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Acronyms/Abbreviations

°F	Degrees Fahrenheit
AEA	Alaska Energy Authority
AEEE	Alternative Energy and Energy Efficiency
AFG	Assistance to Firefighters Grant
AHFC	Alaska Housing Finance Corporation
AICC	Alaska Interagency Coordination Center
APA	American Planning Association
APC	Alaska Power Company
AP&T	Alaska Power Telephone
ARC	American Red Cross
BF	Bulk Fuel
CHEMS	Community Health and Emergency Medical Services
CFR	Code of Federal Regulations
City	City of Thorne Bay
DCCED	Department of Commerce, Community, and Economic Development
DCRA	Division of Community and Regional Affairs
DEC	Department of Environmental Conservation
DEED	Department of Education and Early Development
DHSS	Department of Health and Social Services
DHS	Department of Homeland Security
DHS&EM	Division of Homeland Security and Emergency Management
DGGS	Division of Geological and Geophysical Survey
DMA 2000	Disaster Mitigation Act of 2000
DMVA	Department of Military and Veterans Affairs
DNR	Department of Natural Resources
DOE	Department of Energy
DOF	Division of Forestry
DOI	Division of Insurance
DOL	Department of Labor
DOT/PF	Department of Transportation and Public Facilities
DSS	Division of Senior Services

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EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FMA	Flood Mitigation Assistance
FP&S	Fire Prevention and Safety
ft	feet
FY	Fiscal Year
g	gravity as a measure of peak ground acceleration
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HUD	Housing and Urban Development
IBHS	Institute for Business and Home Safety
IG	Inspector General
LEG	Legislative Energy Grant
M	Magnitude
MMI	Modified Mercalli Intensity
mph	miles per hour
msl	mean sea level
mW	Milliwatt
NFIP	National Flood Insurance Program
PDM	Pre-Disaster Mitigation
PGA	peak ground acceleration
RD	US Division of Rural Development
RDA	Rural Development Assistance
RL	repetitive loss
RFC	Repetitive Flood Claim
RPSU	Rural Power System Upgrade
SAFER	Staffing for Adequate Fire and Emergency Response
SBA	U.S. Small Business Administration
SHMP	Alaska State Hazard Mitigation Plan
sq	Square

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SRL	Severe Repetitive Loss
Stafford Act	Robert T. Stafford Disaster Relief and Emergency Assistance Act
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic, and Environmental
US or U.S.	United States
URS	URS Corporation
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VSW	Village Safe Water
WC/ATWC	West Coast/Alaska Tsunami Warning Center

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

1.1 HAZARD MITIGATION PLANNING

Hazard mitigation, as defined in Title 44 of the Code of Federal Regulations (CFR), Part 201.2, 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. It 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. The implementation of the mitigation actions, which include long-term strategies that may include planning, policy changes, programs, projects, and other activities, is the end result of this process.

1.2 PLANNING REQUIREMENTS

1.2.1 Local Mitigation Plans

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

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

FEMA's October 31, 2007 and July 2008 changes to 44 CFR Part 201 combined and expanded flood mitigation planning requirements with local hazard mitigation plans (44 CFR §201.6). Furthermore, all hazard mitigation assistance program planning requirements were combined eliminating duplicated mitigation plan requirements. This change also required participating National Flood Insurance Program (NFIP) communities' risk assessments and mitigation strategies to identify and address repetitively flood damaged properties. Local hazard mitigation plans now qualify communities for several Federal Hazard Mitigation Assistance (HMA) grant programs.

This HMP complies with Title 44 CFR dated December 31, 2010 and applicable guidance documents.

1.3 GRANT PROGRAMS WITH MITIGATION PLAN REQUIREMENTS

FEMA HMA grant programs provide funding to States, Tribes, and local entities that have a FEMA-approved State, Tribal, or Local Mitigation Plan. Two of the grants are authorized under the Stafford Act and DMA 2000, while the remaining three are authorized under the National

Flood Insurance Act and the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act. The Hazard Mitigation Grant Program (HMGP) is a directly disaster funded competitive disaster grant program. Whereas the other Hazard Mitigation Assistance Programs: Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), Repetitive Flood Claims (RFC), and Severe Repetitive Loss (SRL) programs although competitive, rely on specific grant pre-disaster grant funding sources, sharing several common elements.

> *"Hazard mitigation is any sustained action taken to reduce or eliminate long-term risk to people and property from natural hazards and their effects. This definition distinguishes actions that have a long-term impact from those that are more closely associated with immediate preparedness, response, and recovery activities. Hazard mitigation is the only phase of emergency management specifically dedicated to breaking the cycle of damage, reconstruction, and repeated damage. As such, States, Territories, Indian Tribal governments, and communities are encouraged to take advantage of funding provided by HMA programs in both the pre- and post-disaster timeframes.*
>
> *Together, these programs provide significant opportunities to reduce or eliminate potential losses to State, Tribal, and local assets through hazard mitigation planning and project grant funding. Each HMA program was authorized by separate legislative action, and as such, each program differs slightly in scope and intent.*
>
> *The Hazard Mitigation Grant Program (HMGP) may provide funds to States, Territories, Indian Tribal governments, local governments, and eligible private non-profits (PNPs) following a Presidential major disaster declaration. The Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), Repetitive Flood Claims (RFC), and Severe Repetitive Loss Pilot (SRL) programs may provide funds annually to States, Territories, Indian Tribal governments, and local governments. While the statutory origins of the programs differ, all share the common goal of reducing the risk of loss of life and property due to natural hazards" (FEMA 2010).*

1.3.1 Hazard Mitigation Assistance (HMA) Programs

The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. Projects must provide a long-term solution to a problem, for example, elevation of a home to reduce the risk of flood damages as opposed to buying sandbags and pumps to fight the flood. In addition, a project's potential savings must be more than the cost of implementing the project. Funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage. The amount of funding available for the HMGP under a particular disaster declaration is limited. FEMA may provide a State or Tribe with up to 20 percent of the total aggregate disaster damage costs to fund HMGP project or planning grants. In Fiscal Year (FY) 2006 was approximately $232 million, FY 2007 was $316 million, FY 2008 was $1.246 billion, FY 2009 was $359 million, and FY 2010 was $23 million. The cost-share for these grants is 75 percent Federal/25 percent non-Federal. Communities that fulfill "Impoverished Community" criteria and receive FEMA Regional Administrator approval may be funded at percent 90 percent Federal/10 percent non-Federal.

The PDM grant program provides funds to State, Tribes, and local entities, including universities, for hazard mitigation planning and mitigation project implementation prior to a disaster event. PDM grants are awarded on a nationally competitive basis. Like HMGP funding, a PDM project's potential savings must be more than the cost of implementing the project. In

addition, funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage. The total amount of PDM funding available is appropriated by Congress on an annual basis. In FY 2008, PDM program funding totaled approximately $114 million, FY 2009 was $90 million, and FY 2010 was $100 million. The cost-share for these grants is 75 percent Federal/25 percent non-Federal.

The City of Thorne Bay does not currently participate in the NFIP as they have had no historical flood events. They are therefore ineligible for National Flood Insurance Act, Flood Mitigation Assistance grant programs.

The goal of the FMA grant program is to reduce or eliminate flood insurance claims under the NFIP. Particular emphasis for this program is placed on mitigating repetitive loss (RL) properties. The primary source of funding for this program is the National Flood Insurance Fund. Grant funding is available for three types of grants, including Planning, Project, and Technical Assistance. Project grants, which use the majority of the program's total funding, are awarded to States, Tribes, and local entities to apply mitigation measures to reduce flood losses to properties insured under the NFIP. In FY 2010, FMA funding totaled $32.3 million. The cost-share for these grants is 75 percent Federal/25 percent non-Federal. However, 90 percent Federal/10 percent non-Federal to mitigate SRL properties is available in certain situations.

The SRL program provides funding to reduce or eliminate the long-term risk of flood damage to residential structures insured under the NFIP. Structures considered for mitigation must have at least four NFIP claim payments over $5,000 each, when at least two such claims have occurred within any 10-year period, and the cumulative amount of such claim payments exceeds $20,000; or for which at least two separate claim payments have been made with the cumulative amount of the building portion of such claims exceeding the value of the property, when two such claims have occurred within any 10-year period. Congress authorized $40 million for FY 2006 and FY 2007, $80 million for FY 2008, $80 million for FY 2009, and $70 million for FY 2010. The cost-share for these grants is 75 percent Federal/25 percent non-Federal. However, 90 percent Federal/10 percent non-Federal to mitigate SRL properties is available when the State or Tribal plan addresses ways to mitigate SRL properties.

The RFC program provides funding to reduce or eliminate the long-term flood damage risk to residential and nonresidential structures insured under the NFIP. Up to $10 million is available annually to assist States and communities with reducing flood damages to structures which have had one or more claim payments for flood damages. All RFC grants are eligible for up to 100 percent Federal assistance.

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 City of Thorne Bay (City). The adoption resolution is included in Appendix B.

Community Description

Section 3 provides a general history and background of the City, including historical trends for population and the demographic and economic conditions that have shaped the area. Trends in land use and development are also discussed. A location figure of the area is included.

Planning Process

Section 4 describes the planning process and identifies the Planning Team Members, the meetings held as part of the planning process, the Boutet Company, Inc.'s (Boutet) consultants, URS Corporation (URS), and the key stakeholders within the City and the surrounding area. In addition, this section documents public outreach activities (Appendix C) 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 this version of the HMP. The hazard analysis includes the nature, history, location, extent, impact, and probability of future events for each hazard. In addition, historical and hazard location figures are included.

Vulnerability Analysis

Section 6 identifies potentially vulnerable assets—people, residential and nonresidential buildings dwelling units (where available), critical facilities, and critical infrastructure—in the City. The resulting information identifies the full range of hazards that the City could face and potential social impacts, damages, and economic losses.

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 the City. Mitigation actions include preventive actions, property protection techniques, natural resource protection strategies, structural projects, emergency services, and public information and awareness activities. In the spirit of the new requirements, mitigation strategies were developed encouraging participation with the NFIP and the reduction of flood damage to flood-prone structures.

Plan Maintenance

Section 8 describes the Planning Team's formal plan maintenance process to ensure that the HMP remains an active and applicable document. The process includes monitoring, evaluating (Appendix E), and updating the HMP; implementation 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 the FEMA crosswalk, which documents compliance with FEMA criteria.

Appendix B

Appendix B provides the adoption resolution for the City.

Appendix C

Appendix C provides public outreach information, including newsletters.

Appendix D

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

Appendix E

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

2.1 ADOPTION BY LOCAL GOVERNING BODIES AND SUPPORTING DOCUMENTATION

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

DMA 2000 REQUIREMENTS: PREREQUISITES

Local Plan Adoption

Requirement §201.6(c)(5): The local hazard mitigation plan shall include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, Commissioner, Tribal Council).

Element

- Has the local governing body adopted the new or updated plan?
- Is supporting documentation, such as a resolution, included?

Source: FEMA, July 2008.

The City of Thorne Bay is the local jurisdiction represented in this HMP and meets the requirements of Section 409 of the Stafford Act and Section 322 of DMA 2000.

The local governing body of the City adopted the HMP by resolution on . A scanned copy of the resolution is included in Appendix B.

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This section describes the location, geography, and history; demographics; and land use development trends of the City of Thorne Bay.

3.1 LOCATION, GEOGRAPHY, AND HISTORY

"The City of Thorne Bay (City) is located 47 air miles northwest of Ketchikan on the east coast of Prince of Wales Island. It lies 60 miles from Hollis and 36 miles east of the Klawock Junction. It lies at approximately 55.687780 North Latitude and -132.522220 West Longitude (Sec. 12, T071S, R084E, Copper River Meridian.) Thorne Bay is located in the Ketchikan Recording District" (Department of Community, Commerce, and Economic Development [DCCED], Division of Community and Regional Affairs [DCRA] 2011).

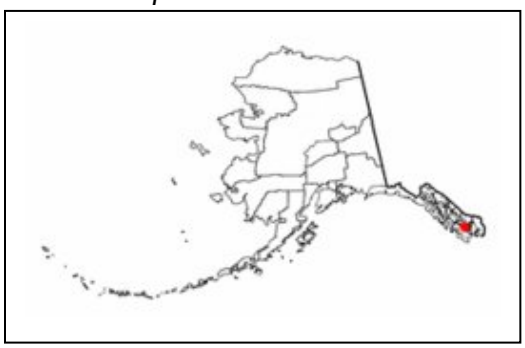

Figure 3-1 Thorne Bay Location Map

The area covers 25.5 square (sq) miles of land and 4.8 sq miles of water. Prince of Wales Island is dominated by a cool, moist, maritime climate. Summer temperatures range from 49 to 63 degrees Fahrenheit (°F) and winter temperatures from 32 to 42°F. The area receives approximately 120 inches or rain and 40 inches of snow (DCRA 2011)

The following is the City's brief historical sketch:

1885 - 1889	The Bay was named after Frank Manley Thorn, superintendent of the U.S. Coast & Geodetic Survey (The name was misspelled when published)
	Thorne Bay developed as a result of a long-term timber sales contract between the U.S. Forest Service and the Ketchikan Pulp Company
1900's	Saltery located on the south shore of Thorne Bay to clean, salt, and ship salmon to Europe
1954	Ketchikan Pulp Company developed a floating logging camp on the east side of present day Davidson Landing
1960	Logging in the present town site ended; buildings moved to Traitor's Cove on Revillagigedo Island.
	The logging industry moved to the City's present site (the largest in North America)
1961	The Ketchikan Pulp Company camp at Hollis was moved on ships and floats to Thorne Bay. It remained on floats until City infrastructure was developed and ready for land settlement
1962	Ketchikan Pulp moved its main logging camp from Hollis to Thorne Bay consisting of a shop, barge terminal, log sort yard, and camp facilities
	Roads were constructed connecting Thorne Bay, Hollis, Craig, and Klawock

1982 Thorne Bay became an incorporated City, changing its status from a company-owned logging camp to an incorporated City (attributed to a an Alaska Statehood Act land selection program)

Unique to most Alaskan communities, Thorne Bay evolved not from an Alaska Native Village or camp but from a logging camp. (DCRA 2010).

3.2 DEMOGRAPHICS

The City is located in the Prince of Wales-Hyder Census Area. The 2000 census recorded 557 residents, of which the median age was 38.8 indicating a relatively middle aged population. The City's population of is expected to remain steady because over half of the population is between 25 and 54 years of age. The City is predominantly white with about 4.8 percent of residents recognize themselves as Alaska Native. The male and female composition is approximately 53.6 and 46.3 percent respectively. The 2000 census revealed that there are 219 households with the average household having approximately 2.9 individuals. The most recent 2010 Department of Commerce, Community and Economic Development (DCCED) certified population is 471. Figure 3-2 illustrates the City's historic population.

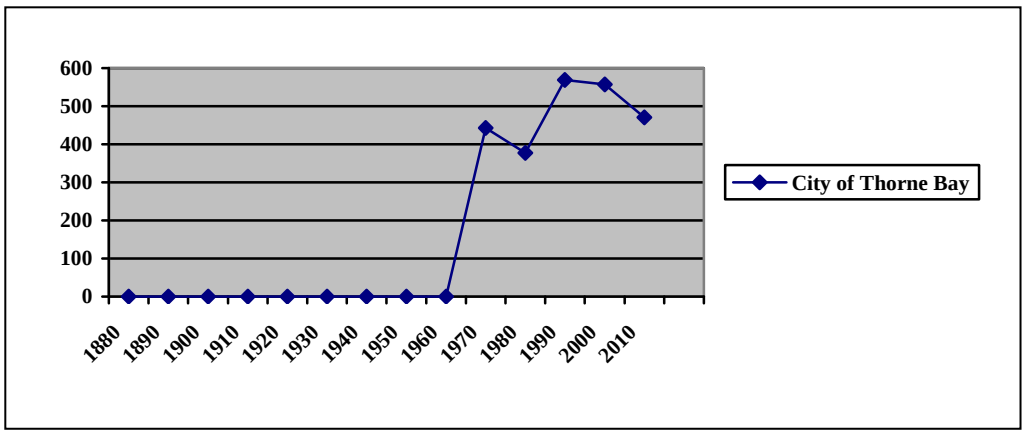

Figure 3-2 Thorne Bay Historic Population

3.3 ECONOMY

There are limited employment opportunities in Thorne Bay. Small sawmills and established government provides the bulk of the employment opportunities such as the United States (US) Forest Service, City, State, and Federal agencies, the Southeast Island School District, the health clinic, and other commercial enterprises along with commercial fishing (18 residents hold commercial fishing licenses), and tourism. Residents also fish and trap, repair and maintain automobile and heavy equipment to supplement their incomes. Food sources include deer, salmon, halibut, shrimp, and crab. (DCRA 2011).

According to the 2000 census, the median household income in the City was $45,625. Approximately 45 individuals (7.8 percent) were reported to be living below the poverty level. The potential work force (those aged 16 years or older) in Thorne Bay was estimated to be 457, of which 269 were actively employed. In 2000 the unemployment rate was 14.6 percent; however, this rate included part-time and seasonal jobs, and practical unemployment or underemployment is likely to be significantly higher.

Figure 3-3 depicts the Thorne Bay Base Map for Zoning and Planning developed by Resource Data Inc., 1999, obtained from the City's website, used with permission of the City of Thorne Bay.

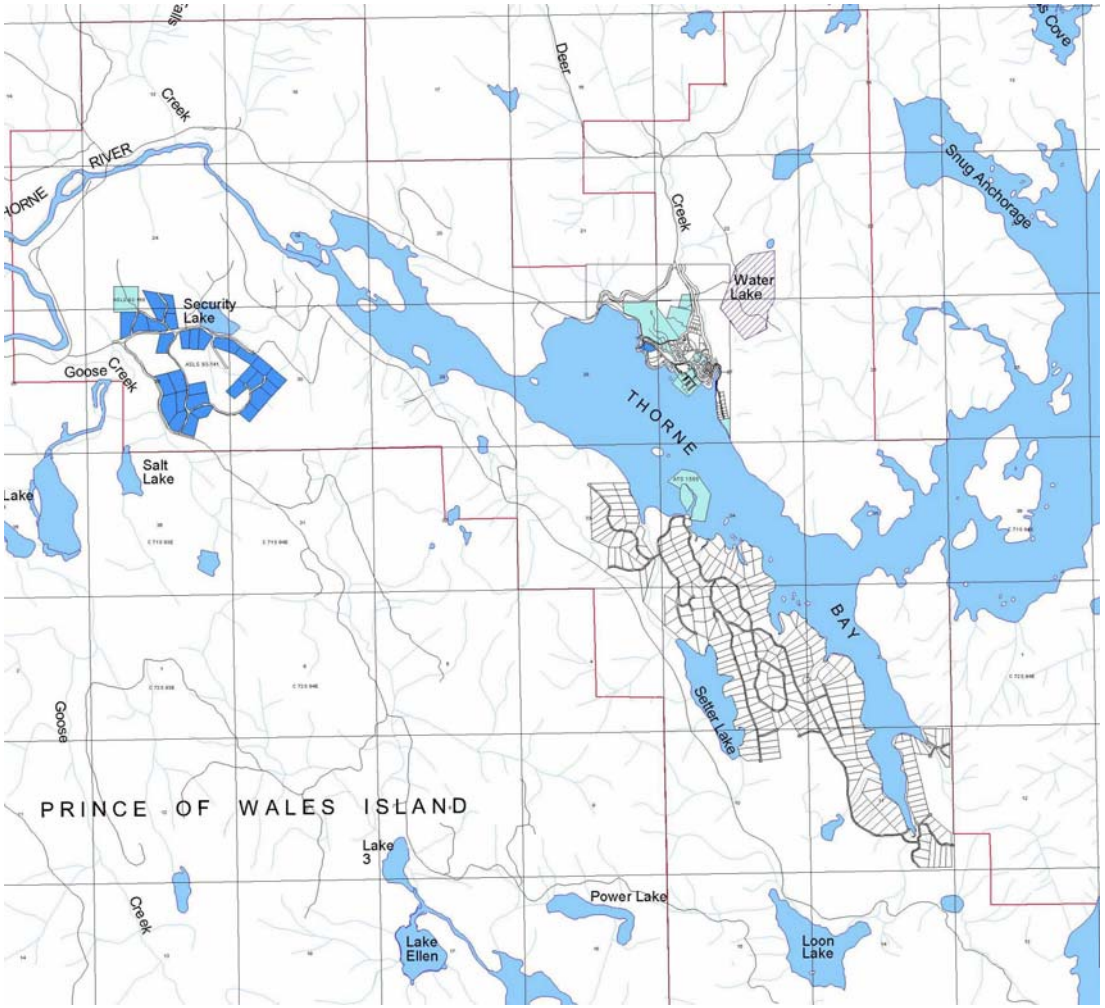

Figure 3-3 Thorne Bay Base Map for Zoning and Planning (Thorne Bay 1999).

The City of Thorne Bay's Visitor Map displays city infrastructure and locational relationships

Figure 3-4 The Thorne Bay Alaska visitor map depicting the City's geographically separated facilities' layout and relationship. The map was obtained from the City's website, used with permission of the City of Thorne Bay.

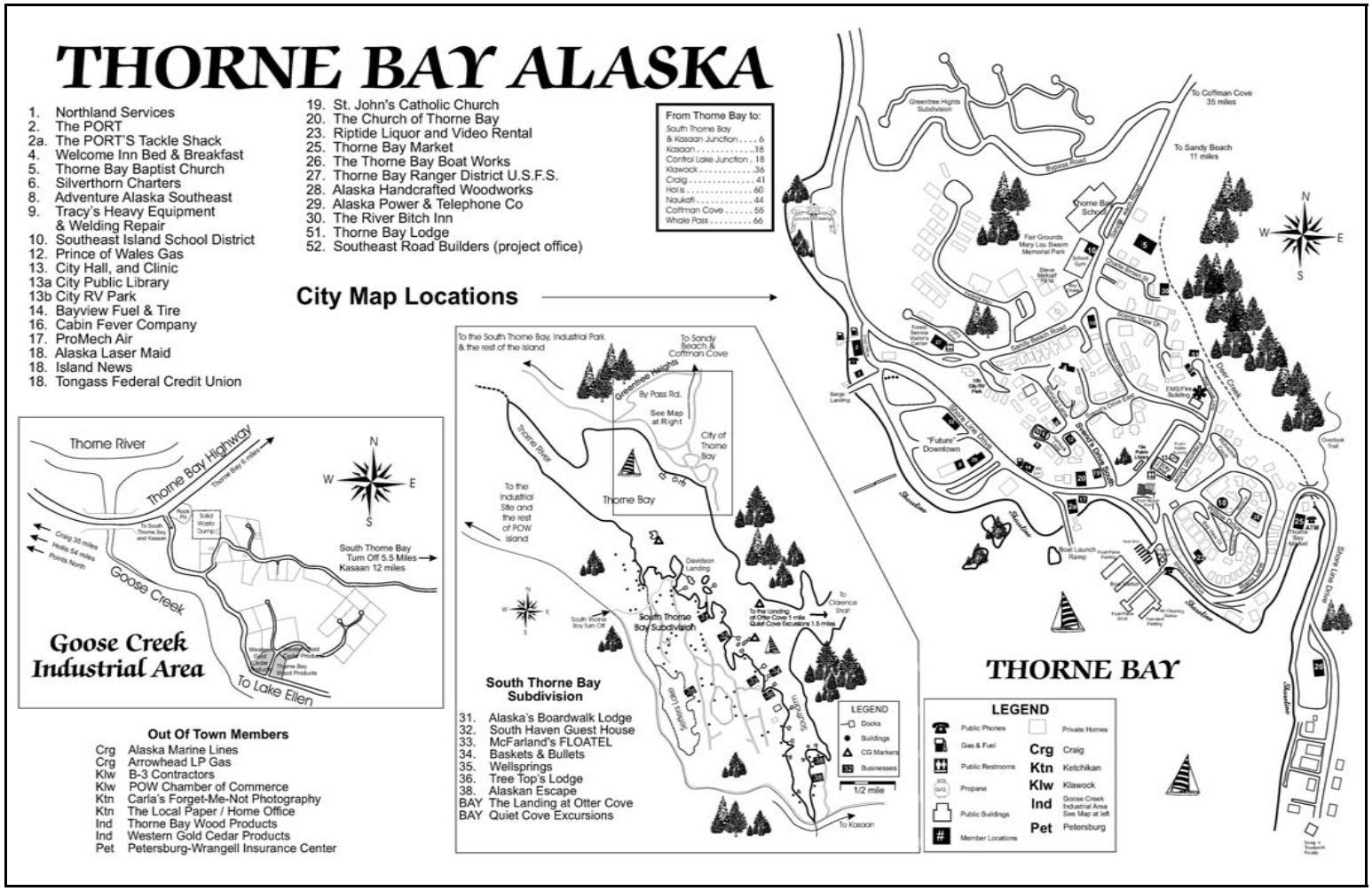

Figure 3-4 **Thorne Bay Visitor Map** (Thorne Bay 1999)

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

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

DMA 2000 Requirements: Planning Process

Local Planning Process

Requirement §201.6(b): An open public involvement process is essential to the development of an effective plan.

In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

Element

- An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
- An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and nonprofit interests to be involved in the planning process; and
- Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

Requirement §201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Element

- Does the plan provide a narrative description of the process followed to prepare the new or updated plan?
- Does the new or updated plan indicate who was involved in the planning process?
- Does the new or updated plan indicate how the public was involved?
- Does the new or updated 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?
- *Does the updated plan document how the planning team reviewed and analyzed each section of the plan and whether each section was revised as part of the update process? (Not applicable until 2013 update)*

Source: FEMA, July 2008.

4.1 OVERVIEW OF PLANNING PROCESS

The first step in the planning process began with discussing the hazard mitigation and project development project with the Wayne Benner, City Administrator. Mr. Benner then called a meeting where URS could explain the process to the mayor and selected City Council Members on January 11, 2011. The Mayor subsequently presented the project to the City Council. The Mayor then appointed the City Administrator Wayne Benner as the Planning Team Leader and identified the Planning Team's composition as, Mayor Jim Gould, Councilman Harvey McDonald, and Planning Commission Member Denise Boule. The team scheduled the first planning team meeting for February 15, 2011.

The Planning Team's role was discussed during their first meeting to include: acting as an advocate for the planning process, assisting with gathering information and support for the public

meeting and other public participation opportunities. They then identified resources and City capabilities. There was also a brief discussion about hazards that affect the community such as earthquakes, flood near the City's bridge, tsunami, and severe weather events which are increasing in intensity.

The hazard mitigation planning process was described and participants were asked to help identify hazards that affect the City and to also review the supplied critical facilities list and to identify any missing facilities.

Mr. Galanes, Boutet' Company Inc., assisted the Planning Team with identifying mitigation actions and projects. These projects will then be prioritized to determine the most important for the community while meeting FEMA's strict eligibility criteria. The top project will be developed for The Boutet' Company to prepare a separately Division of Homeland Security and Emergency Management (DHS&EM) funded HMGP Project Grant Application.

In summary, the following five-step process took place from January through April 2011.

1. Organize resources: Members of the Planning Team identified resources, including staff, agencies, and local community members, who could provide technical expertise and historical information needed in the development of the hazard mitigation plan.
2. Assess risks: The Planning Team identified the hazards specific to Thorne Bay, and with the assistance of a hazard mitigation planning consultant (URS), developed the risk assessment for the five identified hazards. The Planning Team reviewed the risk assessment, 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. Subsequently, the Planning Team identified and prioritized the actions to be implemented.
5. Monitor, evaluate, and update the plan: The Planning Team developed a process to ensure the plan was monitored to ensure it was used as intended while fulfilling community needs. The team then developed a process to evaluate the plan to compare how their decisions affected hazard impacts. They then outlined a method to share their successes with community members to encourage support for mitigation activities and to provide data for incorporating mitigation actions into existing planning mechanisms and to provide data for the plans five year update.

4.2 HAZARD MITIGATION PLANNING TEAM

The Planning Team consists of City Administrator and Team Leader Wayne Benner**,** Mayor Jim Gould; City Council Member Harvey McDonald, and Planning Commission Member Denise Boule. The State of Alaska, Division of Homeland Security and Emergency Management (DHS&EM) provided funding and project oversight to The Boutet Co., Inc. for this planning and project development activity.

URS, Boutet's subcontractor, provided HMP development assistance to the Planning Team. Table 4-1 identifies the hazard mitigation Planning Team.

Table 4-1 Hazard Mitigation Planning Team

NAME	TITLE	ORGANIZATION	PHONE
Wayne Benner	City Administrator	City of Thorne Bay	828.3380
Jim Gould	City Mayor	City of Thorne Bay	828.3380
Harvey McDonald	City Council Member	City of Thorne Bay	N/A
Denise Boule	Library Employee	City of Thorne Bay	N/A
Scott Simmons	Hazard Mitigation Planner	URS Corporation	261.9706
Jim Galanes	Planner	The Boutet Co. Inc.	522.6776
Jacques Boutet	Owner Engineer	The Boutet Co. Inc.	522.6776

4.3 PUBLIC INVOLVEMENT & OPPORTUNITY FOR INTERESTED PARTIES TO PARTICIPATE

Table 4-2 lists the community's public involvement initiatives focused to encourage participation and insight for the HMP effort.

Table 4-2 Public Involvement Mechanisms

Mechanism	Description
Newsletter Distribution (February 2011)	The jurisdiction distributed a newsletter in February 2011 describing the upcoming planning activity. The newsletter encouraged the whole community to provide hazard and critical facility information. It was posted at the City and Tribal Offices and the Post Office to ensure everyone was aware of the meeting.
Newsletter Distribution (May 2011)	In May 2011, the jurisdiction distributed a newsletter describing the HMPs availability and present potential HMP projects for review. The newsletter encouraged the whole community to provide comments or input. It was posted at the City and Tribal Offices and the Post Office to ensure everyone was aware of the meeting.
Radio Announcements	
Fliers	
Newspaper articles	
City Website	

On February 15, 2011, a public meeting was held to introduce the hazard mitigation planning project to the community and other interested parties. An invitation was extended to all individuals and entities identified on the project mailing list via a project newsletter describing the planning process and announcing the upcoming public meeting. A newsletter was developed and was either faxed or emailed to relevant academia, nonprofits, and local, state, and federal agencies on January 20, 2011. The newsletter was placed on the DSH&EM website and signs posted throughout the community announcing the public meeting.

During the meeting, the Planning Team led the attending public through a hazard identification and screening exercise. The attendees identified eight hazards: earthquake, erosion, flood, permafrost, severe weather, and wildland fire which periodically impact the City.

Following the hazard screening process, the Planning Team led the attendees through the process of identifying critical facilities in the community. URS also described the specific information needed from the Planning Team and public to complete the risk assessment including the location, value, and population of residents and critical facilities in the community.

After the community asset data was collected by the Planning Team over the spring of 2011, a risk assessment was completed that illustrated the assets that are exposed and vulnerable to specific hazards.

A Planning Team meeting was held on April 28, 2011 to review and prioritize the mitigation actions identified based on the results of the risk assessment. A second newsletter was prepared and delivered on May 10, 2011 describing the process to date, presenting the prioritized mitigation actions, and announcing the availability of the draft HMP for public review and comment.

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, reports, and technical reports into the HMP. The following were reviewed and used as references for the jurisdiction information and hazard profiles in the risk assessment of the HMP for the City:

- *The City of Thorne Bay Comprehensive Plan, 1999: explains the City's land use initiatives and natural hazard impacts.*
- *The City of Thorne Bay's governing ordinances, explains the City's initiatives to protect and guide the population with building siting and safe practices.*
- *The Thorne Bay, Alaska Overall Economic Development Plan, Fiscal Year 2008.*
- *Interim Report Port Development Feasibility Study, September1985. Prepared for the City of Thorne Bay and City of Kasaan. Submitted by QUARDA/ATC, in association with the McDowell Group. Provided information concerning Prince of Wales economic forecasts for roads, ferry, and barge transportation.*
- *Thorne Bay District Coastal management Program, February 2006. Prepared by Rochelle Rollenhagen, Planning Consultant defines the City's coastal, wetlands, and soils.*
- *Thorne Bay Community Emergency Operations Plan, City of Thorne Bay, explains the City's hazard response initiatives.*
- *State of Alaska, Department of Commerce, Community and Economic Development Community Profile, provided historical and demographic information.*
- *State of Alaska Hazard Mitigation Plan, 2010 (SHMP) defines statewide hazards and their potential locational impacts.*

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

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

5.1 OVERVIEW OF A HAZARD ANALYSIS

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

Hazard profiling is accomplished by describing hazards in terms of their nature, history, magnitude, frequency, location, extent, and probability. Hazards are identified through the collection of historical and anecdotal information, review of existing plans and studies, and preparation of hazard maps of the study area. Hazard maps are used to determine the geographic extent of the hazards and 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 §201.6(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 or updated plan include a description of the types of all natural hazards that affect the jurisdiction?
Source: FEMA, July 2008.

For the first step of the hazard analysis, on February 15, 2011 the Planning Team reviewed nine possible hazards that could affect the Prince of Wales Recording District (Southeast Island REAA). They then evaluated and screened the comprehensive list of potential hazards based on a range of factors, including prior knowledge or perception of their threat and the relative risk presented by each hazard, the ability to mitigate the hazard, and the known or expected availability of information on the hazard (see Table 5-1). The Planning Team determined that seven hazards pose a threat to the City: earthquake, flood, ground failure, tsunami, volcanic, severe weather, and wildland fire. These threats range from minor to extreme and each will be defined within their respective hazard profiles. The remaining hazards excluded through the screening process were considered to pose a lower threat to life and property in the City due to the low likelihood of occurrence or the low probability that life and property would be significantly affected.

Table 5-1 Identification and Screening of Hazards

Hazard Type	Should It Be Profiled?	Explanation
Avalanche	No	This hazard does not exist for the City.
Earthquake	Yes	Coastal Zone Management (CZM): The Queen Charlotte Islands Fault is located approximately 100 miles to the west of Thorne Bay. Major earthquakes between magnitude of 5.0 and 7.0 have occurred along this fault between 1899 and 1973. No earthquakes have been recorded directly in Thorne Bay.
Erosion (Coastal, Riverine, Water flow, Wind)	No	Not identified by 2009 USACE Baseline Erosion Assessment City experiences erosion resulting from high wind driven tides during storm surge events. (See Flood Impacts) CMZ states: Erosion can become a problem when soils are disturbed by development such as road building or logging.
Flood	Yes	The Thorne River bridge is the City's Island's choke point. Thorne Bay infrastructure is located on the north side of Thorne Bay. The City's main residential areas are located near Setter Lake and other infrastructure is located near Goose Creek on the south side of Thorne Bay. All essential ground transportation must cross the Thorne River bridge which experiences flooding along each side of the bridge.
Ground Failure: (Landslide, Debris Flow, Permafrost)	Yes	CZM: Where indurated iron pan layers are present, then the mass movement (landslide) potential of the overlying soils is increased and should be considered in planning. Development of steep slopes with this hazard should be avoided. Excessive removal of vegetation or structural overweighting of these areas may also increase the landslide potential. Soils are a primary factor in determining site locations for different types of development. Many soils mapped within the Thorne Bay Coastal District would be classified by the Soil Conservation Service as high risk for urban development.
Tsunami	Yes	This hazard minimally exists for the City. Tsunamis or seismic sea waves generated in the open ocean are not considered as a potential major impact because of Thorne Bay's sheltered location.
Volcanic Hazards	Yes	Potential for ashfall from nearby undersea volcanoes located to the south and southwest of Prince of Wales Island. Island air traffic patterns have historically been impacted by distant volcano eruptions.
Weather (Severe)	Yes	Severe weather events include heavy rain, snow, storm surge, wind and low temperatures. Winds potentially remove or damage roofs and utility lines. However, severe wind exacerbates these weather impacts affecting utilities and the entire population.
Wildfire (Wildland/Urban Interface)	Yes	The City and the surrounding area become very dry in summer months with potential for weather and human caused dry vegetation ignition (i.e., lightning, trash burning, and campfires).

5.3 HAZARD PROFILE

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

DMA 2000 Requirements: Risk Assessment – Profiling Hazards

Profiling Hazards

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

Element

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

Source: FEMA, July 2008.

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

- Nature
- History
- Location
- Extent (to include magnitude and severity)
- Impact (general impacts associated with each hazard are described in the following profiles – detailed impacts to the City's residents and critical facilities are further described in Section 6 as part of the overall vulnerability summary for each hazard)
- Probability of future events

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

Table 5-2 Hazard Probability Criteria

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

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

Table 5-3 Hazard Magnitude/Severity Criteria

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

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

The hazards profiled for the City 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 Earthquake

5.3.1.1 Nature

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

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

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

- **Surface Faulting** (includes later spreads and flow failure) is the differential movement of two sides of a fault at the earth's surface. Displacement along faults, both in terms of length and width, varies but can be significant (e.g., up to 20 feet [ft]), as can the length of the surface rupture (e.g., up to 200 miles). Surface faulting can cause severe damage to linear structures, including railways, highways, pipelines, and tunnels.
- **Liquefaction** occurs when seismic waves pass through saturated granular soil, distorting its granular structure, and causing some of the empty spaces between granules to collapse. Pore water pressure may also increase sufficiently to cause the soil to behave like a fluid for a brief period and cause deformations. Liquefaction causes lateral spreads (horizontal movements of commonly 10 to 15 ft, but up to 100 ft), flow failures (massive flows of soil, typically hundreds of ft, but up to 12 miles), and loss of bearing strength (soil deformations causing structures to settle or tip). Liquefaction can cause severe damage to property.
- **Ground Failure** (Landslides/Debris Flows)occur as a result of horizontal seismic inertia forces induced in the slopes by the ground shaking. The most common earthquake-induced landslides include shallow, disrupted landslides such as rock falls, rockslides, and soil slides. Debris flows are created when surface soil on steep slopes becomes totally saturated with water. Once the soil liquefies, it loses the ability to hold together and can flow downhill at very high speeds, taking vegetation and/or structures with it. Slide risks increase after an earthquake during a wet winter. (Ground Failure will be covered in more detail in Section 5.3.4)

- **Tsunamis:** As an Oceanic Plate is subducted beneath a Continental Plate, it sometimes brings down the lip of the Continental Plate with it. Eventually, too much stress is put on the lip and it snaps back, sending shockwaves through the earth's crust, causing a tremor under the sea, known as an Undersea Earthquake. Factors that affect tsunami generation from an earthquake event include magnitude (generally, a 7.5 magnitude and above), depth of event (a shallow marine event that displaces seafloor), and type of earthquake (thrust as opposed to strike-slip).

The severity of an earthquake can be expressed in terms of intensity and magnitude. Intensity is based on the damage and observed effects on people and the natural and built environment. It varies from place to place depending on the location with respect to the earthquake epicenter, which is the point on the earth's surface that is directly above where the earthquake occurred. The severity of intensity generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. The scale most often used in the U.S. to measure intensity is the Modified Mercalli Intensity (MMI) Scale. As shown in Table 5-4, the MMI Scale consists of 12 increasing levels of intensity that range from imperceptible to catastrophic destruction. Peak ground acceleration (PGA) is also used to measure earthquake intensity by quantifying how hard the earth shakes in a given location. PGA can be measured as acceleration due to gravity (g) (see Table 5-4) (MMI 2006).

Magnitude (M) is the measure of the earthquake strength. It is related to the amount of seismic energy released at the earthquake's hypocenter, the actual location of the energy released inside the earth. It is based on the amplitude of the earthquake waves recorded on instruments, known as the Richter magnitude test scales, which have a common calibration (see Table 5-4).

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

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

(MMI 2011)

5.3.1.2 History

The Planning Team determined that the City has not experienced damaging effects from their historical earthquake events and only needed to be concerned with earthquakes with a magnitude > M 5.0. Table 5-5 lists historical earthquakes from 1973 to present located within 100 miles of the City. These earthquakes did not induce any major damage due primarily to their community structure types and foundation support system designs.

Table 5-5 Historical Earthquakes for Thorne Bay

(Highlight is earthquake of record)

Year	Month	Day	UTC Time (hhmmss.mm)	Latitude	Longitude	Magnitude	Depth (Miles)
1981	01	20	153654.70	55.361	-134.060	3.8	9.3
1997	11	02	051945.88	55.432	-132.356	3.3	0
2004	05	07	074516.17	56.635	-131.640	2.8	3.7
2004	06	28	094947	54.800	-134.250	6.8	12.4
2004	06	29	135354	54.970	-134.250	3.3	12.4
2004	06	30	000402	54.720	-134.150	3.5	12.4
2004	09	07	022104	56.800	-131.370	4.2	3.1
2007	06	09	055043.44	54.462	-132.249	2.8	8.7
2009	11	08	201831.91	54.910	-132.651	3.2	6.2
2009	11	08	205442.74	54.945	-132.789	4.2	8.7
2009	11	08	210122.51	54.950	-132.508	2.5	6.2
2009	11	08	210858.59	54.970	-132.891	2.8	11.8
2009	11	08	215912.40	54.929	-132.785	2.8	6.2
2009	11	08	223606.96	54.940	-132.662	2.6	15.5
2009	11	08	224914.90	54.930	-132.655	2.6	6.2
2009	11	09	005809.16	54.979	-132.744	2.8	9.3
2010	04	06	085443.20	55.280	-133.561	3.6	10.6
2010	06	16	151350.44	56.700	-132.261	2.8	3.1
2010	08	03	000458.48	55.310	-134.597	2.7	13.7

Since 1977, 19 earthquakes have been recorded within a 100 mile radius of the City of Thorne Bay. The average magnitude of these earthquakes is M 3.32. The largest recorded earthquakes within 100 miles of the City measured M 6.8 occurring on June 28, 2004. It did not cause any damage to critical facilities, residences, non-residential buildings, or infrastructure.

Planning Team members stated that Thorne Bay experienced moderate to severe ground shaking from the November 3, 2002 M 7.9 Denali EQ located approximately 750 miles away. No significant damage occurred from this event. However, North America's strongest recorded earthquake occurred on March 27, 1964 in Prince William Sound, measuring M 9.2 and was felt by many residents throughout Alaska. Thorne Bay felt ground motion resulting from this historic event; however, no local damage occurred.

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

Location

The entire geographic area of Alaska, including the City of *Thorne Bay*, is prone to earthquake effects.

The Denali Fault extends south east toward Prince of Wales Island along Chatham Strait and believed to extend to the southern end of Baranof and Kuiu Islands approximately 83 miles north west of Thorne Bay. Several small unnamed faults are located on Prince of Wales Island, Zarembo, Kosciusko, Kuiu, and Heceta islands northwest of Thorne Bay. The City lies approximately 100 miles east of the Queen Charlotte fault system west of the City and is approximately 30 miles northwest of the smaller Tongass Narrows Fault (DGGS 2009).

Of the 19 recorded earthquakes since 1973, only one exceeded M 5.0 (US Geological Survey [USGS] 2007). The epicenter was located 90.5 miles from the City on the Queen Charlotte Fault. Figure 5-1 shows the locations of active and potentially active faults in Alaska.

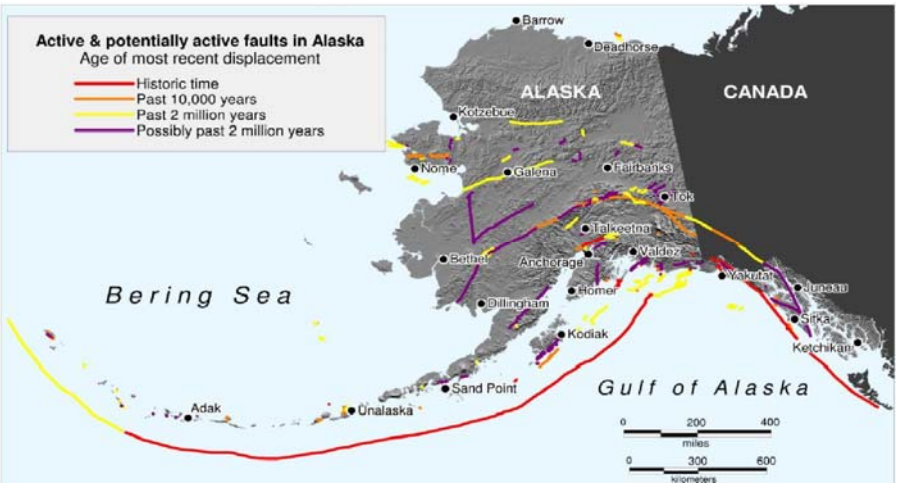

Figure 5-1 Active and Potentially Active Faults in Alaska

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

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

Figure 5-2 depicts known seismic faults on the Prince of Wales Island and the surrounding area.

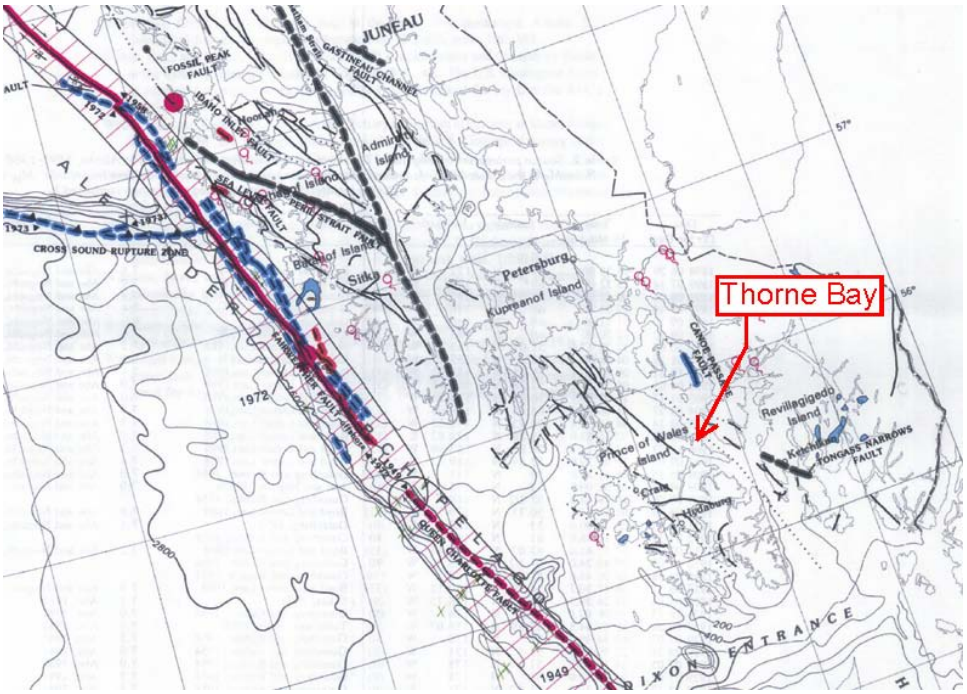

Figure 5-2 Neotechtonic Map of Alaska Image – Prince of Wales Island Area (DGGS 2009)

Extent

Earthquakes felt in the Thorne Bay area have not exceeded M 6.8 in the past 38 years, and damage has not been reported due to an earthquake event.

Based on historic earthquake events and the criteria identified in Table 5-3, the magnitude and severity of earthquake impacts in the City are considered negligible with minor injuries, the potential for critical facilities to be shut down for less than 24 hours, less than 10 percent of property or critical infrastructure being severely damaged, and little to no permanent damage to transportation or infrastructure or the economy.

Impact

The primary earthquake hazard potentially affecting Prince of Wales Island includes ground shaking. The City's secondary seismic hazard concerns include earthquake-induced landslides or other slope failures, and tsunamis.

The City is located in an area that is relatively active with earthquakes centered within 200 miles being felt in the City. The community experiences significant ground movement from earthquakes located along the Denali and Queen Charlotte Faults that may result in infrastructure damage. Moderate shaking may be seen or felt based on past events. Impacts to future populations, residences, critical facilities, and infrastructure are anticipated to remain the same.

Probability of Future Events

The City of Thorne Bay has no official record of significant earthquake activity resulting in damage or injuries. While it is not possible to predict when an earthquake will occur, Figure 5-2 was generated using the USGS Earthquake Mapping model and indicates less

than a 10 percent probability of a M 5.0 or greater earthquake occurring within 10 years and 31 miles of Thorne Bay. However, the brown zone indicate earthquake threats located less than 125 miles from the City. These locations have a 100 percent change of occurring within one year.

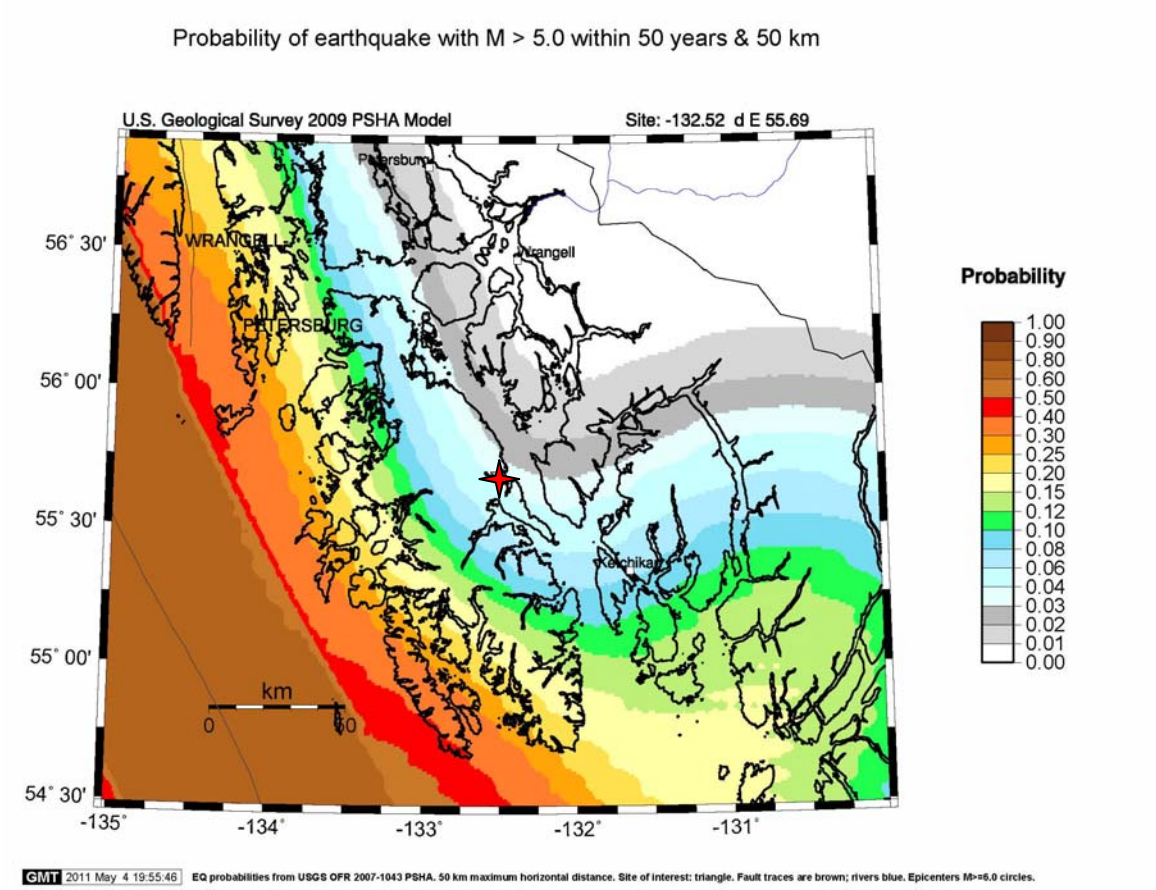

Figure 5-3 Thorne Bay's Earthquake Probability (USGS 2011)

This 2009 shake map is the most current map available for this area which depicts a low earthquake impact probability. However, it is a viable representation to support probability inquiries. According to Peter Haeussler, USGS, Alaska Region:

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

5.3.2 Flood

5.3.2.1 Nature

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

Four primary types of flooding occur in the City including: rainfall-runoff floods; snowmelt floods; ice jam floods; and ice overflow (aufeis) flooding.

Rainfall-runoff Flood

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

Snowmelt Flood

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

Ice Jam Flood

Ice jam floods occur after an ice jam develops; thus, this type of flood can occur any time of the year that a river has ice on it. Ice jams restrict water flow on a river or stream and form during April through June under the following three situations:

- fall freeze up
- midwinter when stream channels freeze forming anchor ice
- spring break-up (i.e., when the existing ice cover is broken into pieces that block flowing water at bridges or other constrictions)

Ice jams commonly develop in areas where the channel slope decreases, becomes shallower, or where constrictions occur such as at bridges, bends in the river, headwaters, and reservoirs. Ice jams frequently impede water along big rivers during spring break-up.

Water levels increase upstream behind the location of the ice jam. The result is flooding of an area by creating a lake-like effect covering a large area. Little damage typically occurs from the water current upstream of the ice jam, but significant damage can result from flooding. However, the downstream effect is very different. As soon as the ice jam is breached there is usually rapid draining of the dammed water. Downstream water levels rise substantially after the ice jam is breached and strong water currents are created, which can cause erosion and other significant damages. Additionally, the rising water causes the ice to float while increased velocities of water move the ice further downstream. The motion of large solid ice blocks is often destructive to natural and material property in the vicinities. When ice jams cause flood events during spring break-up, snowmelt can contribute to the flood. Notable large floods in recent years on the,

Kuskokwim, Koyukuk, and Yukon Rivers (and locally the Porcupine River) were all caused by ice jams and snowmelt.

Ice Overflow (Aufeis) Flood

Aufeis is glaciation or icing of streams and rivers, affecting road surfaces and infrastructure. Aufeis forms during the winter when emerging ground water freezes. Stream glacial flooding occurs when ice forms from the bottom up not from the top down forcing water out of the stream channel. If aufeis occurs on a roadway, it makes travel difficult. For example, the Steese Highway frequently has an aufeis problem in the winter months. In the mid 1980s, several homes in Fox suffered from an aufeis event occurring at the wellhead. The homes flooded 6 ft deep, then froze.

Timing of events

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

5.3.2.2 History

According to the Thorne Bay Coastal Management Program document,

> *"Glacial-fluvial deposits of sorted sand and gravel were deposited along with alluvial deposits at the mouth of the rivers and streams and at beaches. These river and stream deposits have been overlain by finer flood deposits during the last 11,000 years, creating the level terraces along the Thorne River. Deposits of fine sediment from the tidal fluctuation have built the mudflat areas….*
>
> *Obstructions within the Thorne River, such as bridges or log jams, will increase the extent of flooding. Siting of structures near the mouth of the river must be carefully considered to avoid the hazard of extreme high tide levels combined with maximum river flows. A hydrologic study mapping the 100- year flood plain is highly recommended before any development occurs along the Thorne River"* (Thorne Bay 2006).

The USACE Floodplain Management Program report stated,

> *"The City of Thorne Bay has no documented flood events. Wind driven waves cause higher than normal tides, with the only noted damage to the road connecting Thorne Bay to the remainder of Prince William Sound" (USACE 2011).*

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

Location

The Thorne Bay's Planning Team states, the only area with significant flood impacts is the bridge crossing at the Thorne River. This bridge provides access to all of Prince of Wales Island; all freight is transported by barge to Thorne Bay; then transported throughout the Island via ground transportation. All traffic stops when the Thorne River floods at the bridge's location. This is a very critical facility for the entire Island and is subsequently a choke point; vital for the City of Thorne Bay and the Island's survival (Thorne Bay 2011).

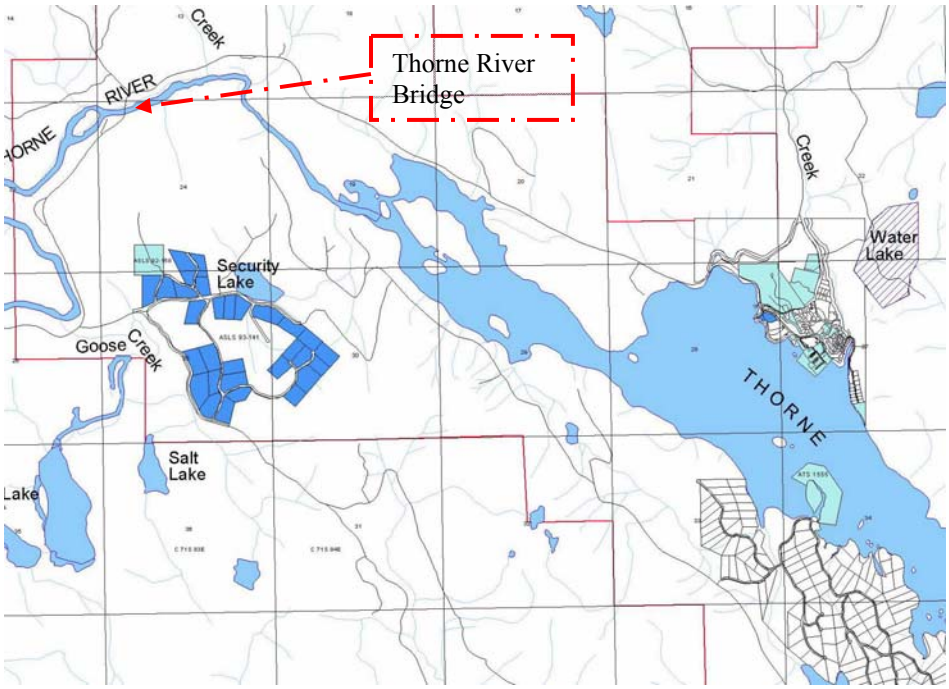

Figure 5-4 Thorne Bay's Flood Impact Area (*Thorne Bay 2011*)

Extent

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

The following factors contribute to riverine flooding frequency and severity:

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

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

Impact

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

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

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

Impacts and problems also related to flooding are deposition and stream bank erosion (erosion is discussed in detail in Section 5.3.2). Deposition is the accumulation of soil, silt, and other particles on a river bottom or delta. Deposition leads to the destruction of fish habitat, presents a challenge for navigational purposes, and prevents access to historical boat and barge landing areas. Deposition also reduces channel capacity, resulting in increased flooding or bank erosion. Stream bank erosion involves the removal of material from the stream bank. When bank erosion is excessive, it becomes a concern because it results in loss of streamside vegetation, loss of fish habitat, and loss of land and property (BKP 1988).

Probability of Future Events

Based on previous occurrences and data contained from the City Local Project Team, there is a 1 in 5 year chance of occurring (1/5=20 percent). History of events is greater than 10 percent but less than or equal to 20 percent likely per year.

5.3.3 Ground Failure (Landslide, Subsidence, Unstable Soils)

5.3.3.1 Nature

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

Landslides are a dislodgment and fall of a mass of soil or rocks along a sloped surface, or for the dislodged mass itself. The term is used for varying phenomena, including mudflows, mudslides, debris flows, rockfalls, rockslides, debris avalanches, debris slides, and slump-earth flows. The susceptibility of hillside and mountainous areas to landslides depends on variations in geology, topography, vegetation, and weather. Landslides may

also be triggered or exacerbated by indiscriminate development of sloping ground, or the creation of cut-and-fill slopes in areas of unstable or inadequately stable geologic conditions.

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

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

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

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

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

- **Complex:** Any combination of landslide types.

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

Permafrost melting (or degradation) occurs naturally as a result of climate change, although this is usually a very gradual process. Thermokarst is the process by which characteristic land forms result from the melting of ice-rich permafrost. As a result of thermokarst, subsidence often creates depressions that fill with melt water, producing water bodies referred to as thermokarst lakes or thaw lakes.

Human induced ground warming can often degrade permafrost much faster than natural degradation caused by a warming climate. Permafrost degradation can be caused by constructing warm structures on the ground surface allowing heat transfer to the underlying ground. Under this scenario, improperly designed and constructed structures can settle as the ground subsides, resulting in loss of the structure or expensive repairs. Permafrost is also degraded by damaging the insulating vegetative ground cover, allowing the summer thaw to extend deeper into the soil causing subsidence of ice-rich permafrost, often leading to creation of thermokarst water bodies. Evidence of this type of degradation can be seen where thermokarst water bodies are abundant in the ruts of an old trail used by heavy equipment (cat trails) or where roads or railroads constructed by clearing and grubbing have settled unevenly. (Subsidence, liquefaction, and surface faulting are described in Section 5.3.1.1)

Seasonal freezing can cause frost heaves and frost jacking. Frost heaves occur when ice forms in the ground and separates sediment pores, causing ground displacement. Frost jacking causes unheated structures to move upwards. Permafrost is frozen ground in which a naturally occurring temperature below 32ºF has existed for two or more years. Permafrost can form a stable foundation if kept frozen but when thawed; the soil weakens and can fail. Approximately 85 percent of Alaska is underlain by continuous or discontinuous permafrost. (DHS&EM 2007)

Indicators of a possible ground failure include:

- Springs, seeps, or wet ground that is not typically wet
- New cracks or bulges in the ground or pavement
- Soil subsiding from a foundation
- Secondary structures (decks, patios) tilting or moving away from main structures
- Broken water line or other underground utility
- Leaning structures that were previously straight
- Offset fence lines

- Sunken or dropped-down road beds
- Rapid increase in stream levels, sometimes with increased turbidity
- Rapid decrease in stream levels even though it is raining or has recently stopped and
- Sticking doors and windows, visible spaces indicating frames out of plumb

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

5.3.3.2 History

The City of Thorne Bay does not have a significant ground failure impact history, however various City plans state a great concern about ensuring all city development and structure are properly sited to avoid slope failure due to soil type.

> *"Erosion can become a problem when soils are disturbed by development such as road building or logging… Road building and infrastructure development is difficult and expensive because of shallow soils, short, high-pitched slopes, and rock outcrops and knolls... Soils are a primary factor in determining site locations for different types of development" (Thorne Bay 2006).*

During the HMP Kickoff meeting, the Project Planning Team reflected comments within their Coastal Management Program, that minimally compacted materials creates severe soil instability during infrastructure development. The City experiences landslides when working with these unstable soils; especially on steep slopes or other locations where vegetation is removed (Thorne Bay 2011).

The Planning Team Members stated "the entire Prince of Wales Island is a relatively young island. The entire island has a very thing vegetative land cover without permafrost deposits. This is supported by the DGGS permafrost map. (Thorne Bay 2011).

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

Location

The City of Thorne Bay's Coastal Management Program states

> *"Development in the Thorne Bay Coastal District is limited due to numerous environmental conditions that include slope, soils, hydrology, and geology. Developers should be encouraged to work within these factors to promote safety and minimize impacts to the natural systems…Soils are a primary factor in determining site locations for different types of development. Many soils mapped within the Thorne Bay Coastal District would be classified by the Soil Conservation Service as high risk for urban development…All potential building or developmental sites should be investigated before development plans are made. Only with a field check can soil information be verified" (Thorne Bay 2006).*

The City does not have permafrost deposits according to the permafrost map completed by the Department of Natural Resources, Division of Geological and Geophysical Survey (DNR/DGGS), the City's Coastal Management Program, and comments received from the Planning Team (Figure 5-10).

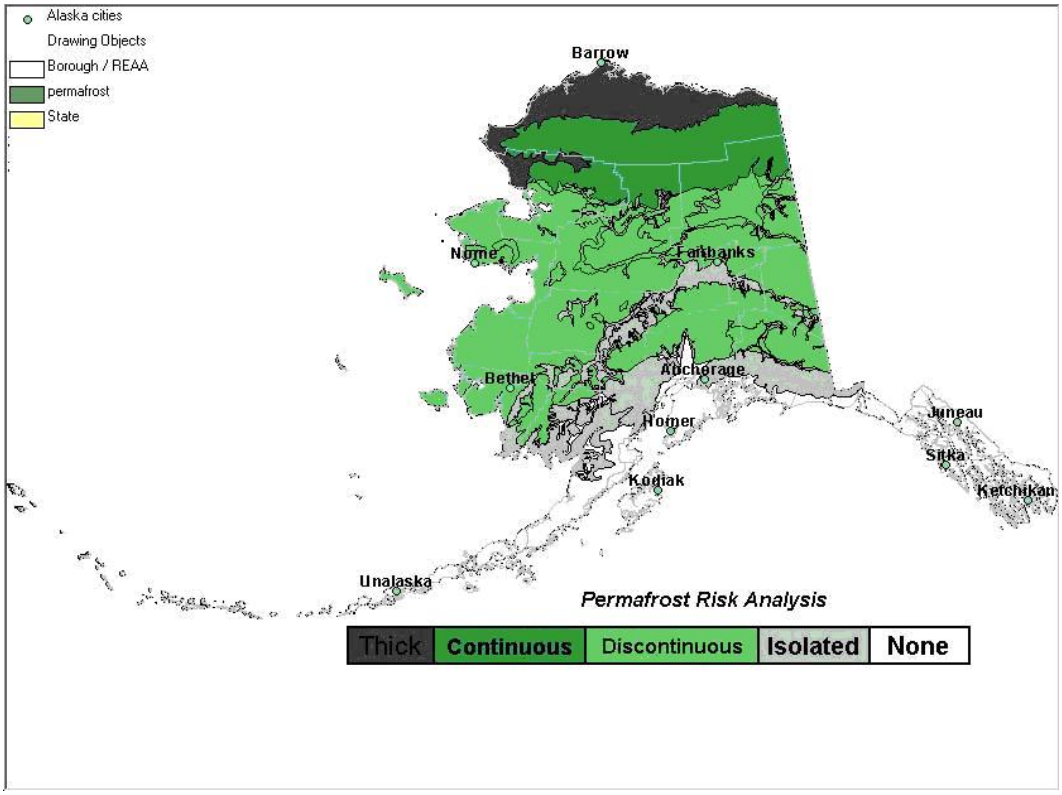

Figure 5-5 DGGS Permafrost Map of Alaska (DHS&EM 2007)

Extent

The geographic extent of landslide events is generally site specific determined by construction, equipment usage, and vegetation removal during construction. The effects depend on what infrastructure will be impacted by ground failure events, as well as the magnitude and force of the moving material. The extent of effects can be limited to one building or property, or an event could have community-wide effects.

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

Based on research and the Planning Team's knowledge of past soils or slope failure events and the criteria identified in Table 5-3, the extent of unstable soil degradation impacts in the City are considered limited. Impacts are most likely to occur in steep slope, unstable soil, and thin vegetative cover locations with little to no warning. The City's 1999 Comprehensive Plan and supporting ordinances require a thorough site investigation before permits are issued for development.

This hazard would not likely cause injuries or death, neither would it shutdown critical facilities and services. However, 10 percent of property could be severely damaged.

Impact

Ground failure events can cause fatalities, injuries, and public and private financial losses to communities in direct and indirect ways. For example, real estate values can decrease and direct costs can be incurred in an effort to prevent or mitigate ground failure events.

Landslides can destroy all types of buildings and infrastructure. Buildings can be swept off foundations; and occupants can be trapped inside buildings as the debris overcomes the structure. Sink holes, landslides, other ground failure forms can damage or block roads, knock out or damage power and other utilities. Ground failure events can also strip forest cover, causing habitat damage and destruction; deposit additional sediment in stream channels, potentially changing channels and stream passages and damage or destroy spawning beds.

Impacts associated with degrading soil structure include surface subsidence, infrastructure, structure, and/or road damage. Ground failure does not pose a sudden and catastrophic hazard but improperly designed and constructed facilities can settle as the ground subsides, resulting in loss of the structure or expensive repairs. Insufficient soil composition restricts use of the ground surface, and affects the location and design of roads, buildings, communities, pipelines, airfields, and bridges. To avoid costly damage to these facilities, careful planning and design in the location and construction of facilities is warranted.

Probability of Future Events

There is no written record defining ground failure impacts for the City. However, the Planning Team stated that soil and slope failure periodically occurs throughout the community. The Planning Team further stated the probability for ground failure occurring follows the criteria in Table 5-2, the probability of future damage resulting from ground failure is unlikely in the next ten years (event has up to 1 in 10 years chance of occurring) as the history of events is less than or equal to 10 percent likely per year (Thorne Bay 2011).

5.3.4 Tsunami and Seiche

5.3.4.1 Nature

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

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

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

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

Tsunamis not only affect beaches that are open to the ocean, but also bay mouths, tidal flats, and the shores of large coastal rivers. Tsunami waves can also diffract around land masses and islands. Since tsunamis are not symmetrical, the waves may be much stronger in one direction than another, depending on the nature of the source and the surrounding geography. However, tsunamis do propagate outward from their source, so coasts in the shadow of affected land masses are usually fairly safe. The seaward side of the Prince of Wales Island and other neighboring islands may receive tsunami impacts from distant sources (WC/ATWC 2011).

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

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

5.3.4.2 History

There is no historical data indicating tsunami events have occurred in Thorne Bay. The general view is that tsunamis affecting Prince of Wales Island occur infrequently. However the City of Klawock located on the seaward side of Prince of Wales Island is reported to have received a slightly increased wave height from the 2006 Indian Ocean tsunami.

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

Location

The State of Alaska, the UAF Geophysical Institute, and the West Coast/Alaska Tsunami Warning Center (WC/ATWC) indicate the City of Thorne Bay has a minimal distant tsunami impact threat due to its isolated location on the lee side of Prince of Wales Island; protected by numerous smaller islands on the seaward side of Prince of Wales Island. However, the City could potentially receive a local source generated tsunami impact (WC/ATWC 2011).

Extent

Based on historic earthquake events, WCATWC information, and the criteria identified in Table 5-3, the magnitude and severity of earthquake impacts in the City are considered negligible with minor injuries, the potential for critical facilities to be shut down for less than 24 hours, less than 10 percent of property or critical infrastructure being severely damaged, and little to no permanent damage to transportation or infrastructure or the economy.

Impact

The UAF GI and the WC/ATWC indicates there is minimal anticipation for distant tsunami impacts however it is possible for the City to be impacted from local generated tsunami impacts (WC/ATWC 2011).

Probability of Future Events

The City of Thorne Bay has no historical record of significant tsunami impacts. While it is not possible to predict when a tsunami will occur, WC/ATWC's (Paul Whitmore) comments, tsunami forecast modeling, and the Table 5-2 indicates a distant source tsunami as well as a locally generated tsunami impact although possible is unlikely to occur, where (event has up to 1 in 10 years chance of occurring) with event history indicating a less than 10 percent probability per year.

5.3.5 Volcanic

5.3.5.1 Nature

Alaska is home to 41 historically active volcanoes stretching across the entire southern portion of the state from the Wrangell Mountains to the far western Aleutian Islands. "Historically active" refers to actual eruptions that have occurred during Alaskan historic time, in general the time-period in which written records have been kept; from about 1760. An average of 1-2 eruptions per year occur 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.

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

There are four general types of volcanoes:

- Lava domes are domes that are formed when lava erupts and accumulates near the vent.
- Cinder cones are cone-shaped and formed by accumulation of cinders, ash, and other fragmented materials originating from an eruption.
- Shield volcanoes are broad, gently sloping volcanic cones of flat domical shape, usually several tens or hundreds of square miles in extent, built chiefly of overlapping and inter-fingering basaltic lava flows.
- Composite or stratovolcanoes are typically steep-sided, symmetrical cones of large dimensions built of alternating layers of lava flows, volcanic ash, cinders, and blocks. Most composite volcanoes have a crater at the summit containing a central vent or clustered group of vents.

Along with the different kinds of volcanoes there are different types of eruptions. The type of eruption is a major determinant of the type of physical results an event will create, and the particular hazards it poses. Six main types of volcano hazards exist including:

- Volcanic gases are made up of water vapor (steam), carbon dioxide, ammonia, as well as sulfur, chlorine, fluorine, and boron compounds, and several other compounds. Wind is the primary source of dispersion for volcanic gases. Life, health, and property can be endangered from volcanic gases within about 6 miles of a volcano. Acids, ammonia, and other compounds present in volcanic gases can damage eyes and respiratory systems of people and animals, and heavier-than-air gases, such as carbon dioxide, can accumulate in closed depressions and suffocate people or animals.
- Lahars are usually created by shield volcanoes and stratovolcanoes and can easily grow to more than 10 times their initial size. They are formed when loose masses of unconsolidated, wet debris become mobilized. Eruptions may trigger one or more lahars directly by quickly melting snow and ice on a volcano or ejecting water from a crater lake. More often, lahars are formed by intense rainfall during or after an eruption since rainwater can easily erode loose volcanic rock and soil on hillsides and in river valleys. As a lahar moves farther away from a volcano, it will eventually begin to lose its heavy load of sediment and decrease in size.
- Landslides are common on stratovolcanoes because their massive cones typically rise thousands of feet above the surrounding terrain, and are often weakened by the very process that created the mountain – the rise and eruption of molten rock (magma). If the moving rock debris is large enough and contains a large content of water and soil material, the landslide may transform into a lahar and flow down valley more than 50 miles from the volcano.
- Lava flows are streams of molten rock that erupt from a vent and move downslope. Lava flows destroy everything in their path; however, deaths caused directly by lava flows are uncommon because most move slowly enough that people can move out of way easily, and flows usually do not travel far from the source vent. Lava flows can bury homes and agricultural land under tens of feet of hardened rock, obscuring landmarks and property lines in a vast, new, hummocky landscape.
- Pyroclastic flows are dense mixtures of hot, dry rock fragments and gases that can reach 50 mph. Most pyroclastic flows include a ground flow composed of coarse fragments and an ash cloud that can travel by wind. Escape from a pyroclastic flow is unlikely because of the speed at which they can move.
- Tephra is a term describing any size of volcanic rock or lava that is expelled from a volcano during an eruption. Large fragments generally fall back close to the erupting vent, while smaller fragment particles can be carried hundreds to thousands of miles away from the source by wind. Ash clouds are common adaptations of tephra.

Ash fall is the most significant volcanic hazard to Dillingham because, unlike other secondary effects of eruptions such as lahars and lava flows, ash fall can travel thousands of miles from the site of the eruption.

Volcanic ash consists of tiny jagged particles of rock and natural glass blasted into the air by a volcano. Ash can threaten the health of people and livestock, pose a hazard to flying jet aircraft, damage electronics and machinery, and interrupt power generation and telecommunications. Wind can carry ash thousands of miles, affecting far greater areas and many more people than other volcano hazards. Even after a series of ash-producing eruptions has ended, wind and human activity can stir up fallen ash for months or years, presenting a long-term health and economic hazard. Aircraft are of special concern because of the disastrous affects volcanic ash can have on airplane engines.

Ash clouds have caused catastrophic failure in airplane engines, most notably in 1989 when KLM Flight 867, a 747 jetliner, flew into an ash cloud from Mt. Redoubt's eruption and subsequently experienced flameout of all four engines. The jetliner fell 13,000 feet before the flight crew was able to restart the engines and land the plane safely in Anchorage. The significant trans-Pacific and intrastate air traffic in Alaska, directly over or near 41 potentially active volcanoes, has necessitated development of a strong communication and warning link between the Alaska Volcano Observatory (AVO), other government agencies with responsibility in aviation management, and the airline and air cargo industry.

5.3.5.2 History

The responsibility for hazard identification and assessment for the active volcanic centers of Alaska falls to the AVO and its constituent organizations (USGS, DNR, and UAF). AVO is in the process of publishing individual hazard assessments for each active volcano in Alaska. As of 2008, published or in-press hazard assessments cover the following volcanoes: Akutan, Aniakchak, Augustine, Emmons Lake, Gareloi, Great Sitkin, Hayes, Iliamna, Kanaga, the Katmai Group, Makushin, Okmok, Pavlof, Redoubt, Shishaldin, Spurr, and Tanaga. Additional reports for Westdahl and Dutton are expected in the future. Each report contains a description of the eruptive history of the volcano, the hazards they pose and the likely effects of future eruptions on populations, facilities, and ecosystems.

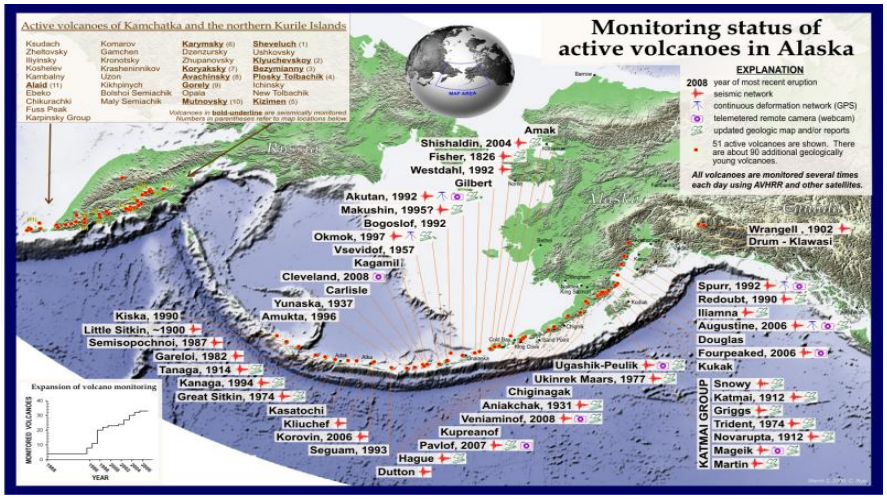

Figure 5-6 Alaska's Monitored Volcanoes (AVO 2008)

Alaska contains 80+ volcanic centers and is at continual risk for volcanic eruptions. The AVO's Catalog of the Historically Active Volcanoes of Alaska states that "Mount Dutton experienced severe volcano-seismic crises in 1984 and 1988 that resulted from the near-surface movement of magma yet did not yield an eruption. Iliamna volcano experienced similar unrest in 1996."

Most of Alaska's volcanoes are far from settlements that could be affected by lahars, pyroclastic flows and clouds, and lava flows; however ash clouds and ash fall have historically caused significant impact on human populations.

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

Although Thorne Bay is far from any active volcanoes, many of the volcanoes in Alaska are capable of producing eruptions that can affect the City. The City of Thorne Bay need only be concerned with significant volcanic ash falls. A large ash plume has the capability of shutting down air, and potentially ferry and barge, operations because tephra is damaging to all engines.

Figure 5-7 1912 Katmai Volcano Impact (USGS 1998)

USGS Bulletin 1028-N explains that Mount Katmai's eruption on June 5, 1912 was up to that point "the greatest volcanic catastrophe in the recorded history of Alaska. More than 6 cubic miles of ash and pumice were blown into the air from Mount Katmai and the adjacent vents in the Valley of Ten Thousand Smokes." The eruption lasted for 3 days. Figure 5- displays the extent of the ash clouds damage path. The USGS Fact Sheet 075-

98, Version 1.0 states, "The ash cloud, now thousands of miles across, shrouded southern Alaska and western Canada, and sulfurous ash was falling on Vancouver, British Columbia, and Seattle, Washington. The next day the cloud passed over Virginia, and by June 17th it reached Algeria in Africa" The photo in Figure 5- shows the extent of the Katmai ash cloud impact area in gray. The Augustine (blue plume), Redoubt (orange plume), and Spurr (yellow plume) were each dwarfed by the Katmai event. "Volcanologist's discovered that the 1912 eruption was actually from Novarupta, not Mount Katmai." (USGS 1998).

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

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

- Mt. Spurr's 1992 eruption brought business to a halt and forced the closure of Anchorage International Airport for 20 hours. Communities 400 miles away reported light dustings of ash. *"Eruptions from Crater Peak on June 27, August 18, and September 16–17, 1992, produced ash clouds (fig. 11) that reached altitudes of 13 to 15 kilometers above sea level. These ash clouds drifted in a variety of directions and were tracked in satellite images for thousands of kilometers beyond the volcano (Schneider and others, 1995). One ash cloud that drifted southeastward over western Canada and over parts of the conterminous United States and eventually out across the Atlantic Ocean (fig. 12) significantly disrupted air travel over these regions but caused no direct damage to flying aircraft" (USGS 2002)*
- In 1992, another eruption series occurred, resulting in three separate eruption events. The first, in June, dusted Denali National Park and Manley Hot Springs with 2 mm of ash – a relatively minor event. In August, the mountain again erupted, covering Anchorage with ash, bringing business to a halt and forcing

officials to close Anchorage International Airport for 20 hours. St. Augustine's 1986 eruption caused a similar disruption in air traffic.

Figure 5-7 displays the air travel routes in the North Pacific, Russia, and Alaska and the active volcanoes which could easily disrupt air travel during significant volcanic eruptions with ash fall events.

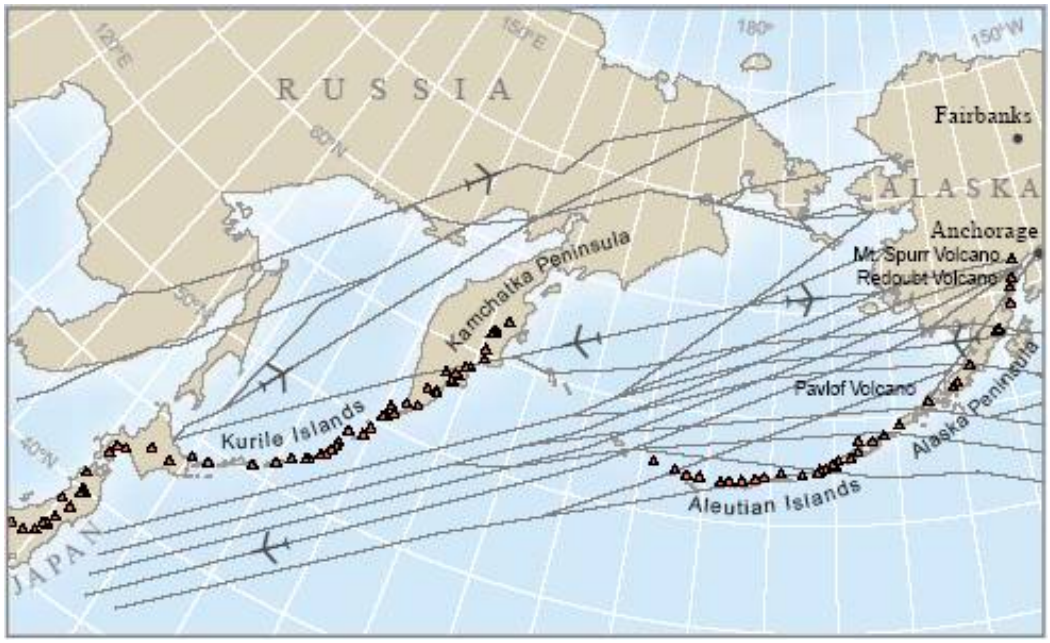

Figure 5-8 North Pacific Air Travel Routes (USGS 2001)

- Small ash clouds from the 2001 eruption of Mt. Cleveland were noted by USGS to have reached Fairbanks. These clouds dissipated somewhere along the line between Cleveland and Fairbanks. A full plume, visible on satellite imagery, was noted in a line from Cleveland to Nunivak Island. No ashfall was noted in Thorne Bay for these events.
- The January 10, 2004 eruption of Augustine volcano resulted in a National Weather Service urgent notification of ash fall in the Bristol Bay area, including Dillingham. No measurable ash was recorded.

Eruptions, explosive and otherwise, of the Augustine Volcano occur every five to ten years. Plumes from at least one Augustine eruption have been caught on camera, from Dillingham, by security cameras in the HUD Housing area. Small, but measurable amounts of ash from these eruptions have fallen within 70 miles of Dillingham.

Ash clouds have prevented air travel between Dillingham and Anchorage, the only connection Dillingham has to a major urban area (Figure 5-5).

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

Location

Figure 5-6 identifies active and inactive volcanoes throughout Alaska. One of the most active volcanoes in proximity to Dillingham is Aniakchak, 150 miles to the south. Potential ashfall from an Aniakchak eruption is shown on Figure 5-7.

Figure x-x depicts Southeast Alaska's Mount Edgecumbe Volcano and three identified sites closest to the City of Thorne Bay with volcanic activity signs, Duncan Canal's volcanic field, Behm Canal-Rudyerd Bay cinder cones, and the Tlevak Strait-Sumez Island's vents, domes, and flows.

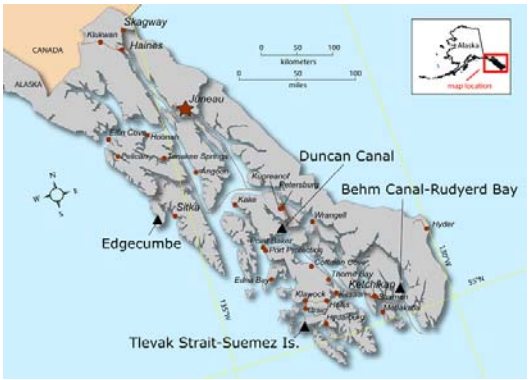

Figure 5- Southeast Area Volcanic Activity Map (AVO 2011)

Figure x-x depicts Southeast Alaska's Mount Edgecumbe Volcano and three identified sites closest to the City of Thorne Bay with volcanic activity signs, Duncan Canal's volcanic field, Behm Canal-Rudyerd Bay cinder cones, and the Tlevak Strait-Sumez Island's vents, domes, and flows

Extent

The effects associated with volcanism include severe blast effects, turbulent clouds of ash and gases, lightning discharge, volcanic mudflows, pyroclastic flows, corrosive rain, flash flood, outburst floods, earthquakes, and tsunamis. Some of the results of these activities have been ash fallout in various communities, disruption of air traffic, road transportation, and maritime activities.

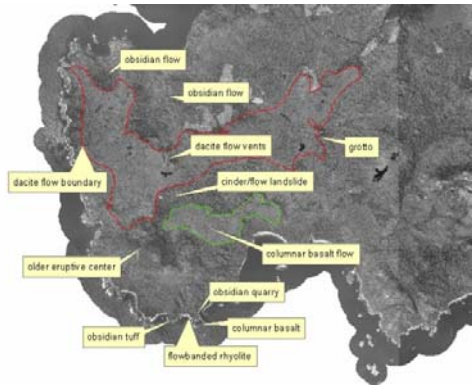

Figure 5- Suemez Island Volcanic Features

In the event of a massive eruption of Aniakchak, Dillingham might receive some ash fall. A tsunami is possible if the eruption included a massive, high speed pyroclastic flow into Bristol Bay.

A much more likely hazard to Dillingham would result from severe volcanic activity elsewhere. Prolonged disruption of air-traffic would disrupt the town's supplies of food, medicine, and medivac services to a full service hospital.

A massive eruption anywhere on earth, such as Tambora in 1815, could severely effect global climate, radically changing Dillingham's (and everyone else's) risk from weather events for weeks, months or years.

Based on actual impacts of historic volcanic activity and the criteria identified in Table 5-3, the magnitude and severity of impacts in the City of Dillingham are considered negligible with minor injuries, the potential for critical facilities to be shut down for more than 24 hours, less than 10% of property or critical infrastructure being severely

damaged, and little to no permanent damage to transportation or infrastructure or the economy.

Impact

An ash fall like the one experienced at Kodiak Island in 1902 would undoubtedly be devastating to the City of Dillingham. Even if no direct impacts of an eruption were to affect Dillingham, the city might still feel the strain on resources should other hub communities be significantly affected by volcanic eruption. An eruption of significant size in southcentral Alaska will certainly affect air routes, which in turn affects the entire state.

Human impacts of a volcanic eruption include respiratory problems from airborne ash, displaced persons/ lack of shelter, and personal injury. Other potential impacts include general property damage (electronics and unprotected machinery), structural damage from ash loading, state/regional transportation interruption, loss of commerce, and contamination of water supply.

These impacts can range from the inconvenient – a few days of no air traffic – to the disastrous – heavy, debilitating ash fall throughout the state, forcing the community to be completely self-sufficient.

Probability of Future Events

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

Based on the criteria identified in Table 5-2 and information presented in the SHMP, it is possible for a volcanic eruption to occur within the next ten years. Vulnerability depends on the type of activity and current weather, especially wind patterns.

5.3.6 Weather (Severe)

5.3.6.1 Nature

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

Heavy and Drifting Snow

Heavy snow generally means snowfall accumulating to four inches or more in depth in 12 hours or less or six inches or more in depth in 24 hours or less. Drifting is the uneven

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

Freezing Rain/Ice Storm

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

Extreme Cold

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

High Winds

High winds occur in Alaska when there are winter low-pressure systems in the North Pacific Ocean and the Gulf of Alaska. Alaska's high wind can equal hurricane force but fall under a different classification because they are not cyclonic nor possess other characteristics of hurricanes. In Alaska, high winds (winds in excess of 60 mph) occur rather frequently over the coastal areas along the Bering Sea and the Gulf of Alaska.

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

(NWS 2011)

5.3.6.2 History

Table 5-7 lists the National Weather Service's major storm events for Thorne Bay's Weather Zone. Each weather event may not have specifically impacted the City but they were listed due to the City's close proximity to listed communities or by location within the identified zone.

Table 5-7 Severe Weather Events

Location(s)	Date(s)	Event	Description
Southeast Island	12/5/1985	Extreme Cold	Cold weather precipitated catastrophic failure of the city water system. The Governor's disaster declaration provided emergency assistance to restore water service and long-time recovery assistance (State Disaster: $258,512.00)
Southeast Island	2/3/1986	Technological, Economic	Collapse of a public bridge isolated residents in sections of the village. DES provided public assistance to replace the bridge (State Assistance: $11,778.00)
Statewide	1/28/89	Extreme Cold	Communities suffering adverse effects of a record breaking cold spell, with temperatures as low as -85 degrees. The State conducted a wide variety of emergency actions, which included: emergency repairs to maintain & prevent

Table 5-7 Severe Weather Events

Location(s)	Date(s)	Event	Description
			damage to water, sewer & electrical systems, emergency resupply of essential fuels & food, & DOT/PF support in maintaining access to isolated communities. (Federal declared disaster: Statewide-$1,319,656.00)
Prince of Wales Island	10/29/93	Rain, Landslide	Funds were made available through emergency highway funding assistance to all roads on Prince of Wales Island eligible under the Department of Transportation ICTEA provision due to heavy rains and numerous mud slides.

(NWS 2011, DHS&EM 2010)

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

Location

The City experiences periodic severe weather impacts. The National Weather Service has continued to modify their system for assigning weather zones to facilitate and more accurately confine weather patterns to relevant geographic areas. Consequently the data in Table 5-7 reflects different zone numbering patterns and should be used to depict weather events that have historically impacted the area; some of which may not have impacted the City s as severely as other areas within the same zone.

Extent

The entire City is equally vulnerable to the effects of severe weather. Winter conditions and annual rain impacts for the area can be significant with approximately 120 inches of precipitation and 40 inches of snow annually. Severe wind storms coupled with high tides are of most concern for the City. Wind speed can exceed 45 mph; and extreme low temperatures fall between 0 and 32ºF.

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

Impact

The intensity, location, and the land's topography influence the impact of severe weather conditions on a community.

Freezing rain coupled with freezing temperatures and severe wind can immobilize a community by bringing transportation to a halt. Airports and roadways are impacted, even closed completely, stopping the flow of supplies and disrupting emergency and medical services. Accumulations of ice can cause knock down trees and power lines, damage light aircraft and sink small boats. A quick thaw after a freezing rain can cause substantial surface flooding. The cost of repairing damages and the loss of business can have severe economic impacts on the City.

Injuries and deaths related to winter storms and storm surge usually occur as a result of vehicle and boating accidents and falling trees and utility outages. Casualties also occur due to overexertion while and hypothermia caused by overexposure to the cold weather.

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

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

Probability of Future Events

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

5.3.7 Wildland Fire

5.3.7.1 Nature

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

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

- **Topography:** 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. The risk of fire is increased significantly during periods of prolonged drought as the moisture content of both living and dead plant matter decreases. The fuel load continuity, both horizontally and vertically, is also an important factor.

- **Weather:** The most variable factor affecting wildland fire behavior is weather. Temperature, humidity, wind, and lightning can affect chances for ignition and spread of fire. Extreme weather, such as high temperatures and low humidity, can lead to extreme wildland fire activity. By contrast, cooling and higher humidity often signal reduced wildland fire occurrence and easier containment.

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

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

5.3.7.2 History

Wildland fires have not been documented within the boundaries of the City; however, wildland fires have occurred in the City's vicinity. The Alaska Interagency Coordination Center (AICC) maintains a website (http://fire.ak.blm.gov/aicc.php) to consolidate Alaska's wildland fire information. Information in Table 5-8 and Figure 5-12 were obtained from this site.

Over 120 wildland fires occurred within 50 miles of the City. Table 5-8 lists eight wildfires that exceeded 26 acres burned for the most recent 70 year historical period (i.e., from 1941 to 2011).

Table 5-8 Wildfire Locations Since 1939 within 50 Miles of the Thorne Bay

Fire Name	Fire Year	Estimated Acres	Latitude	Longitude	Specific Cause
Mill	1998	118	55.66667	-132.6	Other
Copper Mountain	1997	46	55.23333	-132.65	Slash Burn
Smith Cove	1993	127	55.5	-132.333	Equipment
Sunny Hay Fire	1993	30	55.5	-133.167	Other
032013	1990	320	55.5	-132.95	Other
932009	1989	475	55.05	-132.417	Man
N. Thorne	1989	100	55.66667	-132.667	Man
Bay Log	1958	26	55.8	-131.467	Debris Burning

(AICC 2011)

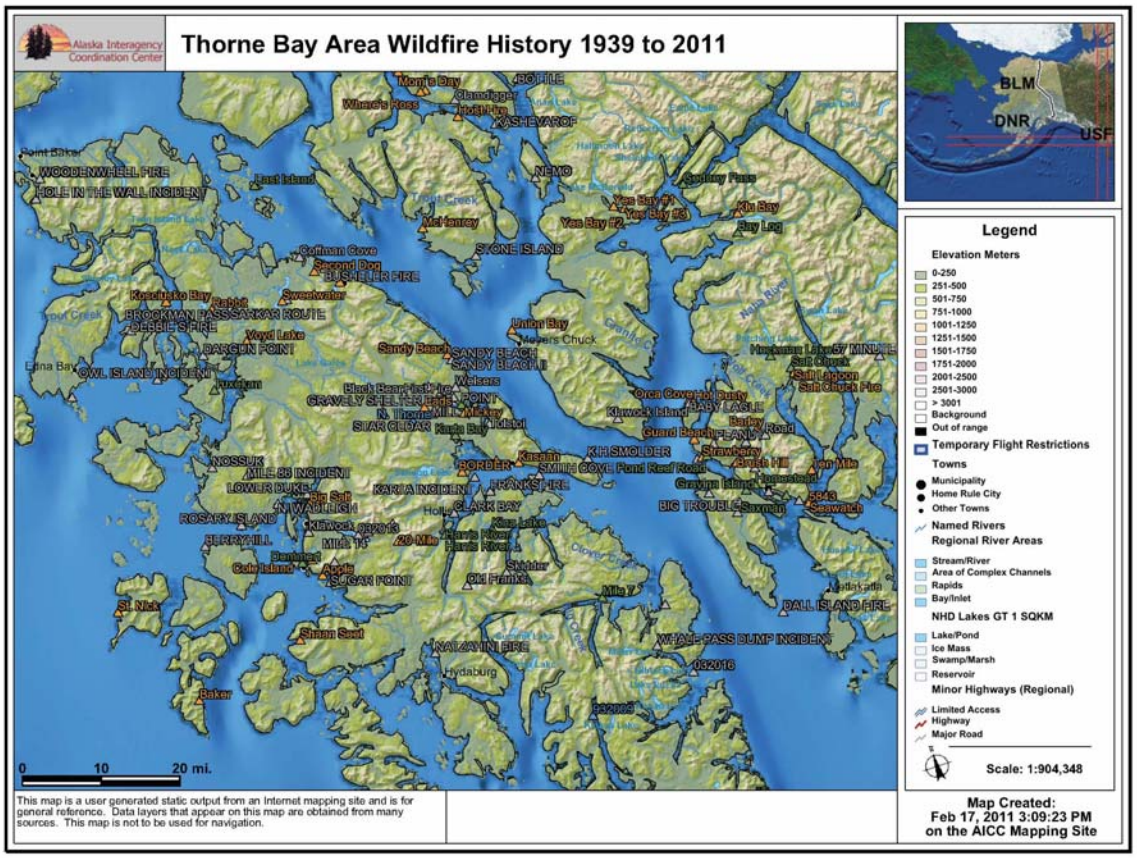

Figure 5-5 Thorne Bay's Historical Wildfires (AICC 2011)

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

Location

Under certain conditions wildland fires may occur in any area with combustible fuel sources adjacent to or within the City of Thorne Bay. Since fuels data is not readily available, for the purposes of this plan, all areas outside City limits are considered to be vulnerable to wildland fire impacts. Since 1939, 149 wildland fire events have occurred within 50 miles of the City (Figure 5-11).

Figure 5-5 historic fire locations and 5-6 depicts the City's critical facilities and their relation to the City's Wildland fire threat.

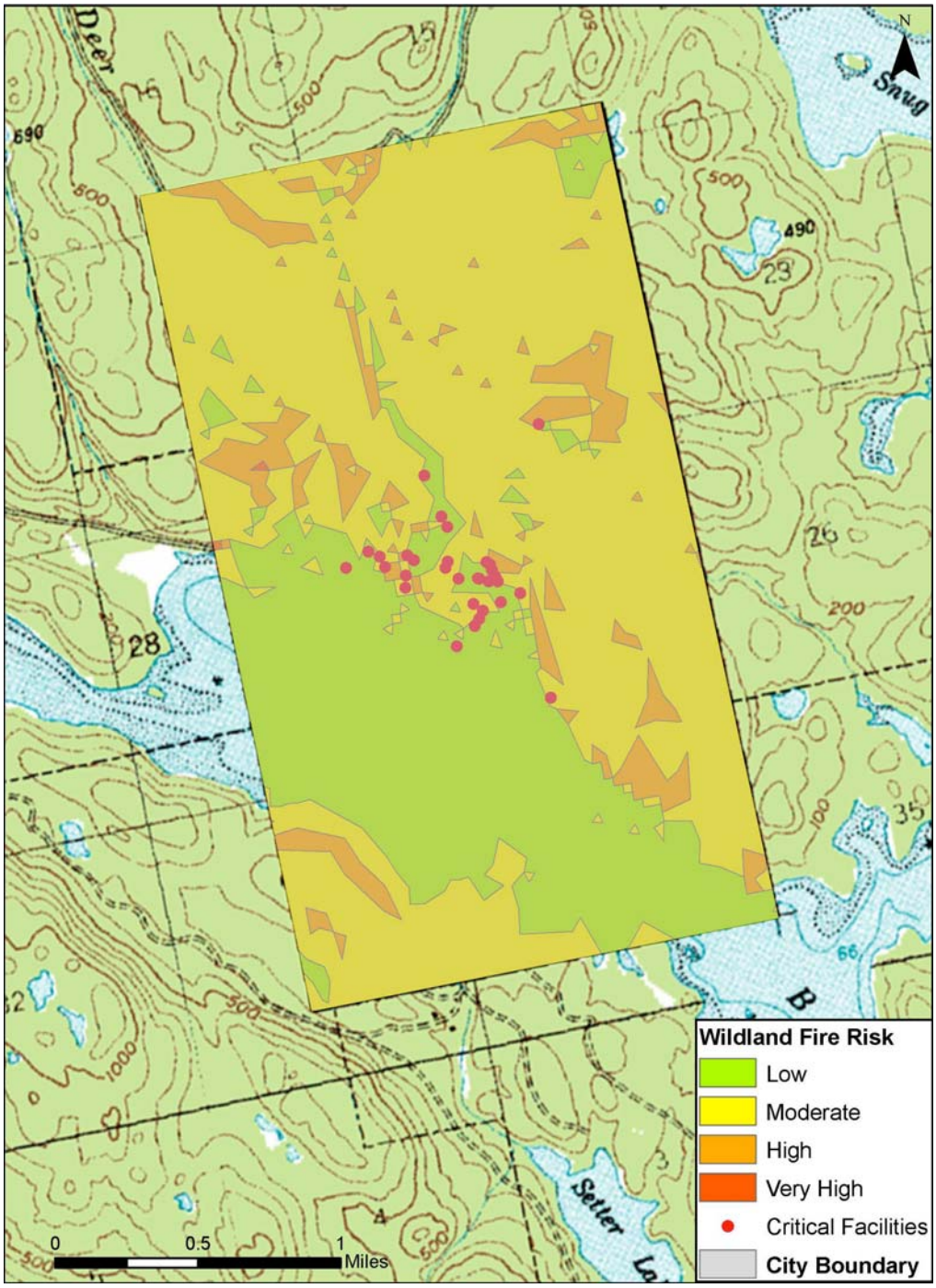

Figure 5-6 Thorne Bay's Wildland Fire Risk

Extent

Generally, fire vulnerability dramatically increases in the late summer and early fall as vegetation dries out, decreasing plant moisture content and increasing the ratio of dead

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

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

An average of 155 acres burned within 50 miles of the City during each of the eight wildland fire events over the 72 year historic period identified in Table 5-8. Recent wildland fires appear to burn much smaller acreage per event. This may be due to the fact that the State's Division of Forestry (DOF) much more efficiently manage wildland fires using a four tiered suppression methodology based on infrastructure criticality while using more modern available resources as the respond to wildland fires which potentially threaten populated areas (DOF 2009).

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

Impact

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

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

Probability of Future Events

Fire is recognized as a critical feature of the natural history of many ecosystems. It is essential to maintain the biodiversity and long-term ecological health of the land. The role of wildland fire as an essential ecological process and natural change agent has been incorporated into the fire management planning process and the full range of fire management activities is exercised in Alaska, to help achieve ecosystem sustainability, including its interrelated ecological, economic, and social consequences on firefighters,

public safety and welfare; natural and cultural resources threatened; and the other values to be protected dictate the appropriate management response to the fire. In Alaska, the natural fire regime is characterized by a return interval of 50 to 200 years, depending on the vegetation type, topography, and location. Recorded wildland fires occurring within 50 miles of the City have an average recurrence rate of approximately 2.5 years.

Based on the history of wildland fires in the Thorne Bay area applying the criteria identified in Table 5-2, it is possible a wildland fire event will occur in the next five years. The event has up to 1 in 5 years chance of occurring and the history of events is greater than 10 percent but less than or equal to 20 percent likely each year.

This section provides an overview of the vulnerability analysis and describes the five specific steps: asset inventory, methodology, data limitations, and exposure analysis for current assets, and areas of future development.

6.1 OVERVIEW OF A VULNERABILITY ANALYSIS

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

1. Asset Inventory
2. Methodology
3. Data Limitations
4. Exposure Analysis For Current Assets
5. Areas of Future Development

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

- A summary of the community's vulnerability to each hazard that addresses the impact of each hazard on the community.

DMA 2000 Requirements: Risk Assessment, Assessing Vulnerability, Overview

Assessing Vulnerability: Overview

Requirement §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

Element

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

Source: FEMA, July 2008.

- Identification of the types and numbers of RL properties in the identified hazard areas.

DMA 2000 Requirements: Risk Assessment, Assessing Vulnerability, Addressing Repetitive Loss Properties

Assessing Vulnerability: Addressing Repetitive Loss Properties

Requirement §201.6(c)(2)(ii): [The risk assessment] must also address National Flood Insurance Program (NFIP) Insured structures that have been repetitively damaged floods.

Element

- Does the new or updated plan describe vulnerability in terms of the types and numbers of repetitive loss properties in the identified hazard areas?

Source: FEMA, July 2008.

- An identification of the types and numbers of existing vulnerable buildings, infrastructure, and critical facilities and, if possible, the types and numbers of vulnerable future development.

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

Assessing Vulnerability: Identifying Structures

Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

Element

- Does the new or updated 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 or updated 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, July 2008.

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

DMA 2000 Recommendations: Risk Assessment, Assessing Vulnerability, Estimating Potential Losses

Assessing Vulnerability: Estimating Potential Losses

Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate.

Element

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

Source: FEMA, July 2008.

6.2 VULNERABILITY ANALYSIS: SPECIFIC STEPS

6.2.1 Asset Inventory

Asset inventory is the first step of a vulnerability analysis. Assets that may be affected by hazard events include population (for community-wide hazards), residential buildings (where data is available), and critical facilities and infrastructure. The assets and associated values throughout the City of Thorne Bay are identified and discussed in detail in the following sections.

6.2.1.1 Population and Building Stock

Population data for the City were obtained from the 2000 U.S. Census. The City's total population for 2000 was 557 and 2010 DCCED/DCRA data reported a population of 471 (Table 6-1).

Table 6-1 Estimated Population and Building Inventory

Population		Residential Buildings	
2000 Census	DCCED 2010 Data	Total Building Count	Total Value of Buildings[1]
557	471	327	$48,657,600

Sources: The City of Thorne Bay, U.S. Census 2000, and 2009 DCCED/DCRA Certified population data.

[1] Average structural value of all single-family residential buildings is $148,800 per structure.

Estimated replacement values for those structures, as shown in Table 6-1, were obtained from the 2000 U.S. Census, and DCCED/DCRA. A total of 327 single-family residential buildings were considered in this analysis. However the City stated that residential replacement values are generally understated as the cost for materials, shipping, and labor exceed the US Census determined value.

6.2.1.2 Repetitive Loss Properties

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

RL properties have had at least two $1,000 claims within any 10-year period since 1978.

Severe Repetitive Loss (SRL) properties are most at risk for repeat flooding. These properties include every property that has experienced: four or more separate building and content claims since 1978 each exceeding $5,000 with cumulative claims exceeding $20,000; or at least two separate building claims with cumulative losses exceeding the value of the main living structure.

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

6.2.1.3 Existing Critical Facilities and Infrastructure

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

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

The total number of critical facilities is listed in Table 6-2.

Table 6-2 Thorne Bay's Critical Facilities

Facility Type	Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood	Ground Failure	Tsunami	Volcanic	Weather (Severe)	Wildland Fire (Wildland/Urban Interface)
Government	10	City Hall (and Health Clinic)	120 Freeman Drive	N/A	N/A	$1,200,000	W1	X		X		X	X	X
	25	US Forest Service Thorne Bay Ranger District HQ	US Forest Service Drive	N/A	N/A	$2,500,000	W1	X		X		X	X	X
	1	US Post Office (and The Port)	Lakeshore Drive	55.686712	-132.520457	$700,000	W1	X		X	X	X	X	X
Transportation	0	Float Plane landing sites (main harbor)	Harbor Road	55.6829	-132.5246	$280,000	AFO	X		X	X	X	X	X
	0	Float plane landing sites (the Port)	Lake Shore Drive	55.6879	-132.5328	$280,000	AFO	X		X	X	X	X	X
	1	Harbor, top of ramp, (1989)	Harbor Road	55.6837	-132.52269	$506,025		X		X	X	X	X	X
	3	Shipping Container / Oil Dock (East)	Lakeshore Drive	55.684012	-132.522145	$500,000	PEQ1	X		X	X	X	X	X
	0	Davidson Landing Dock	Ron's Road	N/A	N/A	$900,000		X		X	X	X	X	X
	15	US Forest Service Thorne Bay Maintenance Shop	Federal Way	N/A	N/A	$250,000	S2L	X		X		X	X	X
Emergency Response	0	Thorne Bay Volunteer Fire	Davidson Landing	55.6848	-132.5224	$150,000	W1	X		X	X	X	X	X

Table 6-2 Thorne Bay's Critical Facilities

Facility Type	Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood	Ground Failure	Tsunami	Volcanic	Weather (Severe)	Wildland Fire (Wildland/Urban Interface)
		Department												
	10	Emergency Services Building	Freeman Drive	55.686	-132.5215	$400,000	S2L	X		X		X	X	X
	1	VPSO Office	Freeman Drive	N/A	N/A	$150,000	W1	X		X		X	X	X
Education	N/A	SE Island Correspondence School	N/A	55.685898	-132.519953	N/A	N/A	X		X		X	X	X
	100	Thorne Bay School (& School District Admin.)	1010 Sandy Beach Road	55.77317	-132.60917	$12,000,000	S2L	X		X		X	X	X
	2	School Maintenance Shop	Rainy Lane	N/A	N/A	$500,000	S2L	X		X		X	X	X
	0	South East Island School District Bldg. (Old)	Barge Facility anchored in Thorne Bay	N/A	N/A	$1,200,000	W1	X		X		X	X	X
Medical Care	3	Health Clinic (& City Office)	120 Freeman Drive	N/A	N/A	N/A	W1	X		X		X	X	X
Community	2	Non-denominational Church (Church of Thorne Bay?)	Shore Line Drive	55.686193	-132.523207	$600,000	W1	X		X	X	X	X	X
	1	Thorne Bay Baptist Church	Sandy Beach Road	N/A	N/A	$500,000	Wood	X		X		X	X	X
	1	St. John Catholic Church	Shore Line Drrive	N/A	N/A	$50,000	Wood	X		X	X	X	X	X

Table 6-2 Thorne Bay's Critical Facilities

Facility Type	Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood	Ground Failure	Tsunami	Volcanic	Weather (Severe)	Wildland Fire (Wildland/Urban Interface)
	0	Civic Center (School Gym)	Sandy Beach Road	55.685651	-132.519836	$250,000	S2L	X		X		X	X	X
	25	Community Club (Bay Chalet)	Sandy Beach Road	55.688865	-132.523235	$1,200,000	W1	X		X		X	X	X
	N/A	Community Recreation Room	N/A	55.685753	-132.520632	N/A	W1	X		X		X	X	X
	0	Community Storage Shed	Sandy Beach Road	55.686895	-132.527719	$60,000	W1	X		X		X	X	X
	8	The Port	Lakeshore Drive	N/A	N/A	$700,000	W1	X		X	X	X	X	X
	2	Library	Freeman Drive	55.686256	-132.520162	$100,000	MH	X		X		X	X	X
	3	Alaska Laser Craft/ Tongas Credit Union/Island Newspaper Offices	Willow Drive	55.685982	-132.521395	$300,000	W1	X		X		X	X	X
	0	Baseball Field	Sandy Beach Road	55.689416	-132.523529	$187,824		X		X		X	X	X
	8	RV Park	Sandy Beach Road	N/A	N/A	$29,010		X		X		X	X	X
	2	Service Station / Maintenance Shop	Lakeshore Drive	55.688454	-132.530513	$450,000	W1	X		X	X	X	X	X
	2	Tracys Heavy Equipment Repair	Lakeshore Drive	55.686319	-132.527993	$600,000	W1	X		X	X	X	X	X
	15	Thorne Bay Market	Lakeshore Drive	55.686551	-132.520197	$1,000,000	S2L	X		X	X	X	X	X

Table 6-2 Thorne Bay's Critical Facilities

Facility Type	Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood	Ground Failure	Tsunami	Volcanic	Weather (Severe)	Wildland Fire (Wildland/Urban Interface)
	10	The Tackle Shop	Lakeshore Drive	55.684844	-132.518126	$500,000	W1	X		X	X	X	X	X
	3	Teacher Housing	Rainy Lane	55.687136	-132.523824	$100,000	MH	X		X		X	X	X
	3	Teachers Housing	Rainy Lane	55.686866	-132.524117	$100,000	MH	X		X		X	X	X
	50	US Forest Service Thorne Bay Residential Complex (24 units@$250K per unit)	Federal Way	N/A	N/A	$6,000,000	W2	X		X		X	X	X
Roads	0	Roads (Community) (36 miles 500,000 / mile)	N/A	N/A	N/A	$18,500,000	HRD2	X		X		X	X	X
	0	Bay View Drive	N/A	N/A	N/A		HRD2			X				
	0	Bypass Road	N/A	N/A	N/A		HRD2			X				
	0	Deer Creek Lane	N/A	N/A	N/A		HRD2			X				
	0	Charlie Brown Street	N/A	N/A	N/A		HRD2			X				
	0	Federal Way	N/A	N/A	N/A		HRD2	X		X		X	X	X
	0	Freeman Drive	N/A	N/A	N/A		HRD2			X				
	0	Finney Drive	N/A	N/A	N/A		HRD2			X				
	0	Lake Shore Drive	N/A	N/A	N/A		HRD2	X		X		X	X	X
	0	Harbor Road	N/A	N/A	N/A		HRD2	X		X		X	X	X
	0	Hemlok Loop	N/A	N/A	N/A		HRD2	X		X		X	X	X
	0	Kasaan Road	N/A	N/A	N/A		HRD2	X		X		X	X	X

Table 6-2 Thorne Bay's Critical Facilities

Facility Type	Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood	Ground Failure	Tsunami	Volcanic	Weather (Severe)	Wildland Fire (Wildland/Urban Interface)
	0	Rainy Lane	N/A	N/A	N/A		HRD2	X		X		X	X	X
	0	Ron's Roads	N/A	N/A	N/A		HRD2	X		X		X	X	X
	0	Sandy Beach Road	N/A	N/A	N/A		HRD2	X		X		X	X	X
	0	Scenic View Drive	N/A	N/A	N/A		HRD2			X				
	0	Shoreline Drive	N/A	N/A	N/A		HRD2	X		X	X	X	X	X
	0	South Thorne Bay Road	N/A	N/A	N/A		HRD2	X		X		X	X	X
	0	Spruce Lane	N/A	N/A	N/A		HRD2			X				
	0	Svend's Drive South	N/A	N/A	N/A		HRD2			X				
	0	Svend's Drive South	N/A	N/A	N/A		HRD2			X				
	0	Thorne Bay Highway (HWS) State owned/maintained	N/A	N/A	N/A		HRD2	X		X		X	X	X
	0	US Forest Service Drive	N/A	N/A	N/A		HRD2	X		X		X	X	X
	0	Willow	N/A	N/A	N/A		HRD2	X		X		X	X	X
	0	Wolverine Court	N/A	N/A	N/A		HRD2			X				
Bridge	0	Thorne Bay River Bridge (State)	Thorne Bay Hwy	N/A	N/A	$2,500,000	Precast concrete	X	X	X		X	X	X
	0	Deer Creek Bridge	Lakeshore Drive	55.684363	-132.521675	$800,000	1- Steel Continuous	X	X	X	X	X	X	X

Table 6-2 Thorne Bay's Critical Facilities

Facility Type	Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood	Ground Failure	Tsunami	Volcanic	Weather (Severe)	Wildland Fire (Wildland/Urban Interface)
Utilities	0	Bulk Fuel Facility Fuel Storage Tanks (>500gal)	N/A	55.687532	-132.529355	N/A	OTF	X		X		X	X	X
	0	Propane Distribution Center Fuel Storage Tanks (>500gal)	N/A	55.688092	-132.529647	N/A	NGP	X		X		X	X	X
	0	Bayview Fuel & Tire Fuel Storage Tanks (2,000 gals)	Lakeshore Drive	N/A	N/A	$250,000	OTF	X		X	X	X	X	X
	0	The Port Fuel Storage Tanks (3,000 gals)	Lakeshore Drive	N/A	N/A	$212,000	N/A	X		X	X	X	X	X
	0	Thorne Bay Electrical Facility Fuel Storage Tanks	Lakeshore Drive	N/A	N/A	$100,000	N/A	X		X	X	X	X	X
	0	Generator	N/A	55.684591	-132.519964	N/A	EPPS	X		X		X	X	X
	0	Thorne Bay Landfill Class III /Bailer (permit: SWPO00119)	Kasaan Road	55.69	-132.559963	$4,577,782	S2L	X		X		X	X	X
	1	Potable Water (Treatment Plant)	Sandy Beach Road	55.69161	-132.52425	$1,500,000	PWTM	X		X		X	X	X
	0	Water Storage Tank	Sandy Beach Road	N/A	N/A	$800,000	PSTS	X		X		X	X	X

Table 6-2 Thorne Bay's Critical Facilities

Facility Type	Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood	Ground Failure	Tsunami	Volcanic	Weather (Severe)	Wildland Fire (Wildland/Urban Interface)
	0	Water Lake (Reservoir)	Sandy Beach Road	55.69294	-132.51339	$50,000	N/A	X		X		X	X	X
	0	Wastewater Collection and Treatment Plant	Lakeshore Drive	55.6794	-132.5174	$3,200,000	WWTS	X		X		X	X	X
	0	Water and Waste Water Piping	Community-wide	N/A	N/A	$8,000,000	WWP1	X		X		X	X	X
	1	ACS Telephone	Sandy Beach Road	55.687573	-132.526739	$50,000	CBO	X		X		X	X	X
	1	Alaska Power and Telephone (AP&T) Utility (425-kw, a 650-kw, and a back-up 325-kw)	N/A	N/A	N/A	$710,114	EPPS	X		X		X	X	X
Total Occ.	309				**Total Estimated Damages:**	$74,792,755								

*DCRA 2009 Pop: 471 or Number of residents based on Census average of 2.54 per household.

** Value of residential structures based on 2000 Census data is 327 structures with $148,800 average cost. City of Thorne Bay estimates average structure replacement cost at approximately $225,000.

*** Value of Critical Facilities (and Occupancy) based on information provided by the City for each structure.

(Thorne Bay 2011, DHS&EM 2010b)

6.2.1.4 Future Critical Facilities and Infrastructure

Immediate plans for future development in the City includes potentially constructing a new Biomass wood boiler, completing a comprehensive water, sewer and solid waste study to evaluate existing infrastructure, to increase system efficiency and decrease operational costs, and a school renovation and remodeling project. No future buildings will be constructed in known hazard areas.

6.2.2 Methodology

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

The methodology used a two pronged effort. First, The Planning Team used the State's Critical Facility Inventory and locally obtained GPS coordinate data to identify critical facility locations in relation to potential hazard's threat exposure and vulnerability. Second this data was used to develop a vulnerability assessment for those hazard where GIS based hazard mapping information was available.

Replacement structure and contents values were developed for physical assets. These value estimates were provided by the Planning Team. For each physical asset located within a hazard area, exposure was calculated by assuming the worst-case scenario (that is, the asset would be completely destroyed and would have to be replaced). Finally, the aggregate exposure, in terms of replacement value or insurance coverage, for each category of structure or facility was estimated. A similar analysis was used to evaluate the proportion of the population at risk. However, the analysis simply represents the number of people at risk; no estimate of the number of potential injuries or deaths was prepared.

6.2.3 Data Limitations

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

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

6.2.4 Exposure Analysis

There is limited GIS data available for the City of Thorne Bay. The results of the GIS based exposure analysis for loss estimations in the City are summarized in Tables 6-4 and 6-5. The following discussion contains data from GIS analysis and information obtained from the Planning Team.

Table 6-4. Potential Hazard Exposure Analysis – Critical Infrastructure

			Government and Emergency Response		Educational		Care		Community	
Hazard Type	Hazard Area	Methodology	* # Bldgs / # Occ	Value ($)	* # Bldgs / # Occ	Value ($)	* # Bldgs / # Occ	Value ($)	* # Bldgs / # Occ	Value ($)
Earthquake	--	descriptive	6/47	4,400,000	4/102	13,700,000	1/3	1,200,000	19/135	12,726,834
Flood	--	Descriptive	--	--	--	--	--	--	--	--
Ground Failure	--	Descriptive	6/47	4,400,000	4/102	13,700,000	1/3	1,200,000	19/135	12,726,834
Tsunami	--	Descriptive	1/1	N/A	--	--	--	--	7/40	3,900,000
Volcano	--	Descriptive	6/47	4,400,000	4/102	13,700,000	1/3	1,200,000	19/135	12,726,834
Weather, Severe	--	Descriptive	6/47	4,400,000	4/102	13,700,000	1/3	1,200,000	19/135	12,726,834
Wildland Fire	Low	Low fuel rank	1/10	400,000	1/100	12,000,000	--	--	6/32	2,737,824
	Moderate	Moderate fuel rank	2/1	850,000	1/0	1,200,000	--	--	--	--
	High	High fuel rank	--	--	--	--	--	--	--	2/17
	Extreme	Extreme fuel rank	--	--	--	--	--	--	--	--

Table 6-5. Potential Hazard Exposure Analysis – Critical Infrastructure

			Highway		Bridges		Transportation Facilities		Utilities	
Hazard Type	Hazard Area	Methodology	Miles	Value ($)	No.	Value ($)	# Bldgs / # Occ	Value ($)	# Bldgs / # Occ	Value ($)
Earthquake		Descriptive	24/0	18,500,000	2/0	3,300,000	4/19	2,156,025	14/3	19,449,896
Flood	--	Descriptive	--	--	2/0	3,300,000	--	--	--	--
Ground Failure	--	Descriptive	24/0	18,500,000	2/0	3,300,000	4/19	2,156,025	14/3	19,449,896
Tsunami	--	Descriptive	1/0	N/A	1/0	N/A	6/4	4,466,000	3/0	562.000
Volcano	--	Descriptive	24/0	18,500,000	2/0	3,300,000	6/19	2,716,025	14/3	19,449,896
Weather, Severe	--	Descriptive	24/0	18,500,000	2/0	3,300,000	6/19	2,716,025	14/3	19,449,896
Wildland Fire	Low	Low fuel rank	--	--	--	--	4/4	1,566,025	3/2	1,550,000
	Moderate	Moderate fuel rank	--	--	1/0	800,000	--	--	3/0	7,777,782
	High	High fuel rank	--	--	--	--	--	--	2/0	50,000
	Extreme	Extreme fuel rank	--	--	--	--	--	--	--	--

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Earthquake

Based on earthquake probability (Peak Ground Acceleration [PGA]) maps produced by the USGS, the entire City area is at risk of experiencing moderate earthquake impacts a result of its proximity to the Denali Fault, Queen Charlotte, and numerous unnamed faults. However, the probability is low (see Section 5.3.1.3). Impacts to the community such as significant ground movement that may result in infrastructure damage are not expected. The entire existing and future Thorne Bay population, residences, and critical facilities are exposed to the effects of an earthquake. This includes 471 people in 327 residences (approximate building value $73,575,000) with 309 people in 67 critical facilities (worth approximately $74,792,755).

Impacts to the community such as significant ground movement that may result in infrastructure damage are not expected. Minor shaking may be seen or felt based on past events. Although all structures are exposed to earthquakes, buildings within the City constructed with wood have slightly less vulnerability to the effects of earthquakes than those with masonry.

Impacts to future populations, residences, critical facilities, and infrastructure are anticipated at the same low impact level as the City is not located in an area with a high probability of strong shaking (i.e., >6.0M).

Flood

Impacts associated with flooding in the City include water damages to the bridge and adjacent approaches, roadbed erosion and damage, boat strandings, areas of standing water in roadways, and damage or displacement of fuel tanks, power lines, or other infrastructure. (see Section 5.3.3.3).

In City has no residential structures or populations at risk to flood impacts. However, the City has two bridges, the DOT owned Thorne River Bridge (worth $2,500,000) and the Deer Creek Bridge (worth $800,000), that are vulnerable to flood impacts.

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

Ground Failure

Ground Failure occurs throughout Alaska from landslides, land subsidence, and subsidence. These hazards periodically cause houses to shift due to ground sinking and upheaval. The City is concerned about construction in unstable soil locations (see Section 5.3.4.3). There are 471 people with 327 residential structures (approximate building value $73,575,000), and 74 critical facilities (approximate facility value $74,232,755.

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

Impacts to future populations, residences, critical facilities, and infrastructure are anticipated at the same impact level. To lessen future impacts the City could institute and enforce land use controls, building codes, and to prohibit new construction in ground failure prone areas.

Tsunami

The WC/ATWC indicates there is no threat from distant source tsunamis; however the WC/ATWC has indicated there is minimal threat from potential unknown local source tsunamis.

Therefore using information provided by the WC/ATWC, residential structures and infrastructure located adjacent to Thorne Bay have a minimal risk from local source tsunami impacts. There are approximately 117 people with 25 residential structures (approximate building value $5,625,000), and 31 people in 9 critical facilities (approximate facility value $7,878,025) located within the potential tsunami inundation area.

Volcano

Using information provided by the City of Thorne Bay, the USGS, and the Alaska Volcano Observatory, the entire existing and future Thorne Bay population, residences, and critical facilities are equally at risk from the effects of a volcanic eruption. There are 471 people with 327 residential structures (approximate building value $73,575,000), and 67 critical facilities (approximate facility value $74,792,755.

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

Weather (Severe)

Using information provided by the Planning Team and the National Weather Service, the entire existing and future City's population, residences, and critical facilities are equally exposed to the effects of a severe weather event. There are 471 people with 327 residential structures (approximate building value $73,575,000), and 67 critical facilities (approximate facility value $74,792,755

Impacts associated with severe weather events includes roof collapse, trees and power lines falling, damage to light aircraft and sinking small boats, injury and death resulting from snow machine or vehicle accidents, overexertion while shoveling all due to heavy snow. A quick thaw after a heavy snow can also cause substantial flooding. Impacts from extreme cold include hypothermia, halting transportation from fog and ice, congealed fuel, frozen pipes, utility disruptions, frozen pipes, and carbon monoxide poisoning. Section 5.3.5.3 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.

Impacts to future populations, residences, critical facilities, and infrastructure are anticipated at the same impact level. To lessen future impacts the City could institute and enforce building codes to accommodate the effects of severe weather on structures.

Wildland Fire

Impacts associated with a wildland fire event include the potential for loss of life and property. It can also impact livestock and pets and destroy forest resources and contaminate water supplies. Buildings closer to the outer edge of town, those with a lot of vegetation surrounding the structure, and those constructed with wood are some of the buildings that are more vulnerable to the impacts of wildland fire.

Impacts to future populations, residences, critical facilities, and infrastructure are anticipated at the same impact level. Community education, building materials, and prepared response personnel are some things that could lessen future impacts.

According to the Alaska Fire Service, there are no wildland fire areas within Thorne Bay's boundaries. However, 120 wildland fires have occurred within a 50-mile radius of the City (see Section 5.3.6.3). There is potential for wildland fire to interface with the population center of the City.

Wildland fire hazard areas were identified using a model incorporating slope, aspect, and fuel load. (See Figure 5-12) South-facing, steep, and heavily vegetated areas were assigned the highest fuel values while areas with little slope and natural vegetation were assigned the lowest fuel risk values. Risk levels of low, moderate, high, and extreme were assigned to the entire region based on the results of this modeling. There are 471 people with 327 residential structures (approximate building value $73,575,000) located in the City and potentially threatened by wildfire events.

Thorne Bay has critical facilities and infrastructure located within areas of low, moderate, high, and extreme risk. Low risk areas contain six community s facilities with 32 people (worth approximately $2,737,824), one education (1 facility with 100 people (worth approximately $12,000,000), one emergency response facility with 10 People (worth approximately $400,000), four transportation facilities with 4 people (worth approximately $1,566,025), and three utilities with two people (worth approximately $1,550,000).

Moderate risk areas contain one government facility with one person (worth approximately $700,000), six community facilities with 18 people (worth approximately $1,610,000), one education facility (worth approximately $1,200,000), one emergency response facility, (worth approximately $150,000), one bridge (worth approximately $800,000), and three utilities (worth approximately $7,777,782)

The City High risk areas contain two community facilities with 17 people (worth approximately $1,100,000) and two utilities (worth approximately $50,000).

There are no residences or critical facilities located in Extreme wildfire hazard areas.

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

Assessing Vulnerability: Analyzing Development Trends

Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

Element

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

Source: FEMA, July 2008.

6.3 LAND USE AND DEVELOPMENT TRENDS

Land use in the City is predominately residential with insufficient lot sizes and set-backs. This situation limits road improvements and commercial or community (or institutional) facilities' development. Suitable developable vacant land is in short supply within the boundaries of the City.

The 1999 Comprehensive Plan states,

> *"H.B. 811, enacted May 21, 1982, provided for a preference to occupants of land formerly under a [US Forest Service] U.S.F.S. timber contract, when the state offered such land for sale. If the occupant, or his successor, had purchased a permanent improvement from the timber contractor or had built a permanent improvement with the approval of the timber contractor and had also occupied the land for at least 90 days prior to its relinquishment by the contractor, then the occupant received first preference to purchase the land from the state. Land used for non-commercial residential purposes was sold for administrative and survey cost only. Other land was offered at fair market value. The state retained the option to adjust lot boundaries prior to sale.*
>
> *Shortly after H.B. 811 was enacted it was apparent that the small lot sizes it created would cause land use problems. The majority of lots in the neighborhoods that include Rainy Lane, Wolverine Court, Finney Drive, and Willow Drive, are under 6,000 square feet. Many houses encroach into the 5-foot setbacks. Several homes are situated over lot lines and into road rights-of-way. Streets are narrow with virtually no off-street parking. H.B. 811 has created crowded, uncomfortable living conditions that are unsafe in many locations.*
>
> *Resolving the many land use problems associated with H.B. 811 means enforcing the provisions of the bill. The city would have to research each lot for specific problems, develop solutions, and be prepared to go to court when necessary. This would be a costly, time-consuming, and complicated project that would be very difficult to track and enforce…*
>
> *The townsite area contains many privately owned lots, most of which are under 6,000 square feet. Many contain two residential structures. Rental housing is limited…Depending on population fluctuations, lack of housing could continue to be a problem in the Thorne Bay area [until] unless more residential land becomes available.*
>
> *The Alaska State Department of Natural Resources manages a permitting program for float homes in the Thorne Bay Coastal District in accordance with the Prince of Wales Island Area Plan. The Thorne Bay Planning Commission has an opportunity to review and comment on all float home applications. Float homes may only be located in designated areas as outlined in the Prince of Wales Island Area Plan.*

The majority of land in the Thorne Bay Coastal District is owned by either the State of Alaska, the U.S. Forest Service, or the City of Thorne Bay. An area near Tolstoi Bay that is being considered for industrial development is owned by the Alaska Mental Health Trust. Most of the land surrounding the district is federally owned as part of the Tongass National Forest…

A three year contract for sawlogs has been initiated. KPC still claims an encumbrance on many parcels of land within the city core.

The KPC contract time frame reduction may affect the encumbrance issue sooner than expected, i.e., the encumbered lands could be released to the city at an earlier date, but at this writing the results of the pulp mill closure are unknown. With most of the developable land in the city center under an encumbrance, commercial and light industrial development that would usually be located within the city center has been precluded. The newly formed encumbered lands committee will be working toward resolving the complex land use planning concerns immersed within the encumbered lands issue" (Thorne Bay 1999).

Development Trends

The City's 1999 Comprehensive Plan states,

"…This comprehensive plan is meant to work in conjunction with other city planning documents as a guide for making decisions that will affect the future of Thorne Bay. Established policy set forth in this plan will guide decisions concerning land use, the development and improvement of public facilities, transportation issues, and the capital expenditures they incur…

The City of Thorne Bay has been continually improving community facilities since incorporation. The following is a description of these facilities including public services such as water, sewer, solid waste and energy, as well as government and public safety"(Thorne Bay 1999)

Thorne Bay is a recently established community which has seen moderate growth since its historic logging camp beginnings in 1885 and transition to a second class city in 1982. Their population reached its peak in 1990 of 569 and has gradually decreased to its current population count of approximately442.

Tables 6-4 and 6-5 list DCRA's identified infrastructure improvement projects for the City. They provide a depiction of the community's ongoing development trends and focus on improving aging infrastructure. Table 6-4 lists projects in various stages of completion:

Table 6-4 Planned and Funded Projects

Lead Agency	Fiscal Year	Project Status	Project Description / Comments	Project Stage	Lead Agency Funding
Division of Community and Regional Affairs (DCRA)	2011	Funded	Community Roads Repair and Resurface - Comments: Legislative - road upgrades; previous funding $262,397	Preliminary	$750,000
Alaska Energy Authority-Alternative Energy and	2010	Funded	Thorne Bay Wood Boiler - BIOMASS - Comments: OTHER FUNDING: Federal	Preliminary	$220,179

Table 6-4 Planned and Funded Projects

Lead Agency	Fiscal Year	Project Status	Project Description / Comments	Project Stage	Lead Agency Funding
Energy Efficiency (AEA-AEEE					
Department of Environmental conservation/ Village Safe Water (DEC/VSW)	2010	Funded	Water, Sewer and Solid Waste Study - Comments: Comprehensive water, sewer and solid waste study which evaluates existing infrastructure, recommends improvements to increase system efficiency and decrease operational costs, and identifies current and future needs for replacement and upgrades.	Preliminary	$135,000
Department of Education and Early Development (DEED)	2009	Funded	K-12 School Structural Repairs - Comments: Renovation and Remodeling	Preliminary	$517,440
DEC/VSW	2008	Funded	Water and Wastewater Infrastructure Project - Comments: Legislative Grant	Preliminary	$326,700
AEA-AEEE	2003	Funded	Assist communities with electrical transmission plan. - Comments: State funding	Preliminary	$10,000
DCRA	2007	Funded	Thorne Bay Library Design & Engineering - Comments: CDBG	Contract	$31,656
AEA-Bulk Fuel (BF)	2006	Funded	Bulk Fuel Facility Conceptual Planning, Construction/Upgrades, Repairs - Comments: OTHER FUNDING: Denali Commission $655. Community is in the process of bulk fuel upgrade conceptual design.	Design	$655
DCRA	2009	Funded	Upgrade of Southside Subdivision Road - Comments: Legislative Grant	Construction	$191,000
DCRA	2008	Funded	Construction of Davidson Landing Dock - Comments: Legislative Grant - Grants to Municipalities	Construction	$73,000
AEA-Legislative Energy Grant (LEG)	2007	Funded	Unknown	Construction	$50,000
DEED	2007	Funded	Thorne Bay House Access Ramp	Construction	$144,301
AEA-AEEE	1997	Funded	Prince of Wales Island Electrical Intertie - Comments: OTHER FUNDING: U.S. Department of Energy $3.95 M; Leg Grant $300,000; Power Project Fund loan $1.2 M. Design and construct a 34.5 kV transmission line connecting the communities of Thorne Bay and Kasaan to	Construction	$5,650,000

Table 6-4 Planned and Funded Projects

Lead Agency	Fiscal Year	Project Status	Project Description / Comments	Project Stage	Lead Agency Funding
			Alaska Power and Telephone's (AP&T) existing grid that includes Craig, Klawock, and the Black Bear Lake hydroelectric project.		

(DCRA 2011)

The City's comprehensive plan describes their water and waste systems as

"Water System

Total replacement of the water system occurred from 1987 to 1989. The new system includes water mains of 8" and 6" PVC pipe, 3/4" polyethylene service lines, and the installation of conventional fire hydrants. During 1994 and 1995, water meters were installed…

The city's water originates at Water Lake, where water is piped to a 286,000 gallon storage tank. The water is detained for chlorination and for treatment with a polymer that assists in the removal of tannin. The tank also serves as a reserve for firefighting and emergency situations such as a pump problem or a break in the main line from Water Lake. The supply system and tank are located on Sandy Beach Road, north of the school, and is gravity fed from Water Lake to the east.

Water System – South Thorne Bay

A water supply for South Thorne Bay has not yet been developed, although some residents use water from South Lake and North Tolstoi Lake, as well as from roof catchment systems. Other residents haul their own water from the city treated water system, or get water from a pipe from a surface water stream along the road. Individual water rights on streams with small dams connected to piping is another utilized alternative.

Wastewater System/Sewer

The City of Thorne Bay's original sewer and wastewater facility was completely replaced in 1996. The city's new wastewater collection system and treatment plant is located at the end of the Deer Creek subdivision. The gravity feed system consists of new ductile iron pipes that run throughout the city and four lift stations that are pumped directly into pressurized main lines. All main lines are then fed into one lift station that carries effluent directly to the wastewater treatment plant. The sewage plant has primary and secondary wastewater treatment. As it is an aerobic system, there are no foul smelling gases to escape. The system also filters out gasoline, benzene, and other chemicals.

Solid Waste

A twenty acre site near the Goose Creek commercial and industrial subdivision [became the new]… community solid waste facility…in 1994 when the city's new solid waste baler, landfill, and household hazardous waste storage facility was complete and on line.

Electrical Utility

The City of Thorne Bay obtains hydroelectric power from Alaska Power and Telephone, the utility that operates the Black Bear Hydroelectric project and provides electricity to other Prince of Wales Island communities. On August 25, 1998, residents voted to approve a six-mile inter-tie and planned extension of hydroelectric transmission lines to

join at the junction of State Highway 30 and the Lake Ellen Road (FDR 2030). These lines were constructed, and are owned and operated by AP&T. Hydroelectric transmission lines extend through a portion of the Goose Creek commercial/industrial subdivision and run adjacent to the subdivision at South Thorne Bay. It is anticipated that AP&T will apply with the Alaska Public Utility Commission to extend service into these areas…

Residents of South Thorne Bay are presently not served by the Thorne Bay Public Utility and most run their own generator systems for electrical needs.

Most homes in Thorne Bay heat with wood. Oil heat, or a combination of oil and wood, is also used. Propane or LP bottled gas is sometimes used as a supplement to a primary heating source such as wood and is common in small mobile homes and travel trailers" (Thorne Bay 1999).

The City of Thorne Bay has benefited from numerous funding opportunities to assist them with upgrading their infrastructure. The City had a new sewage lagoon constructed and their waste heat recovery system upgraded in 1985. A new school was completed in 1989. The 1990's brought substantial sewer system and solid waste management capabilities and improvements; airport upgrades; a new public safety, City office, and clinic complex; harbor and port studies and upgrades, and road improvements. Infrastructure project occurring from 2000-2010 include a medevac landing site, road paving, electric system upgrades, and harbor and dock construction projects.

housing major renovations and modernizations included lead paint removal, new exterior doors and windows and wood stove gaskets; a new school was built to replace the former school's that was destroyed by fire; roads received resurfacing; a new Community Center/Tribal Hall; and a land fill upgrade.

Table 6-5 lists DCRA identified completed projects for the City.

Table 6-5 Completed Projects

Lead Agency	Fiscal Year	Project Status	Project Description / Comments	Project Stage	Total Cost
Division of Community and Regional Affairs (DCRA)	2008	Funded	District-wide School Books and Supplies - Comments: Legislative Grant - Named Recipient	Completed	$30,000
DCRA	2008	Funded	Purchase of Dock Hoist - Comments: Legislative Grant - Grants to Municipalities	Completed	$30,000
Denali	2008	Funded	Davidson Landing Harbor Reconstruction - Comments: Rehabilitation of an existing harbor, docks and walkway.	Completed	$268,000
DCRA	2007	Funded	Construction of Public Restroom and Shower Facility - Comments: Legislative Grant	Completed	$25,000
DCRA	2007	Funded	Public Library Site Preparation and Construction/ Roof Repairs - Comments: Legislative Grant	Completed	$25,000
DCRA	2006	Funded	Harbor Shack Construction - Comments: Legislative Grant	Completed	$70,000

Table 6-5 Completed Projects

Lead Agency	Fiscal Year	Project Status	Project Description / Comments	Project Stage	Total Cost
DCRA	2006	Funded	Southeast Regional Solid Waste Disposal Feasibility Study - Comments: Mini-Grant. Funded through Denali Commission.	Completed	$27,000
Alaska Energy Authority-Alternative Energy and Energy Efficiency (AEA-AEEE	2005	Funded	Prince of Wales Intertie - T&D-CLOSED - Comments: OTHER FUNDING: Federal Prince of Wales Intertie - T&D-CLOSED	Completed	$9,183,279
DCRA	2004	Funded	Medivac Landing Site Construction - Comments: Legislative Grant	Completed	$103,602
DCRA	2003	Funded	Davidson Landing Dock - Comments: Capital Matching	Completed	$26,316
Department of Transportation & Public Facilities (DOT&PF)	2003	Funded	Shoreline Drive Paving - Comments: Improve subgrade and pave for 0.6 mile from Sandy Beach Road to the entrance to the Boat Harbor and Float Plane Dock.	Completed	$40,000
DCRA	2002	Funded	RV Park Upgrade - Comments: Mini-Grant. Denali Commission funding	Completed	$29,010
Denali	2002	Funded	Upgrade existing electric distribution systems and utilities in Klawock, Kasaan and Thorne Bay - Comments: Upgrade existing distribution system components in Klawock, Kasaan, and Thorne Bay to bring them into compliance with National Electrical Safety Code (improving public safety) and increase the operating life of the utilities Total cost of $600,000 split between the three communities in the Capital Projects Database.	Completed	$209,234
AEA-AEEE	2002	Funded	Alaska Power Company (APC) Automated Controls - Comments: OTHER FUNDING: Denali Commission. Install automated switchgear in Hydaburg, Coffman Cove, and Thorne Bay and build a new substation in Thorne Bay. Remote monitoring and control will eliminate the need for emergency operators to be available to start stand-by diesels at Thorne Bay and Hydaburg if grid power is cut off.	Completed	$500,880
DCRA	2002	Funded	Paving and Upgrading Roads - Comments: Capital Matching	Completed	$26,316
AEA-AEEE	2002	Funded	APC Southfork Hydroelectric Project - Comments: OTHER FUNDING: Denali Commission. Design and construction of a 2 milliwatt (mW) run-of-river hydroelectric project and construction of a power house	Completed	$3,535,612

Table 6-5 Completed Projects

Lead Agency	Fiscal Year	Project Status	Project Description / Comments	Project Stage	Total Cost
			near the mouth of South Fork Creek. Design includes a diversion structure less than 10 ft in height located in the South Fork Valley. A 30 inch diameter penstock pipe will descend from the diversion structure to the powerhouse		
DCRA	2001	Funded	Paving Project - Comments: Capital Matching	Completed	$26,317
DOT&PF	2001	Funded	Unknown	Completed	$6,032,789
DCRA	2000	Funded	Design/Survey/Appraise Industrial Site/Deep Water Port - Comments: Mini-Grant	Completed	$37,000
DCRA	2000	Funded	Harbor and Ron's Road Upgrade Project - Comments: Capital Matching	Completed	$26,343
United States (US) DOT	1999	Funded	Prince of Wales Inter-Island Ferry - Comments: FY97 federal funding to provide supplemental ferry service to Ketchikan	Completed	$6,300,000
US Forest Service (USFS)	1999	Funded	Ron's Harbor Road Reconstruction - Comments: Economic Recovery Assistance - Cooperative Forestry	Completed	$5,000
USFS	1999	Funded	Encumbered Lands Project - Comments: Economic Recovery Assistance - Cooperative Forestry	Completed	$5,425
DCRA	1999	Funded	Harbor and Ron's Road Upgrade Project - Comments: Capital Matching	Completed	$26,731
US Department of Agriculture/ Rural Development (USDA/RD)	1999	Funded	Feasibility Study of Tolstoi Bay Industrial park and deep water port	Completed	$62,000
DCRA	1998	Funded	Harbor Boat Grid Project - Comments: Capital Matching	Completed	$26,316
Department of Environmental Conservation/ Village Safe Water (DEC/VSW)	1997	Funded	Water Project Feasibility Study/Design - Comments: OTHER FUNDING: Environmental Protection Agency/Inspector General (EPA/IG) - 1997 - $26,000.	Completed	$52,000
AEA	1997	Funded	Prince of Wales Intertie / Connect Thorne Bay and Kasaan to Black Bear Lake Hydroelectric - Comments: OTHER FUNDING: U.S. Dept. of Energy $1 million. Design and permitting underway. 35 miles of transmission line, constructed by Alaska Power Telephone (AP&T) Prince of Wales Intertie / Connect Thorne Bay and Kasaan to Black Bear Lake	Completed	$2,700,000

Table 6-5 Completed Projects

Lead Agency	Fiscal Year	Project Status	Project Description / Comments	Project Stage	Total Cost
			Hydroelectric		
Alaska Housing Finance Corporation (AHFC)	1997	Funded	Weatherize 1 Home - Comments: Weatherization	Completed	$4,200
DCRA	1997	Funded	Public Safety & Clinic Complex - Comments: Capital Matching	Completed	$26,316
AEA	1997	Funded	Power Purchase Evaluation	Completed	$20,000
DEC/VSW	1997	Funded	Water Project Feasibility Study/Design - Comments: OTHER FUNDING: EPA/IG - 1997 - $26,000. Study to evaluate options for providing piped water and sewer for South Thorne Bay	Completed	$52,000
DCRA	1996	Funded	Harbor Boat Grid Development - Comments: USDA/ US Forest Service (USFS) Match	Completed	$105,240
DCRA	1996	Funded	Public Safety & Clinic Complex - Comments: Capital Matching	Completed	$26,858
AHFC	1995	Funded	Weatherize 1 Home - Comments: Weatherization	Completed	$4,137
AEA	1995	Funded	Biomass Waste Wood Power Feasibility	Completed	$13,300
DCRA	1995	Funded	Biomass Waste Wood Power Generator - Comments: Rural Development Assistance (RDA). Division of Energy contribution of $25,000	Completed	$102,500
DCRA	1995	Funded	Harbor Boat Grid Engineering - Comments: RDA Harbor Boat Grid Engineering	Completed	$80,000
DCRA	1995	Funded	Public Safety & Clinic Complex - Comments: Capital Matching	Completed	$30,211
DEC/VSW	1995	Funded	Solid Waste Project Completion - Comments: Finish construction of solid waste site and solid waste baler facility	Completed	$4,577,782
DCRA	1994	Funded	Goose Creek Industrial Development Site Project	Completed	$364,025
DOT&PF	1994	Funded	South Thorne Bay Road to Kasaan / Engineering - Comments: ED 5. Platted road construction/reconstruction	Completed	$90,000
DCRA	1994	Funded	Sewage Plant/Landfill Replacement Project - Comments: Capital Matching	Completed	$25,000
Department of Natural Resources (DNR)	1994	Funded	City Ball Park, Multi-Purpose Facility Development	Completed	$187,824

Table 6-5 Completed Projects

Lead Agency	Fiscal Year	Project Status	Project Description / Comments	Project Stage	Total Cost
DEC/VSW	1994	Funded	Sewer Replacement - Comments: Install sewer mains, south side of community; design and construct RV dump station	Completed	$655,000
DEC/VSW	1993	Funded	Solid Waste & Baler - Comments: Finish new sewer treatment plant; design and begin construction of solid waste site	Completed	$206,891
DEC/VSW	1993	Funded	Sewer - Comments: Construct 2 additional lift stations and install sewer mains on south side of town	Completed	$1,043,109
DEC/VSW	1992	Funded	Sewage Treatment Plant & Landfill - Comments: Begin construction of new sewer treatment plant Sewage Treatment Plant & Landfill	Completed	$550,000
DEC/VSW	1991	Funded	Sewer Rehabilitation - Comments: Install sewer mains on north side of town; develop treatment plant site and extend utilities	Completed	$546,000
Federal Aviation Administration (FAA)/DOT&PF	1991	Funded	Improve Airport Drainage - Comments: OTHER FUNDING: DOT/PF	Completed	$464,683
DEC/VSW	1990	Funded	Sewer Main & Lift Station - Comments: Design and construct lift station, force main and ocean outfall; design sewer treatment plant	Completed	$600,000
DEC/VSW	1989	Funded	Water Treatment Plant/Hemlock Loop - Comments: Finish construction of new water treatment plant; construct water mains in Hemlock Loop Area	Completed	$300,000
DEC/VSW	1988	Funded	Water System - Comments: Construct water storage tank, begin new water treatment plant; replace water mains in town	Completed	$299,000
DEC/VSW	1987	Funded	Water Tank, Lines - Comments: Construct new water transmission main from water source to the water treatment plant	Completed	$181,800
DEC/VSW	1985	Funded	Solid Waste - Comments: Construct solid waste baler facility (constructed in 1994-1995)	Completed	$95,000
DEC/VSW	1985	Funded	Sewer - Comments: Finish construction of new sewer treatment plant (constructed in 1992-1993)	Completed	$183,000

(DCRA 2011)

Development Planning

The City's 1996 Comprehensive Plan explains that the City of Thorne Bay has implemented various development guidelines,

This [Thorne Bay Comprehensive Plan, 1999] is intended to guide land use decisions and change in Thorne Bay…

Implementation procedures convert the goals and policies outlined in this plan into specific and oftentimes legally binding regulations, controls, and requirements. Implementation tools range from legal controls to cooperation between public and private agencies. The effectiveness of the decisions made about land use relationships hinges on the usefulness of the plan as a development guide to those officials who are making day-to-day development decisions.

Several types of planning techniques can be utilized for [implanting the 1996 Thorne Bay Comprehensive Plan]. These include:

- *zoning*
- *conditional and special use permitting*
- *subdivision controls*
- *capital improvement planning*
- *other specific, related planning documents*

Zoning

The comprehensive plan, text and map provide basic recommendations about long-term land use for the general community… Zoning decisions are based on the comprehensive plan… The comprehensive plan reflects community discussion and provides rationale and direction whereas [the] zoning ordinance is very specific, and divides the city into different types of land uses: residential, commercial, and industrial…

Conditional Use Permits

Conditional use permits are included in zoning regulations as a way to allow consideration of individual land uses. They allow for flexibility in the zoning title by providing for uses that may be suitable in certain locations and not others…

Subdivision

The subdivision ordinance is used to control and regulate the platting of land into lots, blocks, and streets. Regulations have been established for lot arrangement and size, road systems, adequate drainage, utilities, open space, and correlation with adjoining subdivisions as well as with other land uses. A legal description of the lot or lots is provided when the subdivision plat is recorded. Rights-of-way for utilities and streets are dedicated to the city, and recorded on the subdivision plat…

Transportation

The development of a transportation plan that includes traffic flow, maintenance, building standards, and parking requirements is a transportation policy within this plan…

Encumbered Lands

This complex issue has necessitated the formation of an encumbered lands committee. The committee has been holding public meetings and workshops to decide a number of land use issues…

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

1. Developing Mitigation Goals
2. Identifying Mitigation Actions
3. Evaluating Mitigation Actions
4. Implementing Mitigation Action Plans

Within this section the Planning Team developed the mitigation goals and potential mitigation actions for the City of Thorne Bay.

7.1 DEVELOPING MITIGATION GOALS

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

DMA 2000 Requirements: Mitigation Strategy – Local Hazard Mitigation Goals

Local Hazard Mitigation Goals

Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Element

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

Source: FEMA, July 2008.

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, ten goals were developed to reduce or avoid long-term vulnerabilities to the identified hazards (Table 7-1).

Table 7-1 Mitigation Goals

No.	Goal Description
1	Promote recognition and mitigation of all natural hazards that affect the City.
2	Promote cross-referencing mitigation goals and actions with other City planning mechanisms and projects.
3	Reduce possibility of losses from all natural hazards that affect the City.
4	Reduce vulnerability of structures to earthquake damage.
5	Reduce the possibility of damage and losses from flooding.
6	Reduce possibility of damage and losses from ground failure.
7	Reduce possibility of damage and losses from tsunami.
8	Reduce possibility of damage and losses from volcanic activity
9	Reduce vulnerability of structures to severe weather damage.
10	Reduce possibility of damage and losses from wildland fires.

7.2 IDENTIFYING MITIGATION ACTIONS

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

DMA 2000 Requirements: Mitigation Strategy - Identification and Analysis of Mitigation Actions
Identification and Analysis of Mitigation Actions
Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.
Element ■ Does the new or updated 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, July 2008.

DMA 2000 Requirements: Mitigation Strategy - Identification and Analysis of Mitigation Actions: National Flood Insurance Program (NFIP) Compliance
Identification and Analysis of Mitigation Actions: NFIP Compliance
Requirement §201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.
Element ■ Does the new or updated plan describe the jurisdiction(s) participation in the NFIP? ■ Does the mitigation strategy identify, analyze and prioritize actions related to continued compliance with the NFIP?
Source: FEMA, July 2008.

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 a mitigation plan. Mitigation actions are usually grouped into three broad categories: property protection, public education and awareness, and structural projects. On April 28, 2011, the Planning Team selected 14 mitigation actions for potential implantation during the five-year life cycle of this HMP. The Planning Team placed particular emphasis on projects and programs that reduce the effects of hazards on both new and existing buildings and infrastructure. These potential projects are listed in Table 7-2 below.

Table 7-2 Mitigation Goals and Potential Actions
(Bold ID items were selected for implantation by the Planning Team)

Goals		Actions	
No.	**Description**	**ID**	**Description**
1	Promote recognizing and mitigating all natural hazards that affect the City of Thorne Bay (City).	A	Establish a formal role for the jurisdictional Hazard Mitigation Planning Committees to develop a sustainable process to implement, monitor, and evaluate community wide mitigation actions.
		B	Develop, produce, and distribute information materials concerning mitigation, preparedness, and safety procedures for identified natural hazards.
		C	Develop outreach program to educate residents concerning benefits of increased seismic resistance and modern building code compliance during rehabilitation or major repairs for residences or businesses.
		D	Develop outreach program with school district contests having students develop, display, and explain mitigation projects or initiatives.
		E Ongoing	Update public emergency notification procedures and develop an outreach program for potential hazard impacts or events.
		F	Identify and pursue funding opportunities to implement mitigation actions.
		G	Identify critical facilities and vulnerable populations based on mapped high hazard areas.
		H	Identify evacuation routes away from high hazard areas and develop outreach program to educate the public concerning warnings and evacuation procedures.
2	Cross reference Mitigation goals and actions with other City planning mechanisms and projects.	A	The City will aggressively manage their existing plans to ensure they incorporate mitigation planning provisions into all community planning processes such as comprehensive, capital improvement, and land use plans, etc to demonstrate multi-benefit considerations and facilitate using multiple funding source consideration.
		B	Integrate the Mitigation Plan findings for enhanced emergency planning.
		C Ongoing	Develop and incorporate building ordinances commensurate with building codes to reflect survivability from flood, fire, wind, seismic, and other hazards to ensure occupant safety.
		D Ongoing	Develop and incorporate mitigation provisions and recommendations into zoning ordinances and community development processes to maintain the floodway and protect critical infrastructure and private residences from other hazard areas.

Table 7-2 Mitigation Goals and Potential Actions
(Bold ID items were selected for implantation by the Planning Team)

Goals		Actions	
No.	Description	ID	Description
		E	Prohibit new construction in identified mitigatable hazard impact areas (avalanche, flood, erosion, etc.) or require building to applicable building codes for other hazard impacts (earthquake, volcanic ash, weather, etc.).
3	Reduce possibility of losses from all natural hazards that affect the City.	**A**	Purchase and install generators with main power distribution disconnect switches for identified and prioritized critical facilities susceptible to short term power disruption. (i.e. first responder and medical facilities, schools, correctional facilities, and water and sewage treatment plants, etc.)
		B	Develop vegetation projects to restore clear-cut and riverine erosion damage and to increase landslide susceptible slope stability.
4	Reduce vulnerability of structures to earthquake damage.	A	Evaluate critical public facility seismic performance for fire stations, public works buildings, potable water systems, wastewater systems, electric power systems, and bridges within the jurisdiction.
5	Reduce the possibility of damage and losses from flooding.	**A**	Maintain and update erosion hazard locations, identify critical facilities potentially impacted and develop mitigation initiatives such as bank stabilization or facility relocation to prevent or reduce the threat.
		B	Install bank protection such as rip-rap (large rocks), sheet pilings, gabion baskets, articulated matting, concrete, asphalt, vegetation, or other armoring or protective materials to provide river bank protection.
		C	Install walls at the end of a drainage structure to prevent embankment erosion at its entrance or outlet. (end or wing walls).
6	Reduce possibility of damage and losses from ground failure.	**A**	Determine and implement most cost beneficial and feasible mitigation actions for locations with repetitive flooding and significant damages or road closures.
		B	
7	Reduce possibility of damage and losses from tsunami.	**A**	Complete a landslide location inventory; identify threatened critical facilities and other buildings and infrastructure.
		B	Update the storm water management plan to include regulations to control runoff, both for flood reduction and to minimize saturated soils on steep slopes that can cause landslides.
8	Reduce possibility of damage and	A	Evaluate capability of water treatment plants to deal with high turbidity from ash falls, and

Table 7-2 Mitigation Goals and Potential Actions
(Bold ID items were selected for implantation by the Planning Team)

Goals		Actions	
No.	**Description**	**ID**	**Description**
	losses from volcanic activity.	B	Update emergency response plans to discuss volcanic ashfall event management, prioritize response actions, and initiate actions to fill capability gaps.
		C	Upgrade treatment facilities' physical plant to deal with ash fall events.
		D	Develop water plant protection or sustainability plan.
9	Reduce vulnerability of structures to severe weather damage.	**A**	Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.
		B	Develop critical facility list needing emergency back-up power systems, prioritize, seek funding, and implement mitigation actions.
		C	Develop and implement tree clearing mitigation programs to keep trees from threatening lives, property, and public infrastructure from severe weather events.
		D Ongoing	Implement and enforce the most current State adopted building codes to ensure structures can withstand winter storm hazards such as high winds, rain, water, and snow.
10	Reduce possibility of damage and losses from wildland fires.	**A**	Develop Community Wildland Fire Protection Plans for all at-risk communities.
		B	Hold FireWise workshop to educate residents and contractors concerning fire resistant landscaping.
		C	Promote FireWise building siting, design, and construction materials.
		D	Provide wildland fire information in an easily distributed format for all residents.

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: §201.6(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 local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

Element

- Does the new or updated mitigation strategy include how the actions are prioritized?
- Does the new or updated mitigation strategy address how the actions will be implemented and administered?
- Does the new or updated prioritization process include an emphasis on the use of a cost-benefit review to maximize benefits?
- *Does the updated plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred), does the updated plan describe why no changes occurred? (Not applicable until 2014 update)*

Source: FEMA, July 2008.

The Planning Team evaluated and prioritized each of the mitigation actions considered on April 28, 2011 to determine which actions would be included in the Mitigation Action Plan. The Mitigation Action Plan represents mitigation projects and programs to be implemented through the cooperation of multiple entities in the City. To complete this task, the Planning Team first prioritized the hazards that were regarded as the most significant within the community (earthquake, erosion, flood, permafrost, severe weather, and wildland fire).

The Planning Team reviewed the simplified social, technical, administrative, political, legal, economic, and environmental (STAPLEE) evaluation criteria (shown in Table 7-3) 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 the City chooses to implement.

Table 7-3 Evaluation Criteria for Mitigation Actions

Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE)

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

On April 28, 2011, the hazard mitigation Planning Team prioritized each mitigation action that was chosen to carry forward into the Mitigation Action Plan. The hazard mitigation Planning Team considered each hazard's history, extent, and probability to determine each potential actions priority. A rating system based on high, medium, or low was used. High priorities are associated with actions for hazards that impact the community on an annual or near annual basis and generate impacts to critical facilities and/or people. Medium priorities are associated with actions for hazards that impact the community less frequently, and do not typically generate impacts to critical facilities and/or people. Low priorities are associated with actions for hazards that rarely impact the community and have rarely generated documented impacts to critical facilities and/or people.

Prioritizing the mitigation actions in the Mitigation Action Plan Matrix was completed to provide the City with an approach to implementing the Mitigation Action Plan. Table 7-4 defines the mitigation action priorities.

7.4 IMPLEMENTING A MITIGATION ACTION PLAN

Table 7-4 shows the City's Mitigation Action Plan Matrix that shows how the mitigation actions were prioritized, how the overall benefit/costs were taken into consideration, and how each mitigation action will be implemented and administered by the Planning Team.

Table 7-4 City of Thorne Bay Mitigation Action Plan Matrix

(See acronym and abbreviations list for complete titles)

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
1E	Update public emergency notification procedures and develop an outreach program for potential hazard impacts or events.	Medium	City of Thorne Bay,	City of Thorne Bay, AFG, FP&S, SAFER	Ongoing	B/C: Sustained emergency response planning and mitigation outreach programs have minimal cost and will help build and support community capacity enabling the public to prepare for, respond to, and recover from disasters. TF: This project is technically feasible using existing City staff
1F	Identify and pursue funding opportunities to implement mitigation actions.	High	City of Thorne Bay	City of Thorne Bay, (See Section 8.4)	Ongoing	B/C: This ongoing activity is essential for the City as there are limited funds available to accomplish effective mitigation actions. TF: This activity is ongoing demonstrating its feasibility.
2A	The City will aggressively manage their existing plans to ensure they incorporate mitigation planning provisions into all community planning processes such as comprehensive, capital improvement, and land use plans, etc. to demonstrate multi-benefit considerations and facilitate using multiple funding source consideration.	Medium	City of Thorne Bay	City of Thorne Bay, Denali Commission, Division of Community and Regional Affairs (DCRA)	1-3 years	B/C: Coordinated planning ensures effective damage abatement and ensures proper attention is assigned to reduce losses and damage to structures and City 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.
2C	Develop and incorporate building ordinances commensurate with building codes to reflect survivability from flood, fire, wind, seismic, and other hazards to ensure occupant safety.	Medium	City of Thorne Bay	City of Thorne Bay, Denali Commission, Division of Community and Regional Affairs (DCRA)	Ongoing	B/C: Coordinated planning ensures effective damage abatement and ensures proper attention is assigned to reduce losses and damage to structures and City 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.

Table 7-4 City of Thorne Bay Mitigation Action Plan Matrix

(See acronym and abbreviations list for complete titles)

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
2D	Develop and incorporate mitigation provisions and recommendations into zoning ordinances and community development processes to maintain the floodway and protect critical infrastructure and private residences from other hazard areas.	Medium	City of Thorne Bay	City of Thorne Bay, Denali Commission, Division of Community and Regional Affairs (DCRA)	Ongoing	B/C: Coordinated planning ensures effective damage abatement and ensures proper attention is assigned to reduce losses and damage to structures and City 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.
3A	Purchase and install generators with main power distribution disconnect switches for identified and prioritized critical facilities susceptible to short term power disruption. (i.e. first responder and medical facilities, schools, correctional facilities, and water and sewage treatment plants, etc.)	High	City of Thorne Bay	City of Thorne Bay, Lindbergh Grants Program, HMA, AFG, FP&S, SAFER, ANA, EF&S	1-5 years	B/C: Emergency power generation is a minor cost to ensure their availability for use after a hazard strikes. TF: Installing emergency generators is technically feasible for this community as they already have staff to maintain existing community power generation facilities.
5A	Maintain and update erosion hazard locations, identify critical facilities potentially impacted and develop mitigation initiatives such as bank stabilization or facility relocation to prevent or reduce the threat.	Medium	City of Thorne Bay	City of Thorne Bay, NRCS, USACE	2-4 years	B/C: Identifying threatened infrastructure proximity to natural hazards is vital to their sustainability. There are no currently mapped hazard areas. This is a vital first step. This knowledge will help the community focus on activities to protect their vital infrastructure. TF: The project is technically feasible as the community has staff and resources they have used to relocate and elevate buildings.
6A	Determine and implement most cost beneficial and feasible mitigation actions for locations with repetitive flooding and significant damages or road closures.	High	City of Thorne Bay	City of Thorne Bay, HMA, NRCS, USACE, USDA/EWP, USDA/ECP, DCRA/Alaska Climate Change Impact Mitigation Program (ACCIMP)	1-3 years	B/C: Flood hazard mitigation is among FEMA's highest national priorities. FEMA desires communities focus on repetitive flood loss properties. This activity will ensure the City and Tribal Councils focus on priority flood locations and projects.

Table 7-4 City of Thorne Bay Mitigation Action Plan Matrix

(See acronym and abbreviations list for complete titles)

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
						TF: Low to no cost makes this outreach activity very feasible.
7A	Complete a landslide location inventory; identify threatened critical facilities and other buildings and infrastructure.	Medium	City of Thorne Bay	City of Thorne Bay, ANA, HMA,	2-4 years	B/C: Identifying ground failure locations is a minimal cost project which would decrease damage to facilities if they were sited appropriately. Project must be associated with a relocation or construction project. TF: Technically feasible as the community currently has identified permafrost locations but they have not created a map defining the area and they dig test holes to determine permafrost depth prior to construction.
7B	Update the storm water management plan to include regulations to control runoff, both for flood reduction and to minimize saturated soils on steep slopes that can cause landslides.	Medium	City of Thorne Bay	City of Thorne Bay, ANA, HMA, Clean Water State Revolving Fund (CWSRF)	2-4 years	B/C: Identifying storm water impact locations and developing a plan to address those impacts is a minimal cost project which would decrease damage to facilities if storm water run-off would be directed appropriately. TF: Technically feasible as the community currently has identified storm water impact locations but they have not developed a plan to address these damaging events.
8D	Develop water plant protection or sustainability plan.	Medium	City of Thorne Bay	City of Thorne Bay, ANA, HMA,	2-4 years	B/C: Identifying storm water impact locations and developing a plan to address those impacts is a minimal cost project which would decrease damage to facilities if they were sited appropriately.. TF: Technically feasible as the community currently has identified ground failure locations. Volcanic ash fall events would impact the entire community' water supply.

Table 7-4 City of Thorne Bay Mitigation Action Plan Matrix

(See acronym and abbreviations list for complete titles)

Action ID	Description	Priority	Responsible Department	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
9A	Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	Low	City of Thorne Bay	City of Thorne Bay, DCCED/CDBG, Denali Commission	3-5 years	B/C: Scheduling maintenance and implementing mitigation activities will potentially reduce severe winter storm damages caused by heavy snow loads and icy rain. TF: This type activity is technically feasible within the community using existing labor, equipment, and materials. Specialized methods are not new to rural communities as they are used to importing required contractors.
9D	Implement and enforce the most current State adopted building codes to ensure structures can withstand winter storm hazards such as high winds, rain, water, and snow.	Medium	City of Thorne Bay	City of Thorne Bay	Ongoing	B/C: Building code development, implementation and enforcement can effectively reduce future losses to hazardous events. Building codes can actually assist bush communities through making maximum use of materials and shipping costs the first time. TF: This project is technically feasible as the community need only demonstrate cost savings by identifying losses from historical utility impacts and down time.
10A	Develop Community Wildland Fire Protection Plan.	High	City of Thorne Bay	City of Thorne Bay, DOF: VFAG, RAGP	3-5 years	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 cityl resources with existing State and Federal agency support and guidance.

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

The following three process steps are addressed in detail here:

1. Monitoring, evaluating, and updating the HMP
2. Implementation through existing planning mechanisms
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 §201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Element

- Does the new or updated plan describe the method and schedule for monitoring the plan, including the responsible department?
- Does the new or updated plan describe the method and schedule for evaluating the plan, including how, when and by whom (i.e., the responsible department?
- Does the new or updated plan describe the method and schedule for updating the plan within the five-year cycle?

Source: FEMA, July 2008.

The HMP was prepared as a collaborative effort among the Planning Team, URS and Boutet. To maintain momentum and build upon previous hazard mitigation planning efforts and successes, the City will use the Planning Team to monitor, evaluate, and update the HMP. Each authority identified in Table 7-4 will be responsible for implementing the Mitigation Action Plan. The City Administrator, the hazard mitigation Planning Team Leader, (or the Mayor's designee), 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 Mitigation Action Plan. As shown in Appendix E, the Annual Review Worksheet will provide the basis for possible changes in the HMP Mitigation Action Plan 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 Planning Team Leader will initiate the annual review two months prior to the scheduled planning meeting date to ensure that all data is assembled for discussion with the Planning Team. The findings from these reviews will be presented at the annual Planning Team Meeting. Each review, as shown on the Annual Review Worksheet, will include an evaluation of the following:

- 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 Mitigation Action Plan (identify problems and suggest improvements as necessary)
- The adequacy of local resources for implementation of the HMP

A system of reviewing the progress on achieving the mitigation goals and implementing the Mitigation Action Plan 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 achieved the appropriate goals identified in the plan.

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 for DHS&EM to update the HMP (this can take up to one year to obtain and one year to update the plan)
- Thoroughly analyze and update the risk of natural and human-made 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 a new Mitigation Action Plan for the City of Thorne Bay
- Prepare a new draft HMP
- Submit an updated HMP to the DH&EM and FEMA for approval
- Submit the FEMA approved plan for adoption by the City of Thorne Bay
- Return adoption resolution to DH&EM and FEMA to receive formal approval

8.2 IMPLEMENTATION THROUGH EXISTING PLANNING MECHANISMS

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

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

Incorporation into Existing Planning Mechanisms

Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Element

- Does the new or updated plan identify other local planning mechanisms available for incorporating the mitigation requirements of the mitigation plan?
- Does the new or updated plan include a process by which the local government will incorporate the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?
- *Does the updated plan explain how the local government incorporated the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate? (Not applicable until 2014 update)*

Source: FEMA, July 2008.

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

8.3 CITY OF THORNE BAY CAPABILITY ASSESSMENT

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

Thorne Bay's 1999 Comprehensive Plan explains their funds management process within the capital improvement program section quite thoroughly:

> ***"Capital Improvement Programs***
>
> *Capital Improvement Programs (CIP) refer to major expenditures of public or semipublic funds for the improvement or extension of roads, sewers, power lines, parks, etc., projected over several years.*
>
> *Based on the plan's elements, the capital improvement program addresses the financial resources for implementation over a practical intermediate planning period, generally six years. Based on best estimates of available revenue from various resources and real costs for acquisition and development of the needed facilities, the CIP becomes a prime tool for gauging the community's commitment to and capacity for implementing the general desires and needs indicated in the comprehensive plan. Such a program has the following advantages: it focuses attention on community goals, needs and capabilities; and it enhances opportunities for participation in state and federal grant-in-aid programs. It also provides for the most efficient use of public funds, a means of establishing community priorities, and a means of coordinating with related programs of other levels of government…" (Thorne Bay 1999).*

This section outlines the resources available to the City of Thorne Bay for mitigation and mitigation related funding and training.

Table 8-1 Thorne Bay's Regulatory Tools

Regulatory Tools (ordinances, codes, plans)	Existing?	Comments (Year of most recent update; problems administering it; etc.)
Building code	No	The City can exercise this authority.
Zoning ordinances	Yes	The City can exercise this authority.
Subdivision ordinances or regulations	Yes	The City can exercise this authority.
Special purpose ordinances	Yes	*"Evaluate development proposals by means of current city land use documents, including the comprehensive plan, zoning and subdivision ordinances, water-shed ordinance, coastal management program, overall economic development plan, and other applicable ordinances" (Thorne Bay 1999).*
Comprehensive Plan	Yes	Completed in 1996. Describes its long-term planning goals and strategy
Emergency Response Plan	Yes	Provides emergency response and agency coordination initiatives
Land Use Regulation	Yes	1999, Guides land use to protect safety and welfare of residents
Land Use Plan	Yes	1999 (Referenced in Comprehensive Plan)
Wildland Fire Protection Plan	Yes	Defines community fire threats
Sanitation Feasibility Study/Master Plan	No	
City of Thorne Bay Transportation Plan	Yes	Contained within the Comprehensive Plan, provides insight into future transportation needs, use, and land-use conversion.

Federal Resources

The Federal government requires local governments to have a HMP in place to be eligible for mitigation funding opportunities through FEMA such as the HMA Programs (HMGP, PDM, FMA, etc.), Assistance to Firefighters Grant (AFG) Fire Prevention and Safety (FP&S), . The Mitigation Technical Assistance Programs available to local governments are also a valuable resource. FEMA may also provide temporary housing assistance through rental assistance, mobile homes, furniture rental, mortgage assistance, and emergency home repairs. The Disaster Preparedness Improvement Grant also promotes educational opportunities with respect to hazard awareness and mitigation.

- FEMA, through its Emergency Management Institute, offers training in many aspects of emergency management, including hazard mitigation. FEMA has also developed a large number of documents that address implementing hazard mitigation at the local level. FEMA grant funding programs include hazard mitigation, ,

  Five key resource documents are available from FEMA Publication Warehouse (1-800-480-2520) and are briefly described here:

  - How-to Guides. FEMA has developed a series of how-to guides to assist states, communities, and tribes in enhancing their hazard mitigation planning capabilities.

The first four guides describe the four major phases of hazard mitigation planning. The last five how-to guides address special topics that arise in hazard mitigation planning such as conducting cost-benefit analysis and preparing multi-jurisdictional plans. The use of worksheets, checklists, and tables make these guides a practical source of guidance to address all stages of the hazard mitigation planning process. They also include special tips on meeting DMA 2000 requirements (http://www.fema.gov/plan/mitplanning/resources.shtm#1).

- A Guide to Recovery Programs FEMA 229(4), September 2005. The programs described in this guide may all be of assistance during disaster incident recovery. Some are available only after a Presidential declaration of disaster, but others are available without a declaration. Please see the individual program descriptions for details. (http://www.fema.gov/txt/rebuild/ltrc/recoveryprograms229.txt)
- The FEMA Hazard Mitigation Assistance (HMA Unified Guidance, June 1, 2010. The guidance introduces the five HMA grant programs, funding opportunities, award information, eligibility, application and submission information, application review process, administering the grant, contracts, additional program guidance, additional project guidance, and contains information and resource appendices (FEMA 2008).

- FEMA also administers emergency management grants (http://www.fema.gov/help/site.shtm) and various firefighter grant programs (http://www.firegrantsupport.com/) such as
  - Emergency Management Performance Grant (EMPG). This is a pass through grant. The amount is determined by the State. The grant is intended to support critical assistance to sustain and enhance State and local emergency management capabilities at the State and local levels for all-hazard mitigation, preparedness, response, and recovery including coordination of inter-governmental (Federal, State, regional, local, and tribal) resources, joint operations, and mutual aid compacts state-to-state and nationwide. Sub-recipients must be compliant with NIMS implementation as a condition for receiving funds. Requires 50% match.
  - Assistance to Fire Fighters Grant (AFG), Fire Prevention and Safety (FP&S), Staffing for Adequate Fire and Emergency Response Grants (SAFER), and Assistance to Firefighters Station Construction Grant programs (http://forestry.alaska.gov/fire/vfarfa.htm). Information can be found at.
- Department of Homeland Security provides the following grants:
  - Homeland Security Grant Program (HSGP), State Homeland Security Program (SHSP) are 80% pass through grants. SHSP supports implementing the State Homeland Security Strategies to address identified planning, organization, equipment, training, and exercise needs for acts of terrorism and other catastrophic events. In addition, SHSP supports implementing the National Preparedness Guidelines, the National Incident Management System (NIMS), and the National Response Framework (NRF). Must ensure at least 25% of funds are dedicated towards law enforcement terrorism prevention-oriented activities.

  - Citizen Corps Program (CCP). The Citizen Corps mission is to bring community and government leaders together to coordinate involving community members in emergency preparedness, planning, mitigation, response, and recovery activities.
  - Emergency Operations Center (EOC) This program is intended to improve emergency management and preparedness capabilities by supporting flexible, sustainable, secure, strategically located, and fully interoperable Emergency Operations Centers (EOCs) with a focus on addressing identified deficiencies and needs. Fully capable emergency operations facilities at the State and local levels are an essential element of a comprehensive national emergency management system and are necessary to ensure continuity of operations and continuity of government in major disasters or emergencies caused by any hazard. Requires 25% match.
- U.S. Department of Commerce's grant programs include:
  - Remote Community Alert Systems (RCASP) grant for outdoor alerting technologies in remote communities effectively underserved by commercial mobile service for the purpose of enabling residents of those communities to receive emergency messages. This program is a contributing element of the Warning, Alert, and Response Network (WARN) Act.
  - National Oceanic and Atmospheric Administration (NOAA), provides funds to the State of Alaska due to Alaska's high threat for tsunami. The allocation supports the promotion of local, regional, and state level tsunami mitigation and preparedness; installation of warning communications systems; installation of warning communications systems; installation of tsunami signage; promotion of the Tsunami Ready Program in Alaska; development of inundation models; and delivery of inundation maps and decision-support tools to communities in Alaska.
- Department of Agriculture (USDA). Disaster assistance provided includes: Emergency Conservation Program, Non-Insured Assistance, Emergency Forest Restoration Program, Emergency Watershed Protection, Rural Housing Service, Rural Utilities Service, and Rural Business and Cooperative Service (http://www.fsa.usda.gov/FSA/webapp?area=home&subject=diap&topic=landing).
- Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy, Weatherization Assistance Program (http://www1.eere.energy.gov/wip/wap.html). This program minimizes the adverse effects of high energy costs on low-income, elderly, and handicapped citizens through client education activities and weatherization services such as an all-around safety check of major energy systems, including heating system modifications and insulation checks.
  - The Tribal Energy Program offers financial and technical assistance to Indian tribes to help them create sustainable renewable energy installations on their lands. This program promotes tribal energy self-sufficiency and fosters employment and economic development on America's tribal lands (http://www1.eere.energy.gov/wip/tribal.html).
- US Environmental Protection Agency (EPA). Under EPA's Clean Water State Revolving Fund (CWSRF) program, each state maintains a revolving loan fund to provide independent and permanent sources of low-cost financing for a wide range of water

quality infrastructure projects, including: municipal wastewater treatment projects; non-point source projects; watershed protection or restoration projects; and estuary management projects. (http://yosemite.epa.gov/R10/ecocomm.nsf/6da048b9966d22518825662d00729a35/7b68c420b668ada5882569ab00720988!OpenDocument)

- Public Works and Development Facilities Program. This program provides assistance to help distressed communities attract new industry, encourage business expansion, diversify local economies, and generate long-term, private sector jobs. Among the types of projects funded are water and sewer facilities, primarily serving industry and commerce; access roads to industrial parks or sites; port improvements; business incubator facilities; technology infrastructure; sustainable development activities; export programs; brownfields redevelopment; aquaculture facilities; and other infrastructure projects. Specific activities may include demolition, renovation, and construction of public facilities; provision of water or sewer infrastructure; or the development of stormwater control mechanisms (e.g., a retention pond) as part of an industrial park or other eligible project. (http://cfpub.epa.gov/fedfund/program.cfm?prog_num=51)

- Department of Health and Human Services, Administration of Children & Families, Administration for Native Americans (ANA). The ANA awards funds through grants to American Indians, Native Americans, Native Alaskans, Native Hawaiians, and Pacific Islanders. These grants are awarded to individual organizations that successfully apply for discretionary funds. ANA publishes in the Federal Register an announcement of funds available, the primary areas of focus, review criteria, and the method of application. (http://www.acf.hhs.gov/programs/ana/programs/program_information.html)
- Department of Housing and Urban Development (HUD) HUD provides a variety of disaster resources. They also partner with Federal and state agencies to help implement disaster recovery assistance. Under the *National Response Framework* the FEMA and the Small Business Administration (SBA) offer initial recovery assistance (http://www.hud.gov/info/disasterresources_dev.cfm).
  - 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 (http://www.hud.gov/offices/cpd/communitydevelopment/programs/108/index.cfm).
  - Department of Housing and Urban Development (HUD), Office of Homes and Communities, Section 184 Indian Home Loan Guarantee Programs. The Section 184 Indian Home Loan Guarantee Program is a home mortgage specifically designed for American Indian and Alaska Native families, Alaska Villages, Tribes, or Tribally Designated Housing Entities. Section 184 loans can be used, both on and off native lands, for new construction, rehabilitation, purchase of an existing home, or refinance.

    Because of the unique status of Indian lands being held in Trust, Native American homeownership has historically been an underserved market. Working with an expanding network of private sector and tribal partners, the Section 184 Program

endeavors to increase access to capital for Native Americans and provide private funding opportunities for tribal housing agencies with the Section 184 Program (http://www.hud.gov/offices/pih/ih/homeownership/184/).

- 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 (http://www.hud.gov/offices/cpd/communitydevelopment/programs/).

- Department of Labor (DOL), Employment and Training Administration, Disaster Unemployment Assistance. Provides weekly unemployment subsistence grants for those who become unemployed because of a major disaster or emergency. Applicants must have exhausted all benefits for which they would normally be eligible (http://www.workforcesecurity.doleta.gov/unemploy/disaster.asp).
  - The Workforce Investment Act contains provisions aimed at supporting employment and training activities for Indian, Alaska Native, and Native Hawaiian individuals. The Department of Labor's Indian and Native American Programs (INAP) funds grant programs that provide training opportunities at the local level for this target population (http://www.dol.gov/dol/topic/training/indianprograms.htm).
- Federal Financial Institutions. Member banks of Federal Deposit Insurance Corporation, Financial Reporting Standards or Federal Home Loan Bank Board may be permitted to waive early withdrawal penalties for Certificates of Deposit and Individual Retirement Accounts.
- Internal Revenue Service (IRS), Disaster Tax Relief. Provides extensions to current year's tax return, allows deductions for disaster losses, and allows amendment of previous year’s tax returns (http://www.irs.gov/newsroom/article/0,,id=108362,00.html).
- Natural Resources Conservation Service (NRCS) has several funding sources to fulfill mitigation needs. Further information is located at: http://www.ak.nrcs.usda.gov/sitemap.html
  - The Emergency Watershed Protection Program (EWP). This funding source is designed is to undertake emergency measures, including the purchase of flood plain easements, for runoff retardation and soil erosion prevention to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood or any other natural occurrence is causing or has caused a sudden impairment of the watershed.
  - Wildlife habitat Incentives Program (WHIP). This is a voluntary program for conservation-minded landowners who want to develop and improve wildlife habitat on agricultural land, nonindustrial private forest land, and Indian land.
  - Watershed Planning. NRCS watershed activities in Alaska are voluntary efforts requested through conservation districts and units of government and/or tribes. The watershed activities are lead locally by a "watershed management committee" that is

comprised of local interest groups, local units of government, local tribal representatives and any organization that has a vested interest in the watershed planning activity. This committee provides direction to the process as well as provides the decision-making necessary to implement the process. Technical assistance is provided to the watershed management committee through a "technical advisory committee" comprised of local, state and federal technical specialist. These specialists provide information to the watershed management committee as needed to make sound decisions. NRCS also provides training on watershed planning organization and process.

- U.S. Small Business Administration (SBA) Disaster Assistance (http://www.sba.gov/category/navigation-structure/starting-managing-business/managing-business/running-business/emergency-preparedness-and-disaster-) provides information concerning disaster assistance, preparedness, planning, cleanup, and recovery planning.
    - SBA may provide low-interest disaster loans to individuals and businesses that have suffered a loss due to a disaster. (http://www.sba.gov/category/navigation-structure/loans-grants/small-business-loans/disaster-loans). Requests for SBA loan assistance should be submitted to DHS&EM.
- USACE Alaska District's Civil Works Branch studies potential water resource projects in Alaska. These studies analyze and solve water resource issues of concern to the local communities. These issues may involve navigational improvements, flood control or ecosystem restoration. The agency also tracks flood hazard data for over 300 Alaskan communities on floodplains or the sea coast. These data help local communities assess the risk of floods to their communities and prepare for potential future floods (http://www.poa.usace.army.mil/en/cw/index.htm). The USACE is a member and co-chair of the Alaska Climate Change Sub-Cabinet.

State Resources

- DHS&EM is responsible for improving hazard mitigation technical assistance for local governments for the State of Alaska. Providing hazard mitigation training, current hazard information and communication facilitation with other agencies will enhance local hazard mitigation efforts. DHS&EM administers FEMA mitigation grants to mitigate future disaster damages such as those that may affect infrastructure including elevating, relocating, or acquiring hazard-prone properties. (http://www.ak-prepared.com/plans/mitigation/mitigati.htm)

  DHS&EM also provides mitigation funding resources for mitigation planning on their Web site at http://www.ak-prepared.com/plans/mitigation/localhazmitplan.htm.
- Division of Senior Services (DSS): Provides special outreach services for seniors, including food, shelter and clothing (http://www.hss.state.ak.us/dsds/seniorInfoResources.htm).
- Division of Insurance (DOI): Provides assistance in obtaining copies of policies and provides information regarding filing claims (http://www.dced.state.ak.us/insurance/).

- Department of Military and Veterans Affairs (DMVA): Provides damage appraisals and settlements for VA-insured homes, and assists with filing of survivor benefits (http://veterans.alaska.gov/links.htm).
- 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 (http://www.commerce.state.ak.us/dca/).
- Department of Environmental Conservation (DEC). The DEC primary roles and responsibilities concerning hazards mitigation are ensuring safe food and safe water, and pollution prevention and pollution response. DEC ensures water treatment plants, landfills, and bulk fuel storage tank farms are safely constructed and operated in communities. Agency and facility response plans include hazards identification and pollution prevention and response strategies (http://dec.alaska.gov/).
    - The Division of Water's Village Safe Water Program works with rural communities to develop sustainable sanitation facilities. Communities apply each year to VSW for grants for sanitation projects. Federal and state funding for this program is administered and managed by the State of Alaska's Village Safe Water (VSW) program. VSW provides technical and financial support to Alaska's smallest communities to design and construct water and wastewater systems. In some cases, funding is awarded by VSW through the Alaska Native Tribal Health Consortium, who in turn assist communities in design and construct of sanitation projects.
    - Municipal Grants and Loans Program. The Department of Environmental Conservation / Division of Water administer the Alaska Clean Water Fund (ACWF) and the Alaska Drinking Water Fund (ADWF). The division is fiscally responsible to the Environmental Protection Agency (EPA) to administer the loan funds as the EPA provides capitalization grants to the division for each of the loan funds. In addition, it is prudent upon the division to administer the funds in a manner that ensures their continued viability.
    - Under EPA's Clean Water State Revolving Fund (CWSRF) program, each state maintains a revolving loan fund to provide independent and permanent sources of low-cost financing for a wide range of water quality infrastructure projects, including: municipal wastewater treatment projects; non-point source projects; watershed protection or restoration projects; and estuary management, [and stormwater management] projects. (http://yosemite.epa.gov/R10/ecocomm.nsf/6da048b9966d22518825662d00729a35/7b68c420b668ada5882569ab00720988!OpenDocument)

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

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

- Department of Transportation and Public Facilities (DOT/PF) personnel provide technical assistance to the various emergency management programs, to include mitigation. This assistance is addressed in the DHS&EM-DOT/PF Memorandum of Agreement and includes but is not limited to: environmental reviews, archaeological surveys, and historic preservation reviews.
  - DOT/PF and DHS&EM coordinate buy-out projects to ensure that there are no potential right-of-way conflicts with future use of land for bridge and highway projects, and collaborate on earthquake mitigation.
  - Additionally, DOT/PF provides the safe, efficient, economical, and effective State highway, harbor, and airport operation. DOT/PF uses it's Planning, Design and Engineering, Maintenance and Operations, and Intelligent Transportation Systems resources to identify hazards, plan and initiate mitigation activities to meet the transportation needs of Alaskans, and make Alaska a better place to live and work. DOT/PF budgets for temporary bridge replacements and materials necessary to make the multi-modal transportation system operational following natural disaster events.
- DNR administers various projects designed to reduce stream bank erosion, reduce localized flooding, improve drainage, and improve discharge water quality through the stormwater grant program funds. Within DNR,
  - The Division of Geological and Geophysical Survey (DGGS) is responsible Alaska's mineral, land, and water resources use, development, and earthquake mitigation collaboration.

    Their geologists and support staff are leaders in researching Alaska's geology and implementing technological tools to most efficiently collect, interpret, publish, archive, and disseminate information to the public. Information is available at: (http://www.dggs.dnr.state.ak.us/index.php?menu_link=publications&link=publications_search#)
  - The DNR's DOF participates in a statewide wildfire control program in cooperation with the forest industry, rural fire departments and other agencies. Prescribed burning may increase the risks of fire hazards; however, prescribed burning reduces the availability of fire fuels and therefore the potential for future, more serious fires (http://forestry.alaska.gov/pdfs/08FireSuppressionMediaGuide.pdf).
  - DOF also manages various wildland fire programs, activities, and grant programs such as the FireWise Program (http://forestry.alaska.gov/fire/firewise.htm), the USDA Forest Service's Community Forestry Program [CFP] (http://forestry.alaska.gov/community/), and the Volunteer Fire Assistance and Rural Fire Assistance Grant (VFA-RFA) programs (http://forestry.alaska.gov/fire/vfarfa.htm). Information can be found at http://forestry.alaska.gov/fire/current.htm.

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

Local Resources

The City has a number of planning and land management tools that will allow it to implement hazard mitigation activities. The resources available in these areas have been assessed by the hazard mitigation Planning Team, and are summarized below.

Table 8-2 Thorne Bay'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	The City hires consultants with land development and land management knowledge
Engineer or professional trained in construction practices related to buildings and/or infrastructure	No	The City may hire engineering consulting services
Planner or engineer with an understanding of natural and/or human-caused hazards	No	The City hires consultants with hazard mitigation knowledge
Floodplain Manager	No	Taunnie Boothby, State Floodplain Manager
Surveyors	No	The City may hire surveying consulting services
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	No	
Scientists familiar with the hazards of the jurisdiction	No	U.S. Fish & Wildlife Service local office; Alaska Department of Fish & Game local office
Emergency Manager	Yes	City Mayor
Finance (Grant writers)	Yes	City Administrator
Public Information Officer	Yes	City Mayor

Table 8-3 Financial Resources for Hazard Mitigation

Financial Resource	Accessible or Eligible to Use for Mitigation Activities
General funds	Limited funding, can exercise this authority with voter approval
Community Development Block Grants	Limited funding, can exercise this authority with voter approval
Capital Improvement Projects Funding	Limited funding, can exercise this authority with voter approval
Authority to levy taxes for specific purposes	Limited funding, can exercise this authority with voter approval
Incur debt through general obligation bonds	Can exercise this authority with voter approval
Incur debt through special tax and revenue bonds	Can exercise this authority with voter approval
Incur debt through private activity bonds	Can exercise this authority with voter approval
Hazard Mitigation Grant Program (HMGP)	FEMA funding which is available to local communities after a Presidentially-declared disaster. It can be used to fund both pre- and post-disaster mitigation plans and projects.

Table 8-3 Financial Resources for Hazard Mitigation

Financial Resource	Accessible or Eligible to Use for Mitigation Activities
Pre-Disaster Mitigation (PDM) grant program	FEMA funding which available on an annual basis. This grant can only be used to fund pre-disaster mitigation plans and projects only
Flood Mitigation Assistance (FMA) grant program	FEMA funding which is available on an annual basis. This grant can be used to mitigate repetitively flooded structures and infrastructure to protect repetitive flood structures.
United State Fire Administration (USFA) Grants	The purpose of these grants is to assist state, regional, national or local organizations to address fire prevention and safety. The primary goal is to reach high-risk target groups including children, seniors and firefighters.
Fire Mitigation Fees	Finance future fire protection facilities and fire capital expenditures required because of new development within Special Districts.

8.4 CONTINUED PUBLIC INVOLVEMENT

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

DMA 2000 Requirements: Plan Maintenance Process - Continued Public Involvement

Continued Public Involvement

Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

Element

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

Source: FEMA, July 2010.

The City 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 City Office. An address and phone number of the Planning Team Leader to whom people can direct their comments or concerns will also be available at the City Office.

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

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Appendix A

Crosswalk

To be inserted after provided by FEMA.

Appendix B

Adoption Resolution

(To be completed following adoption by the City of Thorne Bay).

Appendix C

Public Outreach

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CITY OF THORNE BAY HAZARD MITIGATION PLAN

February 2011

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

The State of Alaska, Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management (DHS&EM) was awarded a Pre-Disaster Mitigation Program grant from the Federal Emergency Management Agency (FEMA) to prepare Hazard Mitigation Plans (HMP) for six Alaskan Communities. Thorne Bay was selected for participation in this effort.

DHS&EM, and their contractor The Boutet Company, Inc. and URS Corporation are sharing information to assist the community with preparing a FEMA approvable hazard mitigation plan and subsequent hazard mitigation grant program application during 2011 and 2012.

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

The Hazard Mitigation Grant Program project application development process will focus on determining the most essential and FEMA eligible project for the City to develop with The Boutet Company, Inc. The completed project application will then be presented to DHS&EM for statewide competitive grant prioritization and potential FEMA funding.

What is Hazard Mitigation?

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

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

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

Why Do We Need A Hazard Mitigation Plan?

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

The rules have changed. The Local government HMP and Flood Mitigation Assistance (FMA) plans' requirements were consolidated into one planning mechanism. Additionally the Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), Repetitive Flood Loss (RL), Severe Repetitive Flood Loss (SRL) grant programs were also consolidated under FEMA's newly developed Hazard Mitigation Assistance (HMA) program. Each of these programs must use the same application process and eligibility requirements for nationally competitive funding.

The Hazard Mitigation Grant Program (HMGP) is a disaster related assistance program. Applicants typically compete on a statewide basis.

The Planning Process

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

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

- Plan development process
- Identify hazards specific to the jurisdiction
- Identify the population and structures' risks
- Define the jurisdiction's mitigation goals
- List the jurisdiction's mitigation programs, selected actions, and implemented projects
- Provide a copy of the jurisdiction's resolution adopting the plan

FEMA has prepared Planning Guidance which is available at: http://www.fema.gov/library/viewRecord.do?id=4225; and "How to" Guides that explain in detail how each of the DMA2000 requirements are met. These guides are available at http://www.fema.gov/plan/mitplanning/resources.shtm. The City's Hazard Mitigation Plan will follow those guidelines.

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

DHS&EM has previously identified natural hazards that occur in the Nome Census Area that may also occur specifically in Thorne Bay.

We Need Your Help

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

Thorne Bay Hazard Worksheet		
Hazard	Prince of Wales-Hyder Census Area*	Thorne Bay
Avalanche	No	No
Earthquake	Yes	Yes
Erosion	Yes	No
Flood	Yes	Yes
Ground Failure (Landslide, Permafrost, Subsidence)	No	No
Tsunami & Seiche	No	Yes
Volcano	No	Yes
Weather (Severe)	Yes	Yes
Wildland Fire	Yes	Yes
*Hazard Matrix from the State of Alaska Hazard Mitigation Plan for the Southeast Island REAA (Prince of Wales-Hider Census Area(		

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

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

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

Thorne Bay Critical Facilities*	
Facility Type	Facility Name
Airport	Float Plane landing sites (main harbor)
Airport	float plane landing sites (the Port)
Bridge	Bridge
Church	Non- denominational church
Civic Center	School Gym
Community Hall	Community Club
Community Hall	Community Recreation Room
Community Storage Shed	Community Storage Shed
Fire Station (old)	Fire House (Old)
Fire Station	Thorne Bay Fire Department
Fuel Storage Tanks (>500gal)	Bulk Fuel Facility > 500 gal
Fuel Storage Tanks (>500gal)	Propane Distribution Center > 500 gal
Generator	Generator
Harbor/Dock/Port	Harbor (Top of Ramp)
Harbor/Dock/Port	Oil Dock (East)
Landfill/Incinerator	Thorne Bay Landfill
Library	Library
Offices	Island Newspaper Office / Alaska Laser Craft
Park	Baseball Field - Park
Post Office	Post Office
Potable Water Production and Treatment Facility	Potable Water (Treatment Plant)
Power Generation Facility	Bear Lake Hydro Electric Gen
Reservoir/Water Supply	Water Lake
School	School
School	Thorne Bay School
Service/Maintenance Shop	Service Station
Service/Maintenance Shop	Tracy's Heavy Equipment Repair
Sewage Lagoon	Sewage Treatment Plant
Store	Grocery Store
Store	Store
Teachers Quarters	Teacher Housing
Teachers Quarters	Teachers Housing
Telephone	ACS
* Alaska Critical Facilities Inventory	

The Planning Team

The planning team is being led by Wayne Benner with assistance from Mayor Jim Gould, Councilman Harvey McDonald, and Denise Boule. URS Corporation has been contracted by DHS&EM to provide assistance and guidance to the planning team throughout the planning process.

Public Participation

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

PUBLIC MEETINGS – Project Presentation & Data Gathering	
Location	City Administrator's Office
Date	February 15, 2011
Time	5-6 PM

Toll Free call-In number: 1.877.290.1337 Enter Conference Code: 3422356

We encourage you to take an active part in preparing the City of Thorne Bay's Hazard Mitigation Plan and the Mitigation Project Application Development effort. The purpose of this newsletter is to keep you informed and to allow you every opportunity to voice your opinion regarding these important projects. Please contact your community representative, URS planning coordinators, or The Boutet Company Inc. if you have any questions, comments, or requests for more information:

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CITY OF THORNE BAY'S HAZARD MITIGATION PLAN

June 2011 **Newsletter 2**

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

The City of Thorne Bay was one of six communities selected by the State of Alaska, Division of Homeland Security and Emergency Management (DHS&EM) for a Hazard Mitigation Planning (HMP) development project. The plan identifies natural hazards that affect the community including earthquake, flood, ground failure, tsunami, volcano, severe weather, and wildland fire. The HMP also identifies the people and facilities potentially at risk and ways to mitigate hazards. The public participation and planning process has been documented as part of the project. The Boutet Co. Inc. contracted with URS Corporation (URS) to assist in preparing the HMP. The Boutet Co. Inc. will prepare a Hazard Mitigation Grant Program project application for an eligible project identified within the City's Mitigation Strategy.

What is Hazard Mitigation?

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

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

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

Why Do We Need A Hazard Mitigation Plan?

A community is only eligible to receive grant money for mitigation programs by preparing and adopting a HMP. Communities must have an approved mitigation plan to receive grant funding from the Federal Emergency Management Agency (FEMA) for eligible mitigation projects. The Boutet Co. Inc. will work with the City of Thorne Bay to develop an eligible project grant application after the HMP is approved by DHS&EM and FEMA and adopted by the City.

The Planning Process

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

The DMA2000 requires the plan to document the following topics:

- Planning process
- Hazard identification
- Risk and vulnerability assessments
- Goals
- Mitigation programs, actions, and projects
- A resolution from the community adopting the plan

FEMA has prepared Planning Guidance which is available at: http://www.fema.gov/library/viewRecord.do?id=4225; and "How to" Guides that explain in detail how each of the DMA2000 requirements is met. These guides are available at http://www.fema.gov/plan/mitplanning/resources.shtm. The Thorne Bay Hazard Mitigation Plan will follow those guidelines.

In January 2011 the planning process kicked-off by establishing a local planning committee and holding a public meeting. During the meeting the planning committee examined the full spectrum of hazards listed in the State Hazard Mitigation Plan and identified seven hazards that the Thorne Bay HMP would address.

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

A mitigation strategy was the next component of the plan to be developed. Understanding the community's local capabilities and using information gathered from the public and the local planning committee and the expertise of the consultants and agency staff, a mitigation strategy was developed. The mitigation strategy is based on an evaluation of the hazards, and the assets at risk from those hazards. Mitigation goals and a list of potential actions/projects were developed as the foundation of the mitigation strategy. Mitigation goals are defined as general guidelines that explain what a community wants to achieve in terms of hazard and loss prevention. Goals are positively stated future situations that are typically long-range, policy-oriented statements representing community-wide visions. Mitigation actions/projects are undertaken in order to achieve your stated objectives. In April 2011, the local planning committee identified actions/projects for each hazard that focus on six categories: prevention, property protection, public education and awareness, natural resource protection, emergency services, and structural projects. The mitigation actions identified as a high priority by the planning team are listed below, and explained in more detail in the plan.

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

The draft plan is available in the City Office and on the State website (http://www.ready.alaska.gov) for public review and comment. Comments should be made via email, fax, or phone to the contact person below and be received no later than May 20, 2011. The plan will be provided to DHS&EM and FEMA for their approval prior to formal adoption by the City Council of Thorne Bay.

The Planning Committee

The plan was developed with the assistance from a planning committee consisting of a cross section of the community. Planning committee members who helped with development of the plan include Mayor Jim Gould, Team Leader Wayne Benner, Harvey McDonald, and Denise Boule. URS Corporation, The Boutet Co. Inc., and DHS&EM are also providing assistance to the planning committee.

Sample of the City of Thorne Bay's Mitigation Actions. Review the draft HMP for a complete list.

The City will aggressively manage their existing plans to ensure they incorporate mitigation planning provisions into all community planning processes such as comprehensive, capital improvement, and land use plans, etc. to demonstrate multi-benefit considerations and facilitate using multiple funding source consideration.	Develop and incorporate mitigation provisions and recommendations into zoning ordinances and community development processes to maintain the floodway and protect critical infrastructure and private residences from other hazard areas.	Develop and incorporate building ordinances commensurate with building codes to reflect survivability from flood, fire, wind, seismic, and other hazards to ensure occupant safety.
Identify and pursue funding opportunities to implement mitigation actions.	Update public emergency notification procedures and develop an outreach program for potential hazard impacts or events.	Determine and implement most cost beneficial and feasible mitigation actions for locations with repetitive flooding and significant damages or road closures.
Purchase and install generators with main power distribution disconnect switches for identified and prioritized critical facilities susceptible to short term power disruption. (i.e. first responder and medical facilities, schools, correctional facilities, and water and sewage treatment plants, etc.)	Maintain and update erosion hazard locations, identify critical facilities potentially impacted and develop mitigation initiatives such as bank stabilization or facility relocation to prevent or reduce the threat.	Update the storm water management plan to include regulations to control runoff, both for flood reduction and to minimize saturated soils on steep slopes that can cause landslides.
Complete a landslide location inventory; identify threatened critical facilities and other buildings and infrastructure.	Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	Implement and enforce the most current State adopted building codes to ensure structures can withstand winter storm hazards such as high winds, rain, water, and snow.
Develop water plant protection or sustainability plan.	Develop Community Wildland Fire Protection Plan.	

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

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Appendix 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 $\geq$ 1.0)

General Data Requirements:

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

Damage and Benefit Data

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

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

Building Data

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

Use Correct Occupancy Data

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

Questions to Be Answered

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

Common Shortcomings

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

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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: _____ to _____
(date) (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: