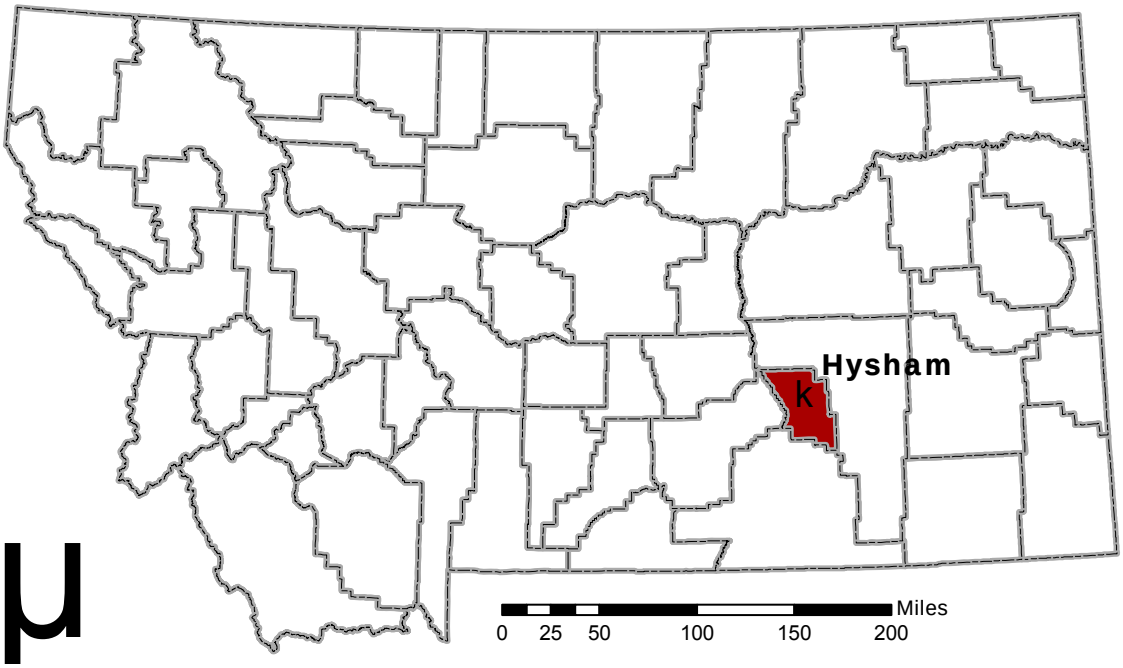
Treasure County, Montana
Town of Hysham, Montana

Pre-Disaster Mitigation Plan
Community Wildfire Protection Plan

May 2007



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EXECUTIVE SUMMARY

Disasters can strike at any time in any place. In many cases, actions can be taken before disasters occur to reduce or eliminate the negative impacts. These actions, termed mitigation, often protect life, property, the economy, and other values. The Treasure County Pre-Disaster Mitigation Plan and Community Wildfire Protection Plan addresses fifteen major hazards with respect to risk and vulnerabilities, specific to the county, including the Town of Hysham. Through a collaborative planning process, the Treasure County hazards were identified, researched, profiled, and prioritized.

The major hazards – agriculture hazards; communicable disease and bioterrorism; earthquake; flood; hazardous material release; landslide and sinkhole; severe thunderstorm; summer weather; terrorism and civil unrest; transportation accident; utility and communications failure; volcanic ashfall; water and air contamination; wildfire; and winter weather – are each profiled in terms of their hazard description, history, probability, magnitude, mapping, associated hazards and other factors, vulnerabilities, and data limitations. The vulnerabilities to critical and special needs facilities, structures, infrastructure, the population, economic, ecologic, historic, and social values, and future development are evaluated for each hazard. The wildfire hazard profile has more detailed information and additional elements such as vegetative fuels, prioritization of the wildland urban interface, and fire department capabilities in order to meet the requirements of a Community Wildfire Protection Plan.

Based on the probability and extent of potential impacts, the hazards are prioritized as follows for Treasure County:

- High Hazards: Wildfire; Winter Weather
- Moderate-High Hazards: Hazardous Material Release; Severe Thunderstorm
- Moderate Hazards: Agriculture Hazards; Communicable Disease and Bioterrorism; Flood; Landslide and Sinkhole; Summer Weather; Terrorism and Civil Unrest; Utility and Communications Failure; Water and Air Contamination
- Low-Moderate Hazards: Transportation Accident
- Low Hazards: Earthquake; Volcanic Ashfall

The following goals are outlined in the plan's mitigation strategy, based on the results of the risk assessment:

1. Promote the use of multi-hazard mitigation measures.
2. Prevent potential wildfire losses.
3. Reduce future losses from winter storms and floods.

Associated with each of the goals are objectives and mitigation actions ranging from wildfire defensible space around buildings to revision of the countywide growth policy to culvert improvements. The mitigation actions are prioritized based on cost, staff

time, feasibility, population benefit, property benefit, values benefit, project maintenance, and the hazards being mitigated. An implementation plan outlines the suggested course of action, given the limited resources available to Treasure County and the Town of Hysham. The county's Local Emergency Planning Committee is responsible for the implementation and maintenance of the plan. Other recommended activities, such integrating this plan into a variety of county and town plans and documents, will further the goals of hazard mitigation in Treasure County.

This plan serves as a guide for understanding the major hazards facing Treasure County and the Town of Hysham and provides a strategy for preventing some of the impacts. This plan exceeds the requirements of a local hazard mitigation plan as outlined in the Interim Final Rule published in the Federal Register on February 26, 2002 at Title 44 of the Code of Federal Regulations, Part 201 as part of the Disaster Mitigation Act of 2000. This plan has been approved by Montana Disaster and Emergency Services and the Federal Emergency Management Agency as a Pre-Disaster Mitigation Plan, and therefore, the county and cities may be eligible for federal mitigation funds. This plan also serves as a Community Wildfire Protection Plan, as required by the National Fire Plan, and has been approved by the Montana Department of Natural Resources and Conservation and the US Bureau of Land Management.

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1. ADOPTION DOCUMENTATION

2. INTRODUCTION

2.1 Purpose

Treasure County and the Town of Hysham recognize that hazards, both natural and human-caused, threaten their communities. Rather than wait until disaster strikes, Treasure County and the Town of Hysham can take proactive measures to prevent losses and lessen the impact from these hazards. Actions taken to reduce or eliminate the long-term risk from hazards are defined as mitigation. Disaster mitigation, or prevention, is an investment that can save lives and money.

Treasure County and the Town of Hysham are taking the steps necessary to become disaster-resistant communities, and through their initiative, wrote this plan to meet the requirements of the Interim Final Rule published in the Federal Register on February 26, 2002 at 44 CFR Part 201 as part of the Disaster Mitigation Act of 2000 for a Pre-Disaster Mitigation Plan. This plan also serves as a Community Wildfire Protection Plan by integrating the goals of the National Fire Plan and the associated 10-Year Strategy Implementation Plan and requirements set forth by the National Interagency Fire Center into the appropriate sections. Effective mitigation planning promotes a broader understanding of the hazards threatening the communities and provides a clearer vision and competitive edge for future mitigation grant funding. By integrating mitigation concepts into local thinking, the communities will find many more opportunities for disaster resistance beyond grant funding. For example, the consideration of disaster mitigation during growth and future development will result in cost-effective solutions and greater disaster resistance, thus saving the communities money in the long-term.

The purpose of this Pre-Disaster Mitigation Plan and Community Wildfire Protection Plan is to:

- Serve as a consolidated, comprehensive source of hazard information
- Educate the communities, including government leaders and the public, on their vulnerabilities
- Prioritize and promote cost-effective mitigation solutions
- Support requests for grant funding
- Encourage long-term community sustainability
- Provide enhanced information and recognition of the wildfire hazard

The mission of the Treasure County Pre-Disaster Mitigation Plan and Community Wildfire Protection Plan is to guide the prevention of all hazards in order to protect citizens, property, the environment, the quality of life, and the economy in Treasure County and the Town of Hysham.

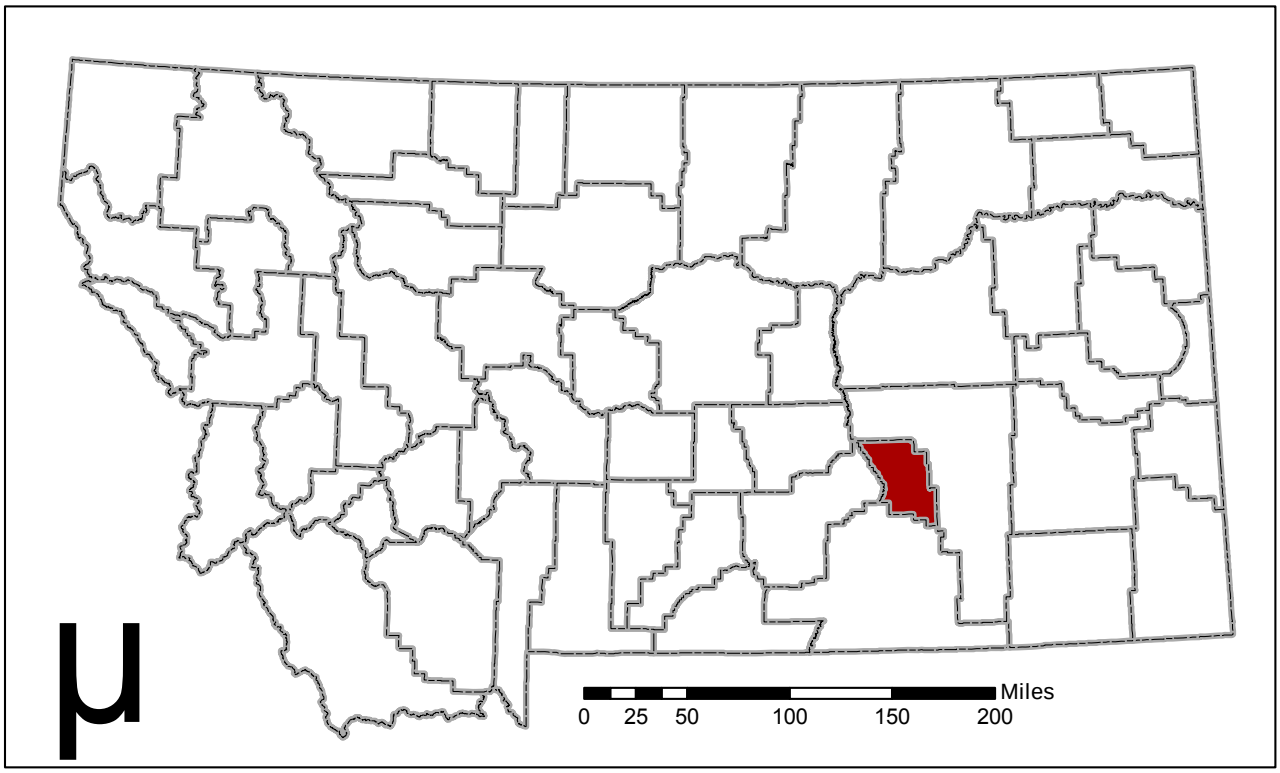
2.2 County Profile

Treasure County is located in east-central Montana as shown in Map 2.2A. The county has a population of about 689 (2005 estimate) with a land area of 979 square miles. (US Census Bureau, 2000) Treasure County is the second smallest county in Montana by population and fourth smallest by land area. The county is bordered on the north and east by Rosebud County, to the south by Big Horn County, and to the west by Yellowstone County.

Map 2.2A

Location Within Montana

Treasure County



Data Source: Montana Natural Resource Information System
Data Date: January 2001
Map Coordinates: NAD 1983, State Plane Montana

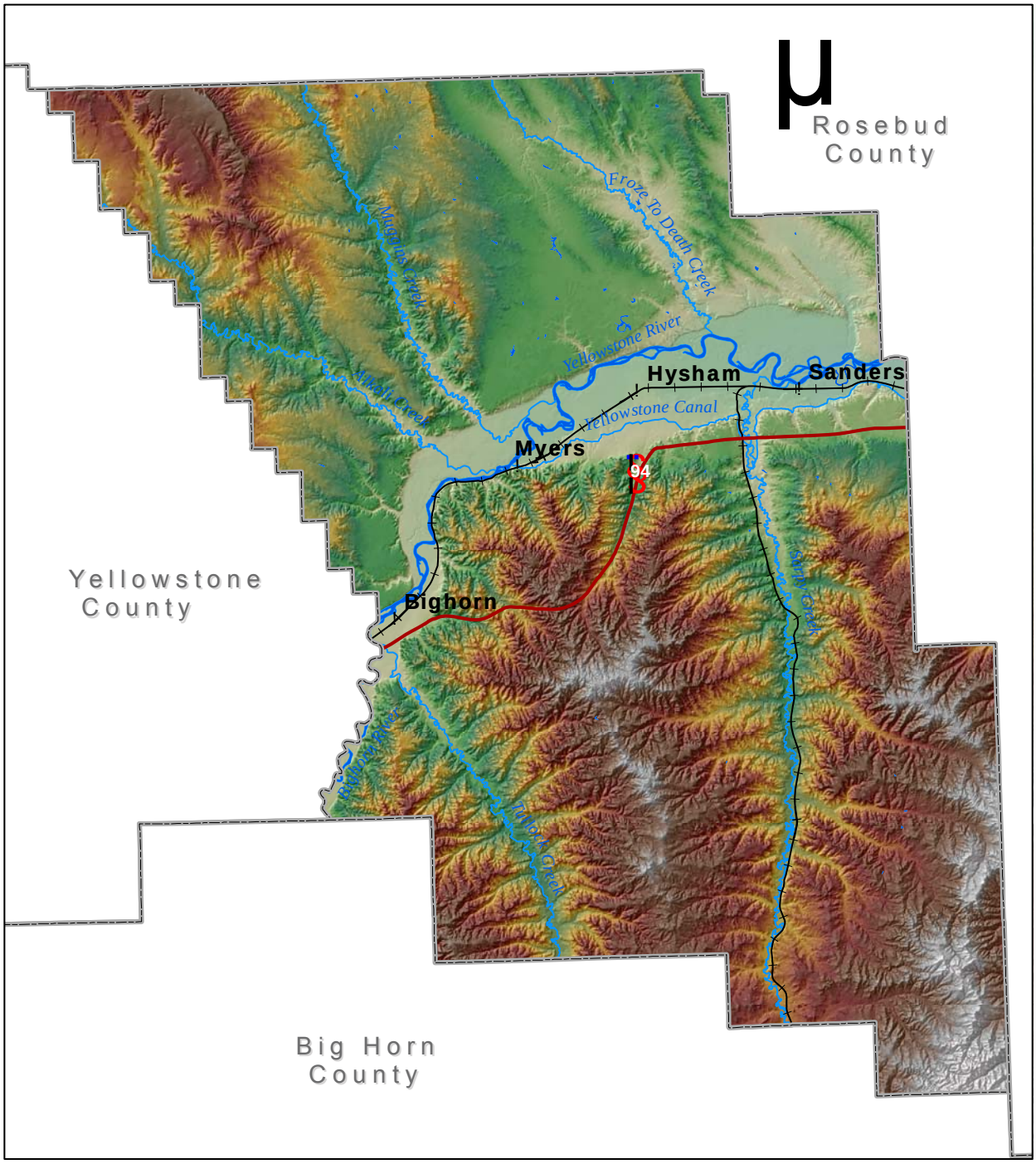
Map Created By:
Pam Shrauger, February 2006

Hysham, the county seat and only incorporated community within Treasure County, has an approximate population of 330. (Montana Department of Commerce, 2000) Other unincorporated communities within Treasure County include Bighorn, Myers, and Sanders. Map 2.2B shows the major features within Treasure County.

Map 2.2B

Features

Treasure County



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Data Date: Varied
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, February 2006

BIG SKY HAZARD MANAGEMENT LLC

The Yellowstone River passes through the middle of Treasure County near where Hysham sits at an elevation of 2,661 feet above mean sea level. Along the western border of the county near Bighorn, the Bighorn River enters the Yellowstone River. The primary land use in the county is agricultural with farms and ranches throughout. To the north of the Yellowstone River lies relatively flat grasslands and to the south rolling, timber covered hills. Other features in the county include a number of creeks and streams, including Alkali Creek, Froze to Death Creek, Muggins Creek, Sarpy Creek, Tullock Creek, and a large irrigation canal stemming from the Yellowstone River.

The Treasure County economy is primarily made up of agriculture, forestry, fishing, hunting, and mining. Recreation generally centers on the Yellowstone River and the associated fishing, hunting, camping, and boating opportunities. Game animals within the county include deer, antelope, pheasants, geese, turkeys, grouse, sage hens, and ducks.

After reaching the Pacific Ocean, early explorer William Clark passed through Treasure County during the summer of 1806 when traveling east along the Yellowstone River. Shortly thereafter, fur traders set up a post near the confluence of the Bighorn and Yellowstone Rivers, and forts were set up as part of the ongoing battles with the Native Americans. By the early 1900's, the area where Treasure County now lies was part of the Crow Reservation until subsequent treaties changed the reservation boundaries. Thousands of cattle grazed this region, and Treasure County was officially established in 1919 with Hysham as its county seat. County government consists of three county commissioners. Hysham is governed by a mayor and town council.

The primary transportation route in Treasure County is Interstate 94 with county roads 311 and 384 serving as secondary roads. An airport serving small private and charter aircraft is located in Hysham (6U7). The closest commercial airport is in Billings.

The climate of Treasure County is typical of most Montana areas and the Northern Plains with hot, dry summers and cold, snowy winters and can feature extreme weather events such as tornadoes, large hail, drought, strong winds, and blizzards. Weather observations are generally taken daily by National Weather Service Cooperative Weather Observers. Table 2.2C shows climate data from two stations in Treasure County. Note that both stations have several periods of missing data. Based on averages, January is the coldest and snowiest month, June is the wettest month, and July is the hottest month.

Table 2.2C Treasure County, MT Climate Statistics

	Hysham 1948 - 2005	Hysham 25 SSE 1957-2005
Annual Average Maximum Daily Temperature	61.3ºF	59.5ºF
Annual Average Minimum Daily Temperature	32.2ºF	29.5ºF
Annual Average Total Precipitation	12.91 inches	14.24 inches
Annual Average Total Snowfall	34.8 inches	52.5 inches
Highest Temperature Recorded	108ºF August 6, 1949	113ºF July 15, 2002
Lowest Temperature Recorded	-48ºF January 20, 1954	-50ºF December 22, 1989
Annual Average # of Days Dropping Below Freezing	174.6 days	193.1 days
Annual Average # of Days Staying Below Freezing	39.2 days	43.0 days
Highest Annual Precipitation	21.74 inches 1993	21.00 inches 1978
Lowest Annual Precipitation	6.48 inches 1960	7.95 inches 1979
1 Day Maximum Precipitation	3.05 inches September 10, 1961	2.33 inches April 26, 1969
Highest Annual Snowfall	93.5 inches 1996	124.7 inches 1984
Highest Daily Snowfall	14.5 inches October 20, 1949	24 inches April 27, 1984
Highest Snow Depth	29 inches March 15, 2005	27 inches December 23-24, 1984

Source: Western Regional Climate Center, 2006.

Overall, Treasure County is faced with many natural and human caused hazards. Of the natural hazards, several are related to the weather including blizzards, heavy snow, ice storms, extreme cold, strong winds, wildfire, extreme heat, drought, dust storms, tornadoes, hail, downbursts, and floods. Other natural hazards are more geologic in nature such as earthquakes and volcanic ashfall. Yet others involve a combination of human and natural factors including communicable disease, erosion, low water supplies, sinkholes, and infestation. The human caused hazards in the county result from human activities, yet still may be triggered by natural events, and include hazards such as hazardous materials release, dam failure, terrorism, civil unrest, transportation accidents, utility failure, water and air contamination, and communications failure. This plan, particularly the risk assessment section, will outline each hazard in detail and how it may affect Treasure County and the Town of Hysham. The mitigation strategy outlines solutions to possibly prevent future damages. Additional hazards may exist that were not apparent to local government or participants through the development of this plan, and certainly, disasters can occur in unexpected ways. Although any and all hazards cannot be fully mitigated,

hopefully, this plan will help the communities understand the hazards better and become more disaster resistant.

3. PLANNING PROCESS

Mitigation planning is a community effort. It also takes time and expertise. For Treasure County and the Town of Hysham, an effective hazard mitigation plan requires input from elected officials, first responders, emergency management, health care providers, schools, public works and road officials, state and federal agencies, businesses, and the public. Following a disaster, many of these stakeholders will be overwhelmed with recovery responsibilities. Therefore, planning for mitigation and involving as many stakeholders as possible before a disaster strikes will make mitigation activities easier following a disaster and may even prevent the disaster in the first place!

The process of developing a Pre-Disaster Mitigation Plan for Treasure County and the Town of Hysham began in 2005 when Montana Disaster and Emergency Services (DES) applied for and received a grant from the Federal Emergency Management Agency (FEMA) to develop the plan. Following a competitive bid process, in December 2005, Treasure County hired a consultant to facilitate the planning process and aid in the plan's development. Treasure County decided to use the same planning process and consultant to develop the county's Community Wildfire Protection Plan with funding from the US Bureau of Land Management. Big Sky Hazard Management LLC, based in Bozeman, Montana with experience in hazard mitigation and emergency management, coordinated the year-long planning process. The Treasure County Disaster and Emergency Services Coordinator, Pat Zent, managed the grants for the county and evaluated the progress of the plan monthly through progress reports and updates on the consultant's website.

A series of five workshops, designed to involve the stakeholders and the public, generated input and comments for the plan. The workshops for the development of the plan's first edition were held in February 2006, May 2006, October 2006, March 2007, and April 2007. Appendix A shows the list of stakeholders identified and invited to the workshops. Appendix C contains the sign-in sheets from each workshop and identifies those that actively participated in the plan's development. At the February 2006 Kick-off Workshop, participants developed the plan's mission statement and identified the hazards to be profiled. Participants of the May 2006 Workshop reviewed hazard mapping and identified critical and special needs facilities within the county. The October 2006 Workshop focused specifically on the wildfire hazard. Participants discussed wildfire hazard areas and possible mitigation activities. At the March 2007 Mitigation Strategy Workshop, participants reviewed the risk assessment results and developed mitigation project ideas based on those results. The April 2007 Workshop attendees reviewed the draft plan, solicited comments, and discussed how to move forward with the plan. Appendix D contains notes from each of the workshops. Participants included representatives from both jurisdictions, Treasure County and the Town of Hysham.

Information from existing plans, studies, reports, and technical information related to hazards, mitigation, and community planning was gathered by Big Sky Hazard Management LLC by contacting individuals throughout the planning process. Many national and state plans, reports, and studies provided background information. Table 3A lists the existing local plans and documents incorporated into this mitigation plan. Additional information was collected through library and internet research. This information was integrated into the appropriate sections of the plan. Documentation on these sources, plans, studies, reports, and technical information can be found in the References Section, Appendix E. Mapping for and drafting of the plan was done by Big Sky Hazard Management LLC based on information collected from a wide variety of sources and subject matter experts. The information was organized into a clear, usable, and maintainable format for the county that also ensured the federal regulations regarding hazard mitigation plans were met.

Table 3A Existing Local Plans and Documents Incorporated

Plan/Report/Study Name	Plan/Document Date
Hysham Volunteer Fire Department By-Laws	1995
Regional Mutual Aid Agreement	May 11, 1992
State of Montana Department of Natural Resources and Conservation and Treasure County Cooperative Agreement	July 18, 2006
State of Montana Multi-Hazard Mitigation Plan and Statewide Hazard Assessment	October 2004
Treasure County and Town of Hysham Inter-Local Agreement	July 19, 2005
Treasure County Comprehensive Development Plan/Growth Policy	September 2003
Treasure County Emergency Operations Plan	2005
Treasure County Planning Data Book and Comprehensive Plan	1979
Treasure County Subdivision Regulations	April 2004

Participation from the public was encouraged through press releases and paid advertisements in the local newspaper, the Hysham Echo. Announcements were also posted on the Big Sky Hazard Management LLC website. Each press release encouraged participation through workshop attendance or the review of documents on the consultant's website. Invitations were sent to active participants and those in communities beyond Treasure County, thus allowing neighboring communities and regional agencies the opportunity to participate. Comments on the draft sections posted on the Big Sky Hazard Management LLC website were readily accepted throughout the planning process. Copies of the press releases and advertisements can be found in Appendix B.

The draft plan was posted on the Big Sky Hazard Management website from April 1, 2007 through May 1, 2007. Comments on the complete plan were accepted until May 1, 2007. Each section was reviewed individually by hazard experts, stakeholders, and members of the community. All comments received consideration and changes to the plan were made where applicable.

The Treasure County Pre-Disaster Mitigation Plan and Community Wildfire Protection Plan is a living, expandable document that will have new information added and changes made as needed. The plan's purpose is to improve disaster resistance through projects and programs, and therefore, opportunities for changes and public involvement will exist as disasters occur and mitigation continues. Details on the plan's maintenance and continued public involvement are further outlined in the Plan Maintenance Procedures, Section 6.

4. RISK ASSESSMENT

A key step in preventing disaster losses in Treasure County and the Town of Hysham is developing a comprehensive understanding of the hazards that pose risks to the communities. The following terms can be found throughout this section.

Hazard:	a source of danger
Risk:	possibility of loss or injury
Vulnerability:	open to attack or damage

Source: Federal Emergency Management Agency, 2001.

This all-hazard risk assessment serves as a single source of hazard information for Treasure County and the Town of Hysham. Other plans may be referenced and remain vital hazard documents, but each hazard has its own profile in this plan. As more data becomes available and disasters occur, the individual hazard profiles can be expanded or new hazards added. This summary of hazards identifies and describes the hazards that threaten Treasure County and the Town of Hysham and determines the values at risk from those hazards. The risk assessment is the cornerstone of the mitigation strategy and provides the basis for many of the mitigation goals, objectives, and proposed actions.

4.1 Hazard Identification

Any number of hazards have the potential to affect the communities in Treasure County from global events to isolated, localized incidents. The only limit to the number of hazards identified is one's imagination. To provide a framework for this hazard assessment, the Local Emergency Planning Committee and local experts at a public workshop identified the hazards with the greatest potential to affect the area. Closely related-hazards were grouped together for simplicity. A workshop facilitator reduced the chances of overlooking a hazard by compiling a comprehensive list of possible hazards using multiple sources, researching local hazard histories, and relying on area hazard experts and residents to identify unique hazards specific to the region. This process produced a list of fifteen probable hazard groups to be profiled. Table 4.1A shows the hazards and how and why they were identified. The level of detail for each hazard correlates to the relative risk of each hazard to the county and is limited by the amount of data available. As new hazards are identified, they can be added to the hazard list, profiled in this section, and mitigated in the mitigation strategy.

Table 4.1A Treasure County Hazards

Hazard Profile	Jurisdiction	How Identified	Why Identified
Agriculture Hazards (including low irrigation supplies and livestock predators)	Treasure County	▪ Public input ▪ US Department of Agriculture ▪ Montana Fish, Wildlife and Parks	▪ Importance of agriculture on the local economy
Communicable Disease and Bioterrorism (including human, animal, and plant diseases)	Treasure County Town of Hysham	▪ Centers for Disease Control ▪ Pandemic studies ▪ US Department of Agriculture	▪ Global disease threat ▪ History of pandemics ▪ Dependence on agricultural economy
Earthquake	Treasure County Town of Hysham	▪ US Geological Survey ▪ Montana Bureau of Mines and Geology ▪ HAZUS-MH	▪ History of regional earthquakes
Flood (including riverine, ice jam, and flash flood, dam failure, and bank erosion)	Treasure County Town of Hysham	▪ National Climatic Data Center ▪ HAZUS-MH ▪ National Weather Service ▪ US Army Corps of Engineers	▪ History of riverine, ice jam, and flash floods ▪ Numerous dams throughout the county ▪ Yellowtail Dam in Big Horn County that could affect Treasure County
Hazardous Material Release (including fixed, mobile, and pipeline sources)	Treasure County Town of Hysham	▪ US Department of Transportation Emergency Response Guidebook	▪ An interstate and a railroad run through the county
Landslide and Sinkhole	Treasure County	▪ US Geological Survey ▪ Montana Department of Transportation	▪ History of sinkholes on Interstate 94
Severe Thunderstorm (including tornadoes, hail, lightning, and downbursts)	Treasure County Town of Hysham	▪ National Climatic Data Center ▪ Storm Prediction Center ▪ National Weather Service ▪ National Severe Storms Laboratory	▪ Extensive history of severe thunderstorms ▪ Potential for tornadoes, large hail, and strong winds
Summer Weather (including extreme heat, drought, dust storms, infestations, low water supplies, and strong winds)	Treasure County Town of Hysham	▪ National Drought Mitigation Center ▪ National Climatic Data Center ▪ National Weather Service ▪ US Department of Agriculture	▪ History of droughts, heat waves, and strong winds ▪ Importance of agriculture to the local economy ▪ Numerous USDA disaster declarations

Table 4.1A Treasure County Hazards (continued)

Hazard Profile	Jurisdiction	How Identified	Why Identified
Terrorism and Civil Unrest	Treasure County Town of Hysham	▪ Federal Bureau of Investigations ▪ National Memorial for the Prevention of Terrorism ▪ Southern Poverty Law Center	▪ Significance of September 11 attacks to the economy ▪ National indications and foreign threats of future terrorist attacks ▪ Potential for school violence and other domestic attacks
Transportation Accident (including vehicular, railway, and aircraft accidents)	Treasure County Town of Hysham	▪ National Transportation Safety Board ▪ Federal Railroad Administration ▪ Montana Highway Patrol ▪ Montana Department of Transportation	▪ Potential for a serious accident involving multiple patients ▪ History of highway closures ▪ History of railroad accidents ▪ History of small plane crashes
Utility and Communications Failure (including electric, telephone, water, sewer, propane, and 911/emergency communication outages)	Treasure County Town of Hysham	▪ Local infrastructure information	▪ Daily and operational dependence on utilities and communications ▪ History of power outages
Volcanic Ashfall	Treasure County Town of Hysham	▪ US Geological Survey ▪ Cascades and Yellowstone Volcano Observatories	▪ History of ashfall in the region
Water and Air Contamination	Treasure County Town of Hysham	▪ US Environmental Protection Agency ▪ Local infrastructure information	▪ Public concern for future water and air quality
Wildfire	Treasure County Town of Hysham	▪ National Interagency Fire Center Archives ▪ US Forest Service ▪ National Weather Service	▪ Extensive history of wildfires ▪ Government lands within the county ▪ Potential for significant wildfire losses
Winter Weather (including blizzards, heavy snow, ice storms, extreme cold, and strong winds)	Treasure County Town of Hysham	▪ National Climatic Data Center ▪ National Weather Service	▪ History of severe winter storms ▪ High probability of blizzards and other potentially damaging storms

4.2 Assets and Community Inventory

In addition to identifying and understanding the hazards of the area, an important aspect of mitigation planning is contemplating the effects such hazards may have on the communities. To thoroughly consider the effects, the assets and values at risk must be first identified. Examples of community assets include the population, critical facilities, businesses, residences, critical infrastructure, natural resources, historic places, and the economy. The following sections identify the specific assets and community inventory.

4.2.1 Critical Facilities

During or following a disaster, some facilities become exceedingly important in protecting the safety of the population, the continuity of government, or the values of the community. Examples include those facilities vital to public safety such as law enforcement, fire services, and health services. These facilities were identified by participants at the second round of workshops and through additional contractor research. Tables 4.2.1A through 4.2.1G list the critical facilities in Treasure County and the Town of Hysham. Replacement values, where available, were gathered from government insurance records. Map 4.2.2C shows the locations of most of the critical facilities.

Table 4.2.1A Critical Facilities – Local Government and Law Enforcement Facilities

Facility	Address	Replacement Value
County Courthouse	307 Rapelje, Hysham	$988,964 Building $161,000 Contents
Hysham Town Offices and Shop	502 Elliot Avenue, Hysham	$50,000 Building $20,000 Contents

Table 4.2.1B Critical Facilities – Fire Stations and Emergency Medical Services Facilities

Facility	Address	Replacement Value
Fire Station	306 Rapelje, Hysham	$493,378 Building $185,558 Contents
County Shop/Ambulance Garage	405 Pioneer Avenue, Hysham	$859,057 Building $509,877 Contents
Individuals have some equipment		

Table 4.2.1C Critical Facilities – Utility and Communication Facilities

Facility	Address	Replacement Value
Grierson Site Repeater	West of Hysham	
Sarpy Site Repeater	7 miles up Sarpy	
Range Telephone	509 Elliot Avenue, Hysham	
Hysham Water Tower (100,000 gallons)		
Hysham Sewer Lagoon	West of Hysham	
Hysham Old Pump House	North of Hysham	$6,200 Building $49,450 Contents
Hysham Old Water Plant		$15,500 Building $44,300 Contents
Hysham New Water Plant	North of Hysham	$77,250 Building $458,350 Contents
Hysham Storage Building		$2,050 Building $2,050 Contents

Table 4.2.1D Critical Facilities – Transportation Facilities

Facility	Address
Montana DOT Section House & Storage Buildings	4th & Spurling, Hysham
Hysham Town Offices and Shop	502 Elliot Avenue, Hysham
Greyhound Station	Buford & Elliot, Hysham

Table 4.2.1E Critical Facilities – Energy Facilities

Facility	Address
Mid-Yellowstone Electric Cooperative	203 Elliott Avenue, Hysham
	Frontage Road
	Big Horn/Rosebud County Line

Table 4.2.1F Critical Facilities – State and Federal Facilities

Facility	Address
USDA NRCS Building	211 Elliot Avenue, Hysham
US Post Office	118 Spurling Street, Hysham
US Post Office	1 Sitting Bull Avenue, Bighorn

Table 4.2.1G Critical Facilities – Hazardous Materials Facilities

Facility	Address	Material(s)
Cenex	Elliot Avenue, Hysham	Fertilizer and other chemicals
Simplot	Sugar Road, Hysham	Fertilizer and other chemicals
Farmers Union	Old Highway 10	Bulk fuel tanks
Farmers Union	Elliot Street, Hysham	Underground propane tanks
Friendly Corner	Elliot Street, Hysham	Underground fuel tanks

Table 4.2.1H Other Local Government Owned Facilities

Facility	Replacement Value
Hysham Storage Building	$30,900 Building

4.2.2 Special Needs Populations

Often, special population groups, such as children, the disabled, and the elderly, require more attention and services during times of disaster. Their needs can be unique in terms of medical equipment, transportation, and staffing. Given their specialized needs, they are often more vulnerable during disasters. Tables 4.2.2A and 4.2.2B list the identified special needs populations in Treasure County.

Table 4.2.2A Special Needs Facilities

Facility	Address
Hysham Clinic	405 ½ Pioneer Avenue, Hysham
Senior Center/Community Center	306 Rapelje, Hysham

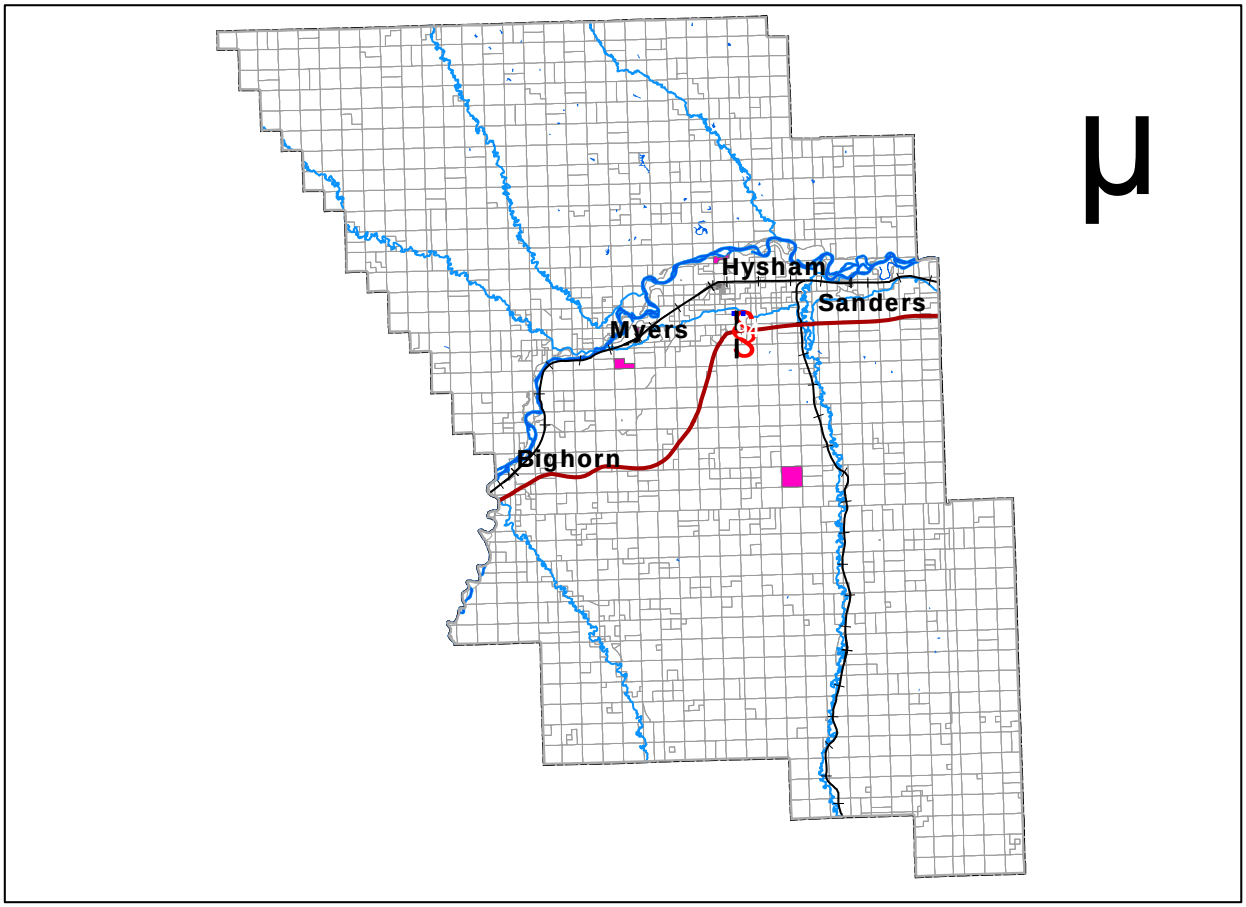
Table 4.2.2B Schools

Facility	Address
Hysham School	Summit Street, Hysham

Map 4.2.2C

Critical and Special Needs Facilities

Treasure County



Town of Hysham

Critical and Special Needs Facilities

Data Source: Montana Natural Resource Information System
Data Date: April 2006
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, February 2007

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4.2.3 Structures

Like critical facilities, structures such as residences and businesses are also vulnerable to hazards. Based on 2000 US Census data, Treasure County has 422 housing units, including 182 which are within the Town of Hysham. The median value of owner-occupied housing units is $40,700. Census data also accounts for 26 private non-farm establishments with employees and 58 non-employer establishments. Tables 4.2.3A through 4.2.3C show additional data on housing units.

Table 4.2.3A 2000 US Census Housing Data on Structure Types

Units in Structure	Treasure County TOTAL	Town of Hysham	Unincorporated Areas of Treasure County
1-unit, detached	313	135	178
1-unit, attached	2	0	2
2 units	0	0	0
3 or 4 units	0	0	0
5 to 9 units	0	0	0
10 to 19 units	14	14	0
Mobile home	91	33	58
Boat, RV, van, etc.	2	0	2

Source: US Census Bureau, 2000.

Table 4.2.3B 2000 US Census Housing Data on Structure Ages

Year Structure Built	Treasure County TOTAL	Town of Hysham	Unincorporated Areas of Treasure County
1999 to March 2000	7	0	7
1995 to 1998	17	6	11
1990 to 1994	5	3	2
1980 to 1989	60	22	38
1970 to 1979	66	31	35
1960 to 1969	34	14	20
1940 to 1959	90	42	48
1939 or earlier	143	64	79

Source: US Census Bureau, 2000.

Table 4.2.3C 2000 US Census Housing Data on Structure Values

Value	Treasure County TOTAL	Town of Hysham	Unincorporated Areas of Treasure County
Less than $50,000	66.9%	74.4%	61.3%
$50,000 to $99,999	22.3%	25.6%	19.6%
$100,000 to $149,999	3.3%	0%	5.8%
$150,000 to $199,999	2.5%	0%	4.4%
$200,000 to $299,999	0%	0%	0%
$300,000 to $499,999	5.0%	0%	8.8%
MEDIAN	$40,700	$37,500	$41,660

Source: US Census Bureau, 2000.

Table 4.2.3D show the results of a housing condition study conducted in 1999.

Table 4.2.3D Physical Housing Condition in Treasure County

Condition	Number of Housing Units
Excellent	1
Good	106
Average	166
Fair	111
Poor	43
Unsound	3

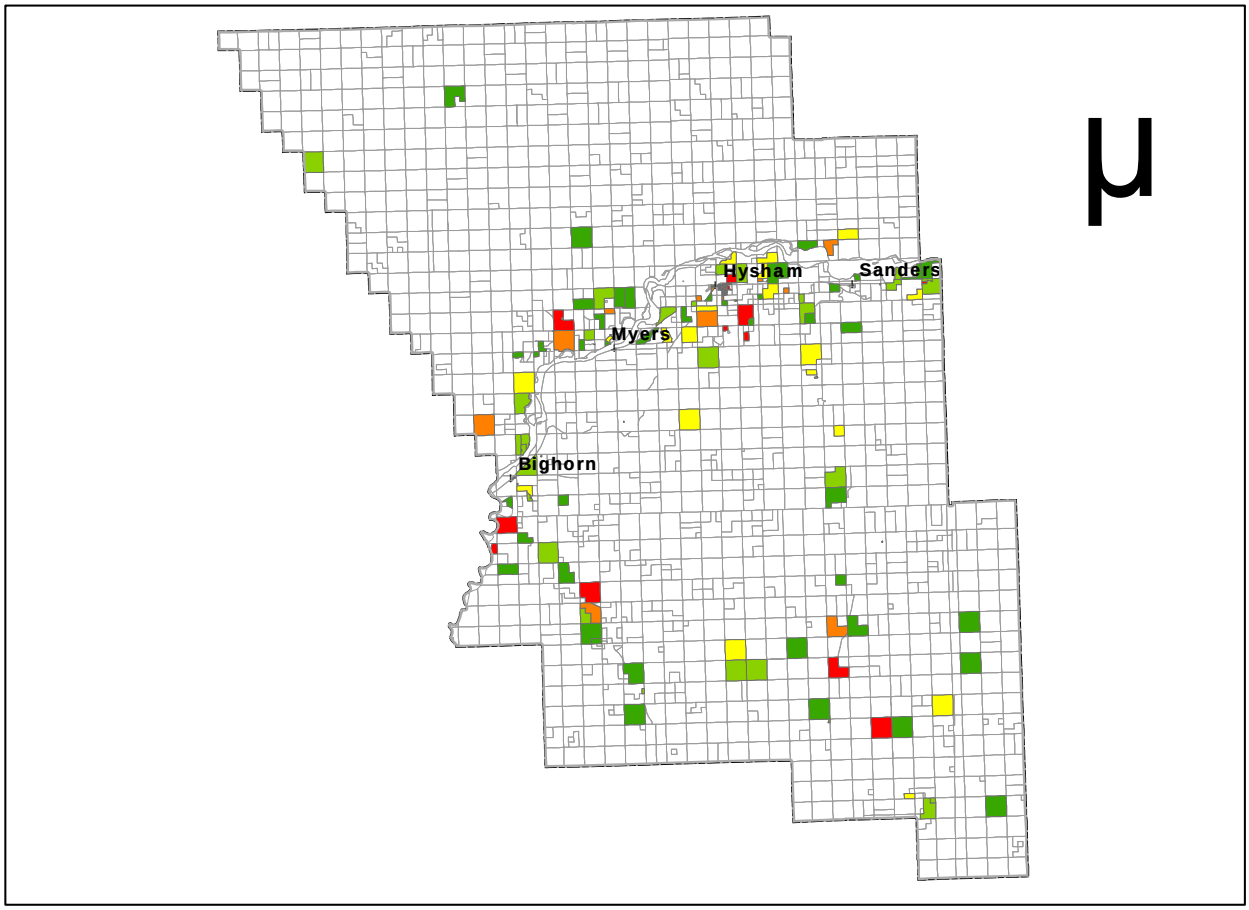
Source: Treasure County, 2003.

Using the census data, the total value of residential structures in Treasure County can be estimated at $17,175,400 (422 housing units * $40,700/unit). The value of the building stock in Hysham is estimated at $6,825,000 and in unincorporated areas of Treasure County at $9,998,400.

Data from the Montana Department of Revenue Computer Assisted Mass Appraisal System (CAMA) can be used to show the distribution of structures throughout the county. This database lists for each parcel of land, the associated taxable land and building values. Map 4.2.3D shows 309 parcels with building values greater than $0. The sum of the structure values (not including land values) assessed in Treasure County is $11,356,780. In comparison, the Federal Emergency Management Agency's HAZUS-MH loss estimation software gives the building stock in Treasure County a replacement value of $50,283,000.

Map 4.2.3D Structure Values by Taxable Land Parcels

Treasure County



Town of Hysham

Taxable Building Value

- <= $20,000
- $20,001 - $50,000
- $50,001 - $75,000
- $75,001 - $100,000
- > $100,000

Map Created By:
Pam Shrauger, May 2006

Data Source: Montana Natural Resource Information System
Data Date: April 2006
Map Coordinates: NAD 1983, State Plane Montana

4.2.4 Infrastructure

Utilities such as electricity, heating fuel, telephone, water, and sewer rely on established infrastructure to provide services. The providers of these services use a variety of systems to ensure consistent service in the county. Each of these services is important to daily life in Treasure County, and in some cases, is critical to the protection of life and property. Most utilities use complicated engineered systems. For simplicity and the protection of this infrastructure, only the key components of the systems are described here. For more detailed information, the individual service providers can be contacted directly. The transportation network is another example of important infrastructure and relies on bridges and road segments.

4.2.4.1 Electricity

Electricity runs lights, computers, medical equipment, water pumps, heating system fans, refrigerators, freezers, televisions, and many other types of equipment. The Mid-Yellowstone Electric Cooperative, based in Hysham, and Yellowstone Valley Electric Cooperative, based in Huntley, provide these services to Treasure County. Much of the electric service is run through overhead lines. These lines are supported by poles and have key components such as transformers and substations. The Mid-Yellowstone Electric Cooperative has nine employees in Hysham. (Treasure County, 2003) Two sets of major electric transmission lines cross the southern part of the county from the Colstrip power plants. Another crosses the middle of the county in the general vicinity of Interstate 94.

4.2.4.2 Heating Fuel

During the cold winter months, the heating of homes and businesses is a necessity. The primary fuel used in Treasure County is propane and in Hysham is electricity, however, a variety of fuels are used as shown in Table 4.2.4.2A. Most systems ultimately require electricity to run their thermostats and blowers.

Table 4.2.4.2A 2000 US Census Housing Data on House Heating Fuel

Fuel Type	Treasure County TOTAL	Town of Hysham	Unincorporated Areas of Treasure County
Bottled, tank, or LP Gas	42.0%	39.5%	43.9%
Electricity	40.6%	47.1%	35.7%
Fuel oil, kerosene	3.4%	3.8%	3.1%
Coal or coke	5.3%	0.6%	8.9%
Wood	7.3%	7.0%	7.5%
Other fuel	0.8%	1.9%	0%
No fuel used	0.6%	0%	1.1%

Source: Montana Department of Commerce, 2000.

Those buildings heated with propane typically have a nearby tank that is refilled regularly by a local propane vendor. The vendor uses a truck to transport the propane to the users. Therefore, the propane vendor relies on accessibility to the communities and rural residents via the road network. Should any areas become isolated due to poor road conditions, the vendor may not be able to access the tanks to refill them.

4.2.4.3 Telephone

Telephone and most internet services in the county are provided by Range Telephone, headquartered in Forsyth, MT. The Range Telephone has one exchange, Hysham, in the county. Similar to electric infrastructure, telephone can be run through overhead or underground lines. Much of the telephone infrastructure in Treasure County lies within the road right-of-ways.

4.2.4.4 Water and Sewer

Municipal water and sewer systems exist within the Town of Hysham. The water system is fed by well pumps from the Yellowstone River aquifer. Sewage is treated in a nearby 2-cell lagoon northwest of Hysham. Most of the infrastructure for water and sewer lies under the road right-of-ways. County residents rely on individual well and septic systems.

4.2.4.5 Transportation

The transportation infrastructure within Treasure County includes the road network, railroad, and air travel. The primary transportation route in Treasure County is Interstate 94 across the county in a general east-west direction and county roads 311 and 384 serving as secondary roads. County road 311 roughly parallels Interstate 94 and county road 384 is the primary road through the Sarpy Creek area. Treasure County is responsible for more than 300 miles of roads and over 40 bridges. The county has two full time road employees and one shop, located in Hysham. The Town of Hysham has 7.6 miles of streets it maintains, 5.2 miles of which are paved. In 1999, the average daily traffic count on Interstate 94 between Hysham and Sarpy Creek was 3,160 vehicles and between Hysham and Interstate 94 was 410 vehicles per day. The Montana Department of Transportation has a three person road crew, a gravel site, and up to three snowplows in Hysham. (Treasure County, 2003)

The railroad is owned and operated by Burlington Northern Santa Fe and transports mixed loads in an east-west direction through the center of the county via a main line and also operates a 38-mile spur line hauling coal from just to the south of the county line to the main line near Hysham. None of the lines provide passenger service. An airport serving small private and charter aircraft is located in Hysham (6U7). The closest commercial airport is in Billings.

4.2.5 Population

As of 2000, the population of Treasure County was 861 people. Of that population, 330 live within the Town of Hysham. The median age is 41.8 years with 16.7% of the population 65 years and older. In terms of education, of the population that is 25 years or older, 86.3% are at least high school graduates and 18.2% have a bachelor's degree. Within the civilian population 18 years and older, 17.0% are veterans. Table 4.2.5A shows the percentage of the civilian non-institutionalized population with disability status by age group.

Table 4.2.5A Disability Status of the Civilian Non-Institutionalized Population

Age Group	Total Population by Age Group	Percentage with a Disability
5 to 20 years	215	2.8%
21 to 64 years	454	15.2%
65 years and over	144	38.9%

Source: Montana Department of Commerce, 2000.

Understanding the limitations of those with special needs or disabilities becomes especially important during times of disaster. Many cannot evacuate on their own or require special equipment or medical supplies.

4.2.6 Economic, Ecologic, Historic, and Social Values

The economy of Treasure County is driven by agriculture, natural resources, and government services. Disasters of any magnitude can threaten the fragile economies and well-being of residents. Table 4.2.6A shows economic statistics for the county. Unless otherwise stated, the statistics are for the year 2000.

Table 4.2.6A Economic Statistics

Category	Treasure County
INCOME	
Median household income, 2003	$30,845
Per capita money income, 1999	$14,392
Person below the poverty level, 2003	12.5%
WORKFORCE	
Population 16 year and over	655
Civilian Workforce, Employed	429 (65.5%)
Civilian Workforce, Unemployed	19 (2.9%)
Armed Forces	0 (0%)
Not in Labor Force	207 (31.6%)
INDUSTRY/JOBS	
Agriculture, forestry, fishing, hunting, and mining	37.1%
Educational, health, and social services	17.9%
Public administration	10.3%
Arts, entertainment, recreation, accommodation, and food services	6.8%
Transportation, warehousing, and utilities	5.4%
Retail trade	5.1%
Other categories (less than 5%)	17.6%
CLASS OF WORKER	
Private wage and salary	58.7%
Government	21.4%
Self-employed not incorporated business	17.5%
Unpaid family workers	2.3%

Source: US Census Bureau, 2000.

In 2002, Treasure County had 115 farms and 606,846 acres in farmland. (US Department of Agriculture, 2002) As of January 1, 2006, Treasure County had 23,000 head of cattle and calves. (US Department of Agriculture, 2006a) Table 4.2.6B demonstrates the types of crops planted and Table 4.2.6C shows the sales from agriculture.

Table 4.2.6B Acres Planted in 2005 in Treasure County

Commodity	Planted	Production
Hay	13,000 acres	36,200 tons
Wheat	6,600 acres	477,000 bushels
Corn for Grain	4,700 acres	406,000 bushels
Barley	3,300 acres	271,000 bushels
Sugarbeets	3,210 acres	78,000 tons
Corn for Silage	2,100 acres	58,000 tons

Source: US Department of Agriculture, 2006a.

Table 4.2.6C 2002 Market Value of Agricultural Production

	Treasure County
Livestock Sales	$14,727,000
Crop Sales	$4,835,000
TOTAL	$19,562,000

Source: US Department of Agriculture, 2002.

The ecological, historical, and social values of Treasure County each tie in to the quality of life for residents and visitors. Without these values, lives and property may not be threatened, but the way of life and connections to history and the environment could be disrupted. These values can have deep emotional meaning and investment.

Ecological values represent the relationship between organisms and their environment. For humans, these values include clean air, clean water, a sustainable way of life, and a healthy, natural environment including a diversity of species. Natural hazards, such as floods and wildfires, are usually part of a healthy ecosystem but often human caused hazards damage ecological values. Native tree and shrub species in Treasure County include American elm, green ash, box elder, alder, buffaloberry, chokecherry, wild plum, ponderosa pine, limber pine, and juniper. Willows and cottonwoods can also be found along riparian areas. According to the Montana Natural Heritage Program, Treasure County has the only two known locations of birchleaf mountain-mahogany (*Cercocarpus montanus var. glaber*) in the state. (Treasure County, 2003) Howrey Island has an active bald eagle nest in the northeast corner of the island. (US Bureau of Land Management, 2004)

Historic values capture a piece of history and maintain a point in time. Historic values can include sites, buildings, documents, and other pieces that preserve times past and have value to people. Early explorers Lewis and Clark traveled through Treasure County and have some historic sites dedicated to their trip.

Social values are often not fixed locations or can be quantified but are an important aspect of quality of life and interpersonal relationships. Examples of social values for many in Treasure County include rodeos, county fairs, and festivals. These gatherings

promote community building and achievement. Other social values include freedom from tyranny, the ability to communicate with others, pride in making the world a better place, and friendships. The realm of social values is only limited by the human imagination and usually relates to how a person feels. Disasters, both natural and human caused, can disrupt important social activities and sometimes have lasting effects on society.

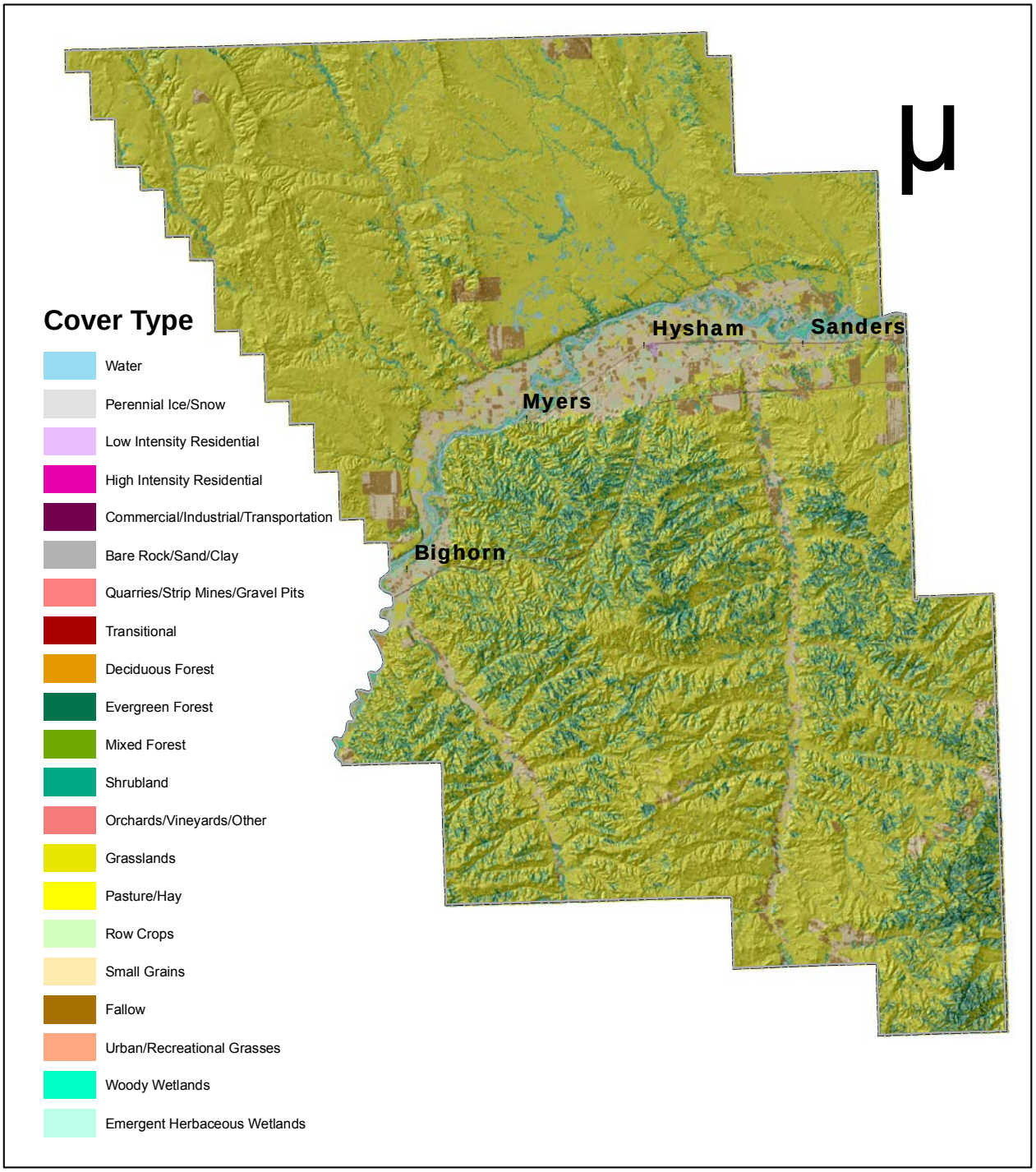
4.3 Land Use and Future Development

Existing land uses and the review processes and regulations for new development play important roles in disaster mitigation. Often, smart development is an inexpensive and effective way to reduce the impact of disasters on the community. Treasure County is primarily rural with most of the land use devoted to agriculture. Map 4.3A shows the land cover in the county and Map 4.3B shows the federal, state, and local government ownership. Map 4.3C shows the structure locations and the type of residential structure and Map 4.3D provides an aerial photograph of the Town of Hysham.

Very little growth is occurring in the county; however, some small population increases are possible over the next ten years. Since 1920, the population has declined fairly steadily and population projections anticipate that trend will continue to an estimated 830 people by 2010. New industrial developments in nearby counties have the potential to spark growth in Treasure County. With respect to growth, building permits are issued by the Town of Hysham, with standard state regulations and inspections applying. Treasure County administers the floodplain and permits for individual sewage treatment systems. No subdivisions in the past ten years have required planning board review. (Treasure County, 2003)

Map 4.3A

Land Cover
Treasure County



0 2.5 5 10 15 20 Miles

Data Source: Montana Natural Resource Information System
Data Date: 2000
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, May 2006

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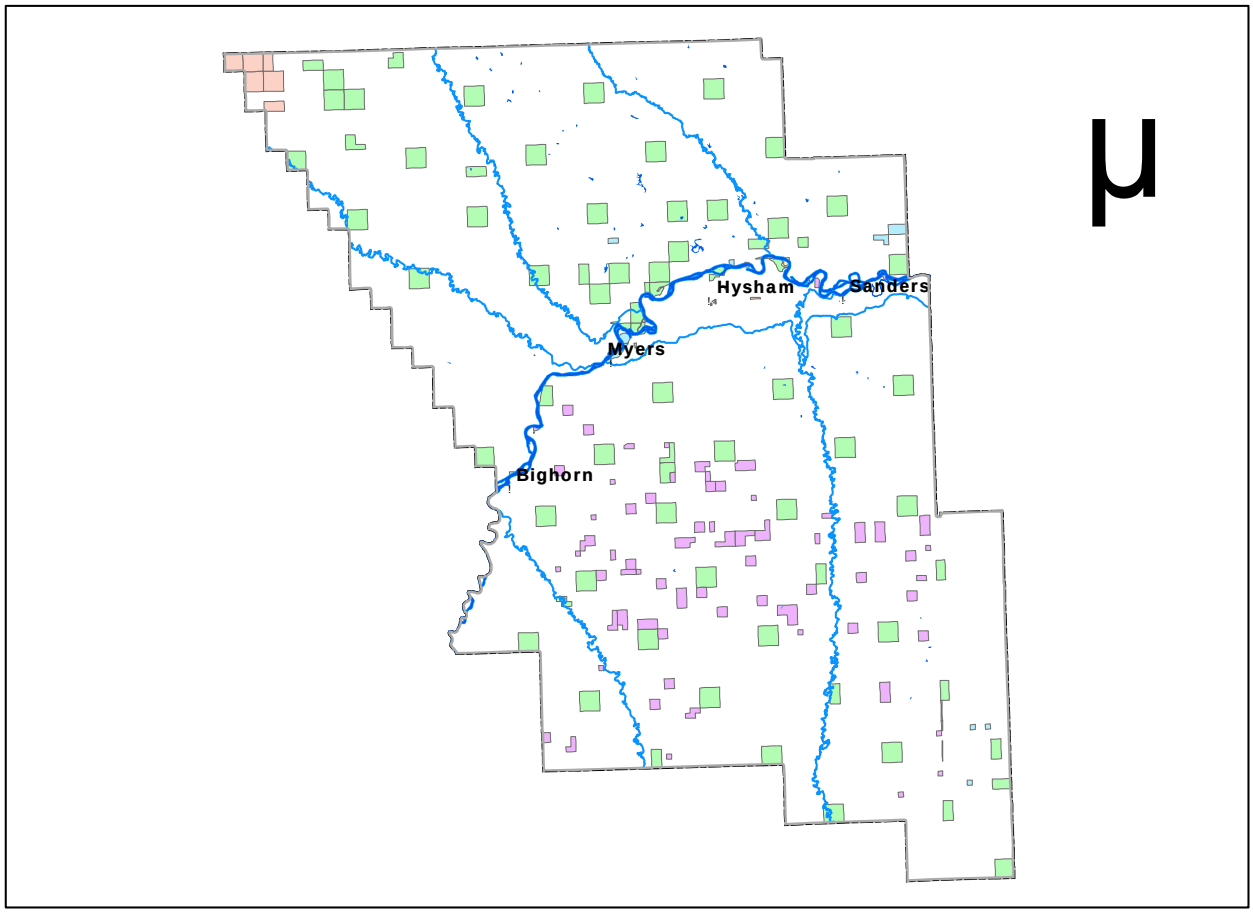
Map 4.3B

Government Land Ownership

Treasure County



Town of Hysham

Owner

- Local Government
- State Government
- Tribal
- USDI Bureau of Land Management
- USDI Fish and Wildlife Service

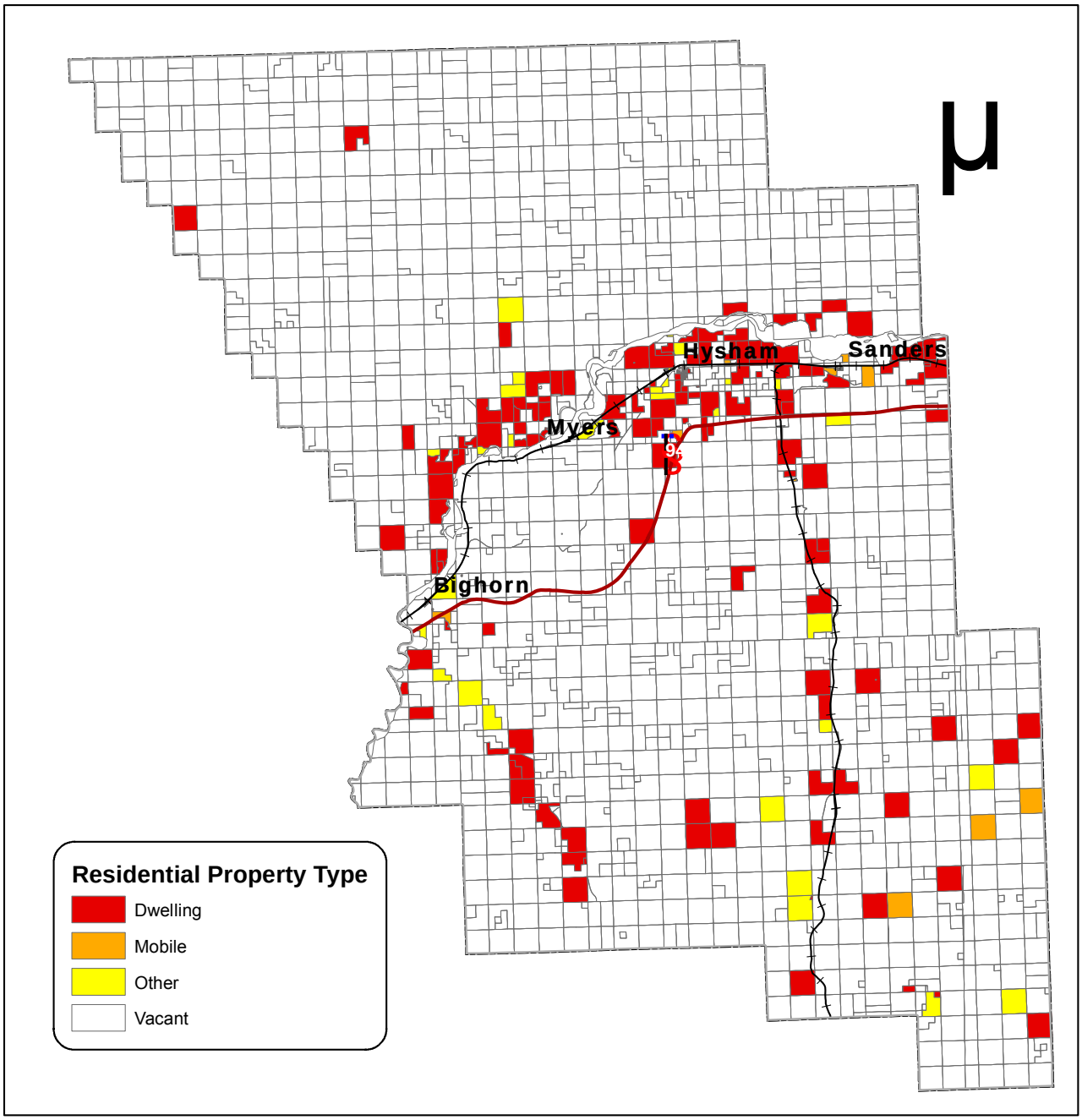
Map Created By:
Pam Shrauger, May 2006

Data Source: Montana Natural Resource Information System
Data Date: April 2006
Map Coordinates: NAD 1983, State Plane Montana

Map 4.3C

Structure Locations

Treasure County



Data Source: Montana Natural Resource Information System
Data Date: April 2006
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, February 2007

Map 4.3D Aerial Photograph of Hysham, Montana

Data Source: Montana Natural Resource Information System
Data Date: July 2005
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, February 2007

BIG SKY HAZARD MANAGEMENT LLC

Several documents exist in Treasure County that guide future development. The descriptions that follow include specific elements as they relate to hazard mitigation.

Treasure County Planning Data Book and Comprehensive Plan, 1979
The Treasure County Planning Data Book and Comprehensive Plan is an older planning document that is still held by the county planning board. None of the goals in the document address hazard mitigation or the protection of lives and property. This document may no longer be relevant; however, it did contain some growth planning for the Town of Hysham. The areas south of Elliot Street were designated residential with commercial development to take place along Elliot Street. West of town was selected for future industrial development with the rest of the area to remain as open space.

Treasure County Comprehensive Development Plan/Growth Policy, September 2003
The Treasure County Comprehensive Development Plan/Growth Policy addresses issues related to growth for all areas of the county, except the Town of Hysham. One of the stated goals in the plan is to, "provide adequate services for public health, safety, and welfare of county residents, and promote the most efficient use of public funds to this end." Related to this goal, two of the objectives are to "ensure that new homes have adequate provision for fire suppression" and to "update the County Disaster and Emergency Services plan."

One of the strategies directly relates to the flood hazard and is to, "create safeguards against potential flood hazards and promote healthy water and groundwater by keeping new development out of floodplains, riparian areas, and wetlands."

Ultimately, the plan hopes to "promote new development near Hysham" where infrastructure currently exists.

The plan goes further to suggest that new subdivisions consider the following and their effect on public health and safety:

- Creation of potential man-made hazards
- Natural hazards
- Existing potential man-made hazards
- Traffic safety
- Emergency vehicle access
- Emergency medical response time
- Cumulative impacts on groundwater
- Other items that endanger public health and safety

Treasure County Subdivision Regulations, April 2004
The countywide Subdivision Regulations apply to all divisions of land in which one or more parcels are 160 acres or less, with some exemptions. To support state law, twelve "purposes" are promoted, one of which is, "The avoidance of danger or injury

by reason of natural hazard or the lack of water, drainage, access, transportation or other public services."

The subdivision regulations continuously emphasize the importance of public health, safety, and welfare and the ability of the governing body to require subdividers to reasonably minimize "potentially significant adverse impacts." During the review process of both major and minor subdivisions, the planning board must consider "relevant evidence relating to agriculture, agriculture water user facilities, local services, the natural environment, wildlife and wildlife habitat, public health, safety, and welfare."

Lands unsuitable for subdivision include potential hazard areas from "flooding, snow avalanches, rock falls, land slides, steep slopes with unsuitable soil conditions in excess of 18 percent slope, high potential for wildfire, subsidence, high water table, polluted or non-potable water supply, high voltage lines, high pressure gas lines, aircraft or vehicular traffic hazards or congestion, or severe toxic or hazardous waste exposure; or because of unreasonable burdens on the general public such as requirements for the excessive expenditure of public funds, environmental degradation, or other features which may be detrimental to the health, safety, or general welfare of existing or future residents. These lands must not be subdivided for building or residential purposes unless the hazards are eliminated or will be mitigated by approved design and construction plans."

Specific to flooding, land in the floodway of a 100-year flood event or land determined by the governing body to be subject to flooding cannot be subdivided for building or residential purposes. A licensed professional engineer must evaluate the flood hazard for unmapped areas that are "within 2,000 horizontal feet and 20 vertical feet of a live stream draining an area of 25 square miles or more." Subdivisions must also have engineered drainage systems for water runoff.

Specific to wind and heavy snow hazards, "utilities must be placed underground, wherever practical."

Specific to wildfires, the regulations have very specific requirements with regard to ingress and egress, water supplies, building sites, road design, densities, and defensible space on road right-of-ways. The regulations don't prohibit development in wildfire hazard areas, rather they require the infrastructure be in place to safely fight the fire. More specifically, subdivisions must comply with the Uniform Fire Code and local fire codes. The regulations require two entrance/exit roads, roads, bridges, and gates designed to allow access by fire equipment, proper placement of residences to minimize the potential for fire spread, and provisions for defensible spaces around structures (see Montana Fire Protection Guidelines for Wildland Residential Interface Development).

Subdivisions must meet the water supply requirements set forth by the local fire protection authority or in the absence of such standards:

- A central water system with a minimum flow of 1,000 gallons/minute.
- With no central water system, the subdivision must have cisterns, reservoirs, or fill ponds with dry hydrants with a minimum storage capacity of 2,500 gallons per dwelling for single-family residences, or for five or more dwellings per unit, 500 gallons per dwelling.
- The water supply must be all-season and accessible by fire equipment including all weather turn-arounds on roads.
- Dry hydrants must have a minimum six inch diameter with the appropriate fixtures.
- Water sources that are dependent on electric power for pumping must have a backup source of power.

Areas outside established fire service areas are considered High Fire Hazard Areas, as well as those areas subject to high wildfire hazard as determined by the planning board, local fire protection authority, US Forest Service, or Montana Department of Natural Resources and Conservation. In addition to complying with the Uniform Fire Code and the other regulations, these subdivisions must meet the following additional requirements:

- Road right of way must be maintained free of slash, trees, tall grass/weeds, and other fire fuels.
- Structures are prohibited on slopes greater than 25% and on specific topographical features ("fire chimneys").
- Densities must be reduced through the following minimum lot standards shown in Table 4.3C.

Table 4.3C Wildfire Minimum Lot Sizes

Slope	Open Grass	Forest & Brush
0%-10%	1 acre	2 acres
10%-20%	2 acres	3 acres
20%-25%	3 acres	4 acres
Over 25%	5 acres	Not permitted

- Open space, park land and recreation areas (including green belts, riding or hiking trails) should be located, where appropriate, to separate residences and other buildings from densely forested areas.
- With no central water system, the subdivision must have cisterns, reservoirs, or fill ponds with dry hydrants with a minimum storage capacity of 3,500 gallons per dwelling for single-family residences, or for five or more dwellings per unit, 700 gallons per dwelling.
- Minimum flow of 500 gallons per minute for lots of one acre or larger and a minimum flow of 750 gallons per minute for lots of less than one acre.

The "(Recommended or Final) Findings of Fact that Weigh Review Criteria" that is issued by the Planning Board includes the "Effect on Public Health and Safety." Reviewers must decide, "Based on available information, the subdivision does not appear to be subject to potential natural hazards such as flooding, snow or rock slides, high winds, wildfire or excessive slopes, nor potential man-made hazards such as high voltage power lines, high pressure gas lines, nearby industrial or mining activity, or high traffic volumes," or "The subdivision is subject to potential hazard from flooding, snow or rock slides, high winds, wildfire, excessive slopes, high voltage power lines, high pressure gas lines, nearby industrial or mining activity, or high traffic volumes. The subdivider has committed to minimize the effect of the hazards by: _____."

4.4 Vulnerability Assessment Methodology

For each hazard, the vulnerability assessment portion of the hazard profile shows the potential losses, specific to Treasure County, from that hazard. Each resource or value, such as critical and special needs facilities, structures, infrastructure, the population, economic, ecologic, historic, and social values, and future development received consideration during this process. Where possible, Geographic Information System (GIS) technologies allowed comparison of the resources and values to the hazard areas. Other evaluations, where GIS mapping was unavailable or not useful, used estimations and plausible scenarios to quantify potential losses.

The Montana Department of Revenue Computer Assisted Mass Appraisal System (CAMA) was used to delineate what parcels of land have taxable structures on them. This data is not entirely accurate. Centrally assessed properties such as those owned by utility companies are not included in the data. Other discrepancies have been found on occasion, such as land parcels containing buildings are listed in the data as having a building value of $0. GIS mapping of the land parcels with structures allowed for the comparison of approximate building locations to the hazard areas where such hazards are spatially recognized. Base maps were compared to available hazard layers to show the proximity of the structures to the hazard areas. If known, the structure replacement value and contents values on record either from county and town insurance records or taxable values gave a basis to approximate potential financial losses. For most hazards, the total dollar exposure was multiplied by a damage factor since many hazard events will not result in a complete loss of all structures. These estimates are general in nature, and therefore, should only be used for planning purposes. The approximations, however, are based on current hazard and exposure data. HAZUS-MH, a loss estimation software program developed by the Federal Emergency Management Agency (FEMA), approximated losses from earthquakes and floods.

Infrastructure such as electric, natural gas, propane, telephone, internet, water, sewer, and transportation systems was assessed more generally using history and a general understanding of such systems to determine what infrastructure losses may occur. Basic mapping exists of the road networks in the county from state datasets. These layers were additionally compared to the hazard areas.

Population impacts were qualitatively assessed based on the number of structures estimated to be in the hazard area. Given 309 estimated structures in the county (based on CAMA parcels with structures) and a population of 861, an estimate of 2.8 people per structure was derived. Other factors used in evaluating the population impacts include the ability of people to escape from the incident without casualty and the degree of warning that could be expected for the event. In general, the loss of life and possible injuries are difficult to determine and depend on the time of day, day of the week, extent of the damage, and other hazard specific conditions.

Qualitative methodologies such as comparison to previous disasters, occurrences in nearby communities, and plausible scenarios helped determine the potential losses to economic, ecological, historical, and social values. In many cases, a dollar figure cannot be placed on values, particularly those that cannot be replaced. Therefore, these types of losses were quantified through narrative descriptions and provide some background on what may occur during a disaster.

The assessment of the impact to future development is based on the mechanisms currently in place to limit development in hazardous areas. Some hazards can be mitigated during development, others cannot. The impacts were assessed through a narrative on how future development could be impacted by the hazard based on current regulations.

Due to the inherent errors possible in any disaster vulnerability assessment, the results should only be used for planning purposes and in developing projects to mitigate potential losses.

4.5 Hazard Profiles

4.5.1 Agriculture Hazards

Including Low Irrigation Supplies and Livestock Predators

4.5.1.1 Description

Agriculture is the primary contributor to the economy in Treasure County. Most industries, such as the service industry, are in some way related to or supported by the agricultural economy. In 2002, Treasure County had 115 farms and 606,846 acres in farmland. (US Department of Agriculture, 2002) As of January 1, 2006, Treasure County had 23,000 head of cattle and calves. (US Department of Agriculture, 2006) Table 4.5.1.1A demonstrates the types of crops planted and Table 4.5.1.1B shows the sales from agriculture.

Table 4.5.1.1A Acres Planted in 2005 in Treasure County

Commodity	Planted	Production
Hay	13,000 acres	36,200 tons
Wheat	6,600 acres	477,000 bushels
Corn for Grain	4,700 acres	406,000 bushels
Barley	3,300 acres	271,000 bushels
Sugarbeets	3,210 acres	78,000 tons
Corn for Silage	2,100 acres	58,000 tons

Source: US Department of Agriculture, 2006.

Table 4.5.1.1B 2002 Market Value of Agricultural Production

	Treasure County
Livestock Sales	$14,727,000
Crop Sales	$4,835,000
TOTAL	$19,562,000

Source: US Department of Agriculture, 2002.

Many hazards to the agricultural community, such as drought, hail, weed and pest infestations, communicable disease, chemical run-off, and wildfires, are profiled in other hazard profiles, however, some hazards, such as low irrigation supplies and livestock predators, aren't as clearly defined by the typical hazards and are profiled here.

Most of Montana has an arid climate and the dry conditions necessitate the use of irrigation systems to produce crops. The Yellowstone River and other water bodies in the county serve as water sources and water is channeled from the water bodies to the agricultural lands. According to the Treasure County Water Resources Survey, the Yellowstone River Basin in Treasure County has 25,345 maximum irrigable acres by

regular irrigation and 2,597 maximum irrigable acres by flood irrigation. (Montana State Engineer's Office, 1951) During periods of drought, the water supplies may be limited and rationed. Given the importance of the water to plant growth, this situation can decrease production, kill crops, and lead to diminished profits or losses for the producers.

Another agriculture hazard is livestock predators. Animals that prey on livestock can have a devastating effect on agricultural profits if not managed properly. The primary example of this type of predator is the wolf. During the early 1900's, wolves lost much of their habitat and were extensively hunted due to their conflicts with people, becoming nearly extinct in Montana. The gray wolf was listed on the endangered species list in 1973. In the 1980's and 1990's, wolves were gradually reintroduced into parts of Montana. Usually, wolves feed on big game animals but they occasionally do kill livestock and other domestic animals. From 1987-2004, 190 cattle and 409 sheep have been confirmed to have been killed by wolves in Montana. In that same timeframe, 166 wolves have been killed in Montana to reduce wolf-livestock conflicts. Since 2000, the wolf population in Montana has ranged from 59-107. In 2005, the US Fish and Wildlife Service allowed for the maximum management of gray wolves in the State of Montana. Eventually, wolves may be delisted from the Endangered Species Act. (Montana Fish, Wildlife and Parks, 2006) In the meantime, local ranchers are concerned with how predators may affect their businesses and the overall economy. Given local dependence on the agricultural economy, a major influx of livestock predators could result in an economic disaster in Treasure County.

4.5.1.2 History

Treasure County has had its share of struggles and agricultural challenges since the area was first settled. Isolated instances of livestock kill may have occurred. Low water supplies are common during drought years. None of the events, however, have resulted in a Presidential disaster declaration. The US Department of Agriculture does designate areas for federal assistance because of events such as drought and infestations, as documented in the Summer Weather Hazard Profile, Section 4.5.8. Significant drought periods include the 1930's, 1950's, 1980's, and the late 1990's through 2005.

4.5.1.3 Probability

The probability of low irrigation supplies can be directly related to the drought probabilities. Generally, a drought similar to the one in the 1950's can be expected once every 50 years and similar to the 1930's "Dust Bowl" can be expected once every 500 years. (National Oceanic and Atmospheric Administration, 2003) The probability of a sudden influx of livestock predators is low, however, as the wolf population increases, the probability of a producer being affected by wolf predation also increases.

4.5.1.4 Magnitude

Worst case scenario, low irrigation supplies or livestock predators could reach a point at which the agricultural economy of Treasure County is devastated. An outbreak of livestock predators in which more than half of the 115 farms in Treasure County are affected is a high magnitude event. Similarly, restricting irrigation water usage to more than half of the irrigating farmers during a particularly dry period is considered high magnitude.

4.5.1.5 Mapping

Since agriculture hazards are regional in nature, mapping does not enhance this hazard profile. The risk is assumed to be the same countywide. In future editions, mapping of the irrigation systems could be added.

4.5.1.6 Associated Hazards and Other Factors

Since agriculture is closely tied to the economy of Treasure County, almost any other natural hazard can have an impact on and be a hazard to agriculture. For example, drought, excessive heat, noxious weeds, bank erosion, water contamination, and wildfire can all directly relate to the amount of water available for irrigation purposes. Similarly, the local weather conditions can have an effect on the food available for wildlife and the number of attacks on livestock by predatory animals. Impacts to agriculture are discussed in other hazard profiles in this plan as they relate to economic values.

4.5.1.7 Vulnerabilities

4.5.1.7.1 Critical and Special Needs Facilities

Critical and special needs facilities generally will not be affected by agriculture hazards such as low irrigation supplies or livestock predators.

4.5.1.7.2 Structures

Structures in the county generally will not be affected by agriculture hazards such as low irrigation supplies or livestock predators.

4.5.1.7.3 Infrastructure

Infrastructure such as electricity, heating fuel, telephone, public drinking water, sewer, and transportation, would, in most cases, be unaffected by agriculture hazards.

4.5.1.7.4 Population

The population of Treasure County could potentially be threatened by livestock predators, however, studies have shown that such predators generally shy away from people and their dwellings, preferring to remain in more undeveloped areas. Although rare, people can be attacked. Hazards severely affecting the food supply could directly threaten the food supplies of local residents.

4.5.1.7.5 Economic, Ecologic, Historic, and Social Values

The obvious impact of agriculture hazards is to the economy. Treasure County, with about 115 farms and 23,000 head of cattle, generates nearly $20 million in sales due to agriculture. Should this economy be destroyed, the effects would be felt throughout the county and the region. Low irrigation supplies and livestock predators can have an immediate and direct impact on the ranching profits, typically to many producers. Should this type of disaster occur, impacts such as the sale of farms and ranches and population decreases may take place. The results may change the historic land uses and modify social activities. Generally, ecologic, historic, and social values will not change significantly.

4.5.1.7.6 Future Development

Future development should not negatively affect the vulnerabilities to agriculture hazards. The primary exception is the possibility of reduced irrigation supplies due to more residential wells. Otherwise, development may deter livestock predators and limit other related hazards. Obviously, development of agricultural lands will reduce the space available for agricultural activities.

4.5.1.8 Data Limitations

Hazards specific to agriculture are not often considered in the disaster planning realm unless related to the population in some other way. Therefore, data regarding the potential for a major event in which these agriculture hazards seriously impact the community is not readily available. Much of the data currently available outlines past statistics regarding agricultural production. These hazards are typically managed through water rights, in the case of irrigation supplies, and wildlife management plans, in the case of livestock predators. Possible solutions and mitigating actions can be identified and included in these documents.

4.5.2 Communicable Disease and Bioterrorism

Including Human, Animal, and Plant Diseases

4.5.2.1 Description

Diseases affect humans, animals, and plants continuously. Each species has its own natural immune system to ward off most diseases. The causes and significance of diseases vary. Of significance in the disaster prevention realm are communicable diseases with the potential for high infection rates in humans or necessitate the destruction of livestock or crops. Such diseases can devastate human populations and the economy.

Disease transmission may occur naturally or intentionally, as in the case of bioterrorism, and infect populations rapidly with little notice. New diseases regularly emerge or mutate. Known diseases, such as influenza, can be particularly severe in any given season. Terrorism experts also theorize attacks using biological agents.

Human epidemics may lead to quarantines, large-scale medical needs, and mass fatalities. Typically, the elderly, young children, and those with suppressed immune systems are at greatest risk from communicable diseases. The following biologic agents are considered the highest bioterrorism threats due to their ease of dissemination or person-to-person transmission, high mortality rate with potential for major public health impacts, and potential for public panic and social disruption: Anthrax, Botulism, Plague, Tularemia, Smallpox, and Viral Hemorrhagic Fevers.

In addition to global disease and bioterrorism concerns, naturally occurring diseases can threaten communities. Natural illnesses of particular concern include Influenza, Meningitis, Whooping Cough, Measles, Norwalk Virus, Severe Acute Respiratory Syndrome (SARS), and food-bourne illnesses such as E. coli and Salmonella outbreaks. These diseases infect populations rapidly, particularly through groups of people within close proximity such as schools, assisted living facilities, and workplaces.

Animal and plant diseases, especially those that infect livestock or crops, can distress the agricultural community. Such diseases could lead to food shortages and negative economic impacts, depending on the animals or plants infected and the geographic extent of the disease. Known livestock and animal diseases include Foot-and-Mouth, Bovine Spongiform Encephalopathy (also known as BSE or Mad Cow Disease), West Nile, Avian Influenza, Exotic Newcastle, Nipah, Vesicular Stomatitis, Swine Fever, Bluetongue, and Brucellosis, among others. Many plant diseases exist that could infect crops and native vegetation throughout the county. Of particular concern for this area are the various Downy Mildew plant diseases.

4.5.2.2 History

Fortunately, Treasure County has not experienced any significant disease outbreaks within its population in recent years. Following World War I, the Spanish influenza pandemic of 1918 killed 20-40 million people worldwide, including 675,000 Americans. (Billings, 1997) In the State of Montana, the Spanish influenza caused 9.9 deaths per 1,000 people from 1918-1919. (Brainerd, 2002)

4.5.2.3 Probability

Quantifying the probability of a human epidemic affecting Treasure County presents challenges due to a limited history of outbreaks. Medical advances over the past fifty years prevent many disease outbreaks, yet the potential still remains. Much of county is in a rural setting, and therefore, is somewhat isolated from the rapid spread of global diseases; however, Interstate 94, a major cross-country travel route, passes through Treasure County and near the Town of Hysham. Therefore, disease could be brought into the local population by travelers.

According to United States officials, the probability of a human influenza pandemic is "very high." (Peck, 2005) This threat is directly related to Avian Bird Flu strain H5N1 concerns. Approximately three human influenza pandemics have occurred over the past 100 years, one severely affecting the United States. Given the warnings from the global community of a significant influenza pandemic, the probability of a communicable disease outbreak in Treasure County is considered moderate to high.

Animal and plant disease outbreaks are even harder to predict. Other than a couple of isolated Mad Cow Disease cases, most global livestock diseases have been confined to specific countries due to strict import regulations. Recent plant disease outbreaks have been easily contained. Given the current awareness of bioterrorism and disease concerns, only a moderate probability of an animal or plant disease epidemic exists.

4.5.2.4 Magnitude

The magnitude of a communicable disease outbreak varies from every day disease occurrences to widespread infection. During the 1918 Influenza Pandemic, infection rates approached 28% in the United States. (Billings, 1997) Other pandemics produced infections rates as high as 35% of the total population. (World Health Organization, 2005) Such a pandemic affecting Treasure County represents a severe magnitude event. Almost any highly contagious, incapacitating disease that enters the Treasure County population would quickly overwhelm local health resources. Similarly, any rapidly spreading bioterrorism event for which little vaccination or containment capability exists is a high magnitude event.

4.5.2.5 Mapping

The communicable disease and bioterrorism hazard is uniform across the county, and therefore, mapping does not enhance this hazard profile.

4.5.2.6 Associated Hazards and Other Factors

Other disasters, such as those resulting in the loss or contamination of potable water or sewer services, may result in an increased probability of disease. In fact, following most major disasters, disease is a primary concern due to the lack of sanitation. More specifically, long-term power outages can lead to household food contamination, and flooded properties often develop mold or mildew toxins. Standing water frequently contains hazardous bacteria and chemicals. In the case of rodent infestations, they are not only inconvenient and damaging to the economy, but they can also heighten disease risks. Often, the time of year and weather conditions contribute to or diminish impacts of a disease outbreak.

4.5.2.7 Vulnerabilities

4.5.2.7.1 Critical and Special Needs Facilities

Vulnerabilities from communicable disease and bioterrorism are often not to the structures themselves but rather to the occupants. In some instances, the accessibility and functionality of critical facilities can be compromised. Contamination of a critical facility could render the facility unusable until it is decontaminated or the threat has passed. With the loss of function of facilities supporting emergency response, delays in emergency services could result. Additionally, with a significant human disease outbreak, resources such as the ambulance service, hospitals, and medical clinics throughout the region could quickly become overwhelmed. Should a building become contaminated by some disease agent, clean up costs and the loss of use of the buildings could result. Such costs could be significant. For example, the cleanup of anthrax in several congressional offices on Capitol Hill in September and October of 2001 cost the Environmental Protection Agency about $27 million. (US General Accounting Office, 2003) For this reason, all critical facilities are assumed to be at some risk from communicable disease. Additionally, diseases can spread quickly in special needs facilities such as schools and elderly housing. Often these facilities, as well as the hospitals and medical clinics, are the first places where diseases are identified and treated.

4.5.2.7.2 Structures

The structural integrities of buildings in Treasure County are not threatened by communicable disease or bioterrorism. Similar to critical facilities, should a structure become contaminated, clean-up costs could be expensive.

4.5.2.7.3 Infrastructure

In most cases, infrastructure would not be affected by communicable disease and bioterrorism. Scenarios that would affect infrastructure include the contamination of the water supplies and diseases that require special provisions in the treatment of wastewater. Should an epidemic necessitate a quarantine or incapacitate a significant portion of the population, physical repairs to infrastructure may be delayed and services disrupted for a time due to limitations in getting affected employees to work.

4.5.2.7.4 Population

Perhaps the most significant impact from communicable disease and bioterrorism is to the population. Disease can spread rapidly through schools, health facilities, and communities. The entire county population of 861 and visitors are at risk for contracting a communicable disease. The number of infections and fatalities in the communities would depend on the transmission and mortality rates. Using a general estimate of 35% for the infection rate and a mortality rate (once infected) of 20%, as can be the case in an influenza pandemic, approximately 302 residents of Treasure County would be infected with about 61 fatal infections. As with any disease, age and other health conditions can be a contributing factor. The ability to control the spread of disease depends on the contagiousness of the disease, the time lapse before the onset of symptoms, the movement of the population, and the warning time involved. Vaccinations, quarantines, and other protective measures can also prevent the spread and impact of the disease. Besides human diseases, animal and plant diseases could negatively affect the agriculture economy and limit food supplies.

4.5.2.7.5 Economic, Ecologic, Historic, and Social Values

The regional and local economy relies heavily on agriculture, and therefore, human, livestock, or plant diseases could negatively affect the economy. With respect to human diseases, an outbreak would most certainly limit travel and may impact the agriculture workforce. Animal and plant diseases extending nationally would have an overarching effect on the national economy. More directly, though, Treasure County has 115 farms covering over 600,000 acres with annual sales totaling nearly $20 million. (US Department of Agriculture, 2002) With an animal disease, about 23,000 head of livestock and nearly $15 million in sales could be affected along with countless wild animals. Crops, although not as critical to the economy as livestock, sell for nearly $5 million per year in Treasure County and also support the livestock industry through feed. Plant diseases, especially those that affect wheat, hay, barley, corn, or sugarbeets would have economic impacts throughout the region. Additionally, plant diseases that affect evergreen trees could affect not only the timber industry but also lead to a greater wildfire hazard.

Communicable diseases, in most scenarios, would not affect historic values. The impact on ecological values is debatable since disease is a normal part of the ecosystem. Should a disease be especially severe for a particular species, however, that species could be eradicated from the region resulting in ecologic imbalances. Human diseases would most likely have the greatest impact on the social values. Quarantines in particular would disrupt social activities and reduce the quality of life for some. Hopefully, such disruptions would only be temporary.

4.5.2.7.6 Future Development

Structures built as a result of new development would have little impact on the communicable disease and bioterrorism vulnerabilities, unless in the rare case, the new structures were part of a lab dealing with biological agents. New residents and population add to the number of people threatened in Treasure County, but the location of such population increases would probably not matter.

4.5.2.8 Data Limitations

Diseases are heavily studied and treated throughout the world. Vast quantities of technical information exists on specific diseases, yet how a new and emerging disease will behave in an untested population is always questionable. Bioterrorism is even more unpredictable. Therefore, determining specific vulnerabilities and potential losses from disease is difficult at best. For a human disease to have a major impact on Treasure County, it first has to enter the community and then spread. That starting point, how the disease progresses, and the preventative actions taken will determine the eventual outcome. The data and analysis are limited by these unknowns. Doctors, veterinarians, horticulturists, scientists, and health officials can provide more detailed information on specific diseases.

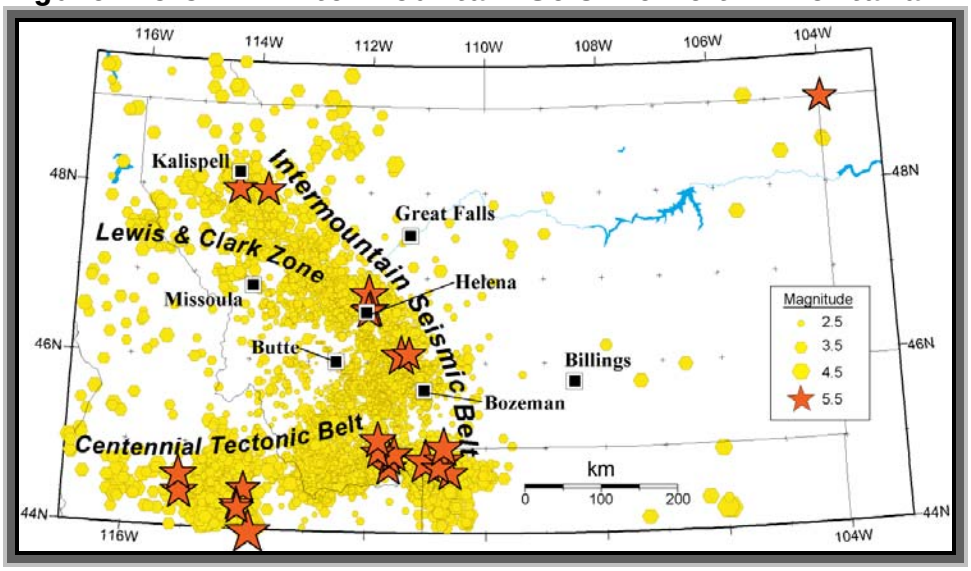
4.5.3 Earthquake

4.5.3.1 Description

One of the most frightening and destructive phenomena of nature is a severe earthquake and its terrible aftereffects. An earthquake is the sudden movement of the Earth, caused by the abrupt release of strain that has accumulated over a long time. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth's surface. Huge plates slowly move over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free, thus, producing an earthquake. (US Geological Survey, 1997)

Montana is generally known as a very seismic state, however, most of the activity occurs along the Intermountain Seismic Belt in western Montana as shown in Figure 4.5.3.1A. Eastern Montana has a much lower frequency of earthquakes with no recognized surface faults, however, some sizable earthquakes (magnitude 4.0 and larger) have been centered in the region and the ground shaking from large earthquakes can travel hundreds of miles. Most shaking felt in Treasure County likely originates from another, more active earthquake region.

Figure 4.5.3.1A Intermountain Seismic Belt in Montana



Source: Montana Bureau of Mines and Geology, 2006.

When earthquakes do occur, they can threaten structural stability, infrastructure, and other property with very little warning, depending on the severity of the earthquake. Geologists primarily measure earthquake severity in two ways: by magnitude and by intensity. Magnitude is based on the area of the fault plane and the amount of slip. The intensity is based on how strong the shock is felt and the degree of damage at a

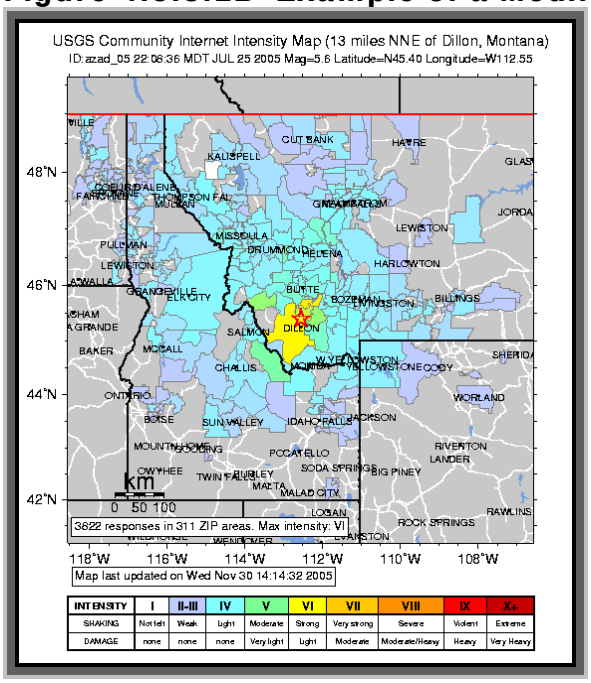
given location. The most commonly used scales are the Richter magnitude scale, moment magnitude scale, and modified Mercalli intensity scale. (National Earthquake Hazards Reduction Program, 2005)

The Richter magnitude scale expresses earthquake size as a number, such as 4.6. This scale is logarithmic where each increase in whole numbers represents a tenfold increase in size and 33 times the energy. Earthquakes with a magnitude of 2.0 or less are generally too small to be felt. Large earthquakes causing significant damage have measured 8.0 or larger. In the United States, a magnitude of 5.5 or greater is capable of causing building and infrastructure damage. Note, however, that the Richter scale measures energy released and not damage. (National Earthquake Hazards Reduction Program, 2005)

The moment magnitude scale is the preferred magnitude scale among geologists. This scale reduces the limitations found with the Richter scale and other magnitude scales. The moment magnitude scale gives the most reliable estimate of earthquake size when the earthquakes are more than approximately 6.0 or are very distant from recording devices. (National Earthquake Hazards Reduction Program, 2005)

The modified Mercalli intensity scale measures the intensities of an earthquake. This scale represents how the earthquake was felt by people and the resulting damages. Each earthquake has several intensities across the area over which it has an effect. Figure 4.5.3.1B shows an example from southwest Montana in 2005. This scale does not measure the characteristics of the earthquakes.

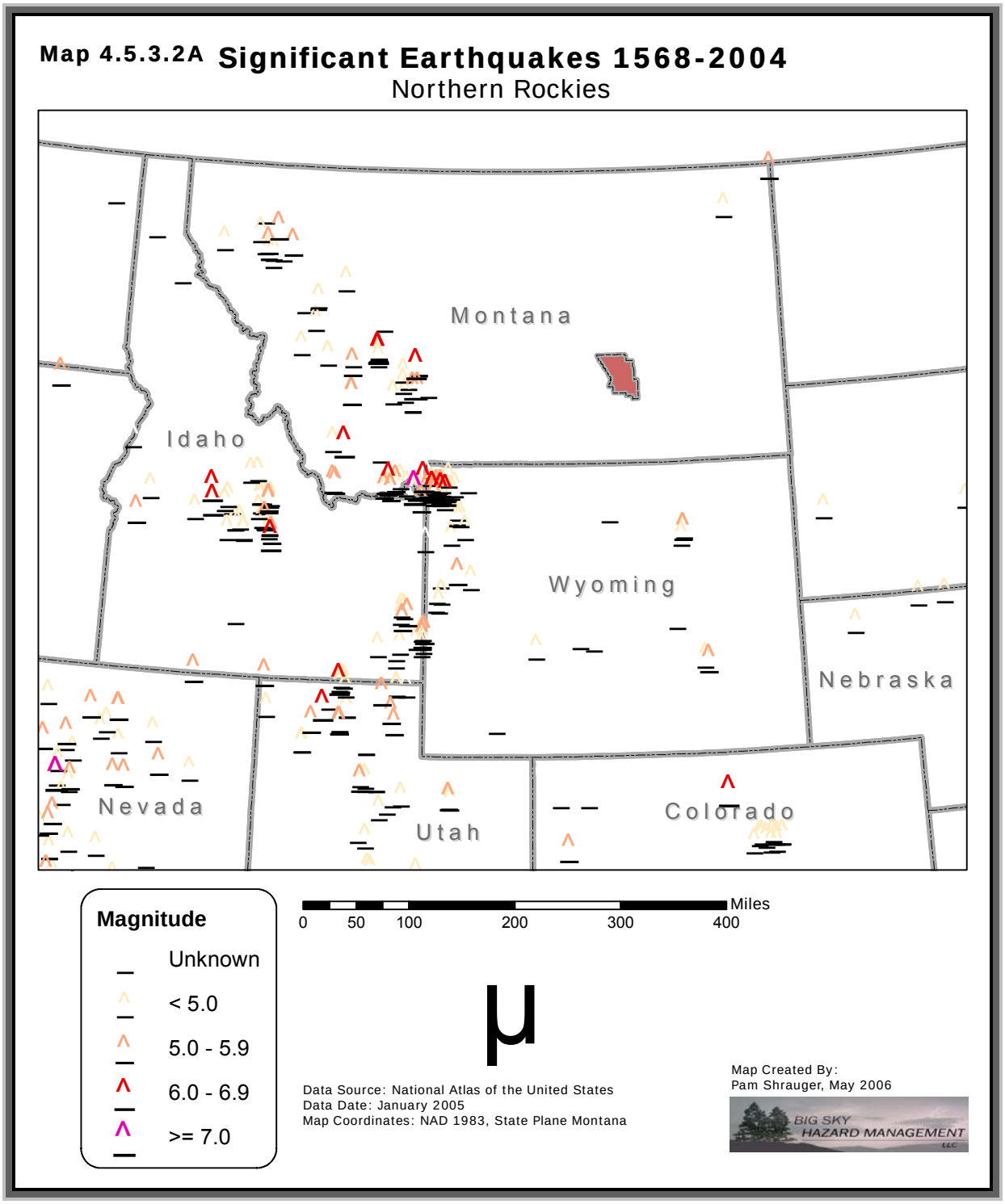
Figure 4.5.3.1B Example of a Modified Mercalli Intensity Scale Map



Source: US Geological Survey, 2005a.

4.5.3.2 History

Relatively few earthquake epicenters have occurred in eastern Montana over the past 100 years. Map 4.5.3.2A shows the significant earthquakes as noted by the US Geological Survey from 1586-2004.

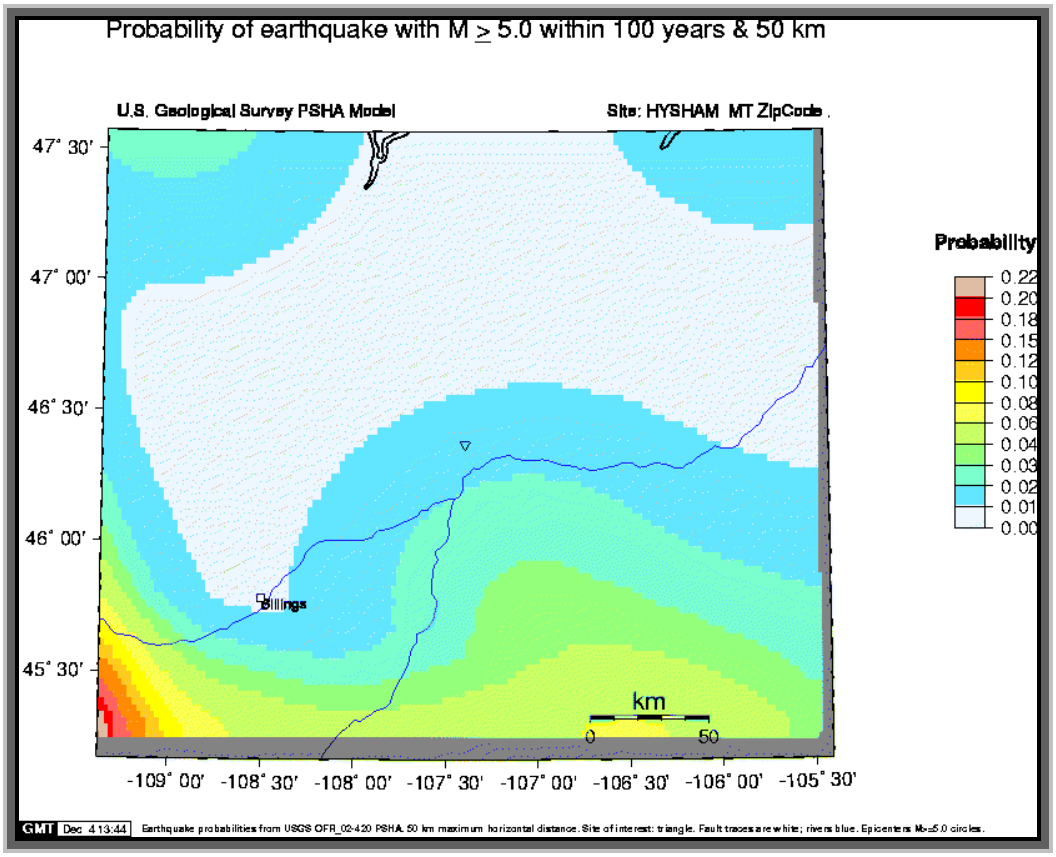


The closest 5.5 magnitude or greater earthquakes occurred about 200 miles away in Yellowstone National Park. These earthquakes were felt hundreds of miles away. Residents of Treasure County may have felt these earthquakes but did not experience any damage.

4.5.3.3 Probability

Strong, damaging earthquakes are infrequent events, particularly in Treasure County. Moderate earthquakes, however, have occurred in areas with no known faults and little seismicity. Although small, the potential for a damaging earthquake in Treasure County exists. Earthquake experts use probabilities when determining the seismicity of an area. Figure 4.5.2.3A shows the probability of a magnitude 5.0 or greater earthquake within 100 years and 31 miles (50 kilometers). Treasure County has an approximate probability of around 1% to 2% with the hazard increasing to the south.

Figure 4.5.2.3A Probability of a 5.0 or greater earthquake within 100 years and 31 miles



Source: US Geological Survey, 2006a

Engineers and building officials typically use a slightly more complex probability scheme. Peak ground acceleration (PGA) is the maximum horizontal acceleration experienced by a particle during the course of the earthquake motion. When

acceleration acts on a physical body, the body experiences the acceleration as a force. Gravity is a commonly known force of nature, and therefore, the units of acceleration are measured in terms of g, the acceleration due to gravity. At 10%g, pre-1940 dwellings are likely to perform poorly and pre-1975 dwellings are likely to have some vulnerability to earthquake shaking. (US Geological Survey, 1996)

Map 4.5.3.5A shows PGA mapping for Treasure County. The earthquake peak ground acceleration that has a 10% probability of exceedance in 50 years across Treasure County ranges from 0 to 2%g and Hysham has an approximate value between 0 and 1%g. For the entire county, the earthquake peak ground acceleration that has a 2% probability of exceedance in 50 years has a value between 4 and 8%g. To make sense of these values, at 0.7%g, the ground shaking is felt indoors by many and outdoors by a few during the day. At night, some people are awakened, and dishes, windows, and doors are disturbed. Walls make a cracking sound. The sensation is described as like a heavy truck striking the building. At 1.5%g, the ground motion is felt by nearly everyone with many awakened. Some dishes and windows may be broken. Unstable objects are overturned. At 3%g, the earthquake is felt by all with many frightened. Some heavy furniture is moved with a few instances of fallen plaster. Damage is considered slight. At 7%g, damage is negligible in buildings of good design and construction, slight to moderate in well-built ordinary structures, and considerable in poorly-built or badly designed structures. Some chimneys may be broken, and the shaking is noticed by people driving cars. (Qamar, 2005)

4.5.3.4 Magnitude

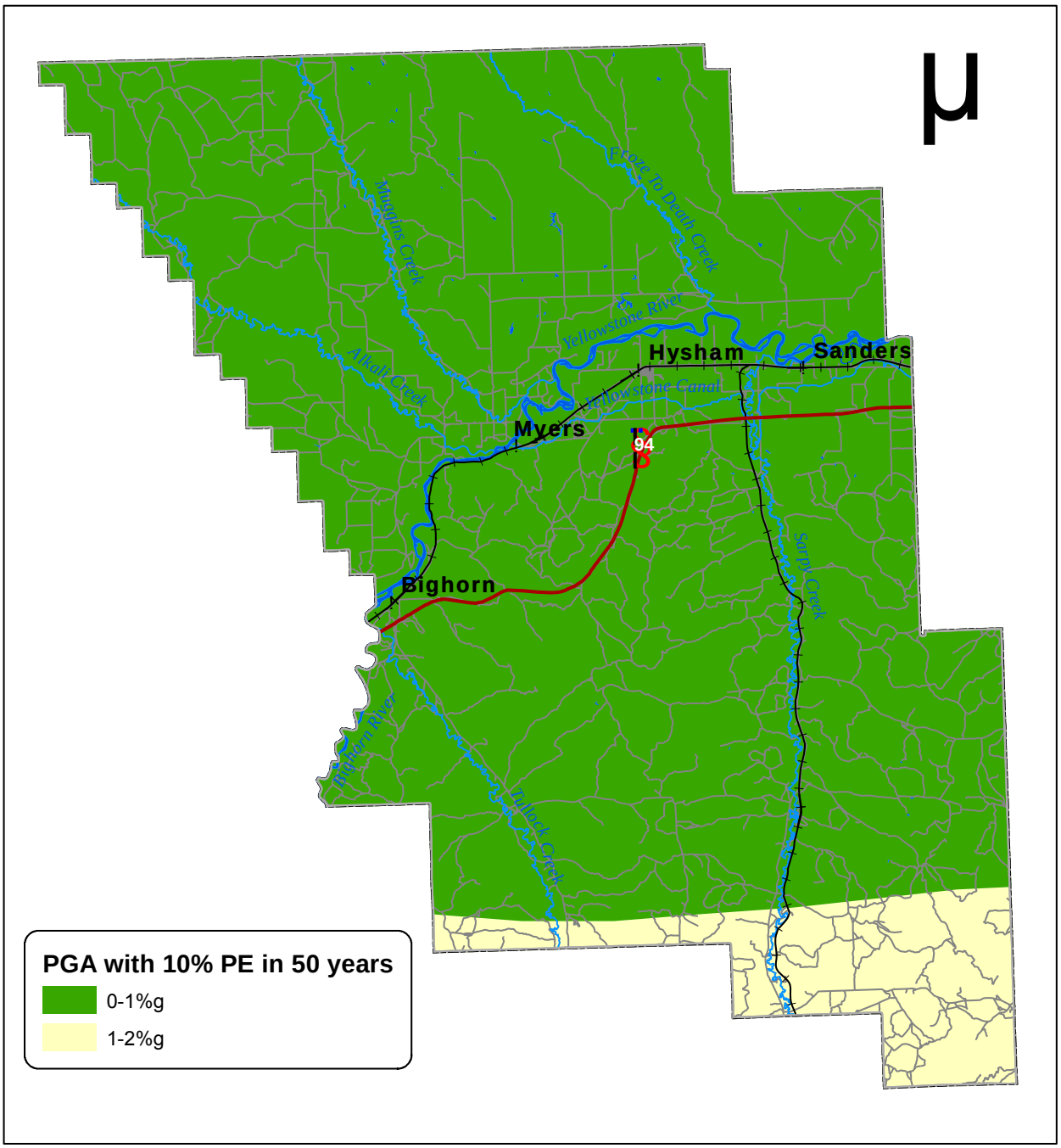
Even a 500-year earthquake event for this region is a relatively weak earthquake. Therefore, for the purposes of this plan, the greatest magnitude earthquake is assumed to be magnitude 5.0-5.5 on the Richter scale. Generally, near the epicenter, the intensity of such an earthquake is likely VI on the modified Mercalli scale. A modified Mercalli intensity of VI estimates that everyone feels the ground shaking, people have trouble walking, and unsecured objects fall. Damage is typically slight in poorly constructed buildings with little structural damage. A more significant earthquake is always possible, but is not probable.

4.5.3.5 Mapping

As discussed in the probability section, structural engineers often use peak ground acceleration as a guide for seismically designing structures. Map 4.5.3.5A shows the earthquake peak ground acceleration that has a 10% probability of exceedance in 50 years. The peak ground accelerations shown on Map 4.5.3.5A are very low and demonstrate the entire county is at low relative risk for earthquake shaking.

Map 4.5.3.5A **Peak Ground Acceleration with a 10% Probability of Exceedance in 50 Years**

Treasure County



Miles
0 2.5 5 10 15 20

Data Source: USGS Earthquake Hazards Program
Data Date: 1996
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, May 2006

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4.5.3.6 Associated Hazards and Other Factors

The seismic action of earthquakes often triggers other events. Strong earthquakes can damage infrastructure resulting in utility failures, communications failures, dam failures, hazardous materials releases, and transportation accidents. Almost any other hazard, such as extreme cold, can exacerbate the effects of and response to a strong earthquake.

4.5.3.7 Vulnerabilities

4.5.3.7.1 Critical and Special Needs Facilities

Earthquake damages are difficult to predict, particularly in areas with low earthquake frequency and severity, such as eastern Montana. A structural engineer can make specific determinations on individual structures. More generally, losses from earthquakes can be estimated using HAZUS-MH, a loss estimation model developed by the Federal Emergency Management Agency. This model uses national datasets and hazard information to estimate the earthquake losses from a particular event at the census tract or county level. Although the default data and methods provided with the model contains many generalizations that could lead to inaccuracies, the model provides a ballpark estimate of what earthquake losses may occur and the magnitude of such.

One scenario was run through the model. The model used a 500-year probabilistic hazard with a 5.5 moment magnitude. The results show the critical and special needs facilities listed in the HAZUS-MH default databases have a 99% probability of no damage and a 1% probability of slight or moderate damage. Given these probabilities, the threat to critical and special needs facilities from earthquakes is low.

4.5.3.7.2 Structures

Using the same HAZUS-MH methodology as the critical and special needs facilities, the building stock in Treasure County was tested through the 500-year probabilistic model. The results estimated that one residential structure would have moderate damage, six would have slight damage, and 386 would have no damage. HAZUS-MH estimates the direct economic losses for buildings countywide would be $20,000. As with any loss estimate, large errors may be present and estimations should only be used for planning purposes.

4.5.3.7.3 Infrastructure

Infrastructure, as quantified in the default HAZUS-MH database, suffers relatively few damages. The transportation network shows very little damage, with the exception of slight damages ($20,000) to airport facilities. The potable water, waste water,

electrical, and natural gas systems remain functional, however, several leaks or breaks result in about $50,000 in damages. Overall, infrastructure remains relatively intact following the 500-year probabilistic earthquake based on HAZUS-MH estimates.

4.5.3.7.4 Population

The effect of earthquakes on the population of Treasure County appears to be negligible. The HAZUS-MH 500-year probabilistic earthquake scenario indicates no casualties. Isolated casualties in any hazard event cannot be ruled out, though.

4.5.3.7.5 Economic, Ecologic, Historic, and Social Values

Given that most structures and infrastructure remains unscathed in all but the most extreme earthquake scenarios, the effect on the economy from earthquakes is assumed to be low. Earthquakes usually have the greatest impact on historic structures. Older buildings, particularly unreinforced masonry, usually cannot withstand strong seismic shaking. Therefore, historic structures could crumble in a strong earthquake. Ecological and social values would likely suffer little damage based on the estimated preservation of the road network and relatively light ground shaking.

4.5.3.7.6 Future Development

Given the relatively low seismic risk in Treasure County, new structures and infrastructure would likely be able to withstand the probable shaking. Treasure County does not have residential building codes, except for electric and plumbing codes required by the state, however, most new construction is generally of decent quality. The Town of Hysham has a building code for all structures.

4.5.3.8 Data Limitations

Since earthquakes are relatively rare events, perhaps the greatest challenges are understanding the true probability and damages possible. Greater development of digital data for use in the HAZUS modules would improve the modeling. Improving the modeling and an assessment of individual facilities by a structural engineer would allow for a more accurate vulnerability assessment.

4.5.4 Flood

Including Riverine, Ice Jam, and Flash Floods, Dam Failure, and Bank Erosion

4.5.4.1 Description

A flood is the inundation of a normally dry area with water. Floods often occur along rivers and streams, in poor drainage areas, or in oversaturated soils. Excessive water levels can develop from a variety of sources including persistent rainfall, rapid snowmelt, heavy downpours, ice jams, and dam failure.

Riverine flooding originates from a body of water, typically a river, creek, or stream, as water levels rise onto normally dry land. The riverine hazard areas may be mapped as part of the National Flood Insurance Program (NFIP). Under this program, an area is broken into zones to depict the level of flood hazard. Most commonly, the areas within the 100-year floodplain are considered the greatest risk. The 100-year floodplain has a 1% chance of exceedance in any given year. Over a 100-year period, a flood of this magnitude or greater has a 63.5% chance of occurring. Structures in the 100-year floodplain are five times more likely to be damaged by flood than a major fire. (Federal Emergency Management Agency, 2005) Locations outside the 100-year floodplain may also experience flood conditions during greater magnitude floods, localized events, or along unmapped creeks, streams, and ditches.

Treasure County is prone to riverine flooding. The county has rivers, creeks, and streams. Flood Insurance Rate Maps (FIRMs) were developed for Treasure County in December 1986. Mapped areas include the Yellowstone and Bighorn Rivers along with several tributaries. The Town of Hysham lies south of the Yellowstone River and is not determined to have a riverine flood hazard through the National Flood Insurance Program. Treasure County does not have a related Flood Insurance Study.

Flash floods can occur anywhere when a large volume of water falls over a short time period, usually from slow moving thunderstorms. Steep terrain or areas with destroyed or damaged vegetation (often from wildfire) are at a greater risk for flash flooding. Because of the localized nature of flash floods, clear definitions of hazard areas do not exist. These types of floods often occur rapidly with significant impacts. Rapidly moving water, only a few inches deep, can lift people off their feet, and only a depth of a foot or two, is needed to sweep cars away. Most flood deaths result from flash floods.

Although not particularly likely, seismic activity, poor maintenance, overwhelming flow conditions, and terrorist activities can all lead to the catastrophic failure of a dam. The result is the rush of water contained by the dam downstream at a rapid pace. The structural integrity of a dam depends on its design, maintenance, and ambient conditions. Dams exist in a variety of shapes, sizes, and materials; uses include

recreation, flood control, irrigation, water supply, and hydroelectricity. Should a dam fail, the consequences can be devastating or minimal depending on the dam's characteristics and regional attributes. Most dams are classified based on the potential hazard to life and property should the dam suddenly fail. Note the hazard rating is not an indicator of the condition of the dam or its probability of failure. Definitions, as accepted by the Interagency Committee on Dam Safety, are as follows:

- Low Hazard Potential
  Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

- Significant Hazard Potential
  Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

- High Hazard Potential
  Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

(Federal Emergency Management Agency, 2004a)

According to the National Inventory of Dams database, Treasure County has 16 dams, all which are rated low hazard dams. (US Army Corps of Engineers, 2005) Perhaps the most hazardous dam to Treasure County is the Yellowtail Dam that lies in neighboring Big Horn County along the Bighorn River. The Yellowtail Dam is a large concrete dam managed by the US Bureau of Reclamation for irrigation, flood control, and hydroelectric power generation. Flood waters from a dam failure at Yellowtail Dam would eventually flood the Bighorn and Yellowstone Rivers in Treasure County.

An ice jam is a stationary accumulation of ice that restricts flow. Ice jams can cause considerable increases in upstream water levels, while at the same time downstream water levels may drop. Types of ice jams include freezeup jams, breakup jams, or combinations of both. (US Army Corps of Engineers, 1994) When an ice jam releases, the effects downstream can be similar to that of a flash flood or dam failure.

Urban flooding is the result of development and the ground's decreased ability to absorb excess water without adequate drainage systems in place. Typically, this type of flooding occurs when land uses change from fields or woodlands to roads and parking lots. Urbanization increases runoff two to six times more than natural terrain. (National Oceanic and Atmospheric Administration, 1992)

Any of these types of floods – riverine, flash, dam failure, ice jams, or urban – may lead to bank erosion. High water levels and rapid flows can remove material in its path. Water is a powerful force that can move boulders and wash away banks. Often banks that have been disturbed by construction or have had vegetation removed are at greater risk of erosion. Other rivers regularly erode banks and build new ones as a normal part of channel movement.

Figure 4.5.4.1A Home near Sanders suffering from severe bank erosion along the Yellowstone River.

Groundwater levels fluctuate from season to season and from year to year. Excessive groundwater may flood basements and crawlspaces but never reach the Earth's surface. Often this type of flooding occurs during or following periods of heavy rainfall or snowmelt.

The National Weather Service issues flood warnings, watches, and advisories when flood conditions are forecast. The following products may be issued:

- Flood Watch: Flood watches inform the public of conditions which may cause gradual flooding within the next 36 hours, but the flooding is neither certain nor imminent.
- Flood Warning: Flood warnings are issued when flooding is expected to occur on main stem rivers.
- Flood Advisory: Flood advisories are issued when main stem river flows are elevated and flooding of low-lying areas is possible.
- Small Stream Flood Advisory: Small stream flood advisories are issued when small streams are rising and flooding of low-lying areas or ponding of water in urban areas are possible.
- Flash Flood Watch: Flash flood watches inform the public of conditions which may cause short duration, intense flooding from heavy precipitation, snow melt, dam failure, or ice jams within the next 36 hours, but the flooding is neither certain nor imminent.
- Flash Flood Warning: Flash flood warnings are issued when flooding is imminent during short term events requiring immediate action. Flash flooding occurs when the water level rises rapidly to inundation within 6 hours of a causative event (i.e. heavy precipitation, snow melt, dam failure, or ice jams).

(National Weather Service, 2005d)

4.5.4.2 History

Most flood events in Treasure County occur during heavy snowmelt or rain events. Documented flood events follow.

1918 Riverine Flood - The Yellowstone River flooded significantly.

1921 Riverine Flood – The Yellowstone River flooded significantly.

1923 Riverine Flood – The Yellowstone River flooded as a result of widespread thunderstorms and rainfall and is noted as a major historical flood in the river's documentation.

May 1978 Riverine Flood - The Yellowstone and Bighorn Rivers flooded significantly. Widespread rain on saturated soils combined with bankfull snowmelt runoff conditions in most streams to cause the flooding. Flood recurrence intervals exceeded 50 years.

June 1997 Riverine Flood - The Yellowstone River flooded significantly.

April 9, 1999 Flash Flood – A flash flood was reported in Sanders along Froze to Death Creek as a thunderstorm moved slowly northeast over the area.

August 29, 2002 Flash Flood – Pease Bottom Road, 15 miles southwest of Hysham, was reported under water with nearby fields also flooded.

May 21, 2006 Flash Flood – Heavy rain to about one inch fell over Hysham. People had to pump water out of their basements and a sewer back up caused water to flow over the steps of a bank.
(National Climatic Data Center, 2006; Miller, 1998)

Recent historical records do not indicate damages from ice jams. The US Army Corps of Engineers, Cold Regions Research and Engineering Laboratory maintains records of historic ice jams. Table 4.5.4.2A shows the recorded ice jams in Treasure County.

Table 4.5.4.2A Recorded Ice Jams in Treasure County from 1947-2003

Date	Location
March 20, 1947	Bighorn River near Bighorn
March 19, 1948	Bighorn River near Bighorn
March 7, 1949	Bighorn River near Bighorn
February 27, 1950	Bighorn River near Bighorn
March 26, 1951	Bighorn River near Bighorn
December 20, 1952	Bighorn River near Bighorn
March 31, 1955	Bighorn River near Bighorn
March 7, 1956	Bighorn River near Bighorn
February 12, 1958	Bighorn River near Bighorn
December 13, 1958	Bighorn River near Bighorn
November 15, 1959	Bighorn River near Bighorn
March 21, 1960	Bighorn River near Bighorn
February 15, 1962	Bighorn River near Bighorn
April 2, 1965	Bighorn River near Bighorn
January 2, 1966	Bighorn River near Bighorn
April 2, 1966	Bighorn River near Bighorn
January 2, 1969	Bighorn River near Bighorn
February 12, 1971	Bighorn River near Bighorn
February 8, 1996	Yellowstone River near Hysham (freeze-up jam) *Five feet of water over a highway near Hysham*
February 8, 1996	Bighorn River near Bighorn (break-up jam)
January 2, 1997	Yellowstone River near Hysham *Some roadways near rivers and streams and the fish and game preserve north of Hysham flooded*
January 3, 1997	Bighorn River near Bighorn
March 15, 2003	Yellowstone River near Hysham (break-up jam)

Source: US Army Corps of Engineers, 2006

Emergency responders specifically note that ice jams have historically occurred downstream in Rosebud County, near Sanders, and three miles east of the confluence with the Bighorn River on the Yellowstone River.

4.5.4.3 Probability

Floodplain mapping through the National Flood Insurance Program geographically demonstrates the 100-year riverine flood probability. The 100-year floodplain has a 1% probability of being exceeded in any given year. The Flood Insurance Rate Maps for Treasure County shows these probabilities.

Based on data from 1918-2005, a significant riverine flood event occurs in Treasure County approximately once every 15-20 years (5 events in 88 years). Approximately

one ice jam occurs in Treasure County every two to three years based on data from 1947-2003 (23 ice jams in 57 years), primarily on the Yellowstone and Bighorn Rivers. Note that additional ice jams may have occurred in other locations or with greater frequency but were not observed or recorded in the ice jam database.

Flood occurrence can vary by season. Spring and summer have the greatest probability of producing damaging snowmelt riverine and heavy rainfall flash floods in Treasure County and winter has the greatest probability of producing ice jam flooding.

4.5.4.4 Magnitude

For flooding, the 500-year events typically represent the worst-case scenarios. Detailed mapping of the 500-year hazard area does not exist for Treasure County, however, such an event would likely cause significant problems. Damages to structures, infrastructure, and the economy could be expected in areas that have never flooded in recorded history. With only four flood insurance policy in force in Treasure County as of September 30, 2006, property owners will not have many options for financial recovery from floods since most homeowners' insurance policies do not cover flood damages. (Federal Emergency Management Agency, 2006a)

4.5.4.5 Mapping

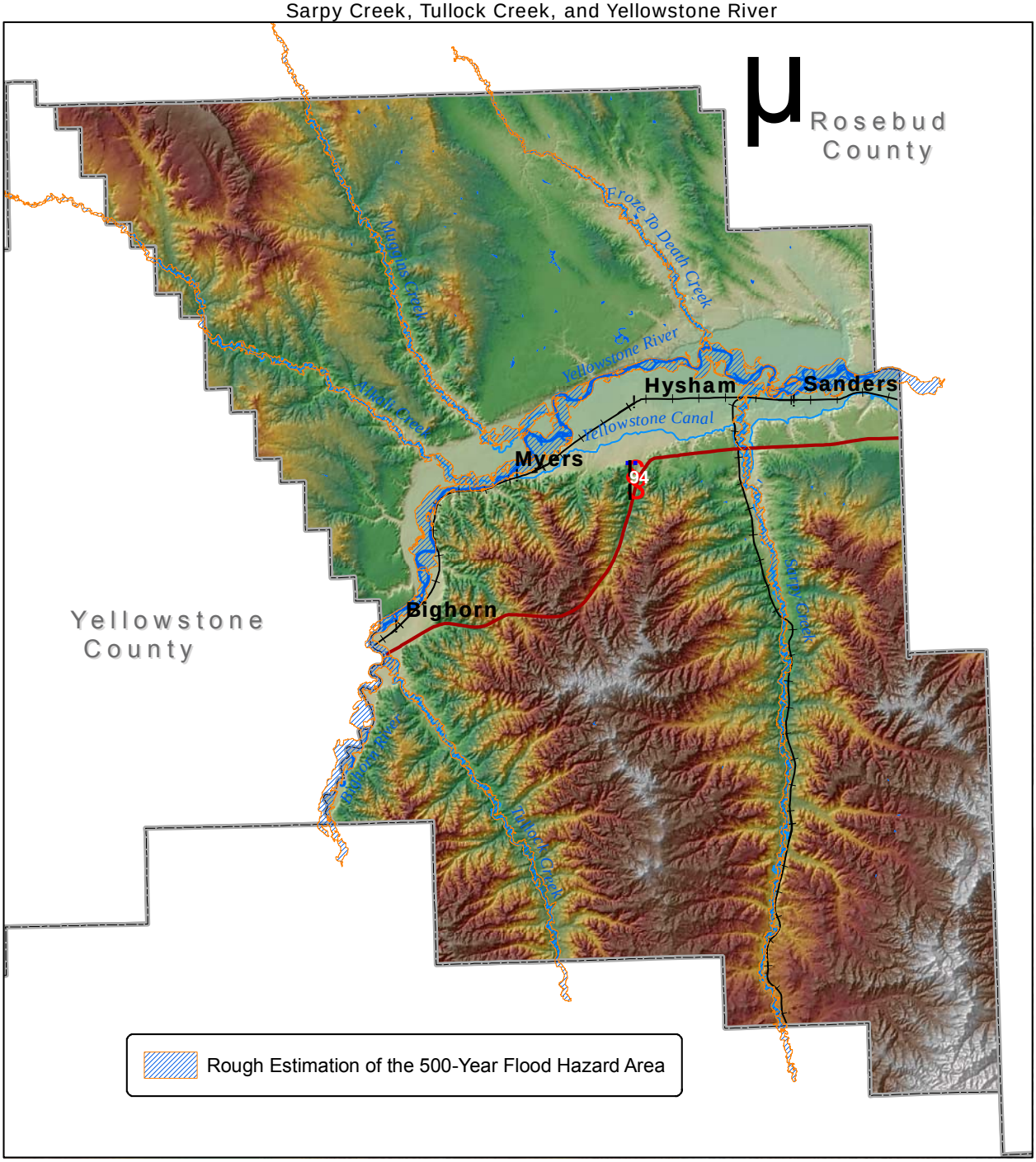
Typically, as part of the National Flood Insurance Program assessment, the Federal Emergency Management Agency (FEMA) conducts a Flood Insurance Study (FIS) to identify the community's risk levels. The Flood Insurance Study includes statistical data for river flow, rainfall, topographic surveys, and hydrologic and hydraulic analyses. After examining the FIS data, FEMA creates Flood Insurance Rate Maps (FIRMs) delineating the different areas of flood risk. Land areas that are at high risk for flooding are called Special Flood Hazard Areas (SFHAs), or floodplains. Treasure County has FIRMs, but not a Flood Insurance Study. Paper copies of the maps can be ordered from the Federal Emergency Management Agency for some areas.

Alternatively, FEMA's HAZUS-MH Flood Module software that uses sophisticated GIS technology was used to show the estimated flood hazard areas. Map 4.5.4.5A shows the estimated 500-year floodplain for Alkali Creek, the Bighorn River, Froze to Death Creek, Muggins Creek, Sarpy Creek, Tullock Creek, and the Yellowstone River as determined by HAZUS-MH. The locations of the dams in Treasure County and their associated hazard designations can be found in Map 4.5.4.5B.

Map 4.5.4.5A **Estimated 500-Year Flood Hazard Areas**

as determined by HAZUS-MH MR2

Alkali Creek, Bighorn River, Froze to Death Creek, Muggins Creek, Sarpy Creek, Tullock Creek, and Yellowstone River



0 2.5 5 10 15 20 Miles

Data Source: HAZUS-MH MR2; US Geological Survey
Data Date: October 2006
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, December 2006

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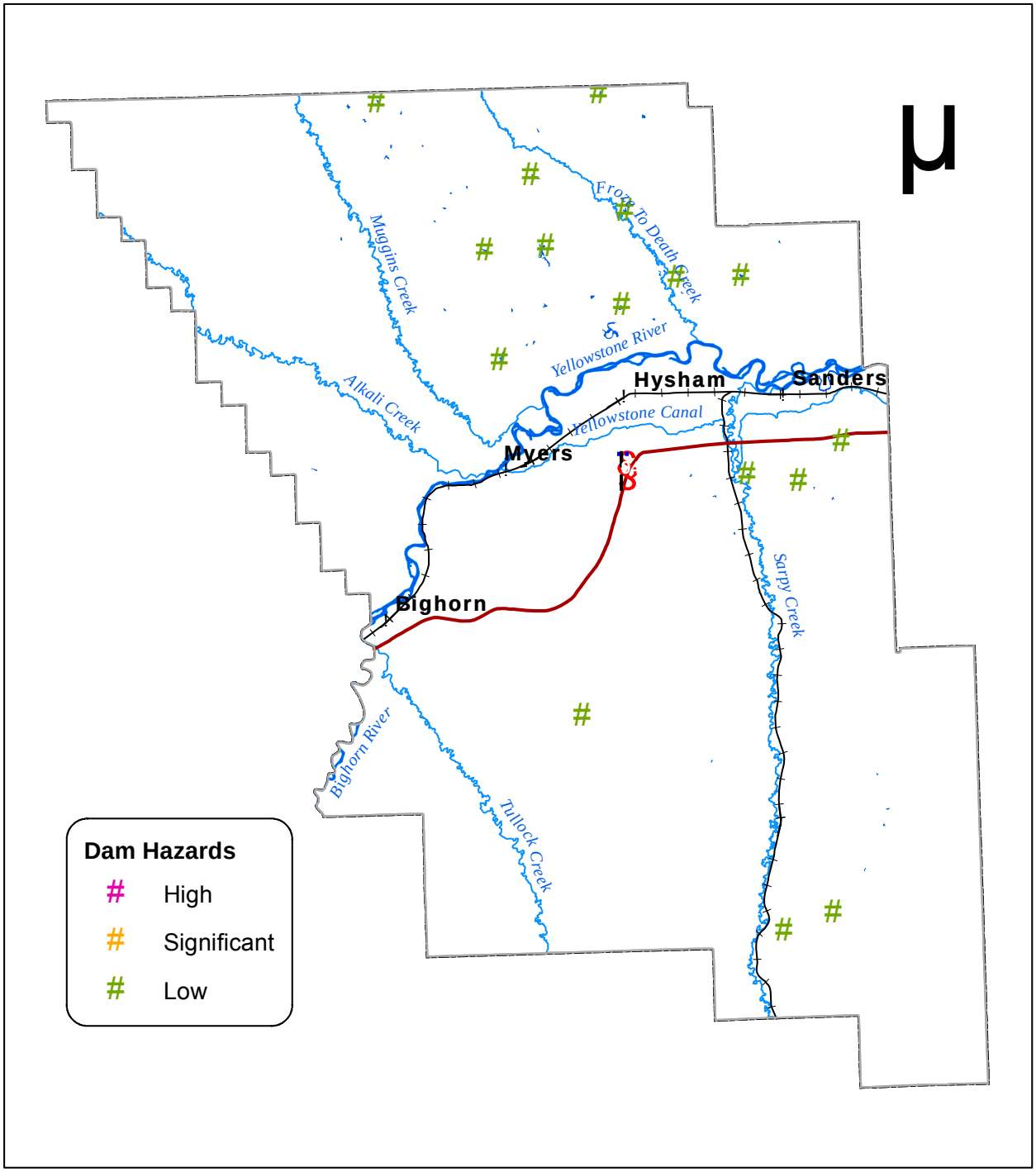
Map 4.5.4.5B

Dams
Treasure County



0 2.5 5 10 15 20 Miles

Data Source: US Army Corps of Engineers
Data Date: 2005
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, May 2006

4.5.4.6 Associated Hazards and Other Factors

Excessive rainfall and heavy snows associated with riverine, flash, ice jam, and groundwater flooding can be related to other hazards. Landslides and mudslides are often attributed to saturated soils and flooding. During the summer, severe thunderstorms can bring heavy rain along with the wind, hail, and tornadoes. Often the runoff causes sediment problems in addition to the flooding. Dams can fail for many reasons. Heavy rainfall or high water levels are often contributing factors in a dam failure. In this scenario, flooding may already be occurring, in which case, a dam failure would aggravate the situation. Dam failure as a terrorist act has also been proposed by many agencies evaluating homeland security.

4.5.4.7 Vulnerabilities

4.5.3.7.1 Critical and Special Needs Facilities

Using FEMA's HAZUS-MH software program, losses from riverine flooding can be estimated. This software models stream networks and estimates floodplain boundaries for various return periods. The data included with HAZUS-MH has a few of the critical and special needs facilities, but certainly not all of them. Runs of this model for Alkali Creek, the Bighorn River, Froze-to-Death Creek, Muggins Creek, Sarpy Creek, Tullock Creek, and the Yellowstone River showed no losses to critical or special needs facilities during floods up to the 500-year event. While this estimate is encouraging, comparing the more detailed database of critical and special needs facilities to the estimated 500-year flood hazard area shows the Hysham Water Plant and Sewer Lagoons are within the 500-year Yellowstone River flood boundary. Given this information, Treasure County's critical and special needs facilities are not immune from flood damages. A break of the Yellowtail Dam could have similar impacts to the Yellowstone River 500-year flood. Additionally, flash floods can cause damages to almost any structure.

FEMA's Benefit-Cost Analysis Module determines damage percentages for various building types. Table 4.5.3.7.1A shows the estimated percentages of building and contents losses from flooding at depths of one foot, three feet, and six feet.

Table 4.5.3.7.1A Flood Building and Contents Loss Estimation Percentages

	Flood Depth		
Structure Type	**1 foot**	**3 feet**	**6 feet**
One Story No Basement	14% Building Damage 21% Contents Damage	27% Building Damage 40.5% Contents Damage	40% Building Damage 60% Contents Damage
Two Story No Basement	9% Building Damage 13.5% Contents Damage	18% Building Damage 27% Contents Damage	24% Building Damage 36% Contents Damage
One or Two Story with Basement	15% Building Damage 22.5% Contents Damage	23% Building Damage 34.5% Contents Damage	38% Building Damage 57% Contents Damage
Manufactured Unit	44% Building Damage 66% Contents Damage	73% Building Damage 90% Contents Damage	81% Building Damage 90% Contents Damage

Source: Federal Emergency Management Agency, 2001.

4.5.3.7.2 Structures

HAZUS-MH runs were used to estimate damages to structures for floods along Alkali Creek, the Bighorn River, Froze-to-Death Creek, Muggins Creek, Sarpy Creek, Tullock Creek, and the Yellowstone River using census block data. The results are shown in Table 4.5.3.7.2A.

Table 4.5.3.7.2A HAZUS-MH Flood Module Estimated Building-Related Economic Losses

Study Area	**Estimated Building Damage**	**Building-Related Economic Loss**
Alkali Creek (500-year flood)	0-10 buildings slightly damaged	$30,000
Bighorn River (500-year flood)	0 buildings	$0
Froze-to-Death Creek (500-year flood)	0 buildings	$0
Muggins Creek (500-year flood)	0-10 buildings slightly damaged	$80,000
Sarpy Creek (500-year flood)	0-10 buildings slightly damaged	$180,000
Tullock Creek (500-year flood)	0-10 buildings slightly damaged	$30,000
Yellowstone River (500-year flood)	0-10 buildings slightly damaged	$670,000

In a similar fashion to the critical and special needs facilities, land parcels with structures on them from the State of Montana's Department of Revenue database were compared to the HAZUS-MH calculated 500-year flood hazard areas. Table 4.5.3.7.2B shows the estimated number of structures within the hazard areas and their associated building values.

Table 4.5.3.7.2B Estimated 500-Year Flood Exposure

Study Area	Parcels with Structures	Estimated Total Building Value
Alkali Creek (500-year flood)	2 parcels	$114,480
Bighorn River (500-year flood)	2 parcels	$145,030
Froze-to-Death Creek (500-year flood)	0 parcels	$0
Muggins Creek (500-year flood)	7 parcels	$166,140
Sarpy Creek (500-year flood)	11 parcels	$489,730
Tullock Creek (500-year flood)	11 parcels	$359,960
Yellowstone River (500-year flood)	21 parcels	$728,670

Table 4.5.3.7.1B in the previous section shows the estimated flood losses for varying flood depths and building types. A break of the Yellowtail Dam could have similar impacts to the Yellowstone River 500-year flood.

4.5.3.7.3 Infrastructure

Road infrastructure is particularly vulnerable to flooding, as history shows. Road and culvert washouts are common with heavy runoff. Sewer backups may also occur when the wastewater treatment facilities are overwhelmed. HAZUS-MH estimates slight bridge and highway damage during the 500-year floods, however, as history has shown, the road infrastructure, particularly gravel county roads, are much more susceptible to flood damages. Other damages to infrastructure, such as well contamination may also occur during significant floods.

Figure 4.5.3.7.3A A culvert between the railroad and Sarpy Creek Road plugged with debris.

4.5.3.7.4 Population

Slow-rising riverine floods usually have a fair amount of warning time and allow people to evacuate from the hazard areas. Flash floods, ice jam floods, and dam failures may not have lengthy lead times. Fortunately, Treasure County does not have any instances of injuries or fatalities from floods in recent history, however, this does not mean floods aren't a threat to the population. Heavy rains can quickly inundate areas not typically prone to flooding, roads can washout and become a hazard to vehicle occupants, normally dry channels may fill up with rushing waters, ice jam breakups can cause rapidly rising waters along rivers, creeks, and streams, and dam breaks may send high, powerful waves down the landscape. Treasure County is not immune from this potential. Throughout the United States, an average of 107 people die each year from floods, based on the 30-year history from 1975-2004. (National Weather Service, 2006e)

4.5.3.7.5 Economic, Ecologic, Historic, and Social Values

Flooding often affects agricultural areas. Such flooding may reduce profits but those losses would, in most cases, have little effect on the overall economy. Persistent rains that delay the beginning of the planting season may have a larger impact. Should an extreme, rare flood event occur over a wide area, the economy of Treasure County could be seriously affected. The closure of key roadways in the county may additionally have an impact on commerce.

Dirty floodwaters often contaminate or destroy everything they touch. Historic values could be lost during flood events. Road washouts could disrupt social values as activities are cancelled and travel is limited. Floods are an important part of the health of rivers and streams and therefore should not significantly affect ecological values, unless large quantities of toxins are released into the floodwaters.

4.5.3.7.6 Future Development

Treasure County participates in the National Flood Insurance Program and has an ordinance regulating development in and around floodplain areas. The Town of Hysham is not mapped, nor does it have a significant riverine flood hazard. Growth is not a serious issue, as the area loses population, however, the statewide trend of increasing population could eventually make its way to Treasure County. Therefore, floods may threaten future developments that are built over the next several years in unmapped flood-prone areas. For subdivisions within Treasure County's jurisdiction, land in the floodway of a 100-year flood event or land determined by the governing body to be subject to flooding cannot be subdivided for building or residential purposes. A licensed professional engineer must evaluate the flood hazard for unmapped areas that are "within 2,000 horizontal feet and 20 vertical feet of a live

stream draining an area of 25 square miles or more." Subdivisions must also have engineered drainage systems for water runoff. (Treasure County, 2004)

4.5.3.8 Data Limitations

Improvements to FEMA's HAZUS-MH flood module will lead to better output, and therefore, more specific information on the actual risk to Treasure County. Flood insurance rate maps with base flood elevations would also improve the flood analysis. Understanding the areas at most probable risk will allow for smarter development and protection of the people in the county. The development of GIS data that pinpoints structure locations will allow for improved analyses on structural vulnerabilities. Hydrologists can provide more information and outlooks on the flood hazard.

4.5.5 Hazardous Material Release

Including Fixed, Mobile, and Pipeline Sources

4.5.5.1 Description

A hazardous material release is the contamination of the environment (i.e. air, water, soil) by any material that because of its quantity, concentration, or physical or chemical characteristics threatens human, animal, or plant health, the environment, or property. An accidental or intentional release of materials could produce a health hazard to those in the area, downwind, and/or downstream with immediate, prolonged, and/or delayed effects. The spread of the material may additionally be defined by weather conditions and topography of the area. A hazardous material release can come from a fixed facility, via its transportation, or intentionally in the case of terrorism.

Fixed facilities housing hazardous substances in Treasure County include the usual facilities within communities such as water treatment plants, gas stations, and supply stores containing substances such as fuel, farm chemicals, propane, and paint. The county also five fixed facilities identified by the Local Emergency Planning Committee as particularly hazardous. These facilities include Cenex, Simplot, two Farmers Union locations, and the Friendly Corner. A fire at the Cenex and Simplot fertilizer plants west of Hysham could send hazardous smoke into the Town of Hysham under normal wind patterns. Treasure County also has two Cenex Pipelines that transport refined petroleum products underground south of the interstate and the Continental Pipeline for crude oil in the far northwest part of the county as shown in Map 4.5.5.5D.

A hazardous material release may also occur due to a transportation accident. The most likely locations for a transportation-related hazardous material release are along the primary roadways. Perhaps most significantly, this includes Interstate 94 through Treasure County. Another hazardous material transporter is the railroad. Owned and operated by Burlington Northern Santa Fe, the railroad transports goods in an east-west direction through the center of the county via a main line and also operates a branch line along Sarpy Creek to just east of Hysham.

In the event of a hazardous material release, the National Weather Service has the ability to issue a variety of warnings or statements. For example, a Hazardous Materials Warning may be issued using information reported by state or local officials. The definition of a Hazardous Materials Warning is, “a warning of the release of a non-radioactive hazardous material that may recommend evacuation or shelter in place.” Other warnings and statements for civil danger, civil emergency, evacuation immediate, local area emergency, radiological hazard, and shelter in place are also available to state and local emergency officials if needed. (National Weather Service, 2005d)

4.5.5.2 History

Based on information from the National Response Center database, the only significant hazardous material release in the county since 1993 was the August 10, 1996 incident on Interstate 94, mile 77 when a semi-tanker overturned and pinene, a highly flammable liquid, and diesel fuel spilled. The interstate was closed for a period of time. The database also cites two other incidents in which releases did not occur, but could have. The first was tractor trailer rollover on Interstate 94 in which two people died on July 9, 2003. The second was the October 18, 2006 derailment of 42 empty coal rail cars on the Sarpy Line, mile 22. (US Coast Guard, 2006)

4.5.5.3 Probability

Since 1993, one significant hazardous material release has been documented by the National Response Center. Additional releases can be expected in the future, however, the specific probability of such is uncertain. Since the county has an active interstate and railroad, the probability is moderate to high.

4.5.5.4 Magnitude

Although hazardous material releases have occurred in Treasure County and neighboring counties, the damages have been limited, still the potential exists for a release with human and property impacts. A serious, yet plausible, scenario includes the release and explosion of a fixed or mobile propane tank. With such an event, an evacuation radius of one mile or more could be expected, based on national standards. (US Department of Transportation, 2004) An even more significant release involving toxic substances such as anhydrous ammonia or chlorine is possible, particularly surrounding the railroad. Affected areas from these types of releases could extend as far away as 5 miles downwind.

4.5.5.5 Mapping

A hazardous material release can occur anywhere, however, buffer zones around the interstate, railroad, and pipelines show the areas that would most likely be affected by a hazardous material incident. Table 4.5.5.5A shows the evacuation radii for some common hazardous materials. This list is generalized for planning purposes and is certainly not all-inclusive. Emergency responders should rely on other sources for more detailed information.

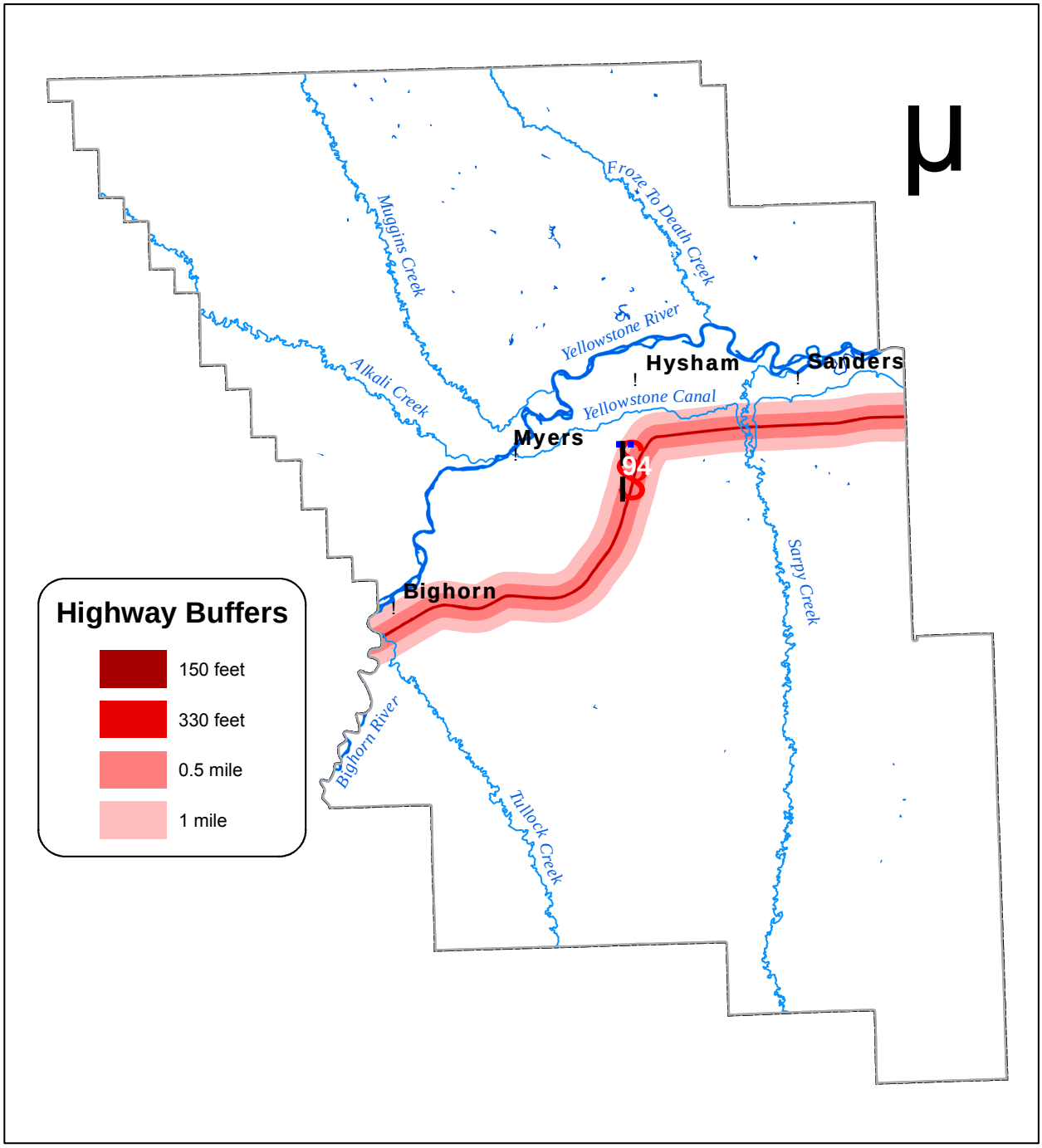
Table 4.5.5.5A Evacuation Radii for Hazardous Material Releases

Material	Potential Hazard	Initial Isolation	Evacuation
Diesel Fuel/Gasoline	Highly Flammable	150 feet	Up to ½ mile
Ammonium Nitrate Fertilizers	Oxidizer	330 feet	Up to ½ mile
Propane	Extremely Flammable	330 feet	Up to 1 mile
Anhydrous Ammonia	Toxic by Inhalation	200 feet	Up to 1.4 miles
Chlorine Gas	Toxic by Inhalation	900 feet	Up to 4.6 miles

Sources: US Department of Transportation, 2004.

Maps 4.5.5.5B through 4.5.5.5D show the highest hazard areas in Treasure County along the interstate, railroad, and pipelines based on the evacuation radii shown in Table 4.5.5.5A. The railroad map has different buffers for the primary line through Hysham than the Sarpy spur line. The primary line carries more hazardous materials and mixed loads. The spur line carries primarily coal and other raw materials.

Map 4.5.5.5B **Hazardous Materials Highway Buffers**
Treasure County



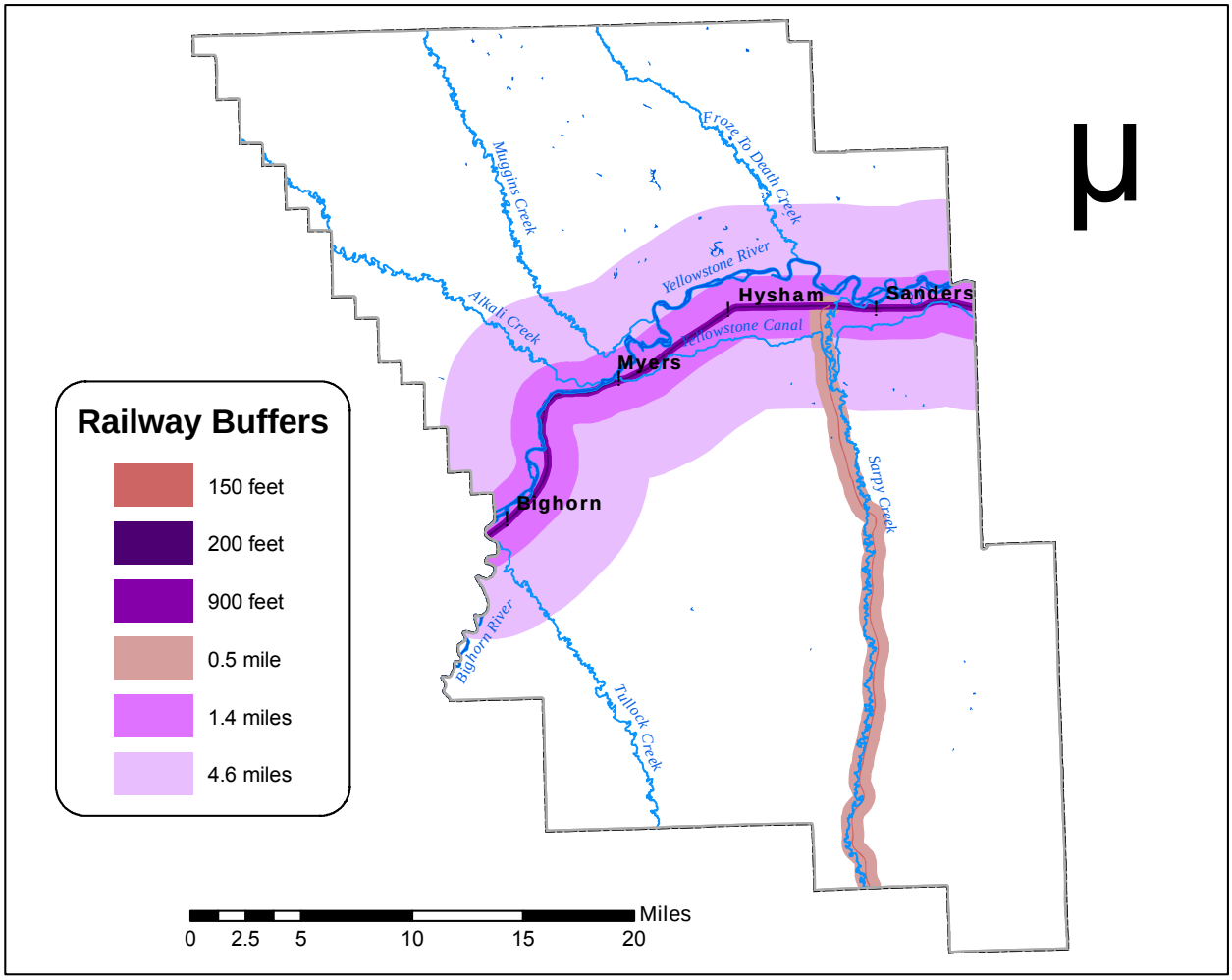
0 2.5 5 10 15 20 Miles

Map Created By:
Pam Shrauger, May 2006

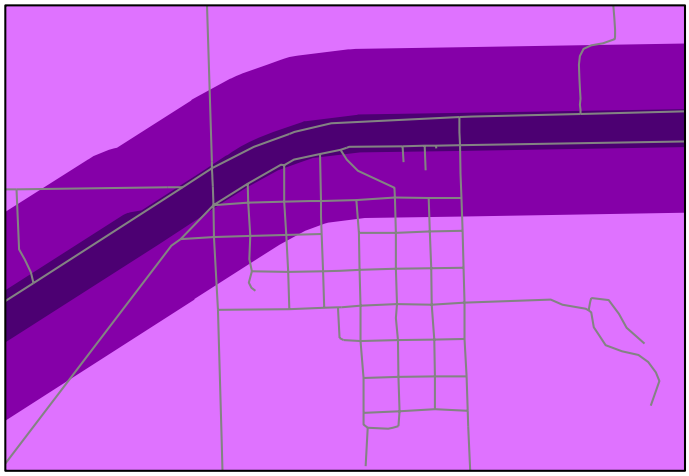
Data Source: Montana Natural Resource Information System
Data Date: Varied
Map Coordinates: NAD 1983, State Plane Montana

Map 4.5.5.5C Hazardous Materials Railway Buffers

Treasure County



Town of Hysham

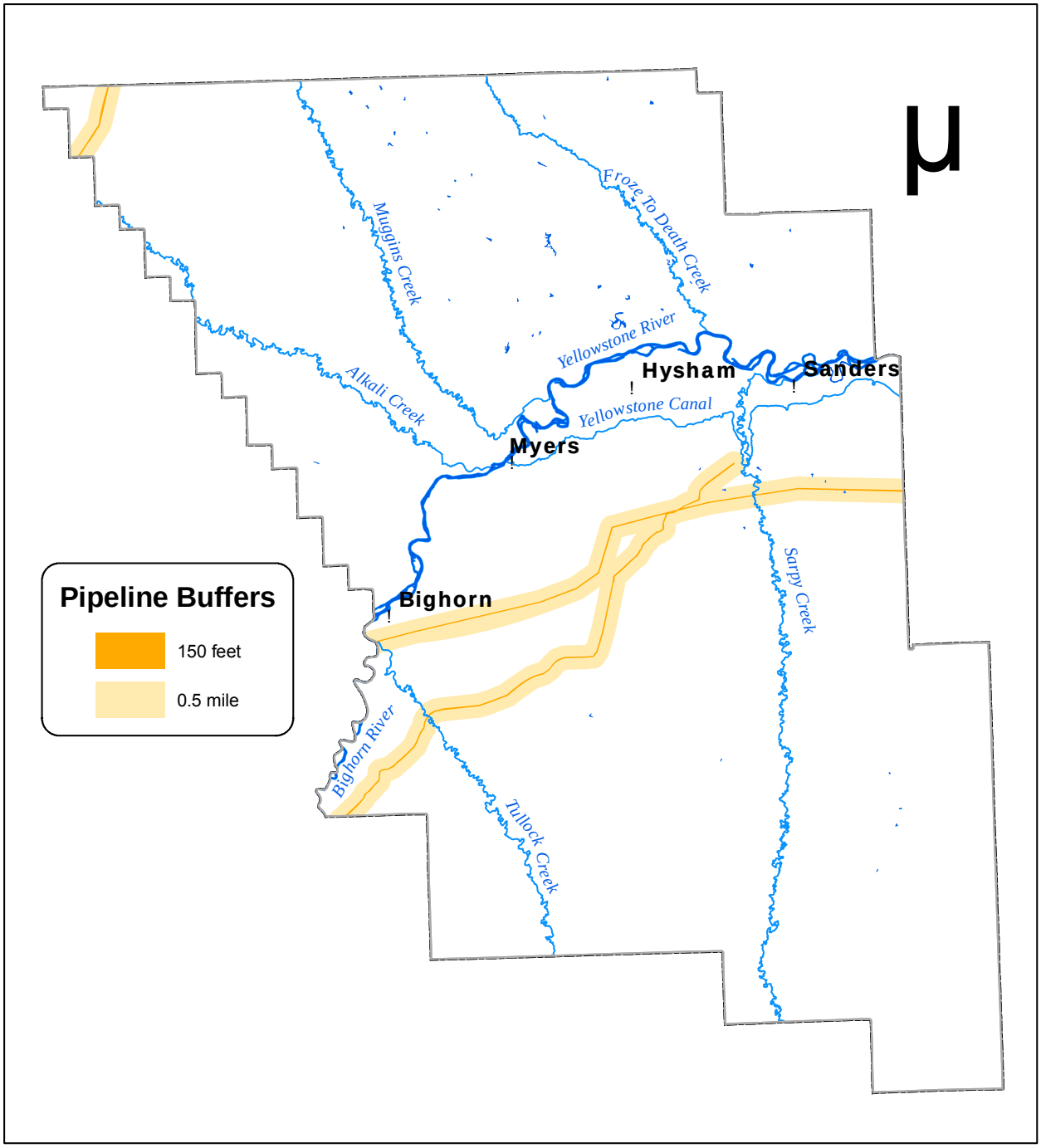


Data Source: Montana Natural Resource Information System
Data Date: Varied
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, May 2006

Map 4.5.5.5D **Hazardous Materials Pipeline Buffers**

Treasure County



Miles
0 2.5 5 10 15 20

Map Created By:
Pam Shrauger, May 2006

Data Source: Montana Natural Resource Information System
Data Date: Varied
Map Coordinates: NAD 1983, State Plane Montana

4.5.5.6 Associated Hazards and Other Factors

Hazardous material releases occur for a variety of reasons but are often initiated by a transportation accident. Almost any hazard that destroys infrastructure can lead to a hazardous material release. For example, floods can wash out bridges or roadways and ultimately cause a hazardous material release. Strong winds, poor visibilities, or slippery roadways from winter storms, wildfires, or tornadoes may also instigate such an accident. Hazardous material releases can also be intentional as is the case with a terrorist act or a domestic incident such as a methamphetamine lab. Hazardous material releases during any disaster will most certainly compound the complexity of the event.

4.5.5.7 Vulnerabilities

4.5.5.7.1 Critical and Special Needs Facilities

The buffers around the highways, railways, and pipelines as shown in Maps 4.5.5.5B, 4.5.5.5C, and 4.5.5.5D represent those areas with an enhanced risk from a hazardous materials release based on their proximity to regular hazardous materials transportation routes and infrastructure. Along the interstate, buffer zones of 150 feet, 330 feet, ½ mile, and 1 mile were established based on the initial isolation and evacuation radii for diesel fuel/gasoline and propane releases, as shown in Table 4.5.5.5A. The primary railway buffers are 200 feet, 900 feet, 1.4 miles, and 4.6 miles, based on the isolation and evacuation radii for anhydrous ammonia and chlorine gas; the spur line buffers are 150 feet and ½ mile based on the isolation and evacuation radii for diesel fuel/gasoline. The pipeline buffers are 150 feet and ½ mile based on the isolation and evacuation radii for petroleum products. Note that the actual evacuation zones are highly dependent on factors such as wind speed, wind direction, material released, and quantity released. Like most other hazards, in an actual event, the entire risk area likely won't be affected, but a small section surrounding the spill location may. Based on these buffer zones, the risk to the critical and special needs facilities is shown in Table 4.5.5.7.1A. Should a hazardous material release affect one of the critical facilities, the level of emergency services available could be reduced. A release near a special needs facility may present unique evacuation challenges.

Table 4.5.5.7.1A Critical and Special Needs Facilities' Hazardous Material Highway Vulnerabilities

Building / Area	Within Buffer Zone
Bighorn Post Office	Railroad – 200 feet
Cenex, Hysham	Railroad – 200 feet
Farmer's Union, Hysham	Railroad – 200 feet
Farmer's Union Bulk Fuel Tanks, Hysham	Railroad – 200 feet
Simplot	Railroad – 200 feet
Treasure County Shop/Ambulance Garage	Railroad – 200 feet
Hysham Clinic	Railroad – 200 feet
Friendly Corner Store/Greyhound Station	Railroad – 900 feet
Hysham Fire Station/Community Center/Senior Center	Railroad – 900 feet
Hysham Post Office	Railroad – 900 feet
Hysham School	Railroad – 900 feet
Hysham Town Offices/Shop	Railroad – 900 feet
Mid-Yellowstone Electric Cooperative	Railroad – 900 feet
Range Telephone	Railroad – 900 feet
Treasure County Courthouse	Railroad – 900 feet
USDA NRCS Building	Railroad – 900 feet
Hysham Sewer Lagoons	Railroad – 1.4 miles
Hysham Water Plant/Old Pumphouse	Railroad – 1.4 miles
Grierson Repeater Site	Railroad – 1.4 miles
Montana DOT Section House & Storage	Railroad – 1.4 miles
Bighorn Post Office	Interstate – 1 mile

None of the critical or special needs facilities lie within the 150 foot or ½ mile buffer zones of the petroleum pipelines.

In terms of a fire at the Simplot or Cenex fertilizer plants, the Farmer's Union facilities and Mid-Yellowstone Electric Cooperative lie within 330 feet, and all of the critical facilities in Hysham lie within a half mile of the plants.

4.5.5.7.2 Structures

Using the same methodology as the critical and special needs facilities, the buffer zones were compared to the state's CAMA data depicting land parcels with structures on them. Tables 4.5.5.7.2A, 4.5.5.7.2B, 4.5.5.7.2C and 4.5.5.7.2D show the estimated number of structures within the high hazard areas.

Table 4.5.5.7.2A Structure Vulnerabilities to Interstate Hazardous Material Releases

Within Buffer Zone	Number of Parcels with Structures
150 feet	6 parcels with structures
330 feet	6 parcels with structures
½ mile	14 parcels with structures
1 mile	25 parcels with structures

Table 4.5.5.7.2B Structure Vulnerabilities to Railway Hazardous Material Releases

Within Buffer Zone	Number of Parcels with Structures
Railroad – 200 feet	35 parcels with structures
Railroad – 900 feet	94 parcels with structures
Railroad – 1.4 miles	248 parcels with structures
Railroad – 4.6 miles	274 parcels with structures
Spur Line – 150 feet	9 parcels with structures
Spur Line – ½ mile	16 parcels with structures

Table 4.5.5.7.2C Structure Vulnerabilities to Pipeline Hazardous Material Releases

Within Buffer Zone	Number of Parcels with Structures
150 feet	7 parcels with structures
½ mile	10 parcels with structures

Table 4.5.5.7.2D Structure Vulnerabilities to Fertilizer Plant Fires

Within Buffer Zone	Number of Parcels with Structures
330 feet	4 parcels with structures
½ mile	185 parcels with structures

Fortunately, unless an explosion is present with the release, structures are typically not damaged in a hazardous materials release.

4.5.5.7.3 Infrastructure

Most hazardous material releases do not usually have an effect on infrastructure, particularly underground infrastructure, yet hazardous materials in their concentrated form are often important components of critical infrastructure such as chlorine for water treatment and PCBs for electric transformers. Similarly, contamination of the water supply may be treated like a hazardous material release. Propane, a necessary fuel for heating, can also be hazardous if released during its delivery due to its explosive potential. Transportation may be limited if a key roadway or railway is blocked by an incident.

4.5.5.7.4 Population

The population impacts are often greater than the structural impacts during a hazardous material release. Depending on the material, the health impacts to humans can be long and short term. A release in Treasure County could threaten the population. Tables 4.5.5.7.4A, 4.5.5.7.4B, and 4.5.5.7.4C show the estimated population within each of the buffer zones. These estimates are based on 2.8 people per structure (861 total population / 309 CAMA structures). Greater population concentrations may be found in community and special needs facilities and businesses.

Table 4.5.5.7.4A Population Vulnerabilities to Interstate Hazardous Material Releases

Within Buffer Zone	Estimated Number of Structures	Population
150 feet	6 parcels with structures	17 people
330 feet	6 parcels with structures	17 people
½ mile	14 parcels with structures	40 people
1 mile	25 parcels with structures	70 people

Table 4.5.5.7.4B Population Vulnerabilities to Railway Hazardous Material Releases

Within Buffer Zone	Estimated Number of Structures	Population
Railroad – 200 feet	35 parcels with structures	98 people
Railroad – 900 feet	94 parcels with structures	264 people
Railroad – 1.4 miles	248 parcels with structures	695 people
Railroad – 4.6 miles	274 parcels with structures	768 people
Spur Line – 150 feet	9 parcels with structures	26 people
Spur Line – ½ mile	16 parcels with structures	45 people

Table 4.5.5.7.4C Population Vulnerabilities to Pipeline Hazardous Material Releases

Within Buffer Zone	Estimated Number of Structures	Population
150 feet	7 parcels with structures	20 people
½ mile	10 parcels with structures	28 people

Table 4.5.5.7.4D Population Vulnerabilities to Fertilizer Plant Fires

Within Buffer Zone	Estimated Number of Structures	Population
330 feet	4 parcels with structures	12 people
½ mile	185 parcels with structures	518 people

In a hazardous material release, those in the immediate isolation area would have little to no warning, whereas, the population further away in the dispersion path may

have some time to evacuate, depending on the weather conditions, material released, and public notification.

4.5.5.7.5 Economic, Ecologic, Historic, and Social Values

Hazardous material releases usually do not have a significant impact on the economy. Exceptions could be an event that restricted access to the area for weeks or month. During the clean-up period, tourism and commerce may be affected as travelers avoid the damaged area. The most serious impacts of a hazardous material release would likely be to the environment and other ecological values. Clean-up efforts may mitigate the effects, but some losses may occur. Sensitive habitats could be damaged or air and water quality reduced. Social values may also be temporarily disrupted until the affected areas are cleared. Unless a building or historic site is significantly damaged directly by the incident, historic values would remain unaffected.

4.5.5.7.6 Future Development

Treasure County and the surrounding areas are rich in natural resources and the continued development of industries related to these natural resources is a distinct possibility. Currently, Treasure County does not have regulations beyond state law regarding this type of development. Future residences and businesses have very few specific considerations with respect to hazardous material releases. New development may increase the number of people and facilities exposed to hazardous material releases.

4.5.5.8 Data Limitations

Understanding when, where, and what substances are mostly likely to be released in a hazardous material incident is the greatest limitation in analyzing this hazard. Hazardous substances pass through Treasure County daily without incident. With so many possibilities and sources for hazardous materials releases in the county, fully describing how a release may occur and what areas would be affected is not possible. A study of the number and types of hazardous materials using the highways and railroads in the county would improve this profile. The various hazardous materials response teams in Montana could provide more details on specific types of materials and probable scenarios.

4.5.6 Landslide and Sinkhole

4.5.6.1 Description

A landslide is the movement of rock, soil, artificial fill, or a combination thereof on a slope in a downward or outward direction. The primary causes of landslides are slope saturation by water from intense rainfall, snowmelt, or changes in ground-water levels on primarily steep slopes, earthen dams, and the banks of lakes, reservoirs, canals, and rivers. (US Geological Survey, 2004) Other causative factors include steepening of slopes by erosion or construction, alternate freezing or thawing, earthquake shaking, volcanic eruptions, and the loss of vegetation from construction or wildfires. The saturation or destabilization of a slope allows the material to succumb to the forces of gravity or ground movement.

Many different types of landslides exist: slides, falls, topples, flows, and lateral spreads. Slides involve the mass movement of material from a distinct zone of weakness separating the slide material from the more stable underlying material. The primary types of slides are rotational slides and translational slides. Falls occur when materials, mostly rocks and boulders, fall abruptly from a steep slope or cliff. Falls are strongly influenced by gravity, mechanical weathering, and the presence of interstitial water. Topples are similar to falls, yet they pivot around a connection point at the base of the material and are most often caused by gravity or fluids in the cracks of the rocks. Flows typically have a higher percentage of water material embedded in them and behave more like a liquid than other types of landslides. The five primary categories of flows are: debris flows, debris avalanches, earthflows, mudflows, and creeps. Lateral spreads usually occur on gentle slope or flat surfaces when liquefaction occurs and leads to fractures on the surface. Complex landslides involve any combination of these types. (US Geological Survey, 2004)

Landslides are typically associated with mountainous regions, but they can also occur in areas of low relief. In these areas, the landslides are often the result of cut-and-fill failures (from roadway and building excavations), river bluff failures, lateral spreading, or mine collapse. Figure 4.5.6.1A shows the terms commonly used when describing a landslide's features. (US Geological Survey, 2004)

Figure 4.5.6.1A Common Landslide Terms on an Idealized Slump-Earth Flow

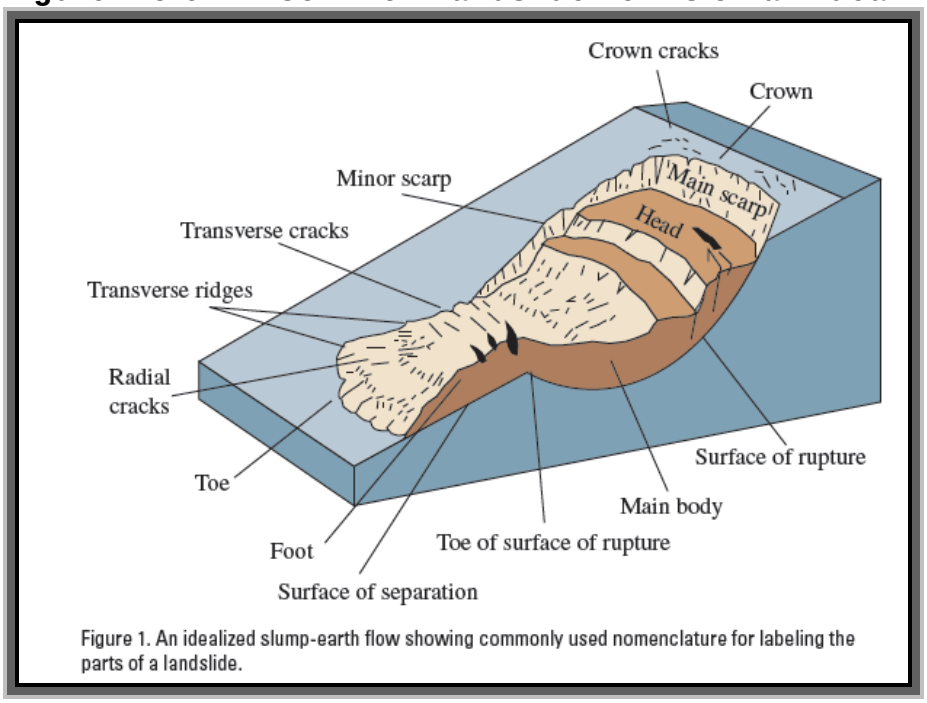


Figure 1. An idealized slump-earth flow showing commonly used nomenclature for labeling the parts of a landslide.

Source: US Geological Survey, 2004.

Since the most destructive landslides are often related to heavy rains and flash flooding, the National Weather Service issues flash flood watches and warnings as described below. These types of alerts are likely during potentially significant landslides.

- Flash Flood Watch: Flash flood watches inform the public of conditions which may cause short duration, intense flooding from heavy precipitation, snow melt, dam failure, or ice jams within the next 36 hours, but the flooding is neither certain nor imminent.
- Flash Flood Warning: Flash flood warnings are issued when flooding is imminent during short term events requiring immediate action. Flash flooding occurs when the water level rises rapidly to inundation within 6 hours of a causative event (i.e. heavy precipitation, snow melt, dam failure, or ice jams).

(National Weather Service, 2005d)

Sinkholes are common where the rock below the land surface is limestone, carbonate rock, salt beds, or rocks that can naturally be dissolved by ground water circulating through them. As the rock dissolves, spaces and caverns develop underground. Sinkholes are dramatic because the land usually stays intact for a while until the underground spaces just get too big. If there is not enough support for the land above the spaces then a sudden collapse of the land surface can occur. These collapses can be small or they can be huge and can occur where a house or road is on top. (US Geological Survey, 2006b)

4.5.6.2 History

Landslides in Treasure County certainly occur, mostly on a small scale. None have made enough of an impact to result in a disaster declaration. Sinkholes also appear periodically. On April 7, 2006, a sinkhole on Interstate 94 west of Hysham at Exit 63 began to open up, eventually closing the primary roadway and detouring traffic through the exit. The culvert under the interstate collapsed. Figure 4.5.6.2A shows a picture of the area during its repair.

Figure 4.5.6.2A Interstate 94 at Exit 63 following a sinkhole in the roadbed.

4.5.6.3 Probability

The actual probability of a major landslide or sinkhole event affecting Treasure County is difficult, if not impossible, to determine. Based on little history of major events, the probability is low to moderate. The probability, however, increases in key areas. Near the rivers, streams, and lakes, the probability of landslides along the shoreline from moving water increases significantly. Landslides also become more probable in the vicinity of steep slopes, canyon bottoms, wildfire burn areas, and excavation sites. Sinkholes are also hard to predict. Generally, the area is known to have other potential sinkhole sites, although specifically where is undetermined.

4.5.6.4 Magnitude

For planning purposes, the greatest magnitude event from a landslide or sinkhole would be an event that closes one of the major transportation routes in the county or destroys several homes. Despite a major sinkhole in the interstate in April 2006, it occurred in such a spot that traffic could be diverted off and then immediately back on the interstate relatively easily. Should a sinkhole or landslide occur in another location, detours and repairs may not be as easy.

4.5.6.5 Mapping

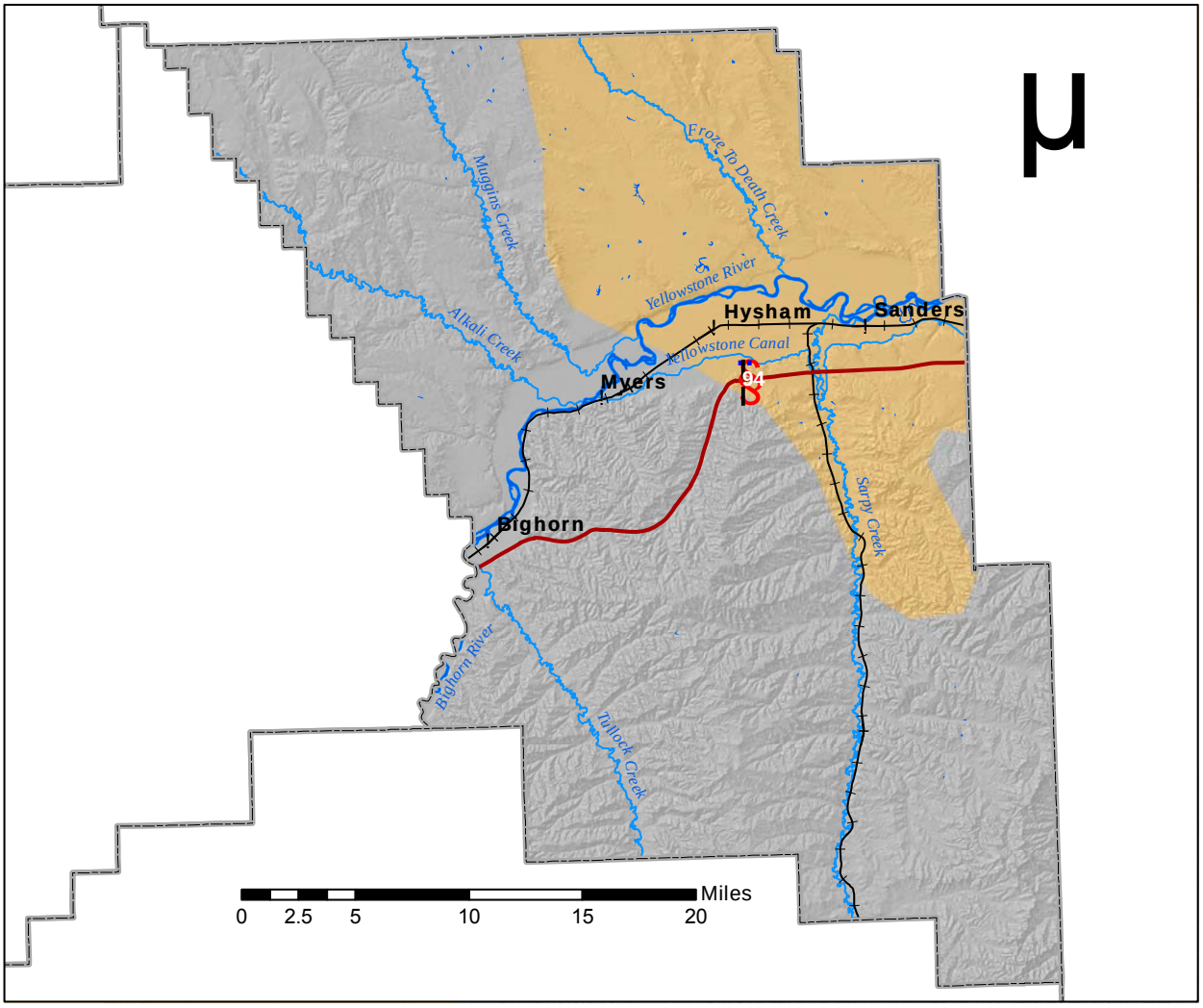
Landslides and sinkholes, due to their site specific nature, are difficult hazards to map. Only a geotechnical engineer or engineering geologist can accurately assess the landslide or sinkhole susceptibility of a particular location. That being said, a US Geological Survey (USGS) study and mapping project looked at the incidence and susceptibility of landslides on a nationwide basis. Therefore, the areas identified are general and not exact to the localized scale. Map 4.5.6.5A shows the classifications within Montana and Treasure County. The following is noted in the USGS study,

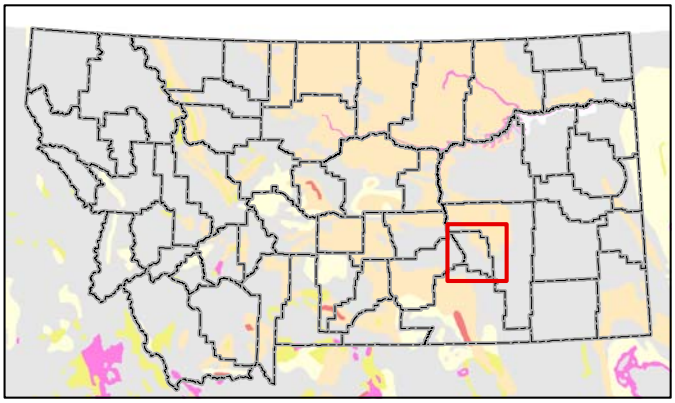
"Susceptibility is not indicated where same or lower than incidence. Susceptibility to landsliding was defined as the probable degree of response of [the areal] rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of landsliding. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated." (US Geological Survey, 2001) Much of Treasure County falls in the Low Incidence category, however, the northeastern part of the county is generalized as High Susceptibility/Low Incidence.

Map 4.5.6.5A

Landslide Overview

Treasure County





Landslide Incidence/Susceptibility

- High Incidence (greater than 15% of area involved)
- High Susceptibility/Moderate Incidence
- High Susceptibility/Low Incidence
- Moderate Incidence (1.5%-15% of area involved)
- Moderate Susceptibility/Low Incidence
- Low Incidence (less than 1.5% of area involved)

Map Created By:
Pam Shrauger, December 2006

BIG SKY HAZARD MANAGEMENT LLC

Data Source: Jonathan W. Godt, USGS
Data Date: February 2001
Map Coordinates: NAD 1983, State Plane Montana

4.5.6.6 Associated Hazards and Other Factors

Landslides, sinkholes, and flooding are closely allied since all are related to precipitation, runoff, and the saturation of ground by water. In addition, debris flows and mudflows usually occur in small, steep stream channels and can be mistaken for floods. The two events often occur simultaneously within a region. (US Geological Survey, 2004) Landslide debris washed downstream can settle in river and stream bottoms, thus, compounding flood problems. Other hazards may also lead to increased landslide and sinkhole hazards. With stripped vegetation, wildfire burn areas are more prone to landslides, particularly during periods of heavy rain or rapid snowmelt. Strong earthquakes have triggered massive landslides within Montana due to the powerful ground shaking. Similarly, a small earthquake could be enough to initiate a landslide as well.

4.5.6.7 Vulnerabilities

4.5.6.7.1 Critical and Special Needs Facilities

The exact threat of landslides and sinkholes to the critical and special needs facilities in Treasure County can only be specifically determined by a geotechnical engineer or engineering geologist, however, the threat can be discussed in more general terms. Those buildings on flat terrain, surrounded by other structures, likely have little vulnerability to landslides. Similarly, buildings on steep slopes, at the bottom of hills, or in unstable soils likely have a higher vulnerability to landslides. Most sinkholes are directly related to the geology beneath the surface and are harder to assess.

4.5.6.7.2 Structures

The most probable areas for landslides in Treasure County are on steep slopes, at the bottom of hills, and in unstable soils. Without a detailed soils and slope map depicting the landslide potential, the number of structures at risk from landslides is unknown. Similarly, predicting sinkholes requires an in-depth understanding of the geology beneath the earth's surface. Fortunately, Treasure County does not have any history of structures being destroyed by landslides and sinkholes. The vulnerability of structures to landslides and sinkholes is considered moderate.

4.5.6.7.3 Infrastructure

Infrastructure may be at risk from landslides and sinkholes. The transportation network is likely the most vulnerable, both from landslides covering the roadway and sinkholes giving way beneath the roadway, particularly during periods of heavy rain and snowmelt. Water and sewer infrastructure, namely broken underground pipes, have caused sinkholes in other parts of the country and the same is possible in

Treasure County. Infrastructure such as power lines could be destroyed by a large landslide, however, the historical record does not demonstrate this potential.

4.5.6.7.4 Population

The primary threats to the population of Treasure County from landslides and sinkholes are while driving. Sinkholes, and even landslides, can quickly destroy road infrastructure, endangering those on the roadways. Additionally, the population could be threatened by a landslide or sinkhole that damages an occupied structure. Given very little history of such, even across the state, the probability of deaths or injuries is low, however, the potential certainly exists. Therefore, the vulnerability of the population is considered moderate. In some cases, the National Weather Service may issue a flash flood warning to alert the public of potential floods and landslides. Travelers would be advised to use extreme caution.

4.5.6.7.5 Economic, Ecologic, Historic, and Social Values

Generally, landslides and sinkholes most significantly threaten the transportation network, and therefore, commerce. As US Representative Denny Rehberg stated in a press release following the April 2006 sinkhole on Interstate 94, "Not only is I-94 important to the economy in rural Eastern Montana, it's a critical part of commerce in the entire state," said Rehberg, a member of the House Appropriations Committee. "Cattle, grain and other agriculture products are shipped on I-94 along with goods that support Montana's oil and gas industries. Saying this stretch of road is important to Montana's economy is an understatement." (Rehberg, 2006) Similar statements could be said for other stretches of roadways in Treasure County.

Unless a building or sites were destroyed, ecological, historical, and social values would likely be preserved following a landslide or sinkhole event. The probability of a specific site of value being destroyed is low. Some quality of life may be diminished if long detours are required due to road closures.

4.5.2.7.6 Future Development

Unless evaluated by a geotechnical engineer or similar professional, new development could occur in areas hazardous from sinkholes. Some provisions are in place within the county subdivision regulations to restrict development in the hazardous areas. More specifically, lands unsuitable for subdivision include potential hazard areas from rock falls, landslides, steep slopes with unsuitable soil conditions in excess of 18 percent slope, and areas with a high potential for subsidence. These restrictions may prevent subdivisions in the most hazardous areas. Non-subdivision developments may still occur in some hazardous areas and others may have an unknown landslide or sinkhole hazard at the time of evaluation.

4.5.6.8 Data Limitations

Data on the landslide and sinkhole hazard is quite limited. Since landslides are not considered a major threat, the hazard has not been thoroughly studied for the area. The national datasets for landslide hazards are general in nature, dated, and somewhat obsolete. Landslides and sinkholes are such site specific events that pinpointing specific hazard areas is quite difficult and costly. Therefore, this hazard profile is general in nature and could be more specific if better data is ever compiled for the county.

4.5.7 Severe Thunderstorm

Including Tornadoes, Hail, Downbursts, and Lightning

4.5.7.1 Description

Thunderstorms develop across eastern Montana when moisture in the atmosphere rises, usually from a front, unstable atmospheric conditions, terrain uplift, or daytime ground heating, and cools higher in the atmosphere, condensing into rain droplets or ice crystals. The cloud grows as these conditions continue and the atmospheric instability allows. Lightning can be produced, with or without rain, as a charge builds up in the cloud. With the right atmospheric conditions, updrafts and downdrafts form in the thunderstorm structure. Strong updrafts and downdrafts can produce hail, damaging downbursts, and even tornadoes.

Hail develops when a supercooled droplet collects a layer of ice and continues to grow, sustained by the updraft. Once the hail stone cannot be held up any longer by the updraft, it falls to the ground. Hail up to 2.75 inches in diameter, the size of baseballs, has been reported in Treasure County; however, neighboring counties have had hail to six inches in diameter.

Downburst winds, which can cause more widespread damage than a tornado, occur when air is carried into a storm's updraft, cools rapidly, and comes rushing to the ground. Cold air is denser than warm air, and therefore, wants to fall to the surface. On warm summer days, when the cold air can no longer be supported up by the storm's updraft or an exceptional downdraft develops, the air crashes to the ground in the form of strong winds. These winds are forced horizontally when they reach the ground and can cause significant damage. These types of strong winds can also be referred to as straight-line winds. Downbursts with a diameter of less than 2.5 miles are called microbursts and those with a diameter of 2.5 miles or greater are called macrobursts. A derecho, or bow echo, is a series of downbursts associated with a line of thunderstorms. This type of phenomenon can extend for hundreds of miles and contain wind speeds in excess of 100 mph.

Tornadoes form when the right amount of shear is present in the atmosphere and causes the updraft and downdraft of a thunderstorm to rotate. A funnel cloud is the rotating column of air extending out of a cloud base, but not yet touching the ground. The funnel cloud does not become a tornado until it touches the ground. Once in contact with the surface, it can create great damage over a small area. In 1971, Dr. Theodore Fujita developed the Fujita tornado damage scale to categorize various levels of tornado damage. In 2006, enhancements to this scale resulted in more accurate categorizations of damage and the associated wind speeds. Both scales are shown in Table 4.5.7.1A.

Table 4.5.7.1A Tornado Scales

Fujita Scale		Enhanced Fujita Scale	
Scale	**Estimated Wind Speed**	**Scale**	**Estimated Wind Speed**
F0	<73 mph	EF0	65-85 mph
F1	73-112 mph	EF1	86-110 mph
F2	113-157 mph	EF2	111-135 mph
F3	158-206 mph	EF3	136-165 mph
F4	207-260 mph	EF4	166-200 mph
F5	261-318 mph	EF5	>200 mph

Sources: Storm Prediction Center, 2006a.

A severe thunderstorm is defined by the National Weather Service as a thunderstorm that produces wind gusts at or greater than 58 mph (50 kts), hail ¾ inch or larger in diameter, and/or tornadoes. These criteria represent thresholds where significant damages can occur. Strong winds and tornadoes can take down trees, damage structures, tip high profile vehicles, and create high velocity flying debris. Large hail can damage crops, dent vehicles, break windows, and injure or kill livestock, pets, and people.

Although not considered severe by National Weather Service definition, lightning and heavy rain can also accompany thunderstorms. Lightning develops when ice particles in a cloud move around, colliding with other particles. These collisions cause a separation of electrical charges. Positively charged ice particles rise to the top of the cloud and negatively charged ones fall to the middle and lower sections of the cloud. The negative charges at the base of the cloud attract positive charges at the surface of the Earth. Invisible to the human eye, the negatively charged area of the cloud sends a charge called a stepped leader toward the ground. Once it gets close enough, a channel develops between the cloud and the ground. Lightning is the electrical transfer through this channel. The channel rapidly heats to 50,000 degrees Fahrenheit and contains approximately 100 million electrical volts. The rapid expansion of the heated air causes thunder. (National Weather Service, 2006a)

To protect people and property, the National Weather Service issues informational products alerting the public to varying degrees of hazardous weather. The following may be issued for severe thunderstorm events:

- Hazardous Weather Outlook: Hazardous weather outlooks alert the public to the possibility for severe weather in the area from one to seven days in advance.
- Severe Thunderstorm Watch: Severe thunderstorm watches are issued by the Storm Prediction Center when conditions for severe thunderstorms appear favorable for an area over the next several hours. Watches are typically in effect for 4-6 hours.

- Severe Thunderstorm Warning: Severe thunderstorm warnings are issued when Doppler radar indicates or the public reports a thunderstorm with wind gusts of 58 mph or greater and/or hail ¾ inch or larger in diameter. The warning is usually valid for 30-60 minutes.
- Tornado Watch: Tornado watches are issued by the Storm Prediction Center when conditions for tornadoes appear especially favorable for an area over the next several hours. Watches are typically in effect for 4-6 hours.
- Tornado Warning: Tornado warnings are issued when Doppler radar indicates or the public reports a tornado. The warning is usually valid for 15-45 minutes.

(National Weather Service, 2006d)

4.5.7.2 History

Reports of severe thunderstorms and tornadoes are collected from trained spotters by the local National Weather Service (NWS) office in Billings, MT. These records are archived by the National Climatic Data Center. Since official records can only indicate events that have been reported to the National Weather Service, events are often underreported in rural area and areas lacking trained spotters.

Since 1955, three tornadoes have been recorded in Treasure County. Table 4.5.7.2A lists these and funnel cloud reports. Map 4.5.7.5A in the mapping section shows the estimated locations of these tornadoes. The strongest tornado reported the county was an F1 on the Fujita scale.

Table 4.5.7.2A Reported Tornadoes and Funnel Clouds

Location	Date	Magnitude	Additional Information
Treasure County	07/06/1955	F1	2 miles long, 73 yards wide $2,500 estimated property damage
5 Miles Southeast of Hysham	06/18/1997	N/A	Sheriff reported funnel cloud.
Bighorn	06/29/1997	N/A	The funnel cloud reported by the public went up and down several times.
9 Miles South of Bighorn to 13 Miles Southeast of Bighorn AND 20 Miles Southwest of Hysham to 23 Miles Southeast of Hysham	08/23/1998	F0	Two small tornadoes knocked down several trees, antennas, and power poles. One power pole which contained a transformer started fires after it fell. The tornadoes also damaged some houses and sheds. 7 miles long, 50 yards wide $300,000 estimated property damage
2 Miles West of Hysham	07/02/1999	N/A	Treasure County Sheriff and Montana Highway Patrol observed a funnel cloud west of Hysham.

Source: National Climatic Data Center, 2006.

Since 1991, 47 severe hail reports (3/4 inches or greater) have been recorded in Treasure County. Table 4.5.7.2B lists the reports of hail 2.00 inches in diameter or

greater and other significant hail events. Map 4.5.7.5B in the mapping section shows the estimated locations of the hail reports.

Table 4.5.7.2B Hail Reports of 2.00 inches in Diameter or Greater (and other select events)

Location	Date	Size	Additional Information
Treasure County	06/19/1991	2.00 in.	Destroyed crops and killed wildlife according to local residents.
Hysham	06/28/2001	2.75 in.	Occurred around 9PM.
8 Miles Southeast of Hysham	06/28/2001	2.75 in.	Heavy damage to homes and vehicles.
Hysham	06/28/2001	2.75 in.	Around 9:38PM, another wave of large hail resulted in broken windows.
11 Miles Northwest of Hysham	07/26/2001	2.75 in.	
4 Miles North of Hysham	07/26/2001	2.50 in.	
1 Mile North of Hysham	05/21/2006	1.75 in.	Windows broken out.
Hysham	05/21/2006	1.00 in.	Hail lasted 20 minutes, and combined with strong winds, took down trees and knocked out power.
25 miles South Southeast of Hysham	06/14/2006	2.00 in.	

Source: National Climatic Data Center, 2006

Since 1991, 14 severe thunderstorm wind reports (58 mph or greater) have been recorded in Treasure County. Table 4.5.7.2C lists the reports of 70 mph or greater and other significant thunderstorm wind events. Map 4.5.7.5C in the mapping section shows the estimated locations of the severe thunderstorm wind reports.

Table 4.5.7.2C Severe Thunderstorm Wind Reports of 70 mph or Greater (and other select events)

Location	Date	Speed	Additional Information
Treasure County	08/30/1989	70 mph	
Treasure County	07/09/1994	70 mph	
Hysham	07/09/1994	N/A	$50,000 in estimated property damage
Hysham	06/29/2002	70 mph	Five inch diameter tree limb was blown through a car windshield.
Hysham	05/21/2006	70 mph	Fallen trees in town and a porch roof blown off.
Hysham	06/04/2006	70 mph	3-4 inch tree branches blown down.
25 Miles South Southeast of Hysham	07/12/2006	70 mph	Severe wind gusts for a period of 20 minutes.

Source: National Climatic Data Center, 2006

Table 4.5.7.2D shows a summary of severe thunderstorm events.

Table 4.5.7.2D Severe Thunderstorm Events Summary for Treasure County

Event Type	Treasure County
Reported Tornadoes	1 event (1991-2006) Highest Magnitude: F1 (1955) $302,500 estimated property damages
Reported Severe Hail	47 events (1991-2006) Highest Magnitude: 2.75” 4 damaging events since 2001
Reported Severe Thunderstorm Winds	14 events (1991-2006) Highest Magnitude: 70 mph 4 damaging events since 1994

Source: National Climatic Data Center, 2006

4.5.7.3 Probability

A study on severe thunderstorm climatology conducted by the National Severe Storms Laboratory based on data collected from the National Weather Service from 1980-1999 assigns probabilities for various severe thunderstorm events for each day of the year. Based on this study, the probabilities and approximate peak season for Treasure County are as follows:

- The daily probability for a tornado in late June is 0.2%-0.4%.
- The daily probability for severe hail in late June and early July is 1%-4%.
- The daily probability for severe thunderstorm winds in mid July is 1%-2%.

Note that severe weather reporting has improved significantly since 1995, and therefore, these estimates are probably rather low.
(National Severe Storms Laboratory, 2003)

Based on the historical record, the following can be expected on average:

- One tornado or funnel cloud every 2-3 years.
- In an average year, 2-3 severe hail events.
- In an average year, about 1 severe thunderstorm wind event.

4.5.7.4 Magnitude

Reported severe thunderstorm events over the past sixteen years provide an acceptable framework for determining the magnitude of severe thunderstorms and tornadoes that can be expected and should be planned for. For tornadoes, even though the maximum intensity that was reported in Treasure County is an F1, stronger tornadoes can occur. The Federal Emergency Management Agency places this region in Zone II (160 mph) for structural wind design. (Federal Emergency Management Agency, 2004b) Hail sizes up to 6.00 inches, or larger than softballs, can be expected based on historical reports in neighboring counties. This size hail and even smaller sizes can damage structures, break windows, dent vehicles, ruin crops, and kill or injure people and livestock. Non-tornadic, thunderstorm winds over 100

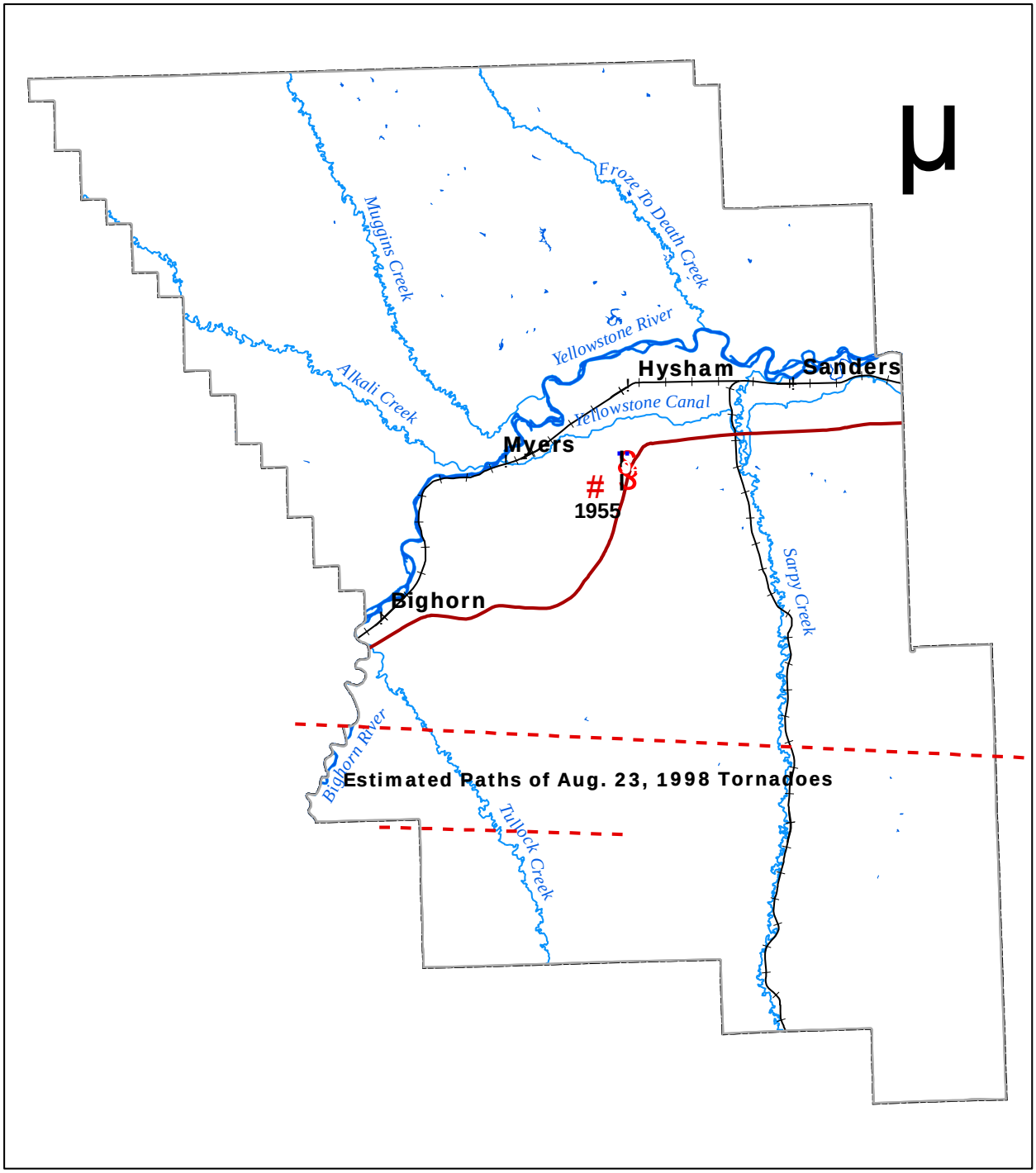
mph should also be planned for. As history demonstrates in neighboring counties, these types of winds can remove roofs, move mobile homes, topple trees, take down utility lines, and destroy poorly-built or weak structures.

4.5.7.5 Mapping

Many severe thunderstorm records maintained by the National Climatic Data Center contain location estimates for the reported events. The locations are based on where the reporting party estimates they are in relation to a town center. This data is then converted to an approximate latitude and longitude. These locations are not extremely accurate. Maps 4.5.7.5A through 4.5.7.5C show the approximate locations and distribution of historic events in Treasure County. Note that if more than one event occurred at the same location, only one event may be visible on the map.

Map 4.5.7.5A

Reported Tornadoes
Treasure County



0 2.5 5 10 15 20 Miles

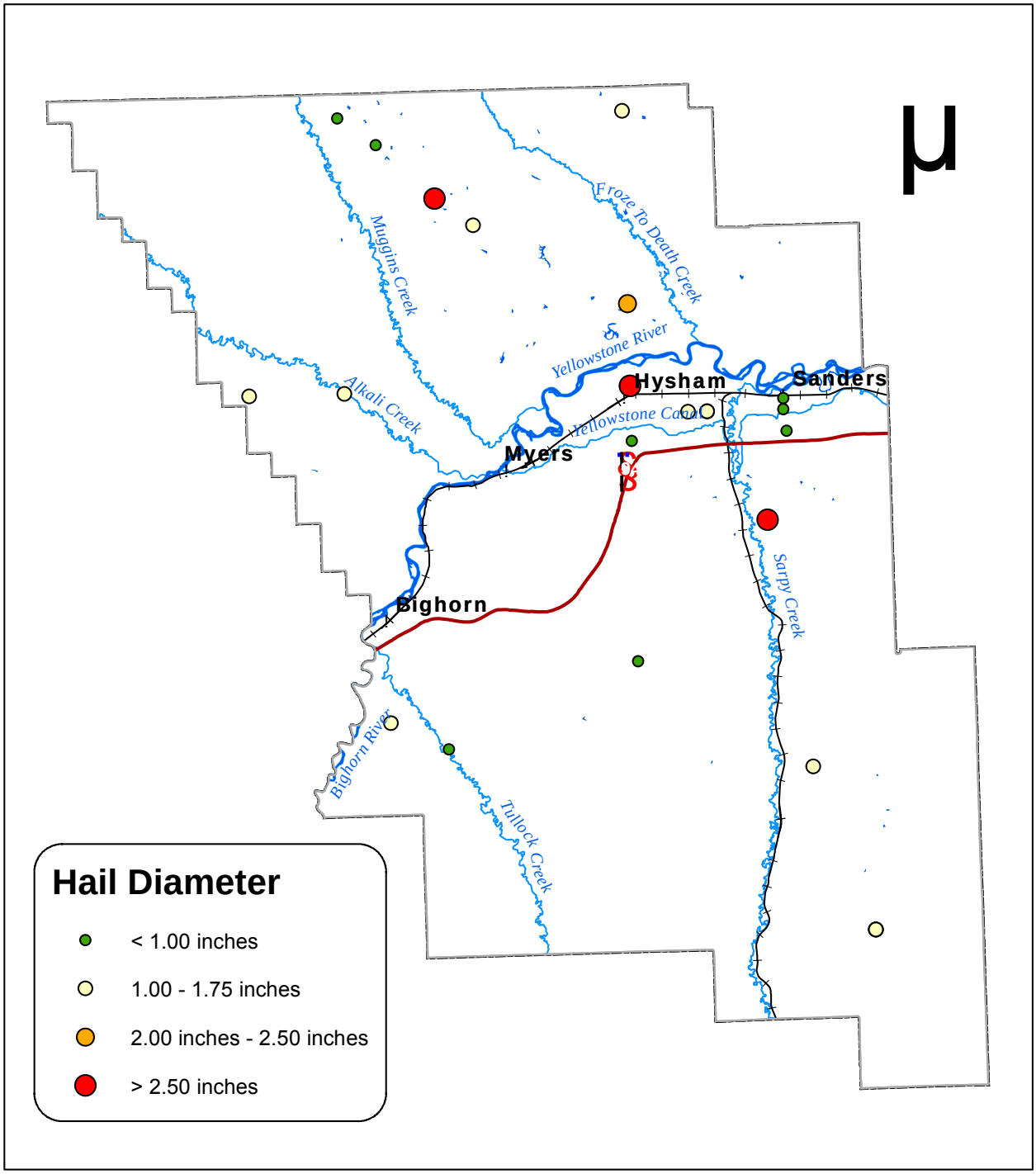
Data Source: National Climatic Data Center
Data Date: January 2006
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, May 2006

BIG SKY HAZARD MANAGEMENT LLC

Map 4.5.7.5B

Reported Severe Hail
Treasure County



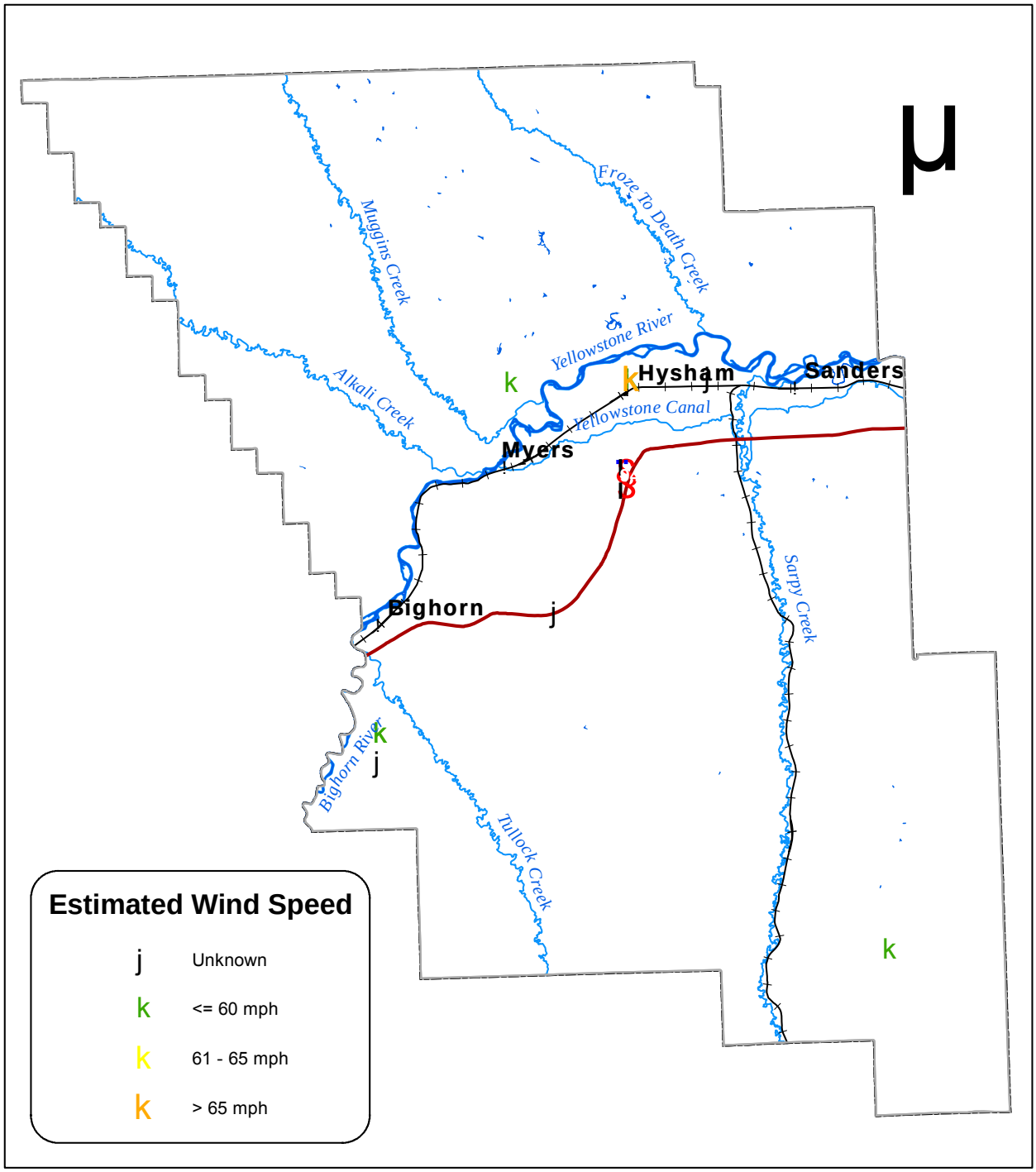
0 2.5 5 10 15 20 Miles

Data Source: National Climatic Data Center
Data Date: January 2006
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, May 2006

BIG SKY HAZARD MANAGEMENT LLC

Map 4.5.7.5C **Reported Severe Thunderstorm Winds**
Treasure County



0 2.5 5 10 15 20 Miles

Data Source: National Climatic Data Center
Data Date: January 2006
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, May 2006

4.5.7.6 Associated Hazards and Other Factors

Most severe thunderstorms occur during the hot summer months and may be associated with other summer and human caused hazards. Lightning in thunderstorms may spark wildfires or structure fires. When coupled with strong winds, these fires can quickly spread. Slow-moving thunderstorms often trigger flash floods due to the extended duration of the heavy rainfall. The heavy rain, hail, strong winds, and tornadoes with severe thunderstorms become problematic for ground and air travelers. Such conditions can cause accidents and could even possibly lead to a hazardous material release. Should winds be strong enough, they can take down power and communication infrastructure and lead to long-term outages. Severe thunderstorms associated with the passage of a strong cold front may usher in cooler temperatures and relieve extreme heat and drought conditions.

4.5.7.7 Vulnerabilities

4.5.7.7.1 Critical and Special Needs Facilities

Many of the critical and special needs facilities, although adequate for most events, may not be able to withstand 160 mph winds, as recommended by the Federal Emergency Management Agency. (Federal Emergency Management Agency, 2004b) Most structures should be able to provide adequate protection from hail but the structures could suffer broken windows and dented exteriors.

The Storm Prediction Center has developed damage indicators to be used with the Enhanced Fujita Scale for different types of buildings. Some of the indicators for different building types are shown in Tables 4.5.7.7.1A, 4.5.7.7.1B, and 4.5.7.7.1C.

Table 4.5.7.7.1A Institutional Buildings

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	59-88 mph (72 mph)
Loss of roof covering (<20%)	72-109 mph (86 mph)
Damage to upper walls and roof, loss of rooftop HVAC equipment	75-111 mph (92 mph)
Broken glass in windows or doors	78-115 mph (95 mph)
Uplift of lightweight roof deck and insulation, significant loss of roofing material (>20%)	95-136 mph (114 mph)
Façade components torn from structure	97-140 mph (118 mph)
Damage to curtain walls or other wall cladding	110-152 mph (131 mph)
Uplift of pre-cast concrete roof slabs	119-163 mph (142 mph)
Uplift of metal deck with concrete fill slab	118-170 mph (146 mph)
Collapse of some top story exterior walls	127-172 mph (148 mph)
Significant damage to building envelope	178-268 mph (210 mph)

Source: Storm Prediction Center, 2006a

Table 4.5.7.7.1B School Building (Junior or Senior High School)

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	55-83 mph (68 mph)
Loss of roof covering (<20%)	66-99 mph (79 mph)
Broken windows	71-106 mph (87 mph)
Exterior door failures	83-121 mph (101 mph)
Uplift of metal roof decking; significant loss of roofing material (>20%); loss of rooftop HVAC	85-119 mph (101 mph)
Damage to or loss of wall cladding	92-127 mph (108 mph)
Collapse of tall masonry walls at gym, cafeteria, or auditorium	94-136 mph (114 mph)
Uplift or collapse of light steel roof structure	108-148 mph (125 mph)
Collapse of exterior walls in top floor	121-153 mph (139 mph)
Most interior walls of top floor collapsed	133-186 mph (158 mph)
Total destruction of a large section of building envelope	163-224 mph (192 mph)

Source: Storm Prediction Center, 2006a

Table 4.5.7.7.1C Metal Building Systems

Damage Description	**Wind Speed Range** (expected in parentheses)
Threshold of visible damage	54-83 mph (67 mph)
Inward or outward collapsed of overhead doors	75-108 mph (89 mph)
Metal roof or wall panels pulled from the building	78-120 mph (95 mph)
Column anchorage failed	96-135 mph (117 mph)
Buckling of roof purlins	95-138 mph (118 mph)
Failure of X-braces in the lateral load resisting system	118-158 mph (138 mph)
Progressive collapse of rigid frames	120-168 mph (143 mph)
Total destruction of building	132-178 mph (155 mph)

Source: Storm Prediction Center, 2006a

Since the probability of a tornado or strong wind event is relatively the same across the county, the vulnerabilities to structures depend on the building types and their susceptibility to damages in a wind or tornado event. Even if a structure performs well in the high winds, flying debris and falling trees may damage the building.

4.5.7.7.2 Structures

With the entire county at risk from severe thunderstorms and tornadoes, estimates of damages are hard to determine. Realistically, an event involving a tornado or severe thunderstorm would most likely affect a small area. If that area were in a developed part of the county, roughly 10-20 homes could be damaged. Fifteen homes at a damage factor of 30% would result in roughly $183,150 in damages (15 homes x $40,700/home x 30% damage). Vehicles damaged by hail or falling debris would be additional losses to individuals, businesses, and government.

Tables 4.5.7.7.2A, 4.5.7.7.2B, and 4.5.7.7.2C show the damage indicators for various types of residential and ranch structures. In Treasure County, 315 residences are considered one or two family homes and 91 are mobile homes. (US Census Bureau, 2000)

Table 4.5.7.7.2A One and Two Family Residences

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	53-80 mph (65 mph)
Loss of roof covering material (<20%), gutters, and/or awning; loss of vinyl or metal siding	63-97 mph (79 mph)
Broken lass in doors and windows	79-114 mph (96 mph)
Uplift of roof deck and loss of significant roof covering material (>20%); collapse of chimney; garage doors collapse inward; failure of porch or carport	81-116 mph (97 mph)
Entire house shifts off foundation	103-141 mph (121 mph)
Large sections of roof structure removed, most walls remain standing	104-142 mph (122 mph)
Top floor exterior walls collapsed	113-153 mph (132 mph)
Most interior walls of top story collapsed	128-173 mph (148 mph)
Most walls collapsed in bottom floor, except small interior rooms	127-178 mph (152 mph)
Total destruction of entire building	142-198 mph (170 mph)

Source: Storm Prediction Center, 2006a

Table 4.5.7.7.2B Single Wide Manufactured Homes

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	51-76 mph (61 mph)
Loss of shingles or partial uplift of one-piece metal roof covering	61-92 mph (74 mph)
Unit slides off block piers but remains upright	72-103 mph (87 mph)
Complete uplift of roof, most walls remain standing	73-112 mph (89 mph)
Unit rolls on its side or upside down, remains essentially intact	84-114 mph (98 mph)
Destruction of roof and walls leaving floor and undercarriage in place	87-123 mph (105 mph)
Unit rolls or vaults, roof and walls separate from floor and undercarriage	96-128 mph (109 mph)
Undercarriage separates from unit, rolls, tumbles, and is badly bent	101-136 mph (118 mph)
Complete destruction of unit, debris blown away	110-148 mph (127 mph)

Source: Storm Prediction Center, 2006a

Table 4.5.7.7.2C Small Barns and Farm Outbuildings

Damage Description	**Wind Speed Range** (expected in parentheses)
Threshold of visible damage	53-78 mph (62 mph)
Loss of wood or metal roof panels	61-91 mph (74 mph)
Collapse of doors	68-102 mph (83 mph)
Major loss of roof panels	78-110 mph (90 mph)
Uplift or collapse of roof structure	77-114 mph (93 mph)
Collapse of walls	81-119 mph (97 mph)
Overturning or sliding of entire structure	83-118 mph (99 mph)
Total destruction of building	94-131 mph (112 mph)

Source: Storm Prediction Center, 2006a

4.5.7.7.3 Infrastructure

Above ground infrastructure, namely overhead power lines, communications towers and lines, and structures, are very susceptible to severe thunderstorms. High winds and falling trees can damage this type of infrastructure and disrupt services. Therefore, even an indirect hit by a tornado or strong winds could disrupt regional electricity and possibly telephone services. Table 4.5.7.7.3A shows the Enhanced Fujita Scale Damage Indicators for electric transmission lines.

Table 4.5.7.7.3A Electrical Transmission Lines

Damage Description	**Wind Speed Range** (expected in parentheses)
Threshold of visible damage	70-98 mph (83 mph)
Broken wood cross member	80-114 mph (99 mph)
Wood poles leaning	85-130 mph (108 mph)
Broken wood poles	98-142 mph (118 mph)
Broken or bent steel or concrete poles	115-149 mph (138 mph)
Collapsed metal truss towers	116-165 mph (141 mph)

Source: Storm Prediction Center, 2006a

Should an above ground facility such as the water tower or a sewer lagoon be damaged, water and sewer services could also be disrupted. Debris may also block roadways making transportation and commerce difficult if not impossible.

4.5.7.7.4 Population

Since structures are vulnerable to tornadoes and strong winds, those inside them are also at risk. The National Weather Service in Billings warns for severe thunderstorms and tornadoes for Treasure County. Meteorologists use a variety of tools such as Doppler radar and weather spotters to predict these hazardous events and issue warnings that are broadcast over NOAA Weather Radio and other media. NOAA

weather radio transmitters are located in Forsyth, Billings, and Hardin and provide some coverage over the county. Those with specially built receivers and transmitter coverage can be automatically alerted to weather hazards.

Some events have 15 minutes or more warning time and others have little to no warning. In 2000, the average tornado warning lead time was 10 minutes. (National Oceanic and Atmospheric Administration, 2001) Therefore, the population may have some lead time to take precautions, if they receive the warning. Generally, these warnings recommend that people move to a pre-designated shelter or a basement. If not available, interior rooms or hallways on the lowest floor away from windows or under a sturdy piece of furniture is recommended. Mobile homes, even if tied down, and automobiles are not safe places. With 91 mobile homes in Treasure County, approximately 255 people are at enhanced risk from tornadoes and strong thunderstorm winds. Besides structure failure, wind-driven projectiles and shattered glass can injure or kill occupants.

4.5.7.7.5 Economic, Ecologic, Historic, and Social Values

Large hail is always a threat to the agricultural community. Hail can damage crops and injure or kill livestock. A severe hail event that substantially damages an agricultural area could have economic impacts. Many farmers and ranchers do carry hail insurance. Strong winds and tornadoes could have similar impacts. Ecological values often are not threatened during a severe thunderstorm or tornado due the limited spatial and natural extent of such events. Some social values may be disrupted because of severe thunderstorm threats or during the recovery period following a disaster.

4.5.7.7.6 Future Development

Future development will likely have little effect on the communities' vulnerability to severe thunderstorms and tornadoes. The risk is assumed to be uniform countywide, and therefore, the location of development does not increase or reduce the risk necessarily. Development and population growth may in fact improve the television and radio technology available to residents, and therefore, improve the warning capabilities. Newer structures are generally built to withstand strong winds. Mobile homes, however, continue to be the exception.

4.5.7.8 Data Limitations

Severe thunderstorms and tornadoes can be such isolated events that the vulnerability to a particular area can be hard to determine. Weather data is often limited by the observations taken, and severe thunderstorm and tornado events are only recorded if reported to the National Weather Service. An in-depth study specific to Treasure County would need to be conducted to further develop this hazard profile.

The addition of trained spotters to the area may improve data collection. Historic lightning data may also pinpoint the areas that receive the most thunderstorms. Such data is usually expensive to acquire or produce.

4.5.8 Summer Weather

Including Extreme Heat, Drought, Dust Storms, Infestations, Low Water Supplies, and Strong Winds

4.5.8.1 Description

Summer represents the prime growing season for farmers and ranchers, a time to play for school children, lower heating bills, and a season for outdoor events. Besides all of the pleasant things that summer can bring, it can also usher in disastrous potential with drought, strong winds, dangerous heat, dust storms, low water supplies, and infestations. Many of these hazards extend into the spring and fall months. Each has its own set of challenges but all become more significant with the heat of summer, especially if it's dry. Weather records show the highest temperature recorded in Hysham is 108ºF, and elsewhere in the county is 113ºF. Coupled with low humidities and strong winds, the threat of summer weather hazards increases.

Weather year-round contributes to drought conditions, but its effects are most often felt and compounded during the hot summer months and growing season. The following is an excerpt from the National Drought Mitigation Center:

Drought is an insidious hazard of nature. Although it has scores of definitions, it originates from a deficiency of precipitation over an extended period of time, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector. Drought should be considered relative to some long-term average condition of balance between precipitation and evapotranspiration (i.e., evaporation + transpiration) in a particular area, a condition often perceived as "normal". It is also related to the timing (i.e., principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness (i.e., rainfall intensity, number of rainfall events) of the rains. Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with it in many regions of the world and can significantly aggravate its severity. (National Drought Mitigation Center, 2006)

Droughts can range from minor to severe, short-term to long-term with a variety of determining factors such as precipitation, soil moisture, and river levels. A minor, short-term drought can slip by unnoticed while a long-term severe drought can impact the agricultural economy, natural resources, and even public water supplies. Monitoring of drought conditions occurs nationally, and various indices, such as the Palmer Index, indicate the level of drought.

Dust storms, related to drought and heat, develop when intense ground heating causes convective air currents to lift dry soils and transport them through the air. Dust storms also occur during strong wind events. They can reduce visibilities, scratch surfaces, increase erosion, create unwanted dunes, damage infrastructure and

equipment, and cause respiratory problems in humans and animals. The National Weather Service issues the following products when a dust storm threatens:

- Blowing Dust Advisory: Blowing dust advisories are issued for widespread or localized blowing dust reducing visibilities to less than a mile but greater than ¼ mile with sustained winds of 25 mph or greater.
- Dust Storm Warning: Dust storm warnings are issued when widespread or localized blowing dust reduces visibilities to less than ¼ mile with sustained winds of 25 mph or greater.

(National Weather Service, 2006d)

Strong winds can occur at any time of year for a variety of reasons. Thunderstorm winds are discussed in the Severe Thunderstorm Hazard Profile. High winds can also occur with strong pressure gradients and gusty frontal passages. The closer and stronger two systems (one high pressure, one low pressure) are, the stronger the pressure gradient, and therefore, the winds are. The National Weather Service issues the following products for high winds:

- High Wind Watch: A high wind watch is issued when conditions are favorable for non-thunderstorm sustained winds of 40 mph or greater or gusts of 58 mph or greater for a period of one hour or more, but the timing, location, and/or magnitude are still uncertain.
- High Wind Warning: High wind warnings are issued when non-thunderstorm sustained winds of 40 mph or greater or gusts of 58 mph or greater for a period of one hour or more are expected.

(National Weather Service, 2006d)

Hot weather is normal during any summer, but excessive heat and extreme temperatures can impact people and animals. A heat wave is defined as a prolonged period of excessive heat and humidity. In a normal year, about 175 Americans succumb to the demands of summer heat. These are direct casualties and do not include deaths from other conditions, such as heart conditions, that may have been advanced by the heat. (National Weather Service, 2006b) Exposure to hot temperatures can lead to heat cramps, heat exhaustion, and heat stroke in humans. Heat cramps are muscular pains and spasms due to heavy exertion. Although heat cramps are the least severe, they are an early signal that the body is having trouble with the heat. Heat exhaustion typically occurs when people exercise heavily or work in a hot, humid place where body fluids are lost through heavy sweating. Blood flow to the skin increases, causing blood flow to decrease to the vital organs. This results in a form of mild shock. Heat stroke is the more life-threatening condition. The victim's temperature control system, which produces sweat to cool the body, stops working. The body temperature can rise so high that brain damage and death may result if the body is not cooled quickly. (American Red Cross, 1998)

The heat index is a measure of how hot it feels to people when relative humidity is factored with the actual air temperature. The National Weather Service uses this

index to determine the potential impact of heat on the population. Figure 4.5.8.1A shows the heat index chart.

Figure 4.5.8.1A Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity
Caution Extreme Caution Danger Extreme Danger

Source: National Weather Service, 2006b.

The National Weather Service issues the following products during excessive heat events:

- Excessive Heat Watch: An excessive heat watch is issued when conditions are favorable for heat index values in a 24 hour period with a minimum value of 80 or greater and a maximum of 115 or greater for 3 hours or longer, but the probability of such is still uncertain.
- Excessive Heat Warning: An excessive heat warning is issued when expected heat index values in a 24 hour period have a minimum value of 80 or greater and a maximum of 115 or greater for 3 hours or longer.

(National Weather Service, 2005d)

An infestation is the inhabitance of pests or invasive species in quantities large enough to be harmful or threatening to lives, property, or the economy. Most infestations involve insects, animals, or weeds. Common insect infestations include grasshoppers, mosquitoes, moths, termites, and beetles. Insects can damage crops, destroy organic materials, and carry diseases. In Treasure County, adult grasshopper surveys from 2002 show anywhere from 0 to 14 grasshoppers per square yard. (US Department of Agriculture, 2006b) Grasshoppers can eat large quantities of crops and negatively affect the agricultural community.

Animals become pests when they gather in large numbers, burrow large holes in the ground, enter structures, or carry disease. Mice and prairie dogs are the most

common pests, but birds and other animals can also reach infestation levels. Prairie dogs live in colonies underground and dig tunnels resulting in holes at the Earth's surface, often in agricultural lands, thus reducing productivity and creating uneven terrain.

Noxious weeds can choke out vegetation and crops, putting a strain on natural resources and the economy. Weeds on the state noxious weed list include Canada thistle, common tansy, dalmatian toadflax, diffuse knapweed, field bindweed, houndstongue, leafy spurge, ox-eye daisy, Russian knapweed, spotted knapweed, St. Johnswort, sulfur cinquefoil, whitetop hoary cress, and yellow toadflax. (Montana Department of Agriculture, 2003) Noxious weeds within Treasure County include leafy spurge, spotted knapweed, Russian knapweed, and dalmatian toadflax. (Montana State Library, 2006) Noxious weeds can invade natural growth areas and choke out desired plants on agricultural and grazing lands.

4.5.8.2 History

Summer weather hazards affect the region not only during the hot summer months, but throughout the year with a long history throughout eastern Montana. Paleoclimate studies show extreme periods of drought hundreds of years ago in the northern Great Plains including 200-370 A.D., 700-850 A.D., and 1000-1200 A.D. Compared to these periods over the past 2,000 years, the droughts since 1200 A.D. have been relatively wet and minor. (Laird et al, 1996) With the development of weather monitoring networks, climate records generally date back 75 years in the state. Table 4.5.8.2A lists the recognized periods of drought in Treasure County.

Table 4.5.8.2A Periods of Drought in Treasure County since 1900

Time Period	Description
1905-1906	Annual precipitation dropped to 60% of normal.
1917-1922	Following a very rainy period, less than normal precipitation levels persisted for about five years with annual precipitation dropping to 60% of normal.
1930's	The "Dust Bowl", as it is called, resulted in widespread drought conditions, soil erosion, and grasshopper infestations.
1950-1962	Many counties across the state applied for federal drought aid due to a lack of precipitation. Annual precipitation amounts persisted around 70% of normal.
1980's	Starting in 1979, periods of drought continued for a decade with very little precipitation relief. Treasure County, along with the rest of the state, received a federal drought declaration in 1985. Across the state, cattle herds were reduced by a third. In 1986, grasshopper infestations affected Treasure County.
1997-2005	The US Department of Agriculture issued Natural Disaster Determinations for drought for Treasure County, as a primary or contiguous county, in 2000 (S1468), 2001 (S1538), 2002 (S1624), 2003 (S1849), and 2004 (S1916 and S1972). Additionally, USDA Secretarial Designation S1468 provided for losses due to grasshoppers from May 17, 2000 through September 30, 2000.

Sources: Montana State Library, 2006; Montana Disaster and Emergency Services, 2004; National Climatic Data Center, 2006; US Department of Agriculture, 2005.

Treasure County received USDA Secretarial Designations (S1468), as a contiguous county, for production and physical losses related to high winds from January 1, 2000 through September 15, 2000. (US Department of Agriculture, 2005)

With respect to hot temperatures, periods of sustained record-breaking heat is often the most threatening to the population and others not accustomed to or prepared for it. Some significant record-breaking heat waves include:

- July 4-11, 1954: Highs in the low to mid 100's.
- July 19-21, 1960: Highs in the mid 100's.
- August 3-5, 1961: Highs in the mid 100's.
- August 21-26, 1969: Highs in the lower to mid 100's.
- June 4-8, 1988: Highs in the upper 90's and lower 100's.
- July 12-15, 2002: Highs in the mid 100's.

(Western Regional Climate Center, 2006)

The warmest year on record for Hysham was 1953, the warmest summer was 1988, the warmest month was August 1983, and the warmest day was August 6, 1949. (National Climatic Data Center, 2006)

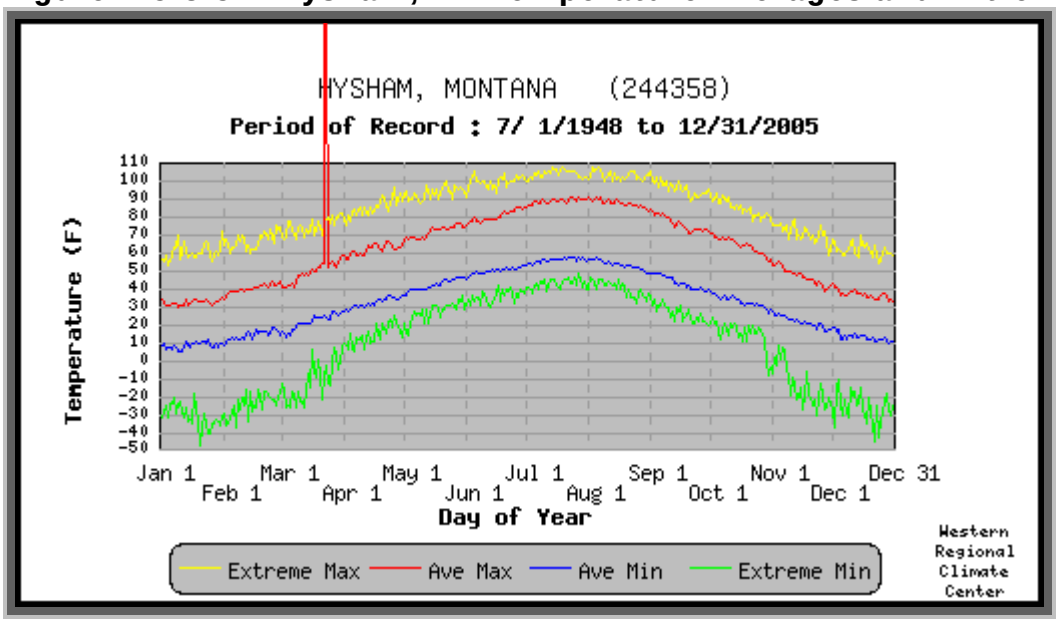
Infestations of all kinds have moderately affected Treasure County. This type of hazard does not typically result in Presidentially declared disasters, however, Treasure County has been part of USDA designations providing assistance due to grasshopper infestations. In 1986, Treasure County received a state disaster declaration (MT-86-8) due to a grasshopper infestation. The state and local government each paid half of $25,466 in losses. (Montana Disaster and Emergency Services, 2004)

4.5.8.3 Probability

The National Oceanic and Atmospheric Administration Paleoclimatology Program studies drought by analyzing records from tree rings, lake and dune sediments, archaeological remains, historical documents, and other environmental indicators to obtain a broader picture of the frequency of droughts in the United States. According to their research, "…paleoclimatic data suggest that droughts as severe as the 1950's drought have occurred in central North America several times a century over the past 300-400 years, and thus we should expect (and plan for) similar droughts in the future. The paleoclimatic record also indicates that droughts of a much greater duration than any in the 20th century have occurred in parts of North America as recently as 500 years ago." Based on this research, the 1950's drought situation could be expected approximately once every 50 years or a 20% chance every ten years. An extreme drought, worse than the 1930's "Dust Bowl," has an approximate probability of occurring once every 500 years or a 2% chance of occurring each decade. (National Oceanic and Atmospheric Administration, 2003)

Typically, the hottest month in Hysham is July, closely followed by August, with mean temperatures in the lower 70's. Figure 4.5.8.3A shows the extreme and average temperatures for Hysham. "Extreme Max" is the maximum of all daily maximum temperatures recorded for the day of the year. "Ave Max" is the average of all daily maximum temperatures recorded for the day of the year. "Ave Min" is the average of all daily minimum temperatures recorded for the day of the year. "Extreme Min" is the minimum of all daily minimum temperatures recorded for the day of the year. Note the spike in the average max is a data problem and can be ignored. (Western Regional Climate Center, 2006)

Figure 4.5.8.3A Hysham, MT Temperature Averages and Extremes



Source: Western Regional Climate Center, 2006

The probability of an infestation affecting Treasure County can only be assessed qualitatively. Infestation rates depend highly on ambient weather and habitat conditions. Explosive growth rates in pest populations, invasive species, or other types of infestations depend on many factors. Since a disastrous infestation requiring federal assistance has only occurred once in Treasure County, the probability of an infestation disaster is low to moderate.

4.5.8.4 Magnitude

The possible magnitude of the summer weather hazards varies by the type of event. A 500-year drought with a magnitude similar to that of the 1930's is an example of a high magnitude event. Such an occurrence would cause serious problems in Treasure County. Wind gusts of 80 mph or greater represent a high magnitude wind event, and coupled with blowing dust or wildfires, creates even more problems. Temperatures of 100ºF or greater for three or more days, especially with high humidities, signifies a potentially serious health threat for those heat-sensitive individuals in Treasure County. A weed or insect infestation that overwhelms the county and makes a significant impact on the regional economy is a high magnitude event for infestations.

4.5.8.5 Mapping

Drought, dust storms, strong winds, extreme temperatures, and infestations are usually regional hazards and are not enhanced by mapping. All county areas are assumed to have the same risk level. Mapping of the current drought status is published by the US Drought Monitor each Thursday at http://drought.unl.edu/dm.

4.5.8.6 Associated Hazards and Other Factors

Often the most common hazard associated with summer weather is wildfire. Favorable conditions for wildfires include dry, drought conditions, strong winds, and extreme temperatures. Infestations can additionally lead to dead, dry fuels for fires. Counter intuitively, drought can quickly be followed by flash flooding. Dry soils are not as permeable to water, particularly if the vegetation has been killed, and therefore, heavy rains run off faster than on moist soils with green vegetation and can more easily lead to flash flooding. Blight and grasshopper infestations also have a greater probability of occurring in drought conditions.

High winds can aggravate almost any other hazard. Strong winds can cause aviation accidents, tip tractor trailers, derail trains, spill hazardous materials, cause power outages, and melt snow quickly as the wind exchanges the cool air above the snow pack with early season warm temperatures, leading to flooding. Ultimately, summer weather hazards become much more significant when combined with other related hazards.

4.5.8.7 Vulnerabilities

4.5.8.7.1 Critical and Special Needs Facilities

Drought and extreme heat typically do not have a direct impact on structures. Strong winds may damage weak buildings but none of the critical or special needs facilities are known to be of poor construction that cannot withstand strong, non-thunderstorm winds. Most infestations do not damage the structural integrity of a building (except in the case of termites), however, some scenarios may make a structure uninhabitable. Mold and mildew infestations, typically following a flood, produce toxins harmful to humans. Other infestations such as mice may lead to building closures due to disease fears such as hantavirus. Only those infestations that limit emergency operations or special needs sheltering in some way would have a negative impact. Examples include the contamination of medical supplies by mice or other infestations that lead to the facility's closure. Such instances are very rare or insignificant.

4.5.8.7.2 Structures

Similar to critical and special needs facilities, residences and businesses are rarely affected by drought, extreme heat, and infestations. Strong winds can damage weak or poorly built structures. At 51-78 mph, mobile homes and small outbuildings may experience visible damage. Uplift of the roof occurs at roughly 73-114 mph. Complete destruction of mobile homes and small outbuildings usually occurs at 94-148 mph. In contrast, single family residences usually experience visible damage at

53-80 mph, roof uplift at 104-142 mph, and complete destruction at 142-198 mph. See the Severe Thunderstorm Hazard Profile for more damage indicators.

4.5.8.7.3 Infrastructure

Summer weather typically does not create problems with critical infrastructure, however, occasionally, it can have profound impacts. Severe droughts can negatively affect public water supplies. Should a public water or sewer system be affected, the losses could total into the millions of dollars if equipment is damaged and outside water is shipped in. During periods of extreme heat, temporary power outages may occur more frequently due to high electric demand. Most infestations are not serious enough to damage critical infrastructure, however, powerful weeds can be strong enough to penetrate paved and gravel roadways but usually do not cause significant damage. Above ground infrastructure, namely power lines, are vulnerable to high winds and falling trees.

4.5.8.7.4 Population

Drought evolves slowly over time and the population typically has ample time to prepare for its effects. Should a drought affect the water available for public water systems or individual wells, the availability of clean drinking water could be compromised. This situation would require emergency actions and could possibly overwhelm the local government and financial resources. Extreme heat can be dangerous to those with existing medical conditions. Such heat can quickly lead to overexertion, especially for those with heart conditions. As mentioned in the infrastructure section, power outages may result from high energy demands. In these instances, sensitive and special needs populations may become more vulnerable without air conditioning and medical equipment relying on electricity. These populations may even need to be moved to shelter outside the affected area with air conditioning. In some instances, infestations can have an impact on human health and wellness, usually through the transfer of disease.

4.5.8.7.5 Economic, Ecologic, Historic, and Social Values

Drought and infestations can certainly have an effect on the regional economy. High numbers of insects such as grasshoppers and beetles or low irrigation supplies may damage crops and reduce the amount of feed available for livestock. With annual agricultural sales of nearly $20 million, drought can severely diminish profits for the 115 farms in Treasure County. Forage and small grains are important aspects of the agricultural economy and losses from drought and infestations can have an effect locally. Being natural hazards, the summer weather hazards don't usually have profound negative impacts on the ecological, historic, or social values. Natural resources such as river and streams, and therefore tourism, can be influenced by drought.

4.5.8.7.6 Future Development

Future development's greatest impact on the summer hazards would possibly be to ground water resources. New water and sewer systems or significant well and septic sites could use up the water available, particularly during periods of drought. Fortunately, public systems, individual wells, and septic systems are monitored and permitted by Montana Department of Environmental Quality. Therefore, the impact of future development with respect to drought is considered low. Current regulations do not require new development to meet wind-resistance design codes, so new development could have an impact on the wind vulnerabilities in Treasure County, particularly mobile homes or poorly built structures.

4.5.8.8 Data Limitations

The greatest data limitation with drought is the inability to pinpoint the start and end of drought periods and the associated correlation with economic losses. An online database of historical USDA drought declarations and the associated losses would prove beneficial in documenting the effects of drought and directing mitigation activities. Additional anemometers spread throughout the county with archived data would allow for a more detailed wind analysis.

With very little history of significant infestations that cause harm to human life or property, assessing the risk of disastrous infestation consequences can only be done qualitatively. Additionally, small infestations of grasshoppers, mosquitoes, prairie dogs, and other species are a normal and healthy part of nature, and therefore, do not often result in community-wide disasters. Agriculture agents and vector-borne disease scientists can provide more detailed information on the infestation risk.

4.5.9 Terrorism and Civil Unrest

4.5.9.1 Description

Terrorism and civil unrest are human caused hazards that are intentional and often planned. Terrorism, both domestic and international, is a violent act done to try and influence government or the population of some political or social objective. Terrorist acts can come in many recognized forms or may be more subtle using untraditional methods. The primary recognized forms of terrorism are chemical, explosive, biological, radiological, and cyber; however, terrorism's only limitation is the human imagination.

Chemical terrorism is the use of chemical agents to poison, kill, or incapacitate the population or animals, destroy crops or natural resources, or deny access to certain areas. Chemical agents can be broken into five different categories: nerve agents, vesicants, cyanide, pulmonary agents, and incapacitating agents. Known nerve agents include tabun, sarin, soman, GF, and VX and can cause a variety of conditions affecting the central nervous system either through vapor or liquid form. Vesicants cause blisters on the skin and can damage eyes, airways, and other tissues and organs. Vesicant agents include sulfur mustard, Lewisite, and phosgene oxime. Cyanides can be in solid salt or volatile liquid format, or when combined with acid, a vapor or gas. Their absorption can cause everything from nausea to death, depending on the amount absorbed. Pulmonary agents such as phosgene and perfluroroisobutylene cause pulmonary edema usually hours after exposure. Incapacitating agents produce reversible disturbances within the central nervous system and cognitive abilities and include the agent BZ. (Sidell, 2006)

Terrorism using explosive and incendiary devices includes bombs and any other technique that creates an explosive, destructive effect. Bombs can take many forms from a car bomb to a mail bomb. They can be remotely detonated using a variety of devices or directly detonated in the case of a suicide bomb.

Bioterrorism is the use of biological agents, such as Anthrax, Ricin, and Smallpox, to infect the population, plants, or animals with disease. Bioterrorism is further discussed in the Communicable Disease and Bioterrorism Hazard Profile, Section 4.5.2.

Radiological terrorism involves the use of radiological dispersal devices or nuclear facilities to attack the population. Exposure to radiation can cause radiation sickness, long-term illness, and even death. Terrorism experts fear the use of explosive and radiological devices in the form of a "dirty bomb" to attack the population. A "dirty bomb" is a low-tech, easily assembled and transported device made up of simple explosives combined with a suitable radioactive agent. As with chemical and

biological events, radiological incidents present contamination challenges for first responders.

Cyberterrorism is the attack or hijack of the information technology infrastructure that is critical to the US economy through financial networks, government systems, mass media, or other systems. Any cyber attack that creates national unrest or instability would be considered cyberterrorism.

Civil unrest and violence typically occur on a smaller scale than terrorism when large groups, organizations, or distraught individuals take action with potentially disastrous or disruptive results. Civil unrest can result following a disaster that creates panic in the community. Violence can be small scale, such as domestic violence, or larger and require significant government response, as is profiled in this plan.

Most times, terrorist acts, both domestic and international, are driven by a terrorist group or hate organization. Occasionally, individuals, as was the case in the Oklahoma City bombing, perform independent acts. Usually, the perpetrators have an underlying belief that drives the act. Some of the types of groups include the following:

- Black Separatists: They typically oppose integration and racial intermarriage, and they want separate institutions, or even a separate nation, for blacks. Most forms of black separatism are strongly anti-white and anti-Semitic. (Southern Poverty Law Center, 2006)
- Christian Identity: This religion asserts that whites, not Jews, are the true Israelites favored by God in the Bible. For decades, Identity has been one of the most influential ideologies for the white supremacist movement. (Southern Poverty Law Center, 2006)
- Eco-Terrorists: These environmentally-oriented, subnational groups use or threaten to use violence of a criminal nature against innocent victims or property for environmental-political reasons. They may also aim their attacks at an audience beyond the target, often of a symbolic nature. Organizations identified by the FBI as having terrorist cells include the Animal Liberation Front (ALF) and the Earth Liberation Front (ELF). Although supporting organizations generally advocate peaceful demonstrations, the FBI estimates that the ALF/ELF have committed more than 600 criminal acts in the United States from 1996-2001, resulting in damages in excess of $43 million. The most destructive acts committed by the ALF/ELF involve arson. (Federal Bureau of Investigation, 2002)
- Ku Klux Klan: This organization, with its mystique and long history of violence, is the most infamous, and oldest, American hate group. Although blacks have typically been the Klan's primary target, it has also attacked Jews, immigrants, homosexuals, and, until recently, Catholics. (Southern Poverty Law Center, 2006)

- Neo-Confederate: Many groups celebrate traditional Southern culture and the Civil War's dramatic conflict between the Union and the Confederacy, but some groups go further and embrace racist attitudes towards blacks, and in some cases, white separatism. (Southern Poverty Law Center, 2006)
- Neo-Nazi: These groups share a hatred for Jews and a love for Adolf Hitler and Nazi Germany. While they also hate other minorities, homosexuals, and even sometimes Christians, they perceive "the Jew" as their cardinal enemy, and trace social problems to a Jewish conspiracy that supposedly controls governments, financial institutions, and the media. (Southern Poverty Law Center, 2006)
- Racist Skinhead: These groups form a particularly violent element of the white supremacist movement. Racist Skinheads often operate in small "crews" that move from city to city. (Southern Poverty Law Center, 2006)

When notified by a government official, the National Weather Service has the ability to send alert messages through the Emergency Alert System and over NOAA Weather Radio. Examples include the following:

- Local Area Emergency Message: This message defines an event that by itself does not pose a significant threat to public safety and/or property, but the event could escalate, contribute to other more serious events, or disrupt critical public safety services. Instructions, other than public protective actions, may be provided by authorized officials. Examples of when this message may be used include: utility disruptions, road closures, or a potential terrorist threat where the public is asked to remain alert.
- Civil Emergency Message: This message outlines a significant threat or threats to public safety and/or property that is imminent or in progress. The hazard is usually less specific or severe than those requiring a Civil Danger Warning.
- Law Enforcement Warning: This warning is issued for a bomb explosion, riot, or other criminal event. An authorized law enforcement agency may block roads, waterways, or facilities, evacuate or deny access to affected areas, and arrest violators or suspicious persons.
- Radiological Hazard Warning: This warning warns of the loss, discovery, or release of a radiological hazard such as the theft of a radiological isotope used for medical, seismic, or other purposes, discovery of radioactive materials, or a transportation accident involving nuclear weapons, nuclear fuel, or radioactive wastes. Authorized officials may recommend protective actions be taken if a radioactive hazard is discovered.
- Civil Danger Warning: This warning is issued when an event presents a danger to a significant civilian population. The message usually warns of a specific hazard and outlines specific protective actions such as evacuation or shelter in place.
- Shelter In Place Warning: This warning is issued when the public is recommended to shelter in place (go inside, close doors and windows, turn off air conditioning or heating systems, and turn on the radio or TV for more

information). Examples include hazardous material releases or radioactive fallout.
(National Weather Service, 2005d)

4.5.9.2 History

Fortunately, Treasure County has not been the location of a modern terrorism event. Significant terrorist acts occurring in the United States since 1950 include:

January 27-29, 1975 – In New York City, a bomb at a Wall Street bar killed 4 and injured 60. Two days later, a bomb exploded in a US Department of State bathroom. A domestic terrorist organization claimed responsibility.

August 3, 1977 – Two bombs were left at offices in New York City, killing one person and injuring eight; one building housed US Department of Defense personnel. The bombs were planted by members of the Armed Forces of National Liberation (FALN), a Puerto Rican pro-independence organization.

February 29, 1993 – A bombing in the parking area of the World Trade Center killed 6 and wounded about 1,000. The bombing was organized by the foreign terrorist organization, Al Qaeda.

April 19, 1995 – Domestic terrorist Timothy McVeigh blew up the Alfred P. Murrah Federal Building in Oklahoma City, killing 168 people and injuring hundreds more.

September 11, 2001 – Four commercial planes hijacked by 19 members of the Al Qaeda terrorist organization were intentionally crashed into buildings; two planes hit the World Trade Center buildings in New York City, one into the Pentagon outside Washington, DC, and one into a field in Pennsylvania after passengers stormed the cockpit. Nearly 3,000 people were killed.

October 2001 – Letters containing the deadly anthrax bacterium were mailed to members of Congress and television networks. One person died. The perpetrator remains at-large.
(National Memorial Institute for the Prevention of Terrorism, 2006)

4.5.9.3 Probability

The probability of a terrorist or civil unrest event affecting Treasure County directly is low to moderate. The county is not considered a terrorist target nor is it an area at high risk for civil unrest. A shooting by a disgruntled employee or student is possible. A large scale attack cannot be ruled out, and therefore, a small probability exists. Of greater probability is a terrorist attack that has an indirect effect on the county through its economy. The September 11th terrorist attacks in New York, Washington,

and Pennsylvania had a significant impact on the national economy and required the activation of many local resources. Another attack could have a similar effect. Such an attack in another part of the country has a greater probability than a direct attack within Treasure County, but even the probability of such an attack elsewhere is unknown and is the subject of much debate.

4.5.9.4 Magnitude

Although a terrorist event or civil unrest could cause actual destruction in Treasure County, the probability is remote that more realistic scenarios will be considered for planning purposes. An attack on the United States that collapses the economy or requires warfare and the drafting of soldiers is considered a high magnitude event. An attack on the critical electric infrastructure in neighboring Rosebud County is also possible. On a smaller but very significant scale would be an attack on a facility such as a school or business involving shooters, homemade bombs, or the taking of hostages. High schools across the country have struggled with similar events, and therefore, such an incident is possible, although not likely, in Treasure County.

4.5.9.5 Mapping

Given the uncertainties associated with terrorism and civil unrest, uniform risk is assumed throughout the county. Mapping does not enhance this hazard profile.

4.5.9.6 Associated Hazards and Other Factors

The only limitations of terrorism and civil unrest are the human imagination and motivations, therefore, any hazard that can be “created” can be the result of terrorism or civil unrest. For example, terrorists can compromise a dam, leading to catastrophic dam failure. Other hazards that people can initiate given the appropriate materials and motivation include communicable disease, transportation accidents, hazardous material releases, utility or communications failures, and wildfires; all can be intentionally triggered.

4.5.9.7 Vulnerabilities

4.5.9.7.1 Critical and Special Needs Facilities

Critical and special needs facilities play prominent roles in Treasure County. Often, terrorists target facilities that are highly important for government services and community stability. Threat data is not specific enough to identify what facilities are most vulnerable, therefore, all critical and special needs facilities are considered to have the same risk countywide. Given the rural nature of the region, a major terrorist attack making a direct impact in Treasure County is not expected. Perhaps the greatest threat to the communities is a disgruntled student, employee, or resident

threatening others with violence. The extreme example of a bomb, depending on its size, could cause structural losses to a critical or special needs facility.

4.5.9.7.2 Structures

Structure losses are possible from terrorism and civil unrest but are not likely. Often the losses are at critical facilities or to the population. Looting, however, can be commonly found in association with these types of events. Therefore, this hazard places both the population and property at risk. Communities and places of public gathering are generally going to be the areas of greatest risk.

4.5.9.7.3 Infrastructure

Terrorism officials emphasize that potential targets include our nation's delicate infrastructure. The county does have several regional electric transmission lines and pipelines at risk. Should an attack occur, Treasure County could locally lose electricity, telephone, or internet services. More localized incidents could disrupt water or sewer services. Other attacks could limit fuel or propane supplies and affect transportation and heating capabilities.

4.5.9.7.4 Population

The effects of terrorism and civil unrest are usually felt by the population. During times of unrest, the greatest risk is to human lives. Terrorists typically try to make a dramatic statement that will generate media interest. Attacking the population through a large loss of life is a common tactic. Depending on the type of attack, casualties could be light or involve much of the Treasure County population.

4.5.9.7.5 Economic, Ecologic, Historic, and Social Values

Terrorist attacks generally have a damaging effect the economy. Any time the public's safety is compromised, more people stay home until they are more confident in their safety. Therefore, depending on the type of attack and remaining threat, the tourism and travel industry in the county may be affected. Attacks in the United States, like the September 11, 2001 attacks, would likely have a damaging effect on the national economy.

Given the agricultural nature of Treasure County, an attack on the nation's livestock could have local impacts. The Communicable Disease and Bioterrorism hazard profile outlines this hazard in more depth. Many people in the area depend heavily on the agriculture economy. Unfortunately, livestock is scattered throughout the county, with very little protection, and remains vulnerable to an attack.

Unless a specific site is attacked, historical values will probably remain unaffected. Ecological values could be harmed if a damaging chemical, biological, or radioactive agent is used. Social values, however, can be damaged with any sort of terrorist or violent attack, particularly one that occurs locally. Community members may not feel safe and may have lasting emotional impacts.

4.5.9.7.6 Future Development

Development should have little to no impact on the terrorism hazard, except for the increase in population and the associated increase in potential for life and property losses should an event occur.

4.5.9.8 Data Limitations

Since terrorism and civil unrest are such isolated events and little history exists on the effects to Treasure County, the probability and vulnerabilities are difficult to quantify. Therefore, generalities were made to estimate the potential losses. Given the uncertain nature of this hazard, facility managers and ranchers can only be encouraged to identify their security weaknesses and address them internally.

4.5.10 Transportation Accident

Including Vehicular Accidents, Railroad Accidents, and Aircraft Accidents

4.5.10.1 Description

A transportation accident, for the purposes of this plan, is any large-scale vehicular, railroad, or aircraft accident involving mass casualties. Interstate and active railways pass through the county and Hysham has a small airport with larger commercial aircraft passing overhead.

The primary transportation routes in Treasure County are Interstate 94 and many county roads. An automatic traffic recorder eight miles west of Miles City on Interstate 94, calculated an average of 3,981 vehicles per day with 24.7% of that traffic being large trucks. The traffic passing through Treasure County is likely somewhat similar. (Montana Department of Transportation, 2005) Other secondary routes include Route 311 which roughly parallels Interstate 94 and Route 384 through the Sarpy Creek area. Treasure County is responsible for more than 300 miles of roads and over 40 bridges. The Town of Hysham has 7.6 miles of streets it maintains, 5.2 miles of which are paved. Passenger cars, trucks, and tractor trailers all use these roadways. Accidents along any of the roadways could disrupt travel to or from the Treasure County communities. Treasure County is ranked 48th out of 56 counties for traffic safety problems by the Montana Department of Transportation. (Montana Department of Transportation, 2006)

The railroad is owned and operated by Burlington Northern Santa Fe and transports mixed loads in an east-west direction through the center of the county via a main line and also operates a 38-mile spur line hauling coal from just to the south of the county line to the main line near Hysham. With any railroad lies the potential for derailments, hazardous material releases, and other accidents. The significance of such incidents depends on the location, number of cars derailed, and type and release of materials onboard. None of the lines in Treasure County provide passenger service.

An airport serving small private and charter aircraft is located in Hysham (6U7). The closest commercial airport is in Billings. Aviation accidents can occur for a multitude of reasons from mechanical failure to poor weather conditions to intentional causes. The size of accidents also varies widely from single engine incidents to large commercial crashes. The location of the accident, such as a remote area versus a populated location, also plays an important role in the amount of destruction.

4.5.10.2 History

The history of transportation accidents in Treasure County are primarily small magnitude incidents, some with fatalities, but most with very little effect on the entire community. Traffic accidents along the roadways occur regularly, usually

inconveniencing travelers, overwhelming local emergency resources, and occasionally causing delays. To date, no accidents have had a notable impact on the county as a whole. Table 4.5.10.2A shows the traffic fatalities in Treasure County and Table 4.5.10.2B provides more information on all motor vehicle crashes in recent years. Table 4.5.10.2C shows the aircraft accidents since 1964 as documented by the National Transportation Safety Board (NTSB). Since 1978, the Burlington Northern Santa Fe Railroad has had a total of 11 accidents involving three injuries and $201,047 in damages within Treasure County, according to the Federal Railroad Administration. Table 4.5.10.2D shows statistics on these accidents.

Table 4.5.10.2A Traffic Fatalities in Treasure County

Time Period	Number of Fatalities
1935-1944	3
1945-1954	12
1955-1964	13
1965-1974	10
1975-1984	7
1985-1994	6
1995-2004	6
2005	0

Source: Montana Highway Patrol, 2006.

Table 4.5.10.2B Vehicle Crashes in Treasure County

Year	Crashes	Fatal Crashes	Injury Crashes	Property Damage Crashes
2002	38	2	10	26
2003	58	1	19	38
2004	28	0	13	15
2005	45	0	19	26

Source: Montana Highway Patrol, 2006.

Table 4.5.10.2C Aircraft Accidents in Treasure County

Date	Casualties	Cause/Location
08/18/1964	None	A partial loss of power forced the pilot to make a hard landing and the landing gear collapsed off-airport near Hysham.
03/31/1971	None	A precautionary highway landing was made near Hysham due to poor weather conditions on a flight from Miles City to Billings. The plane hit a guard rail.
06/16/1983	None	Following engine problems and shut down, the pilot made an emergency landing in soft terrain and the landing gear collapsed near Hysham.
05/20/1997	1 Injury	After an engine exhaust valve failed, an emergency landing was attempted at the Hysham airstrip. Unable to land properly, another landing attempt in a nearby field resulted in the landing gear stripping off and the wings being structurally damaged.

Source: National Transportation Safety Board, 2006.

Table 4.5.10.2D Railroad Accident Statistics in Treasure County

Type of Accident	***Number of Accidents***
Broken Train Collision	1
Derailment	6
Head On Collision	1
Highway-Rail Impact	1
Obstruction Impact	1
Other	1
Cause	***Number of Accidents***
Equipment Defect	2
Track Defect	3
Highway-Rail Crossing	1
Human Factor	3
Other	2
Casualties	***Number of People***
Killed	0
Injured	3

Source: Federal Railroad Administration, 2006.

4.5.10.3 Probability

Without specific vehicular mass casualty accident data, the probability of such an accident can only be expressed qualitatively. The probability of such is increased during winter storms, periods of poor visibility from snow, smoke, or dust, during holiday festivities with more instances of drinking and driving, and during times of increased traffic volume. Vehicle accidents with minor damage and injuries occur regularly. Serious, fatal accidents are less frequent but still occur.

Railroad accidents in Treasure County have historically had very little impact on the communities. Since 1978, 11 railroad incidents occurred in the county resulting in $201,047 in track and equipment damages. Based on this historical record, on average, a railroad accident occurs in Treasure County once every 2-3 years with annualized damages of roughly $7,180.

Aircraft accidents are documented carefully. To date, only small private plane incidents have occurred. Although an incident involving a commercial passenger flight and mass casualties cannot be ruled out, the probability is considered low. In an average ten-year period, one aircraft incident can be expected.

4.5.10.4 Magnitude

With a relatively low probability of a major aircraft accident and little impacts from railroad accidents, a traffic accident appears to be the most realistic scenario for a

high magnitude event affecting Treasure County. A mass casualty incident that overwhelms the emergency response resources within the county and neighboring counties, such as a bus or plane crash, represents a high magnitude event.

4.5.10.5 Mapping

Map 2.2B in the Introduction shows the major transportation routes in Treasure County. Theoretically, the closer a structure is to the transportation infrastructure, the higher the hazard.

4.5.10.6 Associated Hazards and Other Factors

Probably the most significant and common hazard associated with transportation accidents is the release of hazardous materials. Many hazardous material releases occur as an element of a transportation accident. Any transportation accident involving the release of hazardous materials significantly increases the complexity and potential damages from such an accident. Transportation accidents can also occur independently due to poor operator judgment or equipment problems.

Many times, weather hazards lead to transportation accidents. Examples include winter weather when snow and ice make roadways slick. Blizzards, smoke, dust storms, and volcanic ashfall can lead to reduced visibilities and increase the probability of an accident. Floods and earthquakes may damage the infrastructure of transportation networks. Tornadoes, hail, and strong winds can cause confusion, reduce visibilities, damage infrastructure, and knock down trees and poles, blocking roadways. Terrorists have used transportation, particularly mass transportation, as a method of delivering their attacks throughout the world. Should above-ground electric or telephone infrastructure be damaged in a transportation accident, it could lead to a long-term utility or communication outage. Almost any hazard can cause or aggravate a mass casualty transportation incident.

4.5.10.7 Vulnerabilities

4.5.10.7.1 Critical and Special Needs Facilities

Except in the very rare case of an aircraft, train, or vehicle crashing into a critical or special needs facility, the facilities should remain unaffected by a transportation accident. An accident involving a first response agency or blocking a primary transportation route could delay emergency services.

4.5.10.7.2 Structures

Like the critical and special needs facilities, except in the very rare case of an aircraft, train, or vehicle crashing into a structure, buildings should be unaffected by a

transportation accident. For example, should structures be affected, damages could vary in the tens or hundreds of thousands of dollars depending on the structure or structures impacted. Should an accident occur in a developed area, structural losses in the neighborhood of $81,400 (2 homes x $40,700/average housing unit) could be expected. A large commercial jet crash could potentially destroy an entire segment of a populated area for a loss of roughly $407,000 (assuming approximately 10 structures were destroyed). The likelihood of such a high magnitude accident is extremely low.

4.5.10.7.3 Infrastructure

In most cases, infrastructure remains unaffected during transportation accidents. The most likely impact would be the closure of a major roadway due to a vehicular accident resulting in travel inconveniences and long detours. Theoretically, an aircraft or vehicle can take out power lines, telephone lines, or other important pieces of infrastructure resulting in service disruptions; the probability of such is low.

4.5.10.7.4 Population

Of all the resources and values, transportation accidents pose the most common risk to the population. Aircraft and vans or busses could have mass casualties. The magnitude of such population impacts varies from the size of the aircraft or vehicle to the number of vehicles involved. Anywhere from 2-200 people or more could be involved.

4.5.10.7.5 Economic, Ecologic, Historic, and Social Values

Road or railway closures due to a transportation accident could have a temporary effect on the local economy. The local agricultural economy has a strong dependence on the transportation infrastructure. Alternate means of transportation would be needed within a relatively short time frame.

Unless a building or sites were damaged, historical values would remain intact. Slight ecological values could also be lost should vehicle fluids or hazardous materials seep into a water body or wildlife habitat. Social values may be temporarily lost due to road closures and inconvenient detours, however, an accident involving a large number of local residents and/or children may have lasting emotional effects.

4.5.10.7.6 Future Development

Future development, particularly the associated increase in traffic, may increase the probability of a major transportation accident. Otherwise, the specific locations of where development occurs, except for possibly in the immediate vicinity of the

airports or the railroad, should not significantly affect the vulnerabilities from this hazard.

4.5.10.8 Data Limitations

Transportation accidents have had impacts on the county in the past, however, historical records documenting such are not readily accessible; therefore, assessing the potential damages from such are limited to quantitative assessments and descriptions. The National Transportation Safety Board keeps very detailed records of damaging aircraft incidents. These records allow for in-depth analysis of individual accidents. The randomness of aircraft accidents, however, limits the usefulness of such information in determining the potential for losses and areas of greatest hazard. Data outlining the normal flight patterns would help to quantify the potential for a major accident. A log and mapping of vehicle accidents could help pinpoint the most dangerous traffic locations, however, even detailed data would not rule out a major accident at any given location.

The Federal Railroad Administration records are sufficient for calculating railroad problems over the past 30 years. Where the data is not useful is in determining the probability of a large-scale accident involving hazardous materials. An analysis of the current railroad weaknesses, numbers, and types of materials transported would enhance this profile. Such information would not necessary be placed in a public plan for security reasons.

4.5.11 Utility and Communications Failure

4.5.11.1 Description

The public has come to rely upon utility and communication services for everyday life and basic survival. Many in Treasure County and Hysham depend on the typical utility and communication infrastructure such as water, sewer, electricity, propane, telephone, internet, and gasoline. Cell phone coverage is limited throughout the county, and therefore, is not a relied upon means of communications in all areas. Water and sewer services are either through a public system, as is the case in Hysham, or through individual wells and septic systems. Electricity is provided by the Mid-Yellowstone Electric Cooperative and the Yellowstone Valley Electric Cooperative. Homes and businesses are heated with fuels such as electricity and propane. Those buildings heated with propane typically have a nearby tank that is refilled regularly by a local propane vendor. Telephone and most internet services are provided by Range Telephone. Privately-owned gas stations are located in Hysham.

Almost any hazard can cause a utility outage, but disruptions can also occur due to human error or equipment failures. The most common hazards that interrupt electric services are heavy snow, ice, and wind, water supplies may be threatened by drought, and sewer services can be disrupted by flood. Often utility or communication outages are short lived. Crews quickly respond and resolve the problem causing the outage. During a widespread or complicated outage, services may be down for days or even weeks. Most problems arise during these longer term outages. For example, electricity is needed to maintain water supplies and sewer systems, but also to run blowers for heating systems. Essentially, without electricity, most facilities are without heat, water, fuel, or other appliances during a long term outage. This problem becomes particularly significant during the cold winter months. Telephone services are important for day-to-day business, but are most important for 911 communications in an emergency. Without telephone service, emergency services can be severely delayed. Emergency services for Treasure County are dispatch out of Rosebud County. In most cases, a long term utility outage would force many businesses to close until the services were restored. Gasoline shortages are also common during times of disaster.

In the event of a utility or communication outage, the National Weather Service has the ability to send out messages over the Emergency Alert System and NOAA Weather Radio (the radios often have battery back-ups). Examples of alerts include:

- Local Area Emergency Message: This message defines an event that by itself does not pose a significant threat to public safety and/or property, but the event could escalate, contribute to other more serious events, or disrupt critical public safety services. Instructions, other than public protective actions, may be provided by authorized officials. Examples of when this message may be used

include: utility disruptions, road closures, or a potential terrorist threat where the public is asked to remain alert.

- 911 Telephone Outage Emergency Message: This message notifies the public of a local or state 911 telephone network outage by geographic area or telephone exchange. The message may provide alternative phone numbers to reach 911 or dispatch personnel.

(National Weather Service, 2005d)

4.5.11.2 History

Most utility or communication outages in Treasure County have been short-lived. Examples of significant outages in the county include:

August 23, 1998 – Two small tornadoes about twenty miles south of Hysham knocked down several trees, antennas, and power poles. One power pole which contained a transformer started wildfires after it fell.

October 5, 2005 – An early season winter storm dropped five to eight inches of snow in the Hysham area, bringing down numerous tree limbs and causing power outages. (National Climatic Data Center, 2006)

4.5.11.3 Probability

Over the past eight years, two utility failures have been noted in Treasure County. Based on the historical occurrence, a significant outage occurs approximately once every four years. The probability can also be broken down by service type. Electric power outages are the most common and are the only type of outage noted in the historical record. Significant water, sewer, communications, heat, propane, internet, or fuel outages have not been noted in the historical record, so the probability of such is somewhat lower but all could occur.

4.5.11.4 Magnitude

Possibly the most significant outage scenario for Treasure County is the loss of electricity for a week or more during a particularly cold winter spell. Without generators, an extended power outage would additionally lead to the loss of running water, sewer services, and the ability to heat the buildings, which in turn may lead to pipe ruptures. Any equipment such as medical equipment, computers, and cell phones requiring power to run would eventually be incapacitated. Those facilities with generators would still be able to use appliances, equipment, and heating systems, however, community water and sewer services may not be available. Such a long term outage could lead to emergency sheltering and necessitate the activation of other emergency resources.

4.5.11.5 Mapping

Mapping of utility and communications infrastructure is maintained by the individual services providers. Table 4.5.11.5A summarizes the providers and methods by which utility and communication services are provided. Each entity maintains its own infrastructure.

Table 4.5.11.5A Utility and Communications Infrastructure and Providers

Service	Providers	Infrastructure
Electricity	Mid-Yellowstone Electric Cooperative Yellowstone Valley Electric Cooperative	Mix of overhead and underground electric distribution and transmission lines
Propane	Various Providers	Individual propane tanks filled by company trucks
Telephone	Range Telephone	Mix of overhead and underground phone lines
Cable and Internet	Range Telephone	Mix of overhead and underground lines and satellite dishes
Water	Town of Hysham	Buried water lines from pump/well system
Sewer	Town of Hysham	Buried lines connected to a two-cell lagoon
Transportation	Town of Hysham Treasure County Montana Department of Transportation	Snow plows and heavy road equipment
Gasoline	Privately-owned stations	Pump stations and tanks

4.5.11.6 Associated Hazards and Other Factors

Utility and communications failures are often related to other hazards. Hazards that have the potential to damage structures frequently have the ability to damage infrastructure, resulting in a loss of services. Utility outages can be a component of almost any hazard, but the following hazards can directly cause utility outages: earthquakes, floods, strong winds, tornadoes, hail, lightning, landslides, sinkholes, wildfires, extreme heat, drought, terrorism, civil unrest, transportation accidents, volcanic ashfall, heavy snow, and ice storms. The ability to restore services may also depend on the ability of repair crews to access the affected areas. In the case of a quarantine or pandemic, repair crews may not be available to quickly restore services.

4.5.11.7 Vulnerabilities

4.5.11.7.1 Critical and Special Needs Facilities

Utility and communications failures do not often affect structures; however, an electric outage during winter could result in frozen and burst water pipes, causing water damage within the interiors of structures. A propane or natural gas outage could produce similar results. The failure of the sewer system could lead to a system back-up and structures without sewer backflow valves may experience damages from sewer backwater.

Utility or communication disruptions could also limit the ability to provide emergency services. Gas station pumps may not operate without electricity, and therefore, emergency vehicles may not have enough fuel during long term outages. Communications are vital to effective emergency operations and the lack of communication capabilities may significantly affect the abilities of emergency response organizations. Special needs facilities may need to move occupants to alternate locations due their dependence on local utilities.

4.5.11.7.2 Structures

Similar to critical and special needs facilities, structures across the county could be without heat during a utility outage or flooded with sewer backups. During cold weather, structures without heat may be uninhabitable for a time being. Generally, structures are not directly affected by utility or communications failures.

4.5.11.7.3 Infrastructure

Infrastructure supports utility and communication services. Therefore, utility and communication failures are often related to the infrastructure support. Minor damages or problems with the infrastructure may indicate a short-term outage whereas large-scale damages may suggest a long term outage. Many services rely on other utilities to operate. For example, the water supply pumps and sewer lift stations both require electricity to continue operations. One or both may go down during long-term electric outages. Propane and gasoline refills require the transportation network to be open since deliveries are done by truck. This interdependency can lead to more complex utility outage problems.

4.5.11.7.4 Population

Over the past 100 years, the population has become more and more dependent on the nation's infrastructure. Heat, running water, sanitation, and communications all require electricity and without these services in the long term, the population may suffer. Propane and electricity are critical to heat, especially during the cold winter

months. Approximately, 362 people in Treasure County rely on propane for heat and 350 rely on electric heat. Telephone services are needed to call 911 for emergency assistance. Water is needed for cooking, cleaning, and drinking, and sewer is needed for sanitation. Each is important for the health and safety of humans. Without these services, emergency resources may be needed. Emergency supplies can often hold the populations over temporarily but may take some time before arriving.

4.5.11.7.5 Economic, Ecologic, Historic, and Social Values

The economy depends heavily on utility and communication services. Electricity alone powers many systems used in day-to-day business. Businesses, such as restaurants, require electricity and water to operate. Without these services, many businesses could be shut down. Closed businesses and government offices essentially put the economy at a standstill until services are restored. Fuel shortages due to a power outage, low supplies, or transportation closures, could have lasting effects on everyone from the individual commuter to any business that ships inventory. Ultimately, the economy has a high dependence on utility or communications services.

Social values such as going from one place to another could be disrupted by a fuel shortage or transportation closure. Other social events may be cancelled due to the reliance on the utility services. Otherwise, ecological and historical values would remain unaffected.

4.5.11.7.6 Future Development

Future development is not expected to have significant impacts on this hazard. Increased populations add to the challenges of managing a long term utility outage but would not increase the damages necessarily.

4.5.11.8 Data Limitations

Brief power outages occur regularly in Treasure County but since long-term utility outages are not a normal event, understanding the specific problems and concerns of this hazard is the greatest limitation. Studies of each of the critical facilities would allow for a more in-depth discussion of their vulnerabilities, however, such data would likely be kept internal for security purposes. A record of the utility and communication outages in the county and the impacts could help pinpoint vulnerable times and locations.

4.5.12 Volcanic Ashfall

4.5.12.1 Description

Active volcanoes do not exist in Treasure County, but since dense volcanic ash can travel hundreds of miles, the hazard of volcanic ashfall exists. The closest volcano to the county is the Yellowstone Caldera within Yellowstone National Park, about 210 miles away. Its last non-hydrothermal eruption was thousands of years ago. Currently, the most active region in the continental United States is the Cascade Range to the west in Washington and Oregon, about 700 miles away. This region includes the volcanoes at Mount St. Helens, Mount Rainer, and Mount Hood. Treasure County lies within reasonable range of ashfall from these volcanoes under normal upper atmospheric wind and stability conditions. In addition to ashfall and other effects, large eruptions have been known to change weather patterns globally.

The Yellowstone Caldera, one of the world's largest active volcanic systems, has produced several giant volcanic eruptions in the past few million years, as well as many smaller eruptions and steam explosions. Although no eruptions of lava or volcanic ash have occurred for many thousands of years, future eruptions are likely. Over the next few hundred years, hazards will most likely be limited to ongoing geyser and hot-spring activity, occasional steam explosions, and moderate to large earthquakes. To better understand Yellowstone's volcano and earthquake hazards and to help protect the public, the US Geological Survey, the University of Utah, and Yellowstone National Park formed the Yellowstone Volcano Observatory, which continuously monitors activity in the region. (US Geological Survey, 2005b)

If a large caldera-forming eruption were to occur at Yellowstone, its effects would be felt worldwide. Thick ash deposits would bury vast areas of the United States, and the injection of huge volumes of volcanic gases into the atmosphere could drastically affect global climate. Fortunately, the Yellowstone volcanic system shows no signs that it is headed toward such an eruption. The probability of a large caldera-forming eruption within the next few thousand years is exceedingly low. Any renewed volcanic activity at Yellowstone would most likely take the form of non-explosive lava eruptions. (US Geological Survey, 2005b)

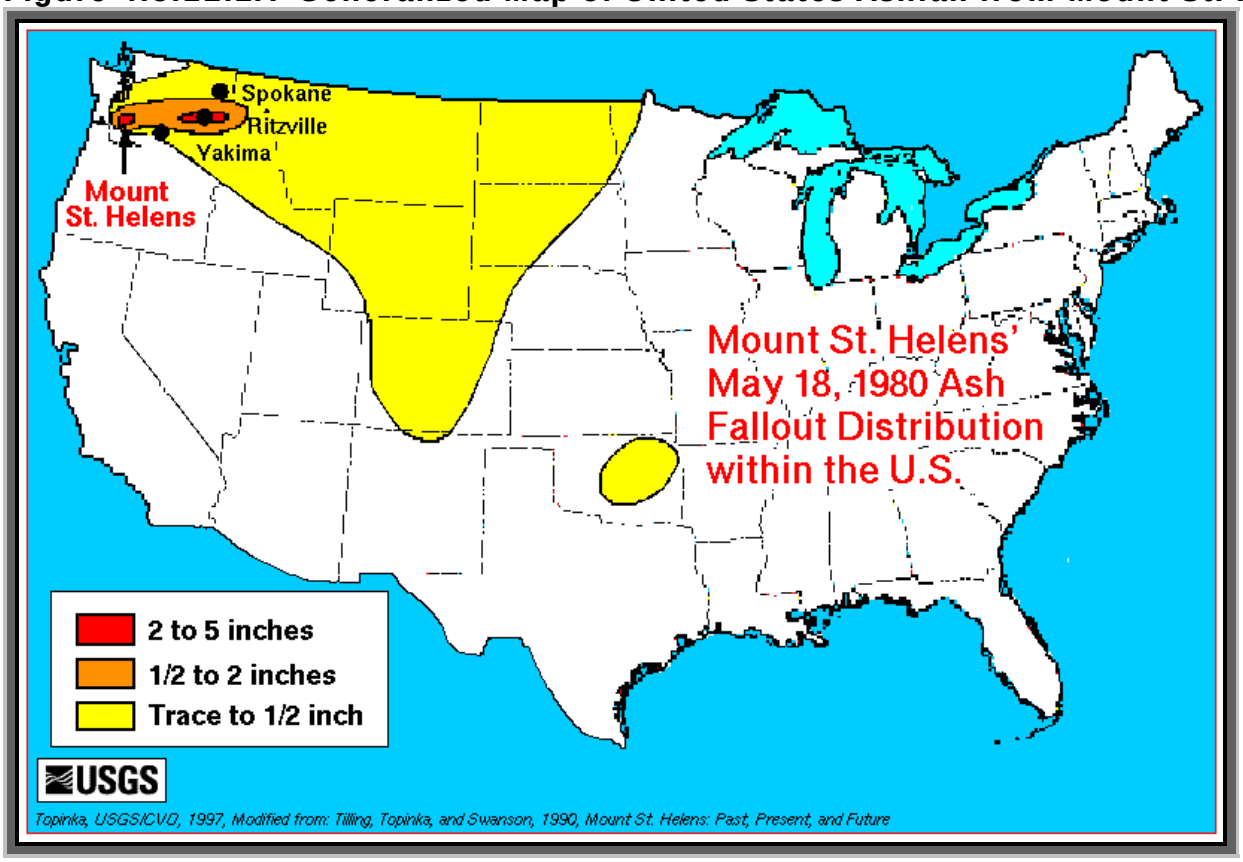
The Cascade Region does not have the same caldera-forming potential as Yellowstone, but has been much more active in recent years. The volcanoes in this region can drop and have dropped measurable ash over Montana.

Volcanic ashfall may not sound harmful hundreds of miles away, but depending on the volume of ash that falls, it can create problems. Ash in the air can affect those with respiratory sensitivities, reduce visibilities, and clog air intakes. Its corrosive properties can damage vehicles and other machinery. When wet, the ash becomes glue-like and hard to remove.

4.5.12.2 History

On May 18, 1980, Mount St. Helens in the Cascade Range of Washington erupted, sending ash high into the atmosphere. Over the course of several days, the ash fell from the sky, primarily over eleven states, including Montana. Less than a half inch fell over Treasure County but the ash on the ground was measurable, as shown in Figure 4.5.12.2A.

Figure 4.5.12.2A Generalized Map of United States Ashfall from Mount St. Helens



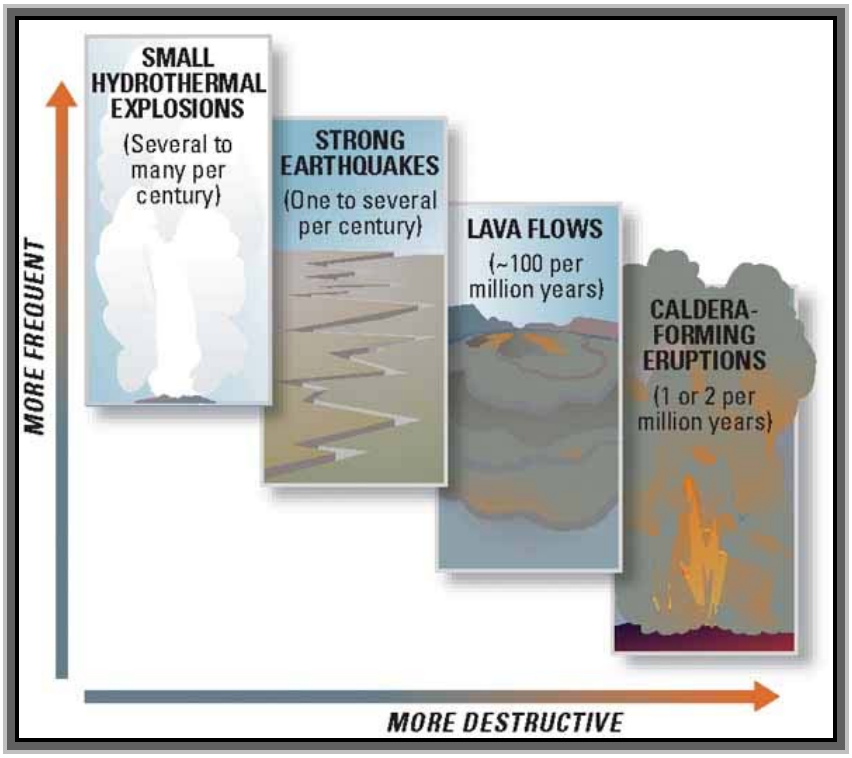
Source: Cascades Volcano Observatory, 2006

The Yellowstone region has produced three exceedingly large volcanic eruptions in the past 2.1 million years. In each of these cataclysmic events, enormous volumes of magma erupted at the surface and into the atmosphere as mixtures of red-hot pumice, volcanic ash (small, jagged fragments of volcanic glass and rock), and gas that spread as pyroclastic ("fire-broken") flows in all directions. Rapid withdrawal of such large volumes of magma from the subsurface then caused the ground to collapse, swallowing overlying mountains and creating broad cauldron-shaped volcanic depressions called "calderas." (US Geological Survey, 2005b) Studies have shown that ash from each of these eruptions fell where Treasure County now sits.

4.5.12.3 Probability

Volcanic eruptions are rare events when compared to other hazards. Scientists evaluate natural hazards by combining their knowledge of the frequency and the severity of hazardous events. In the Yellowstone region, damaging hydrothermal explosions and earthquakes can occur several times a century. Lava flows and small volcanic eruptions occur only rarely - none in the past 70,000 years. Massive caldera-forming eruptions, the most potentially devastating of Yellowstone's hazards, are extremely rare - only three have occurred in the past several million years. U.S. Geological Survey, University of Utah, and National Park Service scientists with the Yellowstone Volcano Observatory (YVO) see no evidence that another such cataclysmic eruption will occur at Yellowstone in the foreseeable future. Recurrence intervals of these events are neither regular nor predictable. (US Geological Survey, 2005b) Figure 4.5.12.3A shows the probability of the various events that can occur in Yellowstone National Park.

Figure 4.5.12.3A Recurrence Intervals for Geological Events in Yellowstone National Park



Source: US Geological Survey, 2005b

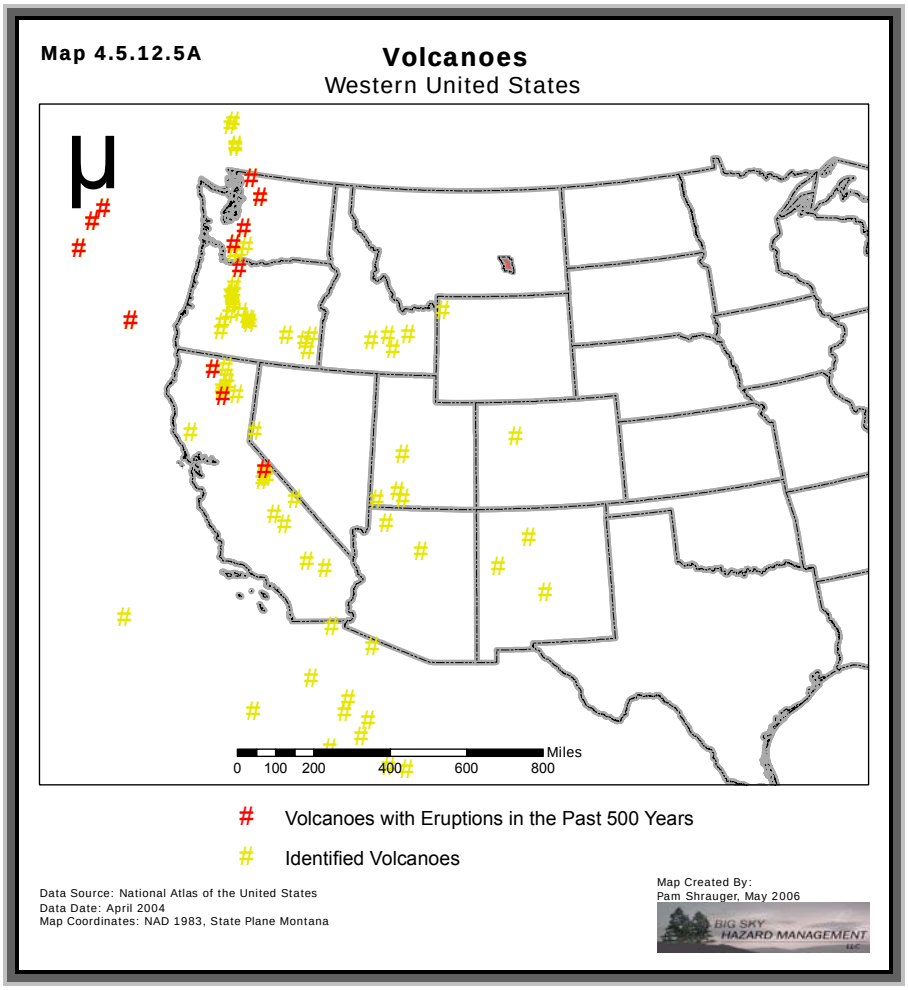
The Cascade region, being more active, has a higher probability of eruptions over the next 100 years. Active monitoring occurs in the region, with Mount St. Helens showing signs of another possible eruption. Based on eruptions in the Cascade region over the past 4,000 years, the probability of an eruption is about 1.25% in any given year or approximately 1-2 eruptions per 100 years within the Cascade Range.

4.5.12.4 Magnitude

A large caldera-forming eruption of Yellowstone Park is always possible with devastating consequences for many communities across the United States. Given the extremely low probability of such an event, however, a more realistic magnitude over the next 500 years will be considered for planning purposes. A Cascade Range eruption that leaves an inch or more of ash over Treasure County is a high magnitude volcanic ashfall event for this area. Such an event would not only affect the county, but many other communities throughout the region and west to the Pacific coast. Rainfall would additionally compound problems with the ash removal.

4.5.12.5 Mapping

Following an eruption, the areas affected by ash will depend on the type of eruption, atmospheric stability, and wind conditions. Forecasts estimating the amount of ash will generally be issued at that time. Given the broad, regional nature of volcanic ashfall, Treasure County is assumed to have the same risk countywide. Map 4.5.12.5A shows the identified volcanoes in the region.



4.5.12.6 Associated Hazards and Other Factors

Volcanic eruptions are often related to earthquake activity as magma moves below the surface. Given the distance of Treasure County from the volcanoes, however, such earthquake shaking probably wouldn't be felt. Important factors during a volcanic eruption with regard to ashfall include wind speed, wind direction, and atmospheric stability. These factors dictate when, where, and how much ash will fall. Rainfall also plays an important role in the characteristics of the ash – either dry and dust-like or wet and glue-like. Wet ash is much more difficult to remove and may cause more damage.

4.5.12.7 Vulnerabilities

4.5.12.7.1 Critical and Special Needs Facilities

Theoretically, large amounts of wet volcanic ash could weigh enough to bring down even strong roofs. Given the large distances between Treasure County and any active volcanoes, this is very unlikely. A more likely issue is the removal of ash from building air intakes and vehicles. This removal takes time and care since volcanic dust is corrosive to metals. In most cases, critical and special needs facility clean-ups would be done by the building owner or facility maintenance. Therefore, any damages would be minimal. Additionally, emergency responders may look to alternatives to driving in ashfall given its corrosive properties and potential to damage vehicle engines. With the reduced visibilities and volcanic ash in the air, aircraft may not be able to fly to the affected area to provide medical or emergency supplies.

4.5.12.7.2 Structures

Like the critical and special needs facilities, structures throughout the county are vulnerable to ashfall, however, the greatest challenge would most likely be the removal of the ash and not structural damages. Heavy ash does have the potential to clog air systems. Many residents would need guidance and assistance in removing ash from their personal property.

4.5.12.7.3 Infrastructure

Since volcanic ash is corrosive, particularly when wet, above ground infrastructure such as power lines, telephone lines, and sewer lift stations may experience mechanical and connectivity problems. With only an inch or two of ash, however, such damages and disruptions would probably be relatively minor.

4.5.12.7.4 Population

Light ashfall does not usually significantly affect the general population but those with respiratory sensitivities may experience additional problems. Ashfall conditions that exist for several days could lead to significant health problems even in the general population. Most communities recommend staying indoors, closing windows, and turning off air conditioners, thus minimizing the human exposure to the ash. Given the distances between Treasure County and active volcanoes, local officials would probably have some warning before the ash began to fall. The degree of population impacts will greatly vary, depending on the type of event.

4.5.12.7.5 Economic, Ecologic, Historic, and Social Values

Depending on the season, ashfall can have an impact on the agricultural economy. Deep ash, which is not very likely in this region, can kill plants, thus affecting crops and forage. Additionally, the soluble fluoride in the ash can cause health problems in livestock grazing on ash-covered grass. (US Geological Survey, 2006c) Imminent eruptions may also limit regional travel and therefore have an effect on the tourism industry. Unless several inches of ash fall, the effects on the economy will likely be minimal. Ecological and historical values, in most cases, would not be lost following a volcanic eruption. Should travel be limited to emergency travel only and communications lost, social values could be temporarily disrupted.

4.5.12.7.6 Future Development

Future development will have little to no effect on the volcanic ashfall vulnerabilities. An increase in the population and number of structures would increase the exposure.

4.5.12.8 Data Limitations

Volcanic eruptions that affect Treasure County are so extremely rare that documenting the potential impacts and probability is very limited. Continued study of the Yellowstone caldera and other volcanic areas will hopefully allow scientists, and therefore local officials, to better understand this hazard.

4.5.13 Water and Air Contamination

4.5.13.1 Description

Clean water and air are critical to the health and quality of life in Treasure County. A healthy environment is important for sustainable communities. The contamination of water and air can occur for a variety of reasons including the accidental release of a hazardous material, intentional contamination, small releases that build-up over time, releases of materials not yet known to be hazardous, or imbalances in the environment that negatively affect water or air quality.

Water is essential for life and plays a vital role in the proper functioning of the Earth's ecosystems. The pollution of water has a serious impact on all living creatures, and can negatively affect the use of water for drinking, household needs, recreation, fishing, transportation, and commerce. The US Environmental Protection Agency (EPA) and the Montana Department of Environmental Quality (DEQ) enforce federal and state clean water and safe drinking water laws, provide support for municipal wastewater treatment plants, and take part in pollution prevention efforts aimed at protecting watersheds and sources of drinking water. (US Environmental Protection Agency, 2006)

The following facilities have or had permits issued by the Environmental Protection Agency to discharge waste water into rivers:

- Hysham Wastewater Treatment Plant (expired January 2006)
- PV Ranch Company Feedlot (expired July 2005)
- Sarpy Creek Farms (expired July 2005)
- Willems Farms and Feedlot (expired July 2005)

(US Environmental Protection Agency, 2006)

Farmers and ranchers often apply fertilizer, herbicide, and pesticide chemicals on their land. Water can become contaminated by these chemicals following heavy rains and floods.

Air pollution comes from many different sources such as factories, power plants, dry cleaners, cars, buses, trucks, and even windblown dust and wildfires. Air pollution can threaten the health of human beings, trees, lakes, crops, and animals, as well as damage the ozone layer and buildings. Air pollution also can cause haze, reducing visibility in national parks and wilderness areas. Under the Clean Air Act, EPA sets limits on how much of a pollutant is allowed in the air anywhere in the United States. Although national air quality has improved over the last 20 years, many challenges remain in protecting public health and the environment. (US Environmental Protection Agency, 2006) The Environmental Protection Agency does not have any records of entities in Treasure County releasing pollutants into the air. (US Environmental Protection Agency, 2006)

The National Weather Service issues air quality forecasts and several agencies have partnered to develop a national air quality website at http://airnow.gov. Montana DEQ also issues smoke forecasts daily during the wildfire season.

4.5.13.2 History

Fortunately, Treasure County has not experienced a significant event in which water or air quality has been compromised. Wildfires frequently create temporary air quality problems during the summer months, but such conditions usually pass within a few days.

4.5.13.3 Probability

The probability of water or air contamination in Treasure County can only be expressed qualitatively due to a lack of historical records documenting such. The probability of a major event can be expressed as low to moderate based on history, a lack of Superfund sites, and a small number of point sources. Known and future industries could always increase the probability if not managed properly. Certainly nearby wildfires increase the probability of poor air quality.

4.5.13.4 Magnitude

A high magnitude event for Treasure County would be any contamination of water or air that requires remediation actions or precautionary measures for the public. Examples include the contamination of water in the Yellowstone aquifer supporting the public water system in Hysham or unhealthy air quality conditions that require people to stay inside. Any long term situations would require emergency assistance and possibly disaster declarations.

4.5.13.5 Mapping

Since major water or air contamination would likely affect an entire watershed or region, the risk is assumed to be the same countywide.

4.5.13.6 Associated Hazards and Other Factors

The primary hazards related to water and air contamination are hazardous material releases, wildfires, terrorism, and volcanic ashfall. Smoke from wildfires is the most common air pollutant in Montana that significantly diminishes air quality. Hazardous materials, in any form, have the potential to additionally contaminate water and/or air. Terrorists, domestic or international, could use chemicals to contaminate the water or air. Volcanic ash, depending on the density, can be hazardous to breathe

and corrosive to property. During periods of extended drought, dust storms could also reduce air quality.

4.5.13.7 Vulnerabilities

4.5.13.7.1 Critical and Special Needs Facilities

Structures themselves are often not vulnerable to water or air contamination, except in the case of long-term air pollution exposure in which some structures may begin to deteriorate. Often, water or air contamination will make a facility uninhabitable, and thus, emergency service capabilities may be reduced and special needs populations may need to relocate.

4.5.13.7.2 Structures

Structures may not suffer physical damages, however, water or air contamination may make homes and businesses uninhabitable. Structural losses, however, would be minimal.

4.5.13.7.3 Infrastructure

Given the relationship between infrastructure and public water supplies, the water infrastructure could be damaged in a water contamination event. Should the contamination involve fine particles, such as occurs following a wildfire, pumps and treatment facilities could become clogged. Additionally, depending on the type of contamination, extensive cleaning of the infrastructure could be required. Air contamination wouldn't cause infrastructure damages, unless the air contained large quantities of particles, such as volcanic ash.

4.5.13.7.4 Population

The population is generally most threatened by water and air contamination, particularly contaminants that go unnoticed or are difficult to avoid. Should public water supplies or personal wells become contaminated, the population could be at risk, particularly, if water was used while contaminated. Otherwise, alternative water supplies such as bottled water, boil orders, or water from neighboring communities would need to supplement basic water needs in long term situations. Should such assistance be limited, the population may be displaced for the duration.

Air contamination is much more difficult to control. Ultimately, unhealthy air quality can have a direct impact on the population's well being. Anywhere from low levels over a long period to high levels over a short period may result in negative effects on the population. People may be advised to shelter-in-place or evacuate. In some cases, the air pollution may go unnoticed for a period of time. Effects could range

from diseases long after exposure to instant death, depending on the type and level of contamination.

4.5.13.7.5 Economic, Ecologic, Historic, and Social Values

Contaminations of any sort could have a negative impact on the economy. In the case of significant air contamination, residents would either stay in their homes or relocate. Most businesses would suffer due to a lack of employees and customers. Water contamination within the Hysham water supply would shut down drinking water supplies within the town. Business and personal losses could be significant. The ecologic impacts could be profound and far reaching depending on the severity of the contamination. Many species are very sensitive to water and air quality. Historic values would likely remain unchanged, however, social activities may be limited during periods of contamination.

4.5.13.7.6 Future Development

Future development is not expected to have significant impacts on this hazard's vulnerabilities. Increased populations add to the challenges of managing a long term water outage or extensive evacuation, but given the spatial uncertainty of this hazard, any new development, regardless of location, would add to the challenges. The primary exception is the development of industries or facilities that pollute the environment, or have the potential to. This type of development could increase the risk of contamination. Current local regulations do little to deter this type of development; however, the state and federal permitting processes allow for some review of negative impacts.

4.5.13.8 Data Limitations

Since Treasure County has very little history with water or air contamination, quantifying the potential impacts to the communities is limited. Case studies, looking at other Montana communities such as Anaconda and Libby, that have had and continue to have significant environmental contamination problems could provide valuable information on contamination that occurs with little known impacts in the short term but serious impacts over the long term.

4.5.14 Wildfire

4.5.14.1 Description

A wildfire is an uncontrolled fire in a vegetated area. Wildfires are a natural part of the ecosystem. They have a purpose in nature and following years of fire suppression, many areas have built up fuels that can lead to larger, more intense fires. In Treasure County, timber, shrubs, grasses, and rangeland make up the primary fuel sources. These fuels burn rapidly and readily when cured. These types of fires have the potential to destroy structures and natural resources while producing heavy amounts of smoke, particularly when spread by strong winds.

Any flame source can trigger a wildfire, but they are most often triggered by lightning. Once ignited, ambient conditions dictate whether the fire will spread or not. Moist, cool, and calm conditions or a lack of fuels will suppress the fire, whereas, dry, warm, and windy conditions and dry fuels will contribute to fire spread. The terrain, accessibility, and capabilities of the fire agencies are also factors in the fire's growth potential. Problems with wildfire occur when combined with the human environment. People and structures near wildfires can be threatened unless adequately protected through evacuation, mitigation, or suppression.

Wildfire occurrence is weather dependent and highly variable from year to year. Fire season generally runs from March through November but wildfires can occur at any time of year. The light, flashy fuels and timber present in the region are capable of sustaining large, fast moving wildfires. The annual fire season determined by the US Bureau of Land Management is April 15 to October 15. (US Bureau of Land Management, 2004)

4.5.14.1.1 Vegetative Fuels and Landscape

Fire is a normal part of the ecosystem. Prior to suppression activities, wildfires would burn through vegetation, reducing the fuels available and returning nutrients to the soil. Dead trees, seedlings, and diseased trees would all typically burn, cleaning up the understory, giving larger trees room to grow, and reducing the spread of disease and insects. These periodic wildfires would reduce the build-up of hazardous fuels.

Since fire suppression activities became common practice about 100 years ago, the natural cycle of frequent, low-intensity, surface fires was disrupted, and fuels, particularly in forested areas, have built up to hazardous levels. Those same habitats that would experience low-intensity fires now experience stand-replacing, high intensity fires.

Other changes may also occur with the change in fire frequency. Different plant species may begin to change the make-up of the landscape without a regular fire

regime. For example, ponderosa pine trees may encroach on grasslands without regular fires. Some species even rely on fire for seed dispersion. Fire suppression has created a more hazardous environment where fuels build up, leading to more intense and larger fires.

Treasure County has a variety of fuel types and topography. Generally, the area north of the Yellowstone River consists of rolling prairie grazing land with pine tree topped ridges. The most common fuels are native grasses, sagebrush, juniper, and yucca with ponderosa pines along the ridges. Along the Yellowstone River is irrigated farmland with hay, corn, sugar beets, and grain crops and hardwood trees stands along the river bottoms. The area south of the Yellowstone River has rough topography with sharp ridges and deep coulees. The area is fairly continuous ponderosa pine forest intermingled with meadows and cropland benches. (Treasure County, 2005)

Figure 4.5.14.1.1A A mix of fuels and terrain in Treasure County.

The native tree and shrub species in Treasure County include American elm, green ash, box elder, alder, cottonwood, willow, buffaloberry, chokecherry, wild plum, ponderosa pine, limber pine, and juniper. Willow and cottonwood species are also native to the riparian areas. Treasure County has the only two known occurrences of birchleaf mountain-mahogany (Cercocarpus montanus var. glaber) in the state. (Treasure County, 2003)

Map 4.5.14.5C shows the potential natural vegetation groups in Treasure County. Potential natural vegetation is the “climax” vegetation that will occupy a site without disturbance or climate change and is an expression of environmental factors such as topography, soils, and climate across an area. (Rocky Mountain Research Station, 1999) Of course, human activities, such as fire suppression, timber harvesting, livestock grazing, and the introduction of exotic plant, insect, and disease species, have altered the natural environment. Map 4.5.14.5D shows the existing land cover from 2000 in Treasure County.

Different habitats have different natural frequencies and intensities of fire. Table 4.5.14.1.1B shows the various categories for fire regimes. Fire frequency is the average number of years between fires. Severity is the effect of fire on the dominant overstory vegetation. (US Forest Service, 2002)

Table 4.5.14.1.1B Historical Natural Fire Regimes

Code	Description
I	0-35 year frequency, low severity (most commonly associated with surface fires) to mixed severity (in which less than 75% of the dominant overstory vegetation is replaced)
II	0-35 year frequency, stand-replacement severity (greater than 75% of the dominant overstory vegetation is replaced)
III	35-200+ year frequency, mixed severity
IV	35-200+ year frequency, stand-replacement severity
V	200+ year frequency, stand-replacement severity

Source: Interagency Fuels Committee, 2005.

Map 4.5.14.5E shows the historical natural fire regimes (reference fire regimes) for Treasure County. When compared with the Potential Natural Vegetation Groups, the ponderosa pine habitats naturally experience fires of low to mixed severity every 0-35 years, the shrub habitats should experience stand replacement fires every 35-200 years, the grasslands usually have a stand replacement fire every 0-35 years, and the areas along the Yellowstone River now devoted to agriculture would experience low to mixed severity fires every 35-200 years. With fire suppression and land cover modifications, the fire regime has changed throughout the region.

Changes to the ecosystem can have profound effects on the intensity and severity of wildland fires. To qualify the changes, fire ecologists use the term, fire regime condition class. Fire regime condition classes measure the degree of departure from “natural” conditions. Table 4.5.14.1.1C shows the classes and definitions accepted by many agencies.

Table 4.5.14.1.1C Fire Regime Condition Class

Condition Class	Description
I	Fire regimes are within a historical range, and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within a historical range.
II	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). This results in moderate changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range.
III	Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range.

Source: US Forest Service, 2002.

Map 4.5.14.5F shows the percent departure from the normal fire regime and Map 4.5.14.5G shows the fire regime condition classes for Treasure County in 2006. The areas with the greatest departures are the areas converted to agriculture along the Yellowstone River, much of northern Treasure County, parts of southern Treasure County along Sarpy Creek, and a wide area surrounding Tullock Creek and the Bighorn River. Surprisingly, much of the timber area in southern Treasure County shows very little departure from normal, however, regular fires in this habitat are expected.

4.5.14.1.2 Land Management Practices

Treasure County covers approximately 628,427 acres with most of the land privately-owned and used for agricultural. Several very large ranches make up much of the county, particularly in northern Treasure County. In 2002, the county had 115 farms covering approximately 606,846 acres. (US Department of Agriculture, 2002) Much of that acreage, about 574,000 acres, is devoted to cattle grazing. About 33,000 acres are used for crop production, primarily in the irrigated areas near the Yellowstone River. (US Department of Agriculture, 2006a)

Cattle grazing and crop production generally reduce the wildfire hazard. Tillage on the crop lands and grazing in the pastures typically reduces the fuels available for

wildfires. Some of the larger ranches, however, can have significant access problems if a fire ignites in a remote area, particularly during strong wind events. In the interface between tree covered areas and the grasslands, grazing can limit the fire regime by reducing the number of young trees that survive and begin to encroach on the grassland areas.

Some of the privately-owned, undeveloped lands within Treasure County are part of the Conservation Reserve Program (CRP). The US Department of Agriculture (USDA) Farm Service Agency's Conservation Reserve Program (CRP) is a voluntary program available to agricultural producers to safeguard environmentally sensitive lands. Producers enrolled in CRP establish long-term, resource-conserving covers to improve the quality of water, control soil erosion, and enhance wildlife habitat. In return, the Farm Service Agency provides participants with rental payments and cost-share assistance. (Farm Service Agency, 2004) Although the CRP benefits the environment in many respects, CRP lands may increase the fuels available and therefore the wildfire risk in those areas. As of October 31, 2006, Treasure County had 2,345 acres participating in the CRP. (Farm Service Agency, 2006)

The remaining 22,000 acres in Treasure County not devoted to farming or ranching have residential land use, are water bodies, or are managed by government entities. Treasure County has relatively few government owned lands. Most of the larger tracts scattered throughout the county are owned by the State of Montana and managed by the Department of Natural Resources and Conservation. Many scattered parcels, primarily in the forested areas south of the Yellowstone River, are also owned by the Crow Nation. The Bureau of Land Management manages Howrey Island. The Isaac Homestead Wildlife Management Area is managed by Montana Fish, Wildlife & Parks. This scattering of government and private ownership can present unique firefighting challenges and opportunities.

4.5.14.1.3 Wildland Urban Interface

Wildfires become problematic when combined with the human environment. Fire can threaten lives, structures, livestock, equipment, fences, feed supplies, and other resources. Essentially, all areas of Treasure County are at some risk for wildfire. Those areas with high fuel loads, rough terrain, or limited access are at an elevated risk. The wildland urban interface for Treasure County can be defined as the areas where structures or other human development lie within close proximity

Figure 4.5.14.1.3A Fuels and terrain along Interstate 94.

to hazardous vegetative fuels. Since native grasses and non-irrigated croplands can be considered hazardous vegetative fuels, the entire county is within the wildland urban interface by this definition.

Generally, the hazard areas in Treasure County are prioritized as follows:

Figure 4.5.14.1.3B A typical ranch in southern Treasure County along Bear Creek Road.

High Hazard Areas: *Southern Treasure County, including Sarpy Creek and Tullock Creek*.

Southern Treasure has rugged, timber covered terrain. The land use consists primarily of large ranches. Many ranch buildings lie on or near steep terrain and flammable evergreen trees. Sarpy Creek Road is a decent, paved highway. Tullock Creek Road is minimally paved from Interstate 94 to Burnt Creek Road. Other roads in the southern part of the county are dirt and gravel. Depending on the conditions, some roads and driveways may be impassable and buffered by hazardous fuels. Slash piles also exist in some of the remote areas. A subdivision may be possible between Reservation, Bear, and Sarpy Creeks based on a forthcoming land sale. Some properties in southern Treasure County may be designated “highest hazard” based on their proximity to continuous evergreen fuels.

Figure 4.5.14.1.3C Slash piles along Burnt Creek Road in southern Treasure County.

<u>Moderate Hazard Areas</u>:
Along the Yellowstone River in the river bottoms including Howrey Island, Isaac Homestead, and Manuel Lisa Fishing Access.

Figure 4.5.14.1.3D Riparian fuels on Howrey Island.

Figure 4.5.14.1.3E Riparian fuels in Isaac Homestead.

Howrey Island, managed by the US Bureau of Land Management has one access road and experiences high use. Weeds, deadfall, and cottonwoods make up the primary fuels. Isaac Homestead can be accessed off of Webb Road and contains a build-up of weeds and deadfall from the riparian cottonwood forest. Both Howrey Island and Isaac Homestead are managed with the goal, "To provide an interspersion of habitat types that enhances wildlife abundance, particularly white-tailed deer and ring-necked pheasants, and to provide recreational opportunities." (Montana Fish, Wildlife & Parks, 2007) Manuel Lisa Fishing Access, although in Yellowstone County, has impacts in Treasure County through its high use and launching point for people fishing and rafting. Those entering the river at Manual Lisa then drift into Treasure County. Homes and ranches near these areas and along the river are at enhanced risk from the riparian cottonwood fuels and recreational uses.

Figure 4.5.14.1.3F Cabin in northern Treasure County off of Sumatra Road on Cat Coulee Lane.

Low Hazard Areas: *Northern Treasure County.*

Northern Treasure County is very sparsely populated and generally consists of smoother terrain. A few pockets of steep terrain and timber fuels exist in northern Treasure County and are a higher hazard than the general area may indicate. Although northern Treasure County is considered a low wildfire hazard area, this part of the county can present significant firefighting challenges due to its remoteness and lack of access roads. Roads, where they do exist, are dirt or gravel and can become impassible during wet weather.

4.5.14.1.4 Fire Protection Organizations and Capabilities

Fire protection and associated activities in Treasure County are provided by a number of agencies. Treasure County is responsible for fighting wildland fires on state and private lands. The US Bureau of Land Management (BLM) is responsible for wildfires on BLM lands and will assist, if requested, on other non-BLM fires. Montana Department of Natural Resources and Conservation (DNRC) will provide assistance when the fire is beyond the county's capability to control. (Treasure County, 2005)

Hysham Fire Department

As a rural, sparsely populated county with a small tax base, Treasure County has limited fire protection capabilities. The Town of Hysham Fire Department provides fire services to the entire county through an inter-local agreement with Treasure County. The Hysham Fire Department, also known as the Treasure County Fire Department, is composed entirely of volunteers. As of 2006, the department has about 22 rostered volunteers, however, in an actual call-up, about 2 or 3 volunteers may show

Figure 4.5.14.1.4A Fire Station in Hysham

up on a weekday and 5 to 6 may show up on a weekend. The volunteer firefighters get paid $7 per wildland fire, and unfortunately, that is not enough to entice most people to leave work. The town's fire budget is about $4,000 and the county's is about $9,000 per year. State equipment is used when available. Fundraisers and funds generated by providing equipment to out of district fires supplement the small budget.

Training and equipment within the fire department is minimal. The department can only provide very basic structural fire protection. Refilling of water tanks is done at the fire station in Hysham. During periods of drought, a pump can be set up to take water from the Yellowstone River or portable water reservoirs that can be filled by helicopter may be deployed. The fire department also responds to automobile accidents and hazardous materials releases on Interstate 94. (Treasure County, 2003) Table 4.5.14.1.4B shows the vehicle resources of the Hysham Fire Department and Tables 4.5.14.1.4C through 4.5.14.1.4E show the inventory in fiscal year 2005.

Table 4.5.14.1.4B Hysham Fire Department Vehicles

Vehicle	Designation	Type
1995 L9000 Ford – White	TC-1	Tender
1975 F250 Ford – Green with equipment	TC-2	6
1999 F550 Ford – Red with equipment	TC-3	6
1952 GMC 6x6 with 700 gallon water tank – Rust	TC-12	Tender
1993 Ford – White Tanker		
1965 Ford 1 ½ Ton Water Truck		

Table 4.5.14.1.4C Hysham Fire Department Communications Equipment – Fiscal Year 2005

Number	Equipment	Year Purchased
8	14-channel Alphanumeric Radios	2002
2	Kenwood Portable Radios TK270G in trucks	2001
10	Chest pack with radio cases in trucks	1999
4	Portable Radios, Model 5150	1990
4	Motorola Hand Pagers/Radio, VHF two frequency	1997
2	Motorola low band radios w/antenna	1984
10	Used Syntor Radios (REX-4160 PL Proms) in trucks	
1	Motorola HT 600 Radio in trucks	

Table 4.5.14.1.4D Hysham Fire Department Personal Protection Equipment – Fiscal Year 2005

Number	Equipment	Year Purchased
20	Fire shelters with cases	2002
10	Wildfire Yellow Helmet Caps	2001
15	Nomex Ear, Neck, and Face Protectors	2001
15	Flame Resistant Shirts GSA Size XXL	1997
1	Air pack	1992
3	Life-Saver oxygen units (units, cylinders, elder valve with trigger, headgear)	1985
20	Striketeam XTO Goggles	

Table 4.5.14.1.4E Hysham Fire Department Other Equipment – Fiscal Year 2005

Number	Equipment	Year Purchased
1	Heiman 1500 Frameless Portable Tank	2001
6	McLeod Tools	2001
1	1,000 gallon galvanized low profile tank	1984
1	Smith & Wesson Light Bar & Mount	1979
1	HP pump	
1	Gorman-Rupp pump, 2” Briggs gas engine, self-priming centrifugal	
	Equipment in old 1973 Chevy ambulance	
1	Booster Hose Reel	
2	Sure-Seal Drip Torches	
3	Truck Mounting Brackets	
5	Fire Weather Instrument Kits	

Private Firefighting

With very large ranches covering much of the county, individual ranches may have their own firefighting equipment. For example, the PV Ranch in northern Treasure County owns four firefighting vehicles and a motor grader. The four firefighting vehicles are located, one each, at Ridge Camp, Butte Camp, Horse Camp, and at the ranch.

Montana Department of Natural Resources and Conservation

The state firefighting agency, Montana Department of Natural Resources and Conservation (DNRC) provides resources to communities when wildfires exceed the community’s capabilities. In support of these efforts, DNRC keeps about 3-4 vehicles

within the county that the Hysham Fire Department is authorized to use. Table 4.5.14.1.4F shows the DNRC vehicle resources in Treasure County.

Table 4.5.14.1.4F DNRC Vehicles in Treasure County

Vehicle	Designation	Type
1976 Dodge W200 – White	TC-5/DNR1054	6
1983 F350 Ford – White	TC-6/DNR1124	6
	TC-7/DNR	
1977 Dodge W200 – White	TC-8/DNR1110	6

US Bureau of Land Management (BLM)

Federal agencies manage fires on federal lands. Treasure County has few federal tracts of land, however, the US Bureau of Land Management, part of the US Department of Interior, does have a few tracts, including Howrey Island. Treasure County is part of the Miles City Field Office, however, initial fire attack comes from the Billings Field Office. Under the Miles City Field Office Fire Management Plan, Treasure County is within the "Mixed-Grasses Prairie-Sagebrush" Fire Management Unit. Part of the BLM's fire management objective for this unit is to "suppress all fires using the appropriate management response with the intent of minimizing loss of natural resources and improvements, protecting cultural and historic resources, preventing fire spread onto private property, and minimizing the suppression costs." Howrey Island is designated an "area of critical environmental concern", and fire management activities do not allow the use of earth moving equipment, blading of roads, increasing road areas, or unnecessary tree cutting or burning to protect wildlife, recreational, and scenic values. (US Bureau of Land Management, 2004)

Treasure County Sheriff's Department

The Treasure County Sheriff's Department has responsibility for law enforcement throughout the county, including the Town of Hysham through an inter-local agreement. When an emergency proclamation or disaster declaration establishes a mandatory evacuation, the sheriff's department has the authority and responsibility to implement and enforce the evacuation. Otherwise, an evacuation advisory may be issued, and the sheriff's department is responsible for notifying the public. Generally, door-to-door notifications are used, or if time is limited, mobile public address systems in the sheriff's vehicles may be used. (Treasure County, 2005) The Sheriff's Department has a Sheriff, an Undersheriff, and six reserve officers. Table 4.5.14.1.4G shows the Sheriff's Department vehicles.

Table 4.5.14.1.4G Treasure County Sheriff's Department Vehicles

Vehicle	Designation
1997 Ford Crown Victoria – Silver	33-1
2000 Ford Crown Victoria – White	33-2
2001 Chevy Pickup – White	33-4

Treasure County Disaster and Emergency Services
Emergency management within Treasure County is provided by a part-time (10 hours per week) position. Local emergency management is supported by state emergency management with a full-time district representative located in Billings.

Treasure County Extension Office
The County Extension Agent coordinates animal evacuations. The primary plan is for large and small animals to be evacuated to the county fairgrounds.

Public Works/Road Department
One Town of Hysham employee and two Treasure County employees can operate heavy equipment during a wildfire to assist with containment efforts. The county owns two road graders. Table 4.5.14.1.4H shows the Road Department vehicles in Treasure County.

Table 4.5.14.1.4H Treasure County Road Department Vehicles

Vehicle	Designation
1985 Chevy 3/4T Pickup	33-60
1983 International F1954 Dump Truck	33-51
1984 WEPR 16 foot Trailer	33-57
1995 Chevy Pickup 4x4	33-47
1970 Mill Trailer	33-40
10-yard Tandem with Dump Body and Hoist	

Mutual Aid
Mutual aid is used to call up additional resources from other jurisdictions. Montana law allows for fire departments to request mutual aid from other local departments, even if a mutual aid agreement is not in place. (MCA 10-3-209) Additionally, Treasure County has specific mutual aid agreements with Yellowstone, Big Horn, Musselshell, and Rosebud Counties, Montana DNRC, and the US Bureau of Land Management. (Treasure County, 2005) Similarly, law enforcement can request assistance from neighboring jurisdictions and Montana Highway Patrol.

4.5.14.1.5 Community Preparedness

Most people in Treasure County are good at taking care of themselves and neighbors. With wildfires throughout the region almost annually, most are aware of the potential for wildfires locally. Therefore, the wildfire awareness in the community is good. Some of the larger ranches have taken action and have their own basic firefighting equipment to protect their property. Most of the equipment and communications systems are primitive and can be unreliable. Problems do exist with getting residents to comply with fire restrictions. Enforcement and communication of restrictions can be challenging.

Treasure County does have an Emergency Operations Plan, dated 2005, that generally outlines the roles, responsibilities, and system for disaster response and specifically addresses the wildfire hazard. Public information is at the discretion of the Incident Commander and the governing bodies. The recommendation to evacuate is made by the Incident Commander and carried out by the Sheriff. Animal evacuations are coordinated with the County Extension Agent's office and the fairgrounds. Planning to the level of pre-identifying staging areas, water supplies, and evacuation routes has not been formally done.

The National Weather Service issues several products to alert for significant wildfire potential or hazards. These include:

- Fire Weather Watch: A fire weather watch is issued when Red Flag conditions (see below) are expected in the next 24 to 72 hours.
- Red Flag Warning: A red flag warning is issued when Red Flag criteria are expected within the next 12 to 24 hours. A Red Flag event is defined as weather conditions that could sustain extensive wildfire activity and meet one or more of the following criteria in conjunction with "Very High" or "Extreme" fire danger:
    - Sustained surface winds, or frequent gusts, of 25 mph or higher
    - Unusually hot, dry conditions (relative humidities less than 20%)
    - Dry thunderstorm activity forecast during an extremely dry period
    - Anytime the forecaster foresees a change in weather that would result in a significant increase in fire danger. For example, very strong winds associated with a cold front even though the fire danger is below the "Very High" threshold.
- Fire Warning: A fire warning may be issued by local officials when a spreading wildfire or structure fire threatens a populated area. Information in the warning may include a call to evacuate areas in the fire's path as recommended by officials according to state law or local ordinance.
- Dense Smoke Advisory: Dense smoke advisories are issued when the widespread visibilities are expected at a ¼ mile or less for a few hours or more due to smoke.

(National Weather Service, 2005d)

4.5.14.2 History

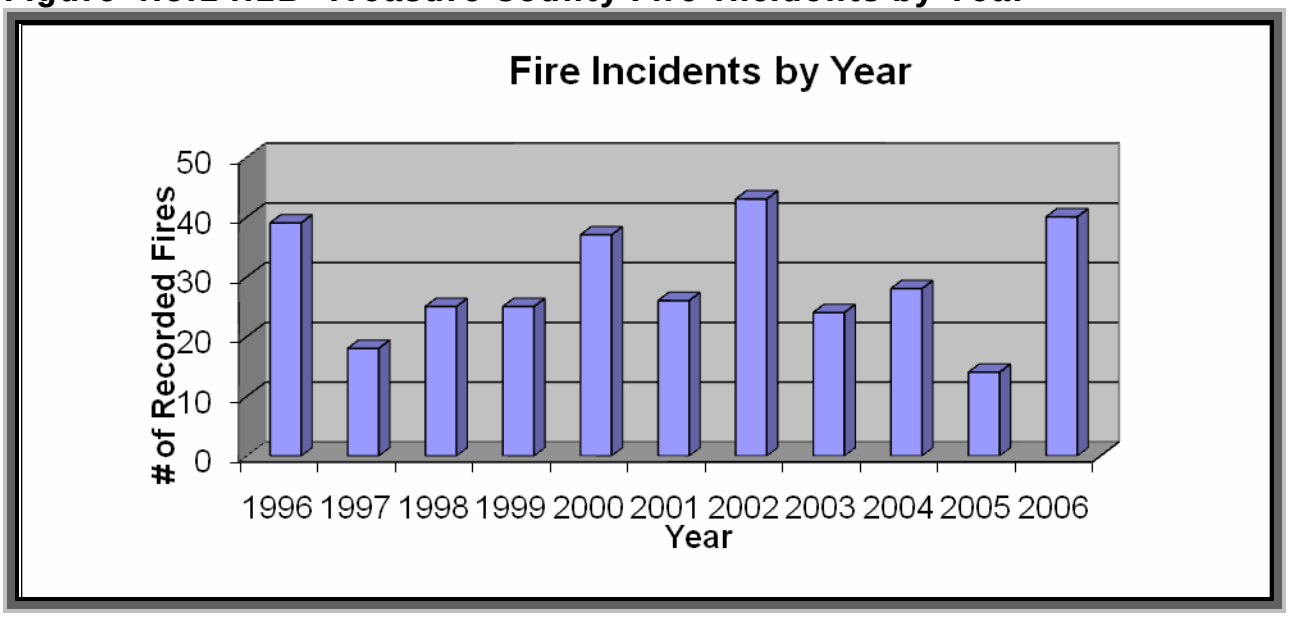
Treasure County has a long history of wildfires ranging from small to large. Some have caused damages and others have not. The extent of damages often depends on the fire spread rate and the effectiveness of suppression and mitigation measures. The history of wildfires can be difficult to compile because of the various firefighting entities involved and a variety of recordkeeping measures over the years. Data from Treasure County 911 Dispatch on the number of fire incidents since 1996 is shown in Table 4.5.14.2A and Figure 4.5.14.2B.

Table 4.5.14.2A Fire Incidents in Treasure County from 1996-2006

Year	Number of Fire Incidents
1996	39 incidents
1997	18 incidents
1998	25 incidents
1999	25 incidents
2000	37 incidents
2001	26 incidents
2002	43 incidents
2003	24 incidents
2004	28 incidents
2005	14 incidents
2006	40 incidents

Source: Treasure County, 2007.

Figure 4.5.14.2B Treasure County Fire Incidents by Year



Source: Treasure County, 2007.

Summaries of some of the larger wildfires in Treasure County since 2000 follow.

2000 Wildfires – The State of Montana suffered a severe wildfire season, and as a result, most of the state, including Treasure County, was declared a Presidential Disaster Area (#1340) for individual assistance. Treasure County did not have any families or businesses register for federal individual assistance following the 2000 wildfires. (Federal Emergency Management Agency, 2006b) A USDA declaration for agricultural production and physical losses, for wildfires from July 13, 2000 through September 25, 2000 was also issued. (US Department of Agriculture, 2005)

2003 Treasure County Complex – The Treasure County Complex was made up of the Johnny, Earl, and Stracks' fires eight miles south of Hysham. This fire burned in ponderosa pine, downed and dead fuels, sagebrush, and grass from August 2-6, 2003. Initially, structure protection was in place for 15 residences and 2 commercial properties. These fires burned approximately 9,998 acres at a cost of $459,000.

2006 Wildfires – Treasure County signed a Cooperative Agreement for assistance on wildfires from July 1, 2006 through March 1, 2007 with the Department of Natural Resources and Conservation. A statewide emergency was declared because of wildfires by the governor on July 11, 2006 through Executive Order 34-06. Map 4.5.14.2C shows the large wildfires tracked by federal agencies in 2006.

2006 Sarpy Fire – The Sarpy Fire was managed as part of the larger Pine Ridge Complex in neighboring counties. The Sarpy Fire burned about 7,139 acres in mid July. The entire Pine Ridge complex burned over 121,000 acres and cost nearly $2 million.

2006 Hutchinson Coulee Fire – The Hutchinson Coulee fire burned about 1,350 acres eight miles south of Hysham from July 27-29, 2006. The fire burned in ponderosa pine, aspen, and grass, threatening ranches, microwave towers, and commercial property.

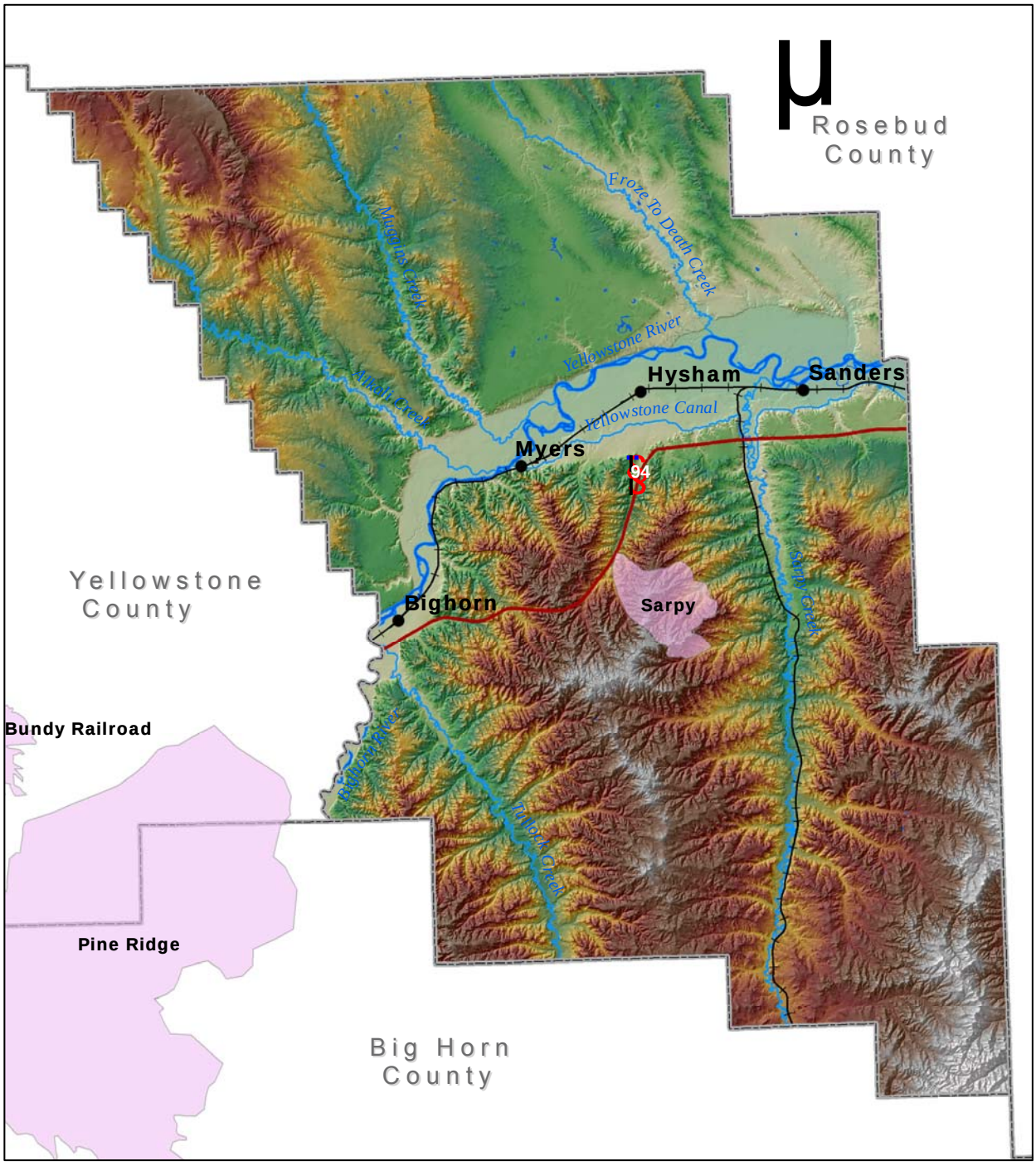
2006 Mailbox Fire – The Mailbox fire burned about 2,100 acres fifteen miles north of Custer from August 10-12, 2006. The fire started on private land in grass and threatened ranch facilities, oil wells, and power lines. Four structures were lost.

(Center for International Disaster Information, 2006)

Map 4.5.14.2C

Large 2006 Wildfires

Treasure County



Map Created By:
Pam Shrauger, January 2007

Data Source: National Interagency Fire Center
Data Date: 2006
Map Coordinates: NAD 1983, State Plane Montana

4.5.14.3 Probability

Wildfires are an annual occurrence in Treasure County. The frequency and size of the wildfires depends on the ambient conditions and other factors. Based on local records from 1996-2006, an average of 29 fire incidents requiring local firefighting resources occur each year in Treasure County. The annual number of fire incidents has ranged from 14 to 43 since 1996. The largest wildfire in recent history was the 2003 Treasure County Complex that burned nearly 10,000 acres. Even larger wildfires are possible in Treasure County.

4.5.14.3.1 Ignition Risks

One of the key factors in the probability of wildfires, besides weather and fuel conditions, is the likelihood of fire ignition. Most wildfires in Treasure County are initiated by lightning strikes. Lightning ground strikes, with or without rain, can easily produce enough heat to start a fire. Lightning develops when ice particles in a cloud move around, colliding with other particles. These collisions cause a separation of electrical charges. Positively charged ice particles rise to the top of the cloud and negatively charged ones fall to the middle and lower sections of the cloud. The negative charges at the base of the cloud attract positive charges at the surface of the Earth. Invisible to the human eye, the negatively charged area of the cloud sends a charge called a stepped leader toward the ground. Once it gets close enough, a channel develops between the cloud and the ground. Lightning is the electrical transfer through this channel. The channel rapidly heats to 50,000 degrees Fahrenheit and contains approximately 100 million electrical volts. The rapid expansion of the heated air causes thunder. (National Weather Service, 2006c) Positive lightning strikes originate from the top of the cloud and contain higher voltages based on the longer distance the charge must travel. Lightning strikes can occur anywhere in the county. These natural ignitions can only be observed and monitored. All areas of the county are at high risk for lightning ignitions.

Figure 4.5.14.3.1A A mix of trees and grasses in Treasure County.

Besides lightning strikes, other human-caused ignition risks exist. Common human-caused ignition risks include campfires, cigarettes, ranch equipment, controlled burns, railroads, fireworks, and arson. A burn permit system exists in Treasure County but is

often not enforced. The probability of ignitions from controlled burns anywhere in the county and along the railroad from railcars is moderate. Holidays such as the Fourth of July can increase the probability of an ignition from fireworks. Areas recognized for their potential ignition risks include recreation areas such as Amelia Island, Howrey Island, Isaac Homestead, Myers Bridge Fishing Access, and Manuel Lisa Fishing Access. These areas are at high risk of ignitions from campfires.

4.5.14.4 Magnitude

The magnitude of future wildfires depends on many factors such as climate, weather, fuel availability, and fire suppression capabilities. History has shown that fires up to and exceeding 10,000 acres are possible. Neighboring counties have also shown such magnitudes; even fires to 100,000 acres in size have occurred.

4.5.14.4.1 Weather and Climate

Weather and climate can influence the size and number of wildfires in any given season. Warm, dry conditions will increase the probability of significant wildfires whereas cool, wet conditions inhibit fire growth. The climate dictates the overall conditions leading up to a wildfire. Treasure County is generally known as having an arid climate with only about 10-15 inches of annual precipitation. The rainiest months are May and June. Snow that falls during the winter usually melts rather quickly as strong downslope winds from the west and southwest raise the temperature above freezing. Climate variability exists such that the county experiences some years with higher than normal precipitation such as 1993 when Hysham received nearly 22 inches and lower than normal precipitation such 1960 when Hysham received only 6.48 inches. Drought is common with impacts on agriculture and fuel moistures.

Seasonal changes often play a role in wildfire behavior. During the coldest months of December, January, and February, grasses are typically dead and could ignite, however, any fires during these months are generally low intensity fires due to the cold temperatures. March, April, and May are often “green-up” months where grasses regenerate and live fuel moisture increases. Prior to greening, however, low intensity fires can occur. During the transition into summer during June, temperatures rise, spring rains subside, and fuels begin to dry. The hot months of July and August typically have the most wildfires. The weather conditions during those months are often conducive to wildfire growth. The fall months of September, October, and November are generally cooler but can exhibit extreme wildfire behavior with strong wind events and dead, frost-killed light fuels.

Key to the growth of any given wildfire, regardless of season, is the weather (a shorter time scale than climate). Specifically, wind, temperature, and relative humidity are important factors in fire behavior. Treasure County often experiences strong, gusty winds. Winds greater than 15 mph can cause significant fire behavior in

grass fires. Winds over 30 mph can result in extreme crown fires in forested areas. Generally, the wind direction will dictate the direction of fire spread, pushing the fire on to nearby fuels. Only under light wind conditions will fire be more influenced by topography and other factors. Temperatures over 80°F can also dry fuels and lead to quicker ignitions of fuels. Similarly, relative humidity, a measure of the amount of moisture in the air, can dictate the amount of fuel moisture; low relative humidities can lead to more extreme fire behavior. Generally, fire activity is greatest during the afternoon because of the high temperatures and lower relative humidities. Active fire behavior can occur at night due to strong winds, however.

Dry thunderstorms occur when dry air at the surface combined with atmospheric instability contributes to high-based clouds. The moisture associated with the cumulus clouds rarely hits the ground. This phenomenon is called virga, rain that evaporates before reaching the ground. In some of the stronger cells, gusty downdrafts can be produced and are often accompanied by dry lightning. Lightning, both in dry or wet thunderstorms, can serve as an ignition source, however, dry lightning typically has dry fuels to ignite and is not suppressed by ambient rainfall.

4.5.14.4.2 Fire Behavior

Fire behavior is primarily influenced by three factors: fuels, weather, and terrain. The interrelationships between these factors can be complex. Generally, however, drier fuels are more easily burned. Wildfires advance when heat from burning fuels is transferred to other fuels that then combust. Weather, primarily wind, temperature, and relative humidity, influences fire in the ways described in the previous subsection. Terrain can also play a role in fire behavior. The shape of landscape, exposure to sunlight, elevation, and natural or human-created barriers can all influence fire behavior. Generally, in the absence of wind, fire will burn upslope as flames ignite fuels higher up. Often, wildfires begin as ground fires that can then climb ladder fuels and become crown fires given the appropriate vegetation.

BehavePlus 3.0 is modeling software used to model fire behavior at the stand level for a single place and time. Outputs of the model include surface rate of spread, spotting distances, size of a point source fire, and probability of ignition from a firebrand. Inputs and results into the various models are shown in Tables 4.5.14.4.2A through 4.5.14.4.2D.

Table 4.5.14.4.2A BehavePlus Run – Timber Wildfire with Winds at 15 mph

Inputs	
Fuel Model	Timber with Litter and Understory
1-Hour Fuel Moisture	3%
10-Hour Fuel Moisture	5%
100-Hour Fuel Moisture	8%
Live Woody Moisture	80%
Mid-flame Wind Speed (upslope)	15 mph
Slope Steepness	5%
Results	
Surface Rate of Spread	51.5 ch/h (0.64 mph)
Size at 2 hours, unsuppressed	179.3 acres
Fire Length at 2 hours, unsuppressed	104.2 ch (1.3 miles)
Maximum Fire Width at 2 hours, unsuppressed	21.9 ch (1,445 feet)
Size at 4 hours, unsuppressed	717.4 acres
Fire Length at 4 hours, unsuppressed	208.3 ch (2.6 miles)
Maximum Fire Width at 4 hours, unsuppressed	43.8 ch (2,891 feet)

Table 4.5.14.4.2B BehavePlus Run – Timber Wildfire with Winds at 30 mph

Inputs	
Fuel Model	Timber with Litter and Understory
1-Hour Fuel Moisture	3%
10-Hour Fuel Moisture	5%
100-Hour Fuel Moisture	8%
Live Woody Moisture	80%
Mid-flame Wind Speed (upslope)	30 mph
Slope Steepness	5%
Results	
Surface Rate of Spread	137.0 ch/h (1.71 mph)
Size at 2 hours, unsuppressed	697.9 acres
Fire Length at 2 hours, unsuppressed	274.9 ch (3.4 miles)
Maximum Fire Width at 2 hours, unsuppressed	32.3 ch (2,132 feet)
Size at 4 hours, unsuppressed	2,791.8 acres
Fire Length at 4 hours, unsuppressed	549.7 ch (6.9 miles)
Maximum Fire Width at 4 hours, unsuppressed	64.7 ch (4,270 feet)

Table 4.5.14.4.2C BehavePlus Run – Tall Grass Fire with Winds at 5 mph

Inputs	
Fuel Model	Tall Grass
1-Hour Fuel Moisture	3%
Mid-flame Wind Speed (upslope)	5 mph
Slope Steepness	0%
Results	
Surface Rate of Spread	159.7 ch/h (2.0 mph)
Size at 2 hours, unsuppressed	3,962.6 acres
Fire Length at 2 hours, unsuppressed	336.9 ch (4.2 miles)
Maximum Fire Width at 2 hours, unsuppressed	149.7 ch (1.9 miles)
Size at 4 hours, unsuppressed	15,850.2 acres
Fire Length at 4 hours, unsuppressed	673.9 ch (8.4 miles)
Maximum Fire Width at 4 hours, unsuppressed	299.5 ch (3.7 miles)

Table 4.5.14.4.2D BehavePlus Run – Tall Grass Fire with Winds at 15 mph

Inputs	
Fuel Model	Tall Grass
1-Hour Fuel Moisture	3%
Mid-flame Wind Speed (upslope)	15 mph
Slope Steepness	0%
Results	
Surface Rate of Spread	654.3 ch/h (8.2 mph)
Size at 2 hours, unsuppressed	28,961.7 acres
Fire Length at 2 hours, unsuppressed	1,323.5 ch (16.5 miles)
Maximum Fire Width at 2 hours, unsuppressed	278.6 ch (3.5 miles)
Size at 4 hours, unsuppressed	115,846.9 acres
Fire Length at 4 hours, unsuppressed	2,646.9 ch (33.1 miles)
Maximum Fire Width at 4 hours, unsuppressed	557.2 ch (7.0 miles)

4.5.14.4.3 Severity Factors

Many factors exist that can increase the magnitude and severity of wildfires in Treasure County. Factors such as the fuel type available, accessibility, topography, water supplies, and weather conditions all become important for fire growth and suppression. These factors can make the difference between fire control and a large, raging wildfire. The most critical factors in Treasure County are the remoteness of many areas, the lack of water supplies, and a very limited number of firefighting volunteers.

The remoteness of much of Treasure County becomes an especially important factor when fighting wildfires. Northern Treasure County, in particular, has very few passable roads. This leaves many areas inaccessible or marginally accessible by fire crews. Often smoke columns can be seen, but observers, dispatchers, and firefighters cannot specifically pinpoint the fire's location. Even once located, the lack of roads can make getting to the fire difficult. The time spent locating and accessing the fire gives the fire more time to grow and become harder to manage. Adding to the difficulties of traveling on foot is the threat of rattlesnakes.

Figure 4.5.14.4.3A Sign at the westbound I-94 rest area.

The only designated fire suppression water supply is from the Town of Hysham's water system. Unless another readily available water supply is found, such as a ranch stock pond that the owner approves for use, water tenders and firefighting vehicles must travel back and forth to Hysham for water. For the more remote locations in the county, this can be very time and resource consuming. Often water supply is a limiting factor in wildfire suppression.

Another limiting factor is the availability of firefighters. Wildfires can take many hours or even days to contain and mop up. Most of the volunteer firefighters in the county have full-time jobs and cannot afford to miss work to fight fires. As of 2006, the department has about 22 rostered volunteers, however, in an actual call-up, about 2 or 3 volunteers may show up on a weekday and 5 to 6 may show up on a weekend. The volunteer firefighters get paid $7 per wildland fire, and unfortunately, that is not enough to entice most people to leave work. As a result, the initial attack on wildfires must be done with minimal resources until mutual aid or state resources can supplement.

4.5.14.5 Mapping

Wildfire potential is mapped in a variety of ways. Since many factors play into wildfire risk, components are often mapped individually. Slope, aspect, fuel density, fuel type, fuel moisture, and weather are all important factors in determining how a fire will behave. Slope is a measure of the steepness of the topography. The steeper the slope, the easier it is for fire to travel because of preheated fuels uphill and the ability for the flame to ignite new fuels above it. Map 4.5.14.5A shows the slope in Treasure County. Aspect is the direction in which the slope faces. Southern exposures tend to have drier fuels and hotter temperatures than northern exposures because of the

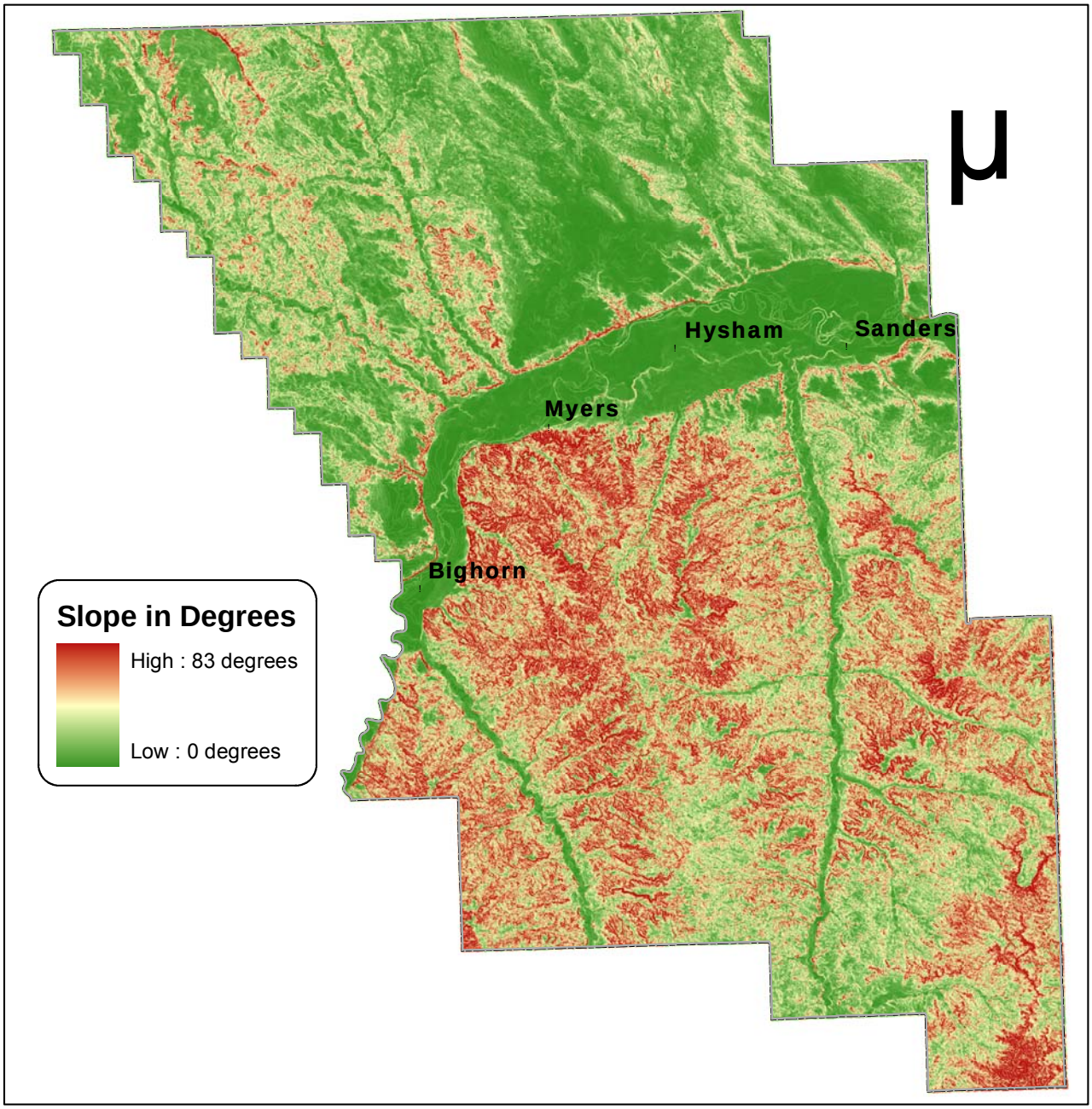
increased sun radiation. Western exposures tend to stay hotter later into the day than eastern exposures because of the afternoon sun radiation. Map 4.5.14.5B shows the aspect in Treasure County.

Map 4.5.14.5C shows the general land cover. Land cover demonstrates the type of fuels available for wildfires. In the case of agriculture, the flammability depends on the crop and its condition at that point in the growing season. Grasslands and shrublands are not usually managed significantly and may contain a build-up of flashy fuels year round.

Map 4.5.14.5D shows the potential natural vegetation groups. Potential natural vegetation is the "climax" vegetation that will occupy a site without disturbance or climatic change and is an expression of environmental factors such as topography, soils, and climate across an area. (Rocky Mountain Research Station, 1999) Given this, Map 4.5.14.5E shows the historical natural fire regimes (reference fire regimes) for Treasure County. This map depicts the normal natural cycles of wildfire without suppression. Under existing conditions, Map 4.5.14.5F shows the percent departure from the normal fire regime and Map 4.5.14.5G shows the fire regime condition classes for Treasure County in 2006. Fire regime condition classes measure the degree of departure from "natural" conditions. Table 4.5.14.5H shows the classes and definitions of fire regime conditions accepted by many agencies.

Map 4.5.14.5A

Slope
Treasure County



0 2.5 5 10 15 20 Miles

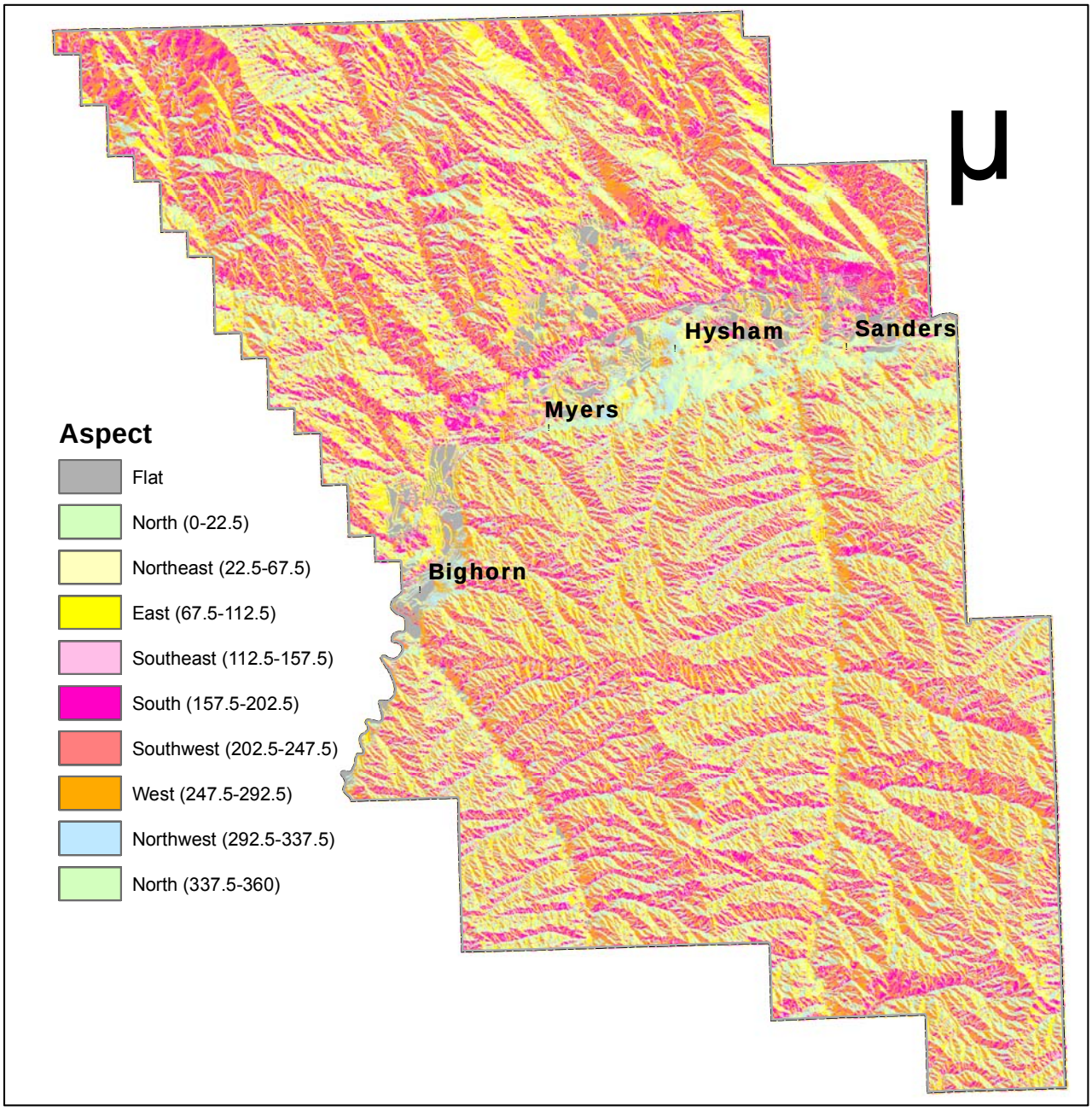
Data Source: Montana Natural Resource Information System
Data Date: 2000
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, May 2006

BIG SKY HAZARD MANAGEMENT LLC

Map 4.5.14.5B

Aspect
Treasure County



0 2.5 5 10 15 20 Miles

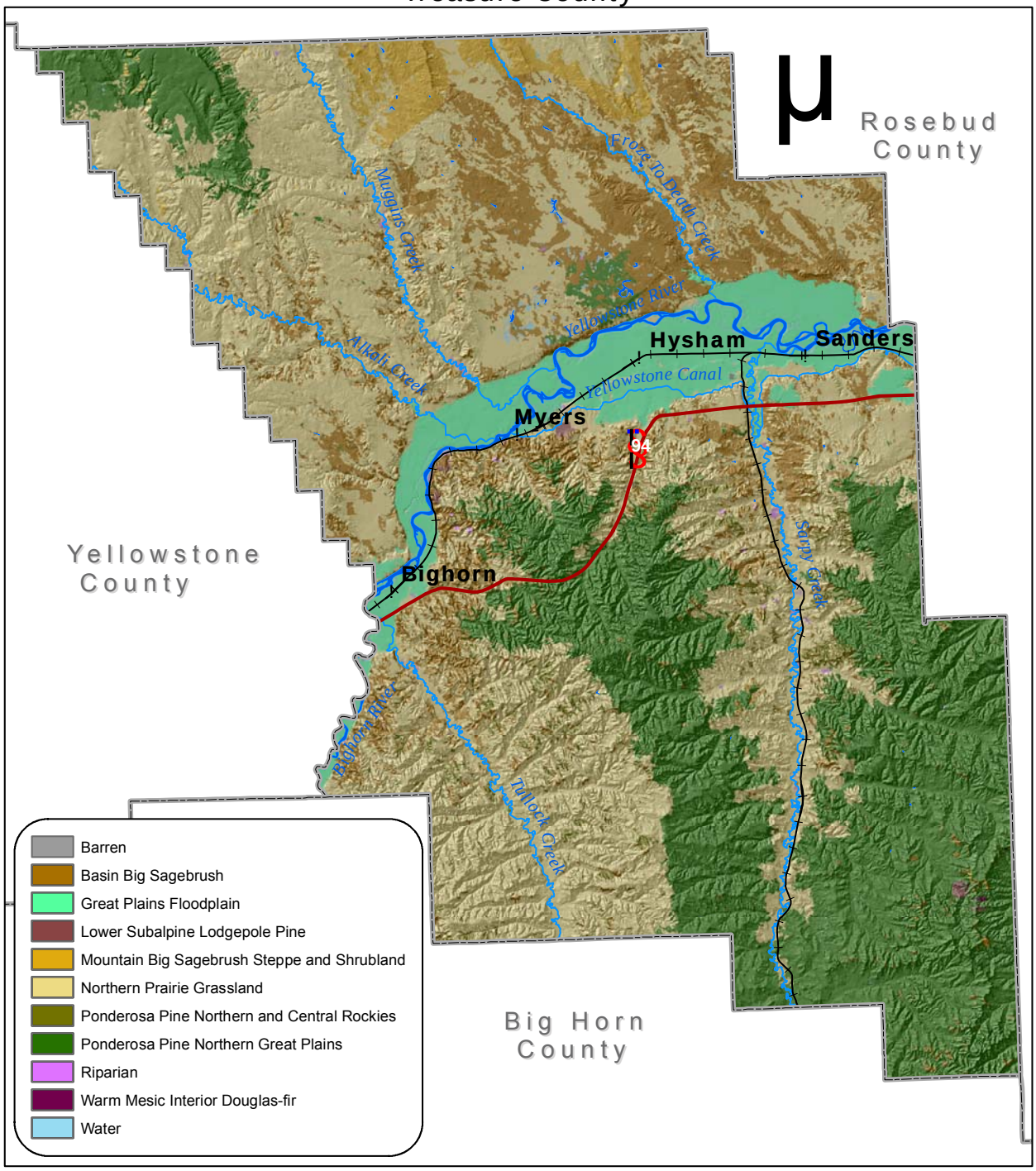
Data Source: US Geological Survey
Data Date: February 1999
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, February 2007

BIG SKY HAZARD MANAGEMENT LLC

Map 4.5.14.5C Potential Natural Vegetation Groups

Treasure County



0 2.5 5 10 15 20 Miles

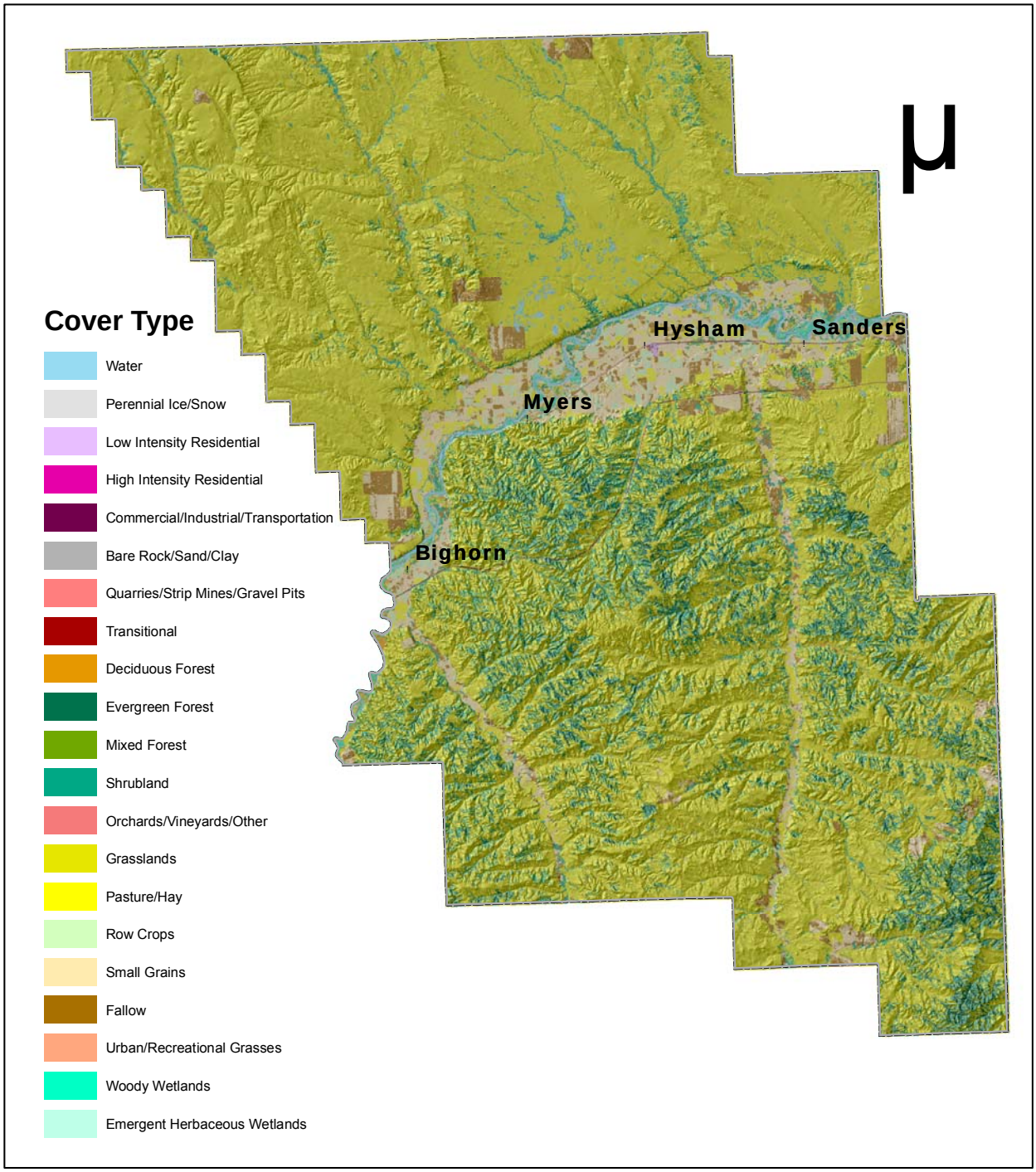
Data Source: Wildland Fire Leadership Council, LANDFIRE Project
Data Date: 2006
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, December 2006

BIG SKY HAZARD MANAGEMENT LLC

Map 4.5.14.5D

Land Cover
Treasure County



0 2.5 5 10 15 20 Miles

Data Source: Montana Natural Resource Information System
Data Date: 2000
Map Coordinates: NAD 1983, State Plane Montana

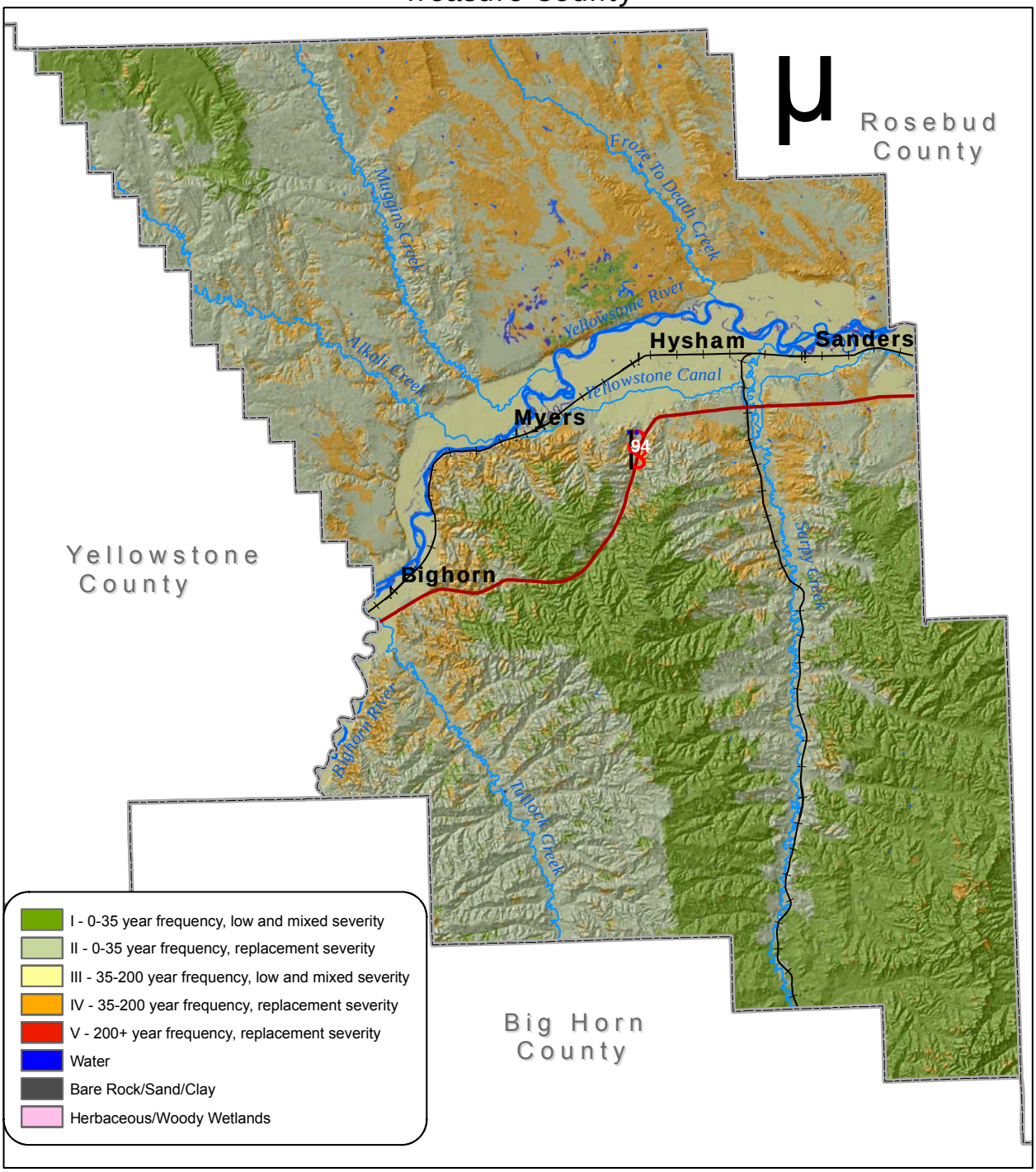
Map Created By:
Pam Shrauger, May 2006

BIG SKY HAZARD MANAGEMENT LLC

Map 4.5.14.5E

Reference Fire Regime

Treasure County



0 2.5 5 10 15 20 Miles

Data Source: Wildland Fire Leadership Council, LANDFIRE Project
Data Date: 2006
Map Coordinates: NAD 1983, State Plane Montana

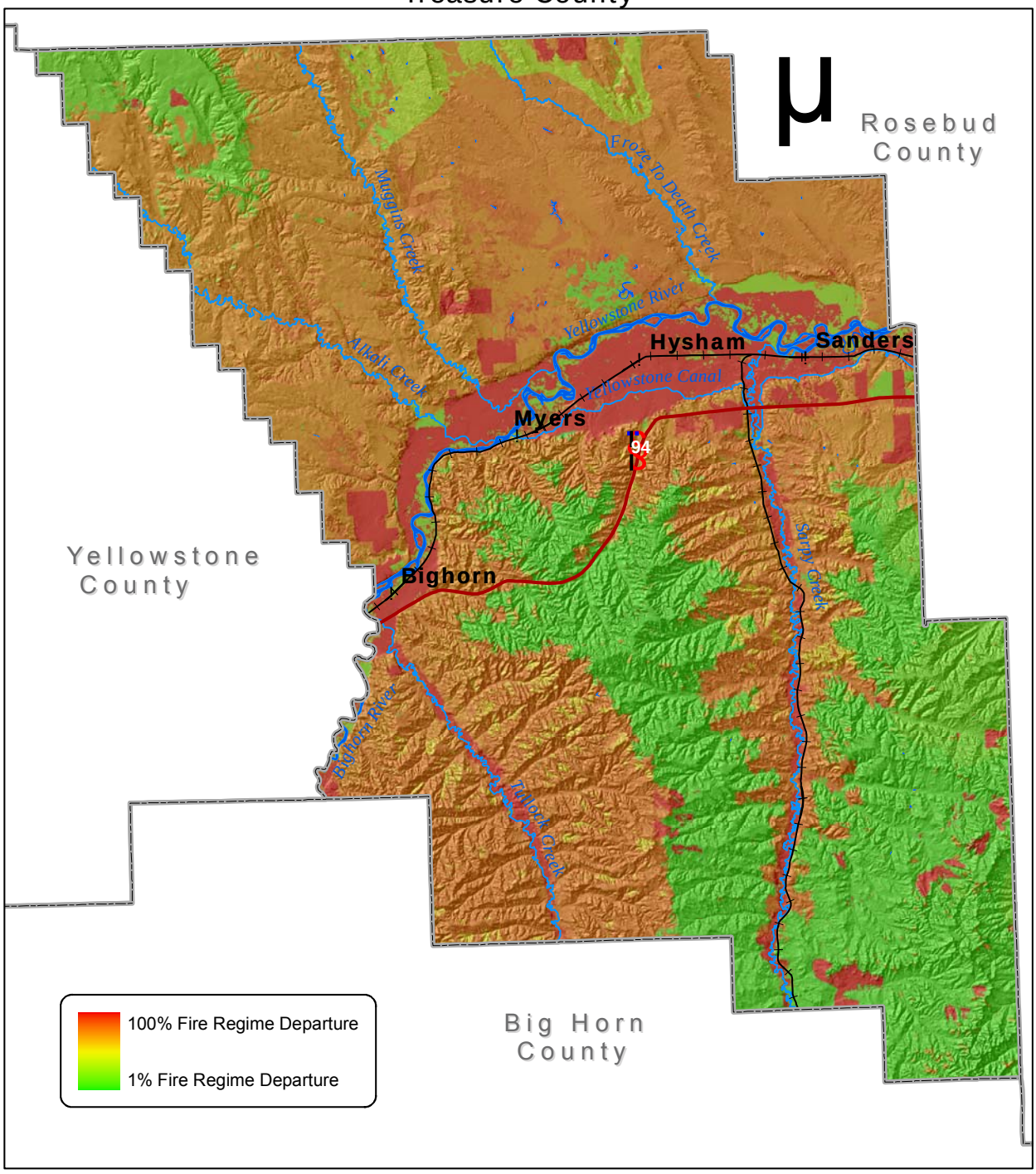
Map Created By:
Pam Shrauger, December 2006

BIG SKY HAZARD MANAGEMENT LLC

Map 4.5.14.5F

Fire Regime Departure

Treasure County



0 2.5 5 10 15 20 Miles

Data Source: Wildland Fire Leadership Council, LANDFIRE Project
Data Date: 2006
Map Coordinates: NAD 1983, State Plane Montana

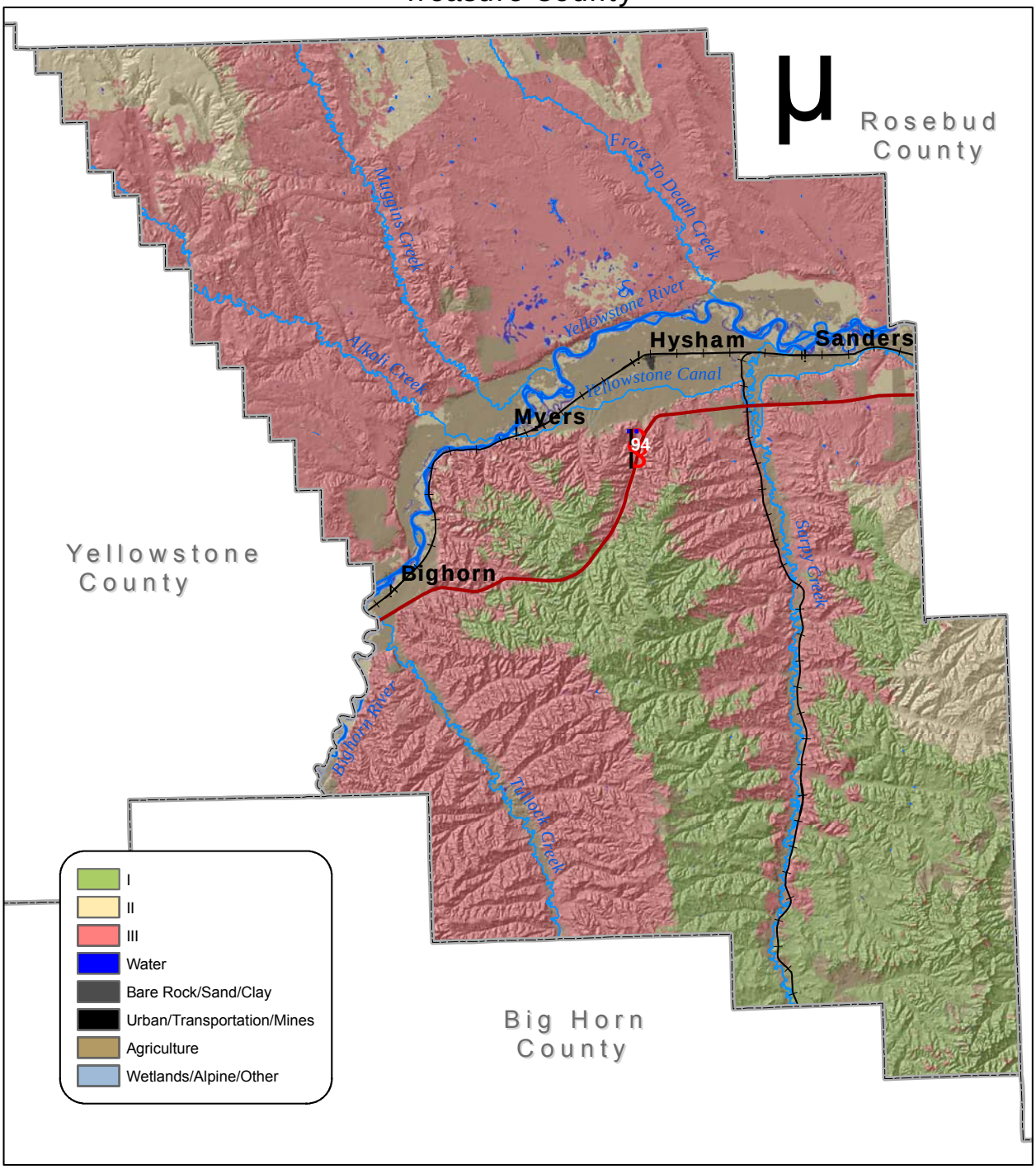
Map Created By:
Pam Shrauger, December 2006

BIG SKY HAZARD MANAGEMENT LLC

Map 4.5.14.5G

Fire Regime Condition Class

Treasure County



0 2.5 5 10 15 20 Miles

Data Source: Wildland Fire Leadership Council, LANDFIRE Project
Data Date: 2006
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, December 2006

BIG SKY HAZARD MANAGEMENT LLC

Table 4.5.14.5H Fire Regime Condition Class

Condition Class	Description
I	Fire regimes are within a historical range, and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within a historical range.
II	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). This results in moderate changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range.
III	Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range.

Source: US Forest Service, 2002.

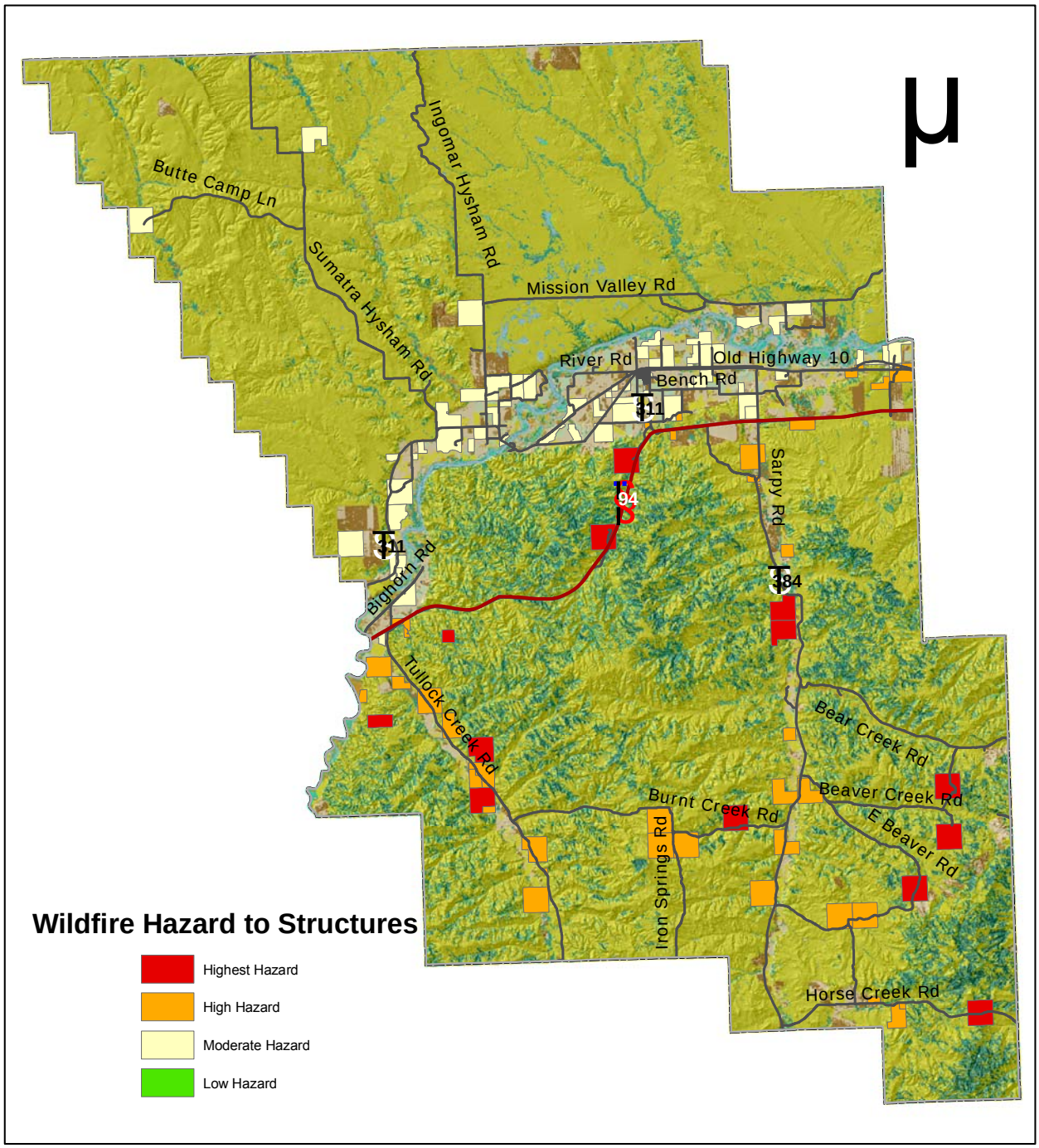
As described in the Wildland Urban Interface description, Section 4.5.14.1.3, generally, the hazard areas in Treasure County are as follows:
High Hazard Areas: Southern Treasure County, including Sarpy Creek and Tullock Creek
Moderate Hazard Areas: Along the Yellowstone River in the river bottoms including Howrey Island, Isaac Homestead, and Manuel Lisa Fishing Access
Low Hazard Areas: Northern Treasure County

Using the state CAMA database that identifies the land parcels with structures on them, a more detailed assessment of the wildland urban interface can be made. Comparing the developed parcels to the land cover and topography data, each parcel can be ranked based on their general wildfire hazard. Note this assessment does not replace an on-site field assessment of individual properties. This assessment should only be used for planning purposes. Those with highest, high, and moderate rankings are particularly encouraged to get an individual risk assessment for their properties. Map 4.5.14.5I shows the hazard designations. Those within close proximity to timber and steep topography were given a “highest” ranking. The remainder in the more rugged, southern part of the county were given a “high” ranking. Those in the Yellowstone River bottoms and in the isolated parts of northern Treasure County were given a “moderate” ranking, and those in the Town of Hysham were given a “low” ranking because of the more urbanized setting and nearby firefighting resources.

Map 4.5.14.5l

Land Cover Comparison to Parcels with Structures

Treasure County



0 2.5 5 10 15 20 Miles

Data Source: Montana Natural Resource Information System
Data Date: 2000; April 2006
Map Coordinates: NAD 1983, State Plane Montana

Map Created By:
Pam Shrauger, February 2007

BIG SKY HAZARD MANAGEMENT LLC

4.5.14.6 Associated Hazards and Other Factors

As if a raging wildfire isn't bad enough, the charred ground and thick smoke plumes it produces can create other hazards. The heavy smoke may lead to unhealthy air conditions affecting those with respiratory problems and otherwise healthy people. The air conditions are often monitored and alerts may be issued. Smoky conditions can also lead to poor visibility and an increased probability of transportation accidents. Air quality advisories and forecasts are issued daily during the wildfire season by the Montana Department of Environmental Quality. Table 4.5.14.6A lists the categories used when rating air quality.

Table 4.5.14.6A Air Quality Index for Particulate Matter

Category	Visibility	Health Effects
Good	10 miles or greater	None
Moderate	6-9 miles	Possibility of aggravation of heart or lung disease among persons with cardiopulmonary disease and the elderly.
Unhealthy for Sensitive Groups	3-5 miles	Increasing likelihood of respiratory symptoms in sensitive individuals, aggravation of heart or lung disease and premature mortality in persons with cardiopulmonary disease and the elderly.
Unhealthy	1½-2½ miles	Increased aggravation of heart or lung disease and premature mortality in persons with cardiopulmonary disease and the elderly; increased respiratory effects in the general population.
Very Unhealthy	1-1¼ miles	Significant aggravation of heart or lung disease and premature mortality in persons with cardiopulmonary disease and the elderly; significant risk of respiratory effects in the general population.
Hazardous	¾ mile or less	Serious aggravation of heart or lung disease and premature mortality in persons with cardiopulmonary disease and the elderly; serious risk of respiratory effects in the general population.

Source: Montana Department of Environmental Quality, 2007.

With vegetation removed and the ground seared from a wildfire, the area also becomes more prone to flash floods and landslides because of the ground's reduced ability to hold water. Following high-intensity wildfires or wildfires that result in water-repellent soils, the loss of protective soil cover, or excessive sediments, special

actions may be taken to mitigate the flood potential. The National Weather Service may also lower precipitation thresholds for issuing flash flood watches and warnings in the burnt area.

4.5.14.7 Vulnerabilities

4.5.14.7.1 Critical and Special Needs Facilities

Wildfires have the greatest potential to threaten structures lacking defensible space. Defensible space is a buffer zone between a structure and flammable fuels. Irrigation, mowed areas, tree thinning, roads, and waterways can serve as buffers to wildfires in some cases. The threat to a structure can truly only be assessed on a case-by-case basis. With respect to the hazards in Treasure County, the more rugged southern part of the county has the greatest wildfire risk. The Town of Hysham is probably the least threatened by wildfires due to the buffers provided by irrigated lands and development. Using the wildland urban interface parameters discussed in Section 4.5.14.5, the critical and special needs facilities in Treasure County can be grouped as shown in Table 4.5.14.7.1A based on their general wildfire hazard.

Table 4.5.14.7.1A Critical and Special Needs Facilities in Highest, High, and Moderate Wildfire Hazard Areas

Facility	Wildfire Hazard Area
Sarpy Site Repeater	Highest Hazard
Grierson Site Repeater	Highest Hazard
Hysham Water Plant	Moderate Hazard
Hysham Sewer Lagoons	Moderate Hazard
Bighorn Post Office	Moderate Hazard
Simplot (HazMat)	Moderate Hazard
Farmer's Union Bulk Fuel Tanks (HazMat)	Moderate Hazard

4.5.14.7.2 Structures

Residences, ranches, and businesses are threatened by wildfires just as critical and special needs facilities are. Using the same criteria for hazard areas, Table 4.5.14.7.2A shows the number of parcels with structures estimated in the various hazard areas. Note that most farmsteads in the area have several outbuildings in addition to the primary residence. Therefore, the number of structures in the hazard areas are likely much greater.

Table 4.5.14.7.2A Structures in the Wildfire Hazard Areas

Wildfire Hazard Area	Estimated Number of Parcels with Structures
Highest Hazard	15 parcels with structures
High Hazard	38 parcels with structures
Moderate Hazard	92 parcels with structures
Low Hazard	164 parcels with structures

The total estimated value of the structures in the highest hazard area is $451,000 and in the high hazard area is $2,008,670 (based on building values listed in the CAMA data). A potential damage factor is rather difficult to determine because the losses will be highly dependent on the fire characteristics and its location. Not all areas in the highest or high hazard categorizations will be affected by one particular wildfire, however, structures in the fire perimeter could have a high loss rate. Given an assumption that 15% of the structures in the highest and high hazard areas could be lost in a probable wildfire, the structure losses from that fire would roughly total $368,951 or about 10 structures. History has shown that personal property losses can be much greater than just that of residences. Outbuildings, fences, equipment, livestock, pastures, and crops are often additional losses.

Figure 4.5.14.7.2B A ranch off of Sarpy Creek Road.

Structures typically catch on fire through one of three mechanisms: firebrands, radiation, or convection. Firebrands are pieces of burning materials that are carried by fire drafts and winds. The burning embers can land on a structure and ignite it depending on the size of the firebrand, how long it burns after contact, and the materials, design, and construction of the structure. Radiation is the transfer of heat through light wavelengths. A sunburn is an example of a burn created by sun radiation. Structures near a wildfire can ignite through radiation depending on the intensity, duration, and proximity of the flaming front. Ignition by convection occurs when the flame comes in direct contact with the structure. Structures on a slope have a greater probability of ignition by convection as the flames climb up a hill. (National Wildland/Urban Interface Fire Protection Program, 1998)

The building materials and surrounding vegetation are critical factors in the probability of a structure igniting from a wildfire. Structures constructed with non-flammable, class A roofing materials with screened vents and no gaps for firebrands to travel into the rafters is much more resistant to wildfires than one that has a wood shake roof, for example. Fire-resistant siding and decking can also prevent fire from engulfing a home. The landscaping around a structure can also make a big difference in the probability of ignition from a wildfire. Removing dead vegetation such as leaves and branches from the immediate vicinity of the structure, moving firewood piles from away from the structure, clearing slash piles, and thinning trees surrounding the structure can make the area more fire resistant. (FireWise Communities, 2007)

4.5.14.7.3 Infrastructure

Often regional electric infrastructure passes through wildland and non-irrigated agricultural areas. In particular, the electric substations and transmission lines are usually buffered by or overhang natural fuels. A wildfire could disrupt electricity should this infrastructure be damaged. Two sets of major electric transmission lines cross the southern part of the county from the Colstrip power plants. Another crosses the middle of the county in the general vicinity of Interstate 94. All three pass through areas at the highest risk for significant wildfires.

Figure 4.5.14.7.3A Major electric transmission line off of Sarpy Creek Road.

Propane tanks also become hazardous infrastructure when a wildfire encroaches on a structure. Temporary disruptions or low flows on the public water system may occur if large amounts of water are used to fight a fire, particularly during periods of drought or peak usage times. Overhead and road infrastructure can be better protected during wildfires if excess vegetation is removed from the road right-of-ways and slash piles in the vicinity are removed. Dirt and gravel roads, particularly private roads, can become very rugged and sometimes impassable for emergency response vehicles. It is often the responsibility of the road or driveway owner to maintain these access points for fire suppression.

4.5.14.7.4 Population

Figure 4.5.14.7.4A Fuels along Interstate 94.

Generally, the population at risk can evacuate before a wildfire moves into their area. Using the estimate of 53 structures or farmsteads in the highest and high hazard areas, roughly 150 people live in areas at enhanced risk for wildfires (53 residences x 2.8 people/residence). Occasionally when strong winds are in place, wildfires can move very rapidly and catch people by surprise, or people may just refuse to evacuate; fatalities are possible. In these types of situations, firefighters can also be at risk from rapidly moving wildfires. Many strong-willed Montanans are often reluctant to leave their pets and livestock behind or want to stay behind and protect their property. Many times, wildfire fatalities of the evacuating population occur when frantic drivers or poor visibilities due to smoke cause an accident.

4.5.14.7.5 Economic, Ecologic, Historic, and Social Values

Figure 4.5.14.7.5A A cow along Sarpy Creek Road. Livestock welfare is a common concern for ranchers during an encroaching wildfire.

Wildfires can certainly have an effect on the regional economy. With annual agricultural sales of nearly $20 million, rapidly moving wildfires can result in direct livestock, feed, and crop losses and additional losses to miles of fences and outbuildings. As of January 1, 2006, Treasure County had 23,000 head of cattle and calves. (US Department of Agriculture, 2006a) Significant wildfires can force ranchers to evacuate or release their cattle to try to preserve their investment. Often the evacuation of livestock becomes a significant

challenge, and severe livestock losses can result. Wildfires may also temporarily destroy land used for grazing.

Natural resources are often lost during wildfires, but since wildfires are an important part of the ecosystem, such losses are usually only financial. Timber can be harvested in parts of Treasure County, however, the industry does not make up a large part of the county's economy. Ecologic diversity could be lost with the only two known locations of birchleaf mountain-mahogany (*Cercocarpus montanus var. glaber*) in the state being in Treasure County. (Treasure County, 2003) This species is heat and drought tolerant, however, it would not likely survive an intense wildfire. Howrey Island and Isaac Homestead are two wildlife areas that do have significant wildfire hazards. Wildlife and scenic values could be lost if a significant wildfire occurred. For example, Howrey Island is one of only four known active bald eagle nesting sites in southeast Montana. (State of Montana, 2007)

Depending on the location, historic losses could also occur. Places such as homes and barns from original homesteads could be lost in a wildfire. Locations on the National Register of Historic Places within Treasure County include the Sanders Gymnasium and Community Hall on Old Highway 10 in Sanders and the Yucca Theatre on Division Street in Hysham. (Montana Historical Society, 2002) This area is also rich in Lewis and Clark early exploration history. Social values may be impacted for those under evacuation orders and others supporting the firefighting effort. Fire restrictions may prevent campfires, hunting, and other recreational activities people often enjoy.

4.5.14.7.6 Future Development

Remote, isolated, forested areas are becoming more popular places to live or to have a second home, as national trends show. Growth in these parts of Treasure County is possible and even likely. Regulating growth in these areas is a delicate balance between protecting private property rights and promoting public safety. Future development could increase wildfire vulnerabilities, putting

Figure 4.5.14.7.6A A farmstead off of Tullock Creek Road.

more people and property in harm's way. The Treasure County Subdivision Regulations do address the wildfire hazard and have very specific requirements with regard to ingress and egress, water supplies, building sites, road design, densities, and defensible space on road right-of-ways. A synopsis follows.

The regulations don't prohibit development in wildfire hazard areas, rather they require the infrastructure be in place to safely fight the fire. More specifically, subdivisions must comply with the Uniform Fire Code and local fire codes. The regulations require two entrance/exit roads, roads, bridges, and gates designed to allow access by fire equipment, proper placement of residences to minimize the potential for fire spread, and provisions for defensible spaces around structures (see Montana Fire Protection Guidelines for Wildland Residential Interface Development). Subdivisions must meet the water supply requirements set forth by the local fire protection authority or in the absence of such standards:

- A central water system with a minimum flow of 1,000 gallons/minute.
- With no central water system, the subdivision must have cisterns, reservoirs, or fill ponds with dry hydrants with a minimum storage capacity of 2,500 gallons per dwelling for single-family residences, or for five or more dwellings per unit, 500 gallons per dwelling.
- The water supply must be all-season and accessible by fire equipment including all weather turn-arounds on roads.
- Dry hydrants must have a minimum six inch diameter with the appropriate fixtures.
- Water sources that are dependent on electric power for pumping must have a backup source of power.

Areas outside established fire service areas are considered High Fire Hazard Areas, as well as those areas subject to high wildfire hazard as determined by the planning board, local fire protection authority, US Forest Service, or Montana Department of Natural Resources and Conservation. In addition to complying with the Uniform Fire Code and the other regulations, these subdivisions must meet the following additional requirements:

- Road right of way must be maintained free of slash, trees, tall grass/weeds, and other fire fuels.
- Structures are prohibited on slopes greater than 25% and on specific topographical features ("fire chimneys").
- Densities must be reduced through the following minimum lot standards shown in Table 4.3C.

Table 4.3C Wildfire Minimum Lot Sizes

Slope	Open Grass	Forest & Brush
0%-10%	1 acre	2 acres
10%-20%	2 acres	3 acres
20%-25%	3 acres	4 acres
Over 25%	5 acres	Not permitted

- Open space, park land and recreation areas (including green belts, riding or hiking trails) should be located, where appropriate, to separate residences and other buildings from densely forested areas.
- With no central water system, the subdivision must have cisterns, reservoirs, or fill ponds with dry hydrants with a minimum storage capacity of 3,500 gallons per dwelling for single-family residences, or for five or more dwellings per unit, 700 gallons per dwelling.
- Minimum flow of 500 gallons per minute for lots of one acre or larger and a minimum flow of 750 gallons per minute for lots of less than one acre.

4.5.14.8 Data Limitations

The addition of more detailed fuels mapping would allow for a better analysis of the risk from wildfires. The maps generally change over time as fuels build up, fires occur, and mitigation takes place. A comprehensive historical wildland fire digital database for the county encompassing all firefighting agencies that includes data on start location, cause, area burned, duration, fuel type, suppression costs, and damage would prove highly beneficial in better pinpointing the hazard areas. LANDFIRE, a multi-agency initiative to produce consistent and comprehensive maps and data describing vegetation, wildland fuel, and fire regimes across the United States will likely have more detailed data available to Treasure County by 2008.

4.5.15 Winter Weather

Including Blizzards, Heavy Snow, Ice Storms, Extreme Cold, and Strong Winds

4.5.15.1 Description

Winters in Montana can be harsh, and Treasure County is no exception. Winds, snow, and cold temperatures blast the region every winter. On average, the coldest month is January with high temperatures in the lower 30's and low temperatures in the single digits. In Hysham, snow has fallen in all months except June, July, and August. Given these facts, most people in the region expect winter conditions, and lifestyles are not disrupted by snow and cold. Exceptional winter storms, though, can and do cause problems for the communities, residents, and travelers. Examples of these types of storms include blizzards, ice storms, heavy snow events, extended extreme cold temperatures, and strong winds. The National Weather Services has the ability to issue Winter Storm Watches and Warnings to alert the public of hazardous winter weather. The definitions of such are as follows:

- Winter Storm Watch: Winter storm watches are issued to give the public 12-48 hours of advance notice of the potential for snow 6 inches or more in 12 hours or 8 inches or more in 24 hours AND sustained or frequent wind gusts of 25-34 mph occasionally reducing visibilities to ¼ mile or less for three hours or more.
- Winter Weather Advisory: Winter weather advisories are issued when a combination of winter weather elements that may cause significant inconveniences are occurring, imminent, or have a high probability of occurring.
- Winter Storm Warning: Winter storm warnings are generally issued when snow 6 inches or more in 12 hours or 8 inches or more in 24 hours AND sustained or frequent wind gusts of 25-34 mph occasionally reducing visibilities to ¼ mile or less for three hours or more are occurring, imminent, or have a high probability of occurring.

(National Weather Service, 2005d)

Blizzards, as defined by the National Weather Service, are a combination of sustained winds or frequent gusts of 35 mph or greater and visibilities of less than a quarter mile from falling or blowing snow for 3 hours or more. A blizzard, by definition, does not indicate heavy amounts of snow, although they can happen together. Irregardless, the falling or blowing snow usually creates large drifts from the strong winds. The reduced visibilities make travel, even on foot, particularly treacherous. The strong winds may also support dangerous wind chills. The National Weather Service issues the following products for blizzards:

- Blizzard Watch: Blizzard watches are issued to give the public 12-48 hours of advance notice of possible blizzard conditions (sustained winds or frequent gusts of 35 mph or greater and visibilities of less than a quarter mile from falling and/or blowing snow for 3 hours or more).

- Blizzard Warning: Blizzard warnings are issued when blizzard conditions (sustained winds or frequent gusts of 35 mph or greater and visibilities of less than a quarter mile from falling and/or blowing snow for 3 hours or more) are occurring, imminent, or have a high probability of occurring.

(National Weather Service, 2005d)

Ice storms develop when a layer of warm (above freezing), moist air aloft coincides with a shallow cold (below freezing) pool of air at the surface. As snow falls into a warm layer of air, it melts to rain, and then freezes on contact when hitting the frozen ground or cold objects at the surface, creating a smooth layer of ice. This phenomenon is called freezing rain. Similarly, sleet occurs when the rain in the warm layer subsequently freezes into pellets while falling through a cold layer of air at or near the Earth's surface. Extended periods of freezing rain can lead to accumulations of ice on roadways, walkways, power lines, trees, and buildings. Almost any accumulation can make driving and walking hazardous. Thick accumulations can bring down trees and power lines. In addition to Winter Storm Watches and Warnings, the National Weather Service issues the following products for ice storms:

- Freezing Rain Advisory: Freezing rain advisories are issued when an accumulation of ice will make roads and sidewalks slippery, but significant and damaging accumulations of ice are not expected.
- Ice Storm Warning: Ice storm warnings are issued when a significant and damaging accumulation of ice is occurring, imminent, or has a high probability of occurring.

(National Weather Service, 2005d)

Large quantities of snow may fall during winter storms. Six inches or more in 12 hours or eight inches or more in 24 hours constitutes conditions that may significantly hamper travel or create hazardous conditions. The National Weather Service issues warnings for such events. Smaller amounts can also make travel hazardous, but in most cases, only results in minor inconveniences. Heavy wet snow before the leaves fall from the trees in autumn or after the trees have leafed out in the spring may cause problems with broken tree branches and power outages. Daily snowfall amounts as high as twelve inches have fallen in May and eight inches have fallen September in Hysham. (Western Regional Climate Center, 2006) In addition to Winter Storm Watches and Warnings, the National Weather Service issues the following products for heavy snow events:

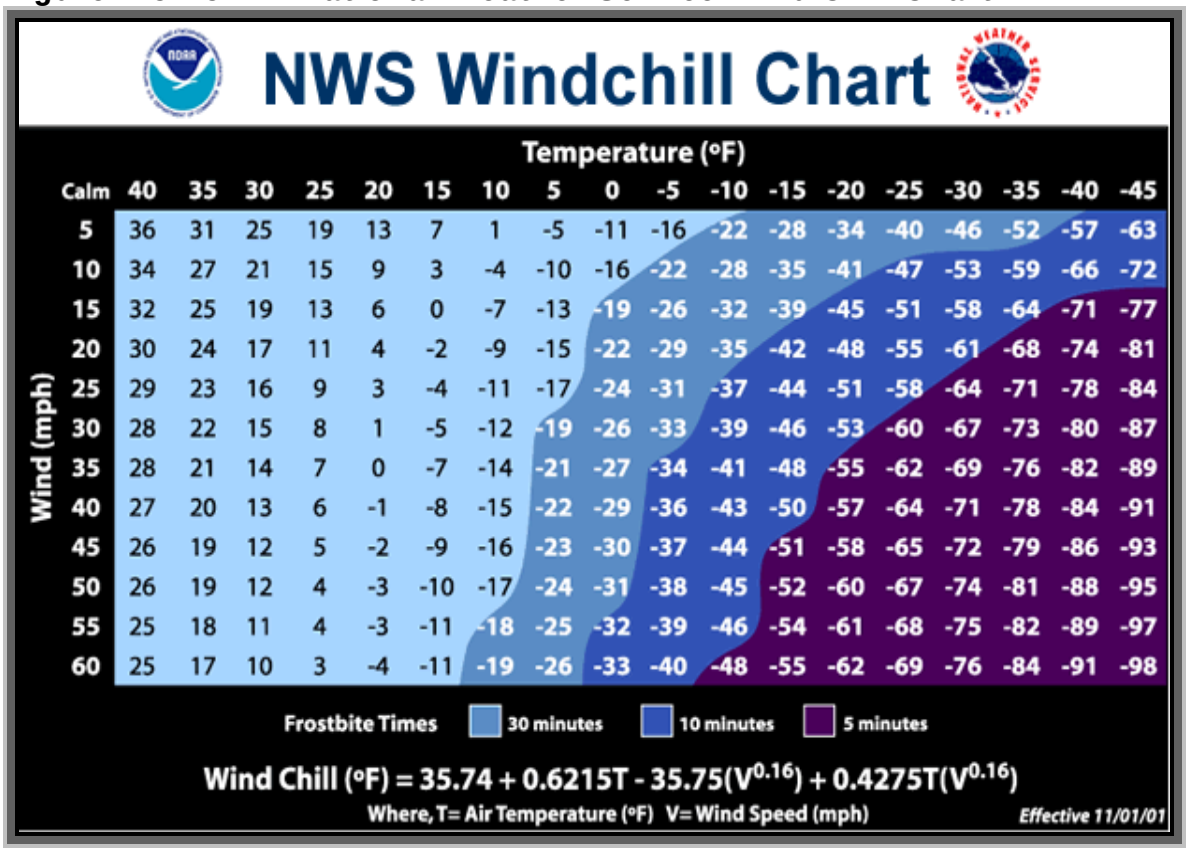
- Snow Advisory: Snow advisories are issued when snow accumulations of 2-5 inches in 12 hours are expected.
- Sleet Advisory: Sleet advisories are issued when sleet accumulations causing hazardous conditions are expected.
- Heavy Snow Warning: Heavy snow warnings are issued when snow accumulations of 6 inches or more in 12 hours or 8 inches or more in 24 hours are expected.

(National Weather Service, 2005d)

Extended periods of cold temperatures frequently occur throughout the winter months in Treasure County. Heating systems compensate for the cold outside. Most people limit their time outside during extreme cold conditions, but common complaints usually include pipes freezing and cars refusing to start. The coldest temperature recorded in Treasure County is -50ºF 25 miles south southeast of Hysham on December 22, 1989. When cold temperatures and wind combine, dangerous wind chills can develop. Cold and winter storms, particularly in the spring, can threaten young livestock.

Wind chill is how cold it feels when outside. Wind chill is based on the rate of heat loss on exposed skin from wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature, and eventually, internal body temperature. Therefore, the wind makes it feel much colder than the actual temperature. For example, if the temperature is 0ºF and the wind is blowing at 15 mph, the wind chill is -19ºF. At this wind chill, exposed skin can freeze in 30 minutes. Wind chill does not affect inanimate objects. (National Weather Service, 2006c) Figure 4.5.15.1A shows the current wind chill chart. The wind chill index changed in 2001 to better reflect the conditions felt by humans. This chart depicts the new, more accurate representation.

Figure 4.5.15.1A National Weather Service Wind Chill Chart



NWS Windchill Chart

Wind (mph) \ Temperature (ºF)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (ºF) V= Wind Speed (mph)

Effective 11/01/01

Source: National Weather Service, 2006c.

The National Weather Service issues the following products for significant wind chills:

- Wind Chill Watch: Wind chill watches are issued to give the public 12-48 hours advanced notice of the potential for wind chills of -40ºF or colder with a wind speed of 10 mph or higher and a duration of 6 hours or more.
- Wind Chill Advisory: Wind chill advisories are issued when wind chills of -20ºF to -39ºF with a wind speed of 10 mph or higher and a duration of 6 hours or more are expected.
- Wind Chill Warning: Wind chill warnings are issued when wind chills of -40ºF or colder with a wind speed of 10 mph or higher and a duration of 6 hours or more are expected.

(National Weather Service, 2005d)

Strong winds can develop with strong pressure gradients and gusty frontal passages. The closer and stronger two systems (one high pressure, one low pressure) are, the stronger the pressure gradient, and therefore, the stronger the winds are. During the winter, blowing snow is often a problem with strong winds. In addition to Winter Storm Watches and Warnings, the National Weather Service issues the following products for high winds and blowing snow:

- High Wind Watch: A high wind watch is issued when conditions are favorable for non-thunderstorm sustained winds of 40 mph or greater or gusts of 58 mph or greater for a period of one hour or more, but the timing, location, and/or magnitude are still uncertain.
- High Wind Warning: High wind warnings are issued when non-thunderstorm sustained winds of 40 mph or greater or gusts of 58 mph or greater for a period of one hour or more are expected.
- Blowing Snow Advisory: Blowing snow advisories are issued for visibilities intermittently at or below ½ mile because of blowing snow.

(National Weather Service, 2005d)

4.5.15.2 History

Snow, cold, and wind are normal occurrences in Treasure County throughout the late fall, winter, and early spring months. Summaries of the more significant events due to their extreme conditions or damages follow. The winter weather records for Treasure County are shown in Table 4.5.15.2A. Note that some time periods within the period of record lack data, so missing observations likely account for discrepancies.

Table 4.5.15.2A Winter Weather Records for Treasure County

	Hysham 1948 - 2005	**Hysham 25 SSE 1957-2005**
Lowest Temperature Recorded	-48ºF January 20, 1954	-50ºF December 22, 1989
Average # of Days Dropping Below Freezing	174.6 days	193.1 days
Average # of Days Staying Below Freezing	39.2 days	43.0 days
Average Annual Snowfall	34.8 inches	52.5 inches
Highest Annual Snowfall	93.5 inches 1996	124.7 inches 1984
Highest Daily Snowfall	14.5 inches October 20, 1949	24 inches April 27, 1984
Highest Snow Depth	29 inches March 15, 2005	27 inches December 23-24, 1984

Source: Western Regional Climate Center, 2006.

December 28, 1996 Heavy Snow – Six to seven inches of snowfall was reported in Hysham and six inches was reported three miles northeast of Sanders.

March 28-29, 1998 Heavy Snow – An early season spring storm dumped heavy snow across much of south central and southeastern Montana. There were several reports of 5 to 12 inches.

December 18-24, 1998 Cold – An Arctic air mass dropped night temperatures to well below zero across much of southern Montana for several days.

December 29-30, 1998 Ice Storm - A widespread area of rain spread eastward over a shallow Arctic air mass at the lower levels of the atmosphere. As a result the rain froze as it came into contact with the surface. Numerous roads were closed across south central Montana for several hours including portions of Interstate 94.

January 10-11, 1999 Ice Storm - A warm front produced a widespread area of freezing rain over southeastern Montana as it slowly moved east. Numerous roads had to be closed for several hours including Interstate 94 between Lockwood and Terry. The freezing rain also caused several minor auto accidents.

February 25-26, 2000 Blizzard - A strong low pressure system crossed southern Wyoming into western Nebraska before slowly tracking northeast into central South Dakota. Wrap around moisture from this system produced widespread rain across much of south central and southeastern Montana which then changed over to snow from west to east overnight. Most of south central and southeast Montana received 6 to 12 inches of snowfall from this system. Gusty northwest winds of 30 to 40 mph combined with the snow to reduce visibility to near zero and produced widespread blizzard conditions across southeast Montana.

November 7, 2000 Winter Storm – All areas of south central Montana received at least six inches of snow. Gusty winds caused areas of blowing and drifting snow. Visibilities were 1/2 mile or less at times.

November 30, 2000 Heavy Snow – Hysham received four inches of new snow.

December 15, 2000 Wind and Blowing Snow – Hysham reported sustained winds of 27-35 mph with a gust to 48 mph along with blowing snow.

February 11, 2002 Wind – Winds gusting to 60 mph in Hysham blew a metal roof off a building, knocked small trees down, and blew down street signs.

March 20, 2002 Heavy Snow – Hysham received twelve inches of new snow.

April 18, 2002 Heavy Snow - Hysham received seven inches of new snow.

October 30, 2002 Heavy Snow – Bighorn received four inches of new snow.

January 22, 2003 Heavy Snow – Hysham received seven inches of new snow and Bighorn received six inches.

February 23, 2003 Heavy Snow – Six inches of new snow fell twenty five miles southeast of Hysham.

March 7, 2003 Heavy Snow – Six inches of new snow fell thirteen miles east of Hysham.

March 8, 2003 Heavy Snow – Six inches of new snow fell five miles south of Bighorn.

March 9, 2003 Heavy Snow – Eighteen inches of new snow fell 25 miles south southeast of Hysham, thirteen inches fell in Hysham, and eleven inches fell five miles south of Bighorn.

November 21, 2003 Heavy Snow – Eight inches of snow fell seven miles northeast of Hysham.

May 11-12, 2005 Heavy Snow - Eight inches of snow fell in Hysham.

October 4-5, 2005 Heavy Snow - Eight inches of snow fell eight miles southwest of Hysham and five inches of snow fell in Hysham with numerous tree branches down and power outages in both areas. Power was out from Custer to Miles City. (National Climatic Data Center, 2006)

4.5.15.3 Probability

From 1996-2005, 21 significant winter weather events have been noted in Treasure County. In that period of 10 years, approximately 3 blizzards or winter storms were particularly severe resulting in road closures or power outages. Based on this historical record, a severe winter storm can be expected approximately once every 3-4 years. Since 1996, 1 blizzard, 2 winter storms (involving a combination of wind, snow, and/or ice), 7 heavy snow events (8 inches or more), 1 high wind event (55 mph or greater), and 2 ice storms have occurred. Table 4.5.15.3A shows the associated probabilities based on this historical record.

Table 4.5.15.3A Winter Weather Recurrence Intervals

Winter Weather Type	Recurrence Interval (estimated)
Blizzard/Damaging Winter Storm	3-4 years
Winter Storm (combination of wind, snow, and/or ice)	5 years
Heavy Snow (8 inches or more)	1-2 years
High Winds (greater than 55 mph)	10 years
Ice Storm	5 years
Any of the Above	About 1 event/year

4.5.15.4 Magnitude

The severe blizzards and winter storms that result in the loss of life, extended road closures, long-term power outages, or significant isolation problems represent a high magnitude winter weather event for Treasure County. Blizzard conditions continuing for 2 or more days and blocked roadways or power outages for a week or more both represent extreme winter weather conditions that are possible. These types of events present significant transportation, sheltering, and logistical challenges.

4.5.15.5 Mapping

The winter weather hazards, such as blizzards, ice storms, heavy snow, extreme cold, and strong winds, usually occur on a regional scale; therefore, Treasure County is assumed to have the same risk from the winter weather hazards countywide. Mapping does not enhance this hazard profile.

4.5.15.6 Associated Hazards and Other Factors

Winter weather can often be associated with other hazards. The most common hazard thought of during winter weather events are transportation accidents. Roadways become hazardous quickly during snow, blowing snow, and ice events. Most accidents involve passenger vehicles; however, an accident involving a commercial vehicle transporting hazardous materials is also possible.

Strong winds and ice or snow accumulations can take down utility lines. A long-term utility outage becomes more significant during extended cold periods as sheltering and cold weather exposure becomes more challenging. Accessing those in rural areas following heavy snow events to deliver supplies or provide emergency services can be difficult; the need for such services would be compounded by any long-term utility outage.

Heavy snow can alleviate drought conditions, improve agricultural conditions, and decrease the wildfire threat, but in doing so, can often increase the probability of flooding come spring.

4.5.15.7 Vulnerabilities

4.5.15.7.1 Critical and Special Needs Facilities

The critical and special needs facilities themselves generally are not threatened by winter weather events. Heavy snow loads on roofs, particularly large span roofs, can cause the roof to leak or even collapse depending on its construction. Extremely cold temperatures may cause pipes to freeze and subsequently burst, causing water damage. Probably the greatest issue for critical and special needs facilities during significant winter weather is the inaccessibility of such facilities due to poor roadways, utility outages, or dangerous wind chills. First responders such as fire, law enforcement, and ambulance may have a difficult time responding during poor road conditions or may not be able to power garage doors or provide certain services during electric outages. Those facilities with back-up generators are better equipped to handle a winter storm situation should the power go out.

4.5.15.7.2 Structures

Most structures usually remain unaffected by winter weather with the primary exceptions being heavy snow loads, frozen pipes, or utility failures. The most common incidents in winter weather conditions are motor vehicle accidents due to poor road conditions. These losses are usually covered by insurance.

4.5.15.7.3 Infrastructure

Winter weather does pose a threat to key infrastructure. Above ground power and telephone lines can be taken out by falling tree branches or thick ice accumulations. Following severe ice storms, power may take weeks to be restored. Water infrastructure may also be threatened by winter weather, particularly rapid freeze and thaw periods that cause underground water mains to burst. This could result in temporary disruptions of running water. The most difficult network to maintain is the road infrastructure. During periods of heavy snow, ice, or blizzards, roads can quickly

become impassable, stranding motorists and isolating communities. Long term road closures during an extended cold period may diminish and threaten propane and fuel supplies.

4.5.15.7.4 Population

The population of Treasure County is most threatened by winter weather while driving or when electric service is lost. Transportation accidents are more common during poor road and visibility conditions and may result in injuries or death. Many residents of Treasure County and Hysham rely on electricity for heat, and although other primary fuel sources include propane, electricity is still needed to run the blowers and heating systems. Therefore, an extended power outage during winter may make many homes and offices unbearably cold. Additionally, during extended winter-time power outages, people often make the mistake of bringing portable generators inside or not venting them properly leading to carbon monoxide poisoning. With poor road conditions, sheltering residents may present significant logistical challenges with getting people to heated facilities, feeding, and providing medical care. These situations, accompanied by stranded motorists that need to be rescued, represent significant threats to the population.

4.5.15.7.5 Economic, Ecologic, Historic, and Social Values

Winter storms may slow transportation, but since winter is not a peak season for agriculture or tourism, the economy would likely be unaffected. The primary exception is extreme cold temperatures during calving operations. Ranchers must take precautions not to lose large numbers of calves during cold weather. This could have an impact on agricultural profits. Businesses and schools may also close temporarily if conditions warrant.

Perhaps the greatest threat to historical values from winter weather is the potential for pipes to freeze and burst during cold weather. Water can easily damage the interiors of structures and their contents, including items of historic value. When roads are impassable, social events may also be postponed or cancelled. Otherwise, ecological values typically remain unaffected.

4.5.15.7.6 Future Development

Future development should have little to no impact from winter weather. The most significant challenge may be, as homes go up in more remote parts of the county, accessing rural residents should sheltering or emergency services be needed in an extreme event.

4.5.15.8 Data Limitations

Since major winter weather incidents occur frequently, but typically do not cause damages, the biggest data limitation is understanding the magnitude of an event that begins to cause problems that challenge Treasure County. Records outlining the winter weather conditions (snow depth, temperature, wind, snowfall rates, water content, and duration) and the problems (number of accidents, condition of roadways, and services needed) would increase the local understanding of this hazard. Meteorologists can provide more detail on the atmospheric elements of winter storms.

4.6 Risk Assessment Summary

The risk assessment profiles the approximate history and estimated vulnerabilities to Treasure County and the Town of Hysham from the hazards identified. As with any assessment involving natural or human caused hazards, all potential events may not be represented here, and an actual incident may occur in a vastly different way than described. This assessment, however, will be used, where possible, to minimize damages from these events in the future.

Every type of event is different, ranging from population to property to economic impacts. Incidents also have different probabilities and magnitudes even within hazards. For example, a light snowstorm will be different than a blizzard and a moderate flood will be different from both of those. Some hazards have estimates of dollar losses and population impacts, whereas, others are more qualitatively assessed based on information that was available during the risk assessment process. In an attempt to rate hazards and prioritize mitigation activities, a summary of the impacts from each hazard is presented in Tables 4.6B through 4.6G to determine the overall estimated impact of that hazard. The overall impact, along with the probability shown in Table 4.6A, is then listed in Table 4.6H to come up with the overall hazard rating. For more information on these determinations, see the individual hazard profiles.

Table 4.6A Probability

Rating	Hazards
High	Wildfire Winter Weather
Moderate-High	Communicable Disease and Bioterrorism Flood Hazardous Material Release Severe Thunderstorm Summer Weather
Moderate	Agriculture Hazards Landslide and Sinkhole Transportation Accident Utility and Communications Failure
Low-Moderate	Terrorism and Civil Unrest Water and Air Contamination
Low	Earthquake Volcanic Ashfall

Table 4.6B Estimated Impact to Critical and Special Needs Facilities

Rating	Hazards
High	Hazardous Material Release
Moderate-High	Communicable Disease and Bioterrorism Severe Thunderstorm
Moderate	Flood Terrorism and Civil Unrest Utility and Communications Failure Wildfire Winter Weather
Low-Moderate	Landslide and Sinkhole Volcanic Ashfall Water and Air Contamination
Low	Agriculture Hazards Earthquake Summer Weather Transportation Accident

Table 4.6C Estimated Impact to Structures

Rating	Hazards
High	Severe Thunderstorm Wildfire
Moderate-High	Flood
Moderate	Hazardous Material Release Landslide and Sinkhole Winter Weather
Low-Moderate	Earthquake Summer Weather Utility and Communications Failure Volcanic Ashfall
Low	Agriculture Hazards Communicable Disease and Bioterrorism Terrorism and Civil Unrest Transportation Accident Water and Air Contamination

Table 4.6D Estimated Impact to Infrastructure

Rating	Hazards
High	Severe Thunderstorm Utility and Communications Failure Winter Weather
Moderate-High	Flood Landslide and Sinkhole Terrorism and Civil Unrest Wildfire
Moderate	Earthquake Volcanic Ashfall Water and Air Contamination
Low-Moderate	Communicable Disease and Bioterrorism Hazardous Material Release Summer Weather
Low	Agriculture Hazards Transportation Accident

Table 4.6E Estimated Impact to the Population

Rating	Hazards
High	Communicable Disease and Bioterrorism Hazardous Material Release Water and Air Contamination Winter Weather
Moderate-High	Severe Thunderstorm Terrorism and Civil Unrest Utility and Communications Failure Wildfire
Moderate	Flood Landslide and Sinkhole Transportation Accident
Low-Moderate	Agriculture Hazards Summer Weather
Low	Earthquake Volcanic Ashfall

Table 4.6F Estimated Impact to Economic, Ecologic, Historic, and Social Values

Rating	Hazards
High	Agriculture Hazards Communicable Disease and Bioterrorism Summer Weather Wildfire
Moderate-High	Hazardous Material Release Terrorism and Civil Unrest Water and Air Contamination Winter Weather
Moderate	Severe Thunderstorm Utility and Communications Failure
Low-Moderate	Flood Landslide and Sinkhole Volcanic Ashfall
Low	Earthquake Transportation Accident

Table 4.6G Estimated Impact to Future Development

Rating	Hazards
High	Wildfire
Moderate-High	Landslide and Sinkhole Severe Thunderstorm
Moderate	Earthquake Flood Hazardous Material Release Water and Air Contamination Winter Weather
Low-Moderate	Agriculture Hazards Communicable Disease and Bioterrorism Utility and Communications Failure
Low	Summer Weather Terrorism and Civil Unrest Transportation Accident Volcanic Ashfall

Agriculture Hazards
Probability: Moderate
Estimated Impact to Critical and Special Needs Facilities: Low
Estimated Impact to Structures: Low
Estimated Impact to Infrastructure: Low
Estimated Impact to the Population: Low-Moderate
Estimated Impact to the Economic, Ecologic, Historic, and Social Values: High
Estimated Impact to Future Development: Low-Moderate
Overall Estimated Impact: Low-Moderate

Communicable Disease and Bioterrorism
Probability: Moderate-High
Estimated Impact to Critical and Special Needs Facilities: Moderate-High
Estimated Impact to Structures: Low
Estimated Impact to Infrastructure: Low-Moderate
Estimated Impact to the Population: High
Estimated Impact to the Economic, Ecologic, Historic, and Social Values: High
Estimated Impact to Future Development: Low-Moderate
Overall Estimated Impact: Moderate

Earthquake
Probability: Low
Estimated Impact to Critical and Special Needs Facilities: Low
Estimated Impact to Structures: Low-Moderate
Estimated Impact to Infrastructure: Moderate
Estimated Impact to the Population: Low
Estimated Impact to the Economic, Ecologic, Historic, and Social Values: Low
Estimated Impact to Future Development: Moderate
Overall Estimated Impact: Low-Moderate

Flood
Probability: Moderate-High
Estimated Impact to Critical and Special Needs Facilities: Moderate
Estimated Impact to Structures: Moderate-High
Estimated Impact to Infrastructure: Moderate-High
Estimated Impact to the Population: Moderate
Estimated Impact to the Economic, Ecologic, Historic, and Social Values: Low-Moderate
Estimated Impact to Future Development: Moderate
Overall Estimated Impact: Moderate

Hazardous Material Release
Probability: Moderate-High
Estimated Impact to Critical and Special Needs Facilities: High
Estimated Impact to Structures: Moderate
Estimated Impact to Infrastructure: Low-Moderate
Estimated Impact to the Population: High
Estimated Impact to the Economic, Ecologic, Historic, and Social Values: Moderate-High
Estimated Impact to Future Development: Moderate
Overall Estimated Impact: Moderate-High

Landslide and Sinkhole
Probability: Moderate
Estimated Impact to Critical and Special Needs Facilities: Low-Moderate
Estimated Impact to Structures: Moderate
Estimated Impact to Infrastructure: Moderate-High
Estimated Impact to the Population: Moderate
Estimated Impact to the Economic, Ecologic, Historic, and Social Values: Low-Moderate
Estimated Impact to Future Development: Moderate-High
Overall Estimated Impact: Moderate

Severe Thunderstorm
Probability: Moderate-High
Estimated Impact to Critical and Special Needs Facilities: Moderate-High
Estimated Impact to Structures: High
Estimated Impact to Infrastructure: High
Estimated Impact to the Population: Moderate-High
Estimated Impact to the Economic, Ecologic, Historic, and Social Values: Moderate
Estimated Impact to Future Development: Moderate-High
Overall Estimated Impact: Moderate-High

Summer Weather
Probability: Moderate-High
Estimated Impact to Critical and Special Needs Facilities: Low
Estimated Impact to Structures: Low-Moderate
Estimated Impact to Infrastructure: Low-Moderate
Estimated Impact to the Population: Low-Moderate
Estimated Impact to the Economic, Ecologic, Historic, and Social Values: High
Estimated Impact to Future Development: Low
Overall Estimated Impact: Low-Moderate

Terrorism and Civil Unrest
Probability: Low-Moderate
Estimated Impact to Critical and Special Needs Facilities: Moderate
Estimated Impact to Structures: Low
Estimated Impact to Infrastructure: Moderate-High
Estimated Impact to the Population: Moderate-High
Estimated Impact to the Economic, Ecologic, Historic, and Social Values: Moderate-High
Estimated Impact to Future Development: Low
Overall Estimated Impact: Moderate

Transportation Accident
Probability: Moderate
Estimated Impact to Critical and Special Needs Facilities: Low
Estimated Impact to Structures: Low
Estimated Impact to Infrastructure: Low
Estimated Impact to the Population: Moderate
Estimated Impact to the Economic, Ecologic, Historic, and Social Values: Low
Estimated Impact to Future Development: Low
Overall Estimated Impact: Low

Utility and Communications Failure
Probability: Moderate
Estimated Impact to Critical and Special Needs Facilities: Moderate
Estimated Impact to Structures: Low-Moderate
Estimated Impact to Infrastructure: High
Estimated Impact to the Population: Moderate-High
Estimated Impact to the Economic, Ecologic, Historic, and Social Values: Moderate
Estimated Impact to Future Development: Low-Moderate
Overall Estimated Impact: Moderate

Volcanic Ashfall
Probability: Low
Estimated Impact to Critical and Special Needs Facilities: Low-Moderate
Estimated Impact to Structures: Low-Moderate
Estimated Impact to Infrastructure: Moderate
Estimated Impact to the Population: Low
Estimated Impact to the Economic, Ecologic, Historic, and Social Values: Low-Moderate
Estimated Impact to Future Development: Low
Overall Estimated Impact: Low-Moderate

Water and Air Contamination
Probability: Low-Moderate
Estimated Impact to Critical and Special Needs Facilities: Low-Moderate
Estimated Impact to Structures: Low
Estimated Impact to Infrastructure: Moderate
Estimated Impact to the Population: High
Estimated Impact to the Economic, Ecologic, Historic, and Social Values: Moderate-High
Estimated Impact to Future Development: Moderate
Overall Estimated Impact: Moderate

Wildfire
Probability: High
Estimated Impact to Critical and Special Needs Facilities: Moderate
Estimated Impact to Structures: High
Estimated Impact to Infrastructure: Moderate-High
Estimated Impact to the Population: Moderate-High
Estimated Impact to the Economic, Ecologic, Historic, and Social Values: High
Estimated Impact to Future Development: High
Overall Estimated Impact: Moderate-High

Winter Weather
Probability: High
Estimated Impact to Critical and Special Needs Facilities: Moderate
Estimated Impact to Structures: Moderate
Estimated Impact to Infrastructure: High
Estimated Impact to the Population: High
Estimated Impact to the Economic, Ecologic, Historic, and Social Values: Moderate-High
Estimated Impact to Future Development: Moderate
Overall Estimated Impact: Moderate-High

Table 4.6H Hazard Ratings

Hazard	Probability	Overall Impact	Overall Rating
Agriculture Hazards	Moderate	Low-Moderate	Moderate
Communicable Disease and Bioterrorism	Moderate-High	Moderate	Moderate
Earthquake	Low	Low-Moderate	Low
Flood	Moderate-High	Moderate	Moderate
Hazardous Material Release	Moderate-High	Moderate-High	Moderate-High
Landslide and Sinkhole	Moderate	Moderate	Moderate
Severe Thunderstorm	Moderate-High	Moderate-High	Moderate-High
Summer Weather	Moderate-High	Low-Moderate	Moderate
Terrorism and Civil Unrest	Low-Moderate	Moderate	Moderate
Transportation Accident	Moderate	Low	Low-Moderate
Utility and Communications Failure	Moderate	Moderate	Moderate
Volcanic Ashfall	Low	Low-Moderate	Low
Water and Air Contamination	Low-Moderate	Moderate	Moderate
Wildfire	High	Moderate-High	High
Winter Weather	High	Moderate-High	High

The hazard priorities can be identified as follows for Treasure County:

High Hazards
- Wildfire
- Winter Weather

Moderate-High Hazards
- Hazardous Material Release
- Severe Thunderstorm

Moderate Hazards
- Agriculture Hazards
- Communicable Disease and Bioterrorism
- Flood
- Landslide and Sinkhole
- Summer Weather
- Terrorism and Civil Unrest
- Utility and Communications Failure
- Water and Air Contamination

Low-Moderate Hazards
- Transportation Accident

Low Hazards
- Earthquake
- Volcanic Ashfall

5. MITIGATION STRATEGY

Hazard mitigation, as defined by the Disaster Mitigation Act of 2000, is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. Studies on hazard mitigation show that, on average, for each dollar spent on mitigation, society saves an average of four dollars in avoided future losses. (Multihazard Mitigation Council, 2005) Mitigation can take many different forms from construction projects to public education.

The development of a mitigation strategy allows Treasure County and the Town of Hysham to create a vision for preventing future disasters, establish a common set of mitigation goals, prioritize actions, and evaluate the success of such actions. The Treasure County Mitigation Strategy is based on the results of the risk assessment and recommendations by stakeholders at public meetings.

The mission of the Treasure County Pre-Disaster Mitigation Plan and Community Wildfire Protection Plan is to guide the prevention of all hazards in order to protect citizens, property, the environment, the quality of life, and the economy in Treasure County and the Town of Hysham.

Rather than wait until a disaster occurs, Treasure County and the Town of Hysham have developed this strategy to move in a more proactive direction for disaster prevention. All losses cannot be entirely mitigated, however, some actions can be taken, as funding and opportunities arise, that may reduce the impacts of disasters, thus, saving lives and property. The mitigation actions were developed based on direct input from stakeholders and prioritized through a multi-step process.

5.1 Goals, Objectives, and Proposed Actions

Goal 1: Promote the use of multi-hazard mitigation measures.

Objective 1.1: Develop and implement population protective measures that can be used for many hazards.

Project 1.1.1: NOAA Weather Radio Transmitter
- Purchase and install a NOAA Weather Radio Transmitter in Hysham.

Project 1.1.2: NOAA Weather Radio Receivers
- Purchase and install NOAA Weather Radios in critical and special needs facilities.
- Educate facility users on the operation of NOAA Weather Radios.
- Provide information on the different types of statements that may be issued over NOAA Weather Radio.
- Regularly test and maintain the radios.
- Encourage the public to purchase NOAA Weather Radios for their homes.

Project 1.1.3: Reverse 911
- Purchase and integrate a Reverse 911 system into Enhanced 911.
- Educate the public on the benefits of Reverse 911.
- Periodically test and evaluate the Reverse 911 system.

Project 1.1.4: Warning Siren
- Evaluate and upgrade the warning siren in Hysham.
- Educate the public on the siren tones and the desired personal protective actions.
- Periodically test and evaluate the siren.

Project 1.1.5: Community Shelter
- Construct a facility in Hysham that serves as a community tornado shelter, particularly for those without basements or a sturdy structure to go to, and has a generator to heat and shelter residents, particularly special needs populations, during a power outage.
- Regularly test the facility with tornado drills and generator tests.
- Use the facility for disaster exercises and training during non-emergencies.

Project 1.1.6: Skywarn Training
- Host National Weather Service Skywarn training at least once every two years.

Project 1.1.7: Disaster Supplies Kits
- Conduct a public education program to encourage individuals and businesses to prepare disaster supplies kits.

Objective 1.2: Mitigate hazards during the construction of new development.

Project 1.2.1: Growth Policy

- Update the county growth policy to address all hazards and encourage growth in low hazard areas.
- Gather input from first responders and emergency service providers when revising the growth policy.
- Support the needs of first responders and emergency service providers in the growth policy and related documents.

Project 1.2.2: Subdivision Regulations

- Update countywide subdivision regulations to adopt higher minimum standards for subdivisions that improve their all-hazard disaster resistance.
- Gather input and support the needs of first responders and emergency service providers when updating subdivision regulations.
- Support the needs of first responders and emergency service providers in the subdivision regulations and related documents.

Objective 1.3: Improve the governments' ability to respond quickly to potential disasters.

Project 1.3.1: Generators

- Install emergency generators at critical and special needs facilities.
- Regularly test and maintain generators at the facilities.

Project 1.3.2: Railroad Emergency Locations

- Encourage Burlington Northern Santa Fe (BNSF) Railroad to provide GPS coordinates for all emergency calls, including fire and ambulance requests.

Goal 2: Prevent potential wildfire losses.

Objective 2.1: Improve community consensus, understanding, preparedness, and participation in wildland firefighting.

Project 2.1.1: Landowner Capacity Building

- Engage landowners in wildfire mitigation, preparedness, and response through a series of meetings throughout the county.
- Familiarize landowners with the local, state, and federal firefighting systems and how they interact.
- Provide basic information and training on wildland firefighting and response.
- Encourage landowners to purchase basic equipment such as radios and water tanks to possibly aid in firefighting efforts once trained.

Objective 2.2: Reduce structure and infrastructure losses during wildfires.

Project 2.2.1: Countywide Fuels Mitigation

- Form a committee consisting of the US Bureau of Land Management, Montana Department of Natural Resources and Conservation, Treasure County Fire Department, Treasure County Disaster & Emergency Services, Treasure County Commissioners, power companies, landowners, and others to plan fuel reduction projects on a landscape basis.
- Create fuel breaks and reductions in all hazard areas but particularly in high hazard areas such as the Hysham Hills and near homes and ranches.

Project 2.2.2: FireWise Building Materials and Defensible Space

- Encourage and provide funding for homeowners in the wildland urban interface to purchase fire resistant building materials and create defensible space from wildfires around their homes and outbuildings using FireWise principles.

Project 2.2.3: Road Improvements

- Use a county road grader for county and private road improvements that will reduce vehicle sparks and improve access for emergency responders.

Project 2.2.4: Public Lands Fuels Mitigation

- Continue efforts to eradicate weeds and remove brush from public lands, including Howrey Island and Isaac Homestead.
- Minimize impacts to wildlife and other values.

Objective 2.3: Acquire a better understanding of the local wildfire hazard.

Project 2.3.1: Fuels Mapping

- Create digital files of local fuel types and conditions.
- Use the mapping to better outline the hazard areas and conduct exercises.

Project 2.3.2: Road and Structure Mapping
- Improve road mapping (including private roads) and structure locations.
- Put printed copies in emergency response vehicles.

Project 2.3.3: Insect and Drought Inspection
- Have a state forester inspect trees for insect kill and drought kill.
- Use the information provided for future mitigation projects and response planning.

Objective 2.4: Increase firefighter knowledge and awareness through training.

Project 2.4.1: Basic Wildland Fire Training
- Bring in state and federal instructors for basic wildland fire training in Treasure County.

Project 2.4.2: Map and Compass Training
- Host Montana Department of Natural Resources and Conservation's Map and Compass Training once every two years.

Project 2.4.3: Eastern Montana Wildfire Awareness Video
- Show the Montana Department of Natural Resources and Conservation's Eastern Montana Wildfire Awareness Video at a wide variety of local meetings in Treasure County.

Objective 2.5: Improve the Treasure County Fire Department's response capabilities.

Project 2.5.1: Fire Liaisons
- Identify people in different geographic parts of the county that know the fuels and terrain and can act as liaisons to state and federal firefighting units.
- Train the identified liaisons in basic firefighting terminology and their roles during a wildfire.

Project 2.5.2: Water Storage
- Pre-identify locations of water storage such as stock ponds that could be used during a wildfire.
- Draft agreements with landowners for using that water to suppress wildfires.
- Gather GPS coordinates of the water supply locations.
- Develop a system to replenish the water used in the firefighting efforts.

Project 2.5.3: Volunteer Firefighting Reimbursement
- Develop a better pay or incentive system for local wildland firefighters to fight the fires.
- Discuss alternatives with other rural counties and volunteer fire departments.

Goal 3: Reduce future losses from winter storms and floods.

Objective 3.1: Protect electric and transportation infrastructure from snow, wind, and flood damages.

Project 3.1.1: Electric Infrastructure Protection

- Upgrade and maintain the electric distribution and transmission system for snow and wind resistance.
- Upgrade and maintain the electric utility's river crossing structures.

Project 3.1.2: Culvert Improvements

- Evaluate culverts throughout the county for flood capacities.
- Replace hazardous culverts in flood prone areas.
- Identify locations for new culvert installations.
- Maintain culvert capacities by regularly clearing the culverts of debris.

5.2 Action Prioritization

Each of the proposed projects has value, however, time and financial constraints do not permit all of the proposed actions to be implemented immediately. By prioritizing the actions, the most critical, cost effective projects can be achieved in the short term. The prioritization of the projects serves as a guide for choosing and funding projects, however, depending on the funding sources, some actions may be best achieved outside the priorities established here.

To ensure that community goals and other factors are taken into account when prioritizing projects, a prioritization model that uses the following factors has been developed: cost, staff time, feasibility, population benefit, property benefit, values benefit, maintenance, and hazard rating. *Cost* considers the direct expenses associated with the project such as material and contractor expenses. *Staff time* evaluates the amount of time needed by a local government employee to complete or coordinate the project. *Feasibility* assesses the political, social, and/or environmental ramifications of the project and the likelihood such a project would proceed through permitting and public review processes. *Population benefit* considers the possible prevention of deaths and injuries through the project's implementation. *Property benefit* estimates the reduction of property losses, including structures and infrastructure, from the hazard being mitigated. *Values benefit* considers the economic, ecologic, historic, and social benefits of the project. *Maintenance* rates the amount of work required to keep the mitigation measure effective and useful. The *hazard rating* is based on the results of the risk assessment and is a measure of the history, probability, severity, and vulnerabilities of the hazard.

Each of the factors was ranked qualitatively for each of the projects. The methods used to assign a category and the associated score can be generally defined as shown in Table 5.2A. The highest possible score is 30. Some factors have a greater range than others, thus indicating a higher weighting. These weightings allow for appropriate prioritization of the project. More specifically, 11 of 30 points account for benefits (population benefit, property benefit, and values benefit), 11 of 30 points account for direct and indirect costs (cost, staff time, and maintenance), 5 of 30 points account for the hazard rating (incorporates hazard probability and impacts; see Section 4.6), and 3 of 30 points account for project feasibility.

Table 5.2A Prioritization Criteria

Factor	Threshold	Rating	Score
Cost *Range: 1-5*	Little to no direct expenses	Low	5
	Less than $5,000	Low-Moderate	4
	$5,000-$25,000	Moderate	3
	$25,001-$100,000	Moderate-High	2
	Greater than $100,000	High	1
Staff Time *Range: 1-3*	Less than 10 hours of staff time	Low	3
	10-40 hours of staff time	Moderate	2
	Greater than 40 hours of staff time	High	1
Feasibility *Range: 1-3*	Positive support for the project	High	3
	Neutral support for the project	Moderate	2
	Negative support for the project	Low	1
Population Benefit *Range: 1-4*	Potential to reduce more than 20 casualties	Very High	4
	Potential to reduce 6-20 casualties	High	3
	Potential to reduce 1-5 casualties	Moderate	2
	No potential to reduce casualties	Low	1
Property Benefit *Range: 1-4*	Potential to reduce losses to more than 20 buildings or severe damages to infrastructure	Very High	4
	Potential to reduce losses to 6-20 buildings or substantial damages to infrastructure	High	3
	Potential to reduce losses to 1-5 buildings or slight damages to infrastructure	Moderate	2
	No potential to reduce property losses	Low	1
Values Benefit *Range: 1-3*	Provides significant benefits to economic, ecologic, historic, or social values	High	3
	Provides some benefits to economic, ecologic, historic, or social values	Moderate	2
	No or very little benefit to economic, ecologic, historic, or social values	Low	1
Maintenance *Range: 1-3*	Requires very little or no maintenance	Low	3
	Requires less than 10 hours per year	Moderate	2
	Requires more than 10 hours per year	High	1
Hazard Rating *Range: 1-5*	see Section 4.6	High	5
	see Section 4.6	Moderate-High	4
	see Section 4.6	Moderate	3
	see Section 4.6	Low-Moderate	2
	see Section 4.6	Low	1

The evaluation of each of the projects using these factors follows. Table 5.2B shows the hazards being mitigated by each of the projects.

Table 5.2B Hazards Mitigated by Each Proposed Project

	Agriculture Hazards	Communicable Disease and Bioterrorism	Earthquake	Flood	Hazardous Material Release	Landslide and Sinkhole	Severe Thunderstorm	Summer Weather	Terrorism and Civil Unrest	Transportation Accident	Utility and Communications Failure	Volcanic Ashfall	Water and Air Contamination	Wildfire	Winter Weather
Project 1.1.1: NOAA Weather Radio Transmitter				X	X	X	X	X	X		X	X	X	X	X
Project 1.1.2: NOAA Weather Radio Receivers				X	X	X	X	X	X		X	X	X	X	X
Project 1.1.3: Reverse 911		X		X	X	X	X	X	X		X	X	X	X	X
Project 1.1.4: Warning Siren				X	X	X	X		X				X	X	
Project 1.1.5: Community Shelter			X	X	X	X	X	X	X		X	X	X	X	X
Project 1.1.6: Skywarn Training				X		X	X	X							X
Project 1.1.7: Disaster Supplies Kits		X	X	X	X	X	X	X	X		X	X	X	X	X
Project 1.2.1: Growth Policy	X			X	X	X				X			X	X	
Project 1.2.2: Subdivision Regulations	X			X	X	X				X			X	X	
Project 1.3.1: Generators			X				X	X	X		X	X			X
Project 1.3.2: Railroad Emergency Locations				X	X	X	X		X	X				X	
Project 2.1.1: Landowner Capacity Building														X	
Project 2.2.1: Countywide Fuels Mitigation														X	
Project 2.2.2: FireWise Building Materials and Defensible Space														X	
Project 2.2.3: Road Improvements				X	X					X				X	
Project 2.2.4: Public Lands Fuels Mitigation														X	
Project 2.3.1: Fuels Mapping														X	
Project 2.3.2: Road and Structure Mapping				X	X	X				X				X	X
Project 2.3.3: Insect and Drought Inspection	X	X						X						X	

Table 5.2B Hazards Mitigated by Each Proposed Project (continued)

	Agriculture Hazards	Communicable Disease and Bioterrorism	Earthquake	Flood	Hazardous Material Release	Landslide and Sinkhole	Severe Thunderstorm	Summer Weather	Terrorism and Civil Unrest	Transportation Accident	Utility and Communications Failure	Volcanic Ashfall	Water and Air Contamination	Wildfire	Winter Weather
Project 2.4.1: Basic Wildland Fire Training														X	
Project 2.4.2: Map and Compass Training														X	
Project 2.4.3: Eastern Montana Wildfire Awareness Video														X	
Project 2.5.1: Fire Liaisons														X	
Project 2.5.2: Water Storage														X	
Project 2.5.3: Volunteer Firefighting Reimbursement				X	X		X			X				X	
Project 3.1.1: Electric Infrastructure Protection			X	X			X	X			X	X			X
Project 3.1.2: Culvert Improvements				X											

<u>Project 1.1.1: NOAA Weather Radio Transmitter</u>

- Purchase and install a NOAA Weather Radio Transmitter in Hysham.

Estimated Cost: Moderate-High ($50,000 estimated for transmitter and installation)
Estimated Staff Time: Low (coordinate project)
Estimated Feasibility: High (no limitations)
Estimated Population Benefit: Very High (may trigger personal protective actions)
Estimated Property Benefit: Low (little property benefit)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Low (very little maintenance)
Hazard Rating: High

Project 1.1.2: NOAA Weather Radio Receivers

- Purchase and install NOAA Weather Radios in critical and special needs facilities.
- Educate facility users on the operation of NOAA Weather Radios.
- Provide information on the different types of statements that may be issued over NOAA Weather Radio.
- Regularly test and maintain the radios.
- Encourage the public to purchase NOAA Weather Radios for their homes.

Estimated Cost: Low-Moderate ($1,000, 20 radios at $50 each)
Estimated Staff Time: Moderate (install radios, distribute information)
Estimated Feasibility: High (no limitations)
Estimated Population Benefit: Very High (may trigger personal protective actions)
Estimated Property Benefit: Low (little property benefit)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Moderate (replace batteries in radios)
Hazard Rating: High

Project 1.1.3: Reverse 911

- Purchase and integrate a Reverse 911 system into Enhanced 911.
- Educate the public on the benefits of Reverse 911.
- Periodically test and evaluate the Reverse 911 system.

Estimated Cost: Moderate-High ($35,000 estimated cost for system)
Estimated Staff Time: Low (system training)
Estimated Feasibility: High (no limitations)
Estimated Population Benefit: Very High (may trigger personal protective actions)
Estimated Property Benefit: Low (little property benefit)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Moderate (system testing)
Hazard Rating: High

Project 1.1.4: Warning Siren

- Evaluate and upgrade the warning siren in Hysham.
- Educate the public on the siren tones and the desired personal protective actions.
- Periodically test and evaluate the siren.

Estimated Cost: Moderate ($5,000 estimated system upgrades)
Estimated Staff Time: Moderate (protocol development)
Estimated Feasibility: High (no limitations)
Estimated Population Benefit: Very High (may trigger personal protective actions)
Estimated Property Benefit: Low (little property benefit)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Moderate (system testing)
Hazard Rating: High

Project 1.1.5: Community Shelter

- Construct a facility in Hysham that serves as a community tornado shelter, particularly for those without basements or a sturdy structure to go to, and has a generator to heat and shelter residents, particularly special needs populations, during a power outage.
- Regularly test the facility with tornado drills and generator tests.
- Use the facility for disaster exercises and training during non-emergencies.

Estimated Cost: Moderate-High ($100,000 estimated building and generator costs)
Estimated Staff Time: Moderate (project management and construction oversight)
Estimated Feasibility: High (few limitations)
Estimated Population Benefit: Very High (provides shelter from a variety of hazards)
Estimated Property Benefit: Low (no property benefit)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: High (building maintenance)
Hazard Rating: High

Project 1.1.6: Skywarn Training

- Host National Weather Service Skywarn training at least once every two years.

Estimated Cost: Low (no direct costs)
Estimated Staff Time: Low (project coordination)
Estimated Feasibility: High (no limitations)
Estimated Population Benefit: Very High (may prompt hazard warnings and protective actions)
Estimated Property Benefit: Low (no property benefit)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Low (little maintenance)
Hazard Rating: High

Project 1.1.7: Disaster Supplies Kits

- Conduct a public education program to encourage individuals and businesses to prepare disaster supplies kits.

Estimated Cost: Low (few direct costs)
Estimated Staff Time: Moderate (outreach)
Estimated Feasibility: Moderate (requires public participation)
Estimated Population Benefit: Very High (could provide vital supplies to individuals in a disaster)
Estimated Property Benefit: Low (little property benefit)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Moderate (continued outreach program)
Hazard Rating: High

Project 1.2.1: Growth Policy

- Update the county growth policy to address all hazards and encourage growth in low hazard areas.
- Gather input from first responders and emergency service providers when revising the growth policy.
- Support the needs of first responders and emergency service providers in the growth policy and related documents.

Estimated Cost: Low (few direct costs)
Estimated Staff Time: Moderate (review, discussion, and revisions of policy)
Estimated Feasibility: Moderate (may generate significant public interest)
Estimated Population Benefit: Moderate (may reduce future casualties)
Estimated Property Benefit: High (may prevent future development in hazardous areas)
Estimated Values Benefit: Moderate (may protect ecologic and economic values)
Estimated Maintenance: Moderate (policy reviews and revisions)
Hazard Rating: High

Project 1.2.2: Subdivision Regulations

- Update countywide subdivision regulations to adopt higher minimum standards for subdivisions that improve their all-hazard disaster resistance.
- Gather input and support the needs of first responders and emergency service providers when updating subdivision regulations.
- Support the needs of first responders and emergency service providers in the subdivision regulations and related documents.

Estimated Cost: Low (few direct costs)
Estimated Staff Time: Moderate (review, discussion, and revisions of regulations)
Estimated Feasibility: Moderate (may generate significant public interest)
Estimated Population Benefit: Moderate (may reduce future casualties)
Estimated Property Benefit: High (may prevent future development in hazardous areas)
Estimated Values Benefit: Moderate (may protect ecologic and economic values)
Estimated Maintenance: High (regulations review, changes, and enforcement)
Hazard Rating: High

Project 1.3.1: Generators

- Install emergency generators at critical and special needs facilities.
- Regularly test and maintain generators at the facilities.

Estimated Cost: Moderate-High ($35,000 estimated cost per generator)
Estimated Staff Time: Low (project management)
Estimated Feasibility: High (no limitations)
Estimated Population Benefit: High (may be critical to emergency operations and sheltering)
Estimated Property Benefit: Moderate (may prevent frozen pipes and equipment damage)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Moderate (test and fuel the generators)
Hazard Rating: High

Project 1.3.2: Railroad Emergency Locations

- Encourage Burlington Northern Santa Fe (BNSF) Railroad to provide GPS coordinates for all emergency calls, including fire and ambulance requests.

Estimated Cost: Low (few direct costs)
Estimated Staff Time: Moderate (coordination with the railroad)
Estimated Feasibility: Moderate (requires railroad participation and training)
Estimated Population Benefit: Moderate (may result in faster response times)
Estimated Property Benefit: Moderate (may result in faster response times)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Low (little maintenance)
Hazard Rating: High

Project 2.1.1: Landowner Capacity Building

- Engage landowners in wildfire mitigation, preparedness, and response through a series of meetings throughout the county.
- Familiarize landowners with the local, state, and federal firefighting systems and how they interact.
- Provide basic information and training on wildland firefighting and response.
- Encourage landowners to purchase basic equipment such as radios and water tanks to possibly aid in firefighting efforts once trained.

Estimated Cost: Low (few direct costs, unless equipment is purchased)
Estimated Staff Time: Moderate (meeting coordination)
Estimated Feasibility: Moderate (requires landowner participation)
Estimated Population Benefit: High (may increase firefighter and resident safety)
Estimated Property Benefit: High (may keep a wildfire from spreading)
Estimated Values Benefit: Moderate (may reduce economic losses)
Estimated Maintenance: Moderate (continued outreach and training)
Hazard Rating: High

Project 2.2.1: Countywide Fuels Mitigation

- Form a committee consisting of the US Bureau of Land Management, Montana Department of Natural Resources and Conservation, Treasure County Fire Department, Treasure County Disaster & Emergency Services, Treasure County Commissioners, power companies, landowners, and others to plan fuel reduction projects on a landscape basis.
- Create fuel breaks and reductions in all hazard areas but particularly in high hazard areas such as the Hysham Hills and near homes and ranches.

Estimated Cost: Moderate-High (estimated $1,000 per acre)
Estimated Staff Time: High (project management, working with land managers)
Estimated Feasibility: Moderate (potential environmental impacts)
Estimated Population Benefit: High (may protect people in the wildfire's path)
Estimated Property Benefit: Very High (may prevent a wildfire from burning structures)
Estimated Values Benefit: Moderate (may have some ecologic and economic benefits)
Estimated Maintenance: Moderate (maintaining the fuel breaks from new growth)
Hazard Rating: High

Project 2.2.2: FireWise Building Materials and Defensible Space

- Encourage and provide funding for homeowners in the wildland urban interface to purchase fire resistant building materials and create defensible space from wildfires around their homes and outbuildings using FireWise principles.

Estimated Cost: Moderate (estimated $2,000 per residence)
Estimated Staff Time: High (project management, work with homeowners)
Estimated Feasibility: Moderate (some challenges convincing homeowners)
Estimated Population Benefit: High (may protect people in the wildfire's path)
Estimated Property Benefit: High (may prevent a wildfire from burning structures)
Estimated Values Benefit: Moderate (may have some ecologic and economic benefits)
Estimated Maintenance: Moderate (continued work with homeowners)
Hazard Rating: High

Project 2.2.3: Road Improvements

- Use a county road grader for county and private road improvements that will reduce vehicle sparks and improve access for emergency responders.

Estimated Cost: Low-Moderate (fuel costs)
Estimated Staff Time: High (grader operation)
Estimated Feasibility: High (no limitations)
Estimated Population Benefit: High (may prevent wildfires and allow emergency access)
Estimated Property Benefit: Moderate (may prevent wildfires from burning structures)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Moderate (annual improvements)
Hazard Rating: High

Project 2.2.4: Public Lands Fuels Mitigation

- Continue efforts to eradicate weeds and remove brush from public lands, including Howrey Island and Isaac Homestead.
- Minimize impacts to wildlife and other values.

Estimated Cost: High (estimated $1,000 per acre)
Estimated Staff Time: Low (project coordination)
Estimated Feasibility: Moderate (potential environmental impacts)
Estimated Population Benefit: High (may protect people in the wildfire's path)
Estimated Property Benefit: Moderate (may prevent a wildfire from spreading to structures)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Moderate (maintaining new growth)
Hazard Rating: High

Project 2.3.1: Fuels Mapping

- Create digital files of local fuel types and conditions.
- Use the mapping to better outline the hazard areas and conduct exercises.

Estimated Cost: Moderate ($15,000 for mapping consultant)
Estimated Staff Time: Low (project coordination)
Estimated Feasibility: High (no limitations)
Estimated Population Benefit: Moderate (increased understanding of fire potential)
Estimated Property Benefit: High (may reduce development in hazardous areas)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Moderate (updates as conditions change)
Hazard Rating: High

Project 2.3.2: Road and Structure Mapping

- Improve road mapping (including private roads) and structure locations.
- Put printed copies in emergency response vehicles.

Estimated Cost: Moderate ($15,000 for mapping consultant)
Estimated Staff Time: Low (project coordination)
Estimated Feasibility: High (no limitations)
Estimated Population Benefit: Moderate (may decrease response times)
Estimated Property Benefit: Moderate (may decrease response times)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Moderate (updates as conditions change)
Hazard Rating: High

Project 2.3.3: Insect and Drought Inspection

- Have a state forester inspect trees for insect kill and drought kill.
- Use the information provided for future mitigation projects and response planning.

Estimated Cost: Low (no direct costs)
Estimated Staff Time: Low (project coordination)
Estimated Feasibility: High (no limitations)
Estimated Population Benefit: Moderate (increased understanding of fire potential)
Estimated Property Benefit: Moderate (may lead to more effective wildfire mitigation)
Estimated Values Benefit: Moderate (may lead to ecologic benefits)
Estimated Maintenance: Moderate (updates as conditions change)
Hazard Rating: High

Project 2.4.1: Basic Wildland Fire Training

- Bring in state and federal instructors for basic wildland fire training in Treasure County.

Estimated Cost: Low (no direct costs)
Estimated Staff Time: Low (project coordination)
Estimated Feasibility: High (no limitations)
Estimated Population Benefit: Moderate (may increase firefighter safety)
Estimated Property Benefit: Moderate (may lead to more effective structure protection)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Moderate (continued training)
Hazard Rating: High

Project 2.4.2: Map and Compass Training

- Host Montana Department of Natural Resources and Conservation's Map and Compass Training once every two years.

Estimated Cost: Low (no direct costs)
Estimated Staff Time: Low (project coordination)
Estimated Feasibility: High (no limitations)
Estimated Population Benefit: Moderate (may increase firefighter safety)
Estimated Property Benefit: Moderate (may lead to more effective structure protection)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Moderate (continued training)
Hazard Rating: High

Project 2.4.3: Eastern Montana Wildfire Awareness Video

- Show the Montana Department of Natural Resources and Conservation's Eastern Montana Wildfire Awareness Video at a wide variety of local meetings in Treasure County.

Estimated Cost: Low (no direct costs)
Estimated Staff Time: Moderate (presentation of the video at meetings)
Estimated Feasibility: High (no limitations)
Estimated Population Benefit: Moderate (may increase wildfire awareness)
Estimated Property Benefit: Moderate (may increase wildfire awareness)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Moderate (continued outreach)
Hazard Rating: High

Project 2.5.1: Fire Liaisons

- Identify people in different geographic parts of the county that know the fuels and terrain and can act as liaisons to state and federal firefighting units.
- Train the identified liaisons in basic firefighting terminology and their roles during a wildfire.

Estimated Cost: Low (no direct costs)
Estimated Staff Time: Moderate (liaison training)
Estimated Feasibility: High (no limitations)
Estimated Population Benefit: Moderate (may enhance wildfire safety and response)
Estimated Property Benefit: Moderate (may enhance wildfire safety and response)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Moderate (continued training)
Hazard Rating: High

Project 2.5.2: Water Storage

- Pre-identify locations of water storage such as stock ponds that could be used during a wildfire.
- Draft agreements with landowners for using that water to suppress wildfires.
- Gather GPS coordinates of the water supply locations.
- Develop a system to replenish the water used in the firefighting efforts.

Estimated Cost: Low (no direct costs)
Estimated Staff Time: Moderate (project coordination)
Estimated Feasibility: Moderate (requires landowner participation)
Estimated Population Benefit: Moderate (may enhance wildfire suppression efforts)
Estimated Property Benefit: Moderate (may enhance wildfire suppression efforts)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Low (little maintenance)
Hazard Rating: High

Project 2.5.3: Volunteer Firefighting Reimbursement

- Develop a better pay or incentive system for local wildland firefighters to fight the fires.
- Discuss alternatives with other rural counties and volunteer fire departments.

Estimated Cost: Moderate (could require financial resources)
Estimated Staff Time: High (project coordination)
Estimated Feasibility: High (no limitations)
Estimated Population Benefit: Moderate (may enhance wildfire suppression efforts)
Estimated Property Benefit: Moderate (may enhance wildfire suppression efforts)
Estimated Values Benefit: Low (little benefit to values)
Estimated Maintenance: Low (little maintenance)
Hazard Rating: High

Project 3.1.1: Electric Infrastructure Protection

- Upgrade and maintain the electric distribution and transmission system for snow and wind resistance.
- Upgrade and maintain the electric utility's river crossing structures.

Estimated Cost: High (could require significant financial resources)
Estimated Staff Time: Low (coordination with the electric companies)
Estimated Feasibility: High (no limitations)
Estimated Population Benefit: High (may protect electric infrastructure)
Estimated Property Benefit: High (may protect electric infrastructure)
Estimated Values Benefit: High (may have significant economic benefits)
Estimated Maintenance: Low (little maintenance)
Hazard Rating: High

Project 3.1.2: Culvert Improvements

- Evaluate culverts throughout the county for flood capacities.
- Replace hazardous culverts in flood prone areas.
- Identify locations for new culvert installations.
- Maintain culvert capacities by regularly clearing the culverts of debris.

Estimated Cost: Moderate (depends on extent of road and culvert improvements)
Estimated Staff Time: High (road construction and culvert maintenance)
Estimated Feasibility: High (few limitations)
Estimated Population Benefit: Moderate (may prevent road washouts and associated casualties)
Estimated Property Benefit: High (may prevent damages to road infrastructure)
Estimated Values Benefit: Moderate (may have some economic and commerce benefits)
Estimated Maintenance: Moderate (continued culvert maintenance)
Hazard Rating: Moderate

Table 5.2C summarizes the scoring for each project.

Table 5.2C Mitigation Project Scores

	Cost	Staff Time	Feasibility	Population Benefit	Property Benefit	Values Benefit	Maintenance	Hazard Rating	TOTAL SCORE
Project 1.1.1: NOAA Weather Radio Transmitter	2	3	3	4	1	1	3	5	22
Project 1.1.2: NOAA Weather Radio Receivers	4	2	3	4	1	1	2	5	22
Project 1.1.3: Reverse 911	2	3	3	4	1	1	2	5	21
Project 1.1.4: Warning Siren	3	2	3	4	1	1	2	5	21
Project 1.1.5: Community Shelter	2	2	3	4	1	1	1	5	19
Project 1.1.6: Skywarn Training	5	3	3	4	1	1	3	5	25
Project 1.1.7: Disaster Supplies Kits	5	2	2	4	1	1	2	5	22
Project 1.2.1: Growth Policy	5	2	2	2	3	2	2	5	23
Project 1.2.2: Subdivision Regulations	5	2	2	2	3	2	1	5	22
Project 1.3.1: Generators	2	3	3	3	2	1	2	5	21
Project 1.3.2: Railroad Emergency Locations	5	2	2	2	2	1	3	5	22
Project 2.1.1: Landowner Capacity Building	5	2	2	3	3	2	2	5	24
Project 2.2.1: Countywide Fuels Mitigation	2	1	2	3	4	2	2	5	21
Project 2.2.2: FireWise Building Materials and Defensible Space	3	1	2	3	3	2	2	5	21
Project 2.2.3: Road Improvements	4	1	3	3	2	1	2	5	21
Project 2.2.4: Public Lands Fuels Mitigation	1	3	2	3	2	1	2	5	19
Project 2.3.1: Fuels Mapping	3	3	3	2	3	1	2	5	22
Project 2.3.2: Road and Structure Mapping	3	3	3	2	2	1	2	5	21
Project 2.3.3: Insect and Drought Inspection	5	3	3	2	2	2	2	5	24
Project 2.4.1: Basic Wildland Fire Training	5	3	3	2	2	1	2	5	23
Project 2.4.2: Map and Compass Training	5	3	3	2	2	1	2	5	23
Project 2.4.3: Eastern Montana Wildfire Awareness Video	5	2	3	2	2	1	2	5	22
Project 2.5.1: Fire Liaisons	5	2	3	2	2	1	2	5	22
Project 2.5.2: Water Storage	5	2	2	2	2	1	3	5	22
Project 2.5.3: Volunteer Firefighting Reimbursement	3	1	3	2	2	1	3	5	20
Project 3.1.1: Electric Infrastructure Protection	1	3	3	3	3	3	3	5	24
Project 3.1.2: Culvert Improvements	3	1	3	2	3	2	2	3	19

5.3 Funding Sources

Funding for mitigation projects exists from a multitude of sources. Some sources may be specifically designed for disaster mitigation activities, while others may have another overarching purpose that certain mitigation activities may qualify for. Most mitigation funding sources are recurring through legislation or government support. Some, however, may be from an isolated instance of financial support. Whenever possible, creative financing is encouraged. Often, additional funding sources are found through working with other agencies and businesses to identify common or complementary goals and objectives. Table 5.3A shows the programs available to Treasure County and the Town of Hysham directly or as a sub-applicant of the state. The traditional, all-hazard and wildfire mitigation programs are shown in bold.

Table 5.3A Mitigation Funding Sources

Name	Description	Managing Agencies
AmeriCorps	Provides funding for volunteers to serve communities, including disaster prevention.	▪ Corporation for National & Community Service
Assistance to Firefighters Grants	Provides funding for fire prevention and safety activities and firefighting equipment and vehicles.	▪ US Department of Homeland Security
Clean Water Act Section 319 Grants	Provides grants for a wide variety of activities related to non-point source pollution runoff mitigation.	▪ US Environmental Protection Agency
Community Development Block Grant (CDBG)	Provides funding for sustainable community development, including disaster mitigation projects.	▪ US Housing and Urban Development
Community Facilities Grant Program	Provides assistance to rural areas and towns to construct, enlarge, or improve essential community facilities and purchase equipment.	▪ US Department of Agriculture, Rural Development
Economic Development Administration (EDA) Grants and Investments	Invests and provides grants for community construction projects, including mitigation activities.	▪ US Economic Development Administration

Table 5.3A Mitigation Funding Sources (continued)

Name	Description	Managing Agencies
Emergency Watershed Protection	Provides funding and technical assistance for emergency measures such as floodplain easements in impaired watersheds.	▪ US Natural Resources Conservation Service
Environmental Quality Incentives Program	Provides funding and technical assistance to farmers and ranchers to promote agricultural production and environmental quality as compatible goals.	▪ US Natural Resources Conservation Service
Federal Excess Personal Property (FEPP) Program	Makes long-term loans of federal firefighting equipment from the US Forest Service.	▪ Montana Department of Natural Resources and Conservation ▪ US Forest Service
Firefighting Property Program	Provides excess US Department of Defense equipment for firefighting purposes.	▪ Montana Department of Natural Resources and Conservation ▪ US Department of Defense
Fireman's Fund Heritage Program	Provides funding for equipment, fire prevention tools, firefighter training, fire safety education, and community emergency response programs.	▪ Fireman's Fund Insurance Company
Flood Mitigation Assistance Program (FMA)	Provides pre-disaster flood mitigation funding (with priority for repetitive flood loss properties under the National Flood Insurance Program).	▪ Montana Department of Natural Resources and Conservation ▪ FEMA – Region VIII
Forest Land Enhancement Program (FLEP)	Promotes sustainable forest management practices on non-industrial private forest lands suitable for growing trees.	▪ Montana Department of Natural Resources and Conservation ▪ US Forest Service
Hazard Mitigation Grant Program (HMGP)	Provides post-disaster mitigation funding.	▪ Montana Disaster & Emergency Services ▪ FEMA – Region VIII

Table 5.3A Mitigation Funding Sources (continued)

Name	Description	Managing Agencies
Hazardous Fuels Mitigation Program	Provides funding for the reduction of hazardous wildland fuels.	▪ US Bureau of Land Management
Hazardous Materials Planning and Training Grants	Provides funding for planning and training for hazardous materials releases.	▪ Montana Disaster & Emergency Services
Homeland Security Grants	Through multiple grants, provides funding for homeland security activities. Some projects can be considered mitigation.	▪ Montana Disaster & Emergency Services ▪ US Department of Justice ▪ US Department of Homeland Security
Housing and Urban Development (HUD) Grants	Provides a number of grants related to safe housing initiatives.	▪ US Housing and Urban Development
Individual Assistance (IA)	Following a disaster, funds can be used to mitigate hazards when repairing individual and family homes.	▪ Montana Disaster & Emergency Services ▪ FEMA – Region VIII
Map Modernization Program	Provides funding to establish or update floodplain mapping.	▪ Montana Department of Natural Resources and Conservation ▪ FEMA – Region VIII
National Fire Plan (NFP)	Provides funding for pre-disaster wildfire mitigation.	▪ Montana Department of Natural Resources and Conservation ▪ US Forest Service
National Wildlife Wetland Refuge System	Provides funding for the acquisition of lands into the federal wildlife refuge system.	▪ US Fish, Wildlife, & Parks
North American Wetland Conservation Fund	Provides funding for wetland conservation projects.	▪ US Fish, Wildlife, & Parks
NRCS Conservation Programs	Provides funding through a number of programs for the conservation of natural resources.	▪ US Natural Resources Conservation Service

Table 5.3A Mitigation Funding Sources (continued)

Name	Description	Managing Agencies
Partners for Fish and Wildlife	Provides financial and technical assistance to landowners for wetland restoration projects in "Focus Areas" of the state.	▪ US Fish, Wildlife & Parks
PPL Montana Community Fund	Provides grants to Montana organizations in the areas of education, environment, and economic development.	▪ PPL Montana
Pre-Disaster Mitigation Competitive Grants (PDMC)	Provides grants through a competitive process for specific mitigation projects, including planning.	▪ Montana Disaster & Emergency Services ▪ FEMA – Region VIII
Public Assistance (PA)	Following a disaster, funds can be used to mitigate hazards when repairing damages to public structures or infrastructure.	▪ Montana Disaster & Emergency Services ▪ FEMA – Region VIII
Ready Reserve Program	Provides funding for basic and advanced wildland firefighter training.	▪ US Bureau of Land Management
Reclamation and Development Grants Program	Provides funding from the interest income of the Resource Indemnity Trust Fund to local governments for dam safety and other water related projects.	▪ Montana Department of Natural Resources and Conservation
Renewable Resource Development Grant	Provides funding to protect, conserve, or develop renewable resources, including water.	▪ Montana Department of Natural Resources and Conservation
Rural Development Grants	Provides grants and loans for infrastructure and public safety development and enhancement in rural areas.	▪ US Department of Agriculture, Rural Development
Rural Fire Assistance Grant (RFA)	Funds fire mitigation activities in rural communities.	▪ National Interagency Fire Center

Table 5.3A Mitigation Funding Sources (continued)

Name	Description	Managing Agencies
SBA Pre-Disaster Mitigation Loan Program	Provides low-interest loans to small businesses for mitigation projects.	▪ US Small Business Administration (SBA)
Small Flood Control Projects	Authority of USACE to construct small flood control projects.	▪ US Army Corps of Engineers (USACE)
Streambank & Shoreline Protection	Authority of USACE to construct streambank stabilization projects.	▪ US Army Corps of Engineers (USACE)
Volunteer Fire Assistance Grant (VFA)	Provides assistance to organize, train, and equip rural and volunteer fire departments to prevent and suppress fires.	▪ Montana Department of Natural Resources and Conservation ▪ US Forest Service
Wetland Program Development Grants (WPDGs)	Provides funding for studies related to water pollution prevention.	▪ US Environmental Protection Agency

This list of potential funding sources is certainly not all inclusive. Many opportunities for mitigation funding exist both in the public and private sectors such as foundations and philanthropic organizations.

5.4 Implementation Process

A critical component of any mitigation program is the implementation of the mitigation projects. In Section 5.2, the proposed actions were scored based on a variety of factors. Table 5.4A shows the prioritized projects by score.

Table 5.4A Prioritized Mitigation Actions

	Cost	Staff Time	Feasibility	Population Benefit	Property Benefit	Values Benefit	Maintenance	Hazard Rating	TOTAL SCORE
Project 1.1.6: Skywarn Training	5	3	3	4	1	1	3	5	25
Project 2.1.1: Landowner Capacity Building	5	2	2	3	3	2	2	5	24
Project 2.3.3: Insect and Drought Inspection	5	3	3	2	2	2	2	5	24
Project 3.1.1: Electric Infrastructure Protection	1	3	3	3	3	3	3	5	24
Project 1.2.1: Growth Policy	5	2	2	2	3	2	2	5	23
Project 2.4.1: Basic Wildland Fire Training	5	3	3	2	2	1	2	5	23
Project 2.4.2: Map and Compass Training	5	3	3	2	2	1	2	5	23
Project 1.1.1: NOAA Weather Radio Transmitter	2	3	3	4	1	1	3	5	22
Project 1.1.2: NOAA Weather Radio Receivers	4	2	3	4	1	1	2	5	22
Project 1.1.7: Disaster Supplies Kits	5	2	2	4	1	1	2	5	22
Project 1.2.2: Subdivision Regulations	5	2	2	2	3	2	1	5	22
Project 1.3.2: Railroad Emergency Locations	5	2	2	2	2	1	3	5	22
Project 2.3.1: Fuels Mapping	3	3	3	2	3	1	2	5	22
Project 2.4.3: Eastern Montana Wildfire Awareness Video	5	2	3	2	2	1	2	5	22
Project 2.5.1: Fire Liaisons	5	2	3	2	2	1	2	5	22
Project 2.5.2: Water Storage	5	2	2	2	2	1	3	5	22
Project 1.1.3: Reverse 911	2	3	3	4	1	1	2	5	21
Project 1.1.4: Warning Siren	3	2	3	4	1	1	2	5	21
Project 1.3.1: Generators	2	3	3	3	2	1	2	5	21
Project 2.2.1: Countywide Fuels Mitigation	2	1	2	3	4	2	2	5	21
Project 2.2.2: FireWise Building Materials and Defensible Space	3	1	2	3	3	2	2	5	21
Project 2.2.3: Road Improvements	4	1	3	3	2	1	2	5	21
Project 2.3.2: Road and Structure Mapping	3	3	3	2	2	1	2	5	21
Project 2.5.3: Volunteer Firefighting Reimbursement	3	1	3	2	2	1	3	5	20
Project 1.1.5: Community Shelter	2	2	3	4	1	1	1	5	19
Project 2.2.4: Public Lands Fuels Mitigation	1	3	2	3	2	1	2	5	19
Project 3.1.2: Culvert Improvements	3	1	3	2	3	2	2	3	19

The proposed and prioritized projects are shown in Table 5.4B with the associated responsible stakeholders and potential funding sources followed by the estimated implementation schedule in Table 5.4C.

Table 5.4B Implementation Scheme for Mitigation Actions

Project ***Jurisdiction***	**Responsible Stakeholder(s)**	**Potential Funding**	**Score**
Project 1.1.6: Skywarn Training *Treasure County* *Town of Hysham*	Treasure County LEPC Treasure County DES National Weather Service	NWS Staff Time	25
Project 2.1.1: Landowner Capacity Building *Treasure County*	Treasure County Fire Dept. Montana DNRC Bureau of Land Management	DNRC BLM Staff Time	24
Project 2.3.3: Insect and Drought Inspection *Treasure County*	Treasure County Fire Dept. Montana DNRC Bureau of Land Management	DNRC BLM Staff Time	24
Project 3.1.1: Electric Infrastructure Protection *Treasure County* *Town of Hysham*	Electric Companies Treasure County LEPC Treasure County DES	FEMA PDMC FEMA HMGP	24
Project 1.2.1: Growth Policy *Treasure County*	County Commissioners Treasure County LEPC	Staff Time	23
Project 2.4.1: Basic Wildland Fire Training *Treasure County* *Town of Hysham*	Treasure County Fire Dept. Montana DNRC Bureau of Land Management	DNRC BLM Staff Time	23
Project 2.4.2: Map and Compass Training *Treasure County* *Town of Hysham*	Treasure County Fire Dept. Montana DNRC Bureau of Land Management	DNRC Staff Time	23
Project 1.1.1: NOAA Weather Radio Transmitter *Treasure County* *Town of Hysham*	Treasure County LEPC Treasure County DES National Weather Service	NWS Fundraising	22
Project 1.1.2: NOAA Weather Radio Receivers *Treasure County* *Town of Hysham*	Treasure County LEPC Treasure County DES National Weather Service	NWS Fundraising	22
Project 1.1.7: Disaster Supplies Kits *Treasure County* *Town of Hysham*	Treasure County LEPC Treasure County DES	Staff Time	22
Project 1.2.2: Subdivision Regulations *Treasure County*	County Commissioners Treasure County LEPC	Staff Time	22
Project 1.3.2: Railroad Emergency Locations *Treasure County* *Town of Hysham*	Burlington Northern Santa Fe Treasure County LEPC Treasure County Fire Dept. Treasure County EMS Rosebud/Treasure 911 Dispatch	Staff Time	22
Project 2.3.1: Fuels Mapping *Treasure County* *Town of Hysham*	Treasure County Fire Dept. Montana DNRC Bureau of Land Management	DNRC BLM Staff Time	22

Table 5.4B Implementation Scheme for Mitigation Actions (continued)

Project ***Jurisdiction***	**Responsible Stakeholder(s)**	**Potential Funding**	**Score**
Project 2.4.3: Eastern Montana Wildfire Awareness Video *Treasure County* *Town of Hysham*	Treasure County Fire Dept. Montana DNRC Bureau of Land Management	DNRC Staff Time	22
Project 2.5.1: Fire Liaisons *Treasure County*	Treasure County Fire Dept. Montana DNRC Bureau of Land Management	DNRC BLM Staff Time	22
Project 2.5.2: Water Storage *Treasure County*	Treasure County Fire Dept. Montana DNRC Bureau of Land Management	DNRC BLM Staff Time	22
Project 1.1.3: Reverse 911 *Treasure County* *Town of Hysham*	Treasure County LEPC Rosebud/Treasure 911 Dispatch	County Budget Town Budget	21
Project 1.1.4: Warning Siren *Town of Hysham*	Treasure County LEPC Treasure County DES	Town Budget	21
Project 1.3.1: Generators *Treasure County* *Town of Hysham*	Treasure County LEPC Treasure County DES County Commissioners Hysham Town Council Facility Managers	County Budget Town Budget	21
Project 2.2.1: Countywide Fuels Mitigation *Treasure County* *Town of Hysham*	Treasure County Fire Dept. Montana DNRC Bureau of Land Management	DNRC BLM Staff Time	21
Project 2.2.2: FireWise Building Materials and Defensible Space *Treasure County* *Town of Hysham*	Treasure County Fire Dept. Montana DNRC Bureau of Land Management	DNRC BLM Staff Time	21
Project 2.2.3: Road Improvements *Treasure County*	Treasure County Fire Dept. County Commissioners	County Budget	21
Project 2.3.2: Road and Structure Mapping *Treasure County* *Town of Hysham*	Treasure County LEPC Treasure County DES Rosebud/Treasure 911 Dispatch County Commissioners Hysham Town Council	County Budget Town Budget	21
Project 2.5.3: Volunteer Firefighting Reimbursement *Treasure County* *Town of Hysham*	Treasure County Fire Dept. County Commissioners Hysham Town Council	County Budget Town Budget	20
Project 1.1.5: Community Shelter *Town of Hysham*	Treasure County LEPC Treasure County DES Hysham Town Council	FEMA PDMC FEMA HMGP Town Budget	19
Project 2.2.4: Public Lands Fuels Mitigation *Treasure County*	Montana DNRC Montana Fish, Wildlife & Parks Bureau of Land Management	DNRC FWP BLM	19
Project 3.1.2: Culvert Improvements *Treasure County* *Town of Hysham*	County Commissioners Hysham Town Council	FEMA PDMC FEMA HMGP County Budget Town Budget	19

Table 5.4C Project Implementation Schedule

Project	Project Initiation	Projected Completion	Possible Grant Application
Project 1.1.6: Skywarn Training	May 2007	Ongoing	
Project 2.1.1: Landowner Capacity Building	May 2007	Ongoing	
Project 2.3.3: Insect and Drought Inspection	May 2007	Ongoing	
Project 1.2.1: Growth Policy	May 2007	May 2008	
Project 1.3.2: Railroad Emergency Locations	May 2007	May 2008	
Project 2.4.3: Eastern Montana Wildfire Awareness Video	May 2007	September 2007	
Project 2.2.4: Public Lands Fuels Mitigation	May 2007	Ongoing	
Project 1.1.1: NOAA Weather Radio Transmitter	September 2007	September 2008	
Project 1.1.7: Disaster Supplies Kits	September 2007	Ongoing	
Project 1.1.4: Warning Siren	September 2007	September 2008	
Project 3.1.1: Electric Infrastructure Protection	November 2007	November 2009	2008 PDMC
Project 2.3.1: Fuels Mapping	January 2008	January 2009	2008 Federal and State WUI Grants
Project 2.2.1: Countywide Fuels Mitigation	January 2008	Ongoing	2008 Federal and State WUI Grants
Project 2.5.2: Water Storage	January 2008	June 2008	2008 Federal and State WUI Grants
Project 2.5.3: Volunteer Firefighting Reimbursement	January 2008	May 2008	
Project 2.4.1: Basic Wildland Fire Training	March 2008	Ongoing	
Project 2.4.2: Map and Compass Training	March 2008	Ongoing	
Project 2.5.1: Fire Liaisons	March 2008	Ongoing	
Project 1.2.2: Subdivision Regulations	May 2008	May 2009	
Project 1.1.2: NOAA Weather Radio Receivers	September 2008	September 2009	
Project 1.1.3: Reverse 911	September 2008	September 2009	
Project 1.1.5: Community Shelter	November 2008	November 2010	2009 PDMC
Project 2.2.2: FireWise Building Materials and Defensible Space	January 2009	January 2010	2009 Federal and State WUI Grants
Project 2.3.2: Road and Structure Mapping	January 2009	Ongoing	
Project 2.2.3: Road Improvements	March 2009	Ongoing	
Project 1.3.1: Generators	September 2009	September 2010	
Project 3.1.2: Culvert Improvements	November 2009	November 2011	2010 PDMC

5.5 Existing Planning Mechanisms and Capabilities

Treasure County is a rural county in Montana that is experiencing little, if any, growth. In fact, the county lost the greatest percentage of population statewide (21%) from 2000-2006. Given that Treasure County is not experiencing growth, it has great potential for disaster mitigation, if and when growth does occur. Its current population and tax base, however, limit the number of resources that can be devoted to mitigation, or even planning for that matter. Local government is run by a handful of people, most part-time. County government consists of three county commissioners and the Town of Hysham is governed by a mayor and a town council. Emergency management is coordinated by one quarter-time position. The fire department and ambulance are run entirely by volunteers. Law enforcement consists of a sheriff, undersheriff, and six reserve officers. The county has a small volunteer planning board. These limited resources, although effective for a rural county, do not allow for many activities beyond the standard course of business; the time that can be devoted to disaster mitigation is limited. Treasure County does have an active Local Emergency Planning Committee, with representatives from many agencies, which meets monthly to discuss emergency management and planning issues. Otherwise, very few planning mechanisms exist and most planning issues are handled by the local elected officials or the planning board. Table 5.5A lists the existing local plans and development mechanisms.

Table 5.5A Existing Local Plans and Development Mechanisms

Plan Name	Date
Treasure County Comprehensive Development Plan/Growth Policy	September 2003
Treasure County Emergency Operations Plan	2005
Treasure County Planning Data Book and Comprehensive Plan	1979
Treasure County Subdivision Regulations	April 2004

As Treasure County and the Town of Hysham develop new plans, such as Capital Improvements Plans, and existing plans are updated, the new plans and updates will utilize the hazard information and projects identified here for consideration and inclusion. Given that very few planning mechanisms exist in Treasure County or Hysham, the information in this mitigation plan will be valuable for future planning efforts. Table 5.5B shows examples of projects and how they can be incorporated into existing and future planning documents.

Table 5.5B Incorporation into Existing and Future Plans

Existing or Anticipated Plan	Mitigation Strategies	Estimated Revision or Creation Date
Town of Hysham Capital Improvements Plan	▪ Purchase and install a NOAA Weather Radio Transmitter in Hysham. ▪ Evaluate and upgrade the warning siren in Hysham. ▪ Construct a facility in Hysham that serves as a community shelter. ▪ Install emergency generators at critical and special needs facilities. ▪ Replace hazardous culverts in flood prone areas.	The development of this plan is currently not anticipated.
Treasure County Capital Improvements Plan	▪ Purchase and install a NOAA Weather Radio Transmitter in Hysham. ▪ Install emergency generators at critical and special needs facilities. ▪ Use a county road grader for county and private road improvements. ▪ Replace hazardous culverts in flood prone areas.	The development of this plan is currently not anticipated.
Treasure County Emergency Operations Plan	▪ Purchase and install a NOAA Weather Radio Transmitter in Hysham. ▪ Purchase and install NOAA Weather Radios in critical and special needs facilities. ▪ Purchase and integrate a Reverse 911 system into Enhanced 911. ▪ Evaluate and upgrade the warning siren in Hysham. ▪ Host National Weather Service Skywarn training at least once every two years. ▪ Conduct a public education program to encourage individuals and businesses to prepare disaster supplies kits. ▪ Identify people in different geographic parts of the county that know the fuels and terrain and can act as liaisons to state and federal firefighting units. ▪ Pre-identify locations of water storage such as stock ponds that could be used during a wildfire.	An update of this plan is currently not anticipated.

Table 5.5B Incorporation into Existing and Future Plans (continued)

Existing or Anticipated Plan	Mitigation Strategies	Estimated Revision or Creation Date
Treasure County Growth Policy	▪ Update the county growth policy to address all hazards and encourage growth in low hazard areas. ▪ Gather input from first responders and emergency service providers when revising the growth policy.	May 2008
Treasure County Subdivision Regulations	▪ Update countywide subdivision regulations to adopt higher minimum standards for subdivisions that improve their all-hazard disaster resistance. ▪ Gather input and support the needs of first responders and emergency service providers when updating subdivision regulations.	May 2009

6. PLAN MAINTENANCE PROCEDURES

An important aspect of any useable plan is the maintenance and upkeep of the document. To facilitate and ensure the plan will remain viable for Treasure County and the Town of Hysham for many years, the plan maintenance responsibilities lie with the Treasure County Local Emergency Planning Committee. This committee meets monthly on the third Thursday of each month and is responsible for coordinating emergency planning issues for the county and town. Given the broad representation of agencies, including members from Treasure County and the Town of Hysham, this committee is a good fit, has many members that participated in the initial plan development, and eliminates the need for an additional committee.

6.1 Plan Monitoring

The plan will be monitored by the Treasure County Local Emergency Planning Committee. This committee meets monthly, however, the committee will formally discuss mitigation progress quarterly during the January, April, July, and October meetings. The status of projects will be reported on and new projects will be initiated during this time. Annually, in January, a "Mitigation Year in Review" meeting will be done as part of the regular meeting. At this meeting, a list of projects completed during the previous calendar year will be documented and put in Appendix I.

6.2 Plan Evaluation

The evaluation of the plan will be conducted by the Treasure County Local Emergency Planning Committee annually at their January "Mitigation Year in Review" meeting. At this meeting, the methods of implementing and maintaining the plan will be evaluated for successes and improvements. Changes to the implementation schedule will be made as needed to ensure hazard mitigation activities continue. New stakeholders and interested parties will be identified and invited to participate in the implementation process. Should a hazard event have occurred during the previous year in which a mitigation project was a factor, either positive or negative, a summary report, including avoided losses, will be written and included in Appendix I.

6.3 Plan Updates

As disasters occur, projects are completed, and hazard information is improved, the Treasure County Pre-Disaster Mitigation Plan and Community Wildfire Protection Plan will need to be updated. To remain an approved plan, an updated plan must be submitted to Montana Disaster and Emergency Services, the Federal Emergency Management Agency, Montana Department of Natural Resources and Conservation, and the US Bureau of Land Management every five years. The next formal submission is required in May 2012. To facilitate the update process, annual updates

to the plan during the April LEPC meeting are recommended. Table 6.3A shows the schedule of plan updates.

Table 6.3A Schedule of Plan Updates

Plan Section	Post-Disaster	Annually	Every 5 Years
Adoption Documentation	X	X	X
Introduction			X
Planning Process	X	X	X
Hazard Identification	X		X
Critical Facilities			X
Structures			X
Infrastructure			X
Population			X
Economic, Ecologic, Historic, and Social Values			X
Land Use and Future Development			X
Vulnerability Assessment Methodology			X
Hazard Profiles	X	X	X
Risk Assessment Summary			X
Goals, Objectives, and Proposed Actions	X	X	X
Action Prioritization	X	X	X
Funding Sources			X
Implementation Process	X	X	X
Existing Planning Mechanisms and Capabilities	X	X	X
Plan Maintenance Procedures			X
Appendices	X	X	X

6.4 Public Involvement

The public is invited to attend the April Treasure County Local Emergency Planning Committee meeting each year on the third Thursday of April to provide input on the Treasure County Pre-Disaster Mitigation Plan and Community Wildfire Protection Plan. In an effort to solicit involvement, a press release will be distributed to the Hysham Echo newspaper prior to the April meeting, encouraging the public to attend. Year round, written comments may also be submitted to the Local Emergency Planning Committee at:

Treasure County DES/LEPC
PO Box 326
Hysham, MT 59038

Stakeholders not involved in the regular meetings will be invited and are encouraged to participate in the January “Mitigation Year in Review” meeting and the April plan update meeting.

Appendix A. INVITED STAKEHOLDERS

Table A1. Invited Stakeholders

Name	Organization
	American Red Cross
Pam Shrauger	Big Sky Hazard Management LLC
	Farmers Union Oil Company
Judi Knapp	Mid-Yellowstone Electric Cooperative Treasure County Conservation District
Ted Church	Mid-Yellowstone Electric Cooperative
Darrell Kurk	Montana Department of Natural Resources and Conservation
Richard Moore	Montana Department of Natural Resources and Conservation
Jay McPhail	Montana Department of Transportation
Tom Gilreath	Montana Department of Transportation
Charlie Hanson	Montana Disaster and Emergency Services
Kent Atwood	Montana Disaster and Emergency Services
	Montana Fish, Wildlife and Parks
Cal Schock	Montana Highway Patrol
Tom Frieders	National Weather Service
	Pelican/Home Oil Company
	Range Telephone
George Haines	Retired Rancher
	Salvation Army
Larry Fink	Town of Hysham Mayor Hysham Schools
Carol Gamble	Treasure County / Rosebud County 911 Dispatch Treasure County Health Board Grocery Store Owner
Noelle Pinkerton	Treasure County Ambulance
Ruth Baker	Treasure County Clerk and Recorder
Doug Hollowell	Treasure County Commission
Mack Cole	Treasure County Commission
Marlo Moehr	Treasure County Commission
Pat Zent	Treasure County Disaster and Emergency Services
Steve Wilkins	Treasure County Disaster and Emergency Services Treasure County Fire Department Treasure County Ambulance Treasure County Sheriff's Office
Lee Ward	Treasure County Fire Department PV Ranch
Leo Cunningham	Treasure County Fire Department Montana Department of Transportation
Travis Gamble	Treasure County Fire Department Treasure County Ambulance Treasure County Recreation Board Treasure County Sheriff's Office
Dan Story	Treasure County Fire Department Treasure County Ambulance
Yvonne Story	Treasure County Fire Department Accountant

Table A1. Invited Stakeholders (continued)

Name	Organization
Joan Cunningham	Treasure County Health Board
Jackie Zent	Treasure County Health Board
Deb French	Treasure County Health Department
Diann Grierson	Treasure County Health Nurse Bed and Breakfast Owner
J.R. Grierson	Treasure County Health Officer Physician
Ina Haines	Treasure County Planning Board
Gary Arneson	Treasure County Road Department
Wayne A. Robison	Treasure County Sheriff Treasure County Fire Department Treasure County Ambulance Treasure County Coroner
Erin Dellera	Treasure County Sheriff's Office
Jennifer Cramer	Treasure County Weed Coordinator Treasure County Animal Control SMEDL Representative
Dena Lang	US Bureau of Land Management
Eric Lepisto	US Bureau of Land Management
Gloria Gunther	US Bureau of Land Management
Irvin Leach	US Bureau of Land Management
Mike Ford	US Bureau of Land Management
Paul Mock	US Forest Service
Dan Devany, Jr.	Yellowstone Irrigation District

Appendix B. PUBLIC INFORMATION DOCUMENTATION

Public information was sent to the Hysham Echo. Each of the news releases and paid advertisements follow.

PRESS RELEASE

For Immediate Release (February, 6, 2006)

Contact: Pam Shrauger
Big Sky Hazard Management LLC
406-581-4512

OR Steven Wilkins
Treasure County Disaster & Emergency Services
406-342-5485

Planning to Prevent Disasters

Did you watch the aftermath of Hurricane Katrina and wonder – could a disaster of that magnitude affect my hometown? Are we doing all we can to prevent such tragedies? What about the wildfires in Oklahoma and Texas? Could that happen here? Residents of Treasure County now have the opportunity to explore the possible disaster scenarios and take part in preventing them. Two new plans, a Pre-Disaster Mitigation Plan and a Community Wildfire Protection Plan, will do just that. The Pre-Disaster Mitigation Plan identifies the major hazards threatening the communities and the values at risk. Based on this assessment, projects ranging from education programs to infrastructure repairs to home relocations are identified as possible solutions to prevent future losses. The Community Wildfire Protection Plan does the same but goes into more detail in addressing the wildfire hazard. Once adopted, these plans will make the county eligible for future grant funds and additional assistance following a disaster.

"We can't do this without the help of our residents," says Steven Wilkins, the Treasure County Disaster and Emergency Services Coordinator. "We want plans that are locally driven and useful, not something to stick on a shelf." The first of four workshops designed to involve the public and local officials in the planning process is scheduled for Thursday, February 23rd from 9:30-11:00 a.m. at the Community Center, 307 Rapelje, Hysham. These workshops are being held in conjunction with the Local Emergency Planning Committee meeting and will be facilitated by Big Sky Hazard Management LLC, an emergency management planning firm based in Bozeman hired to coordinate the plan's development. If you cannot attend the workshop, but would still like to be involved, please contact Pam Shrauger at 406-581-4512.

##

Want to make Treasure County SAFER?
Want to learn more about disasters?

Join us: Thursday, Feb. 23 from 9:30am-11am
Community Center, Hysham

Pre-Disaster Mitigation Kick-off Workshop
Community Wildfire Protection Plan Workshop
…preventing disasters in our hometowns…

For more information, please call 406-581-4512.
www.bigskyhazards.com

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The Hysham Echo, May 11, 2006, Page 5

PRESS RELEASE

For Immediate Release (September 6, 2006)

Contact: Pam Shrauger
Big Sky Hazard Management LLC
406-581-4512

Community Wildfire Protection Plan

As wildfires continue to burn across the state, the importance of planning for disasters becomes especially important. Much can be done before a disastrous wildfire occurs to prevent the potential losses to life and property. That's what the Treasure County Community Wildfire Protection Plan is all about. Where are our hazard areas, how bad can it get, and what can we do now to reduce the long-term risk? Those are some of the topics to be addressed by this plan, now in its initial stages. The public is invited to participate in this plan's development. A meeting will be held Tuesday, October 3 at 9 a.m. in the Community Center. Please call Pam Shrauger of Big Sky Hazard Management LLC, hired to facilitate the planning process, at 406-581-4512 with any questions.

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The Hysham Echo, March 9, 2007, Page 1

The Hysham Echo, March 9, 2007, Page 5

The Hysham Echo, March 30, 2007, Page 1

The Hysham Echo, March 30, 2007, Page 8

Appendix C. MEETING ATTENDANCE RECORDS

Appendix D. WORKSHOP SUMMARIES

Treasure County
Pre-Disaster Mitigation Plan
Community Wildfire Protection Plan

Kick-off Workshop
February 23, 2006 – 10:00 to 11:30 AM
Hysham, Montana

Participants:	Ruth Baker	Treasure County Clerk & Recorder
		Treasure County Clerk of Court
		Treasure County Election Administrator
	Jennifer Cromer	Treasure County Weed/Animal Coordinator
		SMEDL Representative
	Leo Cunningham	Montana Dept. of Transportation
		Treasure County Fire
	Carol Gamble	Rosebud/Treasure Dispatch Supervisor
		Grocery Store Owner
		Mail Route Driver
		Treasure County Health Board
	Travis Gamble	Treasure County Fire and Ambulance
		Body Shop Owner
		Treasure County Recreation Board
	Diann Grierson	Bed & Breakfast Owner
		Local RN
		Cattle Woman
	J.R. Grierson MD	Physician
		Treasure County Health Officer
	George Haines	Retired Rancher
	Ina Haines	Treasure County Planning Board Secretary
	Darrell Kurk	MT DNRC Southern Land Office Fire Program Mgr.
	Wayne Robison	Treasure County Sheriff
		Treasure County Coroner
		Treasure County EMT/Firefighter
	Sgt. Cal Schock	Montana Highway Patrol, Det. 513 Supervisor
	Pam Shrauger	Big Sky Hazard Management Consultant
	Yvonne Story	Accountant for E.H. Oftedal
		Treasure County Fire Secretary
	Lee Ward	Treasure County Fire
		Owner of Ward's Repair
		Worker at PU Ranch
	Steve Wilkins	Treasure County Disaster and Emergency Services
		Treasure County Deputy Sheriff Officer
		Treasure County Fire Chief and Fire Warden and EMT
		Treasure County LEPC Chair
		Owner of S&L Service

Four Phases of Emergency Management: Following Introductions, participants were briefed on the four phases of emergency management with an emphasis on mitigation and its definition.

The Purpose of Mitigation: Participants played a "disaster card game" where the purpose of mitigation as a cost-effective practice was demonstrated.

Parts of a Pre-Disaster Mitigation Plan: Participants received a handout and briefing on the "What, Why, When, Where, and How" of the Pre-Disaster Mitigation Plan. A draft outline was also distributed.

Relation to the Community Wildfire Protection Plan: Participants received an explanation of what a Community Wildfire Protection Plan is and how easily it relates to the Pre-Disaster Mitigation Plan. A draft outline was distributed. The determination of whether or not it will be its own plan or part of the Pre-Disaster Mitigation is pending.

Development of Mission Statement: Participants listed the key components to be included in the plan's mission statement. The following is the draft mission statement for the plan:

The mission of the Treasure County Pre-Disaster Mitigation Plan is to guide the prevention all hazards in order to protect citizens, property, the environment, the quality of life, and the economy in Treasure County and Hysham.

Hazard Identification: The following hazards were identified:

- Agriculture-Related Hazards (including air and water contamination, low irrigation supplies, weeds, and livestock predators)
- Communicable Disease and Bioterrorism (including human, animal, and plant diseases)
- Earthquake
- Flood (including riverine, ice jam, flash flooding, dam failure, and bank erosion)
- Hazardous Materials Release (including fixed and mobile sources)
- Severe Thunderstorm (including tornadoes, hail, and downbursts)
- Sinkholes
- Summer Weather (including extreme heat, drought, dust storms, insect and pest infestations, low water supplies, and strong winds)
- Terrorism and Civil Unrest
- Transportation Accident (including vehicular, railway, and aircraft accidents)
- Utility and Communications Failure (including electric, telephone, water, sewer, propane, and 911/emergency communication outages)
- Volcanic Ashfall
- Wildfire
- Winter Weather (including blizzards, heavy snow, ice storms, extreme cold, and strong winds)

Additional Participants Identified:
These persons and/or entities will be encouraged or further encouraged to attend the next meeting:

- Montana Fish, Wildlife, & Parks
- Bureau of Land Management
- Irrigation Districts
- Town of Hysham
- County Commissioners

Other Resources Identified:

- Treasure County Comprehensive Development Plan
- Treasure County Subdivision Regulations
- Hysham Comprehensive Plan

Treasure County
Pre-Disaster Mitigation Plan
Community Wildfire Protection Plan

Workshop #2
May 16, 2006 – 1:00 to 2:30 PM
Hysham, Montana

Participants:

Carol Gamble	Rosebud/Treasure Dispatch Supervisor
	Grocery Store Owner
	Mail Route Driver
	Treasure County Health Board
Travis Gamble	Treasure County Fire and Ambulance
	Body Shop Owner
	Treasure County Recreation Board
	Reserve Officer
Tom Gilreath	Montana Dept. of Transportation Maintenance Supervisor Custer/Hysham
Diann Grierson	Bed & Breakfast Owner
	Local RN
	Cattle Woman
J.R. Grierson MD	Physician
	Treasure County Health Officer
Gloria Gunther	Bureau of Land Management Miles City Field Office Fire Center Manager
Ina Haines	Treasure County Planning Board Secretary
	Retired Rancher
Charlie Hanson	Montana Disaster and Emergency Services District V Representative
Pam Shrauger	Big Sky Hazard Management Consultant
	Red Cross Disaster Volunteer
Lee Ward	Treasure County Fire
	Owner of Ward's Repair
	Worker at PU Ranch

Risk Assessment Mapping: Following introductions and a quick overview of a PDM plan, participants were shown mapping of hazard areas and historical events, where identifiable through GIS. Suggestions made at the meeting will assist with improving this mapping. These hazard layers will be compared to structures, critical facilities, and infrastructure to identify the values at risk. These maps can be found within the individual hazard profiles as they become available at: www.bigskyhazards.com/draftplans.asp.

Identification of Critical Facilities: Participants identified the following as critical facilities:

- Treasure County Courthouse
- Treasure County Shop
- Hysham Town Shop

- Hysham Old Water Plant/Pump House
- Hysham New Water Plant
- Hysham Storage Building
- Hysham Water Tower
- Hysham Sewer Lagoon
- Hysham School
- Fire Hall and Community Center
- Fire Storage Building
- Electric Substations
- Repeater Sites
- Cenex (HazMat)
- Simplot (HazMat)
- Farmers Union (HazMat)
- Friendly Corner (HazMat)
- MDT Section House and Storage Buildings
- USDA NRCS Building

Note we still need to get a list of the county-owned buildings from the county to add to this list.

Next Meeting: A meeting specific to the Community Wildfire Protection Plan is proposed for July 11, 2006 at 9AM in Hysham (specific location TBD). This meeting is subject to change based on the current wildfire situation. A full PDM meeting is expected in August or September, once the risk assessment is completed.

Treasure County
Community Wildfire Protection Plan

October 3, 2006 – 9:00 to 11:00 AM
Hysham, Montana

Participants:

Ruth Baker	Treasure County Clerk & Recorder
	Treasure County Clerk of Court
	Treasure County Election Administrator
Carol Gamble	Rosebud/Treasure Dispatch Supervisor
	Grocery Store Owner
	Mail Route Driver
	Treasure County Health Board
Travis Gamble	Treasure County Fire Warden
	Body Shop Owner
	Treasure County Recreation Board
	Reserve Sheriff's Officer
Charlie Hanson	Montana Disaster and Emergency Services District V Representative
Dena Lang	Bureau of Land Management Fire Mitigation and Education Specialist
Wayne Robison	Treasure County Sheriff
	Treasure County Coroner
	Treasure County EMT/Firefighter
Pam Shrauger	Big Sky Hazard Management Consultant
	Red Cross Disaster Volunteer
Lee Ward	Treasure County Fire
	Owner of Ward's Repair
	Worker at PV Ranch

Discussion:

Information on the Hysham Volunteer Fire Department: About 22 rostered volunteers but 2-3 may show up on a weekday and 5-6 on a weekend. Pam will get information on the county-owned fire equipment from Ruth. DNRC has 3-4 vehicles stationed in the county. Pam will talk to Darrell Kirk for more information. PV Ranch owns four firefighting vehicles and a motor grader. The four vehicles are one each at Ridge Camp, Butte Camp, Horse Camp, and at the ranch. County has two road graders. Pam will get ISO ratings from Travis. Firefighter training is poor. An Emergency Operations Plan may be written, but no one has it or uses it. Firefighters get $7 per wildland fire (that's not enough to entice most people to leave work).

No formal mutual aid agreements, but will call on Rosebud County or Custer as needed.

Pam will get past wildfire statistics from Carol and Darrell Kirk.

Ignition Risks: Recreation Areas – Amelia Island (FWP), Howrey Island (BLM), Isaac Homestead (FWP), Myers Bridge Fishing Access (FWP), Manuel Lisa Fishing Access (FWP); Controlled Burns – permit system in place, but not enforced; Events – Fourth of July; Railroad; Lightning; Farm Equipment

Fuel types: Ponderosa Pine, Grasses, Sagebrush, Juniper, Slash, Yucca, Cottonwood

Community Preparedness: Good wildfire awareness, but some do not comply with restrictions

Severity Factors: Most critical are the remoteness of many areas, lack of water supplies, and very limited number of firefighting volunteers.

Hazard Areas:

- Southern Treasure County, including Sarpy Creek and Tullock Creek
- Along the Yellowstone River in the river bottoms including Howrey Island (one way in/out, high use, high hazard, home nearby), Isaac's Homestead, and Manuel Lisa Fishing Access (although in Custer County, has impacts in Treasure County)
- Northern Treasure County (remoteness)

Dena will also send Pam examples of wildland-urban interface definitions.
A subdivision may be possible some day between Reservation, Bear, and Sarpy Creeks based on a forthcoming land sale.

Project Ideas:

- Green belts
- Fire breaks
- Fuels mapping
- Identify potential water storage locations
- Use a grader to create fire breaks, reduce vehicle sparks, and improve private roads for emergency response.
- Develop better road mapping (including private roads)
- Have a state forester come out to inspect for insects or disease that affect trees
- Fuel breaks in the Hysham Hills
- Fuel reductions around homes

Grant Information: Funding can be used to hire firefighters and/or contractors, equipment rental, education, and training for projects. Funding may also be available for helping Pam complete the CWPP. Generally on projects, a 25% in-kind match is required from the land owner.

Plan Adoption: Plan will need to be signed off by commissioners. Pam and Dena will try to facilitate this and get some more support for the fire department, for now.

Treasure County
Pre-Disaster Mitigation Plan
Community Wildfire Protection Plan

Mitigation Strategy Workshop
March 15, 2007 – 10:00 AM to Noon
Hysham, Montana

Participants:

Gary Arneson	Treasure County Road Department
Ruth Baker	Treasure County Clerk & Recorder
	Treasure County Clerk of Court
	Treasure County Election Administrator
Jennifer Cramer	Treasure County Weed/Animal Coordinator
	SMEDL Representative
Erin Dellera	Treasure County Sheriff's Office
Larry Fink	Hysham Schools Superintendent
	Hysham Mayor
Mike Ford	Bureau of Land Management Fuels Program Manager (Miles City)
Deb French	Treasure County Health Department
Carol Gamble	Rosebud/Treasure Dispatch Supervisor
	Grocery Store Owner
	Mail Route Driver
	Treasure County Health Board
Travis Gamble	Treasure County Fire Chief
	Treasure County Ambulance
	Treasure County Recreation Board
	Treasure County Sheriff Reserve Officer
	Body Shop Owner
Diann Grierson	Bed & Breakfast Owner
	Local RN
	Cattle Woman
	Treasure County Health Board
J.R. Grierson MD	Physician
	Treasure County Health Officer
Ina Haines	Treasure County Planning Board Secretary
Judi Knapp	Mid-Yellowstone Electric Operations Manager
	Treasure County Conservation District Chairman
Darrell Kurk	MT DNRC Southern Land Office Fire Program Manager
Eric Lepisto	Bureau of Land Management Asst. Fire Management Officer (Miles City)
Noelle Pinkerton	Treasure County Ambulance
Wayne Robison	Treasure County Sheriff
	Treasure County Coroner
	Treasure County EMT/Firefighter
Pam Shrauger	Big Sky Hazard Management Consultant
Jackie Zent	Treasure County Health Board
Pat Zent	Treasure County Disaster and Emergency Services Coordinator

Risk Assessment Summary: The Risk Assessment Summary was reviewed and discussed. The following changes were suggested:

- Add information on the fertilizer plants and the possible impacts to Hysham (up wind) from a fire (Hazardous Material Release Profile)
- Add information on the agricultural chemical runoff following a flood or heavy rain (Water and Air Contamination Profile)

Mitigation Strategy: The following mitigation projects were suggested and discussed:

- NOAA Weather Radio transmitter in Hysham
- NOAA Weather Radios in all critical facilities
- Update the Hysham warning sirens, educate the public
- Reverse 911 (including public education)
- Weather Spotter Training (continue existing program)
- Update land use plans and regulations (growth policy, subdivision regulations) to reflect disaster resistance/first responder needs
- Community tornado shelters and public education
- Upgrade and maintain electric distribution and transmission system for snow and wind resistance
- Upgrade and maintain the electric utility's river crossing structures
- Generators for key facilities during a power outage
- Upsize and install culverts in flood prone areas
- General public disaster preparedness campaign
- Engage landowners in wildfire mitigation, preparedness, and response through training (baby steps – start by going to them with basic information and build up to more sophisticated training and equipment purchases – water tanks, radios)
- Familiarize local ranchers with the local, state, and federal firefighting system and how they interact, ideally before an event occurs
- Use the Ready Reserve program to bring in federal and state instructors for basic wildland fire training at no cost to the participants
- DNRC Map and compass training for local firefighters
- Use the DNRC Eastern Montana Wildfire video at various meetings (once it comes out)
- Educate property owners on FireWise principles
- Countywide fuels mitigation/reduction project (particularly the Hysham Hills)
- Better pay system for local wildland firefighters
- Identify potential water storage locations
- Improved fuels mapping through DNRC (similar to Stillwater County)
- Have a state forester come out to inspect for insect kill and drought kill in trees
- Improve road mapping (including private roads) and put copies in vehicles
- Use county road grader for addition road improvements and fire breaks
- Identify local liaisons that can work with state and federal firefighting crews when they come in
- Continued brush removal and weed eradication from Howrey Island and Isaac Homestead
- Encourage BNSF to provide GPS coordinates for all emergency calls, including fire and ambulance requests

Next Meeting: April 3 at 10AM in the EMS Training Room, Hysham Clinic

Treasure County
Pre-Disaster Mitigation Plan
Community Wildfire Protection Plan

Final Workshop
April 3, 2007 – 10:00 AM to 11:00 AM
Hysham, Montana

Participants:

Gary Arneson	Treasure County Road Department
Jennifer Cramer	Treasure County Weed/Animal Coordinator
	SMEDL Representative
Joan Cunningham	Treasure County Health Board
Carol Gamble	Rosebud/Treasure Dispatch Supervisor
	Grocery Store Owner
	Mail Route Driver
	Treasure County Health Board
Travis Gamble	Treasure County Fire Chief
	Treasure County Ambulance
	Treasure County Recreation Board
	Treasure County Sheriff Reserve Officer
	Body Shop Owner
Ina Haines	Treasure County Planning Board Secretary
Judi Knapp	Mid-Yellowstone Electric Operations Manager
	Treasure County Conservation District Chairman
Wayne Robison	Treasure County Sheriff
	Treasure County Coroner
	Treasure County EMT/Firefighter
Pam Shrauger	Big Sky Hazard Management Consultant
Dan Story	Treasure County EMT/Firefighter
	Simplot
Pat Zent	Treasure County Disaster and Emergency Services Coordinator

Plan Status: A complete draft of the Pre-Disaster Mitigation Plan and Community Wildfire Protection Plan for Treasure County and the Town of Hysham is available on the Big Sky Hazard Management website for all to review. Comments are due no later than May 1, 2007. At that time, the plan will be submitted to Montana Disaster and Emergency Services (DES), Montana Department of Natural Resources and Conservation (DNRC), the Federal Emergency Management Agency (FEMA), and the US Bureau of Land Management (BLM). In addition to the hard copies provided to Montana DES, Montana DNRC, FEMA and BLM, a total of three hard copies and two CD's will be provided to the county and town for distribution as they see fit. Both the county and the town will be asked to pass resolutions adopting the plan. If they choose not to adopt the plan, their reasons must be documented, and they will not be eligible for certain types of federal mitigation and disaster assistance.

Plan Overview: Using the plan's Table of Contents, a brief overview of the plan was given by Pam Shrauger of Big Sky Hazard Management.

Mitigation Strategy: A brief overview of the mitigation strategy was given, highlighting the plan's goals, objectives, and actions.

Plan Maintenance Procedures: The plan will be maintained by the Local Emergency Planning Committee (LEPC) with annual reviews.

Plan Comments: No comments were made on the plan, but comments will be accepted until May 1, 2007. Electronic copies of the plan were distributed.

Thanks to everyone that participated in this process!

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Appendix F. ACRONYMS

ALF – Animal Liberation Front
BLM – Bureau of Land Management
BFE – Base Flood Elevation
BNSF – Burlington Northern Santa Fe
BSE – Bovine Spongiform Encephalopathy
CAMA – Computer Assisted Mass Appraisal
CDBG – Community Development Block Grant
CFR – Code of Federal Regulations
CRP – Conservation Reserve Program
DEQ – Department of Environmental Quality
DES – Disaster and Emergency Services
DHS – Department of Homeland Security
DNRC – Department of Natural Resources and Conservation
DOT – Department of Transportation
EDA – Economic Development Administration
EOC – Emergency Operations Center
ELF – Earth Liberation Front
EMS – Emergency Medical Services
EPA – Environmental Protection Agency
FAA – Federal Aviation Administration
FALN – Armed Forces of National Liberation (translated)
FBI – Federal Bureau of Investigation
FEMA – Federal Emergency Management Agency
FHBM – Flood Hazard Boundary Map
FIRM – Flood Insurance Rate Map
FIS – Flood Insurance Study
FMA – Flood Mitigation Assistance
FWP – Fish, Wildlife & Parks
FWS – Fish & Wildlife Service
GIS – Geographic Information System
GPS – Global Positioning System
HAZUS-MH – Hazards United States Multi-Hazard
HMGP – Hazard Mitigation Grant Program
HUD – Housing and Urban Development
HVAC – Heating, Ventilating, and Air Conditioning
IA – Individual Assistance
LEPC – Local Emergency Planning Committee
LP – Liquefied Petroleum
MDT – Montana Department of Transportation
NCDC – National Climatic Data Center
NIFC – National Interagency Fire Center
NFIP – National Flood Insurance Program

NFP – National Fire Plan
NID – National Inventory of Dams
NOAA – National Oceanic and Atmospheric Administration
NRCS – Natural Resources Conservation Service
NTSB – National Transportation & Safety Board
NWS – National Weather Service
PA – Public Assistance
PCB – Polychlorinated Biphenyl
PDM – Pre-Disaster Mitigation
PDMC – Pre-Disaster Mitigation Competitive
PE – Probability of Exceedance
PGA – Peak Ground Acceleration
RAWS – Remote Automated Weather Station
RFA – Rural Fire Assistance
SARS – Severe Acute Respiratory Syndrome
SBA – Small Business Administration
SFHA – Special Flood Hazard Area
US – United States
USACE – United States Army Corps of Engineers
USDA – United States Department of Agriculture
USGS – United States Geological Survey
USFA – United States Fire Administration
USFS – United States Forest Service
WMD – Weapons of Mass Destruction
WPDG – Wetland Program Development Grants
WUI – Wildland Urban Interface
YVO – Yellowstone Volcano Observatory

Appendix G. FEMA CROSSWALK REFERENCE DOCUMENT

Appendix H. APPROVAL LETTERS

Appendix I. LISTING OF COMPLETED MITIGATION ACTIVITIES