funding available is appropriated by

Congress on an annual basis. In Fiscal Years (FY) 2016 and 2017, PDM program funding totaled approximately $90 million each year. The cost-share for this grant is 75% Federal/25% non-Federal.

The goal of the FMA grant program is to reduce or eliminate flood insurance claims under the NFIP. Particular emphasis for this program is placed on mitigating repetitive loss properties. Seldovia is not an NFIP community.

The Kenai Peninsula Borough has been a member of the NFIP since May 19, 1981. Both the City of Seldovia and SVT do not participate in the NFIP.

1.4 HMP DESCRIPTION

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

Prerequisites

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

Community Description

Section 3 provides a general history and background of the community, including historical trends for population and the demographic and economic conditions that have shaped the area. Location figures of the area are included. This section also provides the community capacity in terms of public facility and service providers, regulatory tools, and staff and financial resources.

Planning Process

Section 4 describes the planning process and identifies the Planning Team Members, the meetings held as part of the planning process, the LeMay Engineering & Consulting, Inc. planner, and the key stakeholders within Seldovia Village and the surrounding area. In addition, this section documents public outreach activities (Appendix A) and the review and incorporation of relevant plans, reports, and other appropriate information.

Hazard Analysis

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

Vulnerability Analysis

Section 6 identifies potentially vulnerable assets—people, residential and nonresidential buildings, and critical facilities and infrastructure—in Seldovia Village, and SVT properties in Anchor Point and Homer. The resulting information identifies the full range of hazards that SVT could face and potential social impacts, damages, and economic losses. Trends in land use and development are also discussed. Land use maps are provided in Appendix B.

Mitigation Strategy

Section 7 defines the mitigation strategy which provides a blueprint for reducing the potential losses identified in the vulnerability analysis. The Planning Team developed a list of mitigation goals and potential actions to address the risks facing Seldovia Village and SVT properties in Anchor Point and Homer. Mitigation actions include preventive actions, property protection techniques, natural resource protection strategies, structural projects, emergency services, and public information and awareness activities. Appendix D contains the Benefit-Cost Analysis Fact Sheet used to prioritize mitigation actions.

Plan Maintenance

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

References

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

Appendix A

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

Appendix B

Appendix B contains SVT Land Use Maps.

Appendix C

Appendix C provides the FEMA Tribal Multi-Hazard Mitigation Plan Review Crosswalk which documents compliance of this Tribal HMP with FEMA criteria.

Appendix D

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

Appendix E

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

Appendix F

Appendix F contains the Adoption Resolution and FEMA approval letter.

2.1 ADOPTION BY LOCAL GOVERNING BODIES AND SUPPORTING DOCUMENTATION

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

DMA 2000 REQUIREMENTS: PREREQUISITES

Tribal Plan Adoption and Assurances

Requirement §201.7(c)(5) and (6): The Tribal HMP shall include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., Tribal Council). The Tribal HMP must assure FEMA that that Tribe will comply with all applicable statues and regulations in effect with respect to the periods in which it receives grant funding.

Element

- Has the local governing body adopted the new plan?
- Is supporting documentation, such as a resolution, included?
- Has the local governing body provided an assurance of compliance with all applicable statues and regulations?

Source: FEMA, 2015.

Seldovia Village is the home of a blend of Aleut, Yupik, Athabascan, Dena'ina Indian, and Sugpiaq Eskimo (also known as Alutiiq) peoples. Seldovia Village lies within the Kenai Peninsula Borough, and all SVT facilities (including the two located in Anchor Point and Homer) are located on land owned by SVT.

The Seldovia Village Census Designated Place (CDP) was originally recognized as an entity, separated from the City of Seldovia, by the United States (U.S.) Census Bureau. The State of Alaska and the Kenai Peninsula Borough also recognized this unincorporated unit. This separate recognition is for elections, demographic data collection, taxes, zoning authority, and/or other purposes.

SVT is a federally-recognized Tribe under the provisions of the U.S. Federal Indian Reorganization Act (IRA) of 1934. SVT is a federally-recognized government that serves everyone—both Native and non-Native within Seldovia Village. SVT's planning area consists of Seldovia Village CDP within the Kenai Peninsula Borough, place Federal Information Processing Standards #68370.

SVT has governance powers and responsibilities in Seldovia Village, primarily between Miles 2 and 6 of Jakolof Bay Road. These powers and responsibilities are based on SVT's governance compact with Seldovia Native Association (SNA). The SNA/SVT governance compact for SNA's original and current land holdings, is formally-recognized by Federal, State, and Borough governments.

SVT is fully committed to its mission of promoting the wellness of its people and communities through health care and social services, economic development, and education. SVT is governed by an elected Council of Tribal members and is a sovereign, self-governing entity that promotes the preservation of Tribal culture, tradition, and community economic development. SVT has 596 members. About 20% of SVT's members are located in Seldovia Village and the Cities of Seldovia, Anchor Point, and Homer.

SVT is the Tribal jurisdiction represented in this HMP and meets the requirements of Section 322 of DMA 2000. SVT will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c), and will amend this HMP whenever necessary to reflect changes in Tribal or Federal laws and statutes as required in 44 CFR 13.11(d).

As the local governing body of SVT, the Seldovia Tribal Council adopted this HMP by resolution on _____, 2019. A scanned copy of the resolution is included in Appendix F.

This section describes the location, geography, and history; demographics; land use; and the community capacity in terms of public facility and service providers, regulatory tools, and staff and financial resources for the SVT community.

3.1 LOCATION, GEOGRAPHY, AND HISTORY

"Seldovia Village is located on the south shore of Kachemak Bay on the southwestern edge of the Kenai Peninsula Borough, northeast of the City of Seldovia (Figures 1, 2, and 3). The Village generally includes the shoreline and adjacent uplands between Seldovia and Jakolof Bays. The Village lies mostly northeast of the City of Seldovia. Jakolof Bay road (a single gravel road) connects Seldovia Village to the City of Seldovia. Residents use the airport, seaplane base, and harbor located at nearby Seldovia.

Seldovia is a 15-minute flight from Homer, a 45-minute flight from Anchorage, and lies at approximately 59.4743 North Latitude and -151.65 West Latitude (Section 31, Township 8 South, Range 14 West, Seward Meridian). Seldovia Village is located in the Seldovia Recording District. The area encompasses 30 square miles of land as Seldovia Village CDP." (Department of Community, Commerce, and Economic Development [DCCED], Division of Community and Regional Affairs [DCRA], 2019 and Gorman, 2007).

Seldovia is accessed via air and sea. The Seldovia Bay Ferry is a passenger and light freight ferry that operates mid-May thru Labor Day. The State Ferry is part of the Alaska Marine Highway and has capacity to transport passengers and vehicles. The State Ferry typically stops in Seldovia two or three times a week for approximately eight months of the year although its schedule varies widely and is more sporadic in the winter.

Seldovia Village stretches from Mile 0.5 to Mile 15 along Jakolof Bay Road. Adjacent to this area of road are acres of the State of Alaska, SNA, and other private landholdings. The Homer Electric Association (HEA) transmission lines transect nine miles of the area, and a microwave communications tower is located within the Village. SVT Barabara Heights Volunteer Fire Department (VFD) is a rural fire department registered with the State of Alaska Department of Public Safety Division of Fire and Life Safety and is situated at Mile 4 of Jakolof Bay Road. Its area of coverage includes from just outside the City of Seldovia limits on Jakolof Bay Road to Red Mountain and the surrounding area. SVT Barabara Heights VFD began with Code Red equipment and now has two fire engines and a brush truck, wildland fire hose, tanks with foam extinguishers, pumps, and small generators. SVT's Barabara Heights VFD constructed a 40-feet

by 60-feet steel structure to house their apparatus/equipment and have had a water well drilled at its location. Future plans for the station include adding heat, electricity, ad restroom facilities as funding allows.

The name Seldovia is derived from "Seldevoy," a Russian word loosely meaning "herring bay." Seldovia was originally named Zaliv Seldevoy, or Herring Bay. SVT is unique in its culture and history. SVT heritage is a blend of Aleut, Yupik, Athabascan, Dena'ina Indian, and Sugpiaq Eskimo (also known as Alutiiq) peoples. Seldovia Village falls within the gulf coast maritime climate zone, characterized by a rainy atmosphere of long, cold winters and mild summers.

The sheltered waters around Seldovia have been home to Native people for thousands of years. While there is no written history of these ancient people, archaeological studies have unearthed bone and bone tools, the remains of fish and animals that people ate, and home sites and graves.

The Seldovia area was a meeting and trading place for the Kodiak Koniaqs, the Aleuts from the Aleutians, the Chugach people from Prince William Sound, and the Tanaina Kenaitze people of Cook Inlet. They traveled over land and across the sea to make their home in Kachemak Bay. Speaking Sugpiaq, Aleut, and Dena'ina, they traded goods, ideas, and regional traditions. This confluence of cultures gave rise to a tradition of subsistence from the sea and land that continues to this day. A cluster of homes known as barabaras existed at the head of Seldovia Bay. Known as the Old Village, only the remains of the barabaras' rectangular pits exist today (SNA, 2019).

Russian traders who sailed the Arctic coast first came to the Aleutian Islands in the 1740s. Reports of abundant furs brought about the Fur Rush, which began in 1742. Soon after a coal mine was discovered near Seldovia in 1790, Russian settlers began to arrive in the area where sea otter stocks were abundant. The Portlock Mine produced coal into the 1800s for the Russian fleet, and Seldovia housed a trading post between 1869 and 1882, as its economy also included fur trapping, timber, and fish processing. As Russians, and later Americans, moved in to exploit the otter, Native people were pressed into service for the fur companies. Men were forced to leave their homes to hunt furs. Consequently, Native families suffered separation and food shortages.

The Seldovia post office was established in 1898. Beginning in 1899, coal-mining operations near Homer provided the first mining employment for Seldovians. Many Seldovians made a business of supplying coal for homes, businesses, and cannery boilers. Eventually, a drop in the price of coal led to the decline of the coal business in Seldovia. Chromium ore deposits at Red Mountain southeast of Seldovia supported sporadic mining operations for years. Seldovia became a stop for prospectors bound for the Interior in the early 1900s. The first school was established in 1908. Development then began around commercial fishing and fish processing. Seldovia's biggest and most sustained economic boom began when Seldovia Salmon Company was built around 1910. At the height of the cannery industry, Seldovia had several canneries. Eventually, they diversified, and began packing shrimp, herring, crab, halibut, and other fish. Seldovia became the major shipping center for Southcentral Alaska in the 1920s. Also, in the 1920s, a sawmill operated on Powder Island until it burnt to the ground. Another small mill was located along the Seldovia Slough. As hunting pressure led to the decline of the wild, fur-

bearing animals, the breeding of foxes in pens or on islands became popular. Fox were introduced to Yukon and Hesketh Islands where they foraged the beaches for mussels and other shellfish. In the 1920s, many Seldovians were involved in fox farms that dotted the south shore of Kachemak Bay. With the Depression in 1932, the demand and price for furs dropped, and most men left the business.

Seldovia was one of the few Cook Inlet ports to remain open to navigation through the winter. With the discovery of gold in the interior, thousands of prospectors from the "Lower 48" states boarded steamers bound for Seldovia. From there, they traveled on small inlet steamers to the gold fields in Upper Cook Inlet.

Railroad construction and other development brought even more shipping business to Seldovia. The Cook Inlet Transportation Company met ocean-going steamers at Seldovia and carried men, livestock, and freight north to Inlet ports. In 1926, construction of the Anderson Dock allowed large ocean-going steamers to tie up, making Seldovia a hub of shipping in Southcentral Alaska.

In the 1920s, a bountiful herring fishery attracted herring fleets from the Pacific Northwest and California to Cook Inlet and Kachemak Bay. Two herring salteries were built in Seldovia, and old sailing ships were converted to floating salteries. The need for more labor brought scores of Scottish and Scandinavian "herring chokers" and fishermen to work in the salteries.

Over time, concentrations of rotting fish discarded by the salteries killed the vegetation necessary for spawning herring. The herring fishery declined, and was closed by the 1930s.

In 1931, a wooden boardwalk was built along the waterfront to facilitate travel through town. Businesses in buildings set on pilings flourished along the wooden walkway, and Seldovia became known through Southcentral Alaska as "the boardwalk town." Many men who came to Seldovia for the herring fishery stayed on to fish salmon, halibut, and crab. They married Alaska Native women and established families that are still the backbone of the town. Seldovia became the major shipping center for southcentral Alaska in the 1920s and was incorporated as a city in 1945. In the 1940s and 50s, chrome mining intensified, but when demand for the ore declined, mining operations were abandoned.

Canneries remained a big part of Seldovia's economy until the 1964 Great Alaska Earthquake brought an end to the cannery industry in Seldovia. The Great Alaska Earthquake of 1964 exploded with titanic force, lasting for more than five minutes. This massive earthquake, the strongest ever recorded in North America, changed Seldovia forever. It was not long before people realized that there was a serious problem: the land dropped four feet. In the late spring of 1964, severe storms and the highest seasonal tides of the year pounded the boardwalk and poured into buildings along the waterfront. The waterfront was doomed, and the City had to be rebuilt.

After a heated debate among residents, a City referendum agreed to accept the Alaska State Housing Authority's offer for an urban renewal project. Waterfront buildings and the boardwalk were demolished. Cap's Hill in the middle of town was leveled to create an area for development. Crews replaced the waterfront community with fill from surrounding hills so the

town could be rebuilt on higher ground. Seawalls were constructed. The charm of old Seldovia is retained in a section of the old boardwalk which remains along Seldovia Slough.

Ten years passed before the town got on its feet again. However, the town would never again be the center of commercial fishing of Kachemak Bay. A new road connecting Homer to Anchorage made Homer the new hub of Kachemak Bay's fishing fleet.

A contract with South Central Timber to log the Jakolof Bay and Rocky/Windy River areas in the 1960s and 70s played a significant role in Seldovia's economy. South Central Timber also built the road that connects the City of Seldovia to Jakolof Bay and over to the Gulf of Alaska. In recent years, SNA sold logging rights to salvage beetle killed trees and potentially threatened trees.

Although the last fish-processing facility closed in 1991, the City of Seldovia Boat Harbor continues to house a small charter and sports fishing community.

3.1 DEMOGRAPHICS

DCCED certified Seldovia Village's population at 180 in 2017. The Alaska Department of Labor (DOL) 2012-2016 American Community Survey (ACS) for Seldovia Village as defined by the U.S. Census Bureau recorded 180 residents, of which the median age was 52.2. Sixty-one percent of the population of Seldovia Village is between 45 and 85 years of age. Seldovia Village is a blended community of Alaska Natives, Russians, and Americans from the lower states of the continental U.S. Approximately 25% of residents recognize themselves as Alaska Native. The male and female composition is approximately 52.9% and 47.1%, respectively. American Fact Finder 2017 data for Seldovia Village identified 206 housing units; 75 were occupied, and 131 were vacant. During the summer, the population is more than double the U.S. Census numbers. Many seasonal residents are present less than a month a year (Gorman, 2007).

3.2 ECONOMY

The City of Seldovia is incorporated as a first-class city. Seldovia enjoys a considerable seasonal visitor industry and is a commercial fishing and a shellfish farming village. Top employers in the area include SVT, the City of Seldovia, and the Kenai Peninsula Borough.

According to the DCRA Community Database (DCCED/DCRA, 2019), the median household income in Seldovia Village is $61,094, and the median family income is $72,188. The annual average unemployment rate from 1990 to 2017 for the Kenai Peninsula Borough fluctuated between a low of 7.9% in 2001, to a high of 15.5% in 1992 (ADOL, 2017). The annual employment rate is 50.7%. Eighteen people live below the poverty line (DCCED/DCRA, 2019).

Additionally, the area of the Seldovia Village is considered a distressed community per the 2017 DOL and Workforce Development, Research, and Analysis Section (DHS&EM, 2018). Most residents rely on subsistence activities to supplement their diets such as berries, seals, salmon, halibut, and bears. Many residents follow traditional Native practices.

3.3 COMMUNITY CAPACITY

The Seldovia community's capacity assessment reviews the technical and fiscal resources available. This subsection outlines the resources available for mitigation and mitigation-related funding and training. Table 1 shows services provided by SVT and the City to the Seldovia community.

Figure 1. Kenai Peninsula Borough Land Usage

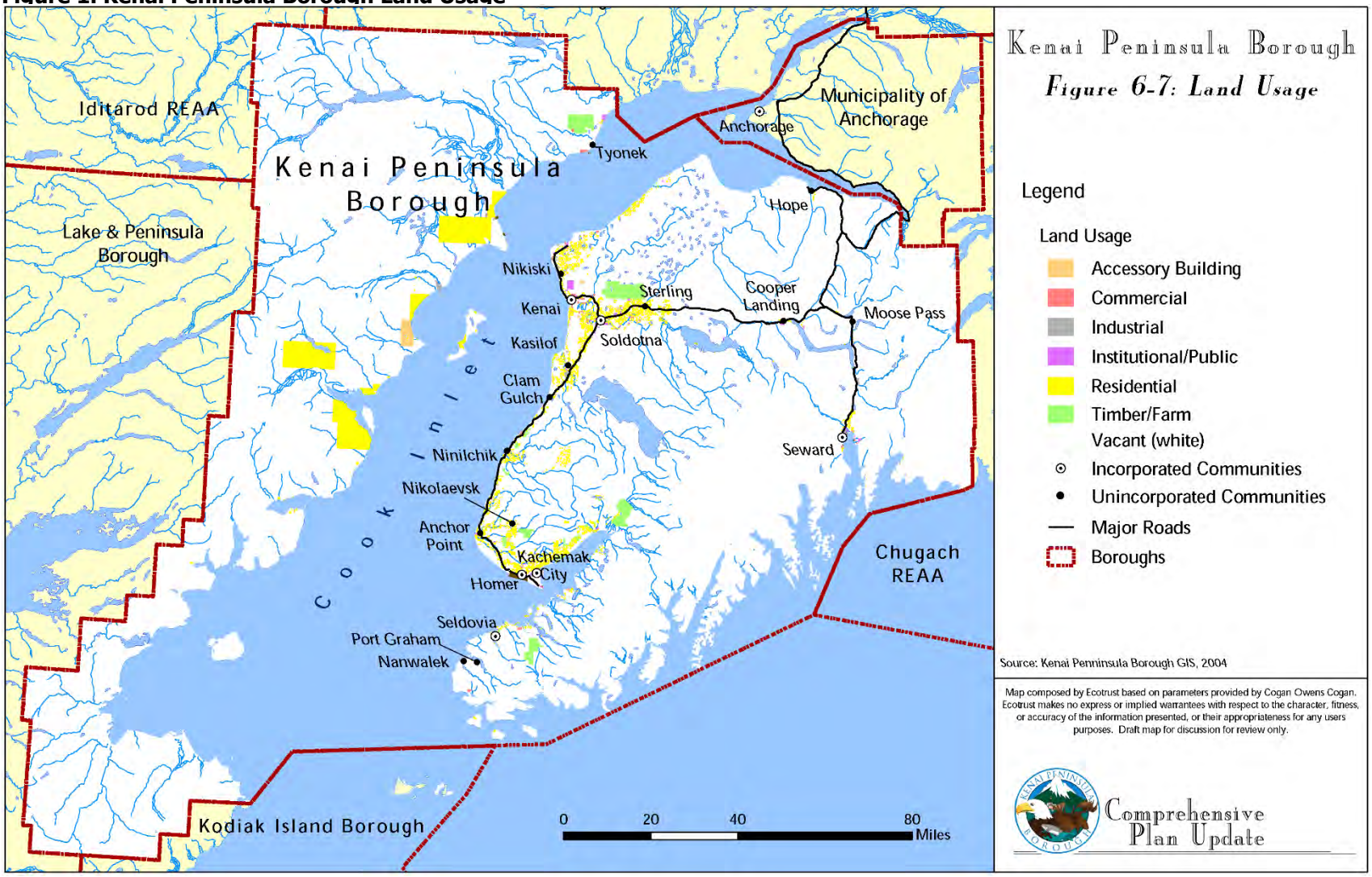


Figure 2. Seldovia Community

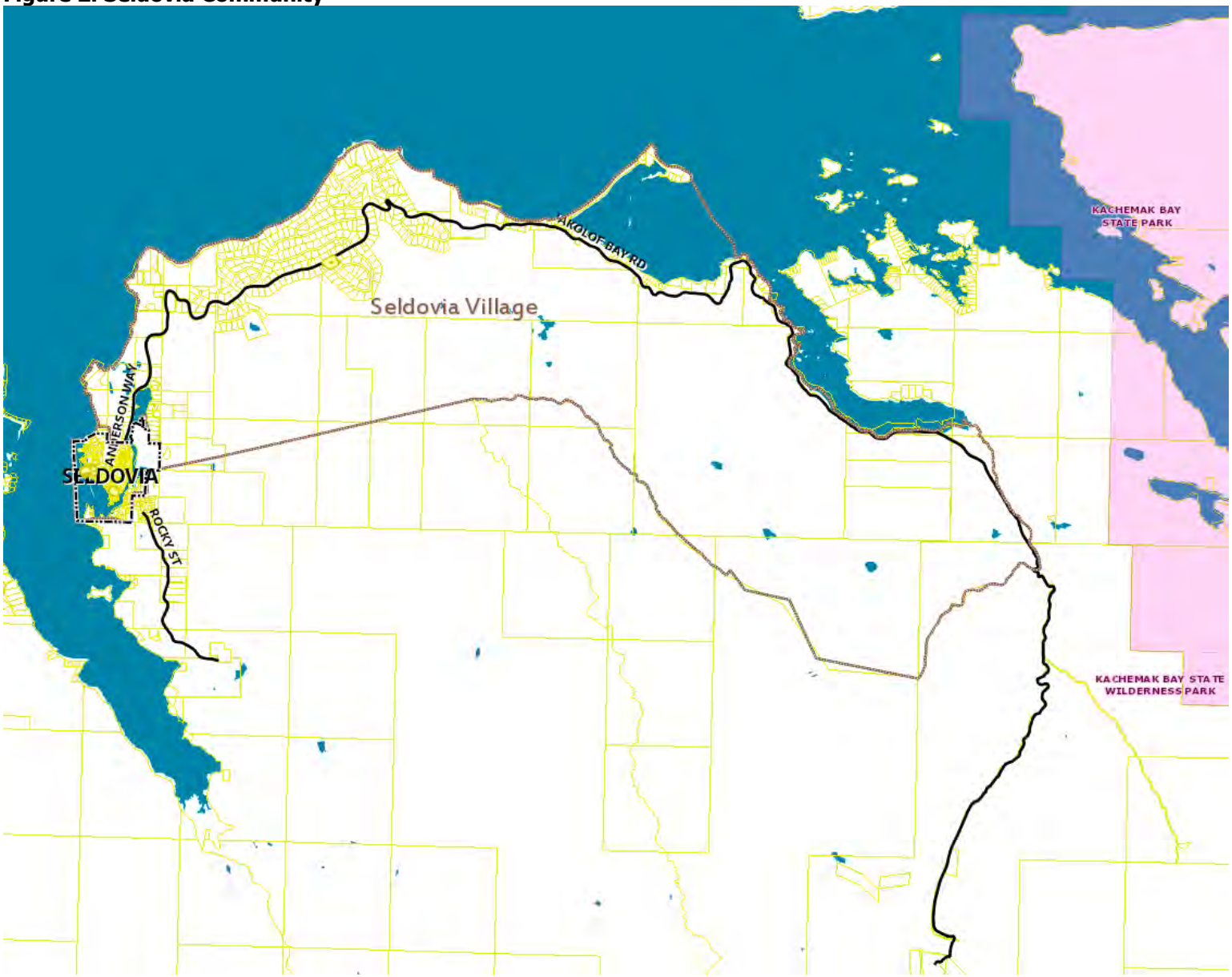


Figure 3. Seldovia Village

Table 1. Public Facility and Service Providers in Seldovia

Public Services	City of Seldovia	Seldovia Village	Other local Providers	State/Federal Agency
Police	XX	Alaska State Troopers and the City of Seldovia provide police services via an agreement.		
Fire Protection	City VFD	Barabara Heights VFD		
Water Utility	XX	Well and Septic-based		
Sewer	XX			
Landfill			Kenai Peninsula Borough	
Road Maintenance	XX	SVT is contracted with the Borough to provide road maintenance.	Kenai Peninsula Borough	State of Alaska
Public Works	XX			The State maintains Main Street in a negotiated agreement with the City of Seldovia.
Public Safety	XX			
Alaska Marine Highway System	Seldovia is accessible year-round by water and air taxi, plus the State ferry system as the schedule and weather allows.			
Development Permit Program	XX	No permitting is required on SVT land.		
Tribal Operation		XX		
Housing Program		XX		
Social Services		XX		State of Alaska
General Assistance		XX		
Natural Resource		XX		
Environmental		XX		
Elderly Program		XX		
Clinic and Health		SVT		
Dental Program				
Mental Health				
Preschool		SVT provides Early Childhood Enrichment.	Seldovia Community Preschool	
Public School			Kenai Peninsula Borough School District	
Electric Power			Homer Electric Association	
Airport Maintenance-improved gravel airstrip with no lights	Under contract to DOT & PF			DOT & PF
Small Boat Harbor and Boat Storage Yard Services	XX			
Communication	GCI has a cell tower in the City; Alaska Communications is			The State of Alaska has TB Bunker Hill for broadcasting and emergency

	the local telephone provider.			communication services with Internet via Spit w/ Spots.
Fuel	Seldovia Fuel & Lube Tank Farm has a maximum capacity of 384,000 gallons.			
Churches			Seldovia Bible Chapel and a Lutheran Church are in Seldovia.	

The SVT Health Center in Anchor Point has a septic tank and public water. The SVT Community Health Center in Homer is connected to public water and sewer.

Table 2. Seldovia Village's Regulatory Tools

Regulatory Tools (ordinances, codes, plans)	Existing?	Comments (Year of most recent update; problems administering it, etc.)
Building code	No	
Zoning ordinances	No	
Subdivision ordinances or regulations	No	
Special purpose ordinances	No	
Comprehensive Plan	No	
Emergency Response Plan	Yes	2016
Land Use	Yes	SVT facilities are located on SVT-owned land.
Community Wildfire Protection Plan	Yes	2008, Alaska Division of Forestry, Department of Natural Resources
Transportation Plan	Yes	2010, Transportation Plan for Seldovia Bay Ferry
Strategic Plan	Yes	2018, Kalani Pannell.

Table 3. SVT's Staff Resources

Staff/Personnel Resources	Y/N	Department/Agency and Position
Planner or engineer with knowledge of land development and land management practices	No	SVT hires consultants with land development and land management knowledge.
Engineer or professional trained in construction practices related to buildings and/or infrastructure	No	SVT hires consultants with engineering consulting services.
Planner or engineer with an understanding of natural and/or human-caused hazards	No	SVT hires consultants with hazard mitigation knowledge.
Floodplain Manager	Yes	Jimmy Smith, State Floodplain Manager
Surveyors	No	SVT hires surveyors as needed.
Staff with education or expertise to assess the jurisdiction's vulnerability to hazards	No	
Personnel skilled in Geospatial Information System (GIS) and/or HAZUS-MH	Yes	SVT Environmental Department
Scientists familiar with the hazards of the jurisdiction	Yes	SVT Environmental Department.

Emergency Manager	Yes	SVT has an Emergency Services Coordinator in Seldovia and one at SVT's Community Health Center in Homer.
Finance (Grant writers)	Yes	SVT has a grants manager and assistant grants manager.
Public Information Officer	Yes	SVT President/Chief Executive Officer (CEO)

3.4 COMMUNICATIONS

Seldovia is an isolated community. Some residents have landlines and CBs. During a recent snowstorm in 2019, landlines were cut off, and residents could not communicate with Homer, the nearest large community across Kachemak Bay.

Table 4. Financial Resources for Hazard Mitigation

Financial Resource	Accessible or Eligible to Use for Mitigation Activities
General funds	SVT has limited funding, can exercise this authority with voter approval.
Community Development Block Grants	SVT has limited funding, can exercise this authority with voter approval.
Capital Improvement Projects Funding	SVT has limited funding, can exercise this authority with voter approval.
Authority to levy taxes for specific purposes	SVT has limited funding, can exercise this authority with voter approval.
Incur debt through general obligation bonds	SVT has limited funding, can exercise this authority with voter approval.
Incur debt through special tax and revenue bonds	
Incur debt through private activity bonds	
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. SVT will be eligible after the Tribal Council adopts this HMP once it is approved by FEMA.
Pre-Disaster Mitigation (PDM) grant program	FEMA funding which is available on an annual basis. This grant can only be used to fund pre-disaster mitigation plans and projects only. SVT will be eligible after the Tribal Council adopts this HMP once it is approved by FEMA.
Flood Mitigation Assistance (FMA) grant program	SVT does not participate in the NFIP and is not eligible to request funding.
United State Fire Administration (USFA) Grants	The Barabara Creek VFD can request these grants. The purpose of these grants is to assist State, regional, national or Local organizations to address fire prevention and safety. The primary goal is to reach high-risk target groups including children, seniors, and firefighters.
Fire Mitigation Fees	SVT can request these fees which finance future fire protection facilities and fire capital expenditures required because of new development within Special Districts.
Bureau of Indian Affairs (BIA) Grants	SVT receives BIA grants annually.
Federal Highways	SVT receives funding for road maintenance.

This section provides an overview of the planning process; identifies the Planning Team members and key stakeholders; documents public outreach efforts; and summarizes the review and incorporation of existing plans, studies, and reports used to develop this HMP. Additional information regarding the Planning Team and public outreach efforts is provided in Appendix A.

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

DMA 2000 Requirements: Planning Process

Tribal Planning Process

Requirement §201.7(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

- An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
- An opportunity for neighboring communities, tribal 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
- Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

Requirement §201.7(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Element

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

Source: FEMA, 2015.

4.1 OVERVIEW OF PLANNING PROCESS

The first step in the planning process began with Beckie Noble being appointed SVT HMP Coordinator in Fall 2018. LeMay Engineering & Consulting, Inc. was selected as SVT's contractor in April 2019. On May 2, 2019, the Planning Team met via Zoom videoconferencing and discussed the Planning Team's role: acting as an advocate for the planning process, assisting with gathering information, and providing support for the public meetings and other public participation opportunities.

The Planning Team held their first public meeting on July 1, 2019. The hazard mitigation planning process was described, and participants were asked to help identify hazards that affect the community and to also identify critical facilities. Ms. Jennifer LeMay, PE, PMP, LeMay Engineering & Consulting, Inc., assisted the Planning Team with identifying mitigation actions and projects. Appendix A contains a list of planning meetings and participants.

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

1. Organize resources: Members of the Planning Team identified resources, including staff, agencies, and local community members, who could provide technical expertise and historical information needed in developing the HMP.
2. Assess risks: The Planning Team identified hazards specific to Seldovia Village and SVT properties in the Cities of Seldovia, Anchor Point, and Homer, and with the assistance of a hazard mitigation planning consultant (LeMay Engineering & Consulting, Inc.), developed a risk assessment for the identified hazards, including the vulnerability analysis, prior to and during the development of the mitigation strategy.
3. Assess capabilities: The Planning Team reviewed current administrative and technical, legal and regulatory, and fiscal capabilities to determine whether existing provisions and requirements adequately address relevant hazards.
4. Develop a mitigation strategy: After reviewing the risks posed by each hazard, the Planning Team developed a comprehensive range of potential mitigation goals and actions. Mitigation actions were then prioritized based on community concerns. The community determined during their August 5, 2019, public meeting that all actions must be listed as high priority.
5. Monitor, evaluate, and update the HMP: The Planning Team developed a process to monitor the HMP to ensure it will be used as intended while fulfilling community needs. The Planning Team then developed a process to evaluate the HMP on a yearly basis to compare how their decisions affect hazard impacts. They then outlined a method to share their successes with Seldovia Village community members to encourage support for mitigation activities and to provide data for incorporating mitigation actions into existing planning mechanisms and providing data for the HMP's five-year update. Opportunities are described in the Continued Public Involvement Section of this HMP (Section 8).

4.2 HAZARD MITIGATION PLANNING TEAM

Table 5 lists the Hazard Mitigation Planning Team members and contact information.

Table 5. Hazard Mitigation Planning Team

NAME	TITLE	ORGANIZATION	PHONE
Beckie Noble	Project Coordinator	SVT	BeckieN@svt.org; 252.5265
Crystal Collier	President/CEO	SVT	ccollier@svt.org; 435.3265
Lillian Elvsaas	Vice President, Tribal Council Member	SVT	levsaas@hotmail.com
Trinket Gallien	Tribal Secretary, Tribal Council Member, Assistance Director	SVT	tgallien@svt.org; 435.3248
Kim Collier	Tribal Council Member, Roads Manager	SVT	kim@ccollier.com
Don Kashevaroff	Tribal Council Member, President of SNA, Inc.	SNA	DKashevaroff@snai.com; 868.8006
Helen Quijance	Tribal Council Member	SVT	hquijance@svt.org
John Crawford	Tribal Council Member	SVT	Crawford.johnleroy@gmail.com
Zach Kashevaroff	Tribal Council Member	SVT	zachkashevaroff@gmail.com
Suzanne Collier	Tribal Council Member	SVT	smcollier@anthc.org
Connie Pavloff	Grants Manager	SVT	cpavloff@svt.org; 435.3293

NAME	TITLE	ORGANIZATION	PHONE
Alix Chartier	Emergency Services Manager in Seldovia	SVT	achartier@svt.org; 435.3250
Liam Dyer	Facility Manager	SVT	Ldyer@svt.org; 435.3226
Mark Ball	Emergency Services Coordinator and Disaster Planner for SVT in Homer	SVT	mball@svt.org
Michael Opheim	Environmental Coordinator; IGAP Manager	SVT	mopheim@svt.org; 435.3247
Stephen Payton	Environmental Technician	SVT	spayton@svt.org
Caleb Billmeier	Grants Specialist; Housing Program Coordinator	SVT	cbillmeier@svt.org; 435.3260
Rick Harkness	Fire Chief	SVT	234.8080
Jan Yeager	Environmental Assistant	SVT	jyeager@svt.org; 435.3245, ext. 220
Bretwood "Hig" Higman, PhD	Local Resident/Expert in Local Geology and Changes in the Cryosphere	Ground Truth Trekking	Hig314@gmail.com; 290.6992
Jennifer LeMay, PE, PMP	Planner	LeMay Engineering & Consulting, Inc.	jlemay@lemayengineering.com; 350.6061

4.3 PUBLIC INVOLVEMENT & OPPORTUNITY FOR INTERESTED PARTIES TO PARTICIPATE

Table 6 lists the community's public involvement initiatives focused to encourage participation and insight for the HMP effort.

Table 6. Public Involvement Mechanisms

Mechanism	Description
Newsletter Distribution (May 29, 2019)	In May 2019, SVT distributed a newsletter describing the upcoming planning activity. The newsletter encouraged the community to provide hazard and critical facility information either by calling or emailing Jennifer LeMay and/or attending the July 1, 2019 meeting at the Seldovia Conference Center in the Tribal Cache Building.
Newsletter Distribution (July 10, 2019)	In July, 2019, SVT distributed a newsletter describing the public comment period. The newsletters encouraged the community to review the Draft HMP and provide comments/input. The August 5th, 2019 public meeting was also announced.

The Planning Team served dinner and held a public meeting on July 1, 2019. SVT mailed newsletters to all SVT boxholders and posted flyers at the U.S. Post Office, SVT buildings, and on SVT's Facebook page. SVT personally invited participants from neighboring communities and government agencies. An email was sent to the Chamber of Commerce to notify area businesses. The SVT meeting was also announced at the City Council meeting on June 24.

During the meeting, the Planning Team led the attending public through a hazard identification update and screening exercise. The attendees developed a list of hazards which periodically impact the community: changes in the cryosphere, severe weather, earthquakes, tsunami, volcanos, flood/erosion, and wildland and conflagration fires.

Following the hazard screening process, the Planning Team led the attendees through the process of confirming critical facilities in the community. LeMay Engineering & Consulting, Inc. also described the specific information needed from the Planning Team and public to complete the risk assessment including the locations and values of critical facilities in the community.

After the community asset data was collected by the Planning Team, a risk assessment was completed that illustrated the assets that are exposed and vulnerable to specific hazards. Mitigation actions were also developed and prioritized.

On July 10, 2019, the availability of the Draft HMP was announced, and a 30-day public comment period began. SVT posted the Draft HMP on its website and Facebook Page. On August 5, 2019, the Planning Team held another public meeting and served dinner. SVT posted a meeting flyer on its web page and posted notices at the U.S. Post Office, SVT Buildings, and on its Facebook Page. During the meeting, mitigation action strategies were reviewed, and public comments were received.

4.4 INCORPORATION OF EXISTING PLANS AND OTHER RELEVANT INFORMATION

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

- *Seldovia, Alaska: An Historical Portrait of Life in Herring Bay*, 1997. Susan Woodward Springer. Published by Blue Willow, Inc., Littleton, Colorado.
- *Seldovia Community Wildfire Protection Plan*, 2008. Alaska Department of Forestry, Department of Natural Resources.
- *Kenai Peninsula Borough Comprehensive Plan*, 2005. Chapter 6: Land Ownership, Management, and Use.
- *The City of Seldovia Hazard Mitigation Plan*, 2017.
- *Seldovia Comprehensive Plan*, prepared by the City of Seldovia and USKH, May 2014.
- *Tsunami Hazard Maps of the Homer and Seldovia Areas, Alaska*, Draft Study was published in 2018 by the State of Alaska Department of Natural Resources Division of Geological and Geophysical Surveys (DGGS). The final study was published in August 2019.
- *Risk Map Report*, FEMA Region X-Kenai Peninsula Borough, Alaska and the Incorporated Cities of Homer, Kachemak, Kenai, Seldovia, Seward, and Soldotna, Published September 2016 by FEMA, DCCED, and the State of Alaska DGGS.
- State of Alaska DCCED Community Profile, provided historical and demographic information, 2019.

A complete list of references consulted is provided in Section 9.

This section identifies and profiles the hazards that could potentially affect SVT and its assets.

5.1 OVERVIEW OF A HAZARD ANALYSIS

A hazard analysis includes the identification, screening, and profiling of each potential hazard. Hazard identification is the process of recognizing the natural events that could threaten an area. Natural hazards result from unexpected or uncontrollable natural events of sufficient magnitude. Human, Technological, Economic, and Terrorism-related hazards are beyond the scope of this HMP. Even though a particular hazard may not have occurred in recent history, all-natural hazards that may potentially affect SVT and its assets 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. Essentially, this HMP profiles low probability, but high consequence events. Hazards that are both unlikely and would have low consequence are not discussed.

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

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: Risk Assessment: Identifying Hazards

Identifying Hazards

Requirement §201.7(c)(2)(i): [The risk assessment shall include a] description of the type of all-natural hazards that can affect the jurisdiction.

Element

- Does the new plan include a description of the types of all-natural hazards with the potential to affect the jurisdiction?

Source: FEMA, 2015.

For the first step of the hazard analysis, on May 14 and 21, 2019, the Planning Team evaluated possible hazards that could affect SVT and its assets according to the State of Alaska HMP (DHS&EM, 2018a). For the Kenai Peninsula Borough Rural Education Attendance Area (REAA), the following eight hazards were applicable to SVT's planning area: changes in the cryosphere, earthquakes, floods (which include erosion), ground failure, tsunami & seiche, volcanic eruption and ash fall, severe weather, and wildland and conflagration fires. They then evaluated and screened the comprehensive list of potential hazards based on a range of factors, including prior knowledge or perception of the 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 7).

Table 7. Identification and Screening of Hazards

Hazard Type	Should It Be Profiled?	Explanation
Changes in the Cryosphere	Yes	Changes in the cryosphere is designated as a hazard in the 2018 *State of Alaska HMP*. Changes in the cryosphere are occurring and have the ability to disrupt subsistence traditions.
Earthquakes	Yes	Earthquakes are designated as a hazard in the 2018 *State of Alaska HMP* with a high probability of occurring in the REAA. The 1964 Great Alaska Earthquake and resulting tsunami caused significant damage in Seldovia, and SVT's planning area remains vulnerable to future earthquakes in the region. Subsidence is also a concern because Seldovia lost four feet of ground elevation as a result of the 1964 Great Alaska Earthquake.
Floods/Erosion	Yes	Flooding is designated as a hazard in the 2018 *State of Alaska HMP* with a high probability of occurring in the REAA. The Kenai Peninsula Borough with the exception of Seldovia participates in the NFIP program. Coastal erosion is impacting Seldovia Village.
Ground Failure	Yes	Ground failure is designated as a hazard in the 2018 *State of Alaska HMP* with a low probability of occurring in the REAA. Landslides are probable in the Barabara Heights Subdivision within Seldovia Village.
Tsunami & Seiche	Yes	Tsunami/seiche is designated as a hazard in the 2018 *State of Alaska HMP* with a high probability of occurring. A historic tsunami occurred in 1964 with the Great Alaska Earthquake.
Volcano	Yes	Volcanic eruption and ashfall is designated as a hazard in the 2018 *State of Alaska HMP* with a high probability of occurring in the REAA. The Seldovia area is home to three of Alaska's Rim of Fire volcanos: Augustine, Redoubt, and Illiamna. Seldovia has been impacted by several volcanic ashfall events, and the potential for volcanic ashfall to impact Seldovia Village is high.
Severe Weather	Yes	Severe weather is designated as a hazard in the 2018 *State of Alaska HMP* with a high probability of occurring in the REAA. High winds, power outages caused by storms, and increased precipitation impacts Seldovia Village.
Wildland and Conflagration Fires	Yes	Wildland and conflagration fires are designated as a hazard in the 2018 *State of Alaska HMP* with a high probability of occurring.

5.3 HAZARD PROFILE

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

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

- Hazard Characteristics;
    - Typical event characteristics;
    - Potential climate change impacts are primarily discussed in the Changes in the Cryosphere hazard profile but are also identified where deemed appropriate within selected hazard profiles;
- History (geologic as well as previous occurrences);
- Location;
- Extent (breadth, magnitude, and severity);

DMA 2000 Requirements: Risk Assessment – Profiling Hazards

Profiling Hazards

Requirement §207.6(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.

Element

- Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new plan?
- Does the risk assessment identify the extent (i.e., breadth, magnitude, or severity) of each hazard addressed in the new plan?
- Does the plan provide information on previous occurrences of each hazard addressed in the new plan?
- Does the plan include recurrence probability statements of future events (i.e., chance of occurrence) for each hazard addressed in the new plan?

Source: FEMA, 2015.

- Impact (general impacts associated with each hazard are described in the following profiles, and detailed impacts to the community's residents and critical facilities are further described in Section 6 as part of the overall vulnerability summary for each hazard); and
- Recurrence probability statement of future events.

The hazards profiled for SVT and Seldovia Village are presented in the rest of Section 5.3. The order of presentation does not signify the level of importance or risk.

5.3.1 Cryosphere

5.3.1.1 Hazard Characteristics

The "cryosphere" is defined as those portions of Earth's surface and subsurface where water is in solid form, including sea, lake, and river ice, snow cover, glaciers, ice caps and ice sheets, and frozen ground (e.g., permafrost) (Figure 4). The components of the cryosphere play an important role in climate. Snow and ice reflect heat from the sun, helping to regulate the Earth's temperature. They also hold Earth's important water resources, and therefore, regulate sea levels and water availability in the spring and summer. The cryosphere is one of the first places where scientists are able to identify global climate change.

A related hazard to the cryosphere includes flood/erosion. Flooding is related to freeze/thaw cycles and winter rain on snow in southcentral Alaska.

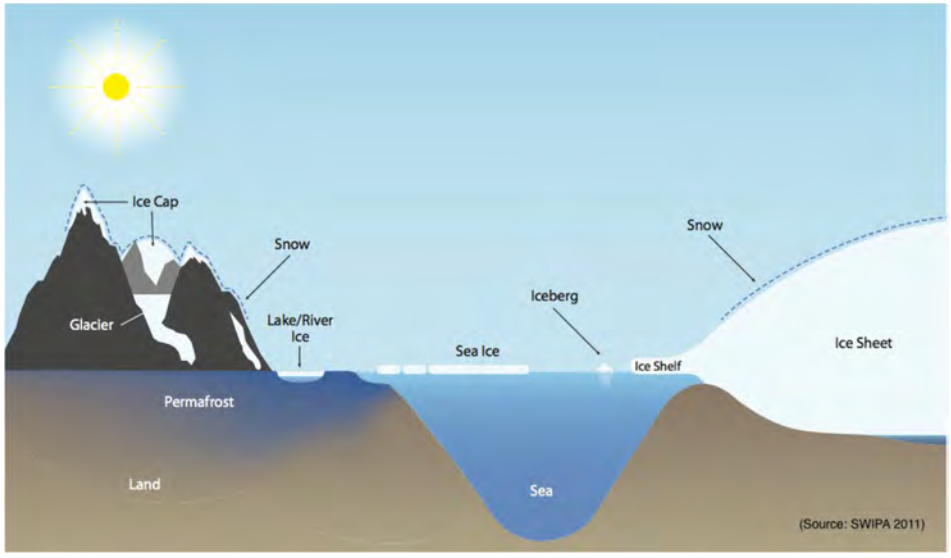
Hazards of the cryosphere can be subdivided into four major groups:

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

Alpine permafrost (outside SVT's planning area) is likely melting in the upper Seldovia area, but poses minimal hazard and will be omitted from further consideration. Snow avalanches occur in low-traffic areas with minimal infrastructure. Of these four major groups, sea ice will be considered as potentially affecting infrastructure within Seldovia Village.

Sea ice is frozen ocean water that forms, grows, and melts in the ocean. Sea ice grows during the winter and melts during the summer. Risks associated with human activities and ice processes are the greatest in the Arctic and sub-Arctic regions because of the prevalence of sea ice in those high latitudes. Hazards from sea ice include threats to shipping from running into ice; equipment or personnel breaking through ice when harvesting subsistence animals; ice push (ivu) and gouging of the land or seafloor; and slush ice build-up that can clog intake valves. Lack of sea ice during fall and winter increases the risk of coastal flooding and erosion from storms in Alaska because the ice is not there to protect the shore.

Figure 4. Cryosphere Components Diagram



Source: DHS&EM, 2018

5.3.1.2 Climate Factors

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

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

soil is thawed, which leads to increased exposure of underlying material to thermal and physical stressors.

Climate change can also have complex downstream effects on hazards. Alpine permafrost melt can weaken bedrock, leading to landslides that impact lowland areas well removed from the cryosphere. Melting glaciers on nearby mountains can change the stress in the earth's crust, changing (typically increasing) the risk of certain earthquakes. Assessing the significance of such changes to a specific area like the SVT planning area may not yet be scientifically feasible; however, it is important to understand that such downstream effects may be occurring and confounding attempts to use recent cultural and geological history to assess hazards.

5.3.1.3 Cryosphere Hazard History

There is no written record defining changes in the cryosphere for Seldovia Village. Visual evidence from the 2017 City of Seldovia HMP included:

- Seldovia has noticed an impact to its fishing industry from climate change.
- Shorelines are changing.
- Winters are warmer.
- Hummingbirds are more acclimated to staying north—sightings in November 2017.

In 2019, Seldovia Village residents are noticing:

- The stocked jack king salmon at the bridge used to arrive in mid-May and now arrive in early to mid-June.
- Seldovia residents have noticed temperatures in the 70-degree Fahrenheit (°F) and 80°F range; typically, summer temperatures occur in the 50's.
- There is less water in wells, creeks, rivers, and waterbodies.
- At Fish Creek near the Rocky Ridge Landfill, more tolerant macroinvertebrates are appearing.
- Algal blooms are more problematic with warming water temperatures in Seldovia.
- The rate of growth for alders has increased.
- Willow is more abundant and grows faster.
- Lupine used to generally grow adjacent to roadways. More invasive weeds have crowded out the lupine. Goatsbeard seems to have crowded out the lupine and pushki (cow parsnip) along Jakolof Road.
- Seldovia did not have ticks in the past. Now, there are ticks.
- Spruce pollen comes off the trees in sheets.
- There is more spruce pollen in Kachemak Bay. One resident commented that she has lived in Seldovia for 57 years and has never seen so much spruce pollen. She also noted that cottonwood is everywhere.
- One resident stated that he has not needed to plow his driveway the last three winters. Snow has shifted to rain instead.
- Berries are impacted, and there is a possible impact on salmon runs.

5.3.1.4 Location, Extent, Impact, and Recurrence Probability

Location

Cryosphere hazards can impact any place in Alaska where water occurs seasonally or permanently in solid form, including snow cover and sea ice in Seldovia.

Extent

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

Impacts

Impacts from a warming climate include a full range of damage from comparatively minor bending or buckling of manmade features due to heterogeneous movement, to complete destruction of infrastructure and buildings due to catastrophic ground failure. 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 the 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.

SVT owns a ferry, and the ferry could be affected by sea ice and a freezing harbor.

Berry abundance is influenced by snow cover, rainfall, soil moisture, air temperature, and availability of insect pollinators, all of which are likely to change. Local experts identified key impacts to berries that are related to climate. These include: earlier ripening, low winter snowpack associated with fewer berries, and hot summer temperatures associated with fewer berries.

Recurrence Probability

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

5.3.2 Earthquake

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

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

Alaska earthquake statistics include:

- Alaska is home to the second-largest earthquake ever recorded (1964 Great Alaska Earthquake, M 9.2);
- Alaska has 11% of the world's recorded earthquakes;
- Three of the eight largest earthquakes in the world occurred in Alaska; and
- Seven of the ten largest earthquakes in the U.S. happened in Alaska.

In addition to the previously mentioned large earthquake, since 1900, Alaska has had an average of:

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

Source: Alaska Earthquake Center (AEC)

5.3.2.1 Hazard Characteristics

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

Ground motion generally increases with the amount of energy released and decreases with distance from the rupture area. In 1964, though Seldovia was far from the epicenter, it was directly over a portion of the rupture. An earthquake causes waves in the earth's interior (i.e., seismic waves) and along the earth's surface (i.e., surface waves). Two kinds of seismic waves occur: P (primary) waves are longitudinal or compressional waves similar in character to sound

waves that cause back and forth oscillation along the direction of travel (vertical motion), and S (secondary) waves, also known as shear waves, are slower than P waves and cause structures to vibrate from side to side (horizontal motion). There are also two types of surface waves: Raleigh waves and Love waves. These waves travel more slowly and typically are more damaging than seismic waves because they cause larger motions and their frequency is close to harmonic frequencies for human structures and for sedimentary deposits.

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

- **Strong Ground Motion** is ground shaking. Strong ground motion intensity is directly correlated with earthquake magnitude (i.e., the larger the earthquake magnitude, the more intense and widespread the ground shaking will be). The strong ground motion severity is also dependent on the distance from the energy source.
- **Surface Rupturing** occurs when the subsurface patch of fault that slips in an earthquake intersects the earth's surface. This causes discrete, differential ground movement during intense earthquake shaking. The relative crustal block motion is dictated by the rupture's fault type, which can be horizontal, vertical, or a combination of both. Earthquakes larger than a M of 6.5 have sufficient energy to create surface ruptures, but whether or not this occurs is dependent on the earthquake's depth. The shallower a depth at which a significant earthquake occurs, the more likely it is to create a surface rupture. Permanent displacement along faults can be substantial. Surface ruptures, as a product of intense strong ground motion, can cause severe damage to existing structures.
- **Landslides/Debris Flows** occur as a result of horizontal seismic inertia forces induced in the slopes by ground shaking. The most common earthquake-induced landslides include shallow, disrupted landslides such as rock falls, rockslides, and soil slides. Debris flows are created when surface soil on steep slopes becomes 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 M. Intensity is based on the damage and observed effects on people and the natural and built environment. It varies from place to place depending on the location with respect to the earthquake rupture (where the fault moved). While the area directly above the rupture usually experiences the most intense earthquake effects (e.g., shaking), the total area affected can cover hundreds of thousands of square miles, depending on the earthquake's M.

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

Earthquakes are also classified by their felt effects (e.g., perceived shaking intensity). However, the effects of an earthquake are directly related to the distance from the earthquake rupture, among other parameters such as the type of crust where the earthquake occurs. In general, the closer one is to an earthquake's epicenter, the more severe the felt effects and damage will

be. An earthquake's intensity is described by the Modified Mercalli Intensity (MMI) Scale. As shown in Table 8, the MMI Scale consists of 10 increasing levels of intensity that range from imperceptible to catastrophic destruction. Peak ground acceleration (PGA) is also used to measure earthquake intensity by quantifying how hard the earth shakes in a given location. PGA can be measured as acceleration due to gravity (g) (MMI, 2006).

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

Table 8. Perceived Shaking, Potential Damage, and Peak Ground Acceleration

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

5.3.2.2 History

Seldovia was forever changed by the 1964 Great Alaska Earthquake. The immediate damage from the tsunami devastated the small boat harbor, but the most lasting damage was related to co-seismic subsidence, which resulted in much of the community, which had been built on boardwalks, being inundated by high tides.

Table 9 lists historical earthquakes from 1971 to the present which exceeded a M of 5 located within 50 kilometers of Seldovia with a M > than 5. There were 674 earthquakes greater than a M of 2.5 from 1971 to May 2019 (AICC, 2019).

Table 9. Historical Earthquakes within 50 km

Time	Latitude	Longitude	Depth	M	Place
2017-03-02T02:11:30.682Z	59.579	-152.655	78	5.5	51 km WSW of Anchor Point
2009-04-30 04:54:58.350Z	58.993	-151.311	52.7	5	Kodiak Island Region
2008-03-27T23:07:45.201Z	59.0095	-152.1691	68.5	5.3	Southern Alaska
2006-02-05 16:15:17.760Z	59.394	-151.747	47.8	5	Kenai Peninsula Borough
2004-02-10 20:33:51.260Z	59.373	-152.028	65.6	5.6	Southern Alaska
1999-05-05 10:30:03.100Z	59.291	-151.523	70.9	5.8	Kenai Peninsula Borough
1978-02-12T08:56:38.900Z	59.448	-152.622	72	5.4	Southern Alaska

5.3.2.3 Location, Extent, Impact, and Recurrence Probability

Location

The entire Seldovia Village as well as the Cities of Seldovia, Anchor Point, and Homer could be impacted by an earthquake. The 1964 earthquake caused significant damage to the Seldovia community, and the community remains vulnerable to future earthquakes in the region, which are low probability, but high impact events. Earthquake damage would be area-wide with

potential damage to critical infrastructure up to and including the complete abandonment of key facilities.

Extent

Although major earthquakes occur relatively infrequently, Seldovia Village and the locations of SVT assets remain vulnerable to significant damages from an earthquake.

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

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

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

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

Impact

The 2016 Risk Map Study presented HAZUS Earthquake Results for Magnitudes 7.1 and 9.2 earthquakes in the Kenai Peninsula Borough. The City of Seldovia has 335 improved parcels, valued at $89,984,700. After a M 7.1 earthquake, the total loss ratio is 0.34% ($310,314 in total damage). After a M 9.2 earthquake, the total loss ratio is 5.15% ($4,632,983 in total damage). Additionally, the study determined that only about 40% of the buildings in the City of Seldovia were built according to modern building codes (FEMA, 2016).

Table 36 of the 2016 Risk Map Study identified the Seldovia City Dock, Seldovia Bible Chapel, Seldovia Post Office, Seldovia City Hall, and Susan B. English School as areas of mitigation interest in the event of an earthquake with a M of 9.2. Table 38 of the 2016 Risk Map Study identified recommended resilience strategies (FEMA, 2016).

The 2016 Risk Map Study did not include impacts to Seldovia Village. However, the City and Village have similarities to identified hazards, and impacts to current and future populations,

residences, critical facilities, and infrastructure are anticipated to remain the same as those identified in the 2016 Risk Map Study for the City of Seldovia.

It is important to note that only the waterfront area of the City of Seldovia was rebuilt after the 1964 Great Alaska Earthquake. Also, the land has been rising two inches a year since the earthquake which has canceled out about half of the subsidence caused by the earthquake.

Recurrence Probability

While it is not possible to predict an earthquake, the U.S. Geological Survey (USGS) has developed Earthquake Probability Maps that use the most recent earthquake rate and probability models. These models are derived from earthquake rate, location, and M data as well as from mapping of active faults, from the USGS National Seismic Hazard Mapping Project.

The measure of peak ground acceleration is relative to the acceleration due to gravity (1 g). At 1 g vertical acceleration, objects will be lofted off the ground as it moves down, and then experience twice their own weight when the ground moves up. One g of horizontal acceleration will make flat ground feel as though it is sloped at 45 degrees – steep enough that most things would fall. Figure 5 indicates that the USGS earthquake probability model places the probability of an earthquake in Seldovia Village with a likelihood of experiencing severe shaking (0.60g to 0.80g peak ground acceleration) at a 2% probability in 50 years, based on the USGS Alaska hazard model. A 2% probability in 50 years is the rare, large earthquake, and statistically, it happens on average every 2,500 years.

5.3.3 Flood and Erosion

5.3.3.1 Hazard Characteristics

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

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

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

Riverine Flooding

This type of flooding occurs when river levels rise and overflow their banks or the edges of their main channels and inundate areas normally above water level. The main driver of riverine flooding is rainfall, but additional factors may include temperature (for melting snow or ice),

slope steepness, and the physical characteristics of the soil or rock forming the riverbed. The damage from a river flood can be widespread as the overflow affects smaller rivers downstream, often causing dams and dikes to break and inundate nearby areas.

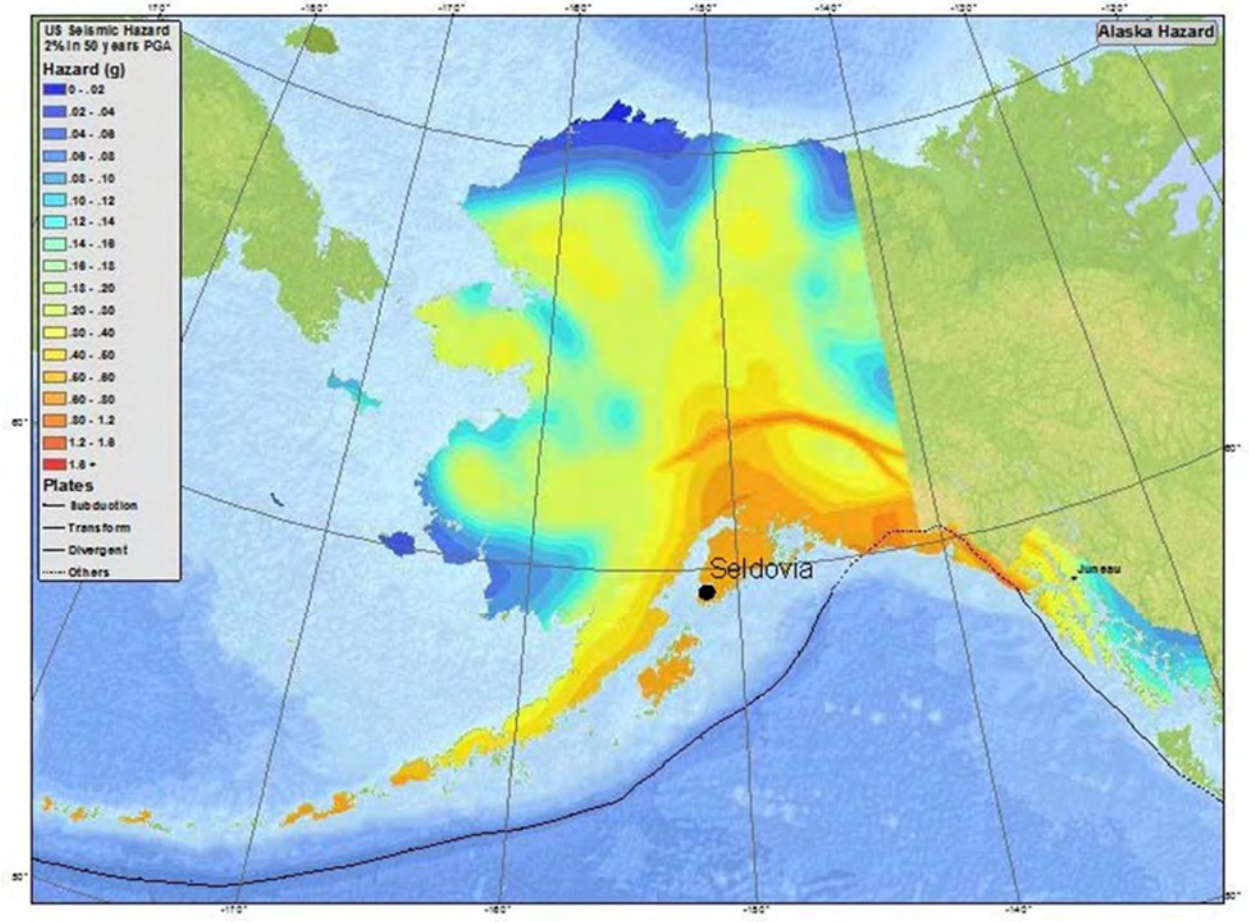
Rainfall-Runoff Flooding

Rainfall-runoff flooding is the most common type of flooding in Alaska, typically occurring in late summer through early fall. Rainfall intensity, duration, distribution, as well as pre-existing soil moisture conditions and geomorphic characteristics of the watershed all contribute to the flood's magnitude. These floods result from high rainfall amounts and accompanying high surface runoff rates.

Snowmelt Flooding

Snowmelt floods typically occur from April through June, but are most common in the spring when rapidly warming temperatures quickly melt snow. Snowpack depth, spring weather patterns, and geomorphic characteristics of the watershed influence the magnitude of flooding. Rainfall and high temperatures can exacerbate snowmelt floods.

Figure 5. USGS Seldovia Earthquake Probability Map



Storm Surges and Nuisance Flooding

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

In contrast, extreme time events not related to storms are sometimes called "Nuisance Flooding." They can damage structures by flooding them with saltwater, or similarly impact coastal wetlands, but because they are not associated with high energy wind waves, they are typically far less destructive.

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

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

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

Erosion is caused by coastal storms and flood events; changes in the geometry of tidal inlets, river outlets, and bay entrances; man-made structures and human activities such as shore

protection structures and dredging; long-term erosion; and local scour around buildings and other structures.

5.3.3.2 Climate Factors

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

Wave climate, sea level rise, and shore-fast ice are also factors. Seldovia is about at the southern edge of historic shore-fast-ice, but even a century ago, it was probably common, while it's basically unheard of outside the heads of the bays now. Wave climate is likely trending toward more frequent large waves, and when those correspond to extreme tides, they can drive erosion. In the long-term, sea level rise may become the biggest factor in erosion, but right now, Seldovia is uplifting faster than sea levels are rising. This is either due to post-1964 uplift, isostatic rebound, or some combination of the two.

Homer and Anchor Point both had significant beach erosion during the Winter of 2018/2019. While erosion did not impact SVT properties, over time, this could become an issue as changes are observed in fishing, subsistence, people leaving the communities, and loss of land.

5.3.3.3 Flood and Erosion History

Seldovia Village does not have a history of flood events in the DHS&EM Disaster Cost Index (DHS&EM, 2018b). Prior to 1985, there was a road that went to Red Mountain and down to Picnic Harbor. The road washed out in 2012. The loss of this road is discussed further in the Impact Subsection on page 5-17.

5.3.3.4 Location, Extent, Impact, and Recurrence Probability

Location

Riverine flooding has not historically had much impact in areas that are heavily used. It's possible extreme flooding could damage or remove the bridge across Barabara Creek, severing connectivity to the City. This area might have some additional vulnerability beyond extreme rain events driving floods because it can form slush floods when heavy rain falls or when the river is iced over with snow on the ice. Such floods have happened historically in the Seldovia area (on the Seldovia River in ~2002, and on Barabara Creek a few years after that.) These floods can bring water levels dramatically higher than usual, but they are slow moving and typically not destructive. The concern here would be if they mobilized logs along the river, and the logs destroyed the bridge and severed the road.

Barabara Creek Bridge also is downstream of a steep gorge that could produce a landslide that has the potential to dam the river, and the breach of the landslide dam could create a violent flood.

Additionally, nuisance flooding from unexpected extreme high tides can occur in Seldovia. The most extreme event was in 2002 when a tide forecast as 23 feet came in as 25.5 feet. An

extreme high tide combined, resulting in flooding. Figures 6 and 7 show the National Oceanic and Atmospheric Administration (NOAA's) automated analyses of these events.

The monthly extreme water levels include a mean sea level (msl) trend of -9.45 millimeters/year with a 95% confidence interval of +/- 1.1 millimeters/year based on monthly MSL data from 1964 to 2006 which is equivalent to a change of -3.10 feet in 100 years. The plots show the monthly highest and lowest water levels with the 1%, 10%, 50%, and 99% annual exceedance probability levels in red, orange, green, and blue. The plotted values are in meters relative to the Mean Higher High Water (MHHW) or Mean Lower Low Water (MLLW) datums established by the Center for Operational Oceanographic Products and Services (1 foot = 0.3 meters). On average, the 1% level (red) will be exceeded in only one year per century, the 10% level (orange) will be exceeded in ten years per century, and the 50% level (green) will be exceeded in 50 years per century. The 99% level (blue) will be exceeded in all but one year per century, although it could be exceeded more than once in other years. Because Seldovia is uplifting, these events are becoming less probable, so they are of minimal concern until sea level rise overtakes this uplift.

Figure 6. NOAA's Automated Analysis of 2002 Event

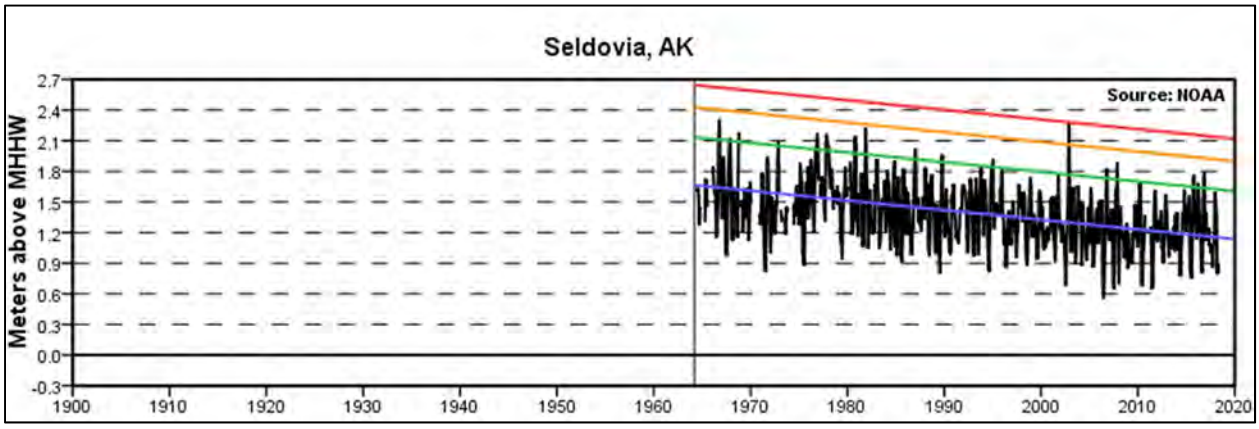


Figure 7. NOAA's Automated Analysis of 2002 Event

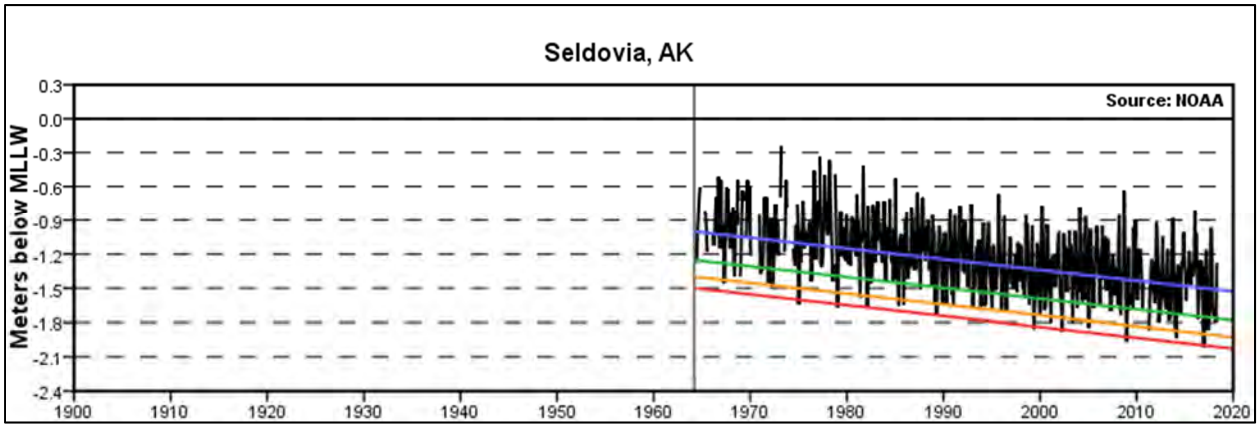


Figure 8. Figures 6 & 7 Legend

Extreme low tides can also be a minor hazard since they can ground boats and potentially damage floating facilities. Seldovia Bay Ferry may be at risk. Also, the ferry can only access Seldovia Village on the bay side (City) or at Kasitsna Bay.

The Seldovia Village study area includes a section of coast between Barabara and Wadsworth Creeks where there's ongoing erosion of soft bluffs, and houses on top of the bluff. This is also an area of concern. Additionally, MacDonald Spit has a history of shifting beaches, causing issues for homeowners there. Both these areas will likely become more of an issue when sea level rise outpaces uplift (decades in the future) and as storm waves become more intense.

There are several stream and river crossings that could isolate Anchor Point and Homer from the highway to Anchorage. In 2002, Deep Creek Bridge went out during a 200-year flood. Sturiwsksi Creek and Kenai River both breached and were lapping against the highway.

Extent

Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence. The following factors contribute to 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 lakes and human-built features such as dams.
- Flow velocity.
- Availability of sediment for transport, and the bed and embankment watercourse erodibility.
- Village location related to the base flood elevation as indicated with their certified high-water mark.

A variety of natural and human-induced factors influence the erosion process. River orientation and proximity to up and downstream river bends can influence erosion rates. Embankment composition also influences erosion rates, as sand and silt erode easily, whereas boulders or large rocks are more erosion-resistant. Other factors that may influence erosion include:

- Geomorphology;
- Amount of encroachment in the high hazard zone;
- Proximity to erosion inducing structures;
- Nature of the topography;

- Density of development;
- Structure types along the embankment; and
- Embankment elevation.

Impact

Red Mountain is a traditional community subsistence gathering place. Jakolof Bay Road used to provide access to the areas bordering what is now the Kachemak Bay State Park and is the only road to Red Mountain/Rocky River/Picnic Harbor/Windy Bay. In the 1980s, the road washed out due to fall floods. Culverts were not maintained, people lost access to this historical use area, and subsistence has been limited. Some people are physically able to carry their bikes and walk around the washed-out road to obtain access. Four-wheelers can still access Red Mountain at the current time.

Nationwide, floods result in more deaths than any other natural hazard. Flooding is Alaska's greatest threat, causing extensive property damage and losses, which include the following:

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

Floods also result in economic losses through business and government facility closure; utilities such as energy generation, communications, potable water, and wastewater; and transportation services disruptions. Floods result in excessive expenditures for emergency response, and generally disrupt the normal function of a community.

Flooding could isolate Seldovia Village from the City of Seldovia if the road connecting the two was affected, rendering the residents of both communities to be self-reliant. The Jakolof Bay Road crosses a low tidal plain, and there are rivers and streams that cross the road between Seldovia and Jakolof Bay.

Flooding at Jakolof Bay depends on how much rain there is; flash flooding occurs, and the depth of ponding can range from 0 to 2 feet very quickly. Flooding also affects subsistence fishing. Flooding can prevent fish from spawning at Jakolof Creek. SVT is working on an incubator project at the current time to see if the number of coho salmon can be increased in an incubator and then released in the creek and Seldovia River after the eggs have reached the ide stage with the project objective being to increase sustainability of subsistence fishing.

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

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

Recurrence Probability

Future populations of Seldovia Village can expect to receive an increased number of flood and erosion events due to greater moisture content in warmer air. Recurrence probabilities require systematic measurements of water levels that are not available for the Seldovia area.

5.3.4 Ground Failure

5.3.4.1 Hazard Characteristics

Ground failure results when rock and soil deform or move downhill under the influence of gravity. “Mass wasting” and “mass movement” are terms used for events that include downslope movement from the originating location. Topography (i.e., slope), geologic setting, lithology (i.e., rock or sediment type), vegetation, and water content are important factors that influence the movement type (i.e., style) and speed as well as the amount and type of damage that may result from failure. Ground failure can occur due to natural processes, human activities, or a combination of the two.

The primary ground failure hazard in the Seldovia area is landslides.

Ground Failure Types

Landslide is a catch-all term that describes a wide variety of processes that result in the downward and outward movement of slope-forming materials including rock, soil, artificial fill, or a combination of these. “Landslide” is often used interchangeably with “slope failure” or “mass movement.” Anything that alters the slope gradient, vegetation cover, surface drainage, or groundwater infiltration can potentially destabilize vulnerable slopes and lead to landslides. In Alaska, degrading permafrost, steep slopes, coastal erosion, heavy rain, retreating glaciers, and ground shaking from earthquakes are some of the important natural mechanisms that can trigger devastating landslides. Human activity—such as construction that undercuts or overloads dangerous slopes, or redirects surface or groundwater flow—can trigger landslides, as can forest clearing.

In general, landslides are classified based on the type of material being transported and the mechanics of material movement. Transported materials include rock, soil (fine-grained

material), and debris (coarse-grained materials). The materials may move by falling, toppling, sliding, spreading, or flowing.

Landslides are often complex, involving multiple movements and material types, and they may begin as one mass movement type and evolve into another as materials collect and continue to move downslope. The most common landslide types can be categorized as listed in Table 10 and displayed in Figure 9.

Table 10. Landslide Types

- Rotational Landslide
- Translational Landslide
- Directed Blast
- Rockfall
- Topple
- Debris Flow
- Debris Avalanche
- Earthflow
- Creep
- Lateral Spread

A ***Rotational Landslide*** is a landslide in which earthen material slides on a failure surface or thin failure zone that curves upward. The slide movement is more-or-less rotational about an axis that is parallel to the slope contour. Rotational landslides generally occur on steep slopes (greater than 20 degrees).

A ***Translational Landslide*** moves downslope along a relatively planar failure surface, and has little rotational movement or backward tilting. Translational landslides commonly occur along geologic discontinuities, such as faults, joints, bedding surfaces, or at the contact between rock and soil. If the failure surface slope is steep, these slides can have considerable run-out distances.

Block Slides occur when material remains relatively coherent as it moves downslope, with little or no internal deformation. The sliding surface may be curved or planar.

A Rockfall is an abrupt, downward rock movement that detaches from a steep slope or cliff. Falling material may bounce or break on impact and then continue to roll downslope. Rockfalls can occur where natural processes (such as weathering and erosion) or human activities (such as digging or blasting) have resulted in an over-steepened slope.

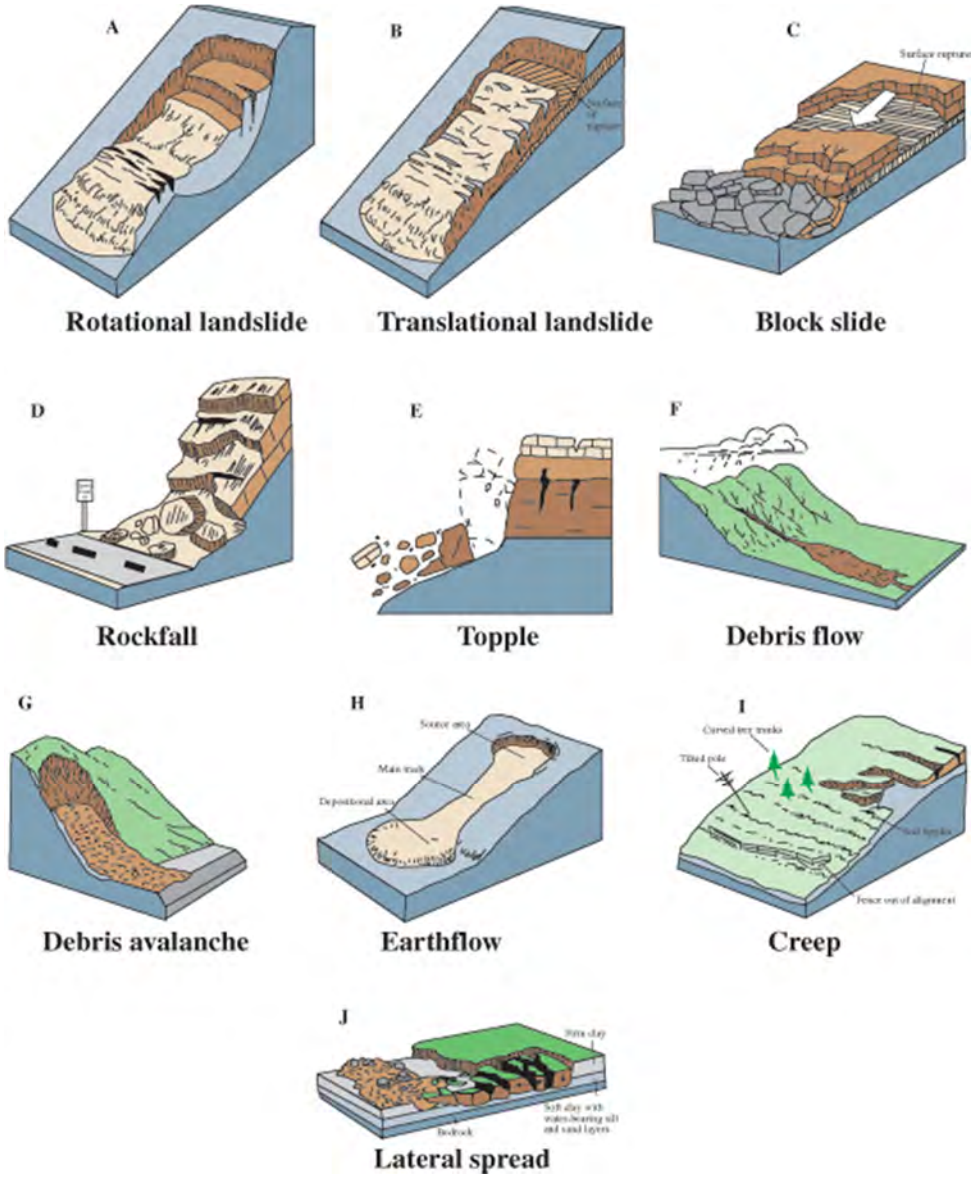
A Topple describes the forward rotation of a mass of soil or rock about a pivot point that separates it from adjacent material. Toppling can be caused by natural processes, for example, stress from the weight of upslope material, or freeze-thaw action in cracks or fractures. Columnar-jointed rocks are notably susceptible to toppling.

Debris Flow is a rapid mass movement in which a saturated slurry of loose soil, rock, organic matter, air, and water flows downslope. Debris flows are commonly composed of a large proportion of silt- and sand-sized material, and are either triggered by landslides of other types or intense surface-water flow, due to heavy precipitation or rapid snowmelt, that erodes and mobilizes loose soil or rock on steep slopes. This landslide type is prevalent in areas with steep canyons and gullies, de-vegetated areas, and in volcanic regions with weak soils. Debris flows may develop from other types of landslides (such as rotational or translational) as they increase in velocity and the internal mass loses cohesion and/or gains water.

Debris Avalanches are very fast-moving debris flows. Debris avalanches occur in steep terrain from collapse of weathered slopes, or when bedrock disintegrates during a rotational or translational landslide as material moves downslope at high velocity.

Earthflows occur on moderately steep slopes, usually under saturated conditions, when earth materials lose shear strength and behave like a liquid. The flows are elongate and commonly

Figure 9. Diagram – Most Common Types of Landslides



occur in fine-grained soil (e.g., marine clay [quick clay] or silt), but granular materials or weathered bedrock with high clay content are also susceptible. Earthflows grow in size through a process known as "head scarp retrogression," which is erosion of the upper portion of a failure surface, and may evolve from slides or lateral spreads as they move downslope. Earthflows can destroy large areas and flow for several miles.

Soil Creep is a slow earthflow that is characterized by almost imperceptibly slow, steady, downslope movement of the uppermost few feet of soil or rock. Creep can pull apart or crack highways and other manmade structures. Creep is indicated by curved tree trunks, bent fences or retaining walls, tilted poles or fences, and small soil ripples or ridges. Creep may be seasonal, where movement within the soil is affected by changes in moisture or temperature, or it may be continuous. In some cases, creep may progressively increase and produce other landslide types.

Solifluction is soil creep resulting from alternating cycles of freezing and thawing. It occurs when fine-grained soil thaws, becomes oversaturated due to poor drainage, and then begins to flow. If sufficient water is present, debris flows may develop.

Lateral Spread is the extension or disruption of a normally coherent upper rock or soil layer on top of a softer, weaker layer that has liquefied or flowed. During a lateral spread event the stronger upper unit may subside into the weaker lower unit, or material from the lower unit may be squeezed into the upper unit. This mass-movement type generally occurs on flat or very gentle slopes.

A ***Slump*** is a form of mass wasting that occurs when a coherent mass of loosely consolidated materials or rock layers moves a short distance down a slope. Slumps often occur as material drops off an eroding surface, for example, on the cutbanks of rivers or along undercut coastal bluffs.

Subsidence is any sinking or settling of the earth's surface, often due to removal of subsurface material. Causes include underground mining; groundwater and petroleum extraction or movement; and degassing and other changes in hydrothermal systems. In Alaska, sediment compaction, thawing ice-rich permafrost, and earthquakes are common subsidence causes.

Tectonic subsidence is the type of subsidence that could occur in Seldovia and occurs when the ground surface is lowered by the sinking of the Earth's crust as crustal plates move.

5.3.4.2 Climate Factors

Studies show that changing climate conditions can increase the frequency of fast-moving, catastrophic landslides. Alaska's warming surface temperatures are impacting slope stability and increasing a variety of ground failure risks. Warming climate has caused many areas to become unstable, and future warming will increase landslide risk.

Population growth and the expansion of settlements and lifelines over potentially hazardous areas are increasing the likelihood of landslide impacts. Increased permafrost thaw causes thermokarst and subsidence due to loss of ground ice. Additionally, increased water from thawing amplifies the potential for ground failure slides, flows, and creep.

5.3.4.3 Related Hazards

Ground failure is associated with many other hazards because these hazards can directly initiate mass movement or destabilize slopes, making them more susceptible to failure. For example,

- Flooding can add weight to a surface (through water and sediment), causing it to be overloaded and unstable.

- Erosion can remove material at the base of a steep slope, resulting in loss of lateral support.
- Thawing permafrost can weaken rock and soil, leading to ground failure, or leave voids in the ground, resulting in subsidence.
- Shaking from earthquakes commonly initiates a variety of ground failures.
- In saltwater adjacent to beaches around Seldovia, peat deposits formed in freshwater marshes are eroding out in what is now the intertidal. In one area where specific measurements have been gathered, radiocarbon dating shows that freshwater peats growing about 1,500 years ago are now 4.5 meters below MHHW. This age is reasonably well-aligned with a previous subduction zone earthquake (the most recent earthquakes occurred about 1,500, 800, and 50 years ago). There is no similar evidence of subsidence in the earthquake that followed, about 800 years ago, and though there was over a meter of subsidence in 1964, about half of that has already been reversed. Thus, this may be evidence that Seldovia has in the past, and might in the future, experience subsidence much greater than 1964.

A similar subsidence event would, especially in combination with an earthquake and tsunami, be one of the most disruptive disasters for Seldovia.

5.3.4.4 History

Some of the most dramatic ground failure events in Alaska were associated with the 1964 Great Alaska Earthquake, which triggered a wide variety of falls, slides, flows, and lateral spreads throughout Southcentral Alaska.

The 1964 Great Alaska Earthquake also caused extensive subsidence. The subsidence zone covered about 110,000 square miles, including the north and west parts of Prince William Sound, the west part of the Chugach Mountains, most of Kenai Peninsula, and almost all the Kodiak Island group. In some areas, subsidence exceeded seven feet. Part of the Seward area is about 3.5 feet lower than before the earthquake, and portions of Whittier subsided more than five feet. The Village of Portage, at the head of Turnagain Arm of Cook Inlet, subsided six feet, partly due to tectonic subsidence and partly due to sediment compaction during the earthquake.

The bluffs from Barabara Point to Seldovia Point are eroding. Erosion related to slumping is a concern. This can happen as a result of adding water to already saturated areas, particularly those with soils with a high clay content. This can result in slumping and erosion of bluff areas.

5.3.4.5 Location, Extent, Impact, and Recurrence Probability

Location

Ground failure can occur anywhere in Alaska where soil conditions, geology, slope, and weather (especially rain events) combine to destabilize the ground surface. Degrading permafrost, steep slopes, heavy rain, retreating glaciers, and ground shaking from earthquakes are some of the important natural mechanisms that can trigger devastating landslides. Human activity—such as construction that undercuts or overloads dangerous slopes, or redirects surface or groundwater flow—can trigger landslides, as can forest clearing or vegetation disturbance.

The area along Wadsworth Creek has areas of active ground deformation and evidence of previous landslides. These past failures extend very near to where homes are built, but no one has directly built one there. The place where the road crosses Wadsworth could be cut by a slide. The area along the coast between Wadsworth and Barabara Creeks is also prone to landslides, and especially if erosion increases, potential failures could affect one or several homes and potentially bits of road. Erosion of the bluffs is driven by the beach being cut away.

New lidar elevation data was collected by Chugachmiut covering the lands owned by Port Graham and Nanwalek Native Corporations. This data shows some signs of ground failure at the head of Seldovia Bay near the Sounding Board on the ridge across from the inner part of Seldovia Bay. This data also shows evidence that there were small glaciers in the area during the Little Ice Age (~200 years ago). The fact that there used to be glaciers suggests that alpine permafrost is a possibility. Melting alpine permafrost, or extreme rain events, could lead to a failure at the head of Seldovia Bay. If there was a failure, it would likely destroy some homes along the bay, and might produce a locally-damaging tsunami (though the water is quite shallow, so it would be limited). This would not affect Seldovia Village locally.

There are two sections of the Jakolof Bay Road between MacDonald Spit and Jakolof Bay that could be destroyed by a landslide. Landsliding during an earthquake could be particularly problematic since many of these areas could fail all at once. Prolonged heavy rain could also lead to a similar event.

Also, the community is concerned with potential breaks developing in the road connecting the Village to the City, losing the bridge at Barabara Creek, or the bridge over Seldovia Slough in a future ground failure event. In 2001/2002, the State of Alaska installed cones where culverts were placed. Rocks occasionally fell on the school bus as it collected children and transported them to school. The children are no longer collected by a school bus.

In Homer, SVT's Health Center is located near a spring or runoff area and is surrounded by wet soils with ditching. Debris flow in Homer in the vicinity of Skyline Drive could be caused by ground failure/landslides. The City of Homer adopted local ordinances to define 'Steep Slope' and require engineering approval for any development of steep slopes within Homer (Homer City Code 21.44.050).

On July 1, 2019, ground failure was observed at Mile 8 of Jakolof Road.

One resident commented during the July 1, 2019 public meeting that she feels quakes (i.e., small ground failures) from landslides near her residence.

Extent

Damage from ground failure 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 or dock) were damaged and transportation was affected.

The extent of ground failure impacts throughout Alaska will vary (depending on the type of failure, its size or extent, and location). Impacts can occur quickly or over time with warning signs. This hazard could cause injuries or death, or shut down critical facilities and services without foreknowledge, and property could be severely damaged.

Homer has the potential to subside. The Homer Spit dropped six feet in the 1964 Great Alaska Earthquake. The SVT's Health Center is built on peat and clay. The Anchor Point Health Clinic is built on sand and gravel. The Seldovia Health Center is built on rock.

Impact

Impacts associated with ground failure include surface subsidence or upheaval, and infrastructure, building, and/or road damage. Ground failure can pose a sudden and catastrophic hazard in the event of a large landslide. Most ground failure damage from non-landslide causes occurs from improperly designed and constructed buildings that settle as the ground subsides, resulting in structure loss or expensive repairs. Ground failure may also impact buildings, docks, and the airport.

Recurrence Probability

Seldovia Village may experience annually recurring landslides (debris flows) and other ground failure damages to residential and public structures and roads. The probability for ground failure is location-specific. Coastal erosion may increase, undercutting slopes and making landslides more frequent along the Wadsworth/Barabara bluffs. Prolonged periods of extreme rain may be more likely as the climate warms. A bit further east, in areas with more glaciers (outside the SVT planning area), there have been a number of very large landslides in recent decades, likely driven by a combination of climate factors.

5.3.5 Tsunami and Seiche

5.3.5.1 Characteristics

A tsunami is a series of waves generated in a body of water by an impulsive disturbance such as vertical seafloor displacement during an earthquake, or the impact of a landslide with the earthquake. A seiche is a harmonic wave occurring within a partially or totally enclosed water body.

Subduction zone earthquakes along plate boundaries often cause tsunamis. However, submarine landslides, submarine volcanic eruptions, and the collapses of volcanic edifices may also generate tsunamis. A single tsunami involves a series of waves, known as a train.

In open water, tsunamis exhibit long wave periods (wind waves are up to 15 seconds while tectonic tsunamis are usually 5 to 30 minutes) and wavelengths that can extend up to several hundred miles, unlike typical wind-generated swells on the ocean, which might have a period of about 10 seconds and a wavelength of 300 feet.

The actual height of a tsunami wave in deep water is generally only one to three feet and is often undetected by people at sea. The energy of a tsunami passes through the entire water column to the seabed and may travel at speeds up to 700 miles per hour (mph). As the front portion of the wave approaches land, it drags on the rising sea bed and slows down, while the still rapidly travelling rear portion catches up to the front, and the tsunami becomes compressed into a steeper and shorter wave.

Therefore, the wave can increase to a height of 90 feet or more as it approaches the coastline and compresses.

Tsunamis can impact both exposed coasts and protected harbors, and the areas of most intense impact are often more related to local bathymetry (e.g., harmonic period of a harbor) than they are to exposure. Precisely predicting where tsunami impact will be more or less severe requires accurate modeling of tsunami impact. Local tsunamis and seiches may be generated from earthquakes, underwater landslides, atmospheric disturbances, or avalanches and last from a few minutes to a day. Initial waves typically occur with very little advance warning. They occur more in Alaska than any other part of the U.S.

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

Nothing can be done to prevent tsunamis, but communities can take steps to be more prepared for their occurrence. This includes preparing response plans, developing warning signals, and distributing evacuation maps, pamphlets, and signs to help residents escape potential risk. Is Seldovia considered "Tsunami Ready"?

5.3.5.2 History

SNA, 2019 stated: The Good Friday Earthquake of 1964 exploded with titanic force. This massive earthquake, the strongest ever recorded in North America, changed Seldovia, forever. It was not long before people realized that there was a serious problem: the land dropped approximately four feet. At high tides, seawater flooded over the boardwalk and poured into buildings along the waterfront. In the autumn of 1964, severe storms and the highest seasonal tides pounded the boardwalk and poured into buildings along the waterfront. The waterfront was doomed (the harbor was torn apart), and the town had to be rebuilt.

In 2002, there was a disastrous tide in Seldovia of over 25 feet. Homes were flooded. In October 2018, there was a high tide of 22.6 feet.

5.3.5.3 Location, Extent, Impact, and Recurrence Probability

Location

A tsunami would affect Seldovia Village. The SVT buildings in Seldovia would be within the tsunami inundation zone (see Figures 10, 11, and 12).

The clinic locations in both Anchor Point and Homer are above their respective designated tsunami inundation zones.

Extent

The most vulnerable areas of the State are the low-lying coastal areas in the Gulf of Alaska and those areas bordering the Pacific Ocean.

Though volcano-generated tsunamis are rarer than earthquake-generated tsunamis, they are a threat to the Aleutian Chain and parts of Cook Inlet. Augustine Volcano has a history of

producing large landslides during eruptions, most recently in 1883, when waves damaged Nanwalek (then English Bay).

Landslide-generated tsunamis on deltas formed by glacial rivers are responsible for most of the tsunami hazard. Most of the destruction and death from tsunamis like this occurred in the minutes following the 1964 Great Alaska Earthquake, when deltas in Valdez, Whittier, and Seward failed and produced locally-destructive tsunamis.

Landslides that come from mountains can also produce destructive tsunamis. Perhaps the most famous such tsunami happened in Lituya Bay in 1958, when an earthquake broke loose a large mass of rock on a mountainside above the bay. The wave washed over 1,700 feet up over a nearby mountain, and destroyed several boats sheltering in the bay. A similar landslide and tsunami happened in 1967 in Grewingk Lake, near the SVT planning area. The most recent example of a tsunami like this in Alaska occurred on Taan Fiord, Icy Bay, in 2015, which reached over 630 feet up a mountainside. Fortunately, nowhere within the SVT planning area has the combination of steep slopes and deep (>150 feet) water required to produce this sort of tsunami.

Waterfront buildings were rebuilt in City of Seldovia at the elevation of the harbor after the 1964 Great Alaska Earthquake. If a tsunami should occur, the City will be impacted as well as the two SVT buildings located within City limits.

Impact

Specific impacts from a tsunami are similar to those resulting from flood events, including water damage to boardwalks, infrastructure, and buildings (both critical and non-critical facilities) and structural damage to buildings caused by floating debris and ice being carried by the tsunami. All residents and critical and non-critical facilities are at risk of being impacted by a tsunami event, thus, Seldovia is highly vulnerable to a tsunami event. Outside the City, the main places that are vulnerable to a tsunami are MacDonald Spit and all coastal residences and businesses.

The City posted tsunami evacuation route signs in 2019. Evacuation maps are available in the Harbormaster's Office. Evacuation routes will also be published in phone books. The Alaska Geophysical Institute Sea Grant has a 30-minute video on tsunamis called *Ocean Fury in Alaska*. Survivors of the 1964 Great Alaska Earthquake and tsunami are interviewed, and the Institute shows what to do if another hazard event of that magnitude occurs again. The Seldovia Library has plans to show this video once a week for educational purposes.

Recurrence Probability

Tsunamis that are small but cause destructive currents have a relatively high probability according to local knowledge.

Figure 10. Maximum Estimated Tsunami Inundation (East)

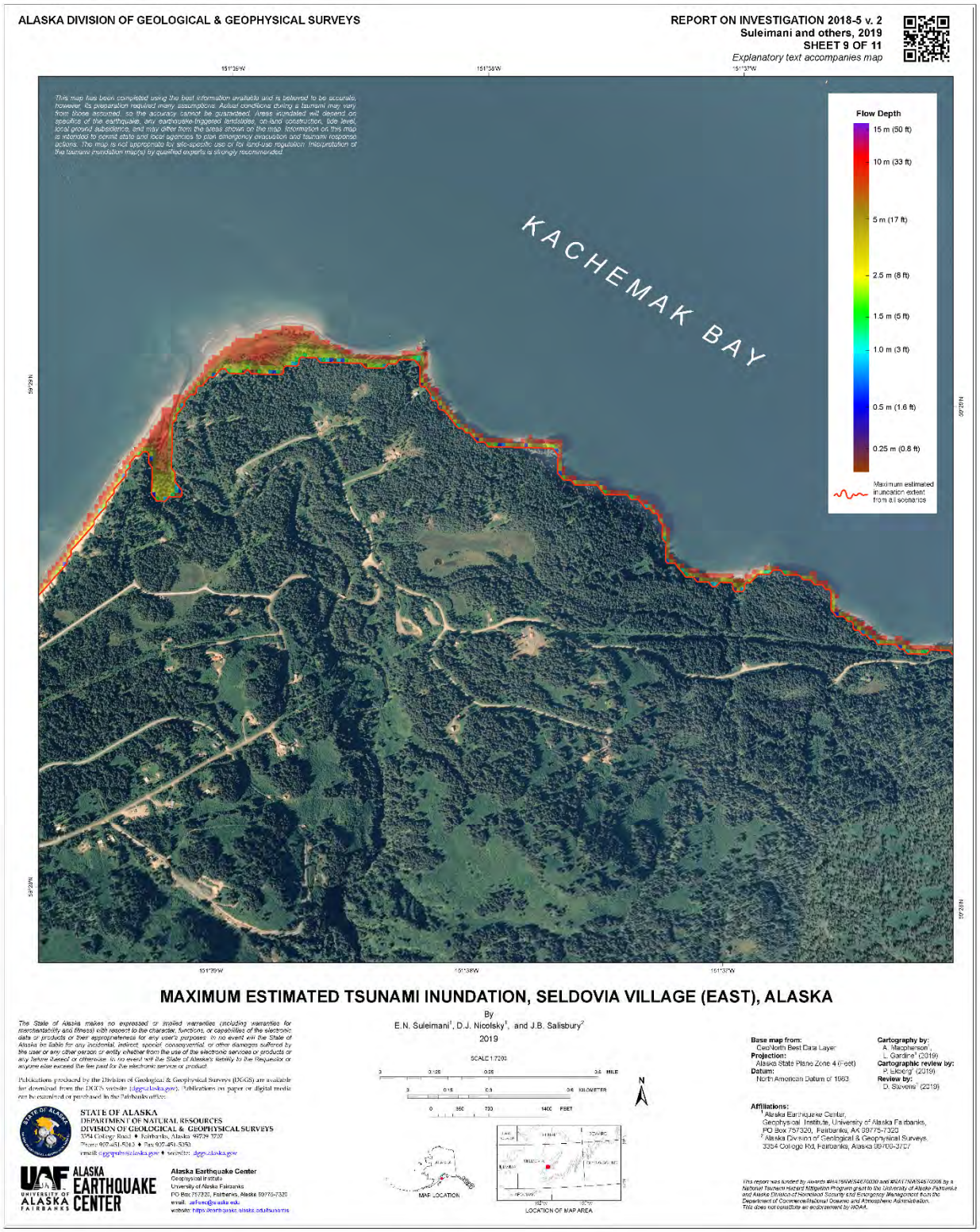


Figure 11. Maximum Estimated Tsunami Inundation (West)

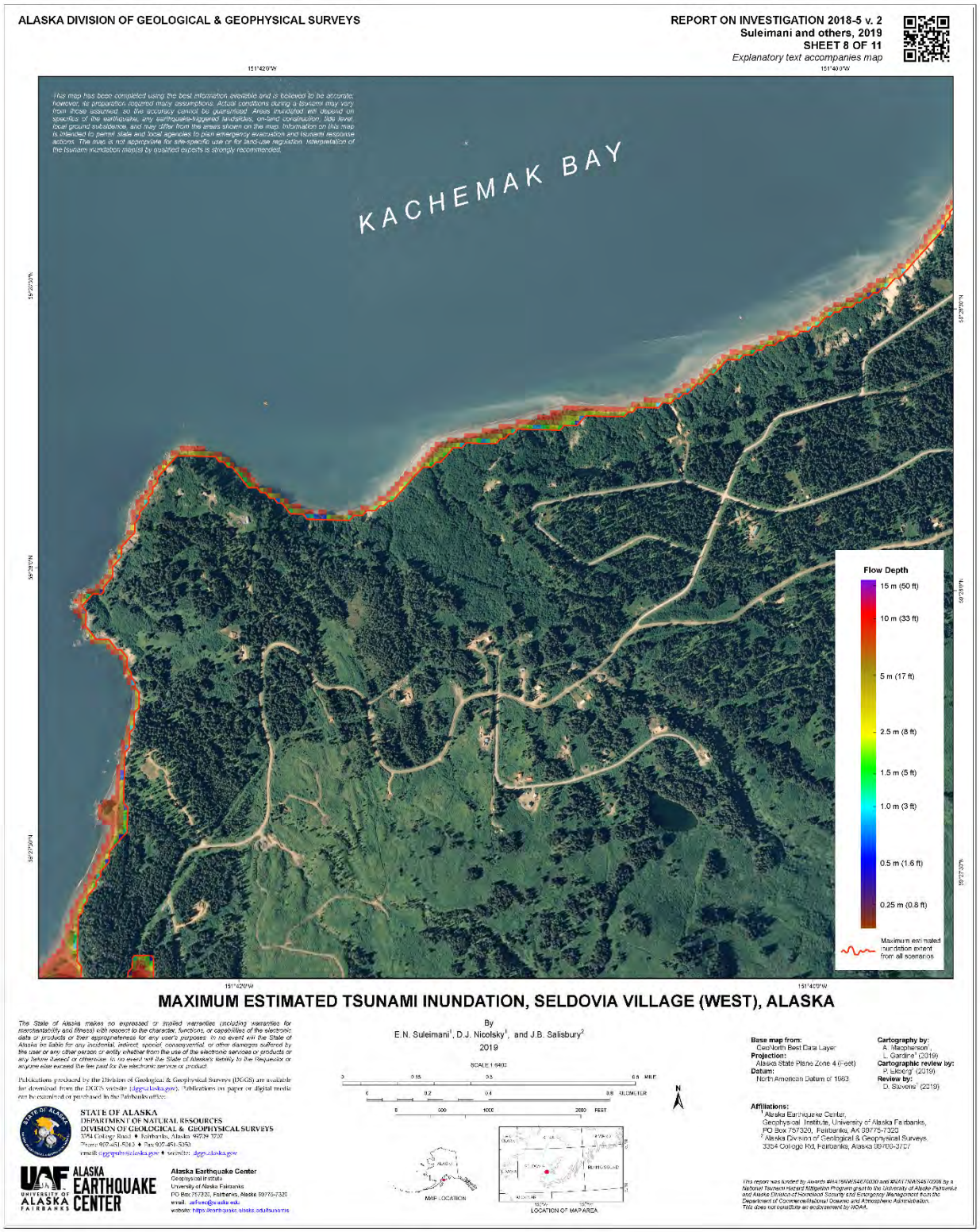
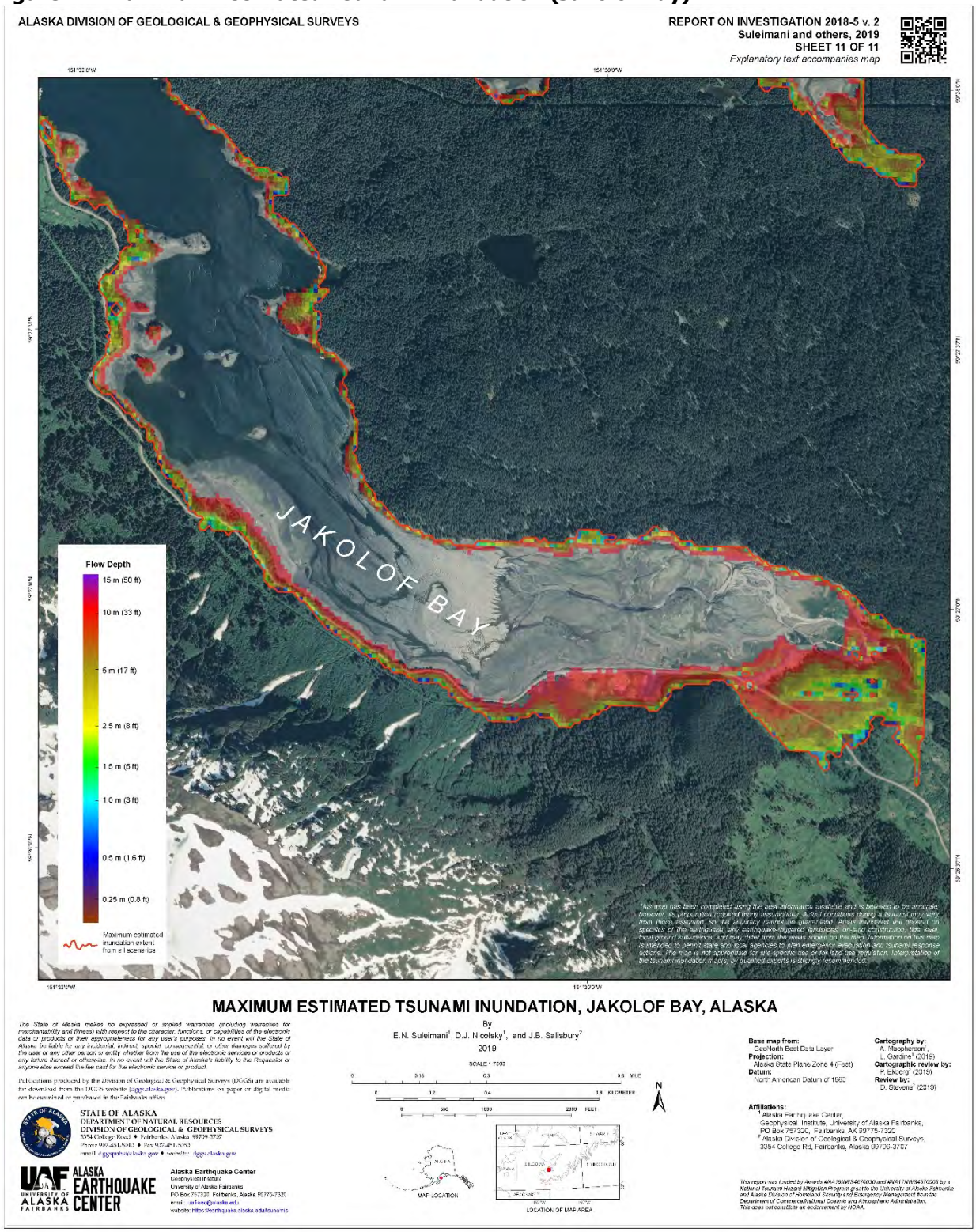


Figure 12. Maximum Estimated Tsunami Inundation (Jakolof Bay)



5.3.6 Volcanoes and Ashfalls

5.3.6.1 Hazard Characteristics

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

Volcanic Ash

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

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

5.3.6.2 History

Seldovia has been impacted by volcanic ashfall events, the only local volcanic hazard other than tsunamis. These ashfall events followed eruptions of Mount Augustine and Redoubt volcanoes (Figures 13 thru 15). Larger eruptions occurred in the geologic past, leaving dramatic layers of ash in the soil around Seldovia. The areas impacted by ash falls from the 1912 eruption and three volcanic eruptions – Augustine 1976, Redoubt 1990, and Spurr 1992 – are shown on Figure 15. The ashfall from the 1912 eruption was significantly greater (100s of times more ash produced by the eruption with Kodiak receiving 100 times as much ashfall than Seldovia) than the 2005 and 2009 eruptions of Redoubt, Spurr, and Augustine Volcanoes. Fourteen earthquakes of M 6 to 7 were associated with this event. Prehistorically in Seldovia, there has

been about one giant ashfall every 1,000 years. Most ash comes from Mount Augustine Volcano, but one is from an unknown source somewhere in the Katmai region.

None were as large as 1912 was in Kodiak, but this isn't out of the realm of possibility.

The responsibility for hazard identification and assessment for the active volcanic centers of Alaska falls to the Alaska Volcano Observatory (AVO) and its constituent organizations (USGS, DNR/DGGS, and UAF/GI). AVO has published hazard assessments for local volcanoes, including Mounts Spurr, Redoubt, Iliamna, Augustine, and the Katmai Group, and provides warnings of likely eruptions.

5.3.6.3 Location, Extent, Impact, and Recurrence Probability

Location

An ashfall that disrupted local air traffic across Kachemak Bay could isolate the Seldovia community. Very large eruptions like Mount Novarupta are very rare, but if one were to happen at one of the Cook Inlet volcanoes, particularly Augustine, it could have severe effects on Seldovia (Figures 12, 13, and 14). Seldovia is closer to Mount Augustine than Kodiak is to Mount Novarupta (Figure 12). Because Seldovia has experienced volcanic ashfall from one of several active volcanoes that are relatively close to the Village, the potential for volcanic ashfall to impact Seldovia Village is high. The mitigation activities discussed in Chapter 7 focus on volcanic ash as the primary volcano-related hazard facing Seldovia Village.

Extent

Extreme ashfalls, such as those documented previously for the Mount Novarupta 1912 eruption, could happen again. There have been at least seven deposits of volcanic ash within 500 miles of Anchorage younger than 6,000 years that approach or exceed the volume of ash ejected by Mount Novarupta in 1912. Such events have occurred at less than 1,000-year intervals, which suggests a probability of about 5% in a 50-year time period. Some, but not all of these events, could result in substantial ash falls on Seldovia Village.

There is also a substantially higher probability of smaller-scale ashfalls on the Kenai Peninsula Borough from the numerous active volcanoes on the Alaska Peninsula or from volcanoes further away, depending on the wind direction at the time of an eruption. For any given eruption, the depth of ash deposited at any given location depends on the total volume of ash ejected, the wind direction, and the distance between the volcano and a given location.

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

- Respiratory problems for at-risk populations such as young children, people with respiratory problems and the elderly;
- Disruption of air, marine, and land traffic;

- Clean-up and ash removal from roofs, gutters, sidewalks, roads, vehicles, mechanical systems and ductwork, engines, and mechanical equipment;
- Clogging of filters and possible severe damage to vehicle engines, furnaces, heat pumps, air conditioners, commercial and public buildings combined heating, ventilation, and air conditioning (HVAC) systems and other engines and mechanical equipment;
- Disruption of public water supplies drawn from surface waters, including degradation of water quality (high turbidity) and increased maintenance requirements at water treatment plants;
- Disruption/clogging of storm water drainage systems;
- Disruption of electric power from ash-induced short circuits in distribution lines, transmission lines, and substations; and
- Disruption of communications.

A major factor in determining ashfall is wind direction. Kodiak was located directly downwind of the main eruption of Mount Novarupta, which is why it was so deeply buried. The same could happen in Seldovia if there was a large eruption at Mount Augustine during a strong westerly.

Additionally, if there is a large ashfall, wind could blow and redistribute ashfall several times which would be a prolonged hazard.

Impact

Very large eruptions like Mount Novarupta are very rare, but if one were to happen at one of the Cook Inlet volcanoes, particularly Augustine, it could have severe effects on Seldovia.

The actual impact to Seldovia would depend in large part on the weather, especially wind patterns, at the time of the eruption. The eruption of Mount Augustine in 1986, and Mount Redoubt in 1989/1990 caused widespread distribution of ash over the central and southern peninsula and resulted in power outages, disruption of traffic, closure of oil platforms and public facilities, and flooding in portions of the Kenai Peninsula Borough. Eruptions of Mount Spurr also have impacted the Borough in the past. Additional potential effects of volcanic activity include severe blast effects, turbulent clouds of ash and gases, lighting discharge, volcanic mudflows, pyroclastic flows (clouds of burning ash and cinders), corrosive rain, flooding, earthquakes, and tsunamis (KPB, 2005).

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

Seldovia has experienced a few inches of ashfall on residents' vehicles. Planes do not fly. People do not operate motorized equipment. Air quality is poor. Seldovia has a shelter in place policy.

One resident noted at the July 1, 2019, public meeting, that ashfall from Mount Augustine fertilizes well. The following year after an eruption, there are often great salmonberries.

Recurrence Probability

Seldovia was affected by volcanic ash from the eruptions of Mounts Augustine and Redoubt in 2005 and 2009, respectively. The recurrence probability for the future residents of Seldovia Village would remain the same as for current residents.

A few years ago, the Alaska Volcanic Observatory (AVO) worked with Ground Truth Trekking and the City of Seldovia to document the largest ashfalls that have impacted Seldovia over the past 7,000 years. They identified about one event per 1,000 years (all larger than historic events in this area, though none leaving as thick a deposit as the ash that fell on Kodiak in 1912.) All but one of the events evaluated came from Mount Augustine. None came from Mount Redoubt. One came from an as-yet unidentified volcano that is probably somewhere in the Douglas/Katmai region.

Figure 13. Volcano Locations

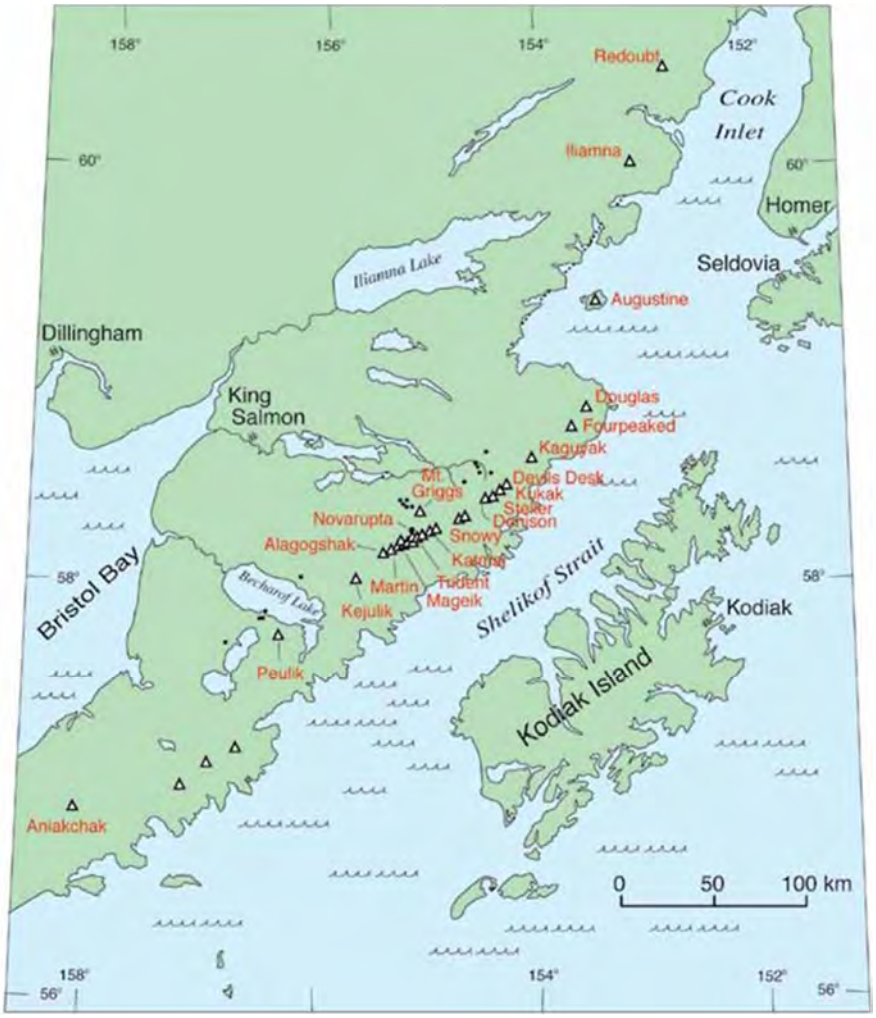


Figure 14. Volcanoes of the Aleutian Arc

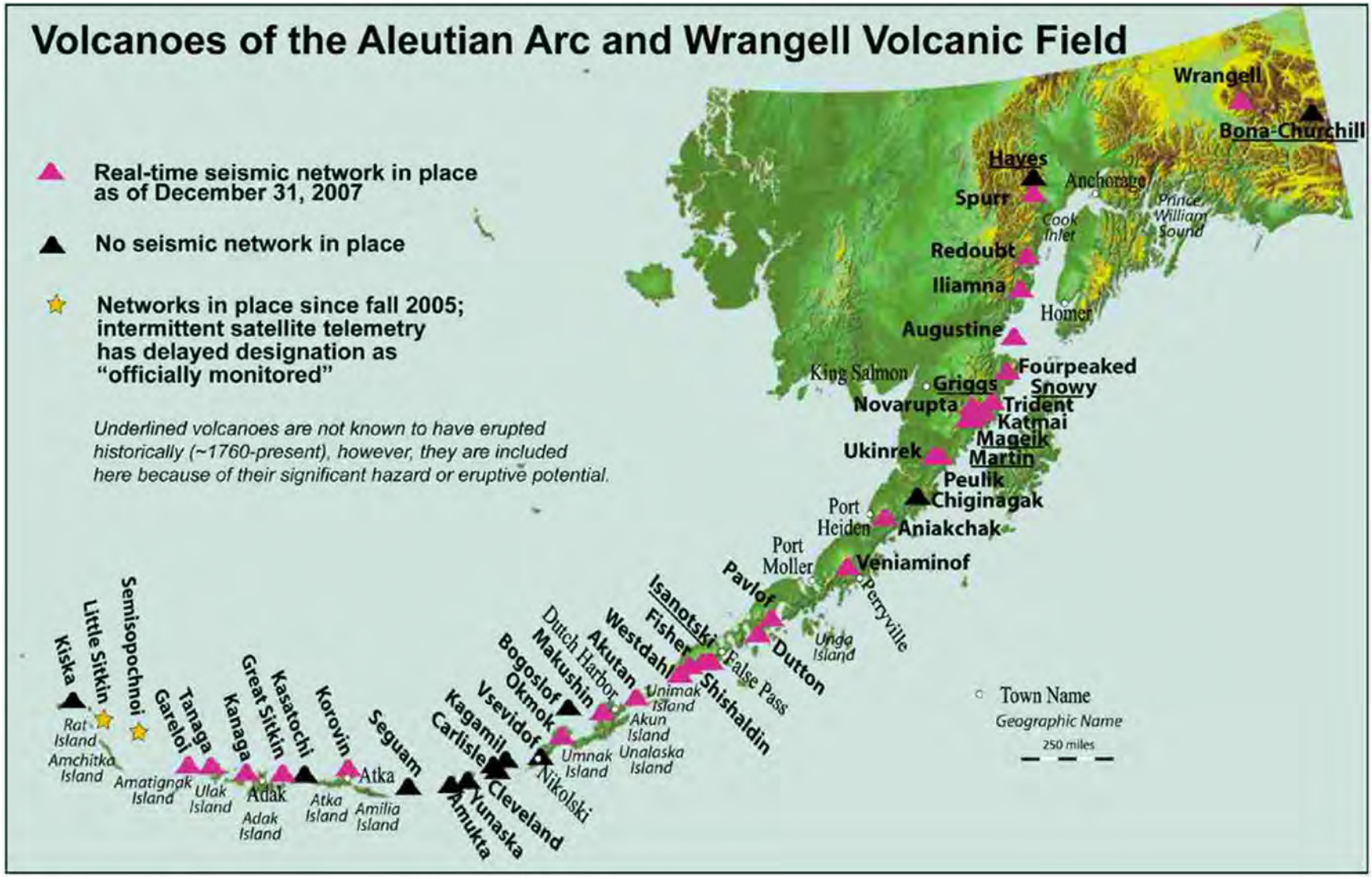


Figure 15. Areas Affected by Ash Falls

5.3.7 Severe Weather

5.3.7.1 Hazard Characteristics

Severe weather occurs throughout Alaska with extremes experienced by the community of Seldovia that include increasing high winds, winter storms, thunderstorms and lightning, hail, heavy and drifting snow, heavy rain/freezing rain/ice storm, and cold.

High Winds

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

Localized downdrafts, downbursts, and microbursts, are also common wind hazards. Downbursts and microbursts are often generated by thunderstorms. Downbursts are areas of rapidly falling rain-cooled air. Upon reaching the ground, downbursts spread out in all

directions in excess of 125 mph. Microbursts are smaller scale, more concentrated downbursts reaching speeds up to 150 mph. Both types of wind, commonly lasting five to seven minutes, are hazardous to aviation. These winds reach hurricane force and have the potential to seriously damage community infrastructure (especially above ground utility lines) while disrupting vital marine transportation.

Winter Storms

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

One winter storm condition that can particularly cause intense blizzard conditions in Seldovia involves northerly winds in upper Cook Inlet combined with westerly winds in lower Cook Inlet. The cold interior area runs over relatively warm ocean water in the upper Inlet, absorbing heat and water, rising over the center of the Inlet (sometimes called lake-effect). This creates a band of intense snow over the middle of the Inlet that is moving with the northerly wind, and if it then steers onshore due to westerlies, it can deliver dramatically more snow than forecast.

Thunderstorms

Thunderstorm hazards include lightning, heavy rain, snow, up drafts, down drafts, severe aircraft turbulence and icing, damaging hail, high winds, and flash flooding. A thunderstorm is considered severe if winds reach 60 mph or generate surface hail at least one inch in diameter. Thunderstorms affect relatively small areas; the average thunderstorm is about 15 miles in diameter and lasts less than 30 minutes in any given location.

Lightning exists in all thunderstorms. It is formed from built-up charged ions within the thundercloud. Lightning is hazardous to humans and frequently starts wildfires in Alaska's interior northern boreal forests. The Bureau of Land Management (BLM) lightning activity sensors positioned across the interior locate an average of 26,000 cloud-to-ground lightning strikes per year. Very active thunderstorm days may feature 8,000 to 12,000 lightning strikes, mainly occurring during the late afternoon hours from the end of June to the beginning of July.

Lightning-caused injuries and deaths are unusual in Alaska. However, in 1986, one person was killed and three others injured near Tok, when they took shelter under a tree that was struck by lightning.

Hail

Thunderstorms produce hail in ball or irregular shapes greater than 0.75 inch in diameter. The size and severity of the storm determine the size of the hailstones. Alaskan hail is small (pea-

sized) and fairly rare. Lightning and hail may become bigger and more frequent with changes in the cryosphere.

Heavy and Drifting Snow

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

Heavy Rain/Freezing Rain/Ice Storm

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

Cold

The definition of extreme cold varies according to the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered “extreme”. In Seldovia Village, extreme cold usually involves temperatures near or below 0 °F with additional wind chills. Excessive cold may accompany winter storms or can occur without storm activity during clear skies with high barometric pressure. Extreme cold accompanied by wind exacerbates exposure injuries such as frostbite and hypothermia.

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

5.3.7.2 Climate Change Influences

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

In contemporary usage, climate change commonly refers to the change in global or regional climate patterns that spans from the mid- to late 20th century to the present. Evidence

collected by scientists and engineers from around the world tells an unambiguous story: the planet is warming. Climate change at high northern latitudes, such as Alaska, is causing rapid and severe environmental change.

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

Global climate is projected to continue changing over this century, and changes to Alaska's climate are expected to be unprecedented (Chapin et al, 2014). Average annual temperatures in Alaska are projected to rise by an additional 2°F to 4°F by 2050, and by 6°F to 12°F by the end of the century depending on emission levels (Stewart et al, 2013). Projections of annual precipitation show an increase across Alaska as part of the broad pattern of increases projected for high northern latitudes.

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

5.3.7.3 History

The Seldovia community has experienced 62 severe weather events from 2000 through 2019 according to NOAA. Notable events are listed below. Of the 62 severe weather events, the 2006 October Southern Alaska Storm was declared a disaster. The remaining events listed in Table 11 were determined to be notable but were not declared disasters.

Table 11. Severe Weather Events

BEGIN DAY	END DAY	YEAR	MONTH	EVENT TYPE	EPISODE NARRATIVE
4	4	2000	December	Winter Storm	A strong 963 mb low 480 miles south of the Alaska Peninsula moved north to Chignik late Monday, weakening to a 971 mb center. The low then looped north northeast, weakening to a 991 mb center in upper Cook Inlet Tuesday afternoon. The front associated with this storm moved into the southeast Alaska Peninsula and southern Kodiak Island Monday afternoon, preceded by brisk easterly winds. By early Tuesday, the front lay in a weakening arc through the extreme northeast Kuskokwim Valley through eastern Prince William Sound and southeast toward the Panhandle of the State. Significant winds were reported in the Homer area. Although reports from available sources only picked up maximum easterly winds of 40 mph, this article appeared nearly a month later in the Homer News..."The windstorm that blew through Homer early this week downed 35 to 40 trees and knocked out power for some 14 hours to three villages near the head of Kachemak Bay late Monday. Homer Electric Association line crews then faced treacherously icy roads while attempting to repair the damage and restore power to Kachemak Selo, Razdolna, and Voznesenka, according to HEA spokeswoman Sandra Ghormley." Peak winds at the Homer ASOS

					reached 37 mph between 6 and 7 pm Monday and the Homer Spit reported gusts of at least 40 mph between 4 and 5 pm the same day.
20	20	2000	December	High Wind	Along the Kenai Peninsula, gusts of 51 mph were reported at the Seldovia airport with gusts of 55 mph reported at the Homer Spit between 7:20 and 8:00 pm Wednesday. Sparse data indicates that these reports were less than peak winds in the zone.
29	30	2001	January	Heavy Snow	10 inches of new snow were reported by the Homer contract observer very early Tuesday at the airport. Total liquid content was .55 at the Homer airport ASOS. Just to the south, Seldovia recorded .70 inches of melted snow (rain). The heavy snow was an overrunning snow as a trough aloft rotated north and northwest from the Gulf of Alaska over colder low-level air.
21	22	2001	December	High Wind	A strong 978 mb low 600 miles south of the Kenai Peninsula Friday morning, intensified to 970 mb and moved across Homer early Saturday, weakening north northwest into the Alaskan interior thereafter. Heavy snows along south and southeast exposures, along with strong east and southeast winds, preceded the front associated with the storm. Homer Electric reported several thousand homes across the Kenai Peninsula cut off from electric power Friday night and Saturday. By Monday evening, with temperatures close to zero, pipes in some homes were in danger of freezing. According to utility officials and several residents..."it was the worst combination of extensive outages and cold weather in recent memory". Around Kachemak Bay and southeast Cook Inlet, the winds and heavy snow knocked down hundreds of trees...taking power lines down with them. Ten workers from Chugach Electric Association were dispatched to help 16 Homer Electric Association lineman repair the lines Saturday. Major problems were reported along North Fork Road near Anchor Point, with homes near Soldotna and Seldovia also affected. Six days later, an emergency shelter was set up by the American Red Cross at the Homer Middle School to help about 16 people. On Thursday, about 150 homes were still without power, mostly those on the North Fork Road between Homer and Anchor Point. It was also reported that about a dozen or so families had been staying at Homer motels, courtesy of the Red Cross. "Winds up to 80 mph" were reported by Joe Gallagher of HEA.
8	9	2002	February	Heavy Snow	A 999 mb low 120 miles south of Sitkinak moved north by Kodiak to a position just offshore from Homer as a weakening 1004 mb low early Saturday. The center then curved west northwest by Augustine Island, dissipating along the western Aleutian Range. Moderately deep arctic air, in place across Kachemak Bay, set the stage for heavy "overrunning" type snow. Friday morning, DOT reports indicated 6" of new snow in Homer and 5" in Ninilchik. By 7:30 pm Friday, Seldovia police reported up to a foot of new snow since midnight, along with whiteout conditions in blowing snow. By 10:00 am Friday, Flight Service personnel in Homer reported 14" of snow at the airport, with over 30" on top of the Bluff. Driving conditions were the "...worst he'd seen in the many years of living there". At the same time, Seldovia police reported 4" of new snow in town with 1½ to 2 feet "out of town", near Jakolof Bay.
17	17	2002	December	Heavy Snow	Overrunning across a modified arctic airmass resulted in areas of freezing rain around Girdwood and heavy snows across portions of the southern Kenai Peninsula on Tuesday. Snowfall reached 16" at higher elevations around Seldovia with the community receiving 10 inches. Snowfall became light and intermittent after 4 pm Tuesday, stopping just before 10 pm that same evening.
6	10	2003	October	Flood	Periods of moderate to heavy rainfall were associated with several storms that moved in from the Gulf of Alaska from October 1st through the 8th and resulted in areas of minor flooding across the Kenai Peninsula. There was not any damage associated with this flooding.

3	4	2003	December	Heavy Snow	A low in the gulf pushed ample moisture over the Kenai Peninsula. At lower elevations, snow accumulated rapidly to 5 inches before changing over to rain. Freezing levels remained low and precipitation measurements from hydrology gages over the Kenai Peninsula support estimates of snowfall in excess of 13 inches above 1,000 feet in elevation.
26	26	2004	January	Heavy Snow	A storm southwest of the Gulf of Alaska pushed moist air over the arctic front in the Homer area. This produced 12 inches of snow for the peak of the snow event over Seldovia by noon Monday. In Homer, snowfall accumulated to 8 inches before tapering off in the afternoon.
21	21	2005	March	Heavy Snow	A moderate low moved from the Gulf of Alaska into lower Cook Inlet overnight Sunday into Monday morning. This resulted in cold air moving from the southwest interior to the lower Cook Inlet region Sunday night. The low pushed a strong surge of marine air over the southern Kenai Peninsula into the cold air resulting in localized heavy snow over the Seldovia area. Monday morning reports from the Alaska State Troopers indicated 12 inches of snow fell over the course of 8 to 9 hours.
8	13	2006	October	Heavy snow	(AK-07-221) declared October 14, 2006 by Governor Murkowski. FEMA declared (DR-1669) on December 8, 2006: Beginning on October 8, 2006 and continuing through October 13, 2006, a strong large area of low pressure that developed in the Northern Pacific and moved into the Southwest area of the state, produced hurricane force winds throughout much of the state and heavy rains in the Southcentral and Northern Gulf coast areas, which resulted in severe flooding and wind damage and threats to life in the southern part of the State, to include the Kenai Peninsula Borough including the Cities of Seward and Seldovia, the Chugach Rural Education Area including the City of Cordova and the City of Valdez, and the Copper River Rural Education Area including the Richardson Highway to Glennallen and highways and drainages in the McCarthy areas. Initial total damages were estimated at $557,415 with a public assistance estimate of $456,855. Federal declaration was made December 2006 including Public Assistance and Hazard Mitigation but not including Individual Assistance. Revised State of Alaska Cost estimates were $1,265,000 in Individual Assistance and $38,241,826 in Public Assistance for a total cost of $39,506,826. There was $26,825,918 available from the Federal Highway Administration leaving a requested amount of $13,948,999.
22	26	2012	December	Heavy Snow	Four-days of heavy snowfall left several feet of snow in the Seldovia/Homer/Anchor Point, Alaska area resulting in widespread power outages in the communities and two sunken fishing vessels. The snow initially began early Saturday, December 22, as a large convective band set up across the southern Kenai Peninsula. The band remained nearly stationary through Sunday night/early Monday. NOAA Kasitsna Bay Laboratory reported two-feet of snowfall by Saturday afternoon, followed by an additional 30" from Saturday afternoon through Sunday afternoon. While the convective band ceased by Monday, heavy snow continued through Christmas Eve (Monday) and Christmas Day (Tuesday) as a trough moved into the area from the west. Measurements after Sunday were more difficult to obtain as much of the area was in panic mode dealing with power outages and broken snow removal equipment. Snow diminished rapidly Wednesday, December 26, followed by light rain. Four to five feet of compacted (and rained on) snow was measured after the episode was over throughout the impacted area. Diesel and hydraulic fluid from the sunken fishing vessels closed several oyster farms in Jakolof Bay.
7	7	2014	February	Heavy Snow	A strong low in the southwest Gulf of Alaska produced strong wind in the Palmer/Wasilla area and snow and high wind in the Kachemak Bay Area.

					The strong wind caused wide spread damage from just south of Kenai to the Homer area. Heavy snow fell in the Kachemak Bay area, combined with the high wind; blizzard conditions occurred around Homer.
4	4	2014	March	Heavy Snow	A potent storm moved into western Prince William Sound overnight. Heavy snow fell over the Anchorage area from this storm. As much as 27 inches of snow fell over the Anchorage Hillside from this storm. This storm also produced moderate snow and gusty northwest wind across the southern Kenai Peninsula in the Kachemak Bay area and across Kodiak Island that resulted in blizzard conditions.
29	29	2015	December	High Winds	Homer Airport measured gusts to 61 mph at 1153 p.m. Wind damage occurred in Soldotna, where a member of the public reported ripped shingles on a roof, a powerline down, and a pontoon boat blown off of a trailer (via social media). This was a significant weather event for the City of Seldovia and Seldovia Village. Hundreds of trees came down that night. The State Ferry Tustumena was tied to the City Dock and reported wind gusts nearing 100 mph. A main line with a center of steel on the ferry snapped. Sailboats tied up in the harbor were seen to lay down on their sides and then pop back up repeatedly. Trees fell on roofs, in neighborhoods, across the roads, and on powerlines. The sounds of chainsaws running lasted well into the spring as community members worked to remove the three damage.

Source: NWS, 2019, DHS&EM 2018b

5.3.7.4 Location, Extent, Impact, and Recurrence Probability

Location

In Seldovia Village, there is potential for weather disasters. Wind-driven waves from intense storms produce coastal flooding and erosion. High winds, common on the Kenai Peninsula, can topple trees, damage roofs and windows, and result in power outages. Heavy snow can cause power outages or collapse roofs of buildings. Storms can cut off air and/or boat travel across Kachemak Bay, isolating Seldovia for the duration of the storm. In early November of 2012, a series of snow events lead to widespread tree damage between 500 and 1,000 feet, breaking power lines and blocking access to the Seldovia water supply dam. If such conditions occurred at lower elevations, they could have had much greater human impact. In 2019, the Planning Team stated that a big storm tends to occur annually. Extreme weather is most prevalent during the winter with any combination of cold temperatures, strong winds, storm surge, and heavy snow.

Winters in Seldovia from 2014-2018 have been milder. One resident stated in July 2019 that he has not needed to plow his driveway the last three winters. Snow has shifted to rain instead.

Seldovia is now characterized by extreme rain in fall/winter months with dry summers. Seldovia also has snowfall in the dead of winter into early spring.

Extent

Interruptions to electricity, communications, and fuel supply during or after severe weather events are one of the most important aspects of a weather emergency in Seldovia Village. Residents stated during the July 1, 2019, public meeting that they used to be able to rely on HEA power. Now, backup generation is necessary, particularly in the southeast portion of Seldovia Village. In Seldovia Village, there is no alternate power option other than what individual households have chosen. Additionally, power outages have repeatedly caused losses

of vaccinations in all three SVT Health Centers. In Seldovia, SVT equipment has suffered from power outages and brown outs. The Health Center in Homer has a backup generator that has proven itself not to be entirely reliable. Seldovia and Anchor Point Health Centers do not have backup generators.

Impact

Residents commented how severe weather has consisted of large rain storms lasting several weeks and hurricane-force winds that knock down old stands of trees and buildings and blow off roofs. Local knowledge indicates that Seldovia Village is receiving stronger windstorms than in the past. Storms that flatten many trees are one of the most likely widespread disasters now. A 2019 windstorm knocked down many trees and approximately ten impacted structures. Power was out which is a regular occurrence in winter storms.

The intensity, location, and the land's topography influence the impact of severe weather conditions on a community. Extreme weather events such as rain, snow, wind, or a combination of these conditions can immobilize a community by bringing transportation (e.g., air, boat, road, snow machine, and ATVs) to a halt. Impacts can range from unfortunate to catastrophic. The airport and roadways are impacted, even closed completely, stopping the flow of supply deliveries, emergency response, and medical transport; and critical activities cannot resume until the weather clears, and the population can move about safely.

Heavy snow accumulations 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, damage repairs, and business disruptions can have severe economic impacts to individuals and public infrastructure.

Weather injuries and deaths 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.

Aircraft may be grounded due to extreme cold and ice fog conditions, cutting off access and delaying community supply deliveries. Long cold spells can cause rivers to freeze, disrupt shipping, and increase the likelihood of ice jams and associated flooding or overflow threats.

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

While the scope, severity, and pace of future climate change impacts are difficult to predict, it is clear that potential changes could impact U.S. agencies' ability to fulfill their respective

missions. The challenges posed by climate change, such as more intense storms, frequency of heavy precipitation, heat waves, drought, and extreme flooding could significantly alter the types and magnitudes of hazards faced by communities and the emergency management professionals serving them. Tree blowdown events are becoming more common in Seldovia with the most recent occurrence on January 1, 2019.

Westerly winds can sometimes produce poorly-forecast extreme snow events when they are combined with a northerly in Upper Cook Inlet and lake effect that creates a narrow band of intense snowfall that's steered into Seldovia by the westerly. In 2012, Seldovia Village had one event where heavy snow led to a great many trees falling, leading to temporarily impassable roads and other minor effects.

Increased wind has been devastating to small branches of forest. One resident stated in 2019 that winds were clocked at 93 mph on his 13-acre property this spring. He lost 13 trees in one event. Some of the trees had diameters of 30 inches. It is necessary for him to remove trees within 100 feet of his house to create open space. Otherwise, a wind event could have a domino effect of destruction, leaving some trees leaning and caught up in the canopy.

Emergency services are cut off in a hazard event. People become isolated. Backup generators, emergency kits, individual response plans are needed and will be an ongoing effort.

Recurrence Probability

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

5.3.8 Fire

While a part of the natural ecosystem, fires in Alaska are a dangerous hazard when they involve remote communities. During the five-year period spanning 2013 through 2018, over 82 fire-related fatalities were recorded in Alaska. Since 2013, the State has declared over 3,077 fire-related emergencies or disasters (DHS&EM, 2018a).

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

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

Fire is a natural wildland management force in the Alaskan Interior. It is a key environmental factor in cold-dominated ecosystems. Without fire, organic matter accumulates, the permafrost table rises, and ecosystem productivity declines. Fire rejuvenates an ecosystem by removing decaying matter and returning nutrients to the soil, preserving vegetative diversity and wildlife habitat unique to Alaska. In the absence of wildland fires, many plant and animal species would no longer thrive.

While fire is critical for maintaining the viability of Alaska's ecosystems, it must be tempered with the need to protect human life and property. This is particularly true of fires burning in "wildland urban interface" areas, where structures and other human development meet or

intermingle with undeveloped wildland. Wildland urban interface (WUI) has gained importance throughout Alaska with increased development adjacent to wildlands.

Urban conflagration is a large destructive fire that is widespread throughout an urban area or community involving one or more developed areas in the community. In contrast to the commonly destructive individual property fire, conflagrations frequently overwhelm resources and damage infrastructure. In rural Alaskan communities, the loss of a critical building, such as a school, may result in a local disaster declaration.

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

Alaska's 10.25 million-acre Kenai Peninsula Borough has experienced a regional spruce bark-beetle outbreak that peaked in 1996 and continues to spread to uninfected areas. Up to 2004, an estimated four million acres of spruce in southcentral Alaska have been affected. While spruce bark beetle outbreaks are natural events, the magnitude of spruce mortality during historic episodes was typically much less (20% to 30%) than the current infestation in which mortality rates exceeded 90% (DOF, 2008).

5.3.8.1 Management in Alaska

Wildland fire management in Alaska is a joint effort among Federal, State, Local, and Tribal governments, Native organizations, VFDs, communities, and landowners. Land management agencies, also known as jurisdictional agencies, have overall land and resource management responsibilities as provided by Federal, State, Local or Tribal law.

BLM in coordination with AICC provides Alaska Fire Management Plan Interactive Web Maps to support their fire mitigation initiatives. Figure 16 displays Alaska's wildland fire management options. Seldovia Village is considered Unplanned and has its own VFD.

5.3.8.2 Hazard Characteristics

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

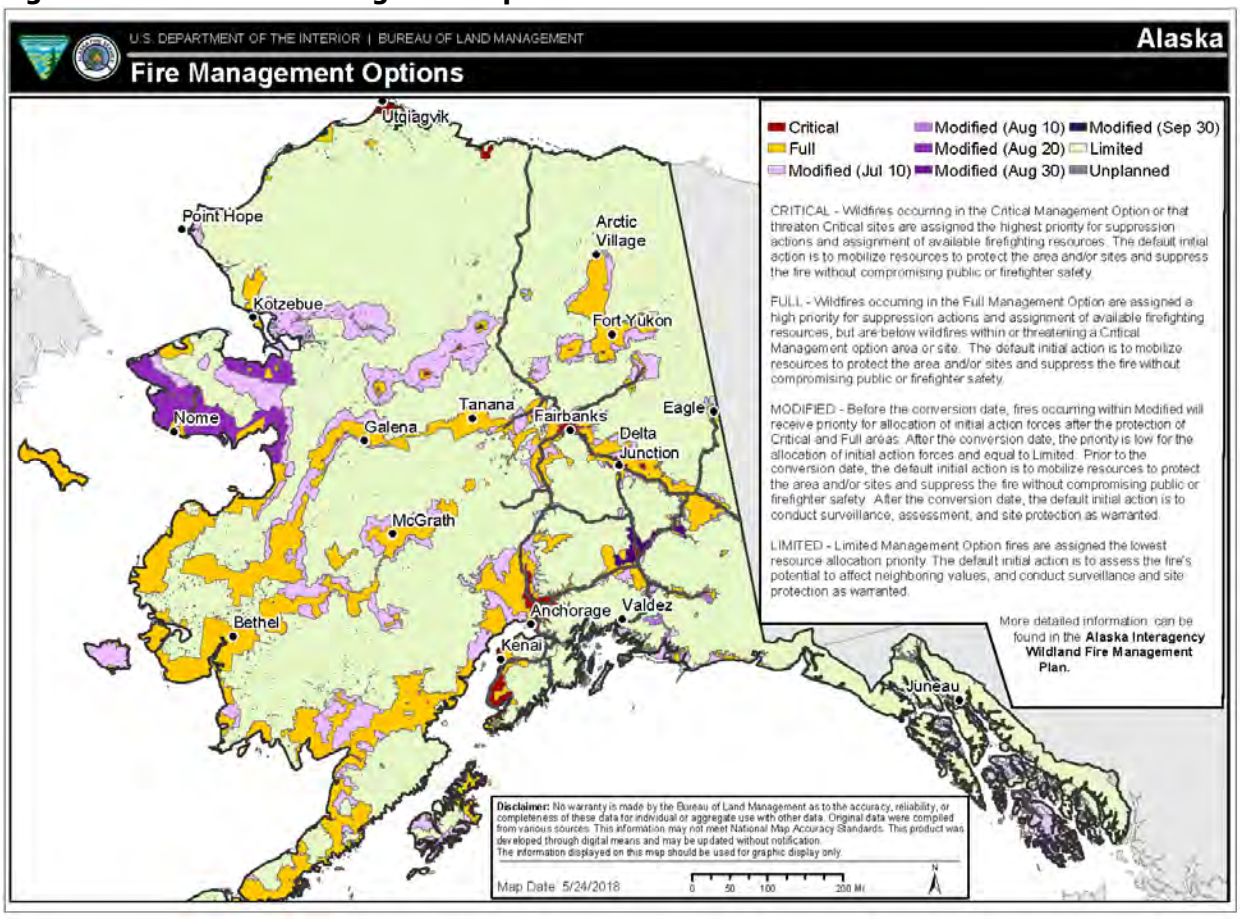
The following three factors contribute significantly to wildland fire behavior and can be used to identify wildland fire hazard areas.

- **Topography:** As slope increases, the rate of wildland fire spread increases. South-facing slopes are also subject to more solar radiation, making them drier, and thereby,

intensifying wildland fire behavior. However, ridgetops may mark the end of wildland fire spread since fire spreads more slowly or may even be unable to spread downhill.

- **Fuel:** The type and condition of vegetation plays a significant role in the occurrence and spread of wildland fires. Certain types of plants are more susceptible to burning or will burn with greater intensity. Dense or overgrown vegetation increases the amount of combustible material available to fuel the fire (referred to as the "fuel load"). The ratio of living to dead plant matter is also important. Climate change is deemed to increase wildfire risk significantly during periods of prolonged drought as the moisture content of both living and dead plant matter decreases. The fuel load continuity, both horizontally and vertically, is also an important factor.
- **Weather:** The most variable factor affecting wildland fire behavior is weather. Temperature, humidity, wind, and lightning can affect chances for ignition and spread of fire. Extreme weather, such as high temperatures and low humidity, can lead to extreme wildland fire activity. By contrast, cooling and higher humidity often signal reduced wildland fire occurrence and easier containment. Climate change increases the susceptibility of vegetation to fire due to longer dry seasons.

Figure 16. Alaska Fire Management Options



The frequency and severity of wildland fires is also dependent on other hazards, such as lightning, drought, and infestations (such as the damage caused by spruce-bark beetle

infestations or spruce needle aphids). The risk of wildfire has increased significantly over the past two decades, due in large part to the spruce-bark beetle infestation that has killed over 90% of the trees on more than 1.5 million acres of forest land in the Kenai Peninsula Borough (KPB, 2005). There is a brown hue in Seldovia's trees attributed to the presence of spruce-bark Beetles. Spruce-bark beetles like dry weather with no rain to be able to fly in a direction unlike mosquitoes, and the cooler temperatures and wetter trees in Seldovia through June help to keep spruce-bark beetle growth under control. Black clouds of spruce-bark beetles have been observed. Spruce-bark beetles cause trees to die and fall to the ground. Alder and Devils Club tend to grow up around the fallen trees and are more resistant to fire than spruce. Spruce needle aphids add to the fire risk and have been seen at MacDonald Spit near Jakolof and King Fisher Creeks. Although aphids don't kill trees, they cause needles to drop and add to the fuel potential. The shoreline has at least a two-inch thick needle bed.

If not promptly controlled, wildland fires may grow into an emergency or disaster. Even small fires can threaten lives and resources and destroy improved properties; they can also impact transportation corridors and/or infrastructure. In addition to affecting people, wildland fires may severely affect livestock and pets. Such events may require emergency water/food, evacuation, and shelter.

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

Conflagration fires are very difficult to control. Complicating factors are wind, temperature, slope, proximity of structures, and community firefighting capability, as well as building construction and contents. Additional factors facing response efforts are hazardous substance releases, structure collapse, water service interruptions, unorganized evacuations, and loss of emergency shelters. Historical national conflagration examples include the Chicago City Fire of 1871 and the San Francisco City Fire following the 1906 earthquake.

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

5.3.8.3 Climate Factors

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

Since 1990, Alaska has experienced nearly twice the number of wildfires per decade compared to a period from 1950 to 1980. Additionally, the sparsely-populated arctic region experienced

only three wildfires over 1,000 acres from 1950 to 1970. Since 2000, there have been over 33 large wildfires in this same region.

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

Wind blows down dead trees that have been affected by spruce-bark beetles. As air temperatures warm, spruce-bark beetles spread; typically, this occurs when temperatures are over 60 °F. Yukon Island and the hill by Seldovia Slough have been affected. There is also evidence that in the late 1800s, spruce-bark beetles wiped out the forest in Seldovia.

5.3.8.4 History

Small out-of-control fires have occurred in the past, particularly those that spread through organic-rich forest duff. Additionally, fires have occurred within Seldovia Village limits but were not of a substantial size. These fires were man-made and a result of people not paying attention to their camp fires. Though Seldovia has not seen the same extent of spruce-bark beetle damage as the rest of the Kenai Peninsula, the increase of dead trees in some areas increases fire risk. The vast majority of wildland fires on the Kenai Peninsula are the result of human activities: open burning being the most prevalent. Lightning-caused fires are infrequent.

In 2004, SVT planted a mixed forest of native and non-native species as a fire prevention measure funded by the Division of Forestry. Species planted included lodgepole pine, Siberian larch, white spruce seedling, and willows at Mile 2 area of Jakolof Bay Road and Miles 11-13 of Jakolof Bay Road. This mixed forest greatly exceeded natural spruce growth. The mixed forest of alders, devils club, berry bushes, and Siberian larch offer protection from fire. Additional plantings have occurred since. In 2019, a number of the pines planted appear dead.

Contractors funded by SNA have clear cut at Mile 2 of Jakolof Bay Road. Additional clear cuts out of Jakolof should be done.

Spruce-bark beetles likely won't take over Seldovia Village like the rest of the Kenai Peninsula Borough due to the prevailing wind (from the southeast) and cooler temperatures, but the potential is there. One local scientist is setting traps on his property in 2019 to monitor the status of spruce-bark beetles.

Planting the mixed forest, making clear cuts, and installing fire breaks have made fire not the hazard it used to be. However, a resident stated that these clear cuts may have created a local "wind-tunnel" effect which caused a substantial loss of timber on private property to the northwest of the Mile 2 clear cut a few years after the clear cut and several more in recent years. This input should be evaluated further by the Barabara Creek VFD before making additional clear cuts.

A home burned down a few years back. Table 12 contains all wildland fire locations within 40 miles of Seldovia since records were kept in 1939 per AICC. Also, see Figure 17.

Table 12. Wildland Fires since 1939 within 40 miles of Seldovia

Fire Name	Fire Year	Estimated Acres	Latitude	Longitude	Specific Cause
Collins Fire	1948	6	59.43333	-151.783	Campfire
China Poot	1954	0.1	59.53333	-151.217	Campfire
Seldovia	1990	0.1	59.45	-151.717	Campfire
Seldovia 3	1990	0.1	59.45	-151.7	Campfire
Seldovia 5	1990	0.1	59.45	-151.7	Campfire
Seldovia 2	1990	0.1	59.45	-151.717	Campfire
Seldovia 4	1990	0.1	59.45	-151.7	Campfire
L. Tutka	1990	0.5	59.46667	-151.5	Burning Building
Seldovia Bay	1992	0.2	59.41667	-151.733	Other
Seldovia VFD #1	1992	0.1	59.43333	-151.7	Powerline
Jakolof	1992	0.1	59.46667	-151.533	Campfire
Tutka Bay	1993	0.3	59.48333	-151.433	Cooking fire
Jakolof Rd	1994	0.5	59.45	-151.5	Warming fire
Seldovia Bay	1995	0.5	59.43333	-151.75	Children
Seldovia FD #2	1996	0.1	59.4	-151.667	Slash burn
Seldovia VFD #1	1996	0.1	59.46667	-151.567	Slash burn
Seldovia VFD #3	1996	0.1	59.45	-151.7	Warming fire
Tutka Bay	1996	0.1	59.48333	-151.433	Cooking fire
Sadie Cove	1997	0.1	59.51667	-151.45	Campfire
Yukon Island	1997	0.1	59.53333	-151.483	Other
Little Tutka	2000	0.1	59.46667	-151.483	Campfire
Sadie Cove	2003	0.1	59.51667	-151.433	
Anisim Point	2008	0.1	59.52722	-151.441	Burning Building
Tutka Bay	2008	0.1	59.44167	-151.409	Campfire
Seldovia VFD # 1	2008	0.1	59.39972	-151.682	
West Sadie Cove	2010	1	59.45195	-151.351	Campfire
Hesketh Island	2013	0.4	59.50731	-151.508	Miscellaneous
Outside Beach	2014	0.1	59.4545	-151.705	Human
Nutbeem Road	2014	0.1	59.46928	-151.673	Human
Camel Rock	2015	0.1	59.45333	-151.718	Human
East Side Beach	2015	0.1	59.45353	-151.718	Human
Jakolof Bay	2016	0.1	59.44125	-151.475	Human
Jakolof Bay	2016	0.1	59.46422	-151.699	Human
Jakolof Bay	2017	0.1	59.46328	-151.535	Campfire

5.3.8.5 Location, Extent, Impact, and Recurrence Probability

Location

The Seldovia Community Wildfire Protection Plan area includes an area of 11,500 acres; lands are located in moderate and low fire danger areas, based on their fuel types (see Tables 13 and 14) (DOF, 2008). Access roads and trails to the east leads along Jakolof Bay and continue into the Rocky River and Red Mountain drainages. This area is primarily bordered on the north side by the southern shore of Kachemak Bay. To the south, lands extend upward to the rocky mountains. To the west, this area includes both sides of Seldovia Bay (DOF, 2008).

Many of Seldovia's residents burn their slash on their properties or on the beach during low tide.

Neither conflagration nor wildland fires have caused major emergencies in Seldovia Village in the past. During times of heightened fire risks, the Kenai Peninsula Borough occasionally establishes burn restrictions as a preventive/mitigative measure. Barabara Heights VFD participates in Fire Wise.

The area considered to be most vulnerable to a conflagration or WUI fire within the City of Seldovia is the hillside area between the School and the Fuel and Lube. Additionally, there is potential for the Barabara Heights subdivision or MacDonald Spit area residents to be cut off from Jakolof Bay Road to the City which would isolate Village residents. This is likely the same corridor that fire could enter the City from. While unusual conditions would need to be in place for a major fire to occur in Seldovia Village, it is possible. Lightning strikes could also cause unexpected fires during unusually dry conditions.

Figure 17. Seldovia Wildland Fires

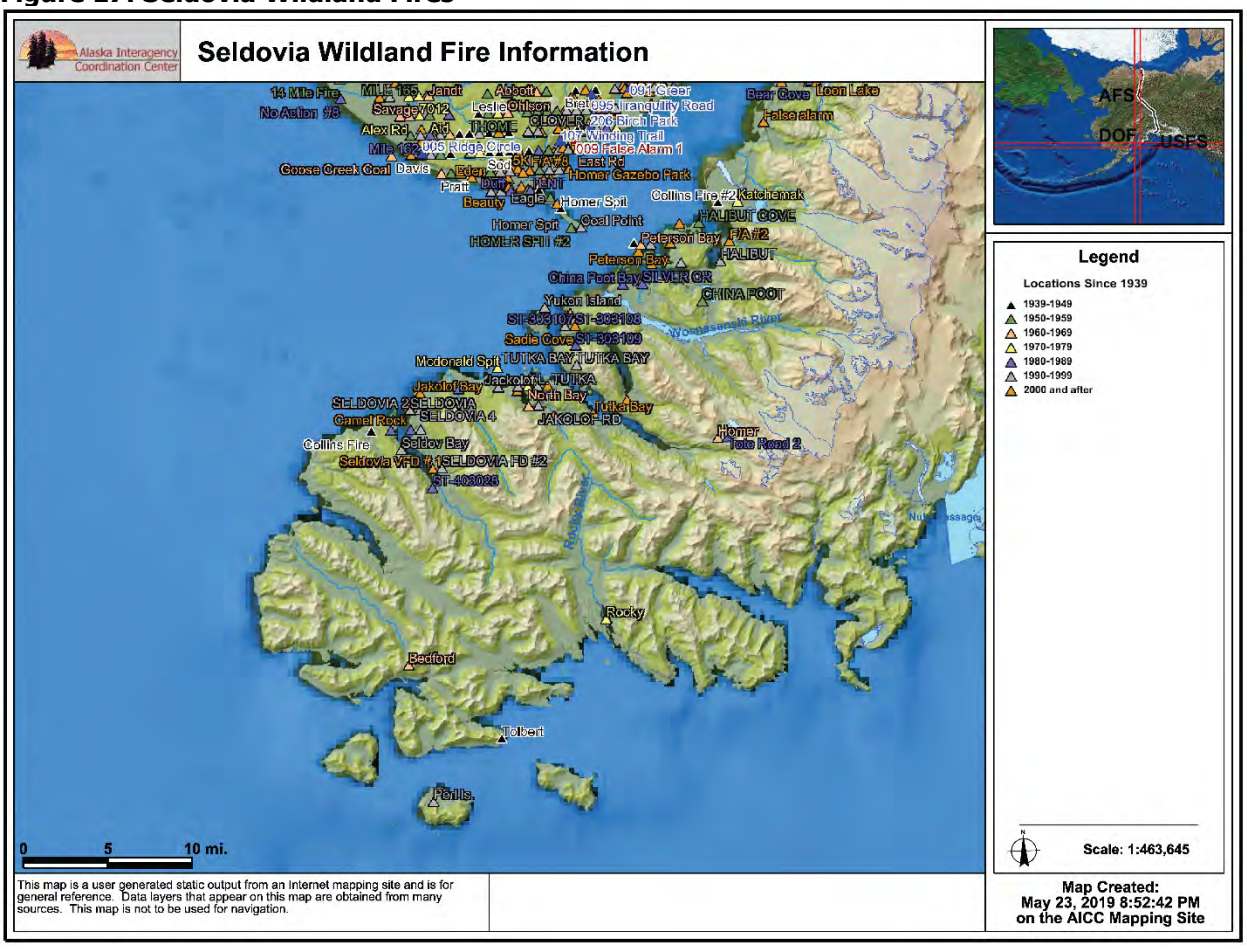


Table 13. Seldovia Acreages by Wildland Fuel Hazard Type

Severity	Acreage
Extreme	0
High	100
Moderate	1,680
Low	6,120
Very Low	3,240

No Risk/No Data	360
Total	11,500

As residents have moved out of the City of Seldovia to Seldovia Village, the fire potential has increased. Residents burn slash and have campfires in this heavily-forested area. HEA has cleared underneath the nine miles of power line. Clearing needs to occur every other year to mitigate fire risk. Powerlines are in a big heavy timber/grass/transition to alder which doesn't like to burn at all and substitutes as a fire break.

Seldovia Village residents typically have three-acre lots to build on. The Barabara Heights VFD Fire Chief stated in 2019 that there are less calls to the VFD since the Fire Wise program was implemented approximately 10 years ago.

Table 14. Overall Assessment Rating of Fire Risks and Hazards in Seldovia

Risk and Hazard	Rating
Wildland Fire Inside City Limits	Moderate Risk
Wildland Fire Outside City Limits	Low Risk
Barriers	Fair
Fire Protection	Fair
Community Fire Wise Rating	Fair

Source: DOF, 2008

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 (Figure 18). However, various other factors, including humidity, wind speed and direction, fuel load and type, and topography can contribute to the intensity and spread of wildland fires. The common causes of wildland fires in Alaska include lightning strikes and human negligence.

Climate and fire data confirm that fire season length and fire severity have increased with the recent ambient temperature increases. Another outcome of the warmer climate trend is the arrival of earlier than normal "snow-free" dates. This translates to an earlier spring fire season. The fire season on the Kenai Peninsula Borough typically occurs from April to September, with the greatest fire activity occurring between May and June, when live fuel moisture is dry from the winter freeze, and high-pressure weather systems bring higher temperatures and lower humidity conditions (DOF, 2008).

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

The fuels on the Kenai Peninsula Borough are mostly in transition from thick, green forests to decaying dead spruce. Spruce forests, whether live or dead, are both flammable and provide

radiant heat and ember spot fires that advance fire through air convection. Seldovia Village maintains old growth Sitka spruce forests with brush and alder underground. There are small pockets of grass.

Impact

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

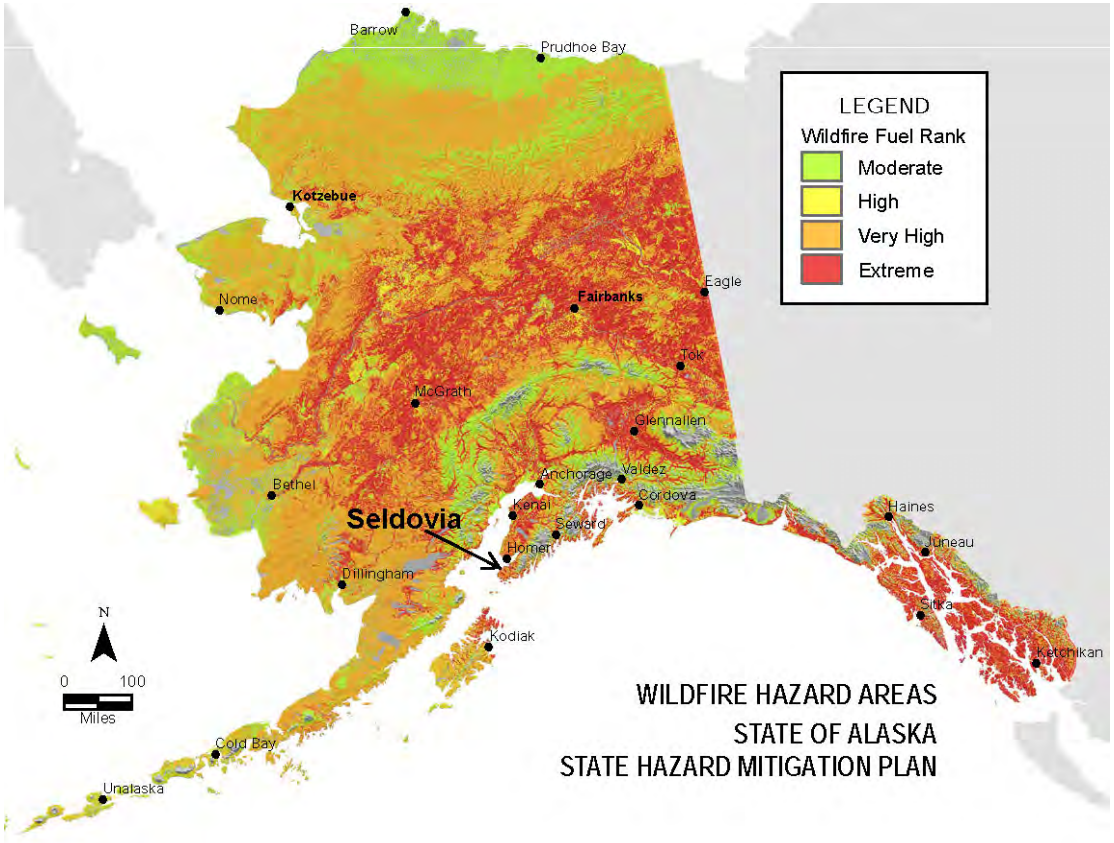
Indirect impacts of wildland fires can be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large, intense fires can harm the soil, waterways, and the land itself. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed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

Very little spruce-bark beetle activity has occurred from Seldovia to Port Graham and Nanwalek (DOF, 2008). Seldovia is a wet area. However, with the spruce-bark beetle invasion, there is a readily-available fuel source for a forest fire should one occur.

Recurrence Probability

Increased community development, fire fuel accumulation, and weather pattern uncertainties indicate that seasonal wildfires will continue into the future. Seldovia Village needs to continually continue their wildfire prevention/mitigation strategies.

Figure 18. Seldovia's Wildland Fire Risk



This section provides an overview of the vulnerability analysis.

6.1 OVERVIEW OF A VULNERABILITY ANALYSIS

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

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

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

DMA 2000 Requirements: Risk Assessment, Assessing Vulnerability, Overview

Assessing Vulnerability: Overview

Requirement §201.7(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.

Element

- Does the new plan include an overall summary description of the jurisdiction's vulnerability to each hazard?
- Does the new plan address the impact of each hazard on the jurisdiction?

Source: FEMA, 2015.

This HMP has been developed for SVT which is a single Tribal Jurisdiction.

6.2 CURRENT ASSET EXPOSURE ANALYSIS

6.2.1 Critical Asset Infrastructure

Assets that may be affected by hazard events include population (for community-wide hazards), residential buildings, and critical facilities and infrastructure. Assets are grouped into two structure types: critical infrastructure and residential properties. The assets and associated values throughout the SVT are identified and discussed in detail in the following subsections.

DMA 2000 Recommendations: Risk Assessment, Assessing Vulnerability, Identifying Structures

Assessing Vulnerability: Identifying Structures

Requirement §201.7(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

Element

- Does the new plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?

DMA 2000 Recommendations: Risk Assessment, Assessing Vulnerability, Identifying Structures

- Does the new plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas?

Source: FEMA, 2015.

6.2.1.1 Critical Infrastructure

Critical infrastructure is defined as a facility that provides essential products and services to the general public, such as preserving quality of life while fulfilling important public safety, emergency response, and disaster recovery functions. Critical facilities and infrastructure for the SVT are profiled in this HMP and include the following (see also Table 15):

- Government: Tribal administrative offices, departments, or agencies;
- Emergency Response: including fire personnel services; and fire-fighting equipment;
- Health Care: medical clinics, congregate living, health, residential and continuing care, and retirement facilities (Health Centers in Seldovia, Anchor Point, and Homer); and
- Community Gathering Places: Alaska Tribal Cache building, and culturally significant and ceremonial facilities.

Facilities listed in Table 14 that are not included in this HMP are included in the City of Seldovia HMP.

Table 15. Alaska's Critical Infrastructure

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

Population data for Seldovia Village was obtained from the 2010 U.S. Census. Seldovia Village's total population for 2010 was 165, and 2017 DCCED/DCRA data reported a population of 180 (Table 16).

There are 206 housing units in Seldovia Village. Most homes are frame and/or log construction, and nearly all units are single-family homes. Estimated replacement values for those structures, as shown in Table 16, were obtained from 2019 Kenai Peninsula Borough Property Assessments.

Table 16. Estimated Population and Building Inventory

Population		Residential Buildings	
2010 U.S. Census	DCCED 2017 Data	Total Building Count	Total Value of Buildings[1]
165	180	206	$25,050,006

Sources: Seldovia Village, U.S. Census 2010, and 2017 DCCED/DCRA population data.
[1] Kenai Peninsula Borough Property Assessments, 2019.

DMA 2000 Recommendations: Estimating Potential Losses

Assessing Vulnerability: Estimating Potential Losses

Requirement §201.7(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate.

Element

- Does the new plan estimate potential dollar losses to vulnerable structures?
- Does the new plan describe the methodology used to prepare the estimate?

Source: FEMA, 2015.

SVT owns two buildings that are located in the City of Seldovia. One building is on the harbor side of Main Street and houses a childcare center, exercise facility, conference center, kitchen, and offices for the Environmental Department, Community Health Representative, and Emergency Services Director. Additionally, there is a rental space that is occupied by SNA as well as a large warehouse and storage. This building is called the Alaska Tribal Cache building. The second building is located on the City side of Main Street and houses Tribal Administrative Offices, SVT Health Center, and Visitor Center and Museum. Additionally, SVT owns another SVT Health & and Wellness Center in Homer that is approximately 12,000 square feet and provides medical/dental/mental/and complimentary services. SVT also owns a Health Center in Anchor Point that is approximately 2,600 square feet.

DMA 2000 Recommendations: Cultural and Sacred Sites

Assessing Vulnerability: Identifying Cultural and Sacred Sites

Requirement §201.7(c)(2)(ii)(D): [The plan should describe vulnerability in terms of] cultural and sacred sites that are significant, even if they cannot be valued in monetary terms.

Element

- Does the new plan describe cultural sites?
- Does the new plan describe sacred sites?

Source: FEMA, 2015.

Historic, cultural, and sacred sites in the SVT community are:

- St. Nicholas Orthodox Church (built by the Russians in 1891, it was restored in 1981, and the church stands today as a National Historic site);
- SVT's Seldovia Visitor Center and Museum;
- Artifacts not on display at the museum are stored in the Alaska Tribal Cache building;

- Main cemetery and an additional smaller century-old cemetery next to the Chissus's house across from the gas station;
- Subsistence areas (Figure 19);
- Red Mountain;
- Peterson Bay Cultural Site;
- Midden sites at Hoen's Lagoon, Outside Beach, Jakolof Bay, Barabara Creek, Sandy Bay, and Lookout Point;
- Subsurface sites along bluffs and beaches that are eroding away;
- Subsistence areas also include Rocky River, Picnic Harbor, Windy Bay, Jakolof and Kachemak Bays, and Cook Inlet.
- Tribal site at the Head of Seldovia Bay.

Subsistence areas are not only culturally significant but are also used today. Prior to the 1980s, clams were abundant in Seldovia, and Port Graham and Nanwalek residents did their clamming in Seldovia before continuing on to the bay. Since the 1980s, Seldovia experienced significant loss of clams, crabs, herring, and shrimp with no explanation. Salmon populations decreased. One resident described the change as, "it was like someone had turned off the water in the bay." Kasitsna Bay is now the only place with good clam recruitments, and SVT would like to start a clam garden, similar to what southeast Alaska has in place. SVT is also working with the State hatchery to plant clams in Seldovia and Jakolof Bays.

SVT has several projects identified to improve subsistence areas. Figure 19 shows SVT's primary and greater traditional use areas. Subsistence also occurs on the City side of the Bay.

- SVT is in the 5th year of studying coho salmon at Fish Creek to determine if the numbers can be increased with an incubator project to a sustainable level. This project also seeks to plant ides from eggs that have been incubated in different parts of Fish Creek.
- Residents fish in Seldovia River, Jakolof Creek, Fish Creek, and Seldovia Slough for subsistence needs.
- The Alaska Department of Fish & Game plans to study Jakolof Bay and Clam Creek to determine how to increase clam recruitment rates.

Commercial fishing occurs in Seldovia Bay, along the mouth of the bay, the coastline from Seldovia Point to Kasitsna Bay and Jakolof Bay.

Historically, Red Mountain was developed as a chromite mine. Red Mountain/Rocky River has been a traditional community gathering place and is a cultural asset. SVT uses Red Mountain and the area towards Rocky River as subsistence areas for hunting bears and goats, birding for ptarmigan and grouse, and picking high alpine berries. Jakolof Bay Road is a 12-mile road through private lands and SNA lands that connects the community to Kachemak Bay State Park. Jakolof Bay Road is the only road to Red Mountain. Prior to 1985, there was a road that went to Red

Mountain and down to Picnic Harbor. The road washed out in 2012. Rocky River indicates the border of Port Graham land.

6.2.1.2 Infrastructure Risk, Vulnerability, and Losses from Identified Hazards

DMA 2000 Recommendations: Assessing Vulnerability

Assessing Vulnerability

Requirement §201.7(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

Element

- Does the new plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?
- Does the new plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas?

Source: FEMA, 2015.

Table 17 identifies properties that are important to SVT and their vulnerabilities to hazard events. Vulnerabilities are described further after Table 18, and the first three hazards are the most important in order of priority from a community viewpoint as discussed on July 1, 2019.

Most Seldovia Village residents could access the Barabara Heights Fire Station at Mile 4 of Jakolof Bay Road if they were cut off from the City in a hazard event. The Fire Station does not have heat, electricity, or restroom facilities in 2019. The Barabara Creek VFD would like to make the building into an emergency shelter as grant funding allows. The Station could serve as a meeting place.

Table 17. SVT Critical Facilities Vulnerabilities

Facility	Severe Weather	Ground Failure	Earthquake	Tsunami	Ashfall	Changes in the Cryosphere	Wildland Fire	Flood/ Coastal Erosion
SVT Ferry	X		X	X	X	X		X
SVT Ferry Dock	X		X	X	X	X		X
SVT Ferry Connex/Shed	X		X	X	X	X		X
Main Street Market (SNA owned)	X		X	X	X	X	X	X
Sea Otter View Cabins at Dan Cove (SNA owned)	X		X	X	X	X	X	X
SVT's Anchor Point Health Center	X		X		X		X	
SVT Homer Health Center	X	X	X		X		X	
Tribal Cache Building/Childcare/Conference Center/Exercise Room/Offices/Kitchen	X		X	X	X	X	X	X
SVT Office Building/Clinic/Museum	X		X	X	X	X	X	X
Barabara Heights VFD Building	X		X		X	X	X	
Jakolof Bay Road (State-owned)	X	X	X	X	X	X	X	X
Jakolof dock (City-owned)	X		X	X	X	X	X	X
Kasitsna Bay dock (BLM-owned)	X		X	X	X	X	X	X
SVT maintains 20 miles of road for the Kenai Peninsula Borough.	X	X	X	X	X	X	X	X
SVT Ferry Assets on Homer Spit (under lease from City of Homer)	X	X	X	X	X	X	X	X

Figure 19. Local Subsistence Map

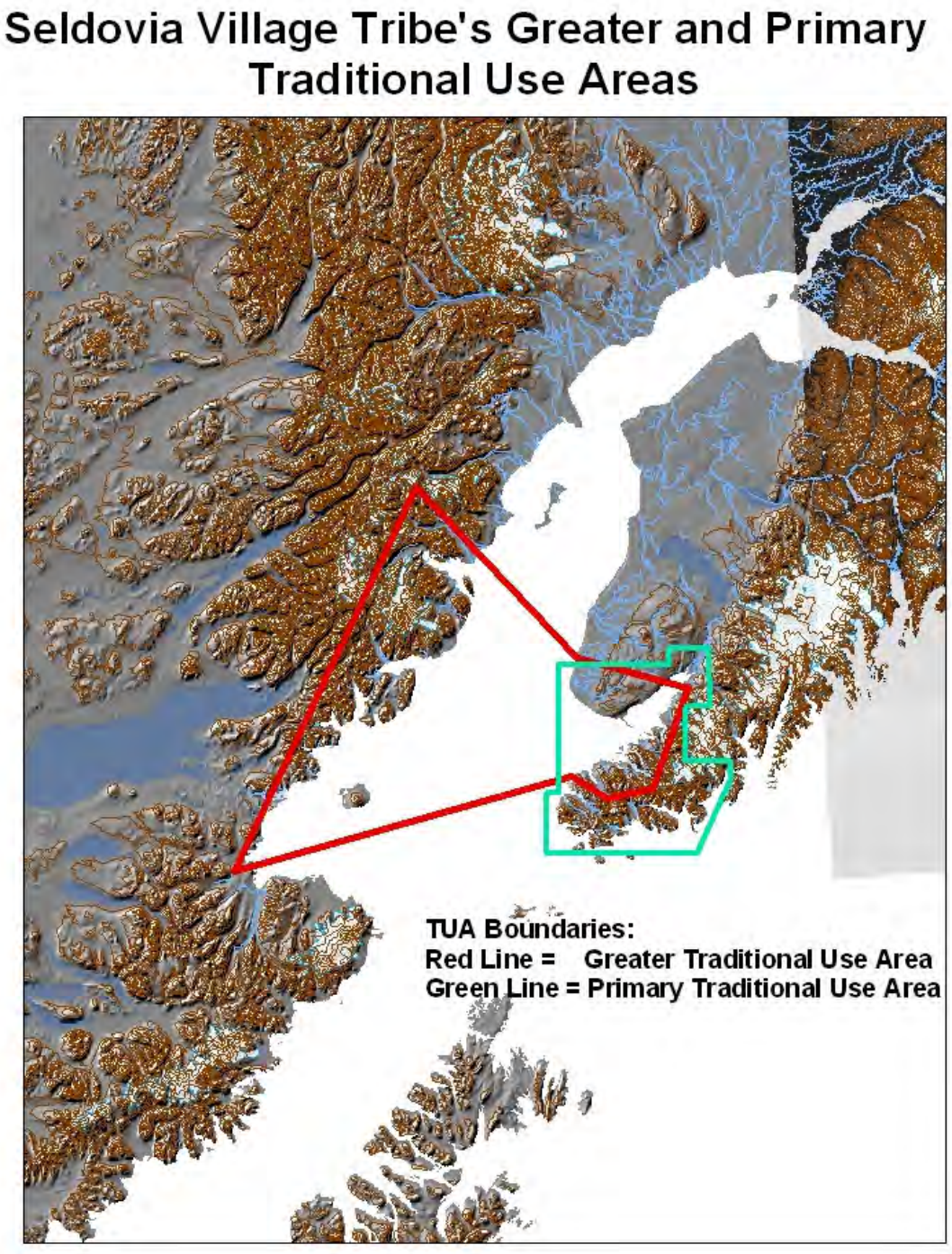


Table 18 lists the critical facilities for SVT and a building cost estimate.

Table 18. SVT Asset Matrix – Structures and Infrastructure

Structure	Loss Estimate
SVT Ferry	
SVT Ferry Dock	
SVT Ferry Connex/Shed	
Main Street Market (SNA owned)	
Sea Otter View Cabins at Dan Cove (SNA owned)	
SVT's Anchor Point Health Center	
SVT Homer Health Center	
Tribal Cache Building/Childcare/Conference Center/Exercise Room/Offices/Kitchen	
SVT Office Building/Clinic/Museum	
Barabara Heights VFD Building	
Jakolof Bay Road (State-owned)	
Jakolof dock (City-owned)	
Kasitsna Bay dock (BLM-owned)	
SVT maintains 20 miles of road for the Kenai Peninsula Borough.	
SVT Ferry Assets on Homer Spit (under lease from City of Homer)	

Earthquake Vulnerabilities

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

Based on PSHAs conducted by USGS in 2019, the entire state may be at risk of experiencing moderate to significant earthquake impacts. The 2018 State of Alaska HMP categorizes the Kenai Peninsula Borough at risk of experiencing high earthquake impacts (see Section 5.3.2.3).

For this vulnerability analysis, it is assumed that 20% of the population and residential/commercial structures from Table 16 will be affected. This includes 36 people in 42 residences (worth $5,010,001) and three critical facilities.

Impacts to the community such as significant ground movement that may result in infrastructure damage are expected near the waterfront based on past events. Although all structures are exposed to earthquakes, buildings within the waterfront area constructed with wood have slightly less vulnerability to the effects of earthquakes than those with masonry.

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

Table 19. Potential Hazard Exposure Analysis – Critical Infrastructure

			Government and Emergency Response		Transportation		Care		Community	
Hazard Type	**Hazard Area**	**Methodology**	**# Bldgs/ # Occ**	**Value ($)**	**# Bldgs/ # Occ**	**Value ($)**	**# Bldgs/ # Occ**	**Value ($)**	**# Bldgs/ # Occ**	**Value ($)**
Changes in the Cryosphere	Entire State	Descriptive	1/0	[redacted]	8/104	[redacted]	3/115	[redacted]	3/50	[redacted]
Earthquake	High	0.6 – 0.8 %g	1/0	[redacted]	8/104	[redacted]	3/115	[redacted]	3/50	[redacted]
Flood/ Erosion	High	Descriptive	1/0	[redacted]	8/104	[redacted]	3/115	[redacted]	3/50	[redacted]
Severe Weather	Entire State	Descriptive	1/0	[redacted]	8/104	[redacted]	3/115	[redacted]	3/50	[redacted]
Tsunami	High	Inundation Map	1/0	[redacted]	8/104	[redacted]	3/115	[redacted]	3/50	[redacted]
Ground Failure	Low	Descriptive	1/0	[redacted]	8/104	[redacted]	3/115	[redacted]	3/50	[redacted]
Volcanic Ashfall	High	Descriptive	1/0	[redacted]	8/104	[redacted]	3/115	[redacted]	3/50	[redacted]
Fire	High	Community Wildfire Protection Plan	1/0	[redacted]	8/104	[redacted]	3/115	[redacted]	3/50	[redacted]

Tribal Office is counted under Care with the Clinic.

Severe Weather Vulnerabilities

The 2018 State of Alaska HMP categorizes the Kenai Peninsula Borough at risk of experiencing high severe weather impacts. Impacts associated with severe weather events include roof collapse, trees and power lines falling, damage to light aircraft and sinking small boats, and injury and death resulting from snow machine or vehicle accidents and overexertion while shoveling (all due to heavy snow). A quick thaw after a heavy snow can also cause substantial flooding. Impacts from extreme cold include hypothermia, halting transportation from fog and ice, congealed fuel, frozen pipes, disruption in utilities, frozen pipes, and carbon monoxide poisoning. Section 5.3.7.4 provides additional detail regarding the impacts of severe weather. Buildings that are older and/or not constructed with materials designed to withstand heavy snow and wind (e.g., hurricane ties on crossbeams) are more vulnerable to the impacts of severe weather. The entire State is threatened by severe weather events.

Severe weather will occur annually in Seldovia Village. Using information provided by SVT and the National Weather Service (NWS), it is assumed that 40% of the existing and future population, residences, critical facilities, and infrastructure will be exposed to the effects of a severe weather event. This includes 72 people in 72 residences (worth $10,020,002) and six critical facilities.

Climate change impacts vary across Alaska. These conditions will negatively impact future populations, residential structures, critical facilities, and infrastructure.

Ground Failure Vulnerabilities

The 2018 State of Alaska HMP categorizes the Kenai Peninsula Borough at risk of experiencing low ground failure impacts. Impacts associated with a ground failure event include landslides blocking access roads and bluffs eroding on which houses are built. Section 5.3.4 contains additional information.

For this vulnerability analysis, it is assumed that 5% of the population and residential/ commercial structures from Tables 16 and 17 will be affected. This includes nine people in nine residences (worth $1,252,500) and one critical facility. These conditions will negatively impact future populations, residential structures, critical facilities, and infrastructure.

Changes in the Cryosphere Vulnerabilities

Alaska can expect to experience ever-changing effects from melting polar ice sheets, mountain glaciers, and other cryosphere impacts. According to mapping completed by the USGS, Seldovia does not have permafrost at ground level. There is likely permafrost at alpine levels. Seldovia Village residents and critical facilities are exposed to impacts from this hazard (see Section 5.3.1.4). For the purposes of this vulnerability assessment, it is assumed that 20% of residents will be affected. This includes 36 people in 42 residences (worth $5,010,001) and no critical facilities.

Based on human location and habitation, a person could experience infrastructure damage and personal injury throughout Alaska. Hunting and fishing subsistence capacity will be affected. The existing, transient, and future population, residential structures, and infrastructure are exposed to changing cryospheric impacts.

Similar to weather vulnerabilities, changing cryospheric conditions also vary across Alaska. Therefore, the entire population and infrastructure could be vulnerable to recurrent cryosphere hazard impacts. However, for the purposes of this vulnerability assessment, it is assumed that 20% of residents will be affected.

Flood and Erosion Vulnerabilities

The 2018 State of Alaska HMP categorizes the Kenai Peninsula Borough at risk of experiencing high flooding and erosion impacts. Impacts associated with flooding in Seldovia Village include creeks or riverine flooding, water damage to structures and contents, storm surges, roadbed erosion and damage, boat strandings, areas of standing water in roadways, and damage or displacement of tanks, power lines, or other infrastructure. Buildings on slab foundations, not located on raised foundations, and/or not constructed with materials designed to withstand flooding events (e.g., cross vents to allow water to pass through an open area under the main floor of a building) are more vulnerable to the impacts of flooding (see Section 5.3.3.4).

Neither the City of Seldovia nor Seldovia Village participate in the NFIP.

For this vulnerability analysis, it is assumed that 5% of the population and residential/ commercial structures from Tables 16 and 17 will be affected. This includes nine people in nine residences (worth $1,252,500) and one critical facility. Seldovia Village's flood- and erosion-threatened population and infrastructure potentially include: the existing, transient, and future population, residential structures, critical facilities, and infrastructure that are exposed to changing flooding and erosion impacts.

Fire Vulnerabilities

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

According to the Alaska Fire Service, there are no wildland fire areas within Seldovia Village's boundaries (see Section 5.3.8.5). There is potential for wildland fire to interface with the population center of Seldovia Village. Conflagration fires could occur. For this vulnerability analysis, it is assumed that 20% of the population and residential/commercial structures from Tables 16 and 17 will be affected. This includes 36 people in 42 residences (worth $5,010,001) and three critical facilities.

Dry forest conditions increase fire fuels and insect infestations. These conditions create optimum conditions for fire propagation, especially around housing and other areas where fire fuels are not controlled near public or private structures. Future populations, residential structures, critical facilities, and infrastructure located in dryer regions of Alaska are anticipated to experience increased fire events compared to historical impacts.

Tsunami Vulnerabilities

The 2018 State of Alaska HMP categorizes the Kenai Peninsula Borough at risk of experiencing high tsunami impacts. Impacts associated with a tsunami event include the potential for loss of

life and property. Buildings adjacent to Seldovia and Kachemak Bays are more vulnerable to the impacts of tsunamis (see Section 5.3.5).

For this vulnerability analysis, it is assumed that 20% of the population and residential/commercial structures from Tables 16 and 17 will be affected. This includes 36 people in 42 residences (worth $5,010,001) and three critical facilities.

Volcanic Ashfall Vulnerabilities

The 2018 State of Alaska HMP categorizes the Kenai Peninsula Borough at risk of experiencing high volcanic impacts. Impacts associated with an ashfall event include the potential for ashfall to damage motors and ashfall impairing air quality (Section 5.3.6).

For this vulnerability analysis, it is assumed that 20% of the population and residential/commercial structures from Tables 16 and 17 will be affected. This includes 36 people in 42 residences (worth $5,010,001) and three critical facilities.

6.2.1.3 Land Use and Development Trends

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

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

Assessing Vulnerability: Analyzing Development Trends

Requirement §201.7(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

Element

- Does the new plan describe land uses and development trends?

Source: FEMA, 2015.

Seldovia Village encompasses all the owned and accessible land outside the City of Seldovia boundaries, extending from Seldovia to Jakolof Bays. For example, the Kenai Peninsula Borough Rocky River Landfill and the City's Jakolof Bay Dock facility are included in the Seldovia Village area. Barabara Heights Subdivision is a sub-unit within the Village.

The ownership pattern for Seldovia Village lands is very mixed, including, but not limited to: the State of Alaska, the Kenai Peninsula Borough, SNA, and private ownership (see Table 20). There are also many private and business properties.

SVT does not own any land other than fee simple. There is adequate land in Seldovia Village for purchase.

There are several commercial enterprises in the Seldovia Village area. There are two small log mills on a three-acre home site, two mechanic shops, and a rock/aggregate pit. There are several commercial set-net fishing sites, one adventure lodge, and one bed and breakfast. There are no stores, shops, or other retail outlets. The University of Alaska Fairbanks offers classes at the Kasitsna Bay Lab. The area also contains the State road/airport maintenance shop and one larger mechanic/welding building (Gorman, 2007).

Set-net fishermen and owners of vacation properties (primarily the MacDonald Spit area) were the first users of the eastern Village area. An early seasonal and non-maintained road also traversed the area, providing access to mines located up Barabara Creek and at Red Mountain. There are also a few homesteads or patented home-sites in the area. Most are accessed via water.

In the 1960s, logging was developed on the Pacific Ocean side of the Borough, near Rocky Bay. The access road to this area and the eventual mill site and camp was from Jakolof Bay. This brought upgrades to Jakolof Bay Road. School children were bussed from the Jakolof Bay campsite. The State has provided maintenance of the road from at least 1969.

Beginning in the late 1960s, homes were built at points along the road. In 1979, the Barabara Heights Subdivision was created when SNA deeded three-acre parcels to each of the original shareholders from its landholdings. A period of home building and sales of property began. Numbers of SNA shareholders and non-native persons built dwellings and moved out of the Seldovia City limits (Gorman, 2007).

The SNA logged area, at Mile Two of Jakolof Bay Road, holds good potential for several developments. These include a recreation area, including groomed trails, a variety of winter sports, and upscale condominiums with spectacular views. With large areas still undeveloped, the opportunity for setting aside and developing parks and trails is favorable.

Table 20. Seldovia Land Ownership

Owner	Percent of Total Area
Kenai Peninsula Borough	1
Municipal	6
Native	6
Private	82
State	4

There are 23 miles of electrical transmission lines that are maintained by HEA and its contractors. There are miles of telephone lines scattered throughout the area with spotty cell phone coverage. There are private docks in the bays serving as loading and unloading docks for boats, a primary source of transportation for many residents in the area. There are 43.9 miles of roads and undedicated access roads and trails throughout the Community Wildfire Protection Plan area (DOF, 2008).

There are several watersheds that provide subsistence activities and personal water consumption including the Rocky Ridge Trail watershed for the Seldovia Reservoir and Barabara Creek watershed. There are Mari culture oyster sites that depend heavily on pristine watersheds (DOF, 2008).

Development Trends

SVT's vision for Seldovia Village is that it remains a residential and vacation property community, providing for limited public safety services, small commercial enterprises, and public parks and trails.

The actual land use pattern within Seldovia Village has changed little, and the number of homes and cabins has increased. Land values, as assessed by the Borough, and home sale prices have increased.

There is a need for a new health care facility in Seldovia. Construction of an LMI Family Housing four-plex is planned. SNA is evaluating leasing more cabins in Seldovia Bay.

6.2.1.4 Data Limitations

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

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

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

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

7.1 DEVELOPING MITIGATION GOALS

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

DMA 2000 Requirements: Mitigation Strategy – Tribal Hazard Mitigation Goals

Tribal Hazard Mitigation Goals

Requirement §201.7(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Element

- Does the plan include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards?

Source: FEMA, 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, goals were developed to reduce or avoid long-term vulnerabilities to identified hazards (Table 21).

Table 21. Mitigation Goals

No.	Goal Description
Multi-Hazards (MH)	
MH 1	Construct a second access road to the airport.
MH 2	Encourage emergency preparedness for all-natural hazards.
MH 3	Determine if the landfill is leaching.
Natural Hazards	
EQ 3	Reduce potential earthquake (EQ) vulnerability, damage, and loss.
SW 4	Reduce potential severe weather (SW) vulnerability, damage, and loss.
GF 5	Reduce potential ground failure (GF) vulnerability, damage, and loss.
CC 6	Combine changes in the cryosphere (CC) with SW 4.
FL 7	Reduce potential flood (FL) and erosion vulnerability, damage, and loss.
V 8	Mitigate potential ashfall vulnerability.
T 9	Reduce potential tsunami (T) vulnerability, damage, and loss.
F 10	Reduce potential wildland fire and conflagration fire (F) vulnerability, damage, and loss.

7.2 IDENTIFYING MITIGATION ACTIONS

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

DMA 2000 Requirements: Mitigation Strategy - Identification and Analysis of Mitigation Actions

Identification and Analysis of Mitigation Actions

Requirement §201.7(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

- Does the new plan identify and analyze a comprehensive range of specific mitigation actions and projects for each hazard?
- Do the identified actions and projects address reducing the effects of hazards on new buildings and infrastructure?
- Do the identified actions and projects address reducing the effects of hazards on existing buildings and infrastructure?

Source: FEMA, 2015.

After mitigation goals and actions were developed, the Planning Team assessed the potential mitigation actions to carry forward into the mitigation strategy. Mitigation actions are activities, measures, or projects that help achieve the goals of an HMP. Mitigation actions are usually grouped into three broad categories: property protection, public education and awareness, and structural projects. The Planning Team placed particular emphasis on projects and programs that reduce the effects of hazards on both new and existing buildings and infrastructure. These potential projects are listed in Table 20.

7.3 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

Requirement: §201.7(c)(3)(iii): [The mitigation strategy section shall include] an action plan describing how the actions identified in Section (c)(3)(ii) will be prioritized, implemented, and administered by the Tribal Government. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

Element

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

Source: FEMA, 2015.

The Planning Team developed each of the mitigation actions on July 1, 2019, to determine which actions would be included in the MAP. The MAP contained in Table 23 represents potential mitigation projects and programs.

Table 22. Mitigation Goals and Potential Actions
(Bold ID items were selected for implementation by the Planning Team)

Goals		Actions	
No.	**Description**	**ID**	**Description**
MH 1	Construct a second access road to the airport.	**A**	There is only one road to the airport. If the bridge is destroyed or otherwise incapacitated, the airport would be inaccessible. Both the City and Seldovia Village would be affected, and there would not be access for residents to access the emergency shelter (the school) from the dump road or East Addition. At one time, there was plans for a platted road to develop another road to the airport from Jakolof Bay Road to Fish Creek. The road was never built.
MH 2	Encourage emergency preparedness for all-natural hazards.	**A**	Develop, produce, and distribute information materials concerning mitigation, preparedness, and safety procedures for all jurisdictional identified natural hazards.
		B	Power is not dependable. Another source is necessary. A study should be conducted evaluating other options.
		C	Develop a list of public facilities that need backup generators and apply for funding to install generators.
		D	Educate residents on the advantages of having backup generators, emergency kits, and individual response plans and how to use them.
		E	Need a Cell Center on Wheels.
		F	Need Lidar data to define hazard areas for tsunami, earthquake, severe weather, and ground failure hazards.
		G	Evaluate landing docks other than the City Dock to evacuate residents from in winter months when air access is eliminated due to weather or darkness in case of a natural emergency.
		H	Install fire suppression response system at the Barabara Heights Fire Station. Also, expand the building so that it could be used as an emergency shelter with a potable water source.
MH 3	Determine if the landfill is leaching.	**A**	At Fish Creek, obtain funding to determine current status of macroinvertebrate data. Funding has not been available to collect data to evaluate against the baseline.
EQ 3	Reduce potential EQ vulnerability, damage, and loss.	**A**	Seismic shutoffs are needed for all facilities with natural gas or propane.
		B	Secure homeowner tanks in case of earthquakes or ground failure. Need someone with seismic expertise to make a punch list identifying what individual homeowners need to address.
SW 4		**A**	Create open space around houses so that trees do not fall on houses in storm events.

Goals		Actions	
No.	**Description**	**ID**	**Description**
	Reduce potential SW vulnerability, damage, and loss.	**B**	Increase power line wire size and incorporate quick disconnects (break away devices) to reduce ice load and wind storm power line failure during severe wind or winter ice storm events.
GF 5	Reduce potential GF vulnerability, damage, and loss.	**A**	Develop a map of potential landslide areas.
		B	Apply for USGS funding to survey the subsidence potential of Seldovia Village and the City of Seldovia.
		C	Secure fuel tanks in case of earthquakes or ground failure. Need someone with structural expertise to develop punch lists for homeowners to address.
		D	Rocky River Road has the potential to be blocked by a road slide. Install mitigation actions.
		E	Mineloop Road has the potential to be blocked; gabions would be helpful to hold back rocks.
FL 7	Reduce potential FL and erosion vulnerability, damage, and loss.	**A**	Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.
		B	Develop and implement tree clearing mitigation programs to keep trees from threatening lives, property, and public infrastructure from severe weather events.
		C	Develop personal use and educational outreach training for a “safe tree harvesting” program. Implement along utility and road corridors, preventing potential winter storm damage.
		D	In 2012, Jakolof Bay Road washed out where the road forks to Rocky Bay. This portion of the road needs to be put back in for subsistence, recreation, and tourism purposes as it is the only road access to Red Mountain.
		E	Old logging road used for subsistence/personal use/berry farms—washouts.
		F	Mile 1 on Jakolof Road wash outs. If land subsides in an earthquake, Seldovia Village could be severed from the City (75 feet wide) between lagoon and slough.
VA 8	Mitigate potential ashfall vulnerability.	**A**	Look at bearing loads of ash on roofs. At what level should homeowners remove ash during a hazard event?
		B	Evaluate potential actions to minimize damage to sensitive equipment in Health Centers.
		C	Purchase a supply of extra oxygen and ashfall masks to keep on hand.
T 9	Reduce potential tsunami vulnerability, damage, and loss.	**A**	DGGS finish their study in August 2019. Restrict development in areas within the tsunami inundation zone.
F 10	Reduce potential wildland and conflagration fire vulnerability, damage, and loss.	**A**	Build two concrete water cisterns to catch/contain natural year-round water flow at two locations on Jakolof Bay Road. One cistern would be at Mile 6 and the other at Mile 8. Easy access to water is needed.
		B	Build one cistern, built-in underground in firehouse building at Mile 4. The water would be piped from a well to the underground containment. This cistern should contain 10,000 gallons of usable water at above freezing temperatures to be used for fire suppression and other emergencies as needed.

Goals		Actions	
No.	**Description**	**ID**	**Description**
		C	Engineer and construct water flow system, piped from source up Barabara Creek to a constructed penstock-dry hydrant access downstream at bridge area of Barabara Creek on Jakolof Bay Road at Mile 5.
		D	Purchase one 10 KW diesel-powered generator light plant for fire apparatus shelter for use during power outages and other emergencies.
		E	Educate homeowners on the importance of creating defensible space around homes and suggested safety practices when using their wood burning stoves.
		F	Add water filtration system and storage to Fire Station.

The Planning Team reviewed the simplified social, technical, administrative, political, legal, economic, and environmental (STAPLEE) evaluation criteria (Table 23) and the Benefit-Cost Analysis Fact Sheet (Appendix D) to consider the opportunities and constraints of implementing each particular mitigation action. For each action considered for implementation, a qualitative statement is provided regarding the benefits and costs and, where available, the technical feasibility. A detailed cost-benefit analysis is anticipated as part of the application process for those projects SVT chooses to implement.

Table 23. Evaluation Criteria for Mitigation Actions
Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE)

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

On July 1 and August 5, 2019, the Planning Team considered each hazard's history, extent, and probability to determine each potential action's priority. A rating system based on high, medium, or low was used. High priorities are associated with actions for hazards that impact the community on an annual or near annual basis and generate impacts to critical facilities and/or people. Prioritizing the mitigation actions in the MAP Matrix was completed on August 5, 2019, to provide SVT with an approach to implementing the MAP. The community listed all mitigation actions as high priorities as each project is the highest priority to someone in the community. Table 23 defines the mitigation action priorities.

7.4 IMPLEMENTING A MITIGATION ACTION PLAN

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

DMA 2000 Requirements: Mitigation Strategy – Tribal Government's Pre- and Post- Disaster Policies

Implementation of Mitigation Actions

Requirement: §201.7(c)(3)(iv): [The mitigation strategy section shall include] a discussion of the Tribal Government's pre- and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including: an evaluation of tribal laws, regulations, policies, and programs related to hazard mitigation as well as development in hazard-prone areas; and a discussion of Tribal funding capabilities for hazard mitigation projects.

Element

- What will happen to the SVT community if no mitigation actions are implemented?
- What will happen to the SVT community if mitigation actions are implemented?
- What Tribal laws, regulations, policies, and programs pertain to hazard mitigation?
- Do land use regulations exist to prevent development in hazard-prone areas?

Source: FEMA, 2015.

DMA 2000 Requirements: Mitigation Strategy – Current and Potential Sources of Funding

Implementation of Mitigation Actions

Requirement: §201.7(c)(3)(v): [The mitigation strategy section shall include] identification of current and potential sources of Federal, Tribal, or private funding to implement mitigation actions.

Element

- What are current sources of Federal, Tribal, or private funding to implement mitigation actions?
- What are future sources of Federal, Tribal, or private funding to implement mitigation actions?

Source: FEMA, 2015.

If no mitigation actions from Table 24 are implemented, Seldovia Village will continue to be vulnerable to all hazards identified in Section 5 and the risks associated with those hazards in Section 6. If mitigation actions from Table 24 are implemented, Seldovia Village will become a resilient community that is prepared for potential hazards identified in Section 5 and the risks associated with those hazards in Section 6. SVT does not have hazard mitigation ordinances or guidelines in their Constitution.

Table 24. SVT Mitigation Action Plan
(See acronym and abbreviations list for complete titles)

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
MH 1A	Construct a second access road to the airport. Either an earthquake, tsunami, or flood could damage the only bridge over Seldovia Slough, thus stopping access to the airport. A study could be done as to whether the second access road should be a trail or full road, and how large a bridge would be needed.	High	SVT CEO	DOT&PF	2019-2024	B/C: Currently, there is only one road to the airport. Seldovia is an isolated community with access by air or boat. If the airport cannot be accessed, then boat is the only potential means for evacuation purposes. TF: This activity would be expensive. Work could be accomplished with conventional labor practices in the community. Negotiating with property owners would be time-extensive. A Borough Plat for easements was created and changed at one time.
MH 1B	Mile 1 on Jakolof Bay Road wash outs near a current shop and could cut off access to the airport. If land subsides in an earthquake, the Village could be severed from the City (75 feet wide) between lagoon and slough. MH1A and B should be implemented together in the same project.	High	SVT CEO	DOT&PF, FEMA	2019-2024	B/C: This action should be combined with MH-1A. TF: This activity would be expensive. Work could be accomplished with conventional labor practices in the community. Negotiating with property owners would be time-extensive.
MH 2A	Encourage emergency preparedness for all-natural hazards. Educate the public about the benefits of having a bug-out bucket (i.e., emergency kits) for each person that contain birth certificates, irreplaceable documents and keepsakes, thermal blankets, food, etc. Educate residents on the advantages of using better insulation and chinks for home energy efficiency that uses less power. Also, educate residents on the benefits of home generators and how to set them up safely and operate them as well as the different options that are available and their tradeoffs.	High	Emergency Services Manager in Seldovia and Emergency Services Coordinator & Disaster Planner in Homer	Staff Time	2019 with annual updates	B/C: Sustained mitigation outreach programs have minimal cost and will help build and support area-wide capacity. This type of activity enables the public to prepare for, respond to, and recover from disasters. Coordinated planning ensures effective damage abatement and ensures proper attention is assigned to reduce losses and damage to structures and residents. 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.

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
	Also, educate residents on seismic shutoffs and how to secure homeowner tanks to prepare for natural disasters. Educate homeowners on the importance of creating defensible space around homes (VFD educates in the spring) and suggested safety practices when using their wood burning stoves and cleaning their chimneys (VFD educates in the fall).					
MH 2B	Conduct a study that evaluates options for heating such as hydro (Windy River), wind, solar, or tidal because the current HEA power source is unreliable. Implement study recommendations so that Seldovia Village has a source of dependable power. Combine this study with options for energy storage and/or battery banks.	High	Grants Department Manager	HMGP Seed Money	2019-2024	B/C: Loss of life potential increases if there is no power source in the winter. Seldovia is an isolated community with limited access. TF: Another source of power should be evaluated. Backup generators that are dependable could also be used.
MH 2C	Develop a list of public facilities that need backup generators and apply for funding to install generators. This includes all three health centers, the Fire Station at Mile 4 of Jakolof Bay Road, Tribal Cache building, and the SVT Administrative Office building. Purchase one 10 KW diesel-powered generator light plant for fire apparatus shelter for use during power outages and other emergencies.	High	Facilities Manger	HMGP, PDM	2019	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. Grant funds should be applied for. Community members could install.
MH 2D	Obtain and store a Cell Center on Wheels (mobile communication cell tower).	High	Emergency Services Manager	PDM, FEMA	2019	B/C: This project would ensure communication could occur should a natural hazard occur. Communication is spotty at best now. F: This project is feasible using existing staff skills. Equipment and materials require grant funding.

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
MH 2E	Need Lidar data to use to define hazard area maps for tsunami, earthquake, severe weather, and ground failure. Maps should be developed documenting historical hazard occurrences as well as potential areas of concern based on slope and bedrock.	High	Environmental Department has GIS Capability	DGGS	2019-2020	B/C: Lidar data is being collected in 2019. Determine which agencies are collecting what types of data. TF: Borough staff have the technical capability to manage and conduct this project with instruction from the federal agencies collecting the data.
MH 2F	Jakolof Bay Dock has a deep and stable harbor to accommodate docking the fast ferry if the need to evacuate Seldovia residents occurred in winter months. Winter moorage at Kasitsna Dock is difficult. A study should be conducted to analyze the currents of both harbors for tsunami. Also, the approach road down to the Jakolof Bay Dock is sketchy year-round and needs to be engineered for in/out access year-round as there is a hairpin turn now which would be difficult to maneuver in winter.	High	SVT CEO	HMGP Seed Grant Money	2019	B/C: Coordinated planning ensures proper attention is assigned to eliminate or reduce loss of life. TF: This is feasible to accomplish.
MH 2G	Install fire suppression response system at the Barabara Heights Fire Station.	High	Emergency Services Manager	SAFER	2019	B/C: Fire personnel have defined this action as a critical need to save loss of life and property. TF: Fire personnel know what is needed and need funding to accomplish.
MH 3	At Fish Creek, obtain funding to determine if the Rocky River Landfill is affecting the surrounding area. The landfill was built on a divide between two wetlands. One is a swamp that leaches into Fish Creek. Rust-colored water is in this creek, and some families use this creek as their water source. A previous IGAP grant allowed the Environmental Department to collect baseline macroinvertebrate data from Fish Creek. The	High	Environmental Department	BIA	2019-2024	B/C: It is reasonable to continue to monitor baseline conditions. Staff are available to conduct monitoring in Seldovia, and baseline data exists. TF: This project is technically feasible.

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
	Department suspects a shift has occurred in macroinvertebrate data and would like funding to confirm this theory against the baseline data.					
EQ 3A	Install seismic shutoffs for all facilities with fuel, natural gas, and/or propane (Seldovia Village, Homer and Anchor Point Health Centers).	High	Facilities Manger	SVT would be responsible for their facilities. Homeowners would be responsible for individual residences.	2019	B/C: This is an easily-implemented mitigation action. TF: This action could be accomplished by existing workers and resources.
EQ 3B	Secure homeowner liquid or gas tanks in case of earthquakes or ground failure. Need someone with seismic expertise to make a punch list identifying what individual homeowners need to address.	High	Facilities Manger	SVT would be responsible for their facilities. Homeowners would be responsible for individual residences.	2019	B/C: Borough resources could supply technical expertise and Engineering Standards/Codes. TF: Residents would be responsible for their own punch lists.
SW 4A	The Barabara Creek VFD will send out flyers with a self-assessment checklist to minimize property damage from natural disasters. Residents should do self-assessments on their own properties and create open space around their houses accordingly so that trees do not fall on houses and that fuels are not readily available in case of fire.	High	Fire Chief	DOF, FireWise	2019	B/C: Borough resources could supply technical expertise. TF: Residents would be responsible for implementing their own punch lists.
SW 4B	Residents could evaluate the use of effective cabling to control where trees would fall should a high magnitude wind storm occur.	High	Individual Homeowner	Individual Homeowner	2019	B/C: Homeowners are responsible for the defensiveness of their property in a natural disaster. Prevention now may save property in the future. TF: Residents would be responsible for implementing their own punch lists.
GF 5A	Apply for USGS funding to survey the subsidence potential of Seldovia Village and the City of Seldovia.	High	Environmental Department	USGS	2019-2024	B/C: Could another subsidence event occur similar to the 1964 Earthquake? TF: The State has resources to study the potential.
GF 5B	Repair and mitigate Rocky River Road to allow the community to access their	High	SVT CEO	DOT&PF	2019-2024	B/C: This project would restore access to historical and subsistence areas. TF: This project is feasible

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
	subsistence areas at Red Mountain/Picnic Harbor/Windy Bay.					using existing construction standards. Equipment and materials require grant funding.
GF 5C	Mineloop Road in the subdivision at Mile 4 has the potential to be blocked; gabions would be helpful to hold back rocks.	High	Roads Department	HMGP, PDM	2019-2020	B/C: This project would ensure that access to the subdivision remains open. TF: This project is feasible using existing construction standards. Equipment and materials require grant funding.
FL 7A	Develop personal use and educational outreach training for a "safe tree harvesting" program. Implement along utility and road corridors, preventing potential winter storm damage.	High	Emergency Services Manager/Fire Chief	DoF, HEA	2019-2020	B/C: This project is essential as winter storms are becoming more severe (particularly winds). TF: This project could be easily implemented by residents of SVT and HEA.
V 8A	Look at bearing loads of ash on roofs. At what level should homeowners remove ash during a hazard event?	High	Facilities Manager	AVO	2019-2024	B/C: AVO has guidelines readily available. 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. Community members would gain knowledge and insight. No labor or equipment is required.
V 8B	Evaluate potential actions to minimize damage to sensitive equipment in Health Centers.	High	Facilities Manager/ Emergency Preparedness Committee	Staff Time	2019	B/C: Coordinated planning ensures effective damage abatement and ensures proper attention is assigned to reduce future losses. TF: This is feasible to accomplish. EMS Directors would gain knowledge and insight.
V 8C	Purchase a supply of extra oxygen and ashfall masks to keep on hand.	High	Facilities Manager/ Emergency Preparedness Committee	Staff Time	2019	B/C: Coordinated planning ensures effective damage abatement and ensures proper attention is assigned to reduce future losses. TF: This is feasible to accomplish.
T 9A	DGGS needs to rerun their analysis when Lidar data is complete. Restrict development in areas within the tsunami inundation zone.	High	SVT CEO	DGGS	2019	B/C: Coordinated planning ensures that effective tsunami inundation levels are identified. TF: This is feasible to accomplish.
T 9B	Analyze tsunami currents at the Jakolof Bay Dock and Kasitsna Dock.	High	SVT CEO	DGGS	2019	B/C: Coordinated planning ensures that effective tsunami inundation levels are identified. TF: This is feasible to accomplish.

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
T 9C	Educate homeowners whose homes are in the tsunami inundation zones.	High	Environmental Department	Staff Time	2019	B/C: Coordinated planning ensures that effective tsunami inundation levels are identified. TF: This is feasible to accomplish.
F10A	Build two concrete water cisterns to catch/contain natural year-round water flow at two locations on Jakolof Bay Road. One cistern would be at Mile 6 and the other at the Mile 8 waterfall.	High	Emergency Services Manager	RFAG, AFG, FP&S, SAFER	In Progress	B/C: A readily accessible source of water is needed to fight potential fires. TF: Work could be accomplished with conventional labor practices in the community.
F10B	Build one cistern, built-in underground in firehouse building at Mile 4. The water would be piped from a well to the underground containment. This cistern should contain 10,000 gallons of usable water at above freezing temperatures to be used for fire suppression and other emergencies as needed.	High	Emergency Services Manager	SAFER	2019-2024	B/C: A readily accessible source of water is needed to fight potential fires. TF: Work could be accomplished with conventional labor practices in the community.
F10C	Engineer and construct a water flow system, piped from a source up Barabara Creek to a constructed penstock-dry hydrant access downstream at bridge area of Barabara Creek on Jakolof Bay Road at Mile 5.	High	SVT EMS Director	RFAG, AFG, FP&S, SAFER	2019-2024	B/C: A readily accessible source of water is needed to fight potential fires. TF: Work could be accomplished with conventional labor practices in the community.
F10D	Add water filtration system to fire station to create potable water (1,000-gallon storage tank and filtration system).	High	SVT EMS Director	RFAG, AFG, FP&S, SAFER	2019-2024	B/C: A readily accessible drinking water source is needed when the VFD Station becomes an emergency shelter. TF: Work could be accomplished with conventional labor practices in the community.

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

8.1 MONITORING, EVALUATING, AND UPDATING THE HMP

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

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

Monitoring, Evaluating and Updating the Plan

Requirement §201.7(c)(4)(i and ii): [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.

Element

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

Source: FEMA, 2015.

DMA 2000 Requirements: Plan Maintenance Process – Reviewing Progress on Achieving Goals and Projects

Requirement §201.7(c)(4)(v): [The plan maintenance process shall include a] system for reviewing progress on achieving goals as well as activities and projects identified in the mitigation strategy.

Element

- Does the new plan explain how progress will be reviewed?

Source: FEMA, 2015.

This HMP was prepared as a collaborative effort among the Planning Team and LeMay Engineering & Consulting, Inc. To maintain momentum, SVT will use the Planning Team to monitor, evaluate, and update the HMP. Each authority identified in Table 24 will be responsible for implementing the MAP. The SVT President/CEO will serve as the primary point of contact and will coordinate local efforts to monitor, evaluate, and revise the HMP.

Each member of the Planning Team will conduct an annual review during the anniversary week of the plan's official FEMA approval date to monitor the progress in implementing the HMP, particularly the MAP. As shown in Appendix E, the Annual Review Worksheet will provide the basis for possible changes in the HMP MAP by refocusing on new or more threatening hazards, adjusting to changes to or increases in resource allocations, and engaging additional support for the HMP implementation. The SVT President/CEO 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:

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

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

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

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

8.2 IMPLEMENTATION THROUGH EXISTING PLANNING MECHANISMS

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

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

Incorporation into Existing Planning Mechanisms

Requirements §201.7(c)(1)(iv) and §201.7(c)(4)(iii): [The plan shall include a] process by which the Tribal Government integrates the HMP into other ongoing tribal planning efforts as well as other FEMA programs and initiatives as well as master plans or capital improvement plans when appropriate.

Element

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

Source: FEMA, 2015.

After the adoption of the HMP, 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.

- Conduct a review of the community-specific regulatory tools to assess the integration of the mitigation strategy. These regulatory tools are identified in the capability assessment section (see Section 3.4).
- Work with pertinent community departments to increase awareness of the HMP and provide assistance in integrating the mitigation strategy (including the MAP) into relevant planning mechanisms. Implementation of these requirements may require updating or amending specific planning mechanisms.
- The SVT President/CEO will be responsible for providing a copy of this HMP to contractors focused on developing new or updating existing Tribal Plans and ensuring that this HMP is incorporated into plans as applicable.

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

8.3 CONTINUED PUBLIC INVOLVEMENT

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

DMA 2000 Requirements: Plan Maintenance Process - Continued Public Involvement

Continued Public Involvement

Requirement §201.7(c)(4)(iv): [The plan maintenance process shall include a] discussion on how the Tribal Government will continue public participation in the plan maintenance process.

Element

- Does the new plan explain how continued public participation will be obtained?

Source: FEMA, 2015.

SVT is dedicated to involving the public directly in the continual reshaping and updating of the HMP. A paper copy of the HMP and any proposed changes will be available at the Tribal Office.

An address and phone number of the President/CEO to whom people can direct their comments or concerns will also be available at the Tribal Office.

SVT Barabara Heights VFD holds an informational booth at the annual local health fair. They give handouts containing safety and emergency prevention information as well as Fire Wise pamphlets to the public. This is a well-attended event. Community surveys will be provided at the booth to remind the community about the potential hazards that could affect Seldovia Village as well as to provide an opportunity for the community to comment on their concerns. See Appendix E for a public opinion survey. Any public comments received regarding the HMP will be collected by the President/CEO, included in the annual report, and considered during future HMP updates.

SVT Barabara Heights VFD also hold an annual Safety Fair Day where they address emergency/disaster preparedness. Members of VFD distribute burn permit and Fire Wise information throughout Seldovia Village on a door-to-door basis; this is an activity ongoing from the spring to autumn season.

The Planning Team will continue to raise community awareness about the HMP and the hazards that affect Seldovia Village.

Federal Resources

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

- FEMA, through its Emergency Management Institute, offers training in many aspects of emergency management, including hazard mitigation. FEMA has also developed a large number of documents that address implementing hazard mitigation at the local level. Key resource documents are available from the FEMA Publication Warehouse (1-800-480-2520) and are briefly described here:
    - How-to Guides. FEMA has developed a series of how-to guides to assist States, communities, and Tribes in enhancing their hazard mitigation planning capabilities. The first four guides describe the four major phases of hazard mitigation planning. The last five how-to guides address special topics that arise in hazard mitigation planning such as conducting cost-benefit analysis and preparing multi-jurisdictional plans. The use of worksheets, checklists, and tables make these guides a practical source of guidance to address all stages of the hazard mitigation planning process. They also include special tips on meeting DMA 2000 requirements.
    - Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments. FEMA DAP-12, September 1990. This handbook explains the basic concepts of hazard mitigation and shows State, Tribal, and Local governments how they can develop and achieve mitigation goals within the context of FEMA's post-disaster

hazard mitigation planning requirements. The handbook focuses on approaches to mitigation, with an emphasis on multi-objective planning.

- Mitigation Resources for Success compact disc (CD). FEMA 372, September 2001. This CD contains a wealth of information about mitigation and is useful for State, Tribal, and Local government planners and other stakeholders in the mitigation process. It provides mitigation case studies, success stories, information about Federal mitigation programs, suggestions for mitigation measures to homes and businesses, appropriate relevant mitigation publications, and contact information.
- A Guide to Federal Aid in Disasters. FEMA 262, April 1995. When disasters exceed the capabilities of State, Tribal, and Local governments, the President's disaster assistance programs (administered by FEMA) is the primary source of Federal assistance. This handbook discusses the procedures and process for obtaining this assistance, and provides a brief overview of each program.
- The Emergency Management Guide for Business and Industry. FEMA 141, October 1993. This guide provides a step-by-step approach to emergency management planning, response, and recovery. It also details a planning process that businesses can follow to better prepare for a wide range of hazards and emergency events. This effort can enhance a business's ability to recover from financial losses, loss of market share, damages to equipment, and product or business interruptions. This guide could be of great assistance to a community's industries and businesses located in hazard prone areas.
- The FEMA Hazard Mitigation Assistance Guidance and Addendum, February 5, 2015. The guidance introduces the five HMA grant programs, funding opportunities, award information, eligibility, application and submission information, application review process, administering the grant, contracts, additional program guidance, additional project guidance, and contains information and resource appendices (FEMA, 2015).

- Department of Agriculture (USDA). Assistance provided includes: Emergency Conservation Program, Non-Insured Assistance, Emergency Watershed Protection, Rural Housing Service, Rural Utilities Service, and Rural Business and Cooperative Service.
- Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy, Weatherization Assistance Program. This program minimizes the adverse effects of high energy costs on low-income, elderly, and handicapped citizens through client education activities and weatherization services such as an all-around safety check of major energy systems, including heating system modifications and insulation checks.
- Department of Health and Human Services, Administration of Children & Families, Administration for Native Americans (ANA). The ANA awards funds through grants to American Indians, Native Americans, Native Alaskans, Native Hawaiians, and Pacific Islanders. These grants are awarded to individual organizations that successfully apply for discretionary funds. ANA publishes in the Federal Register an announcement of funds available, the primary areas of focus, review criteria, and the method of application.

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

State Resources

- DHS&EM is responsible for improving hazard mitigation technical assistance for Tribal and Local governments for the State of Alaska. Providing hazard mitigation training, current hazard information, and communication facilitation with other agencies will enhance local hazard mitigation efforts. DHS&EM administers FEMA mitigation grants to mitigate future disaster damages such as those that may affect infrastructure including the elevation, relocation, or acquisition of hazard-prone properties. DHS&EM also provides mitigation funding resources for mitigation planning.
- Division of Senior Services (DSS): Provides special outreach services for seniors, including food, shelter, and clothing.

- Division of Insurance (DOI): Provides assistance in obtaining copies of policies and provides information regarding filing claims.
- Department of Military and Veterans Affairs (DMVA): Provides damage appraisals and settlements for VA-insured homes, and assists with filing of survivor benefits.
- The Community Health and Emergency Medical Services (CHEMS) is a section within the Division of Public Health within the Department of Health and Social Services (DHSS). DHSS is charged with promoting and protecting the public health and one of CHEMS' responsibilities is developing, implementing, and maintaining a statewide comprehensive emergency medical services system. The department's statutory mandate (Alaska Statute 18.08.010) requires it to:
  - Coordinate public and private agencies engaged in the planning and delivery of emergency medical services, including trauma care, to plan an emergency medical services system;
  - Assist public and private agencies to deliver emergency medical services, including trauma care, through the award of grants in aid;
  - Conduct, encourage, and approve programs of education and training designed to upgrade the knowledge and skills of health personnel involved in emergency medical services, including trauma care; and
  - Establish and maintain a process under which hospitals and clinics can represent themselves to be trauma centers because they voluntarily meet criteria adopted by the department which are based on an applicable national evaluation system.
- DCRA within the DCCED. DCRA administers the HUD/CDBG, FMA Program, and the Climate Change Sub-Cabinet's Interagency Working Group's program funds and administers various flood and erosion mitigation projects, including the elevation, relocation, or acquisition of flood-prone homes and businesses throughout the State. This department also administers programs for State "distressed" and "targeted" communities.
- Division of Environmental Conservation (DEC). The DEC's primary roles and responsibilities concerning hazards mitigation are ensuring safe food and safe water, and pollution prevention and pollution response. DEC ensures water treatment plants, landfills, and bulk fuel storage tank farms are safely constructed and operated in communities. Agency and facility response plans include hazards identification and pollution prevention and response strategies.
- Department of Transportation and Public Facilities (DOT/PF) personnel provide technical assistance to the various emergency management programs, to include mitigation. This assistance is addressed in the DHS&EM-DOT/PF Memorandum of Agreement and includes, but, is not limited to: environmental reviews, archaeological surveys, and historic preservation reviews.

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

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

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

Other Funding Sources and Resources

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

- FEMA, http://www.fema.gov - includes links to information, resources, and grants that communities can use in planning and implementation of sustainable measures.
- American Planning Association (APA), http://www.planning.org - a non-profit professional association that serves as a resource for planners, elected officials, and citizens concerned with planning and growth initiatives.
- Institute for Business and Home Safety (IBHS), http://ibhs.org - an initiative of the insurance industry to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters.
- American Red Cross (ARC). Provides for the critical needs of individuals such as food, clothing, shelter, and supplemental medical needs. Provides recovery needs such as furniture, home repair, home purchasing, essential tools, and some bill payment may be provided.

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

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Appendix A
Public Outreach

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Hazard Mitigation Planning Meetings

	May 2, 2019 3 pm - Kickoff Meeting	May 7, 2019 1 pm - Tsunamigenic Earthquakes in Southern Alaska	May 13, 2019 10 am - Project Coordination	May 20, 2019 10 am - Project Coordination	May 21, 2019 9 am - Team Meeting: Answer Questions regarding Sections 1-4 and Section 5. Discuss dates for first community meeting.	May 28, 2019 11 am- Weekly Meeting. Fire and EMS as relates to HMP Hazard Profile.	June 3, 2019 10 am- Weekly Meeting. Transportation/Communication/Ashfall/Tsunami as relates to HMP Hazard Profile.	June 17, 2019 10 am Weekly Meeting. Cultural, historic, and heritage as it relates to Hazard Mitigation Planning.	June 24, 2019 1 pm Weekly Meeting. Cultural, historic, and heritage, continued. Land use, and trends in development. Communication. Meeting preparation for July 1 public meeting.	July 1, 2019 5-7 pm Public Meeting #1.	July 22, 2019 11 am Weekly Meeting. Public Meeting Discussion. Mitigation Actions.	August 5, 2019 5-7 pm Public Meeting #2.
Jennife LeMay	X	X	X	X	X	X	X	X	X	X	X	X
Beckie Noble	X		X	X	X	X	X	X	X	X	X	X
Crystal Collier	X	X			X	X	X		X	X	X	X
Caleb Billmeier	X	X			X			X	X	X	X	X
Trinket Gallien	X	X					X		X	X	X	X
Michael Opheim	X	X			X	X			X	X	X	X
Alix Chartier						X	X	X		X	X	X
Rick Harkness	X	X				X				X		X
Connie Pavloff	X				X	X	X	X	X	X		X
Liam Dyer	X				X	X	X	X		X		
Mark Ball	X					X	X	X	X	X		X
Don Kashevaroff							X					
Stephen Payton	X	X			X				X	X		X
Kim Collier							X					

Vanessa Putterbaugh							X									
Jan Yeager	X		X			X			X				X			X
Laurel Hilts			X							X			X			
Heidi Geagel			X													
Cassidi Cameron			X													
Layla Jandt-Pedersen			X													
Randi Sweet			X													
Elena Suleimani			X													
Barrett Salisbury			X													
Bretwood 'Hig' Higman			X										X			X
Andrew			X													
Mary Jo			X													
Debbie			X													
Harold			X													
Kirt			X													
Shannon Custer			X										X			X
Jim			X													
Rob Custer										X						X
Katrina Hecks										X			X			X
Darlene Crawford													X			X
John Crawford													X			X
Dominic Hondolero													X			
Doug Latimer													X			
Karen Latimer													X			
Agnes													X			
Jere Murray													X	X		
Sandy Murray													X	X		
Nancy Opheim													X			
Sherri Burt													X			X
Thor M Burt													X			
Zach Kashevaroff													X			
Norm Opheim													X			
Kris Holderied													X			
Honeybee Nordenson																X
Christine Kashevaroff																X
Lou Collier																X
Frank Kashevaroff																X
Ecola Collier																X

Tribal Hazard Mitigation Plan for Seldovia Village

Newsletter #1: May 29, 2019

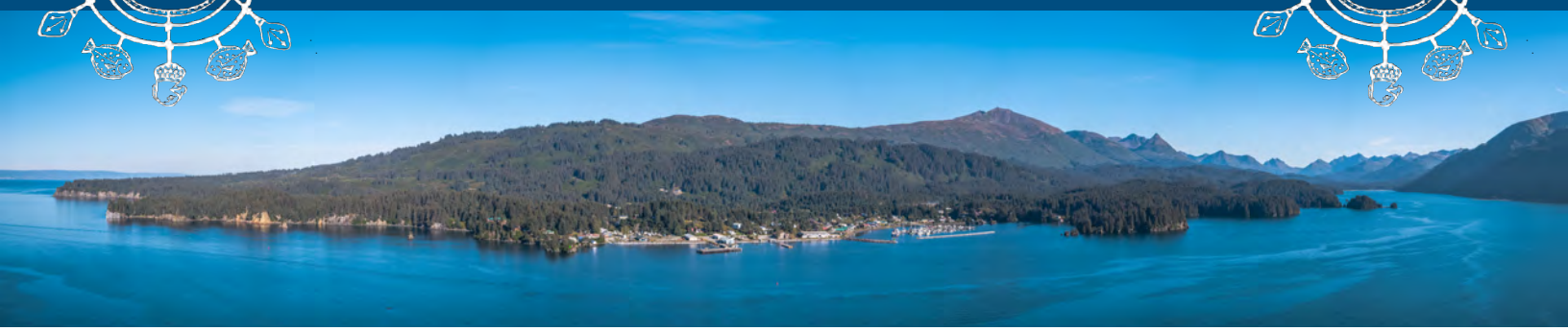
Photo Credit: Department of Commerce, Community and Economic Development; Division of Community and Regional Affairs' Community Photo Library.

Seldovia Village Tribe (SVT) was awarded a grant from FEMA to develop a Tribal Hazard Mitigation Plan (HMP) for Seldovia Village. This HMP will assist the SVT as a valuable resource tool in making decisions and will allow the SVT to apply for FEMA grants to implement mitigation actions. LeMay Engineering & Consulting, Inc. and Seldovia native Bretwood "Hig" Higman, PhD were contracted to assist with development of the HMP. The HMP will identify applicable natural hazards to the Seldovia Village planning area. The HMP will also identify the people/facilities potentially at risk and ways to mitigate damage from future hazard impacts.

Attend the July 1, 2019, Community Introductory Meeting from 5-7 pm at the Seldovia Conference Center in the Alaska Tribal Cache Building: The agenda will be a summary of the hazard mitigation planning process, presentation of applicable hazards, and identification of critical infrastructure that has the potential to be impacted by a natural hazard. You're invited to provide input to the planning process. Refreshments will be served.

For more information, contact:
Crystal Collier, President (907) 435-3265
Jennifer LeMay, PE, PMP, Lead Planner, (907) 350-6061
Hig Higman, PhD, (907) 290-6992

Tribal Hazard Mitigation Plan for the Seldovia Village area



YOUR INPUT MATTERS!

Seldovia Village Tribe (SVT) was awarded a grant from FEMA to develop a Tribal Hazard Mitigation Plan (HMP) for the Seldovia Village area. This HMP will assist the SVT as a valuable resource tool in making decisions and will allow SVT to apply for FEMA grants to implement mitigation actions for this coverage area.

All interested individuals are invited to attend the Community Introductory Meeting, Monday, July 1st, from 5-7 p.m. at the Seldovia Conference Center in the Alaska Tribal Cache Building.

Following a Mexican dinner, a summary of the hazard mitigation planning process, presentation of applicable hazards, and identification of critical infrastructure that has the potential to be impacted by a natural hazard. **You're invited to provide input to the planning process.**

DINNER - Presentation - Discussion

Please RSVP to Tina Yuth by this Thursday, 6/27 @ 907-234-7898

For more information on the project, contact:
Crystal Collier, President (907) 435-3265
Jennifer LeMay, PE, PMP, Lead Planner, (907) 350-6061
Bret Higman, PhD, (907) 290-6992

SVT Public Meeting for 2019 Hazard Mitigation Plan Update

July 1, 2019

5-7 pm at the SVT Conference Center

Name	Organization Represented or Resident	Contact Information (phone and email)
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Caleb Billmeier	SVT	Cbillmeier@svt.org
Trinket Gallien	SVT	tgallien@svt.org
Crystal Collier	SVT	ccollier@svt.org
Darlene & John Crawford	Same @ mile 3	Crawford.darlene@gmail.com
Dominic Hondolero	NOAA Kowtsa Lab	Dominic.Hondolero@noaa.gov.
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m opham	SVT	435-3247
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Put email address if you'd like a copy of the Plan emailed to you.

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Sandy Murray	"	"
Laurel Hilts	SVT	
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Beckie Noble	SVT via phone	
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July 2, 2019

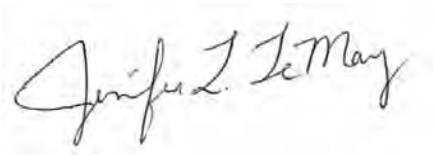
File

Subject: Hazard Mitigation Planning Process Trip Report

On July 1, 2019, I traveled to Seldovia, Alaska. The purpose of this trip was to conduct an introductory public meeting, gather hazard data, review with community leaders the applicable hazards for the area, review potential mitigation strategies, and identify the critical facilities within the community.

Caleb Billmeier gave me a tour of the City of Seldovia and Seldovia Village at 9 am. Afterward, I met with Michael Opheim, Environmental Director, for 90 minutes to ask questions regarding his ongoing projects. After lunch, I toured the Visitor Center and Museum.

The introductory meeting and dinner at 5 pm were well-attended by the community. Twenty-six people attended in person, and three people attended via phone. I gave a Powerpoint© presentation which is included in Appendix A. The audience contributed in a lively discussion regarding the hazards and presentation. I asked the audience to include their email addresses on the sign-in sheet if they would like to receive an email next week of the Draft Hazard Mitigation Plan to provide public comment on. August 5 was announced as the next public meeting date to collect public comments. Dinner will also be served.



7/2/19
Jennifer L. LeMay, PE, PMP/Date
LeMay Engineering & Consulting, Inc.

Hazard Mitigation Planning Process

Tribal Hazard Mitigation Plan for Seldovia Village Tribe

Public Meeting #1

What is Hazard Mitigation?

Hazard mitigation projects eliminate the risk or reduce potential 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 encouraging building codes to prevent damages.

Why is a Hazard Mitigation Plan needed?

Communities must have a FEMA-approved, and community-adopted HMP to receive a project grant from FEMA's pre- and post-disaster grants identified in their Hazard Mitigation Assistance and other agencies' mitigation grant programs. The HMP will make the Seldovia Village Tribe eligible to apply for mitigation funds after the HMP is approved by FEMA and adopted by the Tribal Council. A FEMA-approved and community-adopted HMP enables Tribal governments to apply for the Hazard Mitigation Grant Program (HMGP), a disaster-related assistance program and the Pre-Disaster Mitigation (PDM) grant programs.

Tonight's meeting is a forum to present a summary of the hazard mitigation planning process and identify potential mitigation actions for SVT. The Planning Team has been working to develop a Tribal Hazard Mitigation Plan. Public comments that are received tonight will be incorporated into the Draft Hazard Mitigation Plan. No names will be used, and information will be referenced as anecdotal. The Planning Team welcomes your input. Comments can be provided during this meeting or by email or phone. Send Jennifer LeMay, PE, PMP an email at jlemay@lemayengineering.com or call her at (907) 350-6061.

The Draft Hazard Mitigation Plan will be available for public review later this week. SVT will post the Plan on its Facebook page and Website. They will also have a paper copy in their office available for review. Another public meeting will be held in August. Comments can also be received at the August meeting.

For hazards, we're interested in information related to:

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

Which hazards are applicable to Seldovia Village?

- Floods/Erosion
- Wildland/Conflagration Fires
- Tsunami/Seiche
- Earthquakes/Subsidence
- Volcanic Eruption/Ashfall
- Ground Failure/Landslide
- Severe Weather
- Changes to the Cryosphere

Plan Process

- Introductory meeting occurred via phone on May 2, 2019.
- Gathering of data occurred during May and June.
- Draft Plan available for public comment (July 10, 2019).
- Public hearing for Draft Plan (August 5, 2019).
- FEMA review and pre-approval of Draft Plan.
- Newsletter announcing Final Plan (the public may still comment).
- Seldovia Tribal Council adoption.
- Final Approval from FEMA.

After the 2019 Hazard Mitigation Plan is completed, approved, and adopted, SVT will be eligible to apply for mitigation project funds from DHS&EM and FEMA for five years until the plan requires an update in 2024.

Changes in the Cryosphere

There is no written record defining changes in the cryosphere for Seldovia Village. Visual evidence from the 2017 City of Seldovia HMP included:

- Seldovia has noticed an impact to its fishing industry from climate change.
- Shorelines are changing.
- Winters are warmer.
- Hummingbirds are more acclimated to staying north—sightings in November 2017.

In 2019, the Seldovia community observed:

- Salmon do not arrive in April anymore; their arrival is in May/June.
- Seldovia was happy to have a few 60 °F days in summer; typically, temperatures were in the 50's. Recent summers have had temperatures in the 70's and 80's.
- There is less water in wells, creeks, rivers, and waterbodies.
- At Fish Creek near the Rocky Ridge Landfill, more tolerant macroinvertebrates are appearing. SVT believes the landfill is leaching into the environment.
- Algal blooms are more problematic with warming water temperatures in Seldovia.
- The rate of growth for alders has increased. Alders grown taller and faster than cottonwoods.
- Willow is more abundant and grows faster.
- Lupine used to generally grow adjacent to roadways. More invasive weeds have crowded out the lupine. Pushki has replaced the lupine along Jakolof Road.
- Seldovia did not have ticks in the past. Now, there are ticks.

Changes in the Cryosphere, continued.

- Spruce pollen comes off the trees in sheets in 2019.
- There is more spruce pollen in Kachemak Bay. One resident commented that she has lived in Seldovia for 57 years and has never seen so much spruce pollen. She also noted that cottonwood is everywhere.
- One resident stated that he has not needed to plow his driveway the last three winters. Snow has shifted to rain instead.
- Seldovia had a 56 °F day in February 2019.

Earthquakes

Alaska earthquake statistics include:
Alaska is home to the second-largest earthquake ever recorded (1964 Great Alaska Earthquake, M 9.2);
Alaska has 11% of the world's recorded earthquakes;
Three of the eight largest earthquakes in the world were in Alaska; and
Seven of the ten largest earthquakes in the U.S. were in Alaska.

Seldovia was forever changed by the 1964 Great Alaska Earthquake. The immediate damage from the tsunami devastated the small boat harbor, but the most lasting damage was related to co-seismic subsidence, which resulted in much of the community, which had been built on boardwalks, being inundated by high tides.

The 2016 Risk Map Study presented Hazus Earthquake Results for Magnitudes 7.1 and 9.2 earthquakes in the Kenai Peninsula Borough. The City of Seldovia had 335 improved parcels, valued at $89,984,700. After a M 7.1 earthquake, the total loss ratio was 0.34% ($310,314 in total damage). After a M 9.2 earthquake, the total loss ratio was 5.15% ($4,632,983 in total damage). Additionally, the study determined that only about 40% of the buildings in the City of Seldovia were built according to modern building codes. It is important to note that only the waterfront was rebuilt after the 1964 Earthquake. The 2016 Risk Map Study did not include impacts to Seldovia Village.

Floods/Erosion

Riverine flooding has not historically had much impact in areas that are heavily used. It's possible extreme flooding could damage or remove the bridge across Barabara Creek, severing connectivity to the City. This area might have some additional vulnerability beyond extreme rain events driving floods because it can form slush floods when heavy rain falls or when the river is iced over with snow on the ice. Such floods have happened historically in the Seldovia area (on the Seldovia River in ~2002, and on Barabara Creek a few years after that.) These floods can bring water levels dramatically higher than usual, but they are slow moving and typically not destructive. The concern here would be if they mobilized logs along the river, and the logs destroyed the bridge and severed the road.

Barabara Creek Bridge also is downstream of a steep gorge that could produce a landslide that has the potential to dam the river, and the breach of the landslide dam could create a violent flood. Additionally, nuisance flooding from unexpected extreme high tides can occur in Seldovia. The most extreme event was in 2002 when a tide forecast as 23 feet came in as 25.5 feet. An extreme high tide combined, resulting in flooding.

Floods/Erosion, continued.

Red Mountain/Rocky River is a traditional community subsistence gathering place. Jakolof Bay Road leads to Kachemak Bay State Park and is the only road to Red Mountain. The road has washed out, culverts are not maintained, and people carry their bikes and walk around the road to obtain access to Red Mountain. Four-wheelers can still access Red Mountain at the current time.

Flooding could isolate Seldovia Village from the City of Seldovia if the road connecting the two was affected, rendering the residents of both communities to be self-reliant. Flooding on Jakolof Road depends on how much rain there is; flash flooding occurs, and the depth of ponding can range from 0 to 2 feet very quickly. Flooding also affects subsistence fishing. Flooding can prevent fish from spawning at Jakolof Creek.

The bluffs from Barabara Point to Seldovia Point are eroding. They've been eaten up a lot in the past few years. Erosion related to slumping is a concern. This can happen as a result of adding water to already saturated areas, particularly those with soils with a high clay content. This can result in slumping and erosion of bluff areas.

Ground Failure

The primary ground failure hazard in the Seldovia area is landslides.

The area along Wadsworth Creek has areas of active ground deformation, and evidence of previous landslides. These past failures extend very near to where homes are built, but no one has directly built one there. The place where the road crosses Wadsworth could be cut by a slide.

The Seldovia Village includes a section of coast between Barabara Creek and Wodsworth Creek where there's ongoing erosion of soft bluffs, and houses on top of the bluff. This is clearly an area of concern. The area along the coast between Wadsworth and Barabara Creeks is also prone to landslides, and especially if erosion increases, potential failures that could affect one or several homes and potentially bits of road. Also, McDonald's Spit has a history of shifting beaches, causing issues for homeowners there. Both these areas will likely become more of an issue when sea level rise outpaces uplift (decades in the future) and as storm waves become more intense (likely already happening.)

Ground Failure, continued.

New lidar elevation data was collected by Chugachmiut covering the lands owned by Port Graham and Nanwalek Native Corporations. This data shows some signs of ground failure at the head of Seldovia Bay near the Sounding Board on the ridge across from the inner part of Seldovia Bay. This data also shows evidence that there were small glaciers in the area during the Little Ice Age (~200 years ago). The fact that there used to be glaciers suggests that alpine permafrost is a possibility. Melting alpine permafrost, or extreme rain events, could lead to a failure at the head of Seldovia Bay. If there was a failure, it would likely destroy some homes along the bay, and might produce a locally-damaging tsunami (though the water is quite shallow, so it would be limited). This would not affect Seldovia Village locally.

Down in saltwater adjacent to beaches around Seldovia, peat deposits formed in freshwater marshes are eroding out in what is now the intertidal. In one area where specific measurements have been gathered, radiocarbon dating shows that freshwater peats growing about 1,500 years ago are now 4.5 meters below MHHW. This age is reasonably well-aligned with a previous subduction zone earthquake (the most recent earthquakes occurred about 1,500, 800, and 50 years ago). There is no similar evidence of subsidence in the earthquake that followed, about 800 years ago, and though there was over a meter of subsidence in 1964, about half of that has already been reversed. Thus, this may be evidence that Seldovia has in the past, and might in the future, experience subsidence much greater than 1964.

Ground Failure, continued.

The 1964 Great Alaska Earthquake also caused extensive subsidence. The subsidence zone covered about 110,000 square miles, including the north and west parts of Prince William Sound, the west part of the Chugach Mountains, most of Kenai Peninsula, and almost all the Kodiak Island group. In some areas, subsidence exceeded seven feet. Part of the Seward area is about 3.5 feet lower than before the earthquake, and portions of Whittier subsided more than five feet. The Village of Portage, at the head of Turnagain Arm of Cook Inlet, subsided six feet, partly due to tectonic subsidence and partly due to sediment compaction during the earthquake.

A similar subsidence event would, especially in combination with an earthquake and tsunami, be one of the most disruptive disasters for Seldovia.

Ground Failure, continued.

There are two sections of the Jakolof Bay Road between McDonald's Spit and Jakolof that could be destroyed by a landslide. Landsliding during an earthquake could be particularly problematic since many of these areas could go all at once. Prolonged heavy rain could also lead to a similar event.

Also, the community is concerned with potential breaks developing in the road connecting the Village to the City, losing the bridge at Barabara Creek, or the bridge over the slough in a future ground failure hazard event. In 2001/2002, the State of Alaska installed cones where culverts were placed. Rocks occasionally fell on the school bus as it collected children and transported them to school. The children are no longer collected by a school bus.

In Homer, the Clinic is located near a spring or runoff area and is surrounded by wet soils with ditching. Debris flow in Homer in the vicinity of Skyline Drive could be caused by ground failure/land slides. The City of Homer adopted local ordinances to define ‘Steep Slope’ and require engineering approval for any development of steep slopes without Homer (HCC 21.44.050).

Tsunami and Seiche

Though volcano-generated tsunamis are rarer than earthquake-generated tsunamis, they are a threat to the Aleutian Chain and parts of Cook Inlet. Augustine Volcano has a history of producing large landslides during eruptions, most recently in 1883, when waves damaged Nanwalek (then English Bay).

In Alaska, landslide-generated tsunamis on deltas formed by glacial rivers are responsible for most of the tsunami hazard. Most of the destruction and death from tsunamis like this occurred in the minutes following the 1964 earthquake, when deltas in Valdez, Whittier, and Seward failed and produced locally-destructive tsunamis.

Landslides that come from mountains can also produce destructive tsunamis. Perhaps the most famous such tsunami happened in Lituya Bay in 1958, when an earthquake broke loose a large mass of rock on a mountainside above the bay. The wave washed over 1,700 feet up over a nearby mountain, and destroyed several boats sheltering in the bay. A similar landslide and tsunami happened in 1967 in Grewingk Lake, near the SVT planning area. The most recent example of a tsunami like this in Alaska occurred on Taan Fiord, Icy Bay, in 2015, which reached over 630 feet up a mountainside. Fortunately, nowhere within SVT's planning area has the combination of steep slopes and deep (>150 feet) water required to produce this sort of tsunami.

Tsunami and Seiche, continued.

Waterfront buildings were rebuilt in Seldovia at the elevation of the harbor after the 1964 Great Alaska Earthquake. If a tsunami should occur, the City will be impacted as well as the two SVT buildings located within City limits.

Approximately 75 to 100 of SVT's summer population reside at McDonald Spit. McDonald Spit could likely be underwater should a tsunami occur without adequate warning. The winter population is approximately five people.

The City is posting tsunami evacuation route signs in 2019. Evacuation maps are available in the Harbormaster's Office. Evacuation routes will be published in phone books. The Alaska Geophysical Institute Sea Grant has a 30-minute video on tsunamis called *Ocean Fury in Alaska*. Survivors of the 1964 Great Alaska Earthquake and tsunami are interviewed, and the Institute shows what to do if another hazard event of that magnitude occurs again. The Seldovia Library has plans to show this video once a week for educational purposes and to schools.

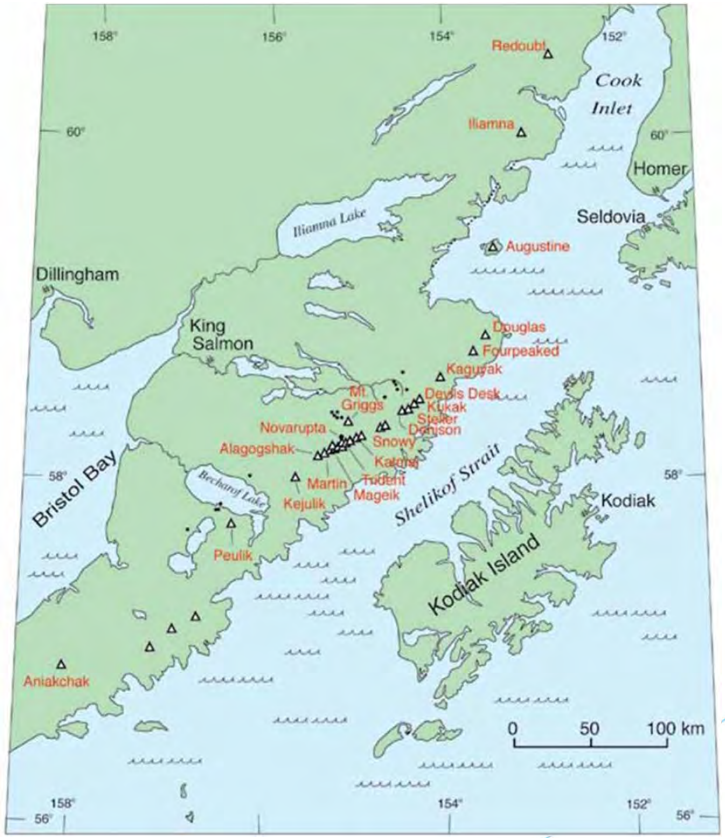
Volcanic Ashfall

Seldovia has been impacted by volcanic ashfall events, the only local volcanic hazard other than tsunamis. These ashfall events followed eruptions of Mt. Augustine and Redoubt volcanoes. Larger eruptions occurred in the geologic past, leaving dramatic layers of ash in the soil around Seldovia. The ash fall from the 1912 eruption was significantly greater (100s of times more ash produced by the eruption with Kodiak receiving 100 times as much ashfall than Seldovia) than the 2005 and 2009 eruptions of Redoubt, Spurr, and Augustine Volcanoes. Fourteen earthquakes of M 6 to 7 were associated with this event. Prehistorically in Seldovia, there has been about one giant ashfall every 1,000 years. Most ash comes from Augustine Volcano, but one is from an unknown source somewhere in the Katmai region. None were as large as 1912 was in Kodiak, but this isn't out of the realm of possibility.

A major factor in determining ashfall is wind direction. Kodiak was located directly downwind of the main eruption of Mt. Novarupta, which is why it was so deeply buried. The same could happen in Seldovia if there was a large eruption at Mt. Augustine during a strong westerly. Additionally, if there is a large ashfall, wind could blow and redistribute ashfall several times which would be a prolonged hazard.

Volcanic Ashfall, continued.

A few years ago, AVO worked with Ground Truth Trekking and the City of Seldovia to document the largest ashfalls that have impacted Seldovia over the past 7,000 years. They identified about one event per 1,000 years (all larger than historic events in this area, though none leaving as thick a deposit as fell on Kodiak in 1912.) All but one of the events evaluated came from Augustine. None came from Redoubt. One came from an as-yet unidentified volcano that is probably somewhere in the Douglas/Katmai region.



Severe Weather

In Seldovia Village, there is potential for weather disasters. Wind-driven waves from intense storms produce coastal flooding and erosion. High winds, common on the Kenai Peninsula, can topple trees, damage roofs and windows, and result in power outages. Heavy snow can cause power outages or collapse roofs of buildings. Storms can cut off air and/or boat travel across Kachemak Bay, isolating Seldovia for the duration of the storm. In early November of 2012, a series of snow events lead to widespread tree damage between 500 and 1,000 feet, breaking power lines and blocking access to the Seldovia water supply dam. If such conditions occurred at lower elevations, they could have much greater human impact. Extreme weather is most prevalent during the winter with any combination of cold temperatures, strong winds, storm surge, and heavy snow.

Winters in Seldovia from 2014-2018 have been milder. One resident commented that he has not needed to plow his driveway the last three winters.

Westerly winds can sometimes produce poorly-forecast extreme snow events when they are combined with a northerly in the upper inlet and lake effect that creates a narrow band of intense snowfall that's steered into Seldovia by the westerly.

Severe Weather, continued.

Interruptions to electricity, communications, and fuel supply during or after severe weather events are one of the most important aspects of a weather emergency in Seldovia Village. Residents stated during the July 1, 2019, public meeting that they used to be able to rely on City power. Frequent power outages are now common. In Seldovia Village, there is no alternate power option other than what individual households have chosen. Now, backup generation is necessary, particularly in the southeast portion of Seldovia Village. Additionally, power outages have repeatedly caused losses of vaccinations in all three SVT clinics. The clinic in Homer has a backup generator that has proven itself not to be entirely reliable. Seldovia and Anchor Point do not have backup generators in their clinics.

Residents commented how severe weather has consisted of large rain storms lasting several weeks and hurricane-force winds that knock down old stands of trees and buildings and blow off roofs. Local knowledge indicates that Seldovia Village is receiving stronger windstorms than in the past. Storms that flatten many trees are one of the most likely widespread disasters now. A 2019 windstorm knocked down many trees and somewhere impacted around 10 structures and did damage, though nothing all that severe. In 2012, Seldovia Village had one event where heavy snow led to a great many trees falling, leading to temporarily impassable roads and other minor effects.

Tundra-Wildland/Conflagration Fire

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

In 2004, SVT planted a mixed forest of native and non-native species as a fire prevention measure that was funded by the Division of Forestry. Species planted included lodgepole pine, Siberian larch, white spruce seedling, and willows at the Mile 2 area of Jakolof Road. This mixed forest greatly exceeded natural spruce growth. Siberian Larch are deciduous trees that don't shed their needles like spruce and are more resilient to fire than spruce. The mixed forest of alders, devils club, berry bushes, and Siberian larch offer protection from fire. Additional plantings have occurred since.

Contractors for SNA clear cut at Mile 2 of Jakolof Road. Additional clear cuts out of Jakolof should be done.

Spruce Bark Beetle likely won't take over Seldovia Village like the rest of the Kenai Peninsula Borough due to the prevailing wind (from the southeast) and cooler temperatures, but the potential is there.

Planting the mixed forest, making clear cuts, and installing fire breaks have made fire not the hazard it used to be. These fire prevention measures should be continued.

Vulnerability of the SVT

Population

- 2010 U.S. Census was 165.
- 2017 DCCED was 180.

Houses and Critical Infrastructure

- 206 single-family residential structures ($25,050,000).
- Critical facilities and infrastructure have been identified.

Tribal Hazard Mitigation Plan for Seldovia Village

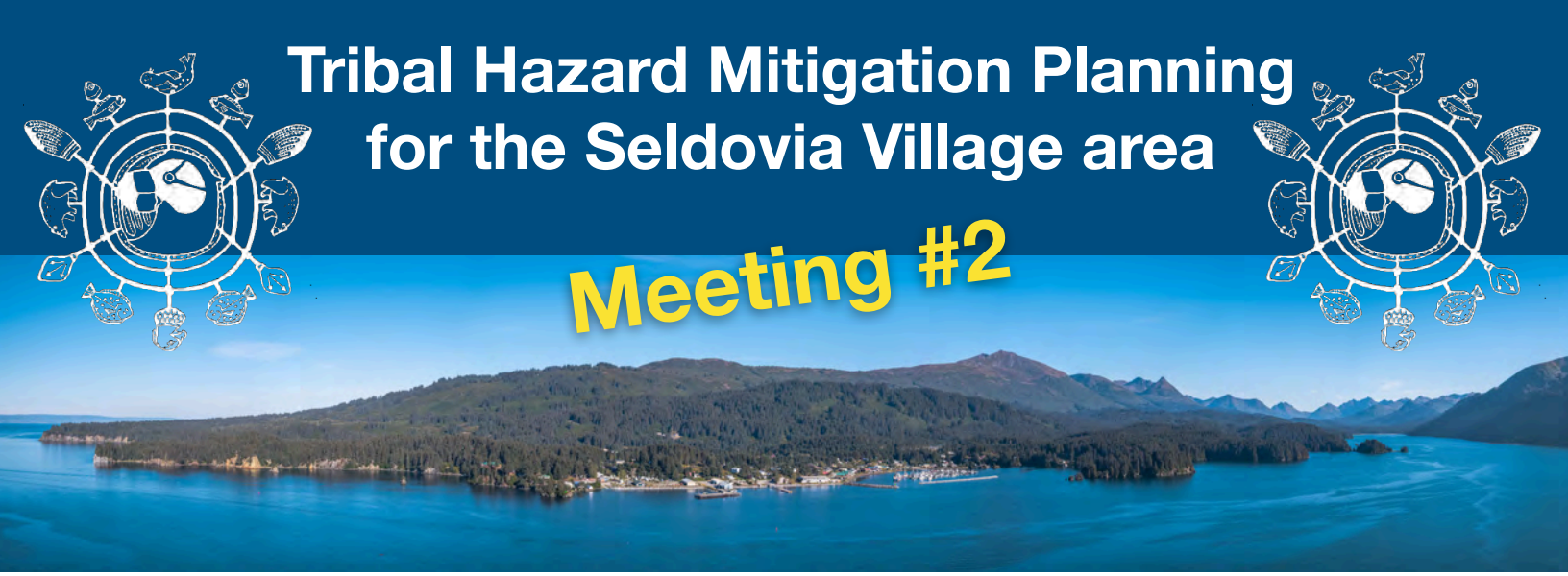
Newsletter #2: July 23, 2019

Photo Credit: Department of Commerce, Community and Economic Development; Division of Community and Regional Affairs' Community Photo Library.

Seldovia Village Tribe (SVT) is developing a Tribal Hazard Mitigation Plan (HMP). On July 1, SVT held a community meeting to discuss natural hazards that could affect Seldovia Village. These hazards included: earthquakes, severe weather, ground failure, floods/erosion, changes in the cryosphere, tsunamis, volcanic ash, and fire. A risk assessment was conducted, and potential mitigation actions were developed. The Draft HMP was posted to SVT's website on July 10 and has been available for public comment. After the August 5 community meeting, the public comment period will close, and the Draft Tribal HMP will be submitted to the Federal Emergency Management Agency (FEMA) for evaluation. Upon FEMA approval of the Draft Tribal HMP, the Tribal Council will adopt the HMP. Then, SVT will be eligible to apply for FEMA and State grants for a five-year period.

Attend the August 5, 2019, Community Meeting from 5-7 pm at the Seldovia Conference Center in the Alaska Tribal Cache Building: The agenda will be a summary of the potential mitigation actions to be implemented to minimize and/or eliminate the impact of natural hazards that are relevant to Seldovia Village. You're invited to provide input to the planning process. Refreshments will be served.

For more information, contact:
Crystal Collier, President (907) 435-3265
Jennifer LeMay, PE, PMP, Lead Planner, (907) 350-6061
Hig Higman, PhD, (907) 290-6992



YOUR INPUT MATTERS!

Seldovia Village Tribe is developing a Tribal Hazard Mitigation Plan (HMP) for the area of the Seldovia Village. On July 1, SVT held a community meeting to identify potential natural hazards to the area. These hazards included: earthquakes, severe weather, ground failure, floods/erosion, changes in the cryosphere, tsunamis, volcanic ash, and fire. A risk assessment was conducted, and potential mitigation actions were developed.

Visit svt.org/environmental-services to find the link to the draft hazard mitigation plan.

All interested individuals are invited to attend the next
Community Dinner and Meeting, Monday, August 5th, from 5-7 p.m.
at the Seldovia Conference Center in the Alaska Tribal Cache Building.

Following dinner, the agenda will include a summary of the potential mitigation actions to be implemented to minimize and/or eliminate the impact of natural hazards that are relevant to Seldovia Village, a **final opportunity for public comment**. A roasted chicken and vegetables dinner will be served.

DINNER - PRESENTATION - DISCUSSION

Please RSVP to Tina Yuth by Thursday, August 1st
@ 907-234-7898, ext. 221.

For more information on the project, contact:
Crystal Collier, President (907) 435-3265
Jennifer LeMay, PE, PMP, Lead Planner, (907) 350-6061
Bret Higman, PhD, (907) 290-6992

SVT Public Meeting for 2019 Hazard Mitigation Plan

August 5, 2019

5-7 pm at the SVT Conference Center

Name	Organization Represented or Resident	Contact Information (phone and email)
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B Nobles (Beckie)	SVT	beckie N@ SVT. org
Alix Chartier	resident SVT	
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Lee Collier	Res.	PO Box 108
Caleb Billmeier	SVT	
San Yaeger	SVT	
Connie Pavaloff	SVT	cpavaloff@svt.org
Darlene Crawford	resident	crawford.darlene@gmail
Sherri Burt	public	sherriburt@yahoo.com
Frank Kashevaroff	Public	

Name	Organization	Contact Information (phone and email)
Michael Opheim		
Stephen Payton		
Bret Higman	Public	
Beckie Noble		
Connie Paulof		
Trinket Gallien		
Laurel Hilts		
Crystal Collier		
Shannon Custer		
Rob Custer		
Ecola Collier	Public	
Connie Rueck	SVT	
Jennifer LeMay	LeMay Engineering + Consulting, Inc.	350-6061
Mark Ball	SVT via phone	

Jennifer L. LeMay, PE, PMP
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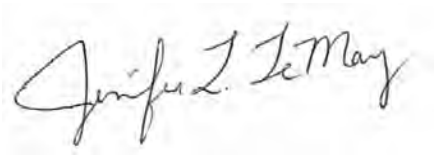
August 6, 2019

File

Subject: Hazard Mitigation Trip Report

On August 5, 2019, I traveled to Seldovia, Alaska. The purpose of this trip was to conduct a public meeting to discuss potential mitigation strategies. Table 23 from the Draft Hazard Mitigation Plan was provided to each person. Six of the Project Team members led groups of meeting participants according to hazard in discussion of each mitigation action. Comments were compiled and discussed with the entire audience. Mitigation priorities were discussed, and all mitigation actions were given a priority of high as all people in the room valued at least one of the mitigation actions as high priority.

The meeting and dinner at 5 pm were well-attended by the community. Twenty-six people attended in person, and one person attended via phone. I asked the audience to include their email addresses on the sign-in sheet if they would like to receive an email of the Draft Hazard Mitigation Plan that was being submitted to FEMA.



8/6/19
Jennifer L. LeMay, PE, PMP/Date
LeMay Engineering & Consulting, Inc.

Table 23. SVT Mitigation Action Plan
(See acronym and abbreviations list for complete titles)

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
MH 1A	Construct second access road to the airport.	Medium	SVT	State of Alaska	2019-2024	B/C: Currently, there is only one road to the airport. Seldovia is an isolated community with access by air or boat. If the airport cannot be accessed, then boat is the only potential means for evacuation purposes. TF: This activity would be expensive. Work could be accomplished with conventional labor practices in the community. Negotiating with property owners would be time-extensive.
MH 2A	Encourage emergency preparedness for all-natural hazards.	High	SVT	SVT	2019-2024	B/C: Sustained mitigation outreach programs have minimal cost and will help build and support area-wide capacity. This type of activity enables the public to prepare for, respond to, and recover from disasters. 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 2B	Conduct a study that evaluates geothermal options for heating and wind/solar/or tidal options for another source of power because current power source is unreliable. Implement study recommendations so that Seldovia Village has a source of dependable power.	High	SVT	HMGP, PDM	2019-2024	B/C: Loss of life potential increases if there is no power source in the winter. TF: Another source of power should be evaluated. Backup generators that are dependable could also be used.
MH 2C	Develop a list of public facilities that need backup generators and apply for funding to install generators. This includes all three clinics and the backup fire building at Jakolof Bay.	High	SVT	HMGP, PDM	2019-2024	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. Grant funds should be applied for. Community members could install.
MH 2D	Educate residents on the advantages of having backup generators,	High	SVT	SVT, HMGP	2019-2024	B/C: Coordinated planning ensures effective damage abatement and ensures proper attention is

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
	emergency kits, and individual response plans.					assigned to reduce losses and damage to structures and residents. TF: This is feasible to accomplish as no cost is associated with the action and only relies on member availability and willingness to serve their community and individual needs.
MH 2E	Obtain and store a Command Center on Wheels.	High	SVT	SVT	2019	B/C: This project would ensure communication could occur should a natural hazard occur. Communication is spotty at best now. F: This project is feasible using existing staff skills. Equipment and materials require grant funding.
MH 2F	Need LIDAR data to use to define hazard areas for earthquake, severe weather, and ground failure.	High	SVT	DGGS	2019-2024	B/C: LIDAR data is being collected in 2019. Determine which agencies are collecting what types of data. TF: Borough staff have the technical capability to manage and conduct this project.
MH 2G	Evaluate a landing dock in Jakolof Bay to evacuate village residents in winter months.	High	SVT	HMGP Seed Grant Money	2019	B/C: Coordinated planning ensures proper attention is assigned to eliminate or reduce loss of life. TF: This is feasible to accomplish.
MH 2H	Install fire suppression response system at the Barabara Heights Fire Station.	High	SVT	SAFER	2019	B/C: Fire personnel have defined this action as a critical need to save loss of life and property. TF: Fire personnel know what is needed and need funding to accomplish.
MH 3	At Fish Creek, obtain funding to determine if the landfill is leaching into the surrounding ground. A previous IGAP grant allowed SVT to collect baseline macroinvertebrate data. Funding has not been available to collect data to evaluate against the baseline.	High	SVT	BIA	2019-2024	B/C: It is reasonable to continue to monitor baseline conditions. Staff are available to conduct monitoring in Seldovia, and baseline data exists. TF: This project is technically feasible.
EQ 3A	Install seismic shutoffs for all facilities with natural gas.	High	SVT	SVT	2019	B/C: This is an easily-implemented mitigation action. TF: This action could be accomplished by existing workers and resources.
EQ 3B	Secure fuel tanks in case of earthquakes or ground failure. Need someone with seismic expertise to make a punch list identifying what	High	SVT	SVT	2019	B/C: Borough resources could supply technical expertise. TF: Residents would be responsible for their own punch lists.

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
	individual homeowners need to address.					
SW 4A	Create defensible space around houses so that downed trees do not fall on houses.	High	SVT	DOF, FireWise	2019	B/C: Borough resources could supply technical expertise. TF: Residents would be responsible for implementing their own punch lists.
SW 4B	Install generators in Tribal Cache and SVT Administrative Office Buildings.	High	SVT	HMGP, PDM	2019	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. Grant funds should be applied for. Community members could install.
SW 4C	Increase power line wire size and incorporate quick disconnects (break away devices) to reduce ice load and wind storm power line failure during severe wind or winter ice storm events.	High	HEA	SVT	2019	B/C: HEA resources could supply technical expertise. TF: HEA has technical capacity.
GF 5A	Need map of potential landslide areas.	Combine with MH-2F.				B/C: Identifying threatened infrastructure proximity to natural hazards is vital to their sustainability. TF: The project is technically feasible with DGGS assistance.
GF 5B	Apply for USGS funding to survey the subsidence potential of Seldovia Village and the City of Seldovia.	High	SVT	HMGP, PDM	2019-2024	B/C: Could another subsidence event occur similar to the 1964 Earthquake? TF: The State has resources to study the potential.
GF 5C	Secure fuel tanks in case of earthquakes or ground failure. Need someone with structural expertise to develop punch lists for homeowners to address.threatened homes. Also, build back road to clinic.	Combine with EQ-3B.				B/C: Borough resources could supply technical expertise. TF: Residents would be responsible for their own punch lists.
GF 5D	Repair and mitigate Rocky River Road to allow the community to access their subsistence areas at Red Mountain/Picnic Harbor/Windy Bay.	Medium	SVT	DOT&PF	2019-2024	B/C: This project would restore access to historical and subsistence areas. TF: This project is feasible using existing construction standards. Equipment and materials require grant funding.
GF 5E	Mineloop Road in the subdivision at Mile 4 has the potential to be blocked;	High	SVT	HMGP, PDM	2019-2020	B/C: This project would ensure that access to the subdivision remains open.

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
	gabions would be helpful to hold back rocks.					TF: This project is feasible using existing construction standards. Equipment and materials require grant funding.
FL 7A	Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	High	SVT	SVT, HEA	2019-2020	B/C: This project is essential as winter storms are becoming more severe (particularly winds). TF: This project could be easily implemented by SVT.
FL 7B	Develop critical facility list needing emergency back-up power systems, prioritize, seek funding, and implement mitigation actions.	Combine with MH-2C.				
FL 7C	Develop and implement tree clearing mitigation programs to keep trees from threatening lives, property, and public infrastructure from severe weather events.	Combine with SW-4A.				
FL 7D	Develop personal use and educational outreach training for a "safe tree harvesting" program. Implement along utility and road corridors, preventing potential winter storm damage.	High	SVT	DoF, HEA	2019-2020	B/C: This project is essential as winter storms are becoming more severe (particularly winds). TF: This project could be easily implemented by residents of SVT and HEA.
FL 7G	Mile 1 on Jakolof Road wash outs near Rick's shop and could cut off access to the airport. If land subsides in an earthquake, village could be severed from the City (75 feet wide) between lagoon and slough. This road already floods when tide comes in as it sits at sea level.	Medium	SVT	State of Alaska	2019-2024	B/C: This action could be combined with MH-1. TF: This activity would be expensive. Work could be accomplished with conventional labor practices in the community. Negotiating with property owners would be time-extensive.
V 8A	Look at bearing loads of ash on roofs. At what level should homeowners remove ash during a hazard event?	Medium	SVT	AVO	2019-2024	B/C: AVO has guidelines readily available. 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. Community members would gain knowledge and insight. No labor or equipment is required.

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
V 8B	Evaluate potential actions to minimize damage to sensitive equipment in clinics.	High	EMS Directors	Staff Time	2019	B/C: Coordinated planning ensures effective damage abatement and ensures proper attention is assigned to reduce future losses. TF: This is feasible to accomplish. EMS Directors would gain knowledge and insight.
V 8D	Purchase a supply of extra oxygen and ashfall masks to keep on hand.	High	EMS Directors	Staff Time	2019	B/C: Coordinated planning ensures effective damage abatement and ensures proper attention is assigned to reduce future losses. TF: This is feasible to accomplish.
T 9	DGGS completes their 2019 study.	High	SVT to coordinate with DGGS	Staff Time	2019	B/C: Coordinated planning ensures that effective tsunami inundation levels are identified. TF: This is feasible to accomplish as DGGS is working at the current time to complete this study.
F10A	Build two concrete water cisterns to catch/contain natural year-round water flow at two locations on Jakolof Bay Road. One cistern would be at Mile 6 and the other at the Mile 8 waterfall.	High	SVT EMS Director	RFAG, AFG, FP&S, SAFER	2019-2024	B/C: A readily accessible source of water is needed to fight potential fires. TF: Work could be accomplished with conventional labor practices in the community.
F10B	Build one cistern, built-in underground in firehouse building at Mile 4. The water would be piped from a well to the underground containment. This cistern should contain 10,000 gallons of usable water at above freezing temperatures to be used for fire suppression and other emergencies as needed.	High	SVT EMS Director	SAFER	2019-2024	B/C: A readily accessible source of water is needed to fight potential fires. TF: Work could be accomplished with conventional labor practices in the community.
F10C	Engineer and construct a water flow system, piped from a source up Barabara Creek to a constructed penstock-dry hydrant access downstream at bridge area of Barabara Creek on Jakolof Bay Road at Mile 5.	High	SVT EMS Director	RFAG, AFG, FP&S, SAFER	2019-2024	B/C: A readily accessible source of water is needed to fight potential fires. TF: Work could be accomplished with conventional labor practices in the community.
F10D	Purchase one 10 KW diesel-powered generator light plant for fire apparatus	High	SVT EMS Director	RFAG, AFG, FP&S, SAFER	2019-2024	B/C: A reliable power source is needed to fight potential fires.

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
	shelter for use during power outages and other emergencies.					TF: A power source could be easily purchased with funding.
F10E	Educate homeowners on the importance of creating defensible space around homes and suggested safety practices when using their wood burning stoves.	High	SVT EMS Director	Staff Time, FireWise	2019	B/C: This project will ensure the community looks closely at their wildland fire hazard to ensure they can safely address actions and needs during a wildland fire event. TF: This is technically feasible using existing Tribal resources with existing State and Federal agency support and guidance.
F10F	Add water filtration system to fire station (couple thousand gallon tank and filtration system).	High	SVT EMS Director	RFAG, AFG, FP&S, SAFER	2019-2024	B/C: A readily accessible drinking water source is needed when the VFD Station becomes an emergency shelter. TF: Work could be accomplished with conventional labor practices in the community.

Appendix B
SVT Property Maps

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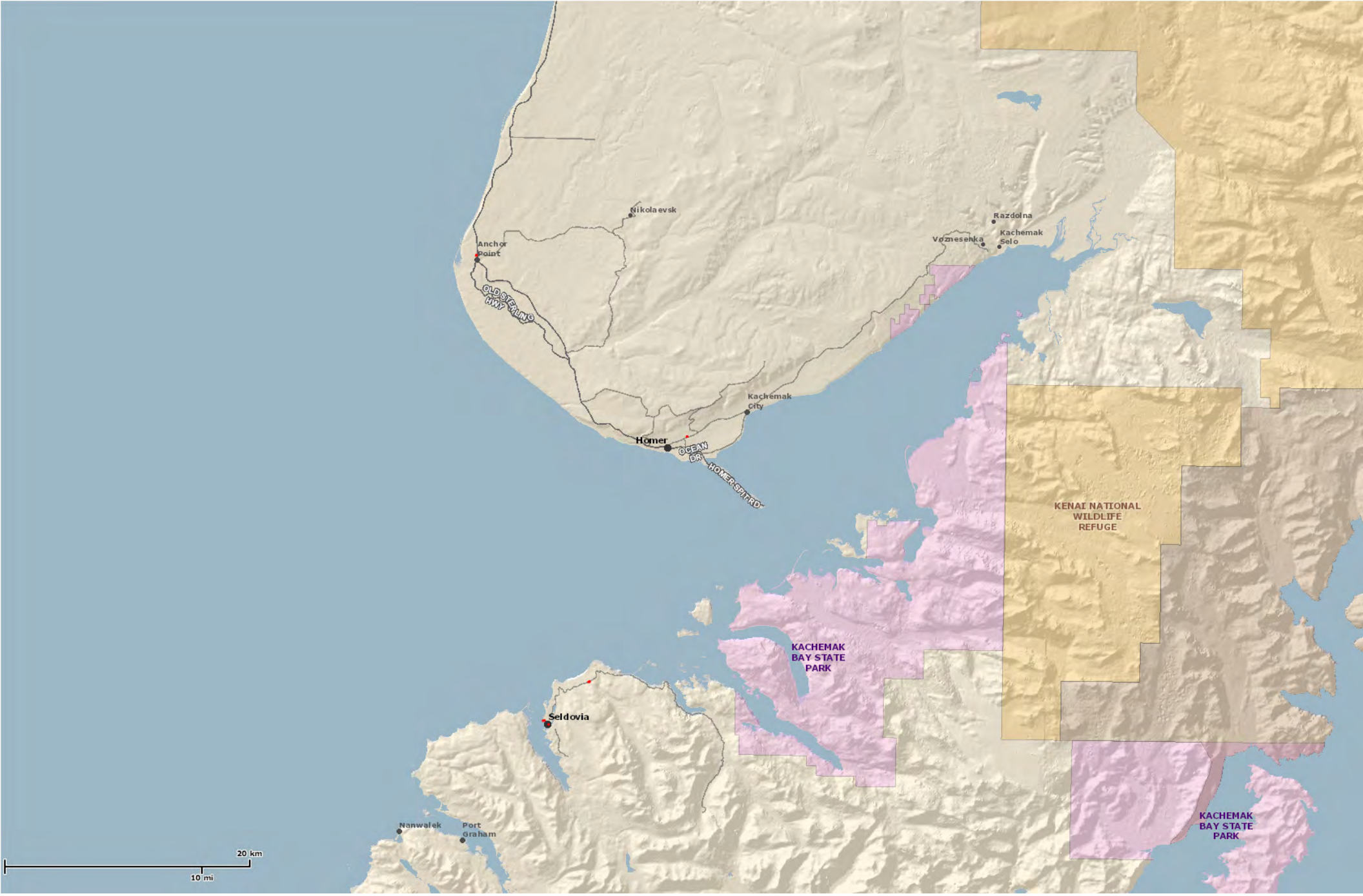

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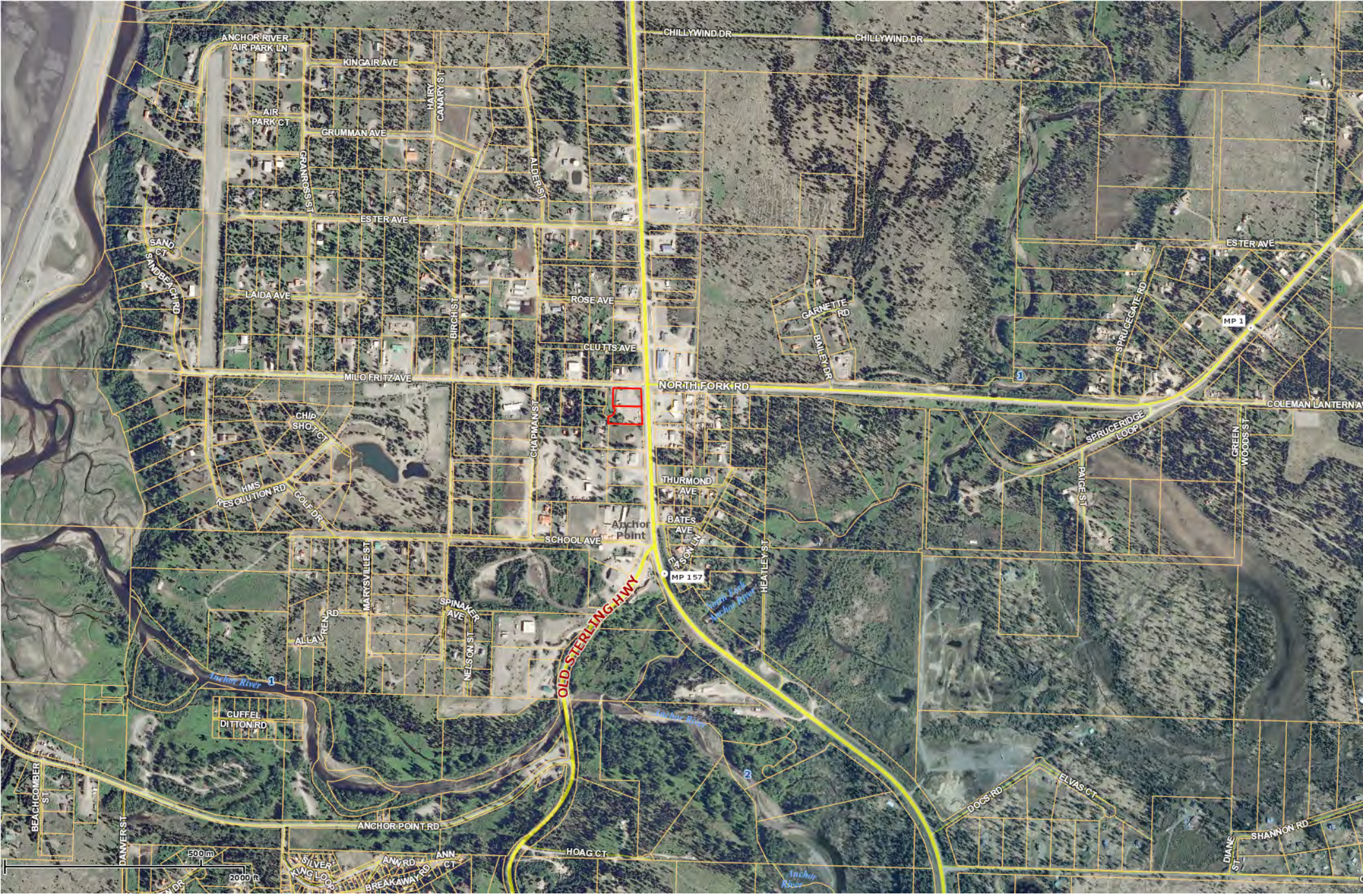
SVT Properties Overview

Red markings indicate properties

KPB Parcel Viewer



Seldovia Village Tribe Property within Anchor Point

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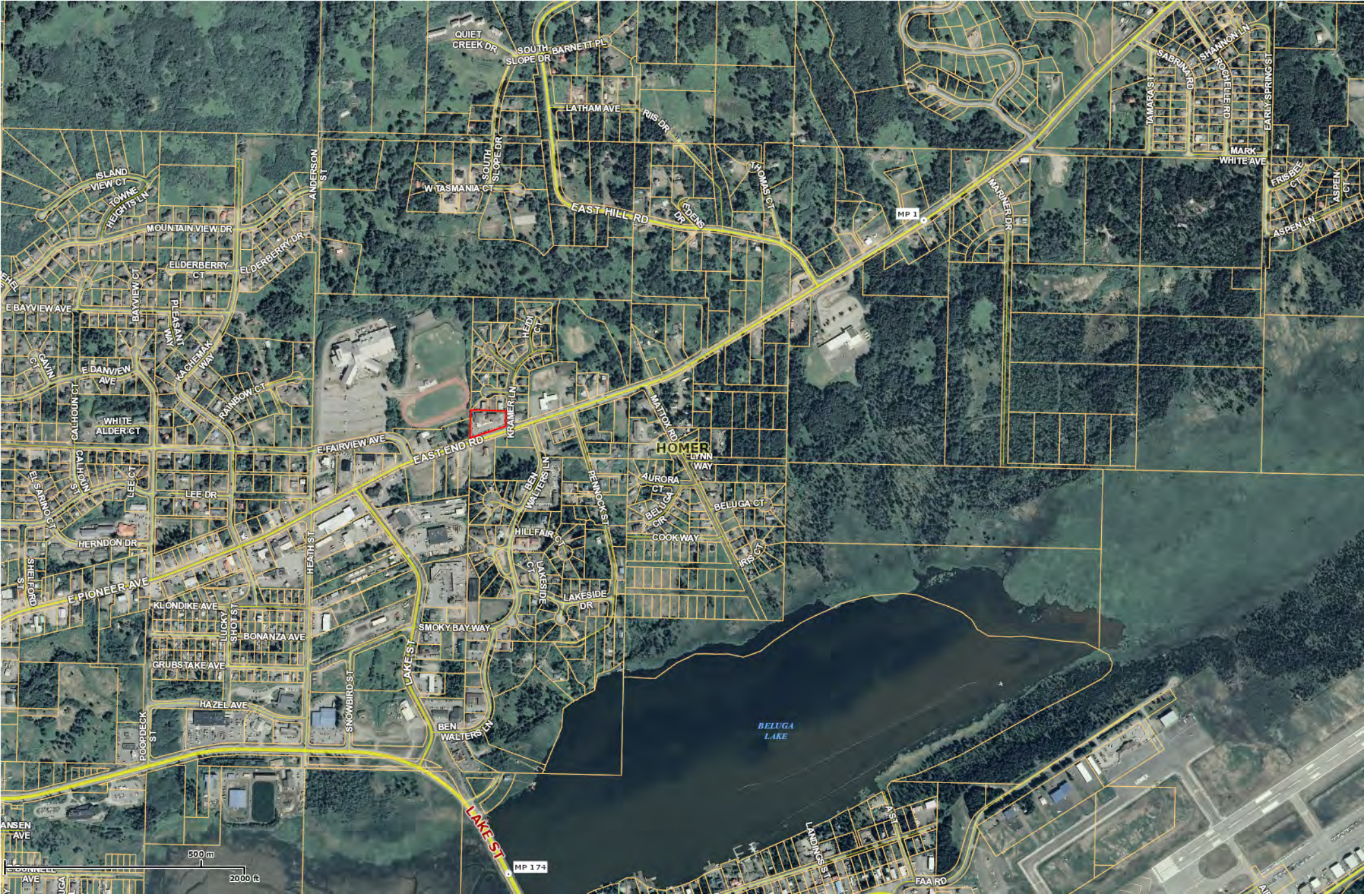
KPB Parcel Viewer



Seldovia Village Tribe Property within City of Homer

Wed Nov 1 2017 11:23:07 AM

KPB Parcel Viewer

Appendix C
FEMA Review Tool

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FEMA Region 10 Tribal Mitigation Plan Review Tool

The *Tribal Mitigation Plan Review Tool* records how the tribal mitigation plan meets the regulations in 44 CFR §§ 201.7 and 201.5 (if applicable) and offers FEMA plan reviewers an opportunity to provide feedback to the tribal government.

- **Section 1**: The Regulation Checklist documents FEMA's evaluation of whether the plan has addressed all requirements. If plan requirements are not met, FEMA uses each Required Revisions section to indicate necessary changes.
- **Section 2**: The Strengths and Opportunities for Improvement summary identifies plan's strengths as well as areas for improvement as part of the next plan update.

The FEMA mitigation planner must reference the *Tribal Mitigation Plan Review Guide* when completing the *Tribal Mitigation Plan Review Tool*.

<table>
<tr><td>Tribal Jurisdiction:
Seldovia Village Tribe</td><td>Title of Plan:
Seldovia Village Tribe Tribal Hazard Mitigation Plan</td><td>Date of Plan
August 13, 2019</td></tr>
<tr><td colspan="2">Tribal Point of Contact: Beckie Noble</td><td rowspan="3">Address:
Seldovia Village Tribe
Drawer L
Seldovia, AK 99663</td></tr>
<tr><td colspan="2">Title: Project Coordinator</td></tr>
<tr><td colspan="2">Agency: Seldovia Village Tribe</td></tr>
<tr><td colspan="2">Phone Number: 907-252-5265</td><td>Email:
beckien@svt.org</td></tr>
</table>

State Reviewer (if applicable):	**Title:**	**Date:**
N/A		

FEMA Reviewer:	**Title:**	**Date:**
Date Received in FEMA Region 10		
Plan Not Approved		
Plan Approvable Pending Adoption		
Plan Approved		

Section 1: REGULATION CHECKLIST

1. Standard Regulation Checklist **Regulation** (44 CFR § 201.7 Tribal Mitigation Plans)	**Location in Plan (section and/or page number)**	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS			
A1. Does the plan document the planning process, including how it was prepared and who was involved in the process? [44 CFR § 201.7(c)(1)]	How: PDF 26-29, Who: PDF 9, 26-29, 123-163		
A2. Does the plan document an opportunity for public comment during the drafting stage and prior to plan approval, including a description of how the tribal government defined "public"? [44 CFR § 201.7(c)(1)(i)]	PDF 9, 26-29, 125-126, 153-154		
A3. Does the plan document, as appropriate, an opportunity for neighboring communities, tribal 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? [44 CFR § 201.7(c)(1)(ii)]	PDF 26-29, 125-126, 153-154; the Draft Plan was posted on SVT's website		
A4. Does the plan describe the review and incorporation of existing plans, studies, and reports? [44 CFR § 201.7(c)(1)(iii)]	PDF 29, 117-119		
A5. Does the plan include a discussion on how the planning process was integrated to the extent possible with other ongoing tribal planning efforts as well as other FEMA programs and initiatives? [44 CFR § 201.7(c)(1)(iv)]	PDF 24, 101, 102-107, 109-110		
A6. Does the plan include a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within the plan update cycle)? [44 CFR § 201.7(c)(4)(i)]	108-109,186-194		
A7. Does the plan include a discussion of how the tribal government will continue public participation in the plan maintenance process? [44 CFR § 201.7(c)(4)(iv)]	PDF 110-111, 190-194		
ELEMENT A: REQUIRED REVISIONS			
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 the tribal planning area? [44 CFR § 201.7(c)(2)(i)]	Type: PDF 32-34, 36-38, 40-43, 47-51, 53-54, 59, 64-67, 72-76 Location: PDF 35, 38-39, 43-45, 51-52, 54, 56-58, 60, 62-64, 70, 77-79 Extent: PDF 35, 39, 45-46, 52-53, 54-55, 60-61, 70-71, 79-80		

1. Standard Regulation Checklist **Regulation** (44 CFR § 201.7 Tribal Mitigation Plans)	**Location in Plan (section and/or page number)**	**Met**	**Not Met**
B2. Does the plan include information on previous occurrences of hazard events and on the probability of future hazard events for the tribal planning area? [44 CFR § 201.7(c)(2)(i)]	Cryosphere: PDF 34, 36; Earthquake: 38, 40, 41; Flooding/Erosion: 43, 47; Ground Failure: 51, 53; Tsunami: 54, 55; Volcanoes and Ash: 59-60, 62; Severe Weather: 67-70, 72; Fire: 76-78, 80-81		
B3. Does the plan include a description of each identified hazard's impact as well as an overall summary of the vulnerability of the tribal planning area? [44 CFR § 201.7(c)(2)(ii)]	Cryosphere: PDF 35, 90-91; Earthquake: 39-40,88; Flooding/ Erosion: 46-47, 91; Ground Failure: 53, 90; Tsunami: 55 91-92; Volcanoes and Ash: 61, 92; Severe Weather: 71-72, 90; Fire: 80, 91		
ELEMENT B: REQUIRED REVISIONS			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan include a discussion of the tribal government's pre- and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including an evaluation of tribal laws and regulations related to hazard mitigation as well as to development in hazard-prone areas? [44 CFR §§ 201.7(c)(3) and 201.7(c)(3)(iv)]	PDF 101		
C2. Does the plan include a discussion of tribal funding sources for hazard mitigation projects and identify current and potential sources of Federal, tribal, or private funding to implement mitigation activities? [44 CFR §§ 201.7(c)(3)(iv) and 201.7(c)(3)(v)]	PDF 102-107, 111-116		
C3. Does the Mitigation Strategy include goals to reduce or avoid long-term vulnerabilities to the identified hazards? [44 CFR § 201.7(c)(3)(i)]	PDF 95		
C4. Does the plan identify and analyze a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with emphasis on new and existing buildings and infrastructure? [44 CFR § 201.7(c)(3)(ii)]	PDF 97-99		
C5. Does the plan contain an action plan that describes how the actions identified will be prioritized, implemented, and administered by the tribal government? [44 CFR § 201.7(c)(3)(iii)]	PDF 102-107		

1. Standard Regulation Checklist **Regulation** (44 CFR § 201.7 Tribal Mitigation Plans)	**Location in Plan (section and/or page number)**	**Met**	**Not Met**
C6. Does the plan describe a process by which the tribal government will incorporate the requirements of the mitigation plan into other planning mechanisms, when appropriate? [44 CFR § 201.7(c)(4)(iii)]	PDF 109-110		
C7. Does the plan describe a system for reviewing progress on achieving goals as well as activities and projects identified in the mitigation strategy, including monitoring implementation of mitigation measures and project closeouts? [44 CFR §§ 201.7(c)(4)(ii) and 201.7(c)(4)(v)]	PDF 108-109, 186-194		
ELEMENT C: REQUIRED REVISIONS			
ELEMENT D. PLAN UPDATES			
D1. Was the plan revised to reflect changes in development? [44 CFR § 201.7(d)(3)]	N/A: Tribal plan is not an update.		
D2. Was the plan revised to reflect progress in tribal mitigation efforts? [44 CFR §§ 201.7(d)(3) and 201.7(c)(4)(iii)]	N/A: Tribal plan is not an update.		
D3. Was the plan revised to reflect changes in priorities? [44 CFR § 201.7(d)(3)]	N/A: Tribal plan is not an update.		
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. ASSURANCES AND PLAN ADOPTION			
E1. Does the plan include assurances that the tribal government will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, including 2 CFR Parts 200 and 3002, and will amend its plan whenever necessary to reflect changes in tribal or Federal laws and statutes? [44 CFR § 201.7(c)(6)]	PDF 13-14		
E2. Does the plan include documentation that it has been formally adopted by the governing body of the tribal government requesting approval? [44 CFR § 201.7(c)(5)]	Appendix F once the resolution is received		
ELEMENT E: REQUIRED REVISIONS			

1. Standard Regulation Checklist **Regulation** (44 CFR § 201.7 Tribal Mitigation Plans) 2. Enhanced Regulation Checklist **Regulation** (44 CFR § 201.5 Enhanced Tribal Mitigation Plans)	**Location in Plan (section and/or page number)** **Location in Plan (section and/or page number)**	**Met** **Met**	**Not Met** **Not Met**
ENHANCED ELEMENT F. STANDARD PLAN REQUIREMENTS			
F1. Does the enhanced plan include all elements of the standard tribal mitigation plan? [44 CFR §§ 201.3(e)(3), 201.5(b), and 201.7]			
ENHANCED ELEMENT F: REQUIRED REVISIONS			
ENHANCED ELEMENT G. INTEGRATED PLANNING			
G1. Does the enhanced plan demonstrate integration to the extent practicable with other tribal and/or regional planning initiatives and FEMA mitigation programs and initiatives? [44 CFR §§ 201.3(e)(3) and 201.5(b)(1)]			
ENHANCED ELEMENT G: REQUIRED REVISIONS			
ENHANCED ELEMENT H. TRIBAL MITIGATION CAPABILITIES			
H1. Does the tribal government demonstrate commitment to a comprehensive mitigation program? [44 CFR §§ 201.3(e)(3) and 201.5(b)(4)]			
H2. Does the enhanced plan document capability to implement mitigation actions? [44 CFR §§ 201.3(e)(3), 201.5(b)(2)(i), 201.5(b)(2)(ii), and 201.5(b)(2)(iv)]			
H3. Is the tribal government using existing mitigation programs to achieve mitigation goals? [44 CFR §§ 201.3(e)(3), 201.5(a) and 201.5(b)(3)]			
ENHANCED ELEMENT H: REQUIRED REVISIONS			

1. Standard Regulation Checklist **Regulation** (44 CFR § 201.7 Tribal Mitigation Plans)	**Location in Plan (section and/or page number)**	**Met**	**Not Met**
ENHANCED ELEMENT I. HMA GRANTS MANAGEMENT PERFORMANCE			
I1. With regard to HMA, is the tribal government maintaining the capability to meet application timeframes and submitting complete project applications? [44 CFR §§ 201.3(e)(3), 201.5(b)(2)(iii)(A)]			
I2. With regard to HMA, is the tribal government maintaining the capability to prepare and submit accurate environmental reviews and benefit-cost analyses? [44 CFR §§ 201.3(e)(3) and 201.5(b)(2)(iii)(B)]			
I3. With regard to HMA, is the tribal government maintaining the capability to submit complete and accurate quarterly progress and financial reports on time? [44 CFR §§ 201.3(e)(3) and 201.5(b)(2)(iii)(C)]			
I4. With regard to HMA, is the tribal government maintaining the capability to complete HMA projects within established performance periods, including financial reconciliation? [44 CFR §§ 201.3(e)(3) and 201.5(b)(2)(iii)(D)]			
ENHANCED ELEMENT I: REQUIRED REVISIONS			

Section 2: STRENGTHS AND OPPORTUNITIES FOR IMPROVEMENT

INSTRUCTIONS: The purpose of the ***Strengths and Opportunities for Improvement*** section is for FEMA to provide more comprehensive feedback on the tribal mitigation plan to help the tribal government advance mitigation planning. The intended audience is the tribal staff responsible for the mitigation plan update. FEMA will address the following topics:

1. Plan strengths, including specific sections in the plan that are above and beyond the minimum requirements; and
2. Suggestions for future improvements.

FEMA will provide feedback and include examples of best practices, when possible, as part of the *Tribal Mitigation Plan Review Tool,* or, if necessary, as a separate document. The tribal mitigation plan elements are included below in italics for reference. FEMA is not required to provide feedback for each element.

Required revisions from the **Regulation Checklist** are not documented in the **Strengths and Opportunities for Improvement** section. Results from the **Strengths and Opportunities for Improvement** section are not required for Plan Approval.

Describe the mitigation plan strengths areas for future improvements, including areas that may exceed minimum requirements.

- Planning process
- *Hazard identification and risk assessment*
- *Mitigation strategy (including Mitigation Capabilities)*
- *Plan updates*
- *Adoption and assurances*
- *Enhanced Plan - Integrated planning*
- *Enhanced Plan - Tribal government mitigation capabilities (commitment to a comprehensive mitigation program)*
- *Enhanced Plan - HMA grants management performance*

Appendix D
Benefit–Cost Analysis Fact Sheet

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Benefit-Cost Analysis Fact Sheet

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

A Benefit-Cost Analysis (BCA) provides an estimate of the "benefits" and "costs" of a proposed hazard mitigation project. The benefits considered are avoided future damages and losses that are expected to accrue as a result of the mitigation project. In other words, benefits are the reduction in expected future damages and losses (i.e., the difference in expected future damages before and after the mitigation project). The costs considered are those necessary to implement the specific mitigation project under evaluation. Costs are generally well determined for specific projects for which engineering design studies have been completed. 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 ≥ 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).

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Appendix E
Plan Maintenance Documents

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Annual Review Questionnaire

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

Mitigation Action Progress Report

Progress Report Period: _____ (date) to _____ (date)

Project Title: _____ Project ID# _____

Responsible Agency: _____

Address: _____

City: _____

Contact Person: _____ Title: _____

Phone #(s): _____ email address: _____

List Supporting Agencies and Contacts:

_____

_____

Total Project Cost: _____

Anticipated Cost Overrun/Underrun: _____

Date of Project Approval: _____ Start date of the project: _____

Anticipated completion date: _____

Description of the Project (include a description of each phase, if applicable, and the time frame for completing each phase): _____

_____

_____

_____

Milestones	Complete	Projected Date of Completion

Plan Goal (s) Addressed:

Goal: _____

Indicator of Success: _____

_____

_____

_____

Project Status

☐ Project on schedule

☐ Project completed

☐ Project delayed*

*explain: _____

_____

☐ Project canceled

Project Cost Status

☐ Cost unchanged

☐ Cost overrun*

*explain: _____

_____

☐ Cost underrun*

*explain: _____

_____

Summary of progress on project for this report:

A. What was accomplished during this reporting period?

_____

_____

_____

_____

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

_____

_____

_____

_____

C. How was each problem resolved?

_____

_____

_____

_____

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

Other Comments:

Tribal Hazard Mitigation Plan Survey

This survey is an opportunity for you to share your opinions and participate in the mitigation planning process. The information that you provide will help us better understand your concerns for hazards and risks, which could lead to mitigation activities that will help reduce those risks and the impacts of future hazard events.

The hazard mitigation process is not complete without your feedback. All individual responses are strictly confidential and will be used for mitigation planning purposes only.

Please help us by taking a few minutes to complete this survey and return it to:

Project Coordinator, SVT

Vulnerability Assessment

The following questions focus on how vulnerable the community or its facilities are to damage from a particular hazard type using the following vulnerability scale:

0= Don't Know 1 =Minimally Vulnerable 2=Moderately Vulnerable 3=Severely Vulnerable

1. How vulnerable to damage are the *structures* in the community from:

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

Please Specify:

2. How vulnerable to damage are the *critical facilities* within our community from:
[Critical facilities include airport, community shelter, bulk fuel storage tanks, generators, Health Center, satellite dish, communications tower, landfill, and stores.]

a. Flooding?	0 1 2 3
b. Wildfire?	0 1 2 3
C. Earthquakes?	0 1 2 3
d. Volcanoes?	0 1 2 3
e. Snow Avalanche?	0 1 2 3
f. Tsunami/Seiches?	0 1 2 3
g. Severe weather storms?	0 1 2 3
h. Ground failure (landslide)?	0 1 2 3
i. Coastal erosion?	0 1 2 3
j. Changes to the cryosphere (permafrost, sea ice?)	0 1 2 3
k. Other hazards?	0 1 2 3
Please Specify:	

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

a. Flooding?	0 1 2 3
b. Wildfire?	0 1 2 3
C. Earthquakes?	0 1 2 3
d. Volcanoes?	0 1 2 3
e. Snow Avalanche?	0 1 2 3
f. Tsunami/Seiches?	0 1 2 3
g. Severe weather storms?	0 1 2 3
h. Ground failure (landslide?	0 1 2 3
i. Coastal erosion?	0 1 2 3
j. Changes to the cryosphere (permafrost, sea ice?)	0 1 2 3
k. Other hazards?	0 1 2 3
Please Specify:	

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

If yes, please describe:_____

_____

_____

Preparedness

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

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

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

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

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

☐	Less than $100	☐	Desire to relocate for protection
☐	$100-$499	☐	Other, please explain
☐	$500 and above		
☐	Nothing / Don't know		
☐	Whatever it takes		

Mitigation Activities

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

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

Statement	Very Important	Somewhat Important	Neutral	Not Very Important	Not Important
Protecting private property	☐	☐	☐	☐	☐
Protecting critical facilities (clinic, school, washeteria, police/fire department, water/sewer, landfill)	☐	☐	☐	☐	☐
Preventing development in hazard areas	☐	☐	☐	☐	☐
Protecting natural environment	☐	☐	☐	☐	☐
Protecting historical and cultural landmarks	☐	☐	☐	☐	☐
Promoting cooperation within the community	☐	☐	☐	☐	☐
Protecting and reducing damage to utilities, roads, or water tank	☐	☐	☐	☐	☐
Strengthening emergency services (clinic workers, police/fire)	☐	☐	☐	☐	☐

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

_____

_____

_____

_____

_____

General Household Information

9. Please indicate your age: _____

and Gender: ☐ Male ☐ Female

Tribal Hazard Analysis

10. Please indicate your level of education:

☐	Grade school/no schooling	☐	College degree
☐	Some high school	☐	Postgraduate degree
☐	High school graduate/GED	☐	Other, please specify
☐	Some college/trade school		

11. How long have you lived in the Seldovia community?

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

12. Do you have internet access? ☐ Yes ☐ No

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

If you have any questions regarding this survey or would like to learn about other ways that you can participate in the development and implementation of the Tribal Hazard Mitigation Plan, please contact the Project Coordinator.

Thank You for Your Participation!

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

Name: _____

Address: _____

_____

Phone: _____

Appendix F: Adoption Resolution and Approval Letter

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(To be completed following adoption).