GALLATIN COUNTY, MONTANA

HAZARD MITIGATION PLAN

DRAFT

PREPARED FOR

Gallatin County, Montana
311 W. Main Street
Bozeman, MT 59715

DECEMBER 2018

Gallatin County Emergency Management
Preparing Our Community

RESPEC

EXECUTIVE SUMMARY

Disasters can strike at any time in any place. In many cases, actions can be taken before disasters strike to reduce or eliminate potential negative impacts. These actions can often mitigate the adverse effects of disasters and protect life, property, the economy and other values. The Gallatin County Hazard Mitigation Plan (HMP) addresses 19 major hazards with respect to risk and vulnerabilities countywide, including Bozeman, Belgrade, Big Sky, Four Corners, Manhattan, Three Forks, and West Yellowstone. Through a collaborative planning process, the Gallatin County hazards were identified, researched, profiled, and prioritized.

The major hazards are each profiled in terms of their hazard description, history, probability and magnitude, mapping, vulnerabilities, data limitations, and other factors. The vulnerabilities to critical facilities; critical infrastructure; structures; the population; economic, ecologic, historic, and social values; and future development are updated for each hazard. Based on the probability and extent of potential impacts that were identified in the risk assessment, the prioritizations of hazards within Gallatin County are displayed in **Table ES-0-1**. The countywide prioritizations are derived from hazard prioritization and ranking exercises held in five distinct community areas (districts) across the county in February 2018. A map (**Figure 2-1**) showing the community district boundaries can be found in Section 2.2.4 on page 2-4.

Table ES-1. Gallatin County Hazard Prioritizations

Level	Hazard
High Priority	Critical Infrastructure Disruption Drought Earthquake Severe Weather Wildfire
Moderate Priority	Avalanche and Landslide Civil Unrest Communicable Disease and Bioterrorism Environmental Hazards Flooding Ground Transportation Accident Hazardous Materials Release Urban Conflagration
Low Priority	Aviation Accident Dam Failure Railroad Accident Terrorism Violence Volcanic Activity and Ash Fall

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

- Goal 1: Prevent losses from wildfires
- Goal 2: Reduce potential losses from earthquakes
- Goal 3: Reduce damages from flooding
- Goal 4: Reduce losses from a transportation or hazardous materials accident
- Goal 5: Prevent significant loss of life and illness from communicable disease and bioterrorism
- Goal 6: Promote all-hazard mitigation measures

Associated with each of the goals are objectives and mitigation actions that range from implementing security measures to increasing available data to providing community education. The mitigation projects are prioritized based on cost, feasibility, population benefit, property benefit, and the probability and impact of the hazards being mitigated. An implementation plan outlines the suggested course of action, given the limited resources available to Gallatin County and the districts. Gallatin County Emergency Management (GCEM) is responsible for implementing and maintaining the plan. Other recommended activities, such as integrating this plan into a variety of county, city, and town plans, regulations, and documents, will further the goals of hazard mitigation in Gallatin County.

The Gallatin County HMP has been prepared in compliance with Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act),42 U.S. C. 5165, enacted under Sec. 104 of the Disaster Mitigation Act of 2000 (DMA 2000) Public Law 106-390 of October 30, 2000, as implemented in Title 44, Chapter 1, Part 201 of the Code of Federal Regulations (CFR) dated October 2007, and most recently amended in October 2015. The HMP includes risk assessments for multiple hazards, a public outreach effort, and development of a mitigation strategy that incorporates measures intended to eliminate or reduce the effects of future disasters within Gallatin County.

The Federal Emergency Management Agency (FEMA) requires state, tribal, and local governments to develop and adopt hazard mitigation plans as a condition for receiving certain types of non-emergency disaster assistance, including funding for mitigation projects. Through the Hazard Mitigation Assistance (HMA) grant programs (Hazard Mitigation Grant Program-HMGP, Pre-Disaster Mitigation-PDM, and Flood Mitigation Assistance-FMA), FEMA offers planning grants that support state, tribal, and local governments in developing and updating mitigation plans. The following web address (URL) provides a table that summarizes FEMA's Assistance Programs and whether a mitigation plan is required to access the program (https://www.fema.gov/hazard-mitigation-plan-requirement).

This plan has been approved by FEMA as an accepted hazard mitigation plan; therefore, the county and various communities may be eligible for federal mitigation funds. This plan serves as a guide for understanding the major hazards that face Gallatin County and the communities/districts and provides a strategy for preventing or reducing some of the impacts.

As part of this HMP update, GCEM elected to incorporate an update to the county's Community Wildfire Protection Plan (CWPP) directly within the HMP document. The CWPP update is included as **Attachment 1** to the HMP. The CWPP is <*explain purpose of document*>

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1.0 INTRODUCTION

Emergency management is typically divided into four interrelated actions: mitigation, preparedness, response, and recovery. This plan focuses on the mitigation phase only. Mitigation actions involve lasting, often permanent, reduction of, exposure to, probability of, or potential loss from hazard events. These actions tend to be centered on where and how to build, improvements and modifications (retrofits) to existing structures to increase resiliency, and management of potential hazards such as wildfire fuel mitigation activities. Examples include: zoning and building code requirements for building or rebuilding in high hazard areas, floodplain buyouts, and prescribed forest management (burning and thinning). Mitigation also can involve educating businesses and the public on simple measures they can take to reduce loss and injury, like fastening bookshelves, water heaters, and file cabinets to walls to keep them from falling during earthquakes.

Cost-effective mitigation measures are the key to reducing disaster losses in the long term. In hazard-prone areas, mitigation can break the cycle of having to rebuild repeatedly with every recurrence of floods, wildfires, earthquakes, or other hazards. Where there is a willingness to mitigate, opportunities can be found. Ongoing efforts might include: educating the private sector about what it can do to mitigate at home and at work; reaching out to planning, zoning, and development agencies to ensure that hazard conditions are considered in comprehensive plans, construction permits, building codes, design approvals, etc.; and creating inventories of existing structures and their vulnerabilities, to aid mitigation planning. Planning is also needed to take advantage of mitigation opportunities in the aftermath of an emergency or disaster when hazard awareness is high, funds are possibly available, and disruption of the status quo makes it possible to rethink design and location of some facilities and infrastructure. Attention to mitigation opportunities can make safer communities. The HMP is a combined effort of Gallatin County; the cities of Bozeman, Belgrade, and Three Forks; the Towns of Manhattan and West Yellowstone; the communities of Big Sky, Four Corners, and Gallatin Gateway; and the public.

1.1 PURPOSE

Gallatin County recognizes that hazards, both natural and human-caused, threaten communities. Rather than wait until disaster strikes, the jurisdictions 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 is an investment that can save lives and money.

The purpose of this HMP is to:

- Serve as a consolidated, comprehensive source of hazard information
- Educate the communities, including government leaders and the public, on their vulnerabilities
- Fulfill federal, state, and local hazard mitigation planning responsibilities
- Prioritize and promote cost-effective mitigation solutions
- Support requests for grant funding
- Encourage long-term community sustainability

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 when designing subdivisions may include multiple access points or removal of drinking water wells from the floodplain that will provide greater disaster resistance, reduce future expenses and contribute to community sustainability.

The plan's intent is to assist the communities in making financial decisions for mitigation projects and clarify actions that could be taken through additional funding. Through an effective and inclusive planning process, communities will become more aware of their hazards and will take a proactive approach to disaster prevention and mitigation.

1.2 AUTHORITIES

The Gallatin County HMP has been prepared in compliance with Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act),42 U.S. C. 5165, enacted under Sec. 104 of the Disaster Mitigation Act of 2000 (DMA 2000), Public Law 106-390 of October 30, 2000, as implemented in Title 44, Chapter 1, Part 201 of the Code of Federal Regulations (CFR) dated October 2007, and most recently amended in October 2015. This legislation required all local governments to have an approved hazard mitigation plan in place to be eligible to receive Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), and Flood Mitigation Assistance (FMA) funding, as well as other types of disaster and mitigation funding.

Gallatin County and the cities of Bozeman, Belgrade, and Three Forks, and the Towns of Manhattan and West Yellowstone have adopted this HMP by resolution (see Appendix K for copies of the resolutions). These governing bodies have the authority to promote mitigation activities in their jurisdictions. This plan is developed, promulgated, and maintained pursuant to the following state and federal statutes and regulations:

- Code of Federal Regulations Title 44, Part 201, 205 and 206
- Public Law 106-390, Disaster Mitigation Act of 2000
- Public Law 93-288, The Disaster Relief Act of 1974, as amended by Public Law 100-707, the Robert T. Stafford Disaster Relief and Emergency Assistance Act
- Public Law 96-342, Improved Civil Defense 1980
- Public Law 99-499, Superfund Amendment and Re-authorization Act (SARA) of 1986, Title III, Emergency Planning Community Right-to-Know (EPCRA), Title 42, Chapter 116
- Public Law 920, Federal Civil Defense Act of 1950, as amended
- Public Law 105-19, Volunteer Protection Act of 1997
- Response to Hazardous Materials Incidents, Title 10, Chapter 3, Part 12 MCA

1.3 BACKGROUND

Gallatin County is located in southwest Montana as shown in **Figure 1-11**, with an area of approximately 2,631 square miles and elevations ranging from approximately 4,000 to 10,700 feet. Gallatin County is bordered by Meagher County to the north, Park County to the east, Jefferson and Broadwater Counties to the northwest, Madison County to the west, and Yellowstone Park to the southeast. The City of Bozeman is the county seat and other incorporated communities include the cities of Belgrade and Three Forks, and the Towns of Manhattan and West Yellowstone. The communities of Big Sky, Four Corners, and Gallatin Gateway represent other population centers.

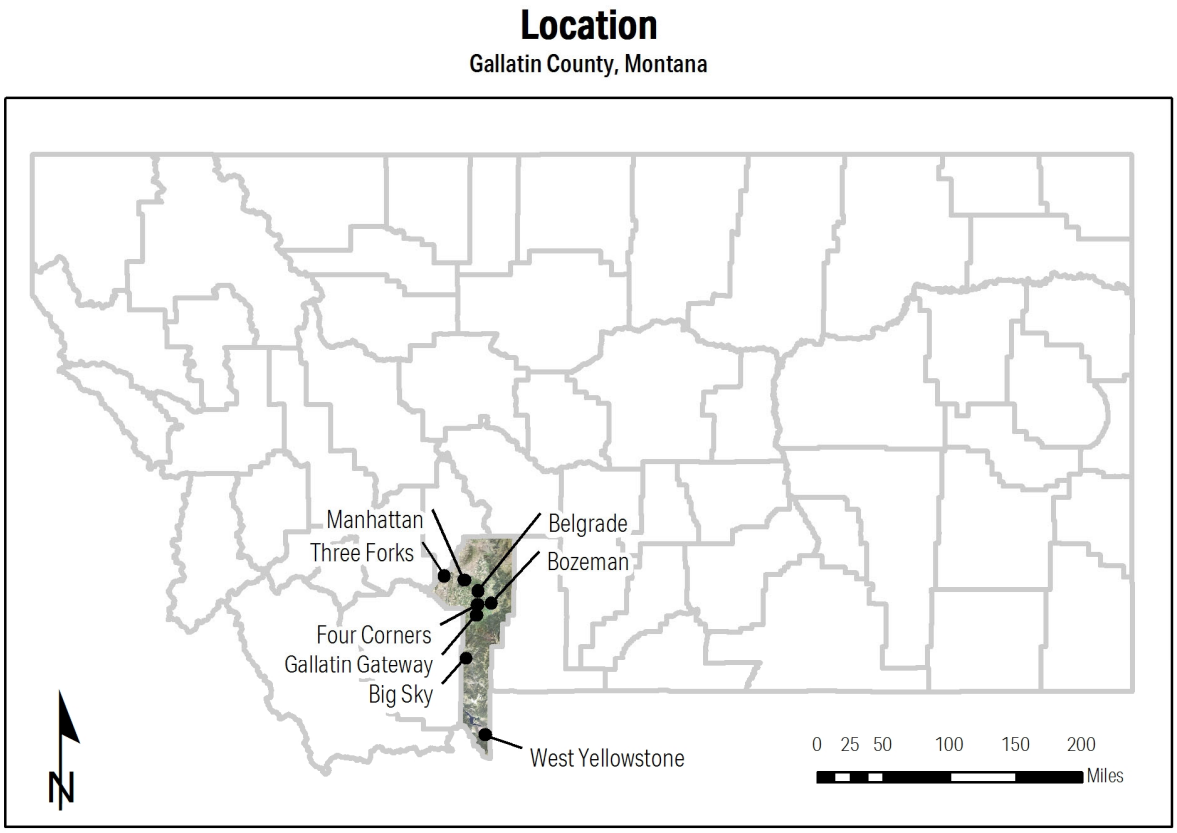
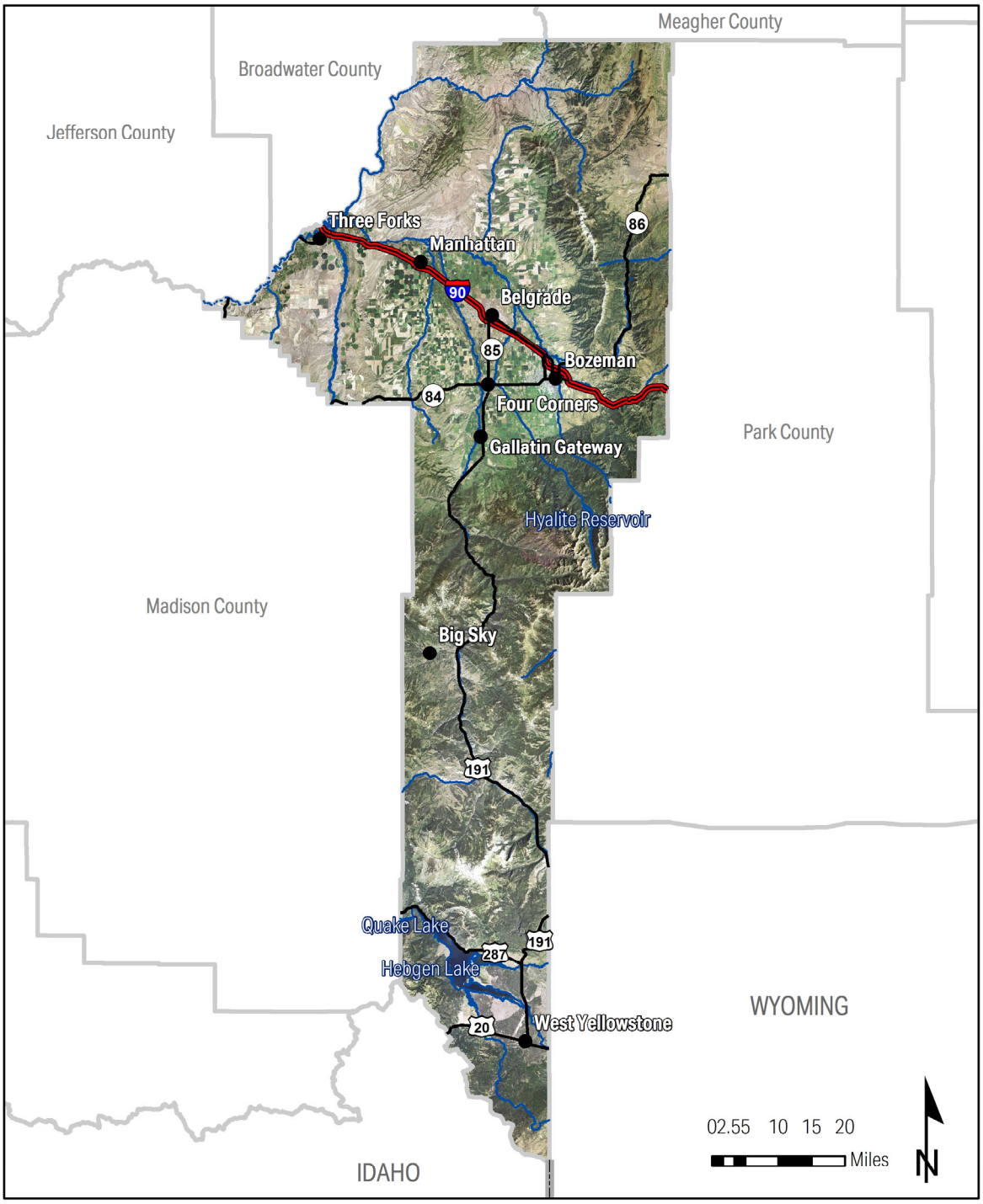


Figure 1-1. Gallatin County Location

Figure 1-22 shows the general features in the county. Gallatin County covers over 2,500 square miles of mountain lands varying in topography. Nearly half of all the land in Gallatin County is under public ownership by the USDA Forest Service, State of Montana, Bureau of Land Management, or the National Park Service. The county contains several mountain ranges which are marked by pristine rivers, creeks, and streams. The Gallatin River flows through Gallatin County from the top of the Gallatin Canyon through Belgrade and on to Manhattan and Three Forks where it flows into the headwaters of the Missouri River.

Features
Gallatin County, MT



Data Source: Montana NRIS
Data Date: August 2017
Mapp Coordinates: NAD 1983, State Plane Montana

Map Updated by:
Libby Ellwood
August 2017

RESPEC

Figure 1-2. Gallatin County Features

The climate of Gallatin County varies greatly. **Table 1-11** details the climate statistics recorded by four weather stations positioned within the county.

Table 1-1. Gallatin County Climate Statistics [Western Regional Climate Center, 2017]

	Montana State University 1982 - 2016	Belgrade (Bozeman-Yellowstone Int'l Airport) 1941 - 2016	Trident 1922 - 2016	West Yellowstone 1924 - 2013
Annual Average Maximum Daily Temperature	55.2°F	56.0°F	60.2°F	50.3°F
Annual Average Minimum Daily Temperature	31.2°F	28.2°F	32.0°F	19.6°F
Annual Average Total Precipitation	18.48 inches	13.92 inches	12.43 inches	21.56 inches
Annual Average Total Snowfall	86.0 inches	47.0 inches	28.5 inches	160.10 inches
Highest Temperature Recorded	105°F July 31, 1892	106°F July 6, 2007	109°F July 22, 1931	97°F July 19, 1936
Lowest Temperature Recorded	-43°F February 8, 1936	-46°F January 26, 1957	-55°F December 31, 1927	-66°F February 9, 1933
Annual Average Number of Days Dropping Below Freezing	181.7 days	199.3 days	172.2 days	270.7 days
Annual Average Number of Days Staying Below Freezing	48.0 days	51.9 days	33.6 days	87.8 days
Annual Average Number of Days Reaching 90°F or Higher	7.4 days	19.8 days	31.3 days	2.2 days
Highest Annual Precipitation	25.57 inches 1997	20.04 inches 1969	20.96 inches 1997	29.32 inches 1955
Lowest Annual Precipitation	10.54 inches 1934	8.65 inches 1961	6.42 inches 1974	15.68 inches 1934
1-Day Maximum Precipitation	2.68 inches May 7, 1988	2.14 inches June 25, 1969	2.00 inches May 25, 1980	2.70 inches June 17, 1925
Highest Annual Snowfall	159.5 inches 1975	87.4 inches 1955	75.0 inches 1989	276.1 inches 1994

1.4 PLAN SCOPE AND ORGANIZATION

The Gallatin County HMP is organized into sections that describe the planning process (Chapter 2.0), assets and community inventory (Chapter 3.0), risk assessment/hazard profiles (Chapter 4.0), mitigation strategies (Chapter 5.0), and plan maintenance (Chapter 6.0). Appendices containing supporting information are included at the end of the plan.

This plan, particularly the risk assessment section, outlines each hazard in detail and how it may affect Gallatin County. The mitigation strategy outlines long-term solutions to possibly prevent or reduce 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, this plan will help the communities understand the hazards better and become more disaster resistant.

2.0 PLANNING PROCESS AND METHODOLOGIES

Mitigation planning is a community effort and takes time and expertise. For Gallatin County, an effective hazard mitigation plan requires input from a variety of stakeholders, including elected officials, first responders, emergency management, healthcare providers, public works, road officials, state and federal agencies, businesses, non-profit organizations, academia, and the public. After 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 after a disaster and may even prevent the disaster in the first place.

2.1 INITIAL PLANNING PROCESS

The planning process for the county's initial hazard mitigation plan began in January 2001 with an advertised public meeting that was held to kick off original Project Impact efforts. Over several years, Project Impact was phased out and the Gallatin County All Hazards All Discipline (AHAD) group became the primary guiding body for HMP development. The AHAD group consists of representatives from emergency management, fire services, medical and health services, law enforcement, media, public individuals, voluntary organizations, and government administration.

Meetings were held throughout 2004 and 2005 with the AHAD group for the purposes of identifying critical facilities, reviewing draft sections, and developing mitigation strategies. Once draft sections were completed, they were distributed over e-mail for review. The full draft of the HMP was posted on the GCEM website to solicit public review and comment. Final public requests soliciting comments on the full draft plan were posted in February 2006, with final plan adoption later that year.

In 2011, the 5-year plan revision process was initiated with public stakeholder meetings. A final update to the HMP was approved by FEMA on September 18, 2012.

2.2 PLAN UPDATE PROCESS

In 2017, Gallatin County once again prepared to update the HMP, through issuance of a Request for Proposals (RFP). A local consultant, RESPEC Inc., was hired to facilitate the plan update for Gallatin County. RESPEC provided experience in hazard mitigation and emergency management and coordinated the planning process in partnership with the county, cities, towns, and community as a whole.

The 2018 Plan update builds on the original 2006 plan and the updated 2012 plan with revised data for each of the defined hazards and an updated and reprioritized list of goals and actions to mitigate identified risks. These risks were discussed with community members in several public meetings held across the county. HAZUS 4.2 and other GIS data were used to provide updated maps as well as data.

The plan update process consisted of the following basic steps:

1. Initial review of the existing plan was undertaken by the contractor.
2. A proposed outline for the updated plan was developed.
3. Initial public meetings were held to educate the public on the upcoming plan update, and to solicit preliminary comments. The meetings were advertised in the Bozeman Daily Chronicle, on the GCEM website, and invitations were sent directly to identified stakeholders.

4. Subsequent public meetings were held to solicit comment on the existing plan to determine what changes and accomplishments have taken place in the county and the jurisdictions over the past five years, and to brainstorm ideas (new hazards, mitigation strategies) for the updated version.
5. The Mitigation Strategy and remaining sections were updated.
6. Stakeholders were asked to review the draft plan and provide comments.
7. Public meetings (advertised through invitations, press releases, and a newspaper ad) were held in each of the jurisdictions to update the community on the newly revised plan and to solicit comments on the update.
8. Following the public comment period, any comments received were incorporated and the final plan was sent to the state and FEMA for review
9. Jurisdictions adopted the updated plan, either before or immediately after state and FEMA conditional approval

2.2.1 COMMUNITY CHANGES

A driving force in updating this type of plan involves the changes that have occurred in the community over the past five years. Perhaps the biggest change in Gallatin County has been the residential and associated commercial growth. According to U.S. Census estimates, the Gallatin County population increased by over 20% between 2010 and 2017, placing it among the fastest-growing counties in the nation.

2.2.2 PLAN CHANGES

Another principal component to updating the plan is adherence to the latest requirements for these plans provided by the federal government. Compliance requires periodic additions and changes to the plan needed to be made. These types of changes were proposed and made by the contractor and reviewed by the communities. Other changes were proposed by community members and made where applicable. Data, methods, and information used in the initial plan were reviewed by the contractor and changes were made if updated information existed. Other items, such as mitigation actions and plan maintenance procedures, were reviewed by local individuals and changes were made as needed.

The 5-year update of the plan featured updates to all sections to improve readability, usability, and methodologies. Specifically, the following major changes were part of the plan's update:

- Addition of an executive summary
- Updated planning process, to include the most recent revision
- Various sections were expanded to provide greater insight into the update process
- New hazards were identified, others were modified, and one was removed
- Updated Geographic Information System (GIS) mapping was added
- Sections specific to critical facilities and infrastructure, the population, structures, and economic, ecologic, historic, and social values were added
- New mitigation goals and strategies were added, modified, and removed to reflect current conditions
- New appendices were added as needed

2.2.3 JURISDICTION PARTICIPATION

This plan includes the following communities:

- City of Belgrade
- Community of Big Sky
- City of Bozeman
- Town of Manhattan
- City of Three Forks
- Town of West Yellowstone

Each community participated in a variety of ways depending on the resources available in the community. Gallatin County applied for, received, and managed the funding for the plan update. Representatives from several county offices were active in all aspects of the plan's update. The cities and towns participated in the plan's update by sending representatives to public meetings, discussing elements of the plan at the public meetings and with the contractor, providing information and comments to the contractor when requested, hosting public meetings, and reviewing the draft plan. *All jurisdictions adopted the plan through resolution upon completion.*

2.2.4 PUBLIC PARTICIPATION

To encourage public interaction and participation in plan content and development, the county was divided into five districts which cover the following areas (refer to **Figure 2-1**):

- District 1: Hebgen Basin – West Yellowstone – Yellowstone National Park
- District 2: Big Sky – Taylor Fork
- District 3: Bozeman – Four Corners (S & E) – Gallatin Gateway – Hyalite – Bear Canyon – Bozeman Pass – Bridger Canyon – Sedan
- District 4: Belgrade – Four Corners (N & W) – Dry Creek – Springhill – Menard - Maudlow – North Bridger
- District 5: Cherry Creek – Amsterdam/Churchill – Manhattan – Three Forks – Willow Creek – Madison River – Trident/Clarkston

Initial public meetings were held in each district in October 2017. Follow-up meetings were held in February 2018. The completed draft was posted on the GCEM website from December 21, 2018 through February 15, 2019. Comments could be provided via email on the GCEM website or via mail or phone. Any comments received were reviewed and integrated where applicable. Comments were readily accepted throughout the planning process.

Since county commission and town council meetings are also open public meetings, the discussions and subsequent adoption of the plan by the governing bodies provided additional opportunities for public comment. The jurisdictions advertised these meetings using their usual public notification procedures, typically by posting meeting agendas on their websites, in local newspapers, and at the meeting locations.

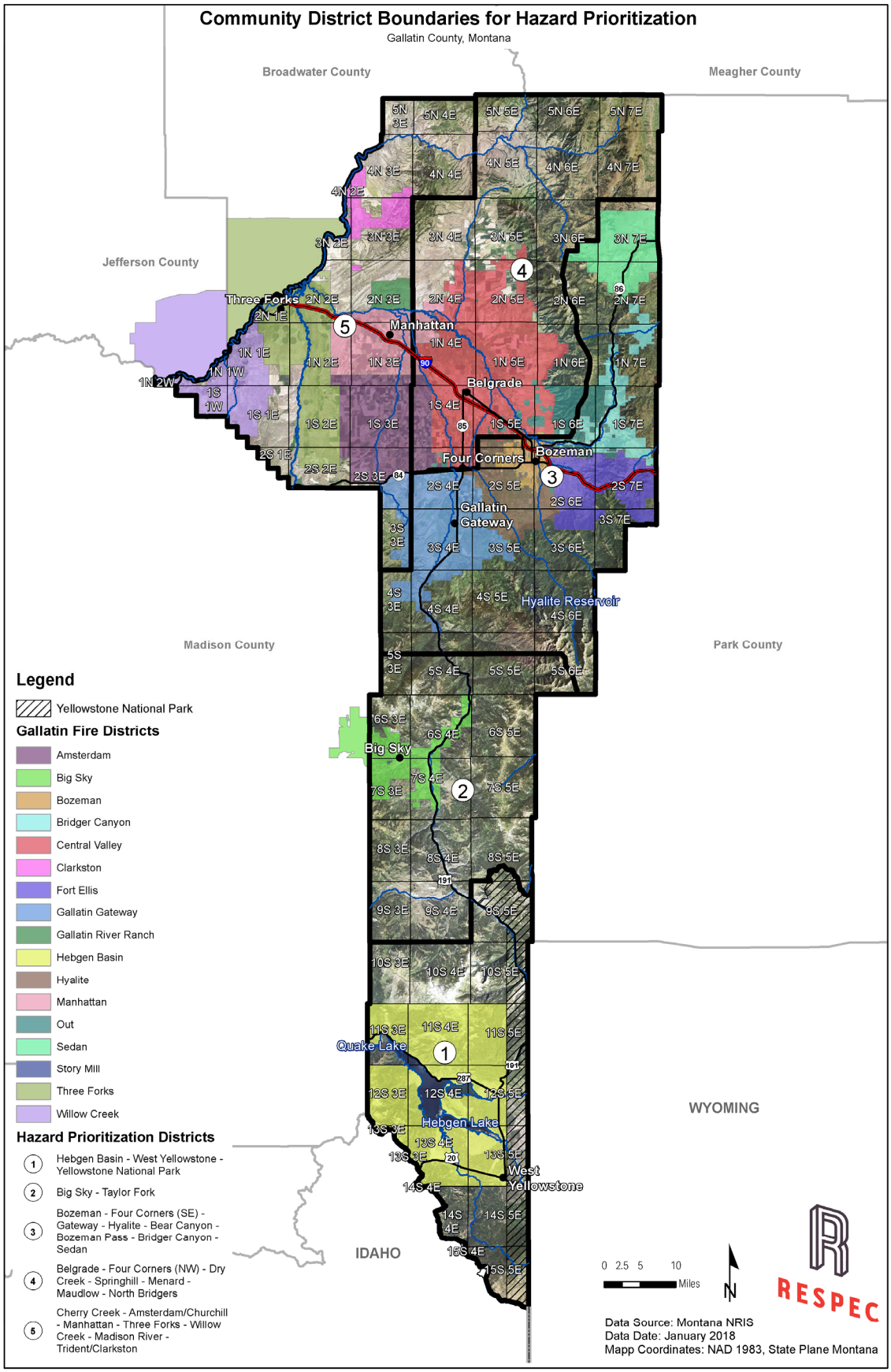


Figure 2-1: Community District Boundaries for Hazard Prioritization

2.2.5 INCORPORATION OF EXISTING INFORMATION

Information from existing plans, studies, reports, and technical information related to hazards, mitigation, and community planning were gathered via personal contact throughout the planning process, and by reviewing the 2006 and 2012 plans. Many national and state plans, reports, and studies provided background information. Data processing and map production was completed by RESPEC using information collected from a wide variety of sources, including the 2006 and 2012 HMPs and subject matter experts. The information was organized into a clear, usable, and maintainable format for the county ensuring that federal regulations regarding hazard mitigation plans were met. A list of existing local plans and documents that were evaluated as part of plan development is included in **Table 2-1.**

Table 2-1. Existing Local Plans and Documents Incorporated

Plan/Report/Study Name	Plan/Document Date
Gallatin County Growth Policy	2003
Gallatin County Subdivision Regulations	February 2014
City of Bozeman Capital Improvements Program	December 2015
Prospera Economic Profile of Gallatin and Park Counties	2017 and 2018
Bozeman Municipal Code	January 2018
Bozeman Community Plan (Growth Policy)	June 2009
Bozeman Unified Development Code	March 2018
Belgrade Growth Policy	October 2006
West Yellowstone Growth Policy	2017
Manhattan Municipal Code	December 2008
Belgrade Municipal Code	2009
Three Forks Municipal Code	October 2017
West Yellowstone Municipal Code	March 2017
City of Bozeman Drought Management Plan	January 2017
Gallatin County Hazardous Materials Plan	April 2009
Gallatin County Emergency Management Plan	January 2017

The Gallatin County HMP is a living, expandable document that can 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 Chapter 6.0.

2.3 RISK ASSESSMENT METHODOLOGIES

A key step in preventing disaster losses in Gallatin County and the incorporated jurisdictions is developing a comprehensive understanding of the hazards that pose risks to the communities. The following terms [Federal Emergency Management Agency, 2001] can be found throughout this plan:

- **Hazard:** A source of danger
- **Risk:** Probability of loss or injury
- **Vulnerability:** Open to attack or damage

This all-hazard risk assessment and mitigation strategy serves as an initial source of hazard information for those in Gallatin County. Other plans may be referenced and remain vital hazard documents, but each hazard has its own profile in this plan. As more data become available and disasters occur, the individual hazard profiles and mitigation strategies can be expanded, or new hazards added. This risk assessment identifies and describes the hazards that threaten the communities 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 potential projects.

The assets and community inventory section includes elements such as critical facilities, critical infrastructure, population, structures, economic values, ecologic values, historic values, social values, current land uses, new development, and future development potential. The list of critical facilities and infrastructure were carried over from the 2012 plan version. Additional elements were included during the plan update based on contractor research.

Each hazard or group of related hazards has its own hazard profile. A standalone hazard profile allows for the comprehensive analysis of each hazard from many different aspects. Each hazard profile contains a description of the hazard containing information from specific hazard experts and a record of the hazard history compiled from a wide variety of databases and sources.

Using local historical occurrence, or more specific documentation if available, a probability was determined. In most cases, the number of years recorded was divided by the number of occurrences, resulting in a simple past-determined recurrence interval. If the hazard lacked a definitive historical record, the probability was assessed qualitatively based on regional history or other contributing factors. The magnitude or extent of the hazard describes a realistic approximation of the worst case scenario. This qualitative approximation is based on past occurrences in the county or in nearby counties. If the past occurrence was not an accurate representation, general knowledge of the hazard was used to approximate the types of impacts that are expected from a low-frequency, high-magnitude event.

Mapping of the hazards, where spatial differences exist, allows for hazard analyses by geographic location. Some hazards, such as riverine flooding, can have varying levels of risk based on location (i.e., near the river versus far away from the river). Other hazards, such as winter storms or drought, cover larger geographic areas and delineation of hazard areas is not typically available or useful on the county scale.

Critical facilities were mapped using data provided by Gallatin County. The mapping of the facilities allowed for the comparison of building locations to the hazard areas where such hazards are spatially recognized. Base maps depicting the critical facility locations were compared to available hazard layers to show the proximity of the facilities to the hazard areas. Given the nature of critical facilities, the

functional losses and costs for alternate arrangements typically extend beyond the structural and contents losses. These types of losses can be inferred based on the use and function of the facility.
Critical infrastructure for services such as electricity, heating fuels, telephone, water, sewer, and transportation systems was assessed in a narrative format 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. These layers were additionally compared to the hazard areas. Most of the other types of infrastructure do not have digital mapping or were withheld by the managing company for security reasons.

Structures were mapped and analyzed in a similar manner as critical facilities. Data showing the locations of most structures countywide was provided by Madison and Gallatin Counties. This GIS mapping allowed for the comparison of building locations to the mapped hazard areas. Using this technique, an approximate number of structures in the various hazard areas can be determined. The value of structures in the hazard areas was determined using Montana Department of Revenue Computer Assisted Mass Appraisal System (CAMA) data that contains the taxable building value of each parcel in the county. The structure points provided by the counties were matched with the closest taxable building values. For some 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 4.0, a loss estimation software program developed by the Federal Emergency Management Agency (FEMA), approximated losses to structures from earthquakes and floods. Where GIS mapping was unavailable or not useful, estimations and plausible scenarios were used to quantify potential structure losses.

Population impacts were qualitatively assessed based on the number of structures estimated to be in the hazard area. Given 47,345 housing units and a population of 104,502, both based on 2016 U.S. Census estimates, an estimate of 2.2 people per structure was derived. Depending on the time of year, population concentrations are likely much greater due to non-resident populations. Other factors used in evaluating the population impacts included 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, time of year, extent of the damage, and other hazard specific conditions.

Qualitative methodologies, such as comparisons to previous disasters, occurrences in nearby communities, and plausible scenarios, helped determine the potential losses to economic, ecologic, historic, 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 on the impact to future development is based on the mechanisms currently in place to limit or regulate 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.

Many unknown variables limit the ability to quantitatively assess all aspects of a hazard with high accuracy. Therefore, data limitations provide a framework for identifying the missing or variable information. These limitations were determined by hazard through the risk assessment process. In some cases, the limitations may be resolved through research or data collection. If a limitation can be reasonably resolved through a mitigation project, the resolution is included as a potential action in the mitigation strategy. Other factors were determined based on an evaluation of past events and a general understanding of the hazard characteristics. This basic listing of secondary hazards provides a link between the hazard profiles and identifies additional hazards that may compound the impacts of the primary event (i.e., poor air quality because of smoke during a wildland fire).

At the end of the risk assessment, the summary brings together data from each of the hazards to show comparisons and ultimately rank the hazards by jurisdiction. The overall hazard rating is determined using qualitative rankings of the probability of future occurrences and likely impacts when compared to other hazards.

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

3.0 RISK ASSESSMENT AND COMMUNITY INVENTORY

This hazard risk assessment serves as a single source for hazard information in Gallatin County. 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 updated or new hazards can be added. This summary of hazards identifies and describes the hazards that threaten Gallatin County, including Bozeman, Belgrade, Manhattan, Three Forks and West Yellowstone, 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 proposed actions.

3.1 HAZARD IDENTIFICATION

Gallatin County is exposed to many hazards. The hazards were identified and profiled through several different means. Hazards were initially identified by participants in the first round of public meetings. Participants represented governmental agencies, private sector interests, and the general public. Subsequently, a history of past events was compiled and possible future events were recognized through internet research, available GIS data, archives research, public meetings, subject matter experts, and an examination of existing plans. The identified hazards were validated and ranked at public meetings held in February 2018.

The hazards (in alphabetical order) have been identified as follows in **Table 3-1**. The level of detail for each hazard is based on the relative risk to the communities and is limited by the amount of data available.

Table 3-1. Gallatin County Hazards

Hazard	Jurisdiction	How Identified	Why Identified
Avalanche and Landslide	/ Gallatin County	/ State DES Website / Historical records from the avalanche.org database / Colorado Avalanche Info. Center / Montana Hazard/Vulnerability Analysis (1989) / USGS National Landslide Study / Montana Department of Transportation District 2 Priorities / Public meeting input / 2018 HAZUS study	/ Potential for landslides and avalanches due to varied terrain / History of fatal avalanches / 2005 HAZUS study identified areas of significant landslide risk
Aviation Accidents	/ Gallatin County / All Incorporated Cities and Towns	/ Federal Aviation Administration / National Transportation Safety Board	/ Potential for mass casualty incident / Increased aircraft traffic at Bozeman-Yellowstone International Airport
Civil Unrest	/ Gallatin County / All Incorporated Cities and Towns	/ State Dept. of Justice website / Public meeting input	/ Potential for organized demonstrations and protests to cause significant disruptions to daily activities
Communicable Disease and Bioterrorism	/ Gallatin County / All Incorporated Cities and Towns	/ Centers for Disease Control and Prevention website / Public meeting input / Local Health Department	/ Large number of livestock areas / History of an influenza outbreak / The area is highly traveled by tourists / Rapid disease spread potential through urban areas

Hazard	Jurisdiction	How Identified	Why Identified
Critical Infrastructure Disruption	/ Gallatin County / All Incorporated Cities and Towns	/ Public meeting input / Subject matter experts	/ Dependence of population on utility services
Dam Failure	/ Gallatin County	/ National Inventory of Dams website / Dam Emergency Action Plans	/ Several high hazard dams and several significant hazard dams exist in the county
Drought	/ Gallatin County / All Incorporated Cities and Towns	/ Montana Drought Advisory / National Drought Mitigation / Data from the Western Regional Climate Center / State DES website / NOAA Paleoclimatology	/ Frequent historical drought events / USDA Disaster Declarations / Importance of agriculture to the local economy
Earthquake	/ Gallatin County / All Incorporated Cities and Towns	/ Montana Bureau of Mines and Geology / US Geological Survey / 2005 HAZUS Study	/ History of nearby earthquakes greater than 6.0 magnitude / Proximity to the active geological region of Yellowstone National Park Gallatin / 2005 HAZUS scenarios defined a significant hazard
Environmental Hazards	/ Gallatin County / All Incorporated Cities and Towns	/ Montana Dept. of Environmental Quality / U.S. Environmental Protection Agency / Public meeting input	/ Recent increases in air quality impacts due to wildfires / Surface and groundwater contamination potential
Flooding	/ Gallatin County / All Incorporated Cities and Towns	/ FEMA / US Army Corp of Engineers / Gallatin County DES	/ History of flooding / Large areas of identified floodplain in developed areas
Ground Transportation Accident	/ Gallatin County / All Incorporated Cities and Towns	/ National Transportation Safety Board / Montana Highway Patrol / Federal Railroad Administration / Montana Department of Transportation	/ Heavily traveled Interstate 90 and Highway 191 traverse the county / History of small transportation accidents / Potential for larger transportation accidents causing mass casualties
Hazardous Materials Release	/ Gallatin County / All Incorporated Cities and Towns	/ Gallatin County Hazardous Material Plan / Environmental Protection Agency / US Department of Transportation Emergency Response Handbook	/ Fixed facilities exist in the county that house hazardous materials / Regular interstate, highway, and railroad traffic transport hazardous materials / History of hazardous material releases
Railroad Accident	/ Gallatin County	/ Montana Rail Link / Public meeting input / U.S. Dept. of Transportation	/ Significant rail traffic through county with potentially hazardous cargo
Severe Weather	/ Gallatin County / All Incorporated Cities and Towns	/ National Climatic Data Center database / National Weather Service / Storm Prediction Center	/ History of severe weather events, including damages
Terrorism	/ Gallatin County / All Incorporated Cities and Towns	/ Bureau of Alcohol, Tobacco & Firearms / Federal Bureau of Investigation	/ Heightened alert since September 11, 2001 / Small scale incidents have occurred in Gallatin County

Hazard	Jurisdiction	How Identified	Why Identified
		/ Gallatin County Emergency Operations Plan / Southern Poverty Law Center website / Anti-Defamation League website	/ Proximity to Yellowstone National Park and National Forest lands
Urban Conflagration	/ Gallatin County / All Incorporated Cities and Towns	/ County Fire Marshal / Local fire departments, districts and fire service areas	/ Increased urbanization and development densities combined with lighter weight home construction materials
Violence	/ Gallatin County / All Incorporated Cities and Towns	/ Local law enforcement / Public meeting input	/ Rapid increases in population / Increased drug traffic and general crime within county
Volcano	/ Gallatin County / All Incorporated Cities and Towns	/ Yellowstone Volcano Observatory / Montana Disaster and Emergency Services	/ Proximity to active volcanic caldera / History of ash fall over the county
Wildfire	/ Gallatin County / All Incorporated Cities and Towns	/ Montana Department of Natural Resources and Conservation / US Forest Service / Gallatin County Community Wildfire Protection Plan	/ Local history of wildfire / Numerous areas of Wildland-Urban Interface (WUI)

3.2 ASSETS AND COMMUNITY INVENTORY

An important piece of assessing the risk of the communities to the studied hazards is to recognize what assets are more vulnerable to those hazards than others. Identifying the assets in the communities is the first step in assessing the vulnerabilities to those assets. In many cases, once important facilities are identified, they can then be prioritized for mitigation. Examples of community assets include the population, critical facilities, government (publicly owned) facilities, businesses, residences, structures housing vulnerable populations, road and utility infrastructure, natural resources, and the economy. The most important facilities typically protect the continuity of government, the safety of the population, or the economy.

3.2.1 CRITICAL FACILITIES AND INFASTRUCTURE

Critical facilities and infrastructure protect the safety of the population, the continuity of government, or the values of the community. In many cases, critical facilities fulfill important public safety, emergency response, and/or disaster recovery functions. In other cases, critical facilities may protect a vulnerable population, such as a school or elder care facility. Examples of critical facilities include: 911 emergency call centers, emergency operations centers, police and fire stations, public works facilities, sewer and water facilities, hospitals, jails, schools, essential businesses, shelters, and public services buildings. The transportation network is another example of important infrastructure and relies on bridges and road/rail segments.

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 Gallatin County and, in some cases, is critical to protecting life and property.

3.2.1.1 CRITICAL FACILITIES

Critical facilities were initially identified throughout the planning process for the 2006 and 2012 plans and then reviewed and updated in 2018. These facilities are listed below in **Table 3-2** through **Table 3-10**. Critical facility locations are shown in **Figure 3-1** through **Figure 3-78**.

Table 3-2. Critical Facilities - Local Government and Law Enforcement

Name	Address	Replacement Value
Law & Justice Center	615 S. 16th Bozeman	
Gallatin County Courthouse	311 West Main Bozeman	
Bozeman City Hall	121 North Rouse Bozeman	
Gallatin County Fairgrounds	901 North Black Bozeman	
Montana State University Police	Roy Huffman Building, 7th & Kagy, Bozeman	$1,492,000
Gallatin County Coordination Center	219 East Tamarack Bozeman	
Gallatin County Emergency Communications Center	1705 Vaquero Parkway Bozeman	
Belgrade City Hall	91 E. Central Belgrade	$1,600,000
Manhattan City Hall	120 West Main Manhattan	$225,000
Three Forks City Office	206 Main Three Forks	
West Yellowstone Police	124 Yellowstone Avenue West Yellowstone	

Table 3-3. Critical Facilities – Fire and Emergency Medical Service (EMS) Stations

Name	Address	Replacement Value
Bozeman Fire Department Station #1	34 N. Rouse Bozeman	$646,000
Bozeman Fire Department Station #2	410 S. 19th Bozeman	$263,000
Bozeman Fire Department Station #3	1705 Vaquero Parkway Bozeman	
Amsterdam Fire District	7170 Church Hill Rd. Amsterdam	$150,000
Bridger Canyon Fire District	8081 Bridger Canyon Rd. Bozeman	$250,000
Central Valley Fire District #1	205 E. Main Belgrade	$1,000,000
Central Valley Fire District #2	3650 Springhill Rd. Belgrade	$750,000
Central Valley Fire District #3	275 Ice Center Rd. Bozeman	$300,000
Central Valley Fire District #4	13500 Springhill Rd Belgrade	
Central Valley Fire District #5	9600 Walker Rd Belgrade	
Fort Ellis Fire Service Area	3725 Bozeman Trail Rd. Bozeman	$100,000
Gallatin Gateway Fire District	320 Webb Street Gallatin Gateway	

Name	Address	Replacement Value
Hyalite Fire Department #1	4541 S. 3rd Rd. Bozeman	
Hyalite Fire Department #2	10200 Cottonwood Rd. Bozeman	
Hyalite Fire Department #3	5400 Gooch Hill Rd. Bozeman	
Manhattan Fire District	222 E. Main St. Manhattan	
Three Forks Fire District	13 E. Date St. Three Forks	$100,000
Hebgen Basin Rural Fire District	10 S. Faithful Street West Yellowstone	
Willow Creek Fire District	107 Main Willow Creek	$90,000
Big Sky Fire Station #1	650 Rainbow Trout Run Big Sky	
Big Sky Fire Station #2	460 Lone Mountain Trail Big Sky	$500,000
Gallatin River Ranch Fire District	Equestrian Center Loop Manhattan	$130,000
Bozeman-Yellowstone International Airport Fire Station	780 Gallatin Field Rd. Belgrade	$156,000
Clarkston Fire Service Area	12455 Clarkston Rd. Three Forks	$100,000

Table 3-4. Critical Facilities - Hospitals and Clinics

Name	Address	Replacement Value
Bozeman Health Deaconess Hospital	905 – 931 Highland Blvd. Bozeman	$20,400,000
Bozeman Health Belgrade Clinic	206 Alaska Frontage Rd. Belgrade	
Bozeman Health Big Sky Medical Center	334 Town Center Avenue Big Sky	
Bozeman Health Big Sky Mountain Clinic	100 Beaverhead Trail Big Sky	$3,000,000
Bozeman Health Outpatient Services	120 N. 19th Suite D Bozeman	$506,000
Bozeman Health Urgent Care	1006 W. Main St. Bozeman	$912,000
Gallatin Community Clinic	214 E. Mendenhall Bozeman	$376,000
Gallatin County Health Department	215 W. Mendenhall Bozeman	
Kurtz, Curt MD	8707 Jackrabbit Rd. Belgrade	$954,000
Three Rivers Clinic	16 Railway Ave. Three Forks	
Allergy and Asthma Consultants PC	1188 N. 15th Ave. Suite 3 Bozeman	$724,000
Belgrade Clinic PLLP	33 W. Main St. Belgrade	$1,400,000
Belgrade Urgent Care	403 W. Main St. Belgrade	$340,000

Name	Address	Replacement Value
Manhattan Medical Services	207 S. 6th St. Manhattan	$79,000
Nature's Wisdom	9202 River Rd. Bozeman	$104,000
Bridger Mountain Physical Therapy	851 Bridger Dr. Bozeman	
Kreitzburg, Susan	2100 Fairway Dr. Suite 102 Bozeman	$207,000
Bridger Eye Center and Optical	113 E. Oak St. #2C Bozeman	$828,000
Rocky Mountain Natural Health	702 N. 19th Ave. Bozeman	$737,000
Bozeman Medical Arts Center	300 N. Willson Ave. Bozeman	$1,474,000
Gallatin Mental Health Center	699 Farmhouse Ln. Bozeman	$267,000
Gallatin Valley Natural Medicine	2022 N. 22nd Ave. #2 Bozeman	$222,000
Family Dermatology Center	2409 W Main St. #1 Bozeman	$812,000
Alcohol and Drug Services of Gallatin County	2310 N 7th Ave. Ste. A Bozeman	$2,019,000
Montana Skin Cancer and Dermatology Center	1727 W College St. Bozeman	$289,000
Hapcic, Karl MD	1125 W. Kagy Blvd. #201 Bozeman	$182,000
Bridger Orthopedic	1450 Ellis St. #201 Bozeman	$700,000
Bridger Orthopedic West	3400 Laramie Dr. Bozeman	
Swingle Health Center	MSU Bozeman	$3,681,000
Yellowstone Family Medical	11 S. Electric West Yellowstone	$500,000
Alpine Physicians Health Center	613 Lamme St. Bozeman	
Bridger Creek Family Health	316 E. Babcock St. Bozeman	

Table 3-5. Critical Facilities - Transportation

Name	Address	Replacement Value
Bozeman-Yellowstone International Airport	850 Gallatin Field Rd. Belgrade	
Yellowstone Airport	625 Yellowstone Airport Rd. West Yellowstone	
Pogreba Field	1680 Airport Rd. Three Forks	
Montana Rail Link	99 Northern Pacific Rd. Belgrade	
Greyhound Bus	2 S. Main St. Three Forks	
Buffalo Bus Lines Inc.	415 Yellowstone West Yellowstone	
Karst Stage	511 N. Wallace Bozeman	

First Student Inc.	3425 N. 27th Ave. Bozeman	
Belgrade School District No. 44, Transportation	17063 Frontage Road Belgrade	
Harlow's Plus Services	1085 Yadon Road Manhattan	
Three Forks Public Schools	210 E. Neal Street Three Forks	
Big Sky School District No. 72	45465 Gallatin Road Big Sky	
West Yellowstone Schools	411 N. Geyser West Yellowstone	

Table 3-6. Critical Facilities - State Government

Name	Address	Replacement Value
Montana Highway Patrol	39 Gold Miner Lane, Suite B Belgrade	
Montana National Guard	350 Airport Rd. Belgrade	
Fish, Wildlife and Parks, Region 3	1400 S. 19th Ave. Bozeman	
Montana Dept. of Transportation	100 Nelson Road Bozeman	
Montana Department of Natural Resources and Conservation	2273 Boothill Court Bozeman	

Table 3-7. Critical Facilities - Federal Government

Name	Address	Replacement Value
US Forest Service	3710 Fallon St. Ste. C Bozeman	
Federal Building (GSA) & US Post Office	32 East Babcock Bozeman	
US Post Office	5711 E. Baxter Ln. Bozeman	
US Post Office	9 Frontage Rd. Three Forks	
US Post Office	96 N. Weaver Belgrade	
US Post Office	201 E. Railroad Manhattan	
US Post Office	4 Rabel Ln. Gallatin Gateway	
US Post Office	209 Grizzly Ave. West Yellowstone	

Table 3-8. Critical Facilities - Assisted Living and Senior Housing

Name	Address	Replacement Value
Evergreen Healthcare	321 N. 5th St. Bozeman	$1,628,000
Bear Creek Respite Care	1002 E. Kagy Bozeman	$139,000
Bozeman Health Hillcrest Senior Living	1201 Highland Blvd. Bozeman	$13,777,000
Bozeman Adult Day Center	807 N. Tracy Bozeman	$1,000,000
Highgate Senior Living	2219 W. Oak Bozeman	$4,892,000

Name	Address	Replacement Value
Spring Meadows	3175 Graf St. Bozeman	
Generations Assisted Living	700 Minnesota Belgrade	$201,000
Open Arms Elderly Care	505 Minnesota Belgrade	$250,000
Our Home Elderly Care	190 Milestone Dr. Belgrade	
Century Village	100 Hamilton Court Manhattan	
Pathways Personal Care Home	622 Main Three Forks	$124,000
Edgewood Vista Adult Day Care	1011 Cardinal Dr. Belgrade	$578,000
Dutch Hearth	991 Pache Rd. Belgrade	$146,000
Church Hill Retirement Home	6151 Shady Rest Church Hill	$1,500,000
Mercy Manor	5830 Sypes Canyon Rd. Bozeman	$234,000
Gallatin Rest Home	1221 W. Durston Bozeman	
Mountain View Care Center	205 N. Tracy Bozeman	$1,939,000
Aspen Pointe at Hillcrest	1201 Highland Blvd. Bozeman	
High Country Care	8659 Haggerty Ln. Bozeman	$169,000
Hyalite Country Care	6040 S. 3rd Rd. Bozeman	
Hamilton House	9430 Haggerty Ln. Bozeman	$132,000
Darlinton Manor	606 N. 5th Ave. Bozeman	
Legion Villa	1215 W. Durston	

Table 3-9. Critical Facilities - Schools

Name	Address	Replacement Value
Manhattan Elementary	416 N. Broadway Manhattan	
Manhattan High School	416 N. Broadway Manhattan	
Chief Joseph Middle School	309 N. 11th Bozeman	$17,000,000
Meadowlark School	4415 Durston Rd. Bozeman	
Emily Dickinson School	2435 Annie St. Bozeman	$7,000,000
Hawthorne School	114 N. Rouse Bozeman	$5,000,000
Hyalite School	3600 W. Babcock Bozeman	

Name	Address	Replacement Value
Irving School	611 S. 8th Bozeman	
Longfellow School	516 S. Tracy Bozeman	
Morning Star School	830 Arnold Bozeman	
Sacajawea Middle School	3535 S. 3rd Bozeman	$12,000,000
Whittier School	511 N. 5th Bozeman	$5,000,000
Bozeman High School	205 N. 11th Bozeman	$44,000,000
Willow Creek High School	407 Main St. Three Forks	$2,500,000
Springhill School	602 Springhill Community Rd. Belgrade	$121,000
Cottonwood School	13233 Cottonwood School Bozeman	
Three Forks Elementary	212 E. Neal Three Forks	
Three Forks High School	210 E. Neal Three Forks	$12,000,000
Pass Creek School	3747 Pass Creek Rd. Belgrade	
Monforton School	6001 Monforton School Rd. Bozeman	
Gallatin Gateway School	100 Mill St. Gallatin Gateway	
Anderson School	10040 Cottonwood Rd. Bozeman	$23,000
LaMotte School	841 Bear Canyon Rd. Bozeman	
Martha Fox Heck School	308 N. Broadway Belgrade	$3,000,000
Quaw Elementary	91 Southview Ave. Belgrade	$4,000,000
Ridge View Elementary	117 Green Belt Dr. Belgrade	$3,500,000
Belgrade Middle School	400 Triple Crown Rd. Belgrade	$3,000,000
Belgrade High School	303 N. Hoffman Belgrade	$20,000,000
Malmborg School	375 Jackson Creek Rd. Bozeman	
West Yellowstone Elementary	500 Delacy West Yellowstone	$4,500,000
West Yellowstone High School	500 Delacy West Yellowstone	
Ophir School	45465 Gallatin Rd. Big Sky	
Lone Peak High School	45465 Gallatin Rd. Big Sky	
Amsterdam School	6360 Camp Creek Rd. Manhattan	$700,000

Name	Address	Replacement Value
Mount Ellis Academy	3641 Bozeman Trail Rd. Bozeman	
Manhattan Christian	8000 Churchill Rd. Manhattan	
Headwaters Academy	418 W. Garfield Bozeman	
Heritage Christian	4310 Durston Bozeman	
Gallatin-Madison Cooperative	21000 Frontage Rd. Belgrade	
Bozeman Christian School	1935 Nelson Rd. Bozeman	$180,000
Great Beginnings Montessori	5860 Springhill Rd. Bozeman	
Sourdough Montessori School	4310 Sourdough Rd. Bozeman	$127,000
Cottonwood Day School	10180 Cottonwood Rd. Bozeman	
Greenwood Academy	2015 Wheat Dr. Bozeman	
Learning Circle Montessori	516 W. Cleveland	
Summit School	3001 W. Villard Bozeman	$450,000
Bridger Alternative School	205 N. 11th Bozeman	
Highland Montessori	111 Highland Blvd. Bozeman	
World Family School	115 E. Dickerson Bozeman	
Petra Academy	4720 Classical Way Bozeman	
Bozeman Montessori	3774 Equestrian Lane Bozeman	
Middle Creek Montessori	1572 Cobb Hill Rd. Bozeman	
Renaissance Montessori	428 N. 11th Ave. Bozeman	
Secret Garden Montessori	900 Cobb Hill Rd. Bozeman	
Yellowstone Montessori	1705 W. Kagy Blvd. Bozeman	

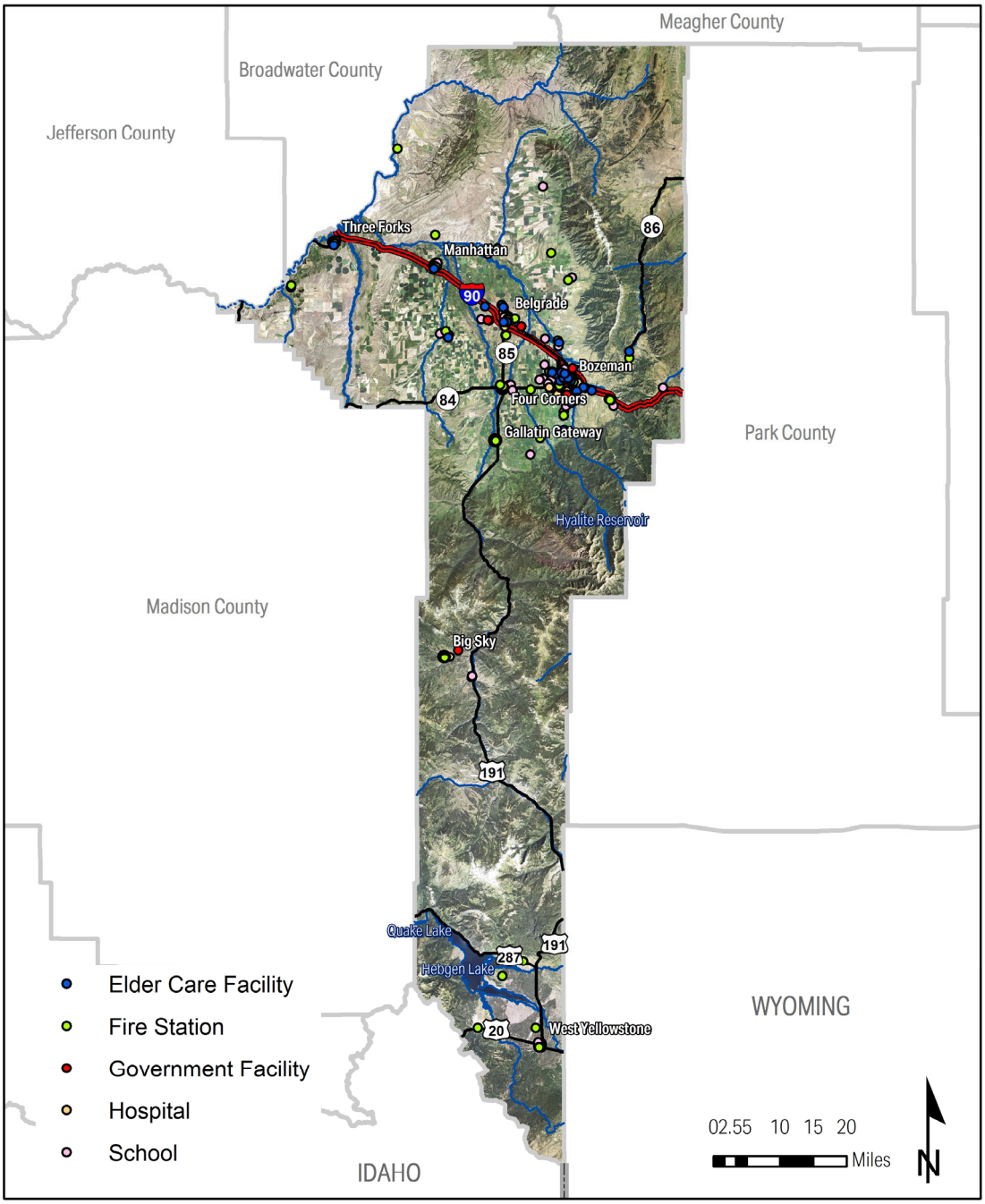
Table 3-10. Critical Facilities - Child Care, Day Care and Preschools

Name	Address	Replacement Value
Ark Child Care Center	403 W. Central Belgrade	
Little Lambs Child Development Center	308 Al Drive Belgrade	
Building Blocks Academy	301 S. 19th Bozeman	
Children's Development Center	804 S. Willson Bozeman	
Montessori Children's House	1450 W. Kagy Bozeman	

Name	Address	Replacement Value
Great Beginnings Montessori	5860 Springhill Rd. Bozeman	
Greenwood Academy	2015 Wheat Dr. Bozeman	
Head Start	32 S. Tracy Bozeman	
Highland Montessori	111 Highland Blvd. Bozeman	
Learning Circle	516 W. Cleveland Bozeman	
Little People's Academy	1612 W. Babcock Bozeman	
Methodist Preschool	121 S. Willson Bozeman	
Heritage Christian Preschool	4310 Durston Rd. Bozeman	
Montana Kids	1105 Campbell Rd. Bozeman	
MSU Child Development Center	Herrick Hall Bozeman	
Pilgrim Preschool	2118 S. 3rd Bozeman	
Sourdough Montessori	4310 Sourdough Rd. Bozeman	
Southwood Child Care	1805 S. Tracy Bozeman	
Sunshine Day Care	1805 S. Tracy Bozeman	
Teddy Bear Express	411 Arnold Bozeman	
Almost Home Child Care	1440 Bobcat Dr. Bozeman	
Little Geysers Child Care	603 Yellowstone Ave. West Yellowstone	

Critical Facilities

Gallatin County, Montana



Data Source: Montana NRIS, Gallatin County GIS
Data Date: August 2017
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Map Updated by:
Libby Ellwood
August 2017

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Figure 3-1. Critical Facilities Overview

Critical Facilities

Belgrade, Montana

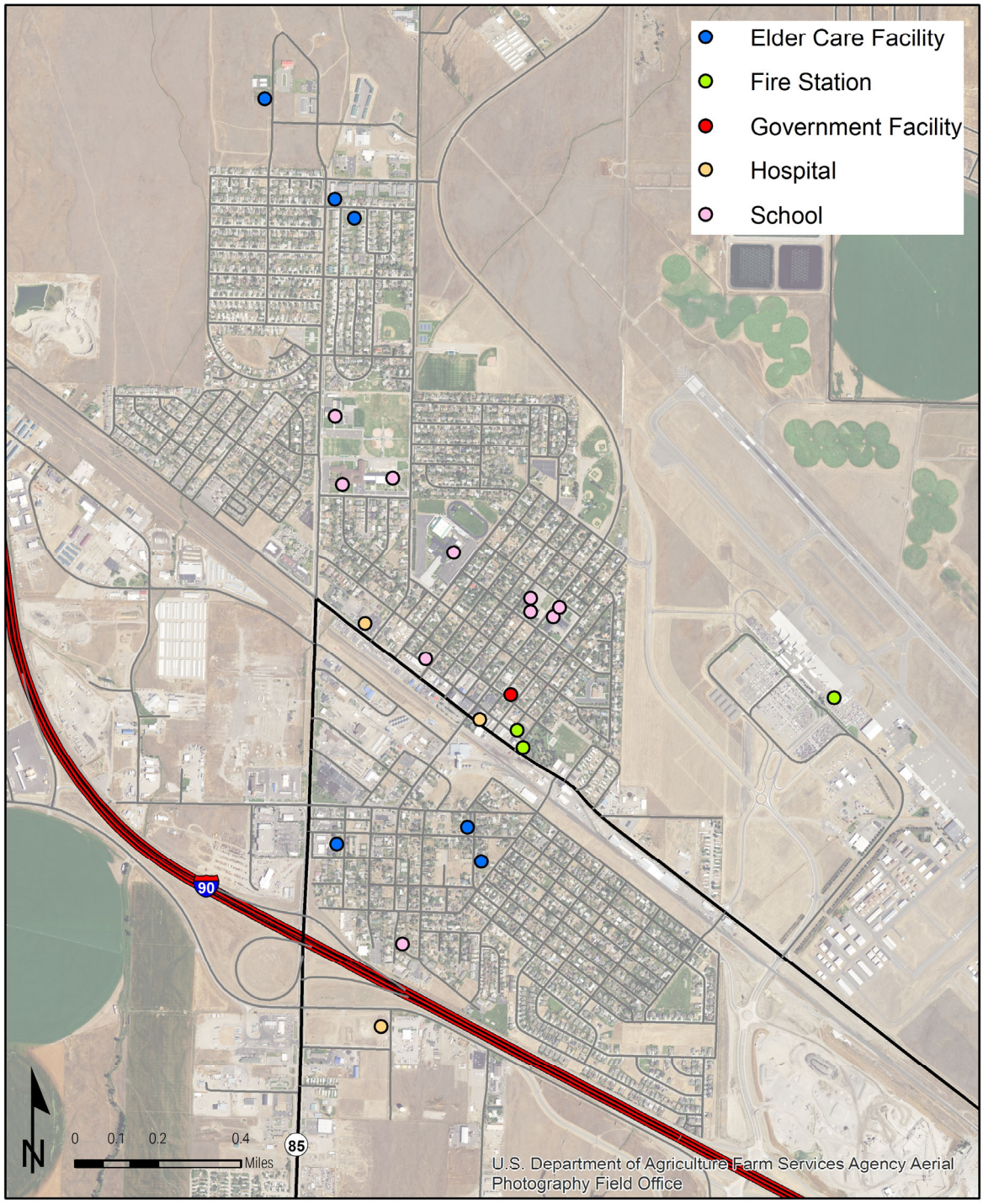

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Figure 3-1. Belgrade Critical Facilities

Critical Facilities

Big Sky, Montana

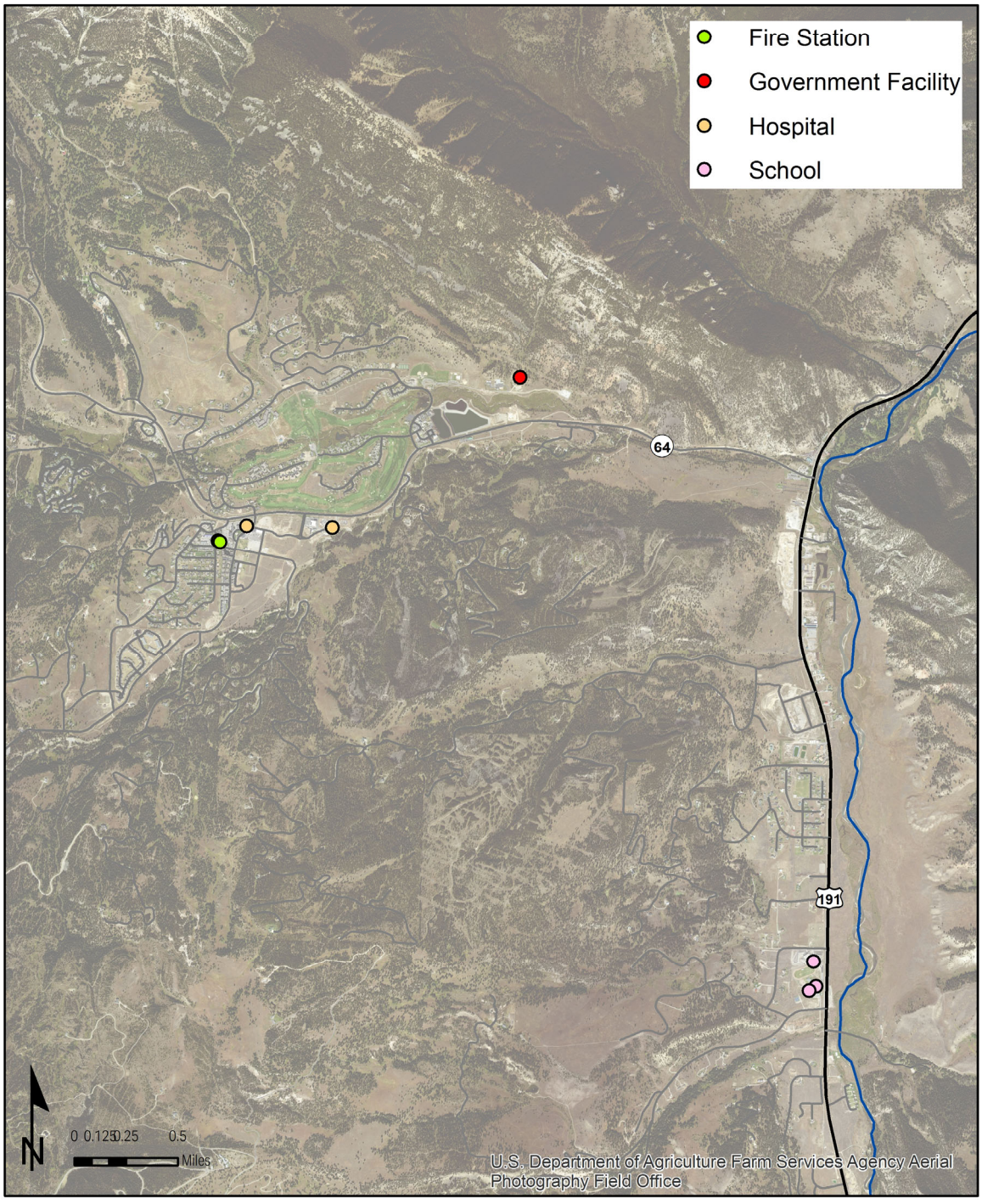

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Figure 3-2. Big Sky Critical Facilities

Critical Facilities

Bozeman, Montana

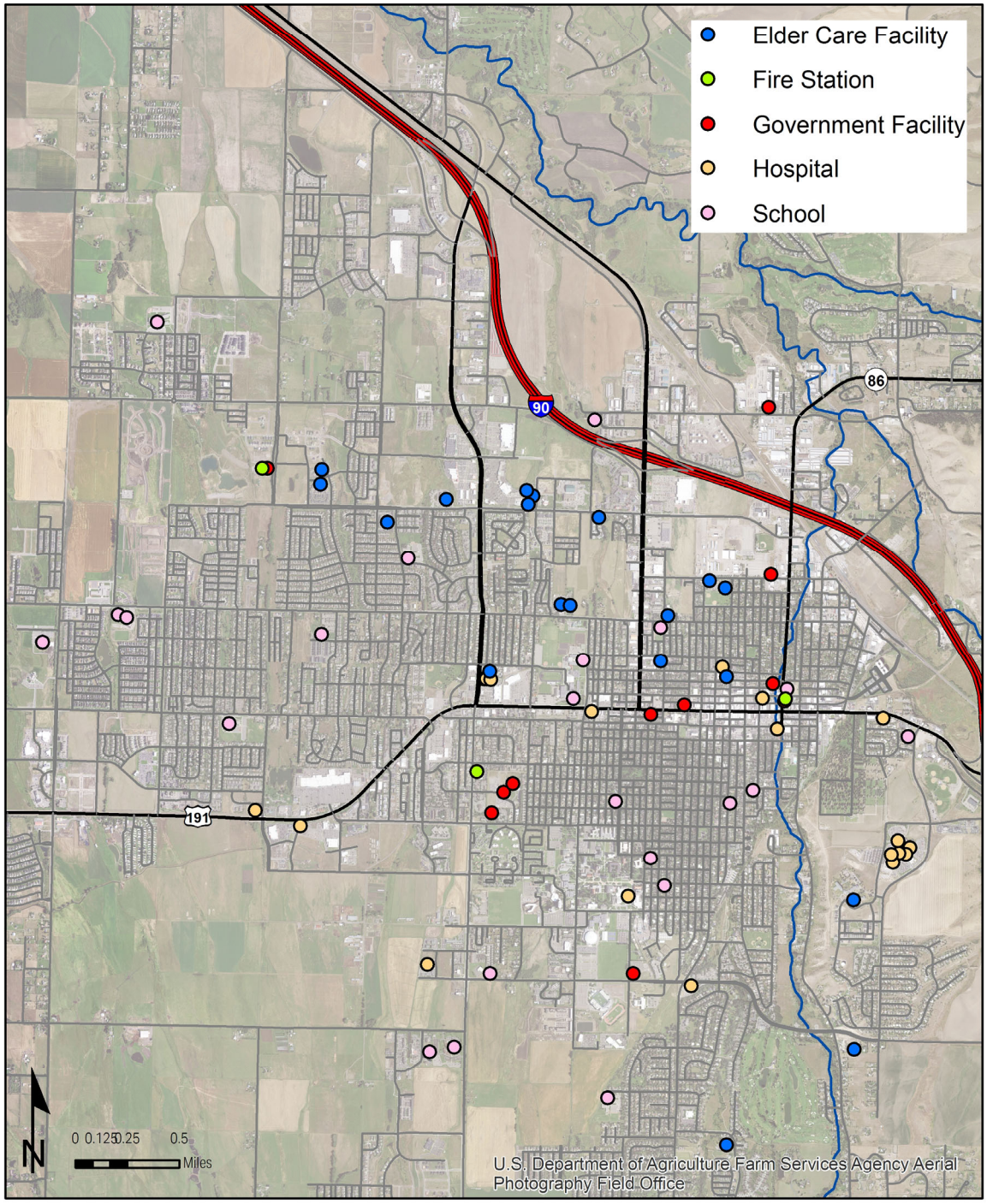

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Figure 3-3. Bozeman Critical Facilities

Critical Facilities
Four Corners, Montana

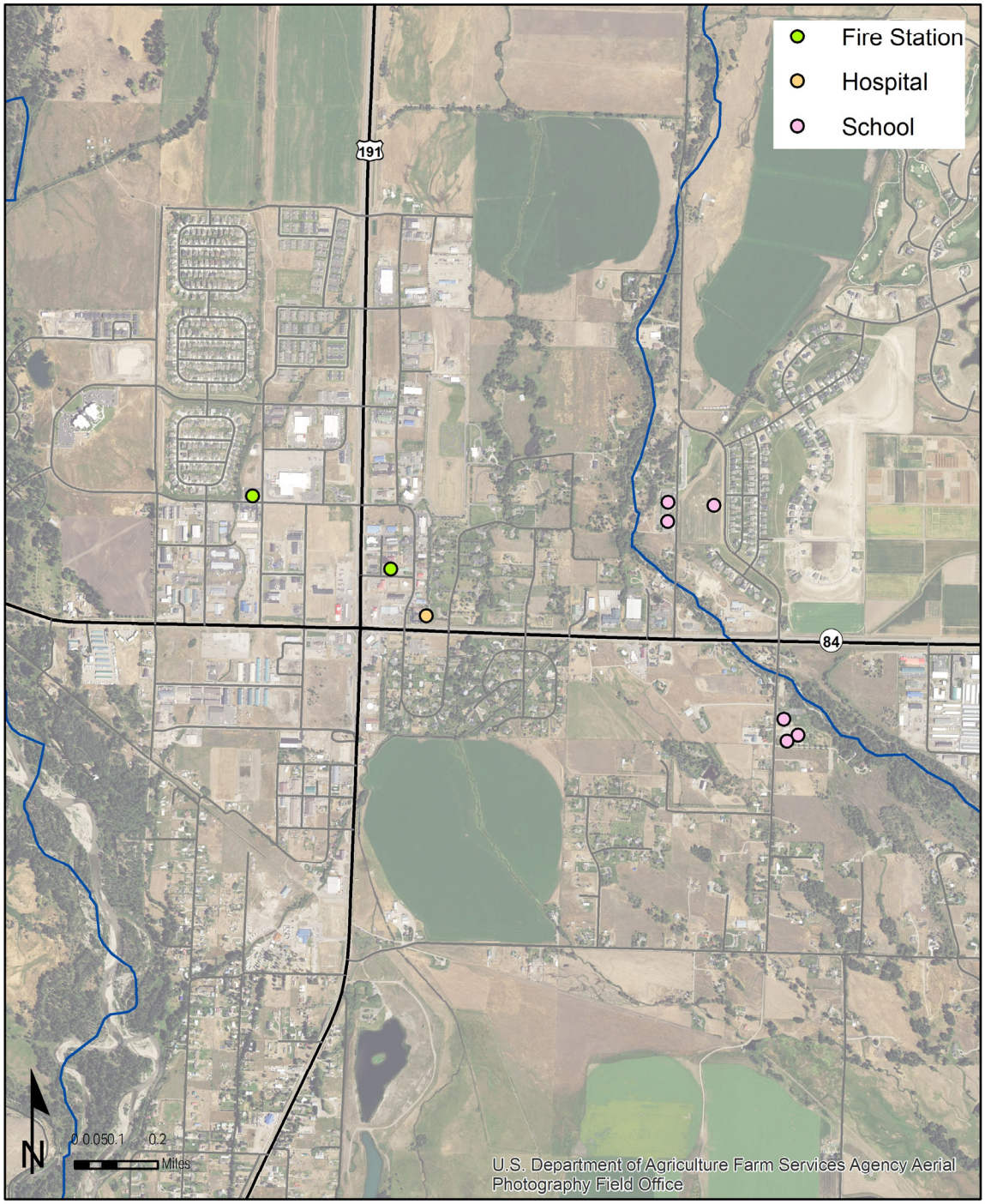

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Figure 3-4. Four Corners Critical Facilities

Critical Facilities

Manhattan, Montana

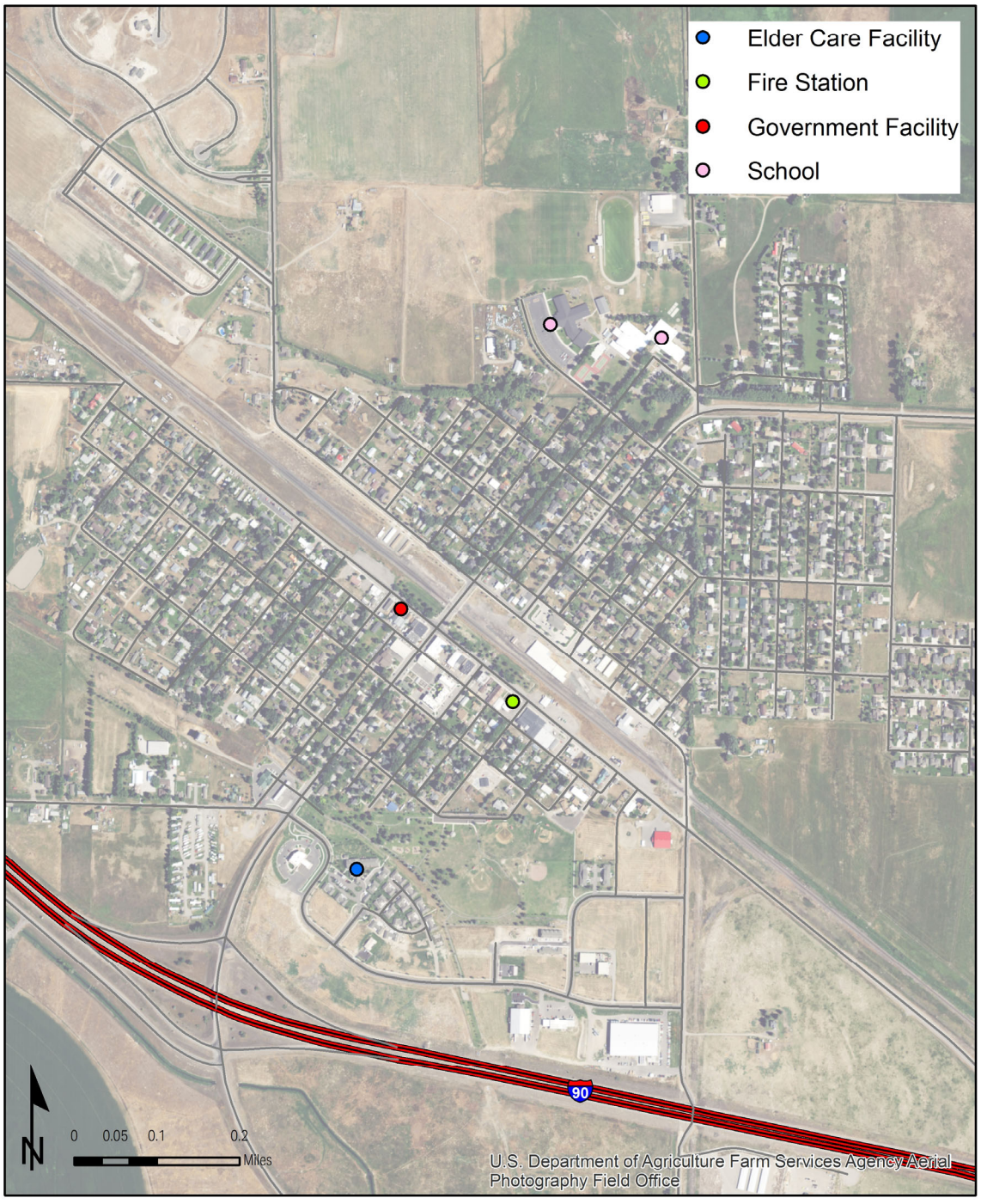

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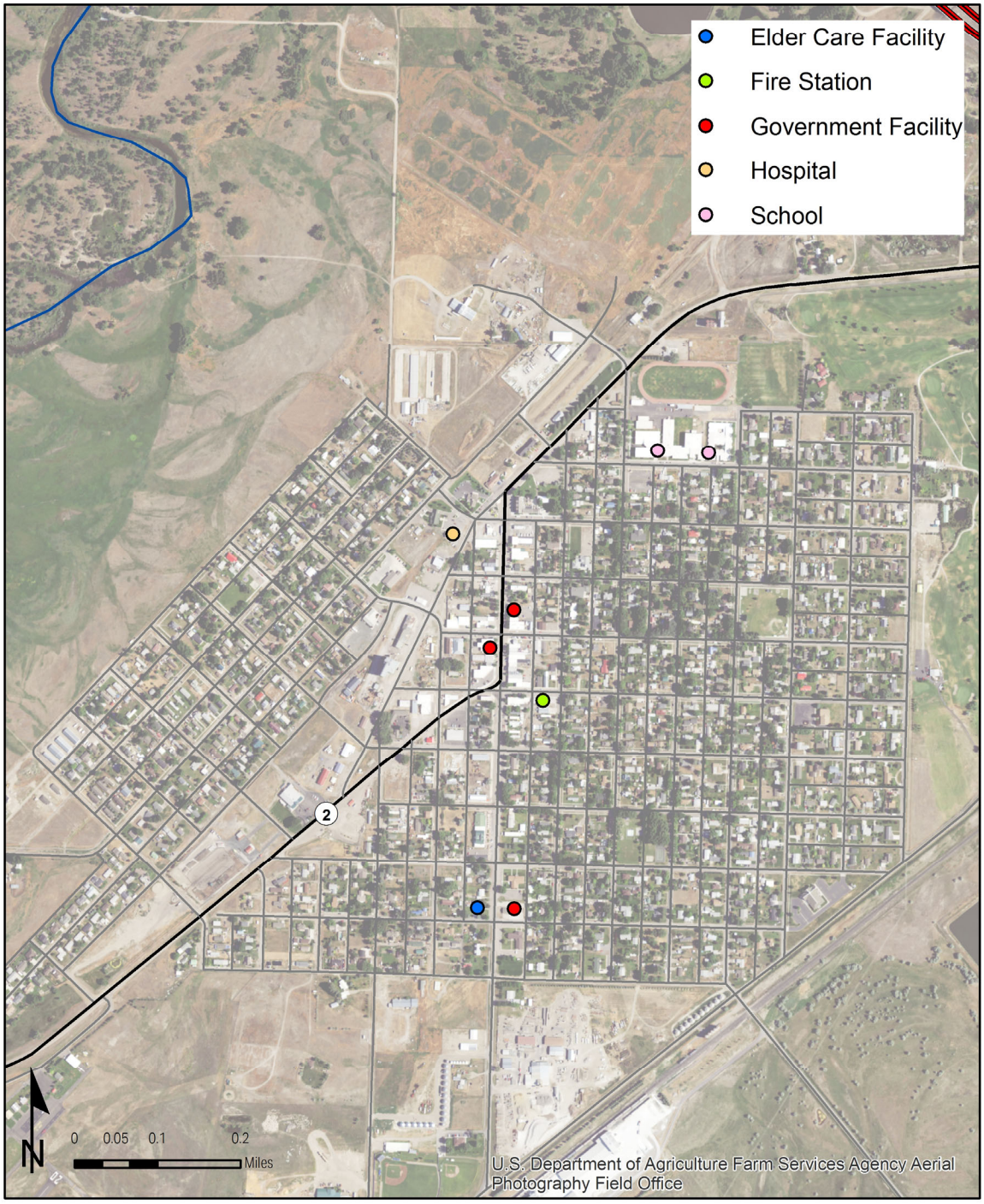
Figure 3-5. Manhattan Critical Facilities

Critical Facilities
Three Forks, Montana



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Data Date: August 2017
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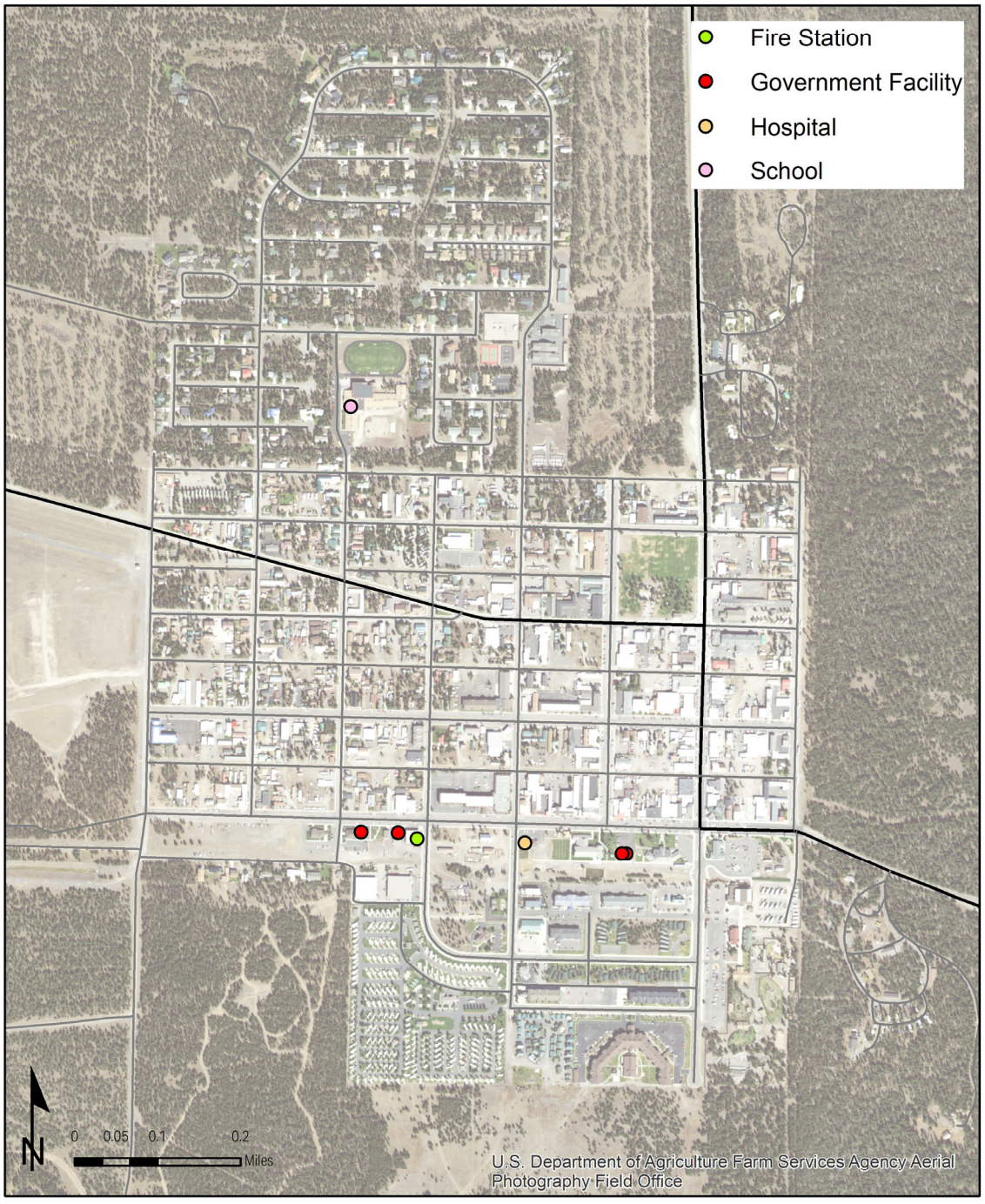
Figure 3-6. Three Forks Critical Facilities

Critical Facilities
West Yellowstone, Montana



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Base: NAIP 2015
Data Date: August 2017
Mapp Coordinates: NAD 1983, State Plane Montana

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Figure 3-7. West Yellowstone Critical Facilities

3.2.1.2 CRITICAL INFASTRUCTURE

Critical facilities were initially identified throughout the planning process for the 2006 and 2012 plans and then reviewed and updated in 2018. A list of critical infrastructure in Gallatin County is included in **Table 3-11**, with more detail provided in the sections below.

Table 3-11. Critical Facilities - Utility and Infrastructure Services

Name	Address	Replacement Value
Northwestern Energy (local office)	121 E. Griffin Dr. Bozeman	
Northwestern Energy (substation)	Quinn Creek Rd. – Bozeman Pass (45.6652 ° N, 110.7960 ° W)	
Northwestern Energy (substation)	Flanders Mill Rd. – Bozeman (45.6937 ° N, 111.0978 ° W)	
Northwestern Energy (substation)	South Church Rd. - Bozeman (45.6633 ° N, 111.0303 ° W)	
Northwestern Energy (substation)	Patterson Road - Bozeman (45.6269 ° N, 111.0833 ° W)	
Northwestern Energy (substation)	City of Bozeman Water Reclamation Facility (45.7222 ° N, 111.0700 ° W)	
Northwestern Energy (substation)	Four Corners (45.6708 ° N, 111.1922 ° W)	
Northwestern Energy (substation)	Belgrade (45.7744 ° N, 111.1794 ° W)	
Northwestern Energy (substation)	Three Forks (45.8783 ° N, 111.5544 ° W)	
Northwestern Energy (substation)	Big Sky (45.2703 ° N, 111.2783 ° W)	
Northwestern Energy Natural Gas Transmission Line	(refer to **Figure 3-9**)	
Fall River Rural Electric (substation)	West Yellowstone (44.6675 ° N, 111.1050 ° W)	
Fall River Rural Electric (substation)	1.3 miles west of W. Yellowstone (44.6722 ° N, 111.1389 ° W)	
Fall River Rural Electric (substation)	Romsett (44.6889 ° N, 111.2408 ° W)	
Fall River Rural Electric (substation)	North side of Hebgen Lake (44.8047 ° N, 111.1853 ° W)	
ExxonMobil Bozeman Terminal	220 W. Griffin Drive Bozeman	
Phillips66 Bozeman Products Terminal	318 W. Griffin Drive Bozeman	
Yellowstone Pipeline Company	(refer to **Figure 3-9**)	
Century Link	2707 W. Main St. Bozeman	
Gallatin County Landfill	10585 2 Dog Rd. Logan	
Bozeman Vehicle Maintenance	1812 N. Rouse Bozeman	$1,400,000

Name	Address	Replacement Value
Gallatin County Road Department	205 W. Baxter Lane Four Corners	
Bozeman Water Reclamation Facility	2245 Springhill Rd. Bozeman	
Bozeman Water Treatment Plant	7022 Sourdough Canyon Rd. Bozeman	
Manhattan Public Works	107 S. 7th St. Manhattan	
Three Forks City Shop	308 1 Ave. East Three Forks	$5,000,000
West Yellowstone Public Works	314 Yellowstone Ave. West Yellowstone	$350,000
Belgrade Public Works	91 E. Central Ave. Belgrade	
West Yellowstone Public Works	314 Yellowstone Ave. West Yellowstone	
Bozeman Lyman Water Treatment	Story Mill Rd. Bozeman	
Bozeman Hilltop Water Tank and Communications Site	Kenyon Dr. Bozeman	
Bozeman Sourdough Road Reservoir	Sourdough Rd. Bozeman	

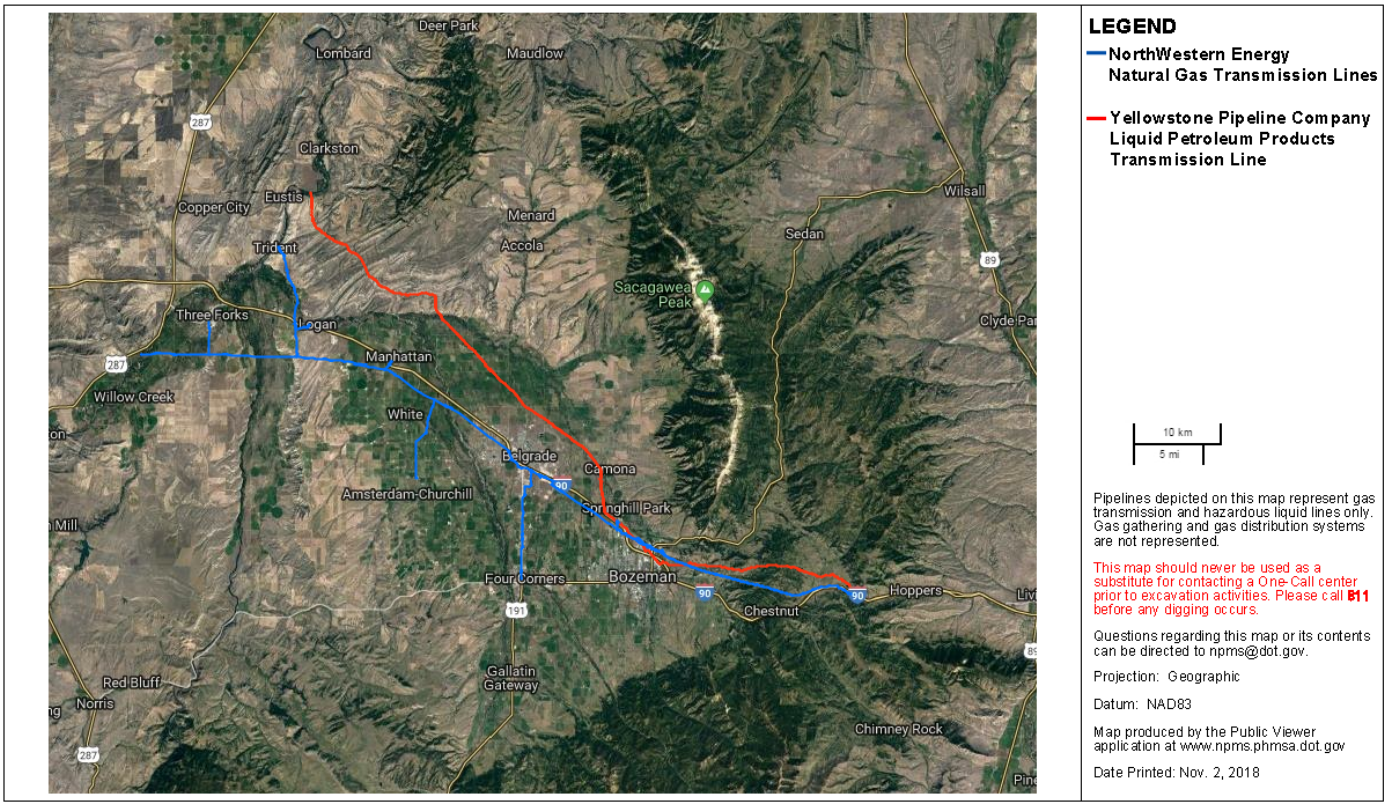


Figure 3-9. Major Natural Gas and Petroleum Pipeline Routes (from National Pipeline Mapping System. www.npms.phmsa.dot.gov)

Electricity

Electricity runs lights, computers, medical equipment, water pumps, heating system fans, refrigerators, freezers, televisions, and many other types of equipment. Northwestern Energy, headquartered in Sioux Falls, South Dakota, provides electricity in Gallatin 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.

Natural Gas

During the cold winter months, the heating of homes and businesses is a necessity. The primary heating fuel used in Gallatin County is natural gas. Overall, a variety of fuels are used as shown in **Table 3-12**. Most systems ultimately require electricity to run their thermostats and blowers.

Table 3-12. Home Heating Fuel [US Census, 2015]

	Natural Gas	Bottled, Tank, or LP Gas	Electricity	Coal or Coke	Wood	Solar Energy	Other Fuel	No Fuel Used
Gallatin County (Total)	22,637	2,855	9,852	6	2,314	36	272	133
Big Sky Community	113	368	241	0	333	0	7	0
City of Belgrade	5,910	860	1,851	0	536	0	65	26
City of Bozeman	13,697	725	6,499	0	735	21	151	100
Gallatin Gateway Community	975	264	405	0	220	0	28	2
Town of Manhattan	1,034	284	260	0	191	3	11	5
City of Three Forks	722	194	156	6	201	12	10	0
Town of West Yellowstone	186	160	434	0	96	0	0	0

Natural gas in portions of Gallatin County is provided by NorthWestern Energy through underground pipeline infrastructure (see **Figure 3-9**). Buildings heated with propane typically have a nearby tank that is refilled regularly by a local vendor. The vendor uses a truck to transport the propane/oil to the users. Therefore, the vendors rely 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.

Telephone

Local telephone services in the county are provided by Century Link (Gallatin Valley and West Yellowstone), and 3 Rivers Communications (Big Sky area). Similar to electric infrastructure, telephone can be run through overhead or underground lines. Much of the telephone infrastructure in Gallatin County lies within the road rights-of-way.

Water and Sewer

Municipal water and sewer systems exist within the incorporated communities and in some unincorporated communities in the county, such as Big Sky and Four Corners. The water systems typically consist of groundwater wells or pumps from a body of water. The sewer systems generally have treatment plants and/or lagoons. Both water and sewer use underground pipes to service customers. County residents outside of the water and sewer districts rely on individual well and septic systems.

Transportation

Transportation infrastructure within Gallatin County includes road, rail, and air networks. The primary road transportation routes in Gallatin County are: Interstate 90; US Highways 20, 191, and 287; and Montana Highways 2, 64, 84, 85, and 86. Gallatin County has an estimated 1,250 miles of county roads.

Montana Rail Link operates two railroad lines through the county. A main line runs through the northern section of Gallatin County and connects to Bozeman, Belgrade, and Manhattan. A second railroad branches from the main line at Logan and runs through Three Forks before connecting to various jurisdictions in Madison County. The railroad transports goods and raw materials along this line.

Bozeman-Yellowstone International Airport (BZN), located in Belgrade, operates within Gallatin County. It is the busiest airport in the State of Montana, and a full service commercial airport with both domestic and international flights. Additionally, Gallatin County has two smaller airports - West Yellowstone Airport (WYS) which has seasonal commercial traffic as well as private aircraft. WYS also houses the West Yellowstone Interagency Fire Center which is operated by the U.S. Forest Service. Pogreba Field (9S5), located in Three Forks, is a general aviation facility serving private, charter, and/or government aircraft.

3.3 POPULATION AND STRUCTURES

Citizens, visitors, and their property are all at risk from various disasters. Protection of life is the top priority in all disasters and incidents. Population statistics are listed below in **Table 3-13**.

Table 3-13. Population Statistics [U.S. Census Projections, 2017)

Location	July 1, 2017 Estimated Population	Change Since 2010 Census
Big Sky	2,308[1]	N/A
Belgrade	8,556	16.3%
Bozeman	46,596	25.0%
Four Corners	3,146[1]	N/A
Gallatin Gateway	856[1]	N/A
Manhattan	1,750	15.1%
West Yellowstone	1,365	7.4%
Three Forks	2,006	7.3%

[1]Sourced from 2010 US Census data—more recent population estimates not available

Like critical facilities, structures such as residences are also vulnerable to hazards. **Table 3-14** and **Table 3-15** detail selected Gallatin County housing statistics.

Table 3-14. Housing Statistics [U.S. Census 2011-2015 American Community Survey]

	Number of Housing Units	Number of Mobile Homes	Number of Facilities Lacking Complete Plumbing	Number of Facilities Lacking Complete Kitchen	Number of Facilities Lacking Telephone Service
Gallatin County (Total)	47,345	3,371	125	226	1,143
Big Sky Community	2,357	29	32	16	31
City of Belgrade	10,063	900	29	9	278

	Number of Housing Units	Number of Mobile Homes	Number of Facilities Lacking Complete Plumbing	Number of Facilities Lacking Complete Kitchen	Number of Facilities Lacking Telephone Service
City of Bozeman	12,081	1,444	36	143	641
Gallatin Gateway Community	2,234	306	16	12	29
Town of Manhattan	2,041	291	5	17	50
City of Three Forks	1,500	252	8	8	58
Town of West Yellowstone	1,714	149	0	21	56

Table 3-15. Structure Age [U.S. Census 2011-2015 American Community Survey]

	Total Housing Units	2010 or later	2000 to 2009	1990 to 1999	1980 to 1989	1970 to 1979	1960 to 1969	1950 to 1959	1940 to 1949	1939 or Earlier
Gallatin County (Total)	43,996	1,465	13,341	8,466	4,944	6,912	2,714	1,768	998	3,388
Big Sky Community	2,357	0	1,067	333	201	340	83	68	50	215
City of Belgrade	10,063	230	3,917	2,497	1,255	1,156	263	338	139	268
City of Bozeman	24,081	1,108	6,614	4,151	2,424	4,179	1,949	1,119	565	1,972
Gallatin Gateway community	2.234	42	611	457	324	404	144	24	56	172
Town of Manhattan	2,041	21	428	435	247	339	62	129	78	302
City of Three Forks	1,500	27	336	252	177	221	69	17	26	375
Town of West Yellowstone	1,714	37	368	341	316	273	144	67	84	84

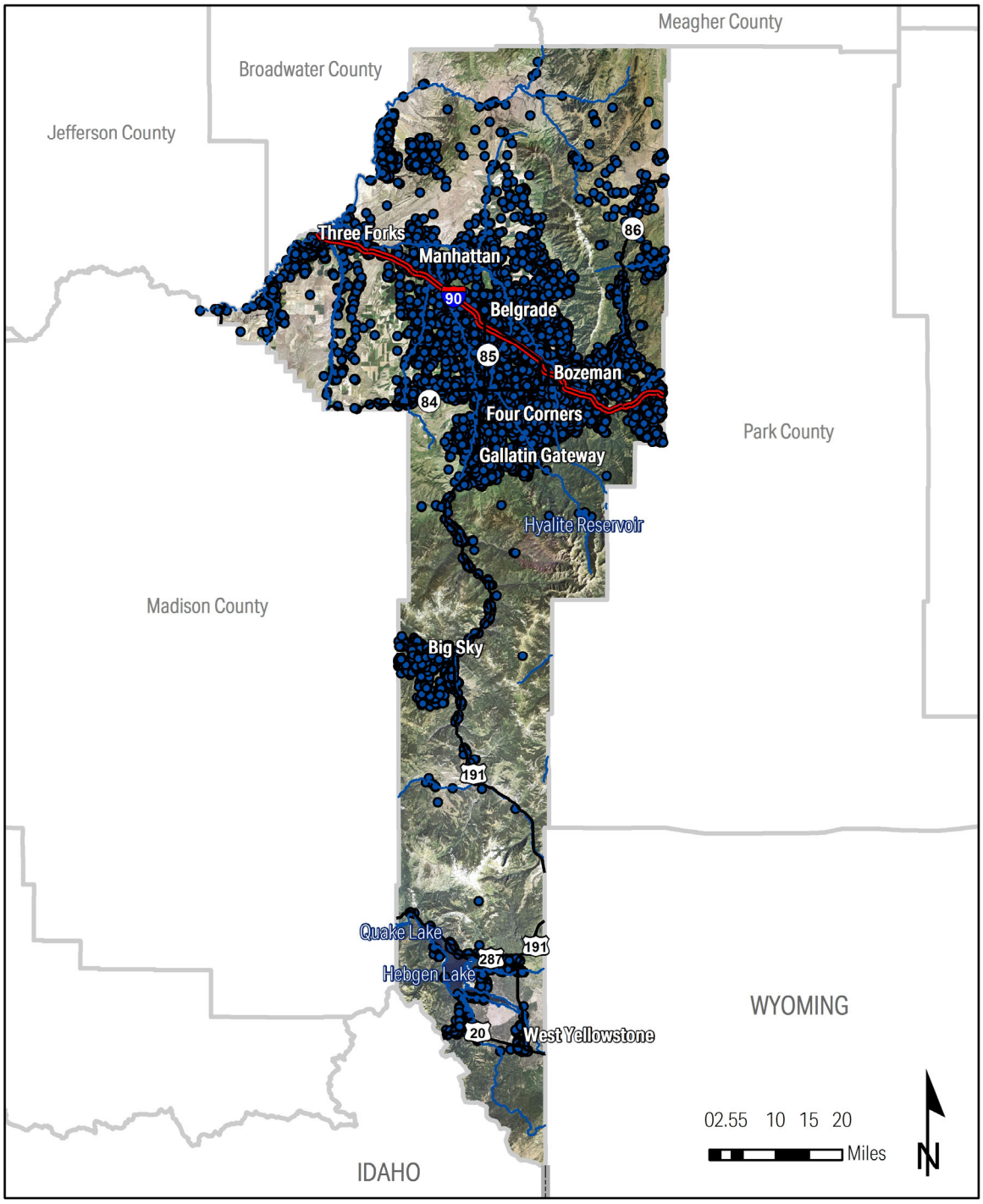
The median home value in Gallatin County is $303,700 according to 2017 U.S. Census estimates, and $362,278 (thru September 2017) according to the Gallatin Association of Realtors. The cost to replace existing structures is listed below in **Table 3-16** using both U.S. Census and Montana Dept. of Revenue, Computer-Assisted Mass Appraisal (CAMA) data, as well as FEMA's HAZUS-MH loss estimation software. **Figure 3-910** shows the locations of structures with values based on the closest CAMA parcel with a building value greater than $0.

Table 3-16. Structure Value [U.S. Census 2011-2015 American Community Survey]

	Census Estimated Median Value	CAMA Estimated Average Value	HAZUS-MH Residential Building Total Replacement Value
Gallatin County	$271,500	$345,920	$7,641,663,000
Big Sky Community	$457,600	$660,260	$340,755,000
City of Belgrade	$244,000	$278,120	$428,268,000
City of Bozeman	$282,400	$454,730	$2,926,557,000
Gallatin Gateway community	$364,300	$466,250	$95,429,000
Town of Manhattan	$241,200	$280,760	$135,709,000
City of Three Forks	$202,800	$125,670	$112,546,000
Town of West Yellowstone	$248,700	$397,300	$181,602,000

Structure Locations

Gallatin County, Montana



Data Source: Montana NRIS
Data Date: August 2017
Mapp Coordinates: NAD 1983, State Plane Montana

Map Updated by:
Libby Ellwood
August 2017

RESPEC

Figure 3-10. Structure Locations

3.4 ECONOMIC, ECOLOGIC, HISTORIC, AND SOCIAL VALUES

Gallatin County is characterized by its abundance of natural resources and beauty, in addition to its strong economic development and growth within recent years.

Disasters of any magnitude can threaten the fragile economies and well-being of residents. Basic economic statistics collected from 2015 U.S. Census data include:

- Median household income: $55,553
- Persons below poverty: 13.2%
- Percent unemployed: 6.3%

The largest private employment sectors in the county, according to the 2015 Bureau of Labor Statistics Quarterly Census of Employment and Wages, include:

- Retail trade: 9,416
- Accommodation and food services: 7,811
- Construction: 7,317
- Professional, scientific, and technical services: 6,950
- Health care and social assistance: 6,067

Based on data from the U.S. Census of Agriculture in 2012, the county had:

- Number of farms: 1,163
- Acres of farmland: 702,713 acres
- Total market value of agricultural products sold: $105,970,000
  - Livestock and poultry sales: $47,168,000
  - Crop sales: $58,802,000
- Number of cattle and calves: 50,089
- Number of sheep and lambs: 18,098

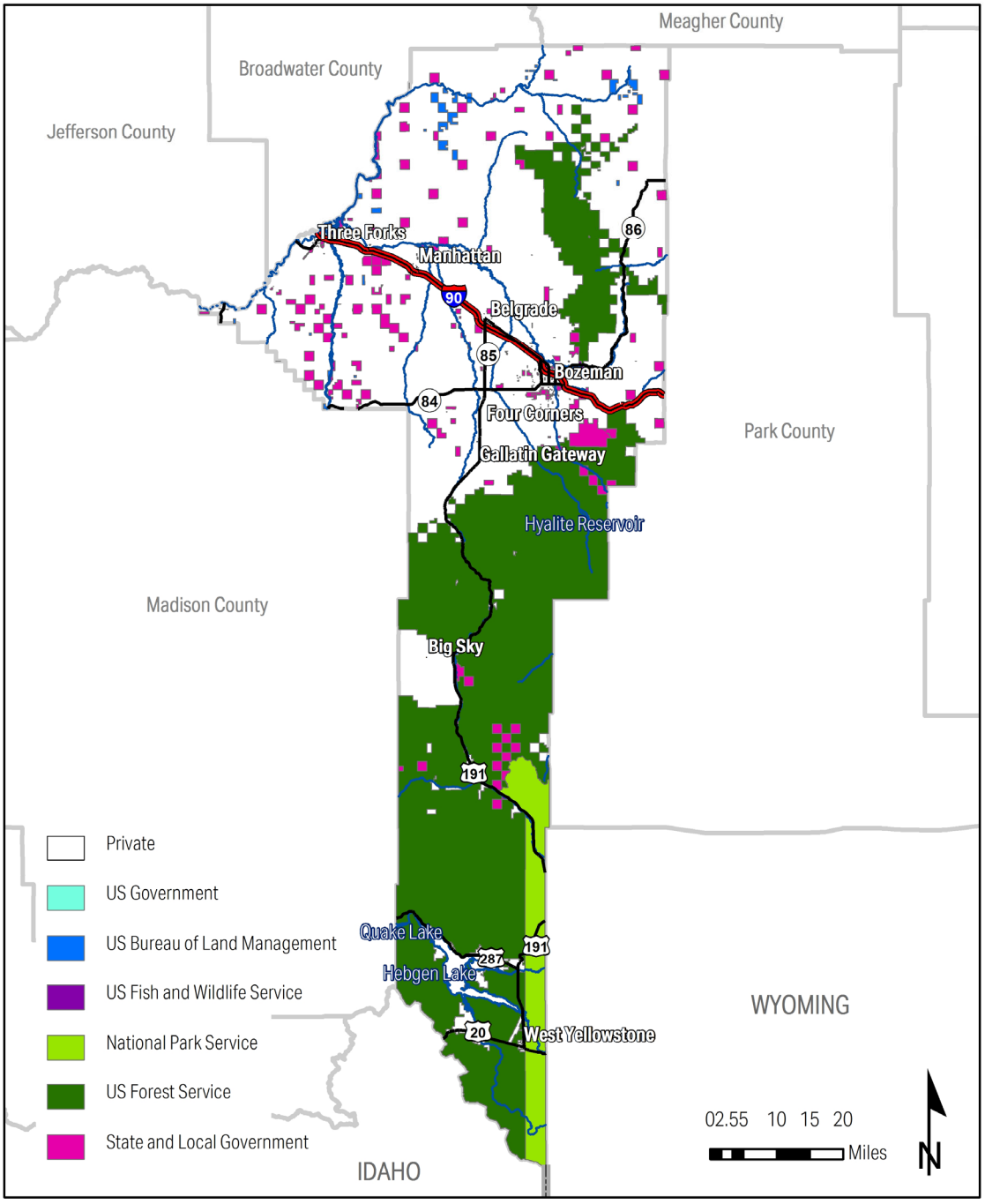
Primary crops (based on number of farms) include forage-land used for hay, wheat, and barley. Historic values capture a piece of history and maintain a point in time. Historic values can include sites, buildings, documents, and other pieces that preserve times past and have value to people. Gallatin County has 21 resources listed in the National Register of Historic Places, many of which are located in Bozeman.

Social values often cannot be quantified but are an important aspect of quality of life and interpersonal relationships. Examples of social values in Gallatin County may include gatherings to promote community building, personal achievement, 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.

3.5 CURRENT LAND USE

Gallatin County has varied land use, with nearly half of land under public ownership by the USDA Forest Service, State of Montana, Bureau of Land Management or the National Park Service. Both urban and rural communities are present, with individual residences and farms interspersed. Growth is occurring throughout the county. **Figure 3-8101** shows the federal, state, and local government ownership within the county.

Land Ownership
Gallatin County, Montana



Data Source: Montana NRIS
Data Date: August 2017
Mapp Coordinates: NAD 1983, State Plane Montana

Map Updated by:
Libby Ellwood
August 2017

RESPEC

Figure 3-81. Gallatin County Land Ownership

3.6 NEW AND FUTURE DEVELOPMENT

According to U.S. Census data, Gallatin County experienced a 32 percent increase in population between 2000 and 2010. From 2010 to 2017, the population of the county was estimated to have increased by 20.4 percent. The rapid increase in population has been associated with an increase in development. Often, smart development is an inexpensive and effective way to reduce the impact of future disasters on the community. The following mechanisms are used by the jurisdictions to guide future development.

3.6.1 GROWTH POLICIES

Gallatin County and the incorporated jurisdictions all have growth policies, as required by state law. The growth policies do not have regulatory authority but guide community development regulations and ultimately replace comprehensive plans. The Gallatin County Growth Policy applies to the parts of Gallatin County that are not within the jurisdictions of the City of Bozeman, City of Belgrade, City of Three Forks, Town of West Yellowstone, or Town of Manhattan.

3.6.1.1 GALLATIN COUNTY GROWTH POLICY

The Gallatin County Growth Policy has the purpose of guiding elected officials in land use, economic development, and capital investment decisions. In section 3.14, Goal 1 of the plan is to protect human life and property from natural hazards, and includes the following objectives:

- Encourage development in natural hazard areas to mitigate the potential hazard(s).
- Encourage development on steep slopes to mitigate potential hazards.
  - Prohibit development and road building on slopes greater than 25 percent.
  - Support the use of covenants that provide appropriate engineering to mitigate safety concerns of development in areas with potential and demonstrated unstable slopes and soils.
  - Encourage development to address emergency services access and driveway standards.
- Restrict development in flood hazard areas to protect property and life from flooding. Encourage compliance with the Floodplain Regulations and the standards developed by the Department of Health.
  - Encourage development to protect neighboring properties and communities from potential flood hazards associated with new development.
- Discourage development in areas prone to wildland fire to protect property and life from fires.
  - Encourage mitigation of fire hazards, including creation of defensible space for each structure, prior to final plat.
  - Encourage reduction of fire fuel loads.
- Encourage development to demonstrate geologically or seismically unstable areas to mitigate potential hazards.

Additionally, the plan supports hazard mitigation through the following goals, objectives, and implementation measures:

- Retention of agricultural lands through voluntary conservation easements and land preservation programs
- Measures to ensure development are compatible with public safety needs
- Conservation of surface and ground water and quality

Specific to fire, the policy emphasizes the provision of a reasonable level of fire protection for residents and property owners through defensible space, consideration of water supplies and response times, fuels mapping, and other programs.

3.6.2 SUBDIVISION REGULATIONS

All subdivisions must conform to state and local requirements, specifically the "Gallatin County Subdivision Regulations". Purposes of the regulations include the following:

- Promote public health, safety, and general welfare by regulating the subdivision of land
- Avoid danger or injury by reason of natural hazard or the lack of water, drainage, access, transportation, or other public improvements

Lands considered unsuitable for development include areas of natural and human-caused hazard, floodways, other waterways, and riparian areas. Subdivisions may be required to have covenants to address public health and safety issues such as mowing to reduce wildfires. Emergency access roads may be required and have their own set of standards. Emergency services may provide the governing body with recommendations for the subdivision (e.g., fire protection standards, water supplies, ingress/egress, and defensible space). The County floodplain ordinance requires new construction to be elevated above the 100-year floodplain.

Subdivisions are also required to go through an extensive Flood Hazard Evaluation. It is the purpose of these regulations to:

- Restrict or prohibit uses which are dangerous to health, safety or property in times of flood, or cause increased flood heights or velocities
- Require that uses vulnerable to floods, including public facilities which serve such uses, be provided with flood protection at the time of initial construction
- Identify lands unsuitable for certain development purposes because of flood hazards
- Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public
- Insure that potential buyers are notified that property is within a 100-year floodplain and subject to the provisions of these regulations
- Insure that those who occupy 100-year floodplains assure responsibility for their actions

4.0 RISK ASSESSMENT/HAZARD PROFILES

4.1 AVALANCHE AND LANDSLIDE

4.1.1 DESCRIPTION

Avalanches and landslides are similar in nature such that both occur when a material on the surface of the earth cannot be supported any longer and gives way to gravity. In the case of an avalanche, the substance is snow, and for a landslide, the substance is mud, rock, or other geologic material. Both can occur rapidly with little warning.

When snow accumulations on a slope cannot be supported any longer, the snow support structure may break and fall creating an avalanche. The subsequent rush of unsupported snow can bury and move things in its path. A majority of avalanches do not cause any damage; however, occasionally people and property may fall in their paths. Snow avalanches kill more people on National Forests than any other natural hazard. Each winter, 25 to 30 people die in avalanches in the United States, and nearly all of these deaths involve recreation on National Forests.

Avalanche formation requires a slope shallow enough for snow to accumulate but steep enough for the snow to accelerate once set in motion by the combination of mechanical failure (of the snowpack) and gravity. The angle of the slope that can hold snow, called the angle of repose, depends on a variety of factors such as crystal form and moisture content. Slopes flatter than 25 degrees or steeper than 60 degrees typically have a lower incidence of avalanches. Human-triggered avalanches have the greatest incidence when the snow's angle of repose is between 35 and 45 degrees; the critical angle, the angle at which human-triggered avalanches are most frequent, is 38 degrees. The rule of thumb is: *A slope that is flat enough to hold snow but steep enough to ski has the potential to generate an avalanche, regardless of the angle.*

In the case of landslides, some move slowly and cause damage gradually, whereas others move quickly enough to destroy property and cause causalities. Gravity is the force driving landslide movement. Factors that allow the force of gravity to overcome the resistance of earth material to landslide movement include: saturation by water, steepening of slopes by erosion or construction, alternate freezing and thawing, earthquake shaking, and volcanic eruptions. Landslides are typically associated with periods of heavy rainfall or rapid snow melt and tend to worsen the effects of flooding that often accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. [Federal Emergency Management Agency, 1989]

4.1.2 HISTORY

The history of avalanches in Gallatin County is much more pronounced than that of landslides. Both, however, have occurred. Avalanches are a normal occurrence in Gallatin County and typically do not cause significant damages; however, injuries and casualties have occurred. **Figure 4-1** outlines the annual number of fatalities due to avalanches in Montana beginning in 1969.

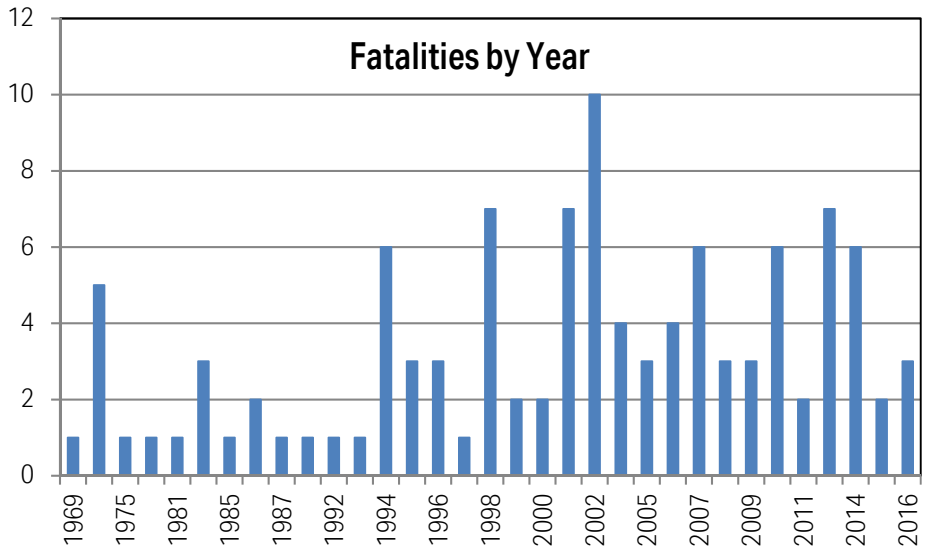


Figure 4-1. Avalanche Fatalities by Avalanche Year [Colorado Avalanche Information Center, US Avalanche Accident Reports for Montana, 2017]

The number of annual fatalities is increasing due to increased use of snowmobiles in the backcountry. Since 1951, 117 people have been killed by avalanches in Montana with numerous additional injuries. Gallatin County has experienced 18 fatalities since 1996. Each incident is detailed below in **Table 4-1**.

Table 4-1. Avalanche Fatalities in Gallatin County [Avalanches.org 2018]

Date	Location	Damage
4/14/2018	Bridger Range	1 sidecountry rider, partially buried, killed
1/2/2018	S. Madison Range	1 snowmobiler buried and killed
10/7/2017	S. Madison Range	2 skiers caught, 1 killed
1/19/2016	N. Madison Range	1 ski patroller caught, partly buried and killed
4/11/2015	N. Madison Range	1 backcountry tourer caught and killed
1/1/2014	N. Gallatin Range	1 snowmobiler caught and killed
2/14/2011	Bridger Range	1 skier triggered, caught and killed
4/14/2010	N. Madison Range	2 snowmobilers caught, 1 killed
12/10/2009	N. Gallatin Range	1 climber caught, partially buried and killed
2/11/2009	West Yellowstone	3 snowmobilers caught, 1 killed
1/20/2008	N. Madison Range	1 skier triggered, caught, buried and killed
3/3/2007	N. Madison Range	1 skier triggered, caught, buried and killed
12/28/2006	S. Madison Range	2 snowmobilers caught, 1 buried and killed
3/24/2002	S. Madison Range	1 snowmobiler triggered, caught and killed
4/4/2001	Bridger Range	1 skier caught, buried and killed
11/26/1999	N. Madison Range	2 skiers caught, 1 buried and killed
3/9/1996	West Yellowstone	1 snowmobiler buried and killed
2/25/1996	West Yellowstone	1 snowmobiler buried and killed

Significant landslides have not been documented in Gallatin County; however, small ones are generally known to have occurred in various locations. Despite the numerous relatively minor incidents in Gallatin County from avalanches and landslides, none were declared state or federal disasters.

4.1.3 PROBABILITY AND MAGNITUDE

The Colorado Avalanche Information Center has compiled statistics on a statewide basis on avalanche fatalities. Montana ranks fifth in the nation with 117 fatalities since 1951. The top three activities being undertaken at the time of an avalanche were backcountry skiing, snowmobiling, and climbing. Ratings have not been compiled for counties within Montana; however, the historical databases show that Gallatin County is one of the more vulnerable counties in the state from avalanche, particularly in the West Yellowstone and Gallatin Canyon areas. **Figure 4-2** below demonstrates that the population is most vulnerable to avalanches during the months of December, January, February, and March.

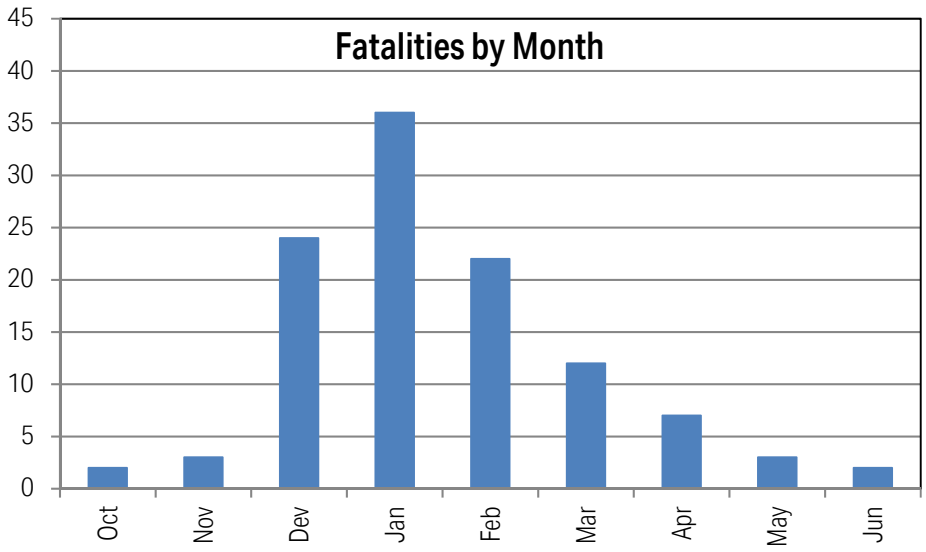


Figure 4-2. Avalanche Fatalities in Montana by Month [Colorado Avalanche Information Center, US Avalanche Accident Reports for Montana, 2017]

Landslides have an even lower probability of creating a disaster based on a very limited history of events. Should landslides occur in this area, they typically do not affect life or property. The probability of a damaging landslide could greatly increase if development were to occur in landslide prone areas. Wildfire burn areas also greatly increase the probability of a landslide triggered by precipitation.

The probability of an avalanche or landslide causing enough damage for a county, state, or federal disaster is considered low based on the historical record.

4.1.4 WARNINGS, WATCHES, AND ADVISORIES

Avalanche warnings may be issued by the National Weather Service in conjunction with the Gallatin National Forest Avalanche Center. This type of warning brings attention to severe avalanche dangers.

During avalanche season, Gallatin National Forest Avalanche Center issues detailed advisories outlining the avalanche hazards. The US Avalanche Danger Scale includes the following levels (**Figure 4-3**):

- **Extreme Avalanche Danger:** Avoid all avalanche terrain. Travel only on gentle slopes well away from areas affected by avalanches.
- **High Avalanche Danger:** Very dangerous conditions. Travel in avalanche terrain is not recommended. Extensive skill, experience, and local knowledge are essential.
- **Considerable Avalanche Danger:** Dangerous avalanche conditions. Use conservative decision making, careful route finding, and good travel habits. Training and experience are essential.
- **Moderate Avalanche Danger:** Dangerous avalanche conditions on some terrain features. Evaluate the snow and terrain carefully and use good travel habits.
- **Low Avalanche Danger:** Generally safe avalanche conditions. Watch for unstable snow on isolated terrain features.

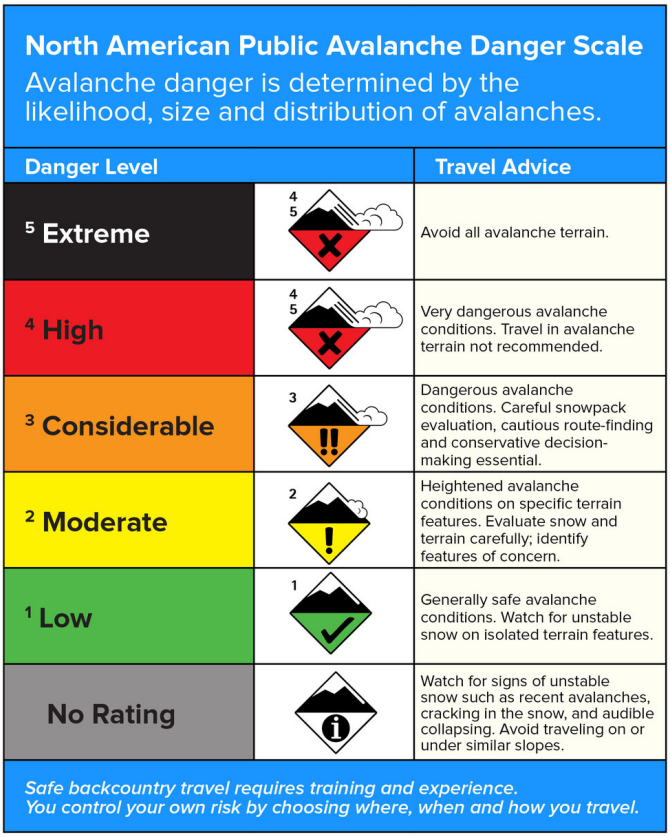


Figure 4-3. Avalanche Danger Scale

Destructive landslides are often associated with heavy rains and flash flooding. The National Weather Service issues flash flood watches and warnings. These alerts are likely during potentially significant landslides. The alerts and warnings issued by the National Weather Service includes:

- **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).

Additionally, landslide risk may be increased following a wildfire. The burnt area is often prone to landslides, particularly when combined with heavy rainfall.

4.1.5 MAPPING

Avalanches and landslides are difficult to map, due to their site-specific nature, based on terrain and snow conditions. Only a geotechnical engineer, engineering geologist, or avalanche specialist can accurately assess the avalanche or landslide susceptibility for a specific location.

4.1.6 VULNERABILITY

4.1.6.1 PROPERTY

Critical facilities in Gallatin County historically have not suffered losses or been threatened by avalanches or landslides. The site-specific threat of avalanches and landslides to critical facilities in Gallatin County can only be realistically determined by a geotechnical engineer or project geologist. More generally, those buildings on flat terrain or surrounded by other structures likely have little vulnerability to landslides and avalanches. Similarly, buildings on steep slopes, at the bottom of hills, or in unstable soils likely have a higher vulnerability to avalanches and landslides.

Critical infrastructure may be at risk from avalanches and landslides. The transportation network is likely the most vulnerable, particularly during periods of heavy rain, snow, or snowmelt. Infrastructure such as power lines could be destroyed by a large landslide or avalanche; however, historical record does not demonstrate this potential.

The most probable areas for landslides 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 residential structures at risk from landslides is unknown. Similarly, predicting avalanches requires an in-depth understanding of the snow surface and other factors. Fortunately, Gallatin County does not have any history of structures being destroyed by avalanches or landslides.

4.1.6.2 POPULATION

The primary threats to the population from avalanches and landslides are while recreating and driving. Avalanches and landslides can quickly bury and destroy road infrastructure, endangering those on the roadways. Additionally, the population could be threatened by an avalanche or landslide that damages an occupied structure. Most often, avalanches threaten those in hazard areas such as snowmobilers, skier, snowboarders, and climbers.

4.1.6.3 ECONOMY

Widespread economic impacts due to avalanches or landslides are not expected in Gallatin County; however, economic impacts may be felt either temporarily or by isolated sectors, such as within the recreational snow sport industry. Possible economic losses include commerce losses due to closed roadways, timber losses in avalanche and landslide areas, and tourism losses due to avalanche and landslide concerns.

4.1.6.4 FUTURE DEVELOPMENT

Unless evaluated by a geotechnical engineer or similar professional, new development could occur in landslide and avalanche hazard areas. Some provisions are in place within the county subdivision regulations to restrict development in hazardous areas. More specifically, lands unsuitable for subdivision include potential hazard areas from snow avalanches, rock falls, landslides, steep slopes in excess of 25 percent grade, subsidence, and slumping. 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 avalanche hazard at the time of evaluation.

4.1.7 DATA LIMITATIONS

In general, data on avalanche and landslide hazards in Gallatin County is quite limited. The data limitations include:

- Limited studies of the hazards for the area
- Site-specific nature of the hazards

4.1.8 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	Moderate	Low	Low	Low	Moderate
Belgrade	Low	Low	Low	Low	Low
Big Sky	High	Moderate	Moderate	Moderate	Moderate
Bozeman	Moderate	Low	Low	Low	Low
Manhattan	Moderate	Low	Low	Low	Low
Three Forks	Moderate	Low	Low	Low	Low
West Yellowstone	Low	Low	Low	Low	Low

4.2 AVIATION ACCIDENTS

4.2.1 DESCRIPTION

Aviation accidents can occur for a multitude of reasons ranging from mechanical failure to poor weather conditions to intentional causes. Accidents can vary from small single engine aircraft to large commercial jets. The location of the accident—such as a remote area versus a populated location—also plays an important role in the amount of destruction caused.

Gallatin County has one large and two smaller airports. Bozeman-Yellowstone International Airport (BZN), located in Belgrade, is the largest of the three and the busiest airport in the State of Montana. Progreba Field (9S5) is located in Three Forks and primarily serves smaller single engine aircraft. West Yellowstone Airport (WYS) is located near West Yellowstone and is primarily used in the summer months for tourism to Yellowstone Park and as a base station for fixed and rotor wing wildland firefighting aircraft.

BZN is a full-service commercial airport serving the needs of travelers in the region. BZN also has a significant cargo capacity and private ancillary services. In 2017 the airport served a total of 1,199,537 passengers over 76,223 tower operations and handled over 5 million pounds of cargo. Seven major airlines offer flights with non-stop service to 17 U.S. cities.

Large passenger aircraft serving these airports often fly over Gallatin County. Small aircraft accidents may be relatively minor in nature involving none or few casualties, whereas a large commercial aircraft could create a mass casualty incident requiring outside assistance.

In addition to established airports and fixed wing traffic, helicopters and other aircraft can be found in most other areas of the county. An active wildfire season increases spotting and suppression activities by air and heliports may be set up in many locations. Other locations, such as Bozeman Health Deaconess Hospital, have frequent helicopter traffic conducting medical transports. There are three private rotor wing services in the county and several Gallatin County residents have their own personal aircraft operating to and from their property.

4.2.2 HISTORY

Table 4-2 briefly summarizes the aviation accident reports filed by the National Transportation Safety Board from 1996 to 2017.

Table 4-2. Aviation Accidents in Gallatin County [National Transportation Safety Board, 2017]

Date	Location	Aircraft Type	Casualties
7/21/2017	Bozeman	Robinson Helicopter	Nonfatal
3/22/2017	Bozeman	STOL King	Nonfatal
7/8/2015	Belgrade	Pilatus PC12	Nonfatal
6/13/2015	Bozeman	Cessna P210N	Nonfatal
9/16/2013	Bozeman	Piper PA 11	Nonfatal
8/12/2013	West Yellowstone	Beech E35	Fatal
8/1/2013	West Yellowstone	Bellanca 7GBVB	Nonfatal
7/14/2013	Bozeman	Boeing E75	Nonfatal
1/15/2011	Three Forks	Bell 206B3	Nonfatal
8/30/2010	Belgrade	Cessna 182C	Fatal
1/18/2009	Three Forks	Byan Nanon	Nonfatal
10/3/2009	Bozeman	Fisher DAK	Nonfatal
9/5/2009	Bozeman	Piper PA-20	Nonfatal
4/3/2008	Three Forks	Piper PA-22	Nonfatal
7/29/2007	Three Forks	Hughes 269C	Nonfatal
6/24/2007	Bozeman	Cessna 170A	Nonfatal
2/6/2007	Belgrade	Beechcraft 200	Fatal
8/2/2006	Belgrade	Cessna 180A	Fatal
4/14/2006	Belgrade	Cessna 425	Nonfatal
11/29/2005	Belgrade	Cessna 425	Fatal
12/4/2004	Belgrade	Cirrus	Fatal
12/4/2004	Belgrade	Cirrus SR22	Fatal
6/24/2004	Bozeman	Cessna 185F	Nonfatal
3/31/2004	Bozeman	Cessna 305A	Nonfatal

Date	Location	Aircraft Type	Casualties
11/5/2002	Bozeman	Riddel IV-P	Fatal
7/31/2002	Belgrade	Blanik L-13	Nonfatal
6/26/2001	Bozeman	Piper PA-38-112	Nonfatal
6/26/2001	Bozeman	Cessna 172M	Nonfatal
3/4/2001	Bozeman	Avia Stroitel AC-5M	Nonfatal
2/8/2001	Bozeman	Piper PA-12	Nonfatal
3/16/2000	Three Forks	Piper PA-18-150	Nonfatal
3/4/2000	Bozeman	Cessna 180H	Nonfatal
10/20/1999	Bozeman	Piper PA-24-250	Nonfatal
8/21/1999	Belgrade	Cessna 180A	Nonfatal
6/17/1999	Belgrade	Let L-13	Nonfatal
2/15/1998	Bozeman	Piper PA-17	Nonfatal
12/7/1997	Bozeman	Pitts S-2B	Fatal
12/7/1997	Bozeman	Cessna P206A	Fatal
10/5/1996	Big Sky	Aerospatiale SA-315B	Nonfatal
8/25/1996	Bozeman	Forney F-1	Nonfatal
8/3/1996	Belgrade	GS G-164A	Nonfatal

4.2.3 PROBABILITY AND MAGNITUDE

As the historical record demonstrates, the probability for a private, small aircraft accident is much greater than one involving a large commercial jet in Gallatin County. Although an incident involving a commercial passenger flight and mass casualties cannot be ruled out, the probability is considered low. Statistics compiled based on NTSB incident reports over the last 20 years can be found in **Table 4-3**.

Table 4-3. Accident Summary [National Transportation Safety Board, 2017]

Location	Number of Incidents	Fatalities
Bozeman	21	3
Belgrade	12	6
Three Forks	5	0
West Yellowstone	2	1
Big Sky	1	0
Total	41	10

According to the National Transportation and Safety Board, 91 aviation accidents have occurred in Gallatin County since 1965, 34 of which involved fatalities. In this period, there was an average of 1.75 aviation accidents per year, with an average of 0.65 aviation accidents involving fatalities per year.

4.2.4 MAPPING

Aviation incidents can occur both on and off airport facilities. Areas close to airports are theoretically at greater risk due to their proximity to local air traffic, though all areas within the county are vulnerable. Mapping does not enhance this hazard profile.

4.2.5 ASSOCIATED HAZARDS AND OTHER FACTORS

The hazard of aviation accidents can involve multiple factors. The two most significant include the location of the accident and the cargo on board. The location of an aviation accident will determine the significance of ground casualties and damages. An aircraft accident in a populated downtown area has a much greater potential for additional casualties and property damage than one that occurs in a remote part of the county. The location also affects the ability of responders to get to the crash site. The mountainous terrain in Gallatin County can make rescues and recovery difficult, particularly during inclement weather. The cargo is an important factor, if such cargo would create a hazardous material release or increased fire hazard. Should the contents of the aircraft be hazardous, the situation would need to be treated not only as an aviation accident but also as a contaminated site. The possibility of an aviation accident as an intentional act cannot be ruled out, in which case the accident site would also become a crime scene and possibly involve mass casualties.

Any hazard that involves aircraft in the response or recovery could have an aircraft accident as an associated hazard. The helicopter crash during the Fridley Fire in adjacent Park County in 2001 is an example, where a firefighting helicopter crashed during bucket operations. Other possibilities include supply aircraft hauling recovery materials following an earthquake or flood.

4.2.6 VULNERABILITY

4.2.6.1 PROPERTY

All critical facilities in Gallatin County are at risk from aircraft accidents. Given the nature of historical events and the probability of a specific facility being hit, the overall vulnerability of any given critical facility is considered very low. Bozeman Deaconess Hospital, however, has been identified as a facility at an increased risk due to the helicopter medical transport operations conducted there. Both physical infrastructure and critical functionality losses are possible.

All above-ground critical infrastructure is at risk from aviation accidents, as well as some below-ground infrastructure. Tall communications towers and power lines carry a slightly elevated risk, due to their elevation. Critical infrastructure damage may result in loss of functionality.

All structures are at risk from aircraft accidents, though the likelihood of an accident impacting any given structure is extremely low. If an aircraft directly impacted a residential structure, damages could vary in the tens or hundreds of thousands of dollars, depending on the structure and nature of the accident. Both structure and content losses could be incurred.

4.2.6.2 POPULATION

Aviation accidents pose the greatest threat to the population, due to the history of fatalities in Gallatin County. In accidents, the impact on population is dependent on the type of aircraft involved, the number of people on board, the location of the accident, and the number of people in the area of the crash site. Typically, with aircraft accidents, very little warning exists so the population would be unaware until after the event occurred.

4.2.6.3 ECONOMY

Tourism and recreation are significant economic drivers in Gallatin County. Aviation accidents large enough to prevent or otherwise deter future tourists from entering the area could have a significant impact on the local economy. Additional possible economic losses include localized agriculture or business losses, and business and revenue losses due to decreased tourism. Losses in the Belgrade area may be slightly higher, as the primary airport of the region is located just outside city limits.

4.2.6.4 FUTURE DEVELOPMENT

Due to the somewhat random location of aircraft accidents, the impact of future development is generally the same regardless of where that development occurs, with a possible exception being the immediate airport vicinity. Therefore, the impact of future development is considered minimal.

4.2.7 DATA LIMITATIONS

Data limitations related to aviation accident hazard include difficulty in predicting where future aircraft accidents will occur and the lack of publicly available digital data that show commercial air traffic lanes overhead.

4.2.8 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	Moderate	Low	Low	Low	Low
Belgrade	Moderate	Moderate	Low	Moderate	Moderate
Big Sky	Moderate	Low	Low	Low	Low
Bozeman	Moderate	Low	Low	Low	Low
Manhattan	Moderate	Low	Low	Low	Moderate
Three Forks	Moderate	Low	Low	Low	Moderate
West Yellowstone	Moderate	Low	Low	Low	Moderate

4.3 CIVIL UNREST

4.3.1 DESCRIPTION

Civil unrest is a human-caused hazard in which a group of people gather with the intention of causing an unlawful public disturbance. Civil unrest can be the product of another event that creates panic in the community, and typically involves damages to property or injuries to people outside the group.

Gallatin County has a politically and socially active populace, and as such many events and protests are held in the County each year. While historically these protests are both peaceful and lawful, the potential exists for any event to escalate into civil unrest.

Figure 4-4. Special Response Team during 2009 Presidential visit.

4.3.2 HISTORY

Fortunately, Gallatin County has not experienced major incidents in which civil unrest caused notable damages or injuries. In recent years isolated events have occurred in which rapid police response de-escalated situations which had the potential to develop into civil unrest. Examples include a protest in front of the Bozeman Islamic Center, in which a masked man was seen openly carrying a shotgun while protesting, as well as the anti-gay protest held at Montana State University by the Westboro church, in which hundreds of community members staged a simultaneous counter-protest. Another example of civil unrest that has occurred numerous times over many years are the protests near Yellowstone National Park to stop the harassment and roundup of bison due to their threat of spreading brucellosis.

4.3.3 PROBABILITY

With very little experience and data locally on this hazard, a specific probability for future civil unrest is hard to determine. Based on the historical record and ability of law enforcement to rapidly identify and deescalate potential civil unrest situations, the probability of a large scale civil unrest is considered low.

4.3.4 MAPPING

The City of Bozeman is the most populous part of Gallatin County. Thus, this area is most likely to experience civil unrest. However, civil unrest can occur anywhere people are able to meet, and thus the risk is considered present in all jurisdictions and throughout the entire county.

4.3.5 ASSOCIATED HAZARDS AND OTHER FACTORS

Civil unrest is often triggered by an emotionally-charged event or outcome. Once initiated, it can lead to other hazards such as violence.

4.3.6 VULNERABILITY

4.3.6.1 PROPERTY

Critical facilities in Gallatin County are at low risk from civil unrest. While damage is possible, it is considered unlikely.

Residential and business property losses are considered the most likely structure losses. Looting is commonly found in association with these types of events. Urban areas, places of public gathering, and important government or economic assets are generally going to be the areas of greatest risk.

4.3.6.2 POPULATION

The effects of civil unrest can be felt by the population, though usually on a limited scale, in comparison with other human-caused violence such as terrorism. The greatest risk is to human lives during times of unrest.

4.3.6.3 ECONOMY

Economic losses will vary dramatically depending upon the incident. Small, isolated incidents are unlikely to have a major impact on the local economy. Large, nationally-publicized incidents have the potential to deter tourism.

4.3.6.4 FUTURE DEVELOPMENT

Development should have little impact on the civil unrest threat. The exception would be the increase in population and the associated increase of potential losses to life and property within the county. With larger communities around, however, development should have little effect in this regard.

4.3.7 DATA LIMITATIONS

Since civil unrest incidents tend to be isolated events, and little history exists in Gallatin County, the probability and potential losses are difficult to quantify. Therefore, generalities have been made to estimate where potential losses could be. Site specific surveys would allow for an analysis of weaknesses of critical facilities, infrastructure, and vulnerable populations to civil unrest incidents.

4.3.8 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	Moderate	Low	Moderate	Moderate	Moderate
Belgrade	Low	Low	Moderate	Moderate	Low
Big Sky	Low	Low	Moderate	Low	Moderate
Bozeman	Moderate	Low	Moderate	Moderate	Moderate
Manhattan	Moderate	Low	Low	Low	Low
Three Forks	Moderate	Low	Low	Low	Low
West Yellowstone	Moderate	Moderate	Moderate	Moderate	Moderate

4.4 COMMUNICABLE DISEASE AND BIOTERRORISM

4.4.1 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 those which might 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 the possibility of attacks using biological agents.

4.4.1.1 HUMAN DISEASE

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 (Category A) because of their ease of dissemination or person-to-person transmission, high mortality rate with potential for major public health impacts, potential for public panic and social disruption, and the necessity for special public health preparedness [Centers for Disease Control and Prevention, 2016]:

- Anthrax
- Botulism
- Plague
- Smallpox
- Tularemia
- Viral Hemorrhagic Fevers

In addition to global disease and bioterrorism concerns, naturally occurring diseases can threaten communities. Natural illnesses of particular concern, among others, include:

- Food-borne illnesses, such as E. Coli and Salmonella
- Influenza
- Meningitis
- Pertussis/Whooping Cough
- Measles
- Norwalk Virus
- Severe Acute Respiratory Syndrome (SARS)

These diseases can infect populations rapidly, particularly in large-group settings such as schools, assisted living facilities, and workplaces.

Well-developed surveillance and epidemiologic capacity is the foundation on which health departments detect, evaluate, and mitigate disease and bioterrorism impacts. Complementing the need for accurate and timely case reports is the need for expertise to analyze the information properly. Epidemiologic expertise is critical to judging whether the incident involves biological or chemical agents or is a consequence of a natural phenomenon, an accident, or terrorism. Extraordinary measures are not necessary to develop a comprehensive terrorism health surveillance and epidemiologic network. Initiating partnerships and developing new or pre-existing data links have always been components of public health systems while using current technology to promote timely disease identification and reporting.

Gallatin County Public Health Department possesses the legal authority to receive reports and investigate unusual illness clusters. The health care system lacks the capabilities needed to effectively handle large numbers of victims.

4.4.1.2 ANIMAL DISEASE

Gallatin County is an agricultural and ranching community. Animal diseases, particularly those that infect livestock, can distress the agricultural community. Such diseases could lead to food shortages and negative economic impacts, depending on the animals infected and the geographic extent of the disease.

Diseases or conditions requiring state and federal reporting and quarantine include [Montana Department of Livestock, 2015]:

- Acute swine erysipelas
- African horse sickness
- African swine fever
- Avian influenza
- Bovine babesiosis
- Bovine spongiform encephalopathy
- Brucellosis
- Cattle fever tick
- Chronic wasting disease
- Classical swine fever
- Contagious equine metritis
- Dourine
- Equine encephalomyelitis
- Equine infectious anemia
- Equine piroplasmosis
- Exotic Newcastle disease
- Foot and mouth disease
- Fowl typhoid
- Glanders
- Heartwater
- Japanese encephalitis
- Lumpy skin disease
- Malignant catarrhal fever
- Mange
- Nairobi sheep disease
- New and Old World Screwworm
- Nipah virus encephalitis
- Peste des petits ruminants
- Porcine Epidemic Diarrhea PEDv
- Pseudorabies
- Rabbit hemorrhagic disease
- Rift Valley Fever
- Rinderpest
- Scrapie

- Sheep pox and goat pox
- Surra
- Swine influenza
- Swine vesicular disease
- Trypanosomosis
- Tuberculosis
- Vesicular exanthema
- Vesicular stomatitis
- Viral hemorrhagic septicemia

Diseases or conditions requiring state reporting and quarantine include:

- Anthrax
- Bluetongue
- Contagious agalactia
- Contagious caprine
- Pleuropneumonia
- Contagious foot rot
- Crimean Congo hemorrhagic fever
- Equine viral arteritis
- Equine rhinopneumonitis, neurologic form
- Ovine pediculosis
- Plague
- Pullorum disease
- S. Pullorum
- Q-Fever
- Rabies
- Theileriosis
- Trichomonosis
- Tularemia
- West Nile Virus

4.4.1.3 PLANT DISEASE

Many plant and crop diseases exist. Of most concern are those diseases that spread rapidly and cause widespread economic losses. The specific diseases that could cause plant epidemics depend on the species. Of specific concern in Gallatin County would be those diseases that affect forage/hay, barley, wheat, oats, or potatoes. Although not categorized as a disease, new pests and weeds introduced could have similar impacts.

4.4.2 HISTORY

Diseases are a part of everyday life. In cases where disease significantly impacts the population actions can be taken to prevent additional infection. Most recently, a statewide measles outbreak in 1988 was noted by the Gallatin County Health Department. Approximately three human influenza pandemics have occurred over the past 100 years, one severely affecting the United States. 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]. In 2008, an outbreak of the infectious disease anthrax killed 25 domestic bison on the Flying D Ranch southwest of Bozeman.

4.4.3 PROBABILITY AND MAGNITUDE

Quantifying the probability of a human epidemic affecting Gallatin County presents challenges due to a limited history of outbreaks. Data documenting disease outbreak in recent years has been compiled by the Montana Department of Public Health and Human Services and is listed in **Table 4-4**. Blank cells indicate data was not available.

Table 4-4. Documented Communicable Disease in Gallatin County [Montana Department of Public Health and Human Services, 2015]

	2009	2010	2011	2012	2013	2014	2015
Acute Flaccid Myelitis							0
Brucellosis			0				0
Campylobacteriosis	32	27	36	31	25	34	44
Chikungunya virus				0			0
Chlamydia	243	233	276	326	327	348	412
Coccidioidomycosis	2	0	0	1	0	0	2
Colorado Tick Fever			2	0		0	0
Creutzfeldt-Jakob Disease			0			0	0
Cryptosporidiosis	18	9	2	5	10	10	6
Cyclosporiasis						2	0
Dengue	1	0	0	0	1	0	1
Ehrlichiosis					0		0
Giardiasis	21	19	10	10	18	19	15
Gonorrhea	4	12	3	3	3	10	26
Haemophilus influenzae			0	2	0	0	0
Hantavirus Pulmonary Syndrome			0	0	1	0	0
Hemolytic Uremic Syndrome (HUS)	0	1	0	0		0	0
Hepatitis A, Acute	2	0	0	2	0	0	1
Hepatitis B, Acute	0		0	0	1		1
Hepatitis B, Chronic			2	5	1	3	1
Hepatitis C, Acute	0	0	0	0	0	0	0
Hepatitis C, Chronic					43	52	52

	2009	2010	2011	2012	2013	2014	2015
HIV			1	1	1	0	2
Legionellosis	1	0	0	0	0	1	0
Listeriosis	0		1	0		0	0
Lyme Disease	1	0	3	1	3	2	0
Malaria	0	0	1			1	1
Meningococcal Disease	2	0	0	1	0	0	0
Pertussis	9	9	49	25	25	39	25
Q Fever		0	0	0	0	1	1
Rabies, Animal	0	3	1	0	0	2	0
Shiga-toxin producing E. coli (STEC)	1	4	5	9	11	5	15
Salmonellosis	18	11	19	9	15	14	23
Shigellosis	0	2	5	0	5	1	4
Spotted Fever Rickettsiosis					0	2	0
Streptococcal Toxic-Shock Syndrome						2	0
Streptococcus pneumoniae	0	0	0	2	0	0	0
Syphilis	0	1	0	1	0	0	2
Tuberculosis	2	0	1	0	0	0	0
Tularemia	0	0	1	0	0	0	1
Varicella		12	16	6	8	8	8
West Nile	0	0	0	0	0	0	0

Medical advances over the past 50 years prevent many disease outbreaks, yet the potential remains. Gallatin County is a popular tourist destination and has a substantial transient population due to Montana State University and Gallatin College students. Travelers that pass through the county after being exposed to a disease could potentially start an epidemic. Lacking the resources of larger population areas, any exposure to one of these diseases could quickly overwhelm county public health capabilities.

Animal and plant disease outbreaks are even harder to predict. Most global livestock diseases have been confined to specific countries due to strict import regulations. Any plant disease outbreaks have been relatively easily contained.

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]. Such a pandemic affecting Gallatin County represents a severe magnitude event. Almost any highly contagious, incapacitating disease that enters the regional population could overwhelm local health resources. Similarly, any rapidly spreading bioterrorism event for which little vaccination or containment capability exists is a high magnitude event.

4.4.4 MAPPING

The communicable disease hazard is uniform across the county, and therefore, mapping does not enhance this hazard profile. Urban areas may be slightly more vulnerable to the rapid spread of human disease; however, rural areas are more vulnerable to plant and animal disease.

4.4.5 ASSOCIATED HAZARDS AND OTHER FACTORS

Other diseases such as those that result in the loss or contamination of potable water or sanitary services may result in an increased probability of disease. Often disease is a concern following a large-scale disaster. The time of year and weather conditions may also be a factor I the development of an epidemic. A bioterrorism event may be tied to or done in conjunction with a larger scale terrorism event.

4.4.6 VULNERABILITY

4.4.6.1 PROPERTY

In general, critical facilities are not structurally threatened by communicable disease and bioterrorism; however, their accessibility and function can be lost. Contamination of a critical facility could render the facility non-functional until decontamination 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 ambulance services and the hospitals could quickly become overwhelmed. This is especially true in rural areas, such as Manhattan and Three Forks, where limited resources exist and replacing any effected staff would be difficult due to a limited population.

Should a building become contaminated by some disease agent, cleanup costs and the loss of use of the buildings could result. Such costs could be significant. For this reason, all critical facilities are assumed to be at some risk from communicable disease.

Diseases can spread quickly in facilities housing vulnerable populations 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.

In most cases, infrastructure would not be affected by communicable disease. 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, support of and physical repairs to infrastructure may be delayed, and services may be disrupted for a time due to limitations in getting affected employees to work.

The structural integrities of residential buildings are not generally threatened by communicable disease. As with critical facilities, should a structure become contaminated, cleanup costs could be expensive.

4.4.6.2 POPULATION

Perhaps the most significant impact from communicable disease is to the population. Disease can spread rapidly through schools, universities, health facilities, and communities. The entire county population of 107,810 (2017 estimate) plus non-residents are at risk for contracting a communicable disease. With nearly 2,000,000 non-resident visitors to Bozeman alone in 2017 (ITRR, 2017), a significant number of persons could be affected by communicable disease. The number of infections and fatalities would

depend on the transmission and mortality rates. In the case of human disease, residents and visitors in urban areas such as Bozeman, Belgrade, Big Sky, and West Yellowstone are most at risk.

Using a general estimate of 35 percent for the infection rate and a mortality rate (once infected) of 20%, as can be the case in an influenza pandemic, approximately 36,575 residents of Gallatin County would be infected with about 7,315 fatal infections. This estimate is extreme but uses plausible infection and mortality rates.

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 virulence of the disease, the time lapse before the onset of symptoms, the movement of the population, and the warning time involved. Vaccinations, anti-virals, quarantines, and other protective measures may also prevent the spread and impact of the disease.
Besides human diseases, animal and plant diseases could negatively affect agriculture and limit food supplies.

4.4.6.3 ECONOMY

Potential economic impacts include service industry losses during human quarantines and limited travel, business interruptions due to a lack of workers and customers during human outbreaks, and direct agricultural losses during animal or plant disease outbreaks. Areas which depend almost exclusively on tourism, such as West Yellowstone, are most susceptible to economic losses associated with communicable disease.

4.4.6.4 IMPACT OF FUTURE DEVELOPMENT

Future development would have little impact on the communicable disease vulnerabilities, unless the new structures regularly processed or handled biological disease agents. New residents add to the number of people threatened in Gallatin County, but the location of such population increases is unlikely to affect the overall hazard.

4.4.7 DATA LIMITATIONS

The data limitations related to the communicable disease and bioterrorism hazard include:

- Uncertainties related to how and when a disease will spread through a population
- The emergence of new, unstudied diseases

4.4.8 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	Moderate	Low	Moderate	Moderate	Moderate
Belgrade	Moderate	Low	High	Moderate	Moderate
Big Sky	Moderate	Low	High	Moderate	Moderate
Bozeman	Moderate	Low	High	Moderate	High
Manhattan	Moderate	Moderate	Moderate	Moderate	Moderate
Three Forks	Moderate	Moderate	Moderate	Moderate	Moderate
West Yellowstone	Moderate	Low	High	High	High

4.5 CRITICAL INFRASTRUCTURE DISRUPTION

4.5.1 DESCRIPTION

Critical infrastructure disruption, which can include utility outages and building/infrastructure closures, can be caused by almost any of the hazards described in this risk assessment or because of human error or equipment failures. Electric, gas, water, telephone and internet are all important services that could become problematic should a long-term outage occur. Electricity is used to power many homes in Gallatin County, to pump wells, and run heating systems, even if electricity is not the primary fuel source. Therefore, if electricity was lost for a long period of time, many residents could be without heat, water, and other appliances. Vulnerable populations needing powered medical equipment would be additionally threatened by a long-term power outage. Natural gas is used as a heat source for many residents in the northern half of Gallatin County. Should that utility be lost in the winter months, the concerns associated with extended cold could be significant. Telephone services are most critical for 911 communications, and the rapid dispatch of needed emergency services. Cell phones would also be lost if telephone service went down. Many of the larger communities in Gallatin County have public water supplies. Should those services be lost, many citizens would be without water and possibly sewer services. Any of these disruptions can be handled in a short time frame but can quickly become problematic in long term situations.

4.5.2 HISTORY

Gallatin County has not had any significant utility outages that can be considered disastrous, though short-term and minor disruptions are fairly common.

4.5.3 PROBABILITY

Due to the history of critical infrastructure disruptions, the probability of a major critical infrastructure disruption in Gallatin County is considered moderate. As growth occurs, the ability of many of the utility systems to keep up with the increased demand may increase the probability of a long-term outage.

West Yellowstone is at increased risk of utility outages, as propane used by the city is delivered via truck daily, and the city is only able to maintain a small amount of fuel reserves. The city is only accessible via US Highways 191 and 20. Should one or both routes become inaccessible, a fuel shortage would rapidly develop in the area. As such, the probability of a critical infrastructure disruption is considered high in West Yellowstone.

4.5.4 MAPPING

Many of the public utility features in Gallatin County have yet to be mapped and those that have been mapped are withheld for system security purposes. Mapping is maintained by the entity managing the utility.

4.5.5 ASSOCIATED HAZARDS AND OTHER FACTORS

Critical infrastructure disruption can be caused by many of the hazards described in these profiles. Anything from an earthquake to a terrorist event could cause utilities to fail. Events that utility systems are particularly vulnerable to include earthquakes, floods, severe thunderstorms, tornadoes, high winds, winter storms, wildfires, and dam breaks.

4.5.6 VULNERABILITY

4.5.6.1 PROPERTY

Critical facilities are vulnerable to utility outages. Some critical facilities do have back-up generators in case of an electricity outage. Most emergency services facilities, to include the 911 dispatch center and the emergency operations center have back up power. Others, however, may have limited functionality following an event due to a utility failure or critical infrastructure disruption.

Critical infrastructure disruptions typically do not impact structures directly. A long-term utility outage during extended cold could result in a large number of frozen water pipes inside homes and businesses. Most often, economic losses occur during long-term utility outages. These losses would be most felt by businesses that require electricity or water to operate.

4.5.6.2 POPULATION

Without services such as heated shelters, food, and drinking water, the population could suffer. Significant casualties would not be expected since these services could be available in a nearby community. If not, necessary sheltering and feeding provisions would be made to protect the population. Significant relocations of vulnerable populations and disruption of normal lifestyles would be expected.

Populations in urban areas would be most vulnerable to critical infrastructure disruptions, as people in these communities are more likely to rely on the infrastructure to fulfill daily needs. Examples include sanitary systems, and heat. Rural areas outside of the incorporated cities and towns may have a higher portion of the population which utilize on-site water, sewer, and fuel storage, and thus rely less on critical infrastructure.

As noted previously, West Yellowstone is particularly vulnerable to heating fuel disruptions due to the need to import fuel daily. Should conditions prevent or delay several deliveries, a substantial portion of the population would be left with no way to heat their homes. Depending on temperature and season, this could have a disastrous impact on the population.

4.5.6.3 ECONOMY

A critical infrastructure disruption often causes temporary business closures, as most businesses rely on internet and telecommunications services to process payments, and other utilities for production, sanitation, and employee wellbeing. These disruptions are expected to be more pronounced in areas with significant tourism, as visitors are likely to leave the area if critical services and utilities are not available.

4.5.6.4 FUTURE DEVELOPMENT

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

4.5.7 DATA LIMITATIONS

Since long term utility outages are not a normal event for Gallatin County, understanding the specific problems and concerns of this hazard are the greatest limitation. Studies of each of the critical facilities would allow for a more in-depth discussion of their vulnerabilities.

4.5.8 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	Moderate	Moderate	Moderate	Moderate	Moderate
Belgrade	Moderate	Moderate	Moderate	Moderate	Moderate
Big Sky	Moderate	Moderate	High	High	High
Bozeman	Moderate	Moderate	Moderate	Moderate	Moderate
Manhattan	Moderate	Moderate	Moderate	Moderate	Moderate
Three Forks	Moderate	Moderate	Moderate	Moderate	Moderate
West Yellowstone	High	Moderate	High	High	High

4.6 DAM FAILURE

4.6.1 DESCRIPTION

Dams have been constructed throughout Montana for various reasons including recreation, flood control, irrigation, water supply, hydroelectricity, and mining. Dams are built and owned by a variety of entities such as private individuals, businesses, and government. The structural integrity of a dam depends on its design, maintenance, and weather/drainage situation. Dam failure occurs when the forces of gravity or other external forces overcome the structural integrity of a dam. The reasons for failure can include poor construction, deterioration, extreme winds, and earthquakes. When dams fail the resulting flow can be compared to riverine or flash flooding in the area downstream from the dam. Problems arise when a dam fails, and people and/or property lie in the inundation area.

Hazard ratings are assigned to dams for emergency management planning purposes. These ratings are based on the potential for loss of life and property damage should the dam fail, and do not reflect the condition or probability of dam failure. Definitions, as accepted by the Federal Emergency Management Agency [FEMA, 2004], are as follows:

- **Low Hazard Potential:** Dam failure or mis-operation 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:** Dam failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damages, disruption of lifeline facilities, or can impact other concerns.
- **High Hazard Potential:** Dam failure or improper operation is likely to cause loss of life.

Gallatin County has six high hazard dams, one significant hazard dam, and four low hazard dams as shown in **Table 4-5**.

Table 4-5. Dams in Gallatin County, Montana [National Inventory of Dams, 2017]

	Hazard Rating	Height (ft)	Storage (acre-ft)	Dam Purpose	Year Constructed	River	Owner
Big Sky Dam/Lake Levinsky[1]	High	52	172	Recreation/ Water Supply	1973	Middle Fork of West Fork Gallatin River	Boyne USA
Golden Meadow	Low	8	63	Stock	1974	Meadow Creek	Higgins Brothers
Green Hollow Creek Dam	High	45	300	Recreation	1990	Green Hollow Creek	Turner Enterprises, Inc.
Hebgen Dam	High	120	525,620	Flood Control, Hydroelectric	1915	Madison River	Northwestern Energy
Kistner Hardy Dam	Significant	8	70	Stock	1945	S. Fork Muddy Creek	Robert Weyerhauser
Middle Creek (Hyalite) Dam	High	125	10,184	Recreation	1951	Middle Creek	Montana DNRC
Pacabo	Low	15	69	Fire Protection, Stock	1956	Darlington Ditch	Harry Gillingham
Real Close	Low	20	52	Irrigation	1963	Duck Creek	Rupert D Koelza
Schutter Reservoir	Low	17	200	Irrigation	Not Available	N/A	Cliff Schutter

[1] Big Sky Dam/Lake Levinsky is located in Madison County, approximately 1 mile west of the Gallatin County boundary. It is included in this table because the effects of a dam failure would occur almost entirely within Gallatin County.

4.6.2 HISTORY

There are no known accidental dam breaks in the history of Gallatin County. Several dams have purposely been breached for various reasons in the past. The most recent was the Mystic Lake Dam in Sourdough Canyon, this dam was breached as a mitigation measure to prevent a future failure. The Mystic Lake Dam was a water retention dam for the City of Bozeman water supply.

In August 2008, two of the mechanical outlet gates at the Hebgen Lake Dam failed causing a rapid increase in water discharge from the dam (flows increased from 800 cubic feet/second [cfs] to 3,400 cfs. Subsequent inspections revealed that the dam was structurally sound. This incident initiated a large-scale repair and replacement project of the dam's outlet works and emergency spillway.

In March 2016, a holding pond containing treated wastewater from the Yellowstone Club breached and spilled approximately 30 million gallons which eventually reached the South Fork West Fork of the Gallatin River. Data results from sampling that occurred immediately following the spill indicated that Montana health standards were not exceeded. Aquatic life standards were, however, exceeded for ammonia and sediment.

4.6.3 PROBABILITY

Several dams throughout the county are classified as high hazard; however, the probability of those dams breaking is considered low. High or significant hazard dams are the most probable to cause damages, and none are known to be unstable. The Montana Department of Natural Resources keeps an assessment of dams not meeting safety standards. Big Sky is at slightly increased risk of dam failure, as the area contains more dams than other jurisdictions in the County.

4.6.4 MAPPING

Figure 4-5 shows the inundation area for the Middle Creek Dam during a Probable Maximum Flood (PMF) even. Inundation mapping for the Middle Creek, and Hebgen Lake dams exist in their Emergency Action Plans.

4.6.5 ASSOCIATED HAZARDS AND OTHER FACTORS

Dam failure is most often associated with other hazards. Heavy rainfall or high-water levels from rapid snowmelt are typically a contributing factor in dam failure. In this scenario, flooding may already be occurring, in which case a dam failure would aggravate the situation. Dams have also broken as a side effect of significant earthquakes. Most dams in Gallatin County have not been seismically assessed. Dam failure as a terrorist act has also been proposed by many agencies evaluating homeland security.

4.6.6 VULNERABILITY

4.6.6.1 PROPERTY

Many of the Gallatin County critical facilities are located within the dam failure inundation areas. During a failure, these facilities could be expected to be significantly impacted. Several roadways may become impassible, making travel to critical facilities more difficult.

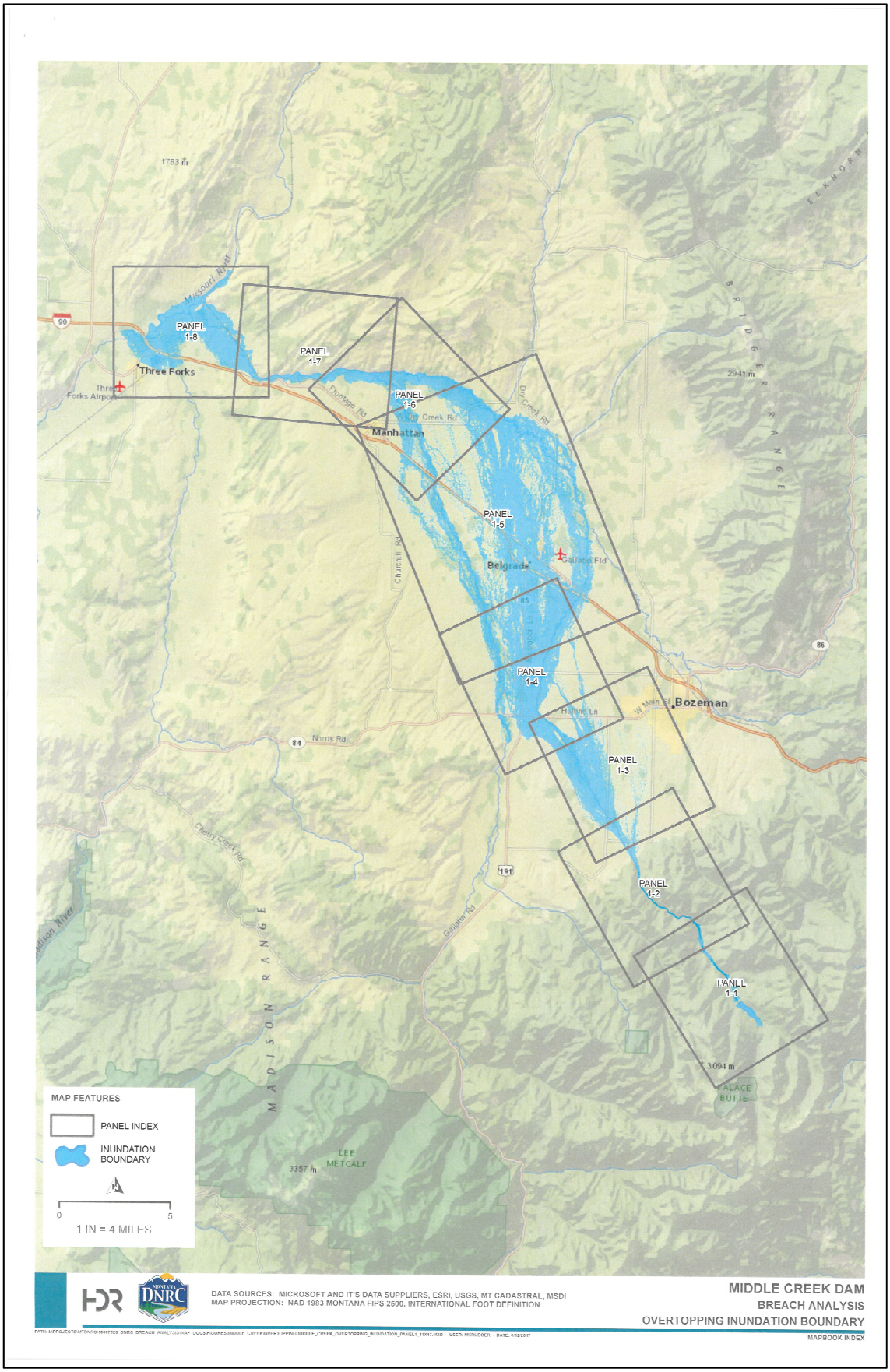

PANEL 1-8
PANEL 1-7
PANEL 1-6
PANEL 1-5
PANEL 1-4
PANEL 1-3
PANEL 1-2
PANEL 1-1
Three Forks
Manhattan
Belgrade
Bozeman
Missouri River
Madison River
MADISON RANGE
GALLATIN RANGE
ELKHORN
Gallatin Fld
Three Forks Airport
Norris Rd
Cherry Creek Rd
Gallatin Rd
Churchill Rd
Hyalite Ln
W Main St
LEE METCALF
ALACE BUTTE
1783 m
2941 m
3094 m
3357 m
MAP FEATURES
PANEL INDEX
INUNDATION BOUNDARY
0
5
1 IN = 4 MILES
DATA SOURCES: MICROSOFT AND IT'S DATA SUPPLIERS, ESRI, USGS, MT CADASTRAL, MSDI
MAP PROJECTION: NAD 1983 MONTANA HPS 2600, INTERNATIONAL FOOT DEFINITION
MIDDLE CREEK DAM
BREACH ANALYSIS
OVERTOPPING INUNDATION BOUNDARY
MAPBOOK INDEX

Figure 4-3. Middle Creek Dam Inundation Area – Probable Maximum Flood (MT-DNRC, 2018)

Depending on the type of infrastructure, dam failure could result in long-term disruptions while new arrangements are made. According to the dam breach models, much of Belgrade, Four Corners, and significant portions of Interstate 90 and Highway 191 would be inundated and susceptible to significant damage following a breach of Middle Creek Dam. Furthermore, the airport would be inaccessible, and the railroad would be disconnected in several places. Interruptions in drinking water and utility services would be expected in some areas.

Failure of the Middle Creek Dam would have significant catastrophic effects on the residential structures within Gallatin County. Just over one hour after total failure a 35-foot high wave of water and debris is forecasted to reach the mouth of Hyalite Canyon. Fifty minutes later the water reaches Four Corners at depths ranging from 2.5 to over 8 feet..

4.6.6.2 POPULATION

With any flooding or dam failure event, the loss of life is always possible. As with flash flooding, the warning time for a dam failure can be fairly short, but some warning does exist. The Middle Creek Dam poses the greatest risk to lives in Gallatin County. This dam currently has an early warning system. The population in West Yellowstone is less vulnerable than other jurisdictions, due to the absence of nearby dams.

4.6.6.3 ECONOMY

Significant economic impacts would be felt in the aftermath of a large dam failure, while a small dam failure would be expected to have only a minimal, localized impact. Business losses may occur due to damage to structures, property, and infrastructure. Additional losses could be incurred in the form of damaged agricultural land and reduced tourism and recreation.

A dam failure would cause significant ecologic disruption in areas affected by the dam breech, which may include loss of habitat in some cases. Historic structures and contents may be damaged if located in the inundation area.

4.6.6.4 FUTURE DEVELOPMENT

Future development could place residences and business in the inundation areas. This is particularly true for development in Manhattan, Belgrade and Four Corners, where land is currently largely rural and agricultural, and is experiencing significant growth and development.

4.6.7 DATA LIMITATIONS

The data limitations related to dam failure include:

- Lack of readily available data outlining inundation areas of high hazard dams
- Lack of a loss ratio specific to dam failure, as many structures in the inundation area may experience little damage while others may be complete losses

4.6.8 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	Low	Moderate	Moderate	Moderate	Low

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Belgrade	Low	Moderate	Moderate	Moderate	Moderate
Big Sky	Moderate	Low	Moderate	Moderate	Moderate
Bozeman	Low	Low	Low	Low	Low
Manhattan	Low	Moderate	Moderate	Low	Moderate
Three Forks	Low	Moderate	Moderate	Moderate	Moderate
West Yellowstone	Low	Low	Low	Moderate	Low

4.7 DROUGHT

"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 long-term conditions that reflect a balance of precipitation and evapotranspiration in a particular area, a condition often perceived as 'normal'." (Sivakumar and Wilhite, 2002)

Droughts can range from minor to severe, short-term to long-term with a variety of determining factors such as precipitation, soil moisture, and tree moisture. A minor, short-term drought can slip by unnoticed while a long -term severe drought can impact the agricultural economy, natural resources such as fish populations, and even public water supplies. In Montana, drought conditions have also been associated with grasshopper infestations and blight.

Montana is known for its arid climate and Gallatin County is no exception. The region has been in drought for the past several years based on climate information, drought indices such as the Palmer Index, and drought monitoring at the national level. **Figure 4-66** shows the drought status of the United States in August 2017. The State of Montana has a Drought Advisory Committee and a State Drought Plan in place to address this hazard. Historical weather records show that Bozeman temperatures can get as high as 106ºF in the summer with extremely low humidity and high winds. Such dry, hot conditions exacerbate drought conditions during periods of low precipitation.

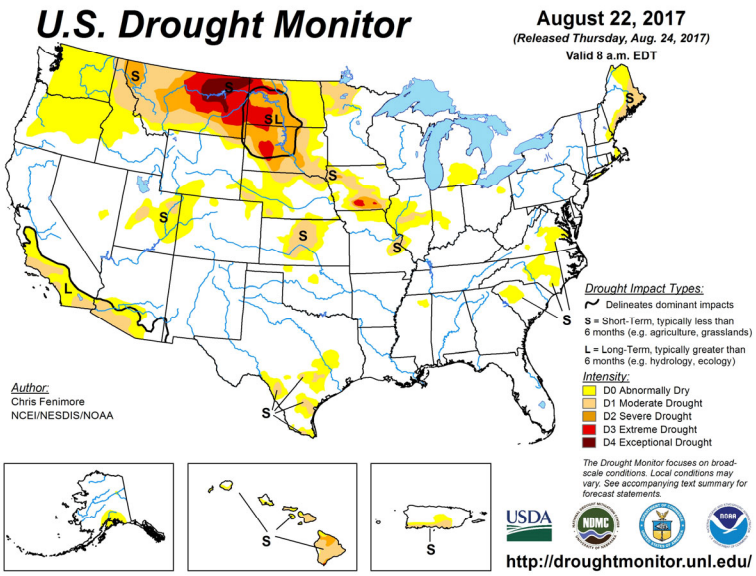


Figure 4-4. US Drought Monitor Map (US Drought Monitor, 2017)

4.7.1 HISTORY

Drought has a long history in Gallatin County and all of Montana. Paleoclimate studies show extreme periods of drought hundreds of years ago. The periods of 200-370 A.D., 700-850 A.D., and 1000-1200 A.D. are identified as long-term periods of drought in the Northern Great Plains. With the development of a more detailed weather monitoring network, climate records generally date back 100 years in Montana. Based on data from Montana Disaster and Emergency Services, Gallatin County has been in drought several times over the past decade. **Table 4-6** identifies and describes these periods.

Table 4-6. Gallatin County Drought Periods since 1900 (USDA, 2018)

Time Period	Description
1930's	The Dust Bowl created erosion problems and dust storms throughout the state.
Mid 1950's	Extended period of reduced rainfall in Eastern and Central Montana.
1960's	Entire state affected, although the impact of this drought was lessened through better conservation practices such as strip cropping.
1970's	By May 1977, over 250,000 acres of Montana farmland was damaged by wind. The State of Montana began taking protective measures due to critically low hydroelectric power supplies.
1985	USDA drought disaster declaration. A typical 2,500-acre farm lost more than $100,000 in equity. The state agriculture industry lost nearly $3 billion in equity.
2000's	Statewide drought disaster designations in 2000, 2001, and 2002. In 2004, Gallatin County was given a USDA Secretarial Disaster Designation. Most protective measures were conducted at the county level.
2010's	Gallatin County received a USDA Secretarial Disaster Designation for drought in 2012 through 2017.

4.7.2 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." (National Climatic Data Center, Paleoclimatology Branch, http://www.ngdc.noaa.gov/paleo/paleo.html). Based on this research, the 1950s drought situation could be expected approximately once every 50 years, or a 20% chance every 10 years. An extreme drought, worse than the 1930s Dust Bowl, has an approximate probability of occurring once every 500 years or a 2% chance of occurring each decade.

It should be noted the probability of a major disaster in Big Sky and West Yellowstone is somewhat reduced, as the communities have little to no agriculture and thus significantly reduced water needs.

4.7.3 MAPPING

Drought is regional hazard, and therefore, mapping at the county level is not appropriate here. The county is assumed to have the same risk countywide. Mapping of the current drought status is published by the

US Drought Monitor weekly and the Montana Drought Advisory Committee monthly from March through October.

4.7.4 ASSOCIATED HAZARDS AND OTHER FACTORS

Drought is most commonly associated with wildfire in Gallatin County. Dry conditions contribute to lower moisture content in the trees and plants that provide fuel for wildfires. An initial look at the driest years show that they do not directly coincide with severe wildfire seasons, however, the effects of drought can carry into the long term. One season of severely low precipitation may not be enough for extreme fire behavior; however, followed by several seasons of below normal precipitation, the conditions can contribute to an increased probability for significant wildfires. Drought often kills trees and plants that then become very dry fuels for wildfires years later. Short-term drought conditions can prime grasses on non-irrigated lands for grass fires and long-term drought conditions can additionally impact the heavier timber fuels for forest fires.

Counter intuitively, in mountainous areas, such as those found in Gallatin County, 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 have a greater probability of occurring in drought conditions. Besides the hydrologic and agricultural impacts, drought can lead to severe dust storms and soil erosion affecting populations in non-agriculture settings. Other concerns include water temperatures for fish populations, wildlife health, plant ecology changes, hydroelectric power supplies, and public water sources.

4.7.5 VULNERABILITY

4.7.5.1 PROPERTY

Generally, critical facilities are not affected directly by drought. Infrastructure relying on the water supply is the primary exception. If the water supply for public drinking water and sewer systems was threatened, those losses could total millions of dollars should equipment be damaged or outside water need to be shipped into the county. The probability of a drought of that significance is considered low.

The most probable losses from drought are to the economy. Drought significantly impacts the agricultural economy and can additionally impact tourism. Gallatin County totaled over $41,000,000 in crop sales during 2002. Crops are very directly affected by drought and this economy could potentially be lost if drought conditions persist for a period of time.

Crops aren't the only aspect of agriculture affected by drought. Livestock can also be impacted. The pasture and food supply available to the animals is directly related to drought conditions. With over $35,000,000 in livestock sales in 2002, this larger agriculture economy is additionally threatened by drought.

Natural resources, and therefore tourism, are influenced by drought. As river and stream levels drop, fish populations and other natural resources are impacted. With fishing and river recreational activities a very

important part of the tourism industry in Gallatin County, those aspects of the economy can be threatened during extended periods of drought.

4.7.5.2 POPULATION

Since drought evolves slowly over time, the population has ample time to prepare for its effects and is warned accordingly. The greatest direct threat to the population from drought is through the drinking water supply. 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. The more urbanized areas such as Bozeman and Belgrade are at increased risk, due to concentrated water demand.

4.7.5.3 ECONOMY

Agriculture is a significant part of the Gallatin County economy and culture. Drought severely threatens the agriculture industry when it causes a loss of forage, feed, or water supplies. These loses can often impact other industries, such as farm supply and transportation services, which are dependent on local agriculture.

The economy can be further impacted by drought through reduced tourism. As drought reduces natural water supplies, fish populations and other natural resources are impacted, which play a large part in drawing tourists and recreationalists to the area.

4.7.5.4 IMPACT OF FUTURE DEVELOPMENT

Future development's greatest impact on the drought hazard would be through possibly limiting ground water resources. Fortunately, public systems, individual wells, and septic systems are carefully monitored and regulated by Montana Department of Environmental Quality. Therefore, the impact of future development with respect to drought is considered low.

4.7.6 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.

4.7.7 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	High	Moderate	Moderate	Moderate	High
Belgrade	High	Moderate	High	Moderate	High
Big Sky	Moderate	Moderate	Moderate	Moderate	Moderate
Bozeman	High	Moderate	High	Moderate	High
Manhattan	High	Moderate	Moderate	Moderate	High
Three Forks	High	Moderate	Moderate	Moderate	High
West Yellowstone	Moderate	Low	Moderate	Moderate	Moderate

4.8 EARTHQUAKE

4.8.1 DESCRIPTION

One of the most frightening and destructive phenomena of nature is a severe earthquake and its terrible aftereffects. An earthquake is a 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 as the huge plates that form the Earth's surface slowly move over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release accumulating energy. When the accumulated energy grows strong enough, the plates break free.

Montana is ranked fourth in the United States for seismicity and has many faults, primarily in the mountainous parts of the state. Yellowstone National Park, within and to the south of Gallatin County, is an active geothermal area with approximately 2,000 earthquakes each year. Gallatin County lies in the middle of the most active areas and has experienced many significant earthquakes. Earthquakes can damage property and infrastructure very rapidly and significantly with little warning, severely impacting those close to the epicenter and being felt for hundreds of miles.

4.8.2 HISTORY

Since 1900, 16 earthquakes of magnitude 5.5 or greater have occurred within 100 miles of Gallatin County as shown in **Table 4-7**. The closest earthquakes to southern Gallatin County were the Hebgen Lake and Yellowstone Park earthquakes, and to northern Gallatin County, the Clarkston and Lombard earthquakes.

Table 4-7. Earthquakes Magnitude 5.5 or greater within 100 miles of Gallatin County, Montana [US Geological Survey, 2017]

Date	Approximate Location	Magnitude
7/06/2017	Lincoln	5.8
7/25/2005	Dillon	5.6
12/8/1976	Yellowstone Gallatin	5.5
6/30/1975	Yellowstone Gallatin	5.9
10/21/1964	Hebgen Lake	5.6
8/19/1959	Hebgen Lake	6.0
8/18/1959	Hebgen Lake	7.5
8/18/1959	Hebgen Lake	6.5
8/18/1959	Hebgen Lake	6.0
8/18/1959	Hebgen Lake	5.6
8/18/1959	Hebgen Lake	6.3
11/23/1947	Virginia City	6.1
10/31/1935	Helena	6.0
10/19/1935	Helena	6.3
10/12/1935	Helena	5.9

Date	Approximate Location	Magnitude
2/16/1929	Lombard	5.6
6/28/1925	Clarkston	6.6

The Clarkston earthquake caused relatively light damages due to the rural nature of the area at that time. Most of the damages were confined to Manhattan, Logan, Three Forks, and Lombard in Gallatin and Broadwater Counties. The earthquake was felt from the North Dakota line to Washington and from the Canadian border to central Wyoming. Un-reinforced brick structures suffered the greatest damages. Bozeman felt five distinct shocks. Pavement and buildings sustained cracks up to an inch wide. Mines in Jardine in neighboring Park County were feared to have been damaged. Bozeman police reported the tower of a high building swaying with many people fainting and rushing to the streets. A train from Livingston was sent to rescue passengers from trains trapped by landslides near Lombard. In Clyde Park in Park County, the stock of tinware at Jack O'Leary's store fell off the shelves.

The initial Hebgen Lake earthquake on August 18, 1959 is the most significant earthquake to have occurred in the region over the past 100 years. This magnitude 7.5 earthquake occurred about 30 miles from Gardiner and about 70 miles from Bozeman. This surface rupturing earthquake changed the geology of the Hebgen Lake area and triggered a major landslide (80 million tons of rock). The result was the creation of a new lake, Earthquake Lake, on the Madison River and State Highway 287 was buried. Twenty-eight people perished and roadway and timber damages totaled over $11 million. The quake was felt in 8 states and 3 Canadian provinces [US Geological Survey, 1976]. The North Entrance to Yellowstone National Park did have some landslides blocking roadways, but all were cleared within 2 days. Also damaged was the Golden Gate just above Mammoth Hot Springs near Gallatin County. Damages in the park were estimated at about $2 million.

4.8.3 PROBABILITY

Large and damaging earthquakes are infrequent events. Gallatin County experiences many small earthquakes every month, but they are undetectable except by instrumentation. The mapping section that follows outlines some of the probabilities used in earthquake modeling as it varies throughout the county. Depending on the earthquake magnitude, recurrence intervals for Western Montana, including Gallatin County, are currently being developed. The geography of Gallatin County is such that it lies within several categories of seismic source zones. The most active of which is the Northern Intermountain Seismic Belt to the north and west. This region is estimated to recurrence rate of 3.84 years for a magnitude 5 or greater earthquake, 22.6 years for a magnitude 6 or greater earthquake, and 133 years for a magnitude 7 or greater earthquake (Wong et al., 2005).

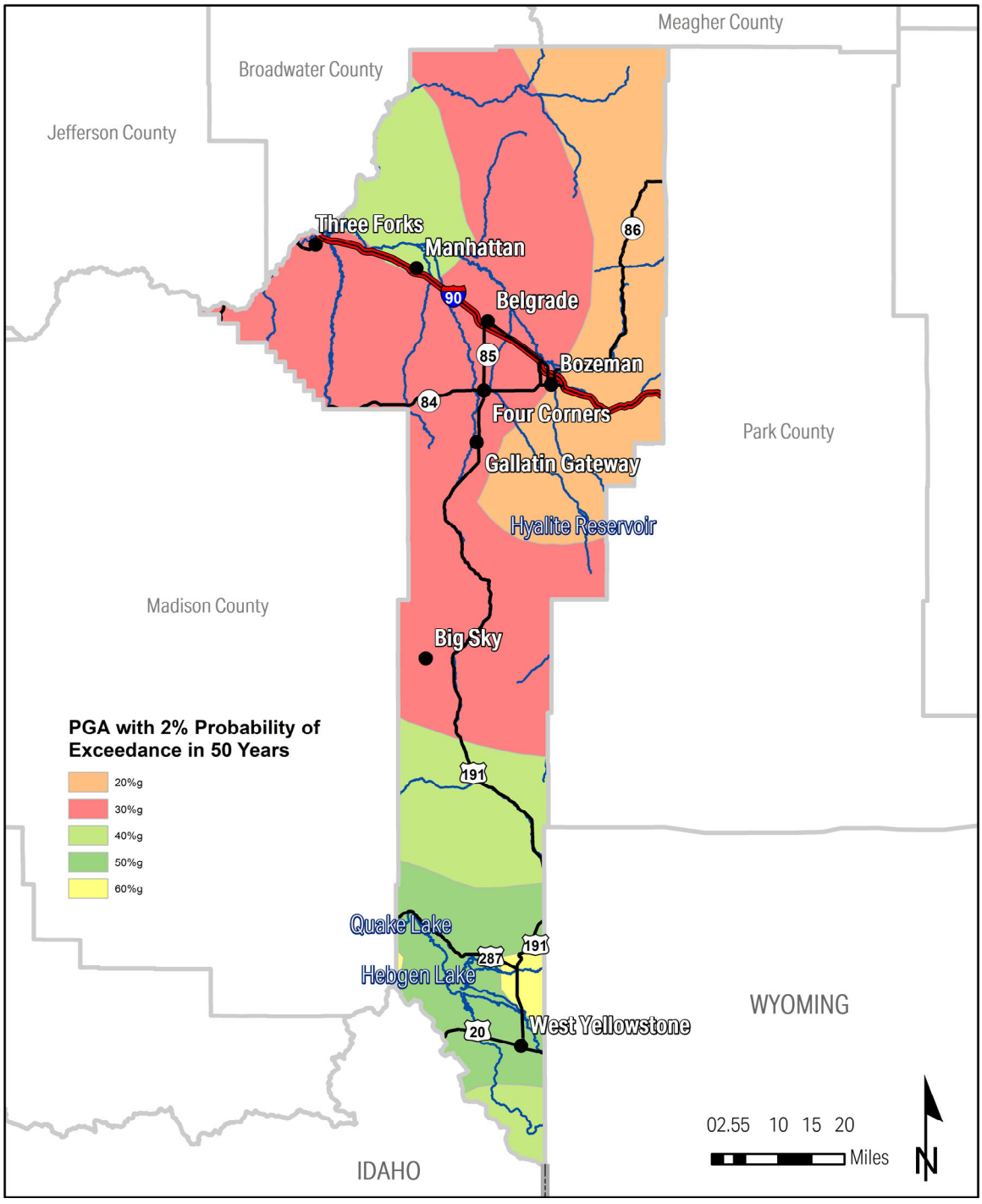
4.8.4 MAPPING

Research through the US Geological Survey's National Seismic Hazard Mapping Project has resulted in peak ground acceleration (PGA) maps related to the probability of seismic shaking. The map for Gallatin County (**Figure 4-57**) shows the strength of seismic shaking that has a 2% probability of being exceeded in a 50-year period. The strength of the shaking is measured as a percentage of the acceleration of gravity (%g). Generally, a PGA of above 20%g would result in major damage. As **Figure 4-57** shows, the entire County is at risk of experiencing an earthquake resulting in major damage, though the area surrounding West Yellowstone is particularly at risk.

History has shown that significant earthquakes (up to magnitude 6.5) may occur anywhere throughout the Intermountain Seismic Belt, even in areas where young faults are not recognized. Examples of damaging earthquakes for which no known surface fault was recognized include the 1925 Clarkston earthquake (magnitude 6.6) and the 1935 Helena earthquakes (magnitude 6.3-5.9).

Earthquake Hazard

Gallatin County, Montana



Data Source: Montana NRIS, USGS
Data Date: August 2017
Mapp Coordinates: NAD 1983, State Plane Montana

Map Updated by:
Libby Ellwood
May 2018

RESPEC

Figure 4-5. Earthquake Hazard in Gallatin County

4.8.5 ASSOCIATED HAZARDS AND OTHER FACTORS

The seismic action of earthquakes often triggers other events. Landslides are quite common in Montana with large earthquakes. During the winter, avalanches can also be triggered. Dam breaks and landslides on waterways may cause flooding. The rupture of gas lines can result in large-scale urban fires, particularly if power outages or broken water mains disrupt water supplies. Any number of additional incidents may occur due to the failure of infrastructure such as hazardous material spills and large-scale transportation accidents. All these associated factors contribute to the severity of the earthquake event.

4.8.6 VULNERABILITY

4.8.6.1 PROPERTY

Since the probability and likely strength of an earthquake varies across the county, the threat to critical facilities can be assessed based on their respective geographic locations. Structural assessments of the individual facilities would further determine the seismic stability of that structure. Based on geography, the critical facilities near the fault lines can be considered the most vulnerable. All critical facilities are at risk from earthquakes in Gallatin County. In addition, un-reinforced masonry construction is particularly vulnerable to seismic shaking. Therefore, any critical facilities with, or within close proximity to un-reinforced masonry can be considered at greatest risk.

Two HAZUS earthquake models were used to estimate the extent of damage caused by an earthquake in Gallatin County. The first scenario considered a magnitude 6.5 earthquake on the Bridger fault, which runs along the base of the Bridger Mountains. The second scenario considered a magnitude 7.5 earthquake on the Madison fault. Based on the results of the HAZUS-MH runs**, Table 4-8Error! Reference source not found.** shows the functionality of critical facilities included in the inventory.

Table 4-8. Critical Facility Functionality Following an Earthquake

Critical Facility Type	6.5 Earthquake – Bridger fault	7.5 Earthquake – Madison fault
Hospital	64% on Day 1 90% on Day 7 99% on Day 90	93% on Day 1 98% on Day 7 99% on Day 90
Fire Stations	82% on Day 1	84% on Day 1
Law Enforcement Stations	70% on Day 1	81% on Day 1
Schools	73% on Day 1 Range: 37-99%	86% on Day 1 Range: 51-99%

The HAZUS 4.2 database for Gallatin County contains over 220 miles of highway, 195 bridges, and 14,272 miles of pipeline valued at over $2.7 billion. Infrastructure, as quantified in the default HAZUS database, suffers damages during both modeled earthquakes, as shown in **Table 4-9**.

Table 4-9. HAZUS Estimated Infrastructure Losses Following an Earthquake

Infrastructure System	Bridger Fault Economic Losses	Bridger Fault Damages	Madison Fault Economic	Madison Fault Damages
Highway	$2,847,000		$1,461,000	

Infrastructure System	Bridger Fault Economic Losses	Bridger Fault Damages	Madison Fault Economic	Madison Fault Damages
Bus	$3,500		$214,000	
Airport	$7,480,000		$5,160,000	
Potable Water	$6,121,000	849 leaks 212 breaks 600 households without service on Day 1	$1,550,000	284 leaks 71 breaks 6 households without service on Day 1
Waste Water	$37,805,000	426 leaks 107 breaks	$8,213,000	143 leaks 36 breaks
Natural Gas	$657,000	146 leaks 37 breaks	$220,000	49 leaks 12 breaks
Total	$54,913,500		$16,818,000	

Many structures, including critical facilities, within Gallatin County have not been seismically assessed. Depending on the construction, those homes, businesses, and critical facilities may not be structured to withstand seismic shaking. Downtown Bozeman also has many non-reinforced, masonry buildings that house businesses. Estimates of building damages generated by HAZUS are outlined in **Table 4-10** and **Table 4-11.**

Table 4-10. Expected Building Damage by Occupancy during 6.5 Magnitude Earthquake on Bridger Fault

Type	Slight Damage	Moderate	Extensive	Complete
Agriculture	63	41	15	6
Commercial	518	440	179	66
Industrial	167	156	67	25
Other Residential	1,397	1,315	680	188
Religion	42	28	10	3
Single Family	7,198	1,834	115	27
Total	9,385	3,814	1,066	315

Table 4-11. Expected Building Damage by Occupancy during 7.5 Magnitude Earthquake on Madison Fault

Type	Slight Damage	Moderate	Extensive	Complete
Agriculture	30	13	2	1
Commercial	274	135	28	3
Industrial	94	50	10	1
Other Residential	920	537	87	6
Religion	21	9	2	1
Single Family	2,600	266	8	2
Total	3,939	1,010	137	14

4.8.6.2 POPULATION

The population would have little or, most likely, no warning prior to an earthquake. Most casualties in a large earthquake in Gallatin County would be anticipated with building collapse, roadway failures, falling objects, and landslides. The number of actual casualties will be dependent on a variety of factors including proximity to the epicenter, time of day, and magnitude, among others. The HAZUS runs estimate up to 340 people injured and 20 casualties in the magnitude 6.5 earthquake event on Bridger Fault depending on time of day, and up to 30 people injured and 5 casualties in a magnitude 7.5 earthquake event on Madison Fault.

4.8.6.3 ECONOMY

The impacts of a strong earthquake in Gallatin County could be far reaching. Economic, physical and functional damages to businesses, particularly downtown businesses in non-reinforced masonry structures, could be substantial. Industries such as construction, however, may see a recovery related boom following an earthquake. The HAZUS runs estimate the losses from capital stock, including inventory, lost wages, and lost rental income would total $584,560,000 after a magnitude 6.5 earthquake along the Bridger fault, and $105,490,000 after a magnitude 7.5 earthquake along the Madison fault.

4.8.6.4 FUTURE DEVELOPMENT

Any future development in Gallatin County is at risk for earthquake damages. Fortunately, construction standards for seismic stability have improved over the past 100 years. Bozeman, Belgrade, Manhattan, Three Forks, and West Yellowstone are the only jurisdictions within Gallatin County that have a building code and inspection program. Other areas of the county are under the state building code that for most single-family homes is only subject to electrical, plumbing, and septic inspections. Much of the new Gallatin County construction is taking place in the areas near the identified and active faults. Should an earthquake occur on these faults, the future development that occurs will be in the highest hazard area.

4.8.7 DATA LIMITATIONS

Since earthquakes are a relatively rare event, perhaps the greatest challenge is understanding the true probability and damages possible. More research is needed to identify fault areas and develop digital data for use in the HAZUS modules. Improving the modeling and assessing individual facilities will allow for a more accurate vulnerability assessment.

4.8.8 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	Moderate	Moderate	High	Moderate	High
Belgrade	Moderate	High	High	High	High
Big Sky	Moderate	Moderate	Moderate	Moderate	Moderate
Bozeman	Moderate	High	High	High	Moderate
Manhattan	Moderate	Moderate	High	Moderate	Moderate
Three Forks	Moderate	Moderate	High	Moderate	Moderate
West Yellowstone	High	High	High	High	High

4.9 ENVIRONMENTAL HAZARDS

4.9.1 DESCRIPTION

As it relates to this plan, an environmental hazard can be classified as any substance which once released to or from the natural environment has the potential to adversely impact human health. The hazard can be human-caused, as in the case where raw sewage from a damaged septic system contaminates groundwater, or occur as part of a natural process, such as when wildfires reduce ambient air quality.

4.9.2 HISTORY

Increased incidences of large wildfires across the western U.S. over the last 20 years has resulted in an increased frequency of poor air quality days in Gallatin County. The effects of wildfire smoke on air quality tend to occur during the peak wildfire season of July – October.

Another phenomenon that significantly affected air quality across the county was the 1980 volcanic eruption of Mount St. Helens in Washington. Up to 1 cm of ash fell over portions of the county.

4.9.3 PROBABILITY AND MAGNITUDE

The probability of an environmental hazard occurring is difficult to quantify, however one can occur almost anywhere at any time. Similarly, the magnitude and intensity of an environmental hazard will largely be driven by the scale of the event that caused the hazard. For example, a small wildfire could cause poor air quality for a short duration over a relatively small area. Conversely, a massive wildfire or volcanic eruption may cause widespread air quality impacts that affect the entire county and beyond.

4.9.4 MAPPING

Environmental hazards can occur anywhere humans are able to interact with the environment. Thus, the potential is considered present throughout the entire county.

4.9.5 ASSOCIATED HAZARDS AND OTHER FACTORS

Environmental hazards can occur as a result of almost any hazard imaginable. Earthquakes or severe weather may cause infrastructure to fail, which releases contamination into the environment. A wildfire or volcano could contaminate air or water resources. Similarly, an aviation, ground transportation, or railroad accident could cause a hazardous materials release which poses an environmental hazard.

4.9.6 VULNERABILITY

4.9.6.1 PROPERTY

Critical facilities and infrastructure are not expected to be physically impacted by environmental hazards, though the functionality could certainly be impacted. Erosion following a wildfire can result in large sediment loads in drinking water sources, which could quickly overwhelm the ability of drinking water treatment plants to treat the water to meet drinking water standards.

4.9.6.2 POPULATION

The general population can be easily and almost entirely affected by poor air quality due to its necessity for life function. Large portions of the population can also be affected by poor water quality, particularly if large-scale water distribution systems are impacted.

4.9.6.3 ECONOMY

Poor air and water quality can affect almost all commercial activities, potentially having a substantial economic impact.

4.9.6.4 FUTURE DEVELOPMENT

Future development can be impacted by impacts to air and water quality.

4.9.7 DATA LIMITATIONS

Data limitations include a lack of historical data, and inability to track environmental hazards such a septic contamination.

4.9.8 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	Moderate	Moderate	Moderate	Moderate	Moderate
Belgrade	High	Moderate	Moderate	Moderate	High
Big Sky	Moderate	Moderate	Moderate	Moderate	Moderate
Bozeman	High	Moderate	High	Moderate	High
Manhattan	High	Moderate	Moderate	Moderate	Moderate
Three Forks	High	Moderate	Moderate	Moderate	Moderate
West Yellowstone	Moderate	Moderate	Moderate	Moderate	Moderate

4.10 FLOODING

4.10.1 DESCRIPTION

Flooding is the inundation of a normally dry area with water. Riverine flooding occurs on rivers, creeks, and streams as water levels rise be it from excessive precipitation, rapid snowmelt, dam failure, or ice jams. Unlike riverine flooding, flash flooding can happen anywhere. As the name implies, flash flooding happens quickly after intense rains, dam or ice jam breaks, or rapid runoff in mountainous or recently burned areas. Urban flooding is the result of development and the ground's decreased ability to absorb the rainfall. Flooding from groundwater does not typically result in floodwaters at the surface, but occasionally basements and crawlspaces can be flooded by excessive groundwater.

Flooding in Gallatin County normally occurs during periods of excessive rainfall or snowmelt. The mountainous terrain in Gallatin County is a contributing factor to rapid flood development and snowmelt problems. Gallatin County has been experiencing both rapid growth and drought for more than five years. The last significant flooding event was in 2008. Since then there has been a steady increase in the amount of development near streams and rivers. Associated with this development are concerns for public health and safety when the next flooding event occurs.

4.10.1.1 FLOODPLAIN MANAGEMENT

The Montana Floodplain and Floodway Management Act (Montana Code Annotated, Title 76, Chapter 5) requires political subdivisions to adopt land use regulations that regulate the use and development of property within the regulated floodways and floodplains. Gallatin County Floodplain Regulations were adopted in 1984 and amended in 1999 and 2011. The regulations are administered through the Gallatin County Planning Department. Within the City of Bozeman, a task force (Gallatin Water Resources Task Force) was put together in May of 2005 to look at water related issues in Gallatin County. The task force discussed floodplain issues several times and reviewed the proposed amendments to the Gallatin County Floodplain Regulations. A common concern was the lack of accurate maps of the areas within floodplains in the county. Several technical reasons were identified for the inaccuracy of floodplain maps.

Riverine flooding problems are managed through a national insurance system called the National Flood Insurance Program (NFIP) under the Federal Emergency Management Agency (FEMA). Gallatin County and the Cities of Bozeman, Belgrade, and Three Forks, as well as the Town of Manhattan are all NFIP participants. FEMA conducts a Flood Insurance Study (FIS) of a region to identify the community's risk levels. The FIS includes statistical data for river flow, rainfall, topographic surveys, as well as 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. These maps are certainly not all inclusive and other flood prone areas may exist. The FIRM maps in Gallatin County were recently digitized and the new digital FIRMs went into effect on September 2, 2011.

In 2012, FEMA, DNRC, and Gallatin County began a floodplain mapping update project for the West Gallatin River and Bozeman Creek and its tributaries to more accurately model these areas and show flood risks. The project's draft floodplain maps will eventually replace existing floodplain maps for the West Gallatin River, Bozeman Creek, Mathew Bird Creek, Nash Spring Creek, Flat Creek, Figgins Creek and the Mill Ditch Diversion. The project utilized high-accuracy topographic information, updated hydrologic data and modern engineering methods to ensure the communities have the best available data. Technical data for the West Gallatin and Bozeman Creek and tributaries floodplain mapping project is available for download on the **City of Bozeman's file share site**. Data including hydrologic analyses, flood profiles, floodway data tables, and HEC-RAS modeling files are available. New FIRM maps from this project are expected to be finalized in late 2019 after a technical and public review process.

Residents of Gallatin County, Bozeman, Belgrade, Three Forks, or Manhattan have the option to purchase flood insurance through the NFIP. As of February 2018, there are 172 policies in force covering over $47 million in property in unincorporated areas of Gallatin County. The City of Bozeman has 99 policies in force, covering over $24 million in property. The City of Three Forks has 76 policies in force, covering over $14 million in property. No policies were in force in the City of Belgrade or Town of Manhattan.

Any NFIP-insured structure that has had at least two paid flood losses of more than $1,000 each in any 10-year period since 1987 is classified as a repetitive loss structure (FEMA, 2018). FEMA currently lists one structure in Gallatin County as being a repetitive loss property for flooding.

4.10.2 HISTORY

Gallatin County has not had a large history of flooding. The most recent, widespread flooding event occurred in late-May 2008 as a result of heavy rainfall and rapid melting of snowpack. **Table 4-12** lists some of the historical flooding events in the county; this data is gathered from the Flood Insurance Studies for the un-incorporated areas of Gallatin County, the City of Bozeman, and the City of Three Forks. Flood flows on the streams studied in detail were caused primarily by snowmelt or snowmelt and rain during April, May, and June. Flooding can also be caused by ice jams forming in the winter. This problem is especially prevalent on the lower Gallatin and Madison Rivers near Three Forks.

Table 4-12. Gallatin County Historical Flood Events.

Date	Location	Cause
April 1893	Bozeman Creek	Rainfall/Warm Temps
April 1937	Bozeman Creek	Rainfall/Warm Temps
April 1947	Bozeman Creek	Chinook Wind
April 1948	Bozeman Creek	Heavy Snow/Warm Temps
July 1958	Bozeman Creek	Rain Event
August 1958	Bozeman Creek	Rain Event
March 1960	Bozeman Creek	Warm Winds/ Rapid Snow Melt
June 1969	Bozeman Creek	Rain Event
May 1970	Bozeman Creek	Warm Winds/ Rapid Snow Melt
January 1974	Bozeman Creek	Warm Winds/ Rapid Snow Melt
June 1975	Bozeman Creek	Warm Winds/ Rapid Snow Melt
April 1977	Bozeman Creek	Warm Winds/ Rapid Snow Melt
Mar-Apr 1952	West Gallatin	Rapid Snow Melt
June 1959	West Gallatin	Rapid Snow Melt
February 1963	West Gallatin	Warm Temps/Ice Jams
May – June 1970	West Gallatin	High Water
June – July 1971	West Gallatin	High Water
June 1974	West Gallatin	Rapid Snow Melt
1899	Jefferson	Rapid Snow Melt
1908	Jefferson	Rapid Snow Melt
1927	Jefferson	Rapid Snow Melt
1948	Jefferson	Rapid Snow Melt
1949	Madison	Ice Jam
January 1997	West Gallatin / Bozeman Creek	Rapid Snow Melt / Warm Temps
May 2008	Flooding along Gallatin River tributaries	Rapid Snow Melt with rain

4.10.3 PROBABILITY

Flooding probabilities are represented spatially via floodplain maps. The 100-year floodplain has a 1% probability of being exceeded in any given year. Probabilities are typically presented as exceedance

probabilities using discharges (in cubic feet per second) at various locations. **Table 4-13** shows the discharges for the stream gauges in and around Gallatin County.

Table 4-13. Peak Discharges and Exceedance Probabilities for Streams in Gallatin County

Location	Probability of Exceedance		
	1%	2%	10%
	100-year event	50-year event	10-year event
Bozeman Creek at Nash Rd.	765 cfs	642 cfs	405 cfs
Bridger Creek	1260 cfs	1090 cfs	725 cfs
East Gallatin River	3300 cfs	2950 cfs	2190 cfs
West Gallatin River at Shed's Bridge	12150 cfs	11200 cfs	8700 cfs
West Gallatin River at Interstate 90	12350 cfs	11400 cfs	8850 cfs
Jefferson River at Three Forks	27600 cfs	25000 cfs	18300 cfs
Madison River at Three Forks	12000 cfs	10800 cfs	8000 cfs

4.10.4 MAPPING

Digital floodplain maps for the county were completed in September 2011 and can be downloaded at: http://gallatincomt.virtualtownhall.net/Public_Documents/gallatincomt_plandept/1FLOODPLAIN/FEMAnew/FEMAmapsNew. These maps cover many of the larger waterways across the county. Older, paper maps exist showing the 100-year floodplain in other parts of the county. Preliminary maps for the West Gallatin and Bozeman Creek mapping restudies (described above in Section 4.10.1.1) can be accessed at: http://dnrc.mt.gov/divisions/water/operations/floodplain-management/gallatin/maps
When all comments and appeals are resolved, the maps are expected to be finalized and become effective in late 2019.

4.10.5 ASSOCIATED HAZARDS AND OTHER FACTORS

Excessive rainfall and heavy snows associated with flooding can be related to other hazards. Landslides and mudslides are often attributed to saturated soils and flooding. Flood conditions in and around dams can also be a factor in causing dam failures. During the summer, severe thunderstorms can bring heavy rain, especially if they are slow moving, along with wind, hail, and tornadoes. Often the runoff causes sediment problems in addition to the flooding. These additional hazards can be factors during flood events.

4.10.6 VULNERABILITY

4.10.6.1 PROPERTY

An analysis of the floodplain shows several critical facilities are in the 100-year floodplain. A GIS analysis using the Gallatin County version of the digitized FIRM maps floodplain data and the critical facilities database identifies the facilities estimated in the 100-year floodplain or historic flood areas. A significant limitation with this approach is that the datasets are not exact and the results should only be used for planning purposes, not actual flood zone determinations. This approach essentially identifies the critical facilities at greatest risk from flooding. Ultimately, these critical facilities can be expected to lose their functionality and sustain damages during a major flood.

Since the 100-year floodplain maps are not available in digital format, a buffer of 1,000 feet was created around the larger creeks and streams and a buffer of 100 feet was created around the smaller creeks and streams. Although the actual floodplain widens and constricts depending on the topography, this methodology produces a preliminary estimate of critical facilities that may be at risk for flooding.

4.10.6.2 POPULATION

Due to the terrain and hazard areas in Gallatin County, the population is considered at moderate risk for riverine flooding. Some warning does exist, particularly with riverine flooding, but rapidly occurring events may leave the population unprepared and in a dangerous situation. The impacts from flooding could be even greater in areas downstream of wildfire burn areas. It is not possible to estimate the population living in the floodplains due to the aforementioned data limitations.

4.10.6.3 ECONOMY

Flooding can have a significant impact on the local economy. Agricultural losses may occur due to damaged crops, planting or harvesting delays, and injured livestock. Additionally, flooding can damage local businesses and cause closures. Flooding which impacts roads may slow commerce or deter tourism.

4.10.6.4 FUTURE DEVELOPMENT

Gallatin County has stringent floodplain regulations that are enforced. The floodplain regulations are in place to promote the public health, safety and general welfare, to minimize flood losses in areas subject to flood hazards and to promote wise use of the floodplain. These regulations were updated as recently as December of 1999.

4.10.7 DATA LIMITATIONS

The HAZUS-MH program is limited in its accuracy for flood losses due to the limitations in the default data, but more importantly because of its incompatibility with most common versions of software and operating systems. Should these limitations be overcome, a more accurate estimate of flood losses will be determined using HAZUS-MH in future updates of this HMP.

4.10.8 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	Moderate	Moderate	Moderate	Moderate	Moderate
Belgrade	High	Moderate	Moderate	Moderate	High
Big Sky	Moderate	Low	Low	Moderate	Moderate
Bozeman	High	Moderate	Moderate	Moderate	Moderate
Manhattan	High	Moderate	Moderate	Moderate	Moderate
Three Forks	High	Moderate	Moderate	Moderate	Moderate
West Yellowstone	Low	Low	Low	Low	Low

4.11 GROUND TRANSPORTATION ACCIDENT

4.11.1 DESCRIPTION

In Gallatin County, a ground transportation accident, for the purposes of this plan, includes any large scale vehicular accident involving mass casualties. The most likely locations for an incident of this magnitude would be on Interstate 90 or on Highway 191. Interstate 90 crosses Northern Gallatin County in an east-west direction. This Interstate is widely used by large trucks, area residents, and distance travelers. Highway 191, south of the Interstate, connects Interstate 90 to West Yellowstone and Yellowstone National Park and is used by tourists visiting the park, local residents, and as a shipping route to the park and points south into Wyoming and Idaho.

4.11.2 HISTORY

Many motor vehicle accidents occur each year in Gallatin County and invariably fatalities do occur, however, a major (mass casualty) incident requiring a significant emergency response only occurs on occasion. Update….. with actual accident/fatality statistics

4.11.3 PROBABILITY

The probability of a major ground transportation accident is considered moderate based on the historical occurrence and recent call increases. Fire departments in Gallatin County have seen a significant jump in the number of motor vehicle responses in the 1980's to where we are today. Therefore, despite a relatively low history of major ground transportation accidents, the increase in motor vehicle accident responses by the local fire departments leads to the assumption that the probability of a major ground transportation accident is increasing. The probability of a large wreck with mass casualties is further increased during the frequent snow storms, periods of poor visibility with blowing snow or smoke, and during times of heavy tourist traffic.

4.11.4 ASSOCIATED HAZARDS AND OTHER FACTORS

The additional hazards associated with a ground transportation accident are the obvious concerns for hazardous material releases. Any ground transportation accident involving the transport of hazardous materials increases the complexity and potential damages from that accident. Some hazards may even cause the accident such as winter storms, wildfires, earthquakes, and strong winds. Almost any hazard can cause or magnify a ground transportation mass casualty incident.

4.11.5 VULNERABILITY

4.11.5.1 PROPERTY

The critical facilities are not anticipated to be impacted by a ground transportation accident. A critical facility could be damaged or made inaccessible from the impact of an accident, but the likelihood is considered low and uniform throughout the county.

Potential losses from a ground transportation accident include vehicular losses, property damages, and roadway damage. Should vehicle fluids or hazardous materials seep into a water supply, that water body would also be threatened. Typically, most losses from a ground transportation accident are covered by insurance. Should the incident be large enough, the largest expenditures would probably be in responding agency costs.

4.11.5.2 POPULATION

Population losses are highly likely in ground transportation accidents. A ground transportation accident has the potential to kill and injure large numbers of people. Any accident involving a bus or many vehicles has the potential for casualties numbering from 10 to 100. Therefore, the potential for large population losses is considered moderate.

4.11.5.3 ECONOMY

The local economy is not expected to be majorly impacted by a ground transportation accident. Big Sky may experience more economic disruption than other areas, as the community is accessible only via US Highway 191. Ground transportation accidents frequently occur in the section of highway extending from Gallatin Gateway to West Yellowstone. A minor accident in this stretch can cause road closures for up to several hours, while a major accident could potentially cause a closure for several days. Any closure has the potential to reduce traffic to and through Big Sky, which could reduce commerce activity.

4.11.5.4 FUTURE DEVELOPMENT

Future development, except for the associated increase in vehicles in the area, will not impact or will just slightly increase the probability of a large ground transportation accident. Otherwise, the specific locations of where development occurs should not significantly affect the vulnerabilities from this hazard.

4.11.6 DATA LIMITATIONS

Without much history of ground transportation accidents with mass casualties in Gallatin County, the ability to assign a probability and possible losses to this hazard is difficult. This hazard profile will always remain somewhat general unless a detailed transportation study is conducted countywide.

4.11.7 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	High	Low	Low	Low	Moderate
Belgrade	High	Low	Low	Low	Moderate
Big Sky	High	Low	Moderate	Moderate	High
Bozeman	High	Low	Low	Low	Moderate
Manhattan	High	Low	Low	Low	Moderate
Three Forks	High	Low	Low	Low	Moderate
West Yellowstone	High	Low	Moderate	Moderate	Moderate

4.12 HAZARDOUS MATERIALS RELEASE

4.12.1 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 health, the environment, or property. An accidental or intentional release of materials could produce a health hazard to those in the immediate area, downwind, and/or downstream. A hazardous material release can come from a fixed facility or via its transportation through the area.

A major fuel pipeline, the Yellowstone Pipeline, runs through northern Gallatin County, just north of Bozeman and Interstate 90 (refer to **Figure 3-9** in Section 3, page 3-21). This pipeline transports refined petroleum products between Billings, MT and Spokane, WA. Should an explosion or leak occur on this pipeline, a large hazardous material release of the fuel and/or fumes could result and threaten the population and property.

The most likely locations for a transportation-related hazardous materials release are on Interstate 90, Highway 191, or the active railways. Interstate 90 crosses northern Gallatin County in an east-west direction. This Interstate is widely used by vehicles transporting hazardous materials. Highway 191, south of the Interstate, connects Interstate 90 to Yellowstone National Park and is used as a shipping route to the park and points south into Wyoming and Idaho. For the most part, the railroad parallels Interstate 90, except for where it goes through the City of Bozeman. Only the east-west railroad sections are currently active with an additional short section used south through Bozeman, and one north to Trident and south again to Willow Creek. The railroad is owned and operated by Montana Rail Link. If a transportation-related release occurred near populated areas or water supplies, serious human impacts could result.

4.12.2 PROBABILITY

The probability of a hazardous materials release can only be realistically assessed qualitatively. The history of events in Gallatin County is moderate with sporadic events over the past 20 years, none of which have resulted in a disaster declaration. The exposure, however, is high with Interstate 90 and an active railroad passing within close proximity to critical facilities and Bozeman.

4.12.3 MAPPING

As with many hazards, the degree of risk to a specific area is hard to quantify, however, data layers from our 2018 HAZUS earthquake study were used to visually show the areas that have concentrations of hazardous materials and areas that would most likely be affected in a hazardous materials incident. Of course, the entire county is at some risk for a hazardous material release.

4.12.4 ASSOCIATED HAZARDS AND OTHER FACTORS

Hazardous material releases can be accidental or intentional. Accidental causes can be due to a ground, air, or railroad accident. Almost any other hazard event may also lead to a hazardous material release. Destruction of a facility or transportation infrastructure may lead to a hazardous material release. Examples include earthquake, flooding, wildfire, avalanche, landslide, dam failure, severe thunderstorm, tornado, wind, structure fire, or even a volcano. Intentional releases may be related to terrorism or a domestic disturbance. A hazardous material release, if severe enough, could lead to civil unrest, a fiery explosion, or utility failure. Hazardous material releases could likely aggravate almost any other hazard.

4.12.5 VULNERABILITY

4.12.5.1 PROPERTY

The buffers around the highways and railways represent the areas that have an enhanced risk for a hazardous materials release. Two buffer zones were established, 0.25 miles and 0.50 miles from the route. These buffer zones were chosen based on minimum evacuation radii that would be established for a

typical hazardous substance release. Of course, the actual evacuation zone for an event is highly dependent on many factors including wind speed, wind direction, material released, and quantity released. Like many of the other hazards, the hazard area in an actual event will not involve the entire area at risk, but more likely only a small section of the identified area, and therefore, a small percentage of the critical facilities. Based on these buffer zones, it was determined that a good portion of the Gallatin County critical infrastructure is at greatest risk.

Since the Interstate 90 and the Montana Rail Link corridor hauls more hazardous materials than the other transportation routes, the highest risk can be assumed to be in that area. Generally, the only structures affected by a hazardous materials release are the structures that house the material on a daily basis. Fortunately, unless an explosion is present with the release, structures are typically not damaged in a hazardous materials release. A large-scale release in an area with numerous structures will put those structures and their contents at risk, however the structure itself will generally make it through the event unharmed.

4.12.5.2 POPULATION

The population impacts from a hazardous materials release are more significant than the potential structure losses. Depending on the material, the health impacts to the public can be long and short term. Should a release occur in Bozeman, the population impacts would be much greater than if one occurred in a more rural area.

In a hazardous materials release, those in the immediate area would have little to no warning, whereas, the population in the dispersion path may have some time to evacuate, depending on the weather conditions and material released.

Many factors will determine the true hazard area in a transportation related hazardous material release. The worst-case scenario would be a release along the railroad near any of the populated areas. Given this scenario, a conservative estimate of 1,000 structures could be directly affected and/or evacuated. With an estimated 2.5 people per structures (and possibly higher for downtown Bozeman, Belgrade, Manhattan or Three Forks), up to 2,500 people could be at risk in such an event.

4.12.5.3 ECONOMY

Temporary business closures may occur with hazardous material releases. In cases where the release causes an explosion or fire, the closure period may be considerable. Any hazardous materials release which impacts surface water has the potential to impact the tourism economy.

4.12.5.4 FUTURE DEVELOPMENT

Much of the future development expected to occur is off the major road and rail networks in the county. The potential, however, does exist for development of agricultural lands bordering the highways and railroad, particularly in the unincorporated parts of Gallatin County. Very few restrictions are in place to prevent development in these areas.

4.12.6 DATA LIMITATIONS

Understanding when, where, and what substances are mostly likely to be released in a hazardous materials incident is the greatest limitation in analyzing this hazard. Hazardous substances pass through Gallatin

County with such regularity and without incident that fully describing how a release may occur and what population and structures may be affected is not possible. A study of the number and types of hazardous materials passing through Gallatin County would help better frame this profile. A complete database of hazardous materials sites would also allow for more accurate estimates of potential losses and population impacts. Digital mapping of the fixed facilities would allow for a more detailed analysis of vulnerabilities from a release at those facilities.

4.12.7 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	Moderate	Low	Moderate	Moderate	Moderate
Belgrade	Moderate	Low	Moderate	Moderate	Moderate
Big Sky	High	Low	Moderate	Moderate	Moderate
Bozeman	Moderate	Low	Moderate	Moderate	Moderate
Manhattan	Moderate	Moderate	Moderate	Moderate	Moderate
Three Forks	Moderate	Moderate	Moderate	Moderate	Moderate
West Yellowstone	Moderate	Moderate	Moderate	Moderate	Moderate

4.13 RAILROAD ACCIDENT

4.13.1 DESCRIPTION

Montana Rail Link (MRL) operates on a railroad that crosses Gallatin County in an east-west direction, roughly parallel to Interstate 90, and passes through the Cities of Bozeman, Belgrade, and Three Forks and the Town of Manhattan. MRL is a Federal Railroad Administration (FRA) Class II regional railroad with more than 900 miles of track serving 100 stations in the states of Montana, Idaho and Washington, and employs approximately 1,000 people. They operate a fleet of more than 2,100 freight cars and 120 locomotives [Montana Rail Link, http://www.montanarail.com/, 2005]. MRL connects with Spokane, Washington, the Burlington Northern & Santa Fe Railway (BNSF) at Laurel and Helena, Montana, the Montana Western Railway at Garrison, Montana, and the Union Pacific Railroad at Sandpoint, Idaho.

Figure 4-6. 2011 Train derailment in Bozeman (photo courtesy of Travis Munter)

Table 4-14 provides a list of documented rail accidents in Gallatin County since 1981.

Table 4-124. Railroad Accidents in Gallatin County, Montana [Federal Railroad Administration, 2017]

Date	Reportable Damage ($)	Casualties
12-10-2018	not available	1 injury
09-20-2016	16,700	0
02-20-2013	15,000	0
05-08-2012	10,500	0
02-20-2011	850,000	0
03-15-2008	1,838,552	0
11-22-2006	25,000	1 Injury
09-26-2006	20,000	0
06-02-2005	35,000	1 Injury
02-13-2005	153,000	0
10-12-2004	10,000	0
08-15-2002	450,000	0
11-08-2002	262,000	2 Injuries
02-27-2001	18,000	0
03-31-2001	23,000	0
10-25-2001	24,227	0
07-09-1998	30,000	2 Injuries
12-05-1997	25,500	0
09-02-1996	11,600	0
10-29-1996	52,000	0
02-08-1993	170,000	0
06-28-1993	22,500	0
10-08-1992	15,000	0
01-09-1991	23,000	0
03-16-1991	288,000	0
07-05-1991	155,000	0
12-29-1991	7,300	0
01-26-1989	8,000	0
03-09-1989	79,500	0
05-26-1989	18,000	0
11-08-1989	202,000	0
05-22-1988	12,500	0
05-25-1988	56,000	0
07-19-1988	11,000	0
10-05-1988	35,500	0
12-19-1988	251,700	0

Date	Reportable Damage ($)	Casualties
09-01-1987	743,970	2 Injuries
05-09-1986	70,000	0
04-13-1985	58,500	0
11-24-1985	25,500	0
11-30-1985	162,000	0
12-14-1985	191,800	0
06-10-1984	5,400	0
08-05-1984	97,200	0
10-24-1984	34,000	0
12-04-1984	25,300	0
11-02-1983	13,200	0
09-01-1982	72,000	0
01-28-1981	5,720	0

4.13.2 HISTORY

The railroads in Gallatin County were operated by Burlington Northern Railroad from 1970 to 1987 until Montana Rail Link assumed control of the route through southern Montana.

4.13.3 PROBABILITY

Since 1981, 49 railroad accidents have occurred resulting in $6,719,669 in track and equipment damages and 9 injuries. Using this historical record, on average, a railroad accident occurs 1.29 times per year (49 accidents / 38 years) in Gallatin County. The average accident causes $137,136 ($6,719,669 / 49 accidents) in damage. Obviously, incidents do not follow averages, and therefore, the maximum and minimum damages over the past 38 years should be noted. Another important consideration in a railroad accident is the release of hazardous materials. The historical record shows this has only occurred twice in the past thirty years, but the potential certainly exists as demonstrated by the number of hazardous material cars involved, but not damaged, in railroad accidents.

4.13.4 MAPPING

*** check availability

4.13.5 ASSOCIATED HAZARDS AND OTHER FACTORS

A railroad accident is hazardous to those in close proximity to, and operating, the train due to physical impacts, but others may be threatened by associated hazards. A hazardous material release is the most probable associated hazard. Those effects are described in detail in the hazardous materials hazard profile. Almost any other hazard could also cause a railroad accident. Weather conditions can damage tracks or affect the locomotives and cars. For example, strong winds can blow cars from the tracks; winter storms, cold weather, and hot weather can warp tracks; avalanches, landslides, and flooding can cover rail routes; hail and tornadoes can damage cars; and fog and smoke can limit visibility. An earthquake or volcano could also damage tracks or equipment. The possibility that a train could be used in a terrorist attack cannot be ruled out. All of these associated hazards increase the probability of a railroad accident occurring.

4.13.6 VULNERABILITY

4.13.6.1 PROPERTY

Gallatin County critical facilities are not considered at enhanced risk from a railroad accident. Certainly, the associated hazards may threaten facilities, but the accident itself should not directly impact the critical facilities. All critical facilities and vulnerable populations are more than 250 feet from the tracks.

Most of the losses from a railroad accident are paid for by Montana Rail Link or their insurance. Potential community losses are most probable to infrastructure such as roadways. Should a derailment occur on a state, county, or city road, that road could be unusable for several days or weeks. Staff time in coordinating the clean up or response could be considered additional railroad accident losses. In terms of structures that could be impacted by a derailment, a limited amount are within 250 feet of the railroad. Most accidents would probably only impact one or two structures Damages could vary in the hundreds of thousands of dollars depending on the structure or structures impacted.

4.13.6.2 POPULATION

Since the active railroad in Gallatin County no longer serves passengers, the potential for high casualties from the impact of a railroad accident is low. The potential certainly exists, however, for casualties to railroad workers and those in the general vicinity, especially since the trains pass through the center of three towns. The potential for large population impacts is considered low, however, particularly when considering the historical record of only 9 injuries over the past 38 years and 49 accidents.

4.13.6.3 ECONOMY

Economic losses due to a train derailment are possible, though likely limited.

4.13.6.4 FUTURE DEVELOPMENT

Future development should have little impact on railroad accident hazard. Most development is occurring away from the railroad's immediate impact area, but few restrictions exist to prevent such development.

4.13.7 DATA LIMITATIONS

The data on the railroad hazard in Gallatin County is based on Federal Railroad Administration records. This data is sufficient in calculating the occurrence 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 railroads, numbers/types of materials transported, and areas with the greatest potential for derailment would enhance this profile. Such information would not necessarily be included in a public plan.

4.13.8 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	Moderate	Low	Low	Low	Low
Belgrade	Moderate	Low	Moderate	Low	Moderate
Big Sky	N/A	N/A	N/A	N/A	N/A
Bozeman	Moderate	Low	Low	Low	Moderate
Manhattan	Moderate	Low	Low	Low	Moderate
Three Forks	Moderate	Low	Low	Low	Moderate
West Yellowstone	N/A	N/A	N/A	N/A	N/A

4.14 SEVERE WEATHER

4.14.1 DESCRIPTION

Thunderstorms in Montana develop when moisture in the air rises, often from daytime ground heating, an unstable atmospheric condition, synoptic front, or by terrain uplift, 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. These strong updrafts and downdrafts can produce hail, strong straight-line winds, and even tornadoes.

Hail is produced when a super cooled 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. Gallatin County regularly has small, pea-sized hail, but larger stones to the size of quarters or larger are possible.

Strong straight-line winds, sometimes stronger than tornadoes at over 100 mph, occur when air is carried into a storm 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, 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.

Tornadoes form when the right amount of shear is present in the atmosphere and causes the updraft and downdraft 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. Although rare, they can and do occur in south central Montana.

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" or larger, and/or tornadoes. Although not considered severe by definition, lightning and heavy rain can also accompany thunderstorms. The severe conditions are often the events that can directly cause widespread damage. Strong winds, hail, and tornadoes have capability to damage structures, infrastructure, crops, livestock, and vehicles.

Figure 4-7. 2008 Summer Hail Storm at Montana State University [Photo courtesy of Patrick Lonergan]

4.14.2 HISTORY

Hail and strong winds frequently occur in thunderstorms in Gallatin County as documented in **Table 4-15** [National Climatic Data Center, 2017]

Table 4-135. Severe Weather Events in Gallatin County since 2000 (NWCC 2017)

Location or County	Date	Time	Type	Magnitude	Deaths	Injuries	Prop. Damage	Crop Damage
MTZ055	1/4/2010	20:00	Winter Storm	N/A	0	0	0K	0K
MTZ055	1/22/2010	8:00	Winter Storm	N/A	0	0	0K	0K
MTZ055	3/18/2010	18:00	Heavy Snow	N/A	0	0	0K	0K
MTZ055	3/30/2010	17:00	Winter Storm	N/A	0	0	0K	0K
MTZ055	4/6/2010	12:00	Winter Storm	N/A	0	0	0K	0K
MTZ055	4/8/2010	13:35	High Wind	55 kts.	0	0	0K	0K
MTZ055	4/28/2010	6:00	Winter Storm	N/A	0	0	0K	0K
MTZ055	5/3/2010	13:15	High Wind	51 kts.	0	0	0K	0K
MTZ008	5/5/2010	14:00	Winter Storm	N/A	0	0	0K	0K
Bozeman	6/30/2010	13:41	Hail	1.00	0	0	0K	0K
Bozeman	6/30/2010	13:47	Hail	1.75	0	0	0K	0K
Belgrade	6/30/2010	14:12	Hail	2.75	0	0	0K	0K
Bozeman	6/30/2010	15:00	Hail	1.50	0	0	0K	0K
Bozeman	6/30/2010	15:00	Hail	2.00	0	0	0K	0K
Gallatin Gateway	6/30/2010	15:00	Hail	1.25	0	0	0K	0K
Bozeman	6/30/2010	15:03	Hail	1.00	0	0	60.0 M	0K
Bozeman	6/30/2010	15:05	Hail	1.75	0	0	0K	0K
Three Forks	7/27/2010	15:05	Hail	1.00	0	0	0K	0K
Gallatin Gateway	7/31/2010	17:00	Hail	1.50	0	0	0K	0K
Bozeman	8/1/2010	16:35	T-storm	52 kts.	0	0	0K	0K
MTZ055	10/26/2010	13:07	Winter Storm	N/A	0	0	0K	0K
MTZ055	11/18/2010	6:15	High Wind	52 kts.	0	0	0K	0K
MTZ055	11/18/2010	8:35	High Wind	51 kts.	0	0	0K	0K
MTZ055	11/18/2010	9:35	High Wind	55 kts.	0	0	0K	0K
MTZ015 - 055	11/18/2010	12:00	Winter Storm	N/A	0	0	0K	0K
MTZ055	11/18/2010	21:24	Winter Storm	N/A	0	0	0K	0K
MTZ008	11/22/2010	6:00	Winter Storm	N/A	0	0	0K	0K
MTZ008-015- 055	11/23/2010	6:59	Blizzard	N/A	0	0	0K	0K
MTZ009	2/6/2011	19:00	Winter Storm	N/A	0	0	0K	0K
MTZ009-048- 055	2/16/2011	4:00	Winter Storm	N/A	0	0	0K	0K
MTZ009 - 055	2/22/2011	3:00	Winter Storm	N/A	0	0	0K	0K
MTZ055	3/10/2011	16:04	High Wind	65 kts.	0	0	0K	0K
MTZ011	3/21/2011	8:00	Winter Storm	N/A	0	0	0K	0K
MTZ051 - 055	4/18/2011	17:00	Winter Storm	N/A	0	0	0K	0K

Location or County	Date	Time	Type	Magnitude	Deaths	Injuries	Prop. Damage	Crop Damage
MTZ009	4/29/2011	4:00	Winter Storm	N/A	0	0	0K	0K
MTZ008-05 - 055	5/9/2011	3:00	Winter Storm	N/A	0	0	0K	0K
MTZ055	5/14/2011	19:36	High Wind	54 kts.	0	0	0K	0K
MTZ008	5/29/2011	3:24	Winter Storm	N/A	0	0	0K	0K
Logan	6/6/2011	15:55	Hail	1.50	0	0	0K	0K
Bozeman	6/12/2011	19:05	Hail	1.00	0	0	0K	0K
Big Sky	6/23/2011	16:04	T-storm	51 kts.	0	0	0K	0K
Bozeman	7/25/2011	17:35	T-storm	50 kts.	0	0	0K	0K
Gallatin	11/12/2011	3:57	Winter Storm	N/A	0	0	0K	0K
Gallatin	11/17/2011	12:00	Winter Storm	N/A	0	0	0K	0K
Gallatin	12/20/2011	20:00	Winter Storm	N/A	0	0	0K	0K
Gallatin	12/28/2011	10:30	High Wind	52 kts.	0	0	0K	0K
Gallatin	01/18/2012	01:07	High Wind	55 kts.	0	0	0K	0K
Gallatin	01/25/2012	02:15	High Wind	52 kts.	0	0	0K	0K
Gallatin	03/06/2012	05:00	Winter Storm	N/A	0	0	0K	0K
Gallatin	03/13/2012	11:15	High Wind	54 kts.	0	0	0K	0K
Gallatin	03/19/2012	05:00	Winter Storm	N/A	0	0	0K	0K
Gallatin	03/30/2012	11:35	High Wind	51 kts.	0	0	0K	0K
Gallatin	04/05/2012	05:00	Winter Storm	N/A	0	0	0K	0K
Bozeman	04/23/2012	15:20	T-storm	57 kts.	0	0	0K	0K
Gallatin	04/26/2012	19:00	Winter Storm	N/A	0	0	0K	0K
Gallatin	06/09/2012	12:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	06/26/2012	10:00	High Wind	60 kts.	0	0	0K	0K
Bozeman	07/10/2012	17:50	T-storm	51 kts.	0	0	0K	0K
Chestnut	09/01/2012	16:12	T-storm	52 kts.	0	0	0K	0K
Gallatin	10/16/2012	14:45	High Wind	54 kts.	0	0	0K	0K
Gallatin	11/08/2012	02:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	11/30/2012	00:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	12/01/2012	00:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	12/02/2012	08:00	High Wind	51 kts.	0	0	0K	0K
Gallatin	12/09/2012	23:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	01/09/2013	04:35	High Wind	52 kts.	0	0	0K	0K
Gallatin	01/10/2013	07:30	Heavy Snow	N/A	0	0	0K	0K
Gallatin	01/28/2013	06:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	01/31/2013	05:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	02/09/2013	18:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	02/17/2013	02:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	02/22/2013	15:00	Heavy Snow	N/A	0	0	0K	0K

Location or County	Date	Time	Type	Magnitude	Deaths	Injuries	Prop. Damage	Crop Damage
Gallatin	03/07/2013	09:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	03/17/2013	04:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	03/20/2013	08:00	High Wind	51 kts.	0	0	0K	0K
Gallatin	06/19/2013	18:27	High Wind	52 kts.	0	0	0K	0K
Big Sky	07/17/2013	18:15	T-storm	60 kts.	0	0	0K	0K
Amsterdam	08/01/2013	17:04	T-storm	68 kts.	0	0	0K	0K
Manhattan	08/01/2013	17:07	T-storm	77 kts.	0	0	0K	0K
Bozeman	08/01/2013	17:10	T-storm	53 kts.	0	0	0K	0K
Manhattan	08/01/2013	17:14	Hail	1.5 in.	0	0	0K	0K
Belgrade	08/01/2013	17:15	Hail	1.75 in.	0	0	0K	0K
Bozeman	08/01/2013	17:37	Hail	1.5 in.	0	0	0K	0K
Bozeman	08/23/2013	15:50	T-storm	50 kts.	0	0	0K	0K
Bozeman	09/16/2013	13:28	T-storm	50 kts.	0	0	0K	0K
Chestnut	09/24/2013	19:25	T-storm	51 kts.	0	0	0K	0K
Gallatin	09/30/2013	11:50	High Wind	52 kts.	0	0	0K	0K
Gallatin	10/03/2013	00:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	11/02/2013	19:30	Heavy Snow	N/A	0	0	0K	0K
Gallatin	11/04/2013	01:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	11/07/213	22:40	High Wind	50 kts.	0	0	0K	0K
Gallatin	11/16/2013	00:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	11/20/2013	04:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	12/02/2013	07:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	12/18/2013	13:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	12/23/2013	22:25	High Wind	59 kts.	0	0	0K	0K
Gallatin	01/03/2014	09:55	High Wind	52 kts.	0	0	0K	0K
Gallatin	01/11/2014	12:55	High Wind	54 kts.	0	0	0K	0K
Gallatin	01/29/2014	06:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	02/12/2014	11:15	High Wind	53 kts.	0	0	0K	0K
Gallatin	02/17/2014	13:48	High Wind	51 kts.	0	0	0K	0K
Gallatin	02/27/2014	18:30	Heavy Snow	N/A	0	0	0K	0K
Gallatin	03/10/2014	14:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	03/17/2014	05:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	03/29/2014	22:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	04/18/201	17:12	High Wind	50 kts.	0	0	0K	0K
Gallatin	04/22/2014	19:40	Heavy Snow	N/A	0	0	0K	0K
Gallatin	04/27/2014	21:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	10/15/2014	17:30	High Wind	51 kts.	0	0	0K	0K
Gallatin	11/09/2014	14:36	High Wind	50 kts.	0	0	0K	0K

Location or County	Date	Time	Type	Magnitude	Deaths	Injuries	Prop. Damage	Crop Damage
Gallatin	11/13/2014	20:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	11/24/2014	16:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	11/29/2014	10:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	12/13/2014	09:00	Heavy Snow	N/A	0	0	0K	0K
Gallatin	03/28/2015	10:54	High Wind	59 kts.	0	0	0K	0K
Church Hill	06/01/2015	15:06	Hail	1 in.	0	0	0K	0K
Gallatin	10/11/2015	10:56	High Wind	56 kts.	0	0	0K	0K
Gallatin	11/02/2015	17:00	Winter Storm	N/A	0	0	0K	0K
Gallatin	11/15/2015	03:41	High Wind	59 kts.	0	0	0K	0K
Gallatin	11/24/2015	11:0	Winter Storm	N/A	0	0	0K	0K
Gallatin	12/09/2015	14:45	High Wind	61 kts.	0	0	0K	0K
Gallatin	12/13/2015	14:00	Winter Storm	N/A	0	0	0K	0K
Gallatin	02/06/2016	09:15	High Wind	65 kts.	0	0	0K	0K
Gallatin	02/15/2016	06:00	High Wind	65 kts.	0	0	0K	0K
Gallatin	02/18/2016	12:42	High Wind	54 kts.	0	0	0K	0K
Bozeman	04/04/2016	18:21	T-storm	56 kts.	0	0	0K	0K
Gallatin	05/09/2016	13:20	Winter Storm	N/A	0	0	0K	0K
Gallatin	10/11/2016	04:30	Winter Storm	N/A	1	0	0K	0K
Gallatin	11/16/2016	16:30	Winter Storm	N/A	0	0	0K	0K
Gallatin	12/16/2016	13:43	Winter Storm	N/A	0	0	0K	0K
Gallatin	12/17/2016	05:00	Extreme Cold	N/A	0	0	0K	0K
Gallatin	12/18/2016	03:00	High Wind	63 kts.	0	0	0K	0K
Gallatin	12/26/2016	14:00	High Wind	50 kts.	0	0	0K	0K
Gallatin	01/31/2017	07:00	Winter Storm	N/A	0	0	0K	0K
Manhattan	04/25/2017	12:38	Funnel Cloud	N/A	0	0	0K	0K
Logan	04/25/2017	15:48	Funnel Cloud	N/A	0	0	0K	0K
Gallatin	05/17/2017	19:00	Winter Storm	N/A	0	0	0K	0K
Gallatin	05/24/2017	14:35	High Wind	50 kts.	0	0	0K	0K
Bozeman	07/05/2017	15:56	T-storm	50 kts.	0	0	0K	0K
Matthews	07/05/2017	16:11	T-storm	52 kts.	0	0	0K	0K
Amsterdam	07/05/2017	16:11	T-storm	56 kts.	0	0	0K	0K

Despite a lack of significant tornadoes in Gallatin County's weather records, in nearby Yellowstone National Park just to the south, an F4 tornado (207-260 mph) formed on July 21, 1987. The Teton-Yellowstone Tornado, as it was named, was 1.5 miles (2.5 km) wide and traveled for 24 miles (39.2 km). The tornado crossed the Continental Divide at an elevation of 10,072 feet (3.070 m). Tornadoes like the Teton-Yellowstone Tornado are rare but possible in places like Gallatin County, Montana. More likely in Gallatin County are smaller, shorter lived, yet damaging tornadoes.

4.14.3 PROBABILITY

The history of hail and strong thunderstorm winds in Gallatin County shows that both are fairly frequent. The data presented in the history is based on reports received by the National Weather Service in Great Falls, MT. Often, unless the event is noticed by a trained spotter or emergency official, the event will go unreported. Therefore, many events may not have been reported or noted by observers and the statistics represent only those events that have been documented.

4.14.4 MAPPING

Severe thunderstorms can occur anywhere in Gallatin County. Due to the sporadic population centers in Gallatin County, mapping the locations of historical events would show where events have been spotted and reported from, but would not necessarily depict the hazard level from severe thunderstorms. Infrequently traveled areas may have a larger concentration of severe thunderstorm events, but because of the low population, events have gone unreported. Therefore, the risk is assumed to be the same countywide.

4.14.5 ASSOCIATED HAZARDS AND OTHER FACTORS

Severe thunderstorms and tornadoes can be associated with other hazards. Lightning can spark wildfire or urban fires, especially when coupled with strong winds, and heavy rains can cause flash flooding. These hazards can also contribute to ground or aircraft accidents if they interfere with travel. Fortunately, most pilots are trained to recognize hazardous weather conditions such as severe thunderstorms. Particularly severe thunderstorms can also lead to widespread power and communications failures.

4.14.6 VULNERABILITY

4.14.6.1 PROPERTY

All critical facilities and vulnerable populations are considered to have the same vulnerability to severe thunderstorms, unless specific reinforcements have been made to protect them from strong winds. Infrastructure, namely power lines, are primarily vulnerable to high winds and falling trees. Power systems are the most likely infrastructure to fail during a severe thunderstorm. Communications towers may also topple under strong winds or large hail. Infrastructure at a reduced risk from severe thunderstorms and tornadoes include those utilities located underground or within reinforced 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 significantly affect only a small area. If that area, however, was in a developed part of the county, 10-20 homes could be damaged. Vehicles damaged by hail or falling debris would be additional losses. Potential losses could also include losses to agriculture. Livestock and crops can be significantly damaged by large hail and strong winds, and therefore, result in diminished profits.

4.14.6.2 POPULATION

The National Weather Service in Great Falls, MT warns for severe thunderstorms and tornadoes when recognized on Doppler radar or by other means. The warnings are broadcast over NOAA weather radio and may be transmitted over television scrolls and cable networks such as the Weather Channel. Some events have 15-20 minutes warning time and others have little to no warning. Depending on the

effectiveness of the warning reaching the population, those at greatest risk may or may not receive the warning and take precautionary measures. A NOAA weather radio transmitter is located in Bozeman, and those with specially built receivers can be alerted to weather hazards rapidly. The numerous campgrounds in the National Forests become particularly vulnerable populations if the warnings are not received. Depending on the significance of the storm, much of the population can be at risk if they do not take appropriate action.

4.14.6.3 ECONOMY

Severe thunderstorms and tornadoes can damage businesses and cause temporary closures. Often the largest losses are seen in the agriculture industry, when weather events damage crops or livestock.

4.14.6.4 FUTURE DEVELOPMENT

Future development will likely have little effect on the 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.

4.14.7 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 Gallatin County would need to be conducted to further develop this hazard profile. Historic lightning data may also pinpoint the areas that receive the most thunderstorms.

4.14.8 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	Moderate	Moderate	Moderate	Moderate	High
Belgrade	High	Moderate	High	Moderate	High
Big Sky	Moderate	Low	Moderate	Low	Moderate
Bozeman	High	Moderate	High	Moderate	High
Manhattan	High	Moderate	Moderate	Moderate	High
Three Forks	High	Moderate	Moderate	Moderate	High
West Yellowstone	High	Moderate	High	Moderate	High

4.15 TERRORISM

4.15.1 DESCRIPTION

(Get update from MATIC?) Terrorism is a human-caused hazard that is intentional and 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 subtle using nontraditional methods. The primary recognized forms of terrorism are chemical, explosive, biological, radiological, and cyber.

Chemical terrorism is the use of chemical agents to poison, kill, or incapacitate the population. 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 with the central nervous system and cognitive abilities and include the agent BZ.

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 to any suspicious package. 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 to infect the population or animals with disease. The agents/diseases that the Centers for Disease Control and Prevention consider the highest priority due to their threat to the population and national security include anthrax, botulism, plague, smallpox, tularemia, and viral hemorrhagic fevers. Bioterrorism could also be used against livestock population and agricultural plants. The following are select animal diseases identified by the USDA as a severe threat to livestock and human health: Avian Influenza, Exotic Newcastle Disease, Nipah, Hendra, Eastern Equine Encephalitis, Venezuelan Equine Encephalomyelitis, Foot and Mouth Disease, Rift Valley Fever, Rinderpest, African Swine Fever, and Classical Swine Fever. Those plant diseases identified by the USDA as a severe threat to plants are: Soybean Rust, Southern Bacteria Wilt, Plum Pox, Downy Mildew of Corn, Brown Stripe Downey Mildew of Maize, Potato Wart, Bacterial Leaf Streak of Rice, Citrus Greening, and Pierce's Disease.

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. As with chemical and biological events, radiological incidents present contamination challenges for first responders.

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

Montana has traditionally attracted activist/extremist individuals and groups because of its low population and large geographic area. Groups active in Montana vary from white supremacists to single issue groups, such as environmental extremists. These groups are attracted to the state and many of them view Montana as their "home", or safe-haven. Because of these views, they commit their illegal activities outside of the state. An example of this would be the Unabomber, Ted Kaczynski. Kaczynski advocated the destruction of technology and the protection of the environment. The Unabomber was responsible for sixteen bombings and three deaths around the United States.

Another example, The World Church of the Creator, which is a white supremacist group with a national following, advocates a "Racial Holy War" against minorities. This group has their national meeting in Superior, Montana once a year. Members of this group have been responsible for numerous homicides in the United States.

Groups such as the Phineas Priesthood of Spokane, WA have used western Montana as a place to hide. The anti-government group, the Freemen, conducted an 81-day standoff with law enforcement in eastern Montana. At the conclusion it was determined they were a "refuge" for individuals around the country involved in criminal anti-government activity. Several of these individuals had spoken about military type action against the current government. Many other organizations besides these that have the potential to use violence exist in parts of Montana and across the country.

Recently, the National Alliance, the largest neo-Nazi organization in the United States, has conducted leafleting campaigns in Southwest Montana and is trying to establish a presence in our communities. This organization has been tied to violent acts throughout the country.

Eco-terrorism is a growing domestic terrorism concern that has been noted in the western United States. The FBI defines eco-terrorism as the use or threatened use of violence of a criminal nature against innocent victims or property by an environmentally-oriented, sub national group for environmental-political reasons, or aimed 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. Many of these attacks have occurred in nearby states such as Washington, Oregon, Utah, Idaho, and Colorado51. One of the goals of these organizations is to preserve undeveloped lands. With the natural resources that exist in Gallatin County and the potential for future development, this type of terrorism is considered the most likely in Gallatin County.

4.15.2 HISTORY

Fortunately, Gallatin County has not been the target of any major terrorist attacks. Some small local level events have required a minimal local government response.

4.15.3 PROBABILITY

With very little experience and data locally on this hazard, a specific probability for future terrorism is hard to determine. Based on the historical record and the terrorism threat present for the area, the probability of a large-scale terrorism event is considered low.

4.15.4 MAPPING

The City of Bozeman is the most populous part of Gallatin County. This area, with close proximity to hazardous material facilities and government buildings, could be considered the area at greatest risk for terrorism. Domestic and international terrorism can be hard to predict, and therefore, specific targets are not easily identified.

National parks are also considered potential terrorist targets, and therefore, Yellowstone National Park to the south puts Gallatin County communities, particularly West Yellowstone, in close proximity to this potential hazard area.

4.15.5 ASSOCIATED HAZARDS AND OTHER FACTORS

Any hazard that can be "created" can be the result of terrorism. For example, dam failure can be the result of a terrorist act of compromising the dam. Other examples include communicable disease, aviation, ground, and railroad accidents, hazardous materials release, utility failure, wildfire, and urban fire. All of these hazards could be the result of a terrorist act if intentionally triggered.

4.15.6 VULNERABILITY

4.15.6.1 PROPERTY

Critical facilities in Gallatin County are considered to be at greatest risk from terrorism. Often, terrorists target facilities that are highly important for government services and community stability or are particularly vulnerable. Threat data is not specific enough to identify what facilities are most vulnerable, and therefore, all critical facilities are considered to have the same risk countywide. Those facilities with barriers, security, and other forms of protection are at lower risk. Most facilities in Gallatin County, however, do not have those protections.

Residential structure losses are possible from terrorism, civil unrest, and violence 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. Urban areas, places of public gathering, and important government or economic assets are generally going to be the areas of greatest risk. Should an event occur, the losses would likely be moderate.

4.15.6.2 POPULATION

The effects of terrorism, civil unrest, and violence are usually felt by the population. The greatest risk is to human lives during times of unrest. Terrorists typically try to make a dramatic impact that will generate media interest. Attacking the population through a large loss of life is a common tactic. Therefore, the greatest vulnerability from terrorism is to human life and the economy.

4.15.6.3 ECONOMY

Economic losses will vary dramatically depending upon the incident. Small, isolated incidents are unlikely to have a major impact on the local economy. Large, nationally-publicized incidents have the potential to deter tourism.

4.15.6.4 FUTURE DEVELOPMENT

Development should have little to no impact on the terrorism, civil unrest, and violence threat. The exception would be the increase in population and the associated increase of potential losses to life and property within the county. With larger communities around, however, development should have little effect in this regard. Given the goals of eco-terrorists, however, future development could serve as the basis for an event over controversial development.

4.15.7 DATA LIMITATIONS

Since terrorism, civil unrest, and violence are such isolated events and little history exists in Gallatin County, the probability and potential losses are difficult to quantify. Therefore, generalities have been made to estimate where potential losses could be. Site specific surveys would allow for an analysis of weaknesses of critical facilities, infrastructure, and vulnerable populations to terrorism, civil unrest, and violent incidents.

4.15.8 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	Low	Low	Moderate	Moderate	Low
Belgrade	Low	Low	Low	Low	Low
Big Sky	Low	Low	Low	Moderate	Low
Bozeman	Low	Low	Moderate	Moderate	Low
Manhattan	Low	Low	Moderate	Low	Low
Three Forks	Low	Low	Moderate	Low	Low
West Yellowstone	Moderate	Moderate	Moderate	High	Moderate

4.16 URBAN CONFLAGRATION

4.16.1 DESCRIPTION

update

4.16.2 HISTORY

update

4.16.3 PROBABILITY AND MAGNITUDE

update

4.16.4 MAPPING

update

4.16.5 VULNERABILITY

4.16.5.1 PROPERTY

update

4.16.5.2 POPULATION

update

4.16.5.3 ECONOMY

update

4.16.5.4 FUTURE DEVELOPMENT

update

4.16.6 DATA LIMITATIONS

update

4.16.7 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	Moderate	Moderate	Moderate	Moderate	Moderate
Belgrade	Low	Low	Low	Moderate	Low
Big Sky	Moderate	Moderate	Moderate	Moderate	Moderate
Bozeman	Moderate	Moderate	Moderate	Moderate	Moderate
Manhattan	Moderate	Moderate	Low	Low	Moderate
Three Forks	Moderate	Moderate	Low	Low	Moderate
West Yellowstone	Moderate	Moderate	Moderate	Moderate	Moderate

4.17 VIOLENCE

4.17.1 DESCRIPTION

(Get update from MATIC?)

4.17.2 HISTORY

update

4.17.3 PROBABILITY

update

4.17.4 MAPPING

update

4.17.5 ASSOCIATED HAZARDS AND OTHER FACTORS

update

4.17.6 VULNERABILITY

4.17.6.1 PROPERTY

update

4.17.6.2 POPULATION

update

4.17.6.3 ECONOMY

update

4.17.6.4 FUTURE DEVELOPMENT

update

4.17.7 DATA LIMITATIONS

update

4.17.8 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	Moderate	Low	Low	Low	Low
Belgrade	Moderate	Low	Low	Low	Low
Big Sky	Moderate	Low	Low	Low	Low
Bozeman	Moderate	Low	Low	Low	Low
Manhattan	Moderate	Low	Moderate	Low	Moderate
Three Forks	Moderate	Low	Moderate	Low	Moderate
West Yellowstone	Moderate	Low	Low	Moderate	Moderate

4.18 VOLCANO

4.18.1 DESCRIPTION

Active volcanoes are not known to be present in Gallatin County, but past eruptions have affected the county and possibility of an eruption in nearby Yellowstone National Park is always present. The active volcanic areas in the Cascade Range such as Mount St. Helens, Mount Rainer, and Mount Hood are to the west of Gallatin County and are within the reasonable range of ash fall with the usual upper atmospheric wind patterns. Theoretically, these volcanoes could deposit ash several inches thick over Gallatin County and any large eruption could change the weather patterns experienced 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 U.S. Geological Survey, the University of Utah, and Yellowstone National Park formed the Yellowstone Volcano Observatory, which continuously monitors activity in the region.53

If a large caldera-forming eruption were to occur at Yellowstone, its effects would be worldwide. Thick ash deposits would bury vast areas of the United States, and 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. An eruption of lava could cause widespread havoc in the Park, including fires and the loss of roads and facilities, but more distant areas such as Bozeman would probably remain largely unaffected {US Geological Survey. Fact Sheet 2005-3024, Steam Explosions, Earthquakes, and Volcanic Eruptions – What's in Yellowstone's Future?, 2005]

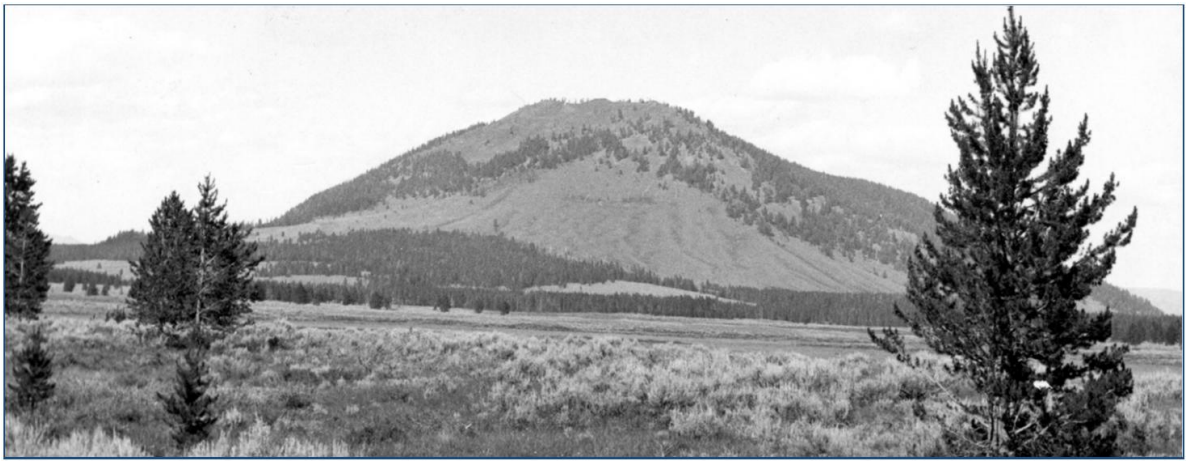


Figure 4-10. Bunsen Peak, Yellowstone Volcano Remnant.

4.18.2 HISTORY

In May 1980, the eruption of Mount St. Helens sent ash high into the atmosphere. Approximately a half an inch of ash fell across Gallatin County. Historical studies have shown that ash from Glacier Peak 11,200 years ago and Mount Mazama 6,600 years ago also fell in Gallatin County.

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. Fact Sheet 2005-3024, Steam Explosions, Earthquakes, and Volcanic Eruptions – What's in Yellowstone's Future?. 2005]

4.18.3 PROBABILITY

Volcanic eruptions are rare events when considered in comparison to other hazards measured on the 100-year scale. The Montana Hazard/Vulnerability Analysis from 1987 estimates the return period of substantial volcanic ash fallout in Gallatin County to generally once every 5,000-8,000 years.11

Scientists evaluate natural-hazard levels 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, though 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 Gallatin 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. Figure 4.61 shows the probability of the various events that can occur in Yellowstone National Park.

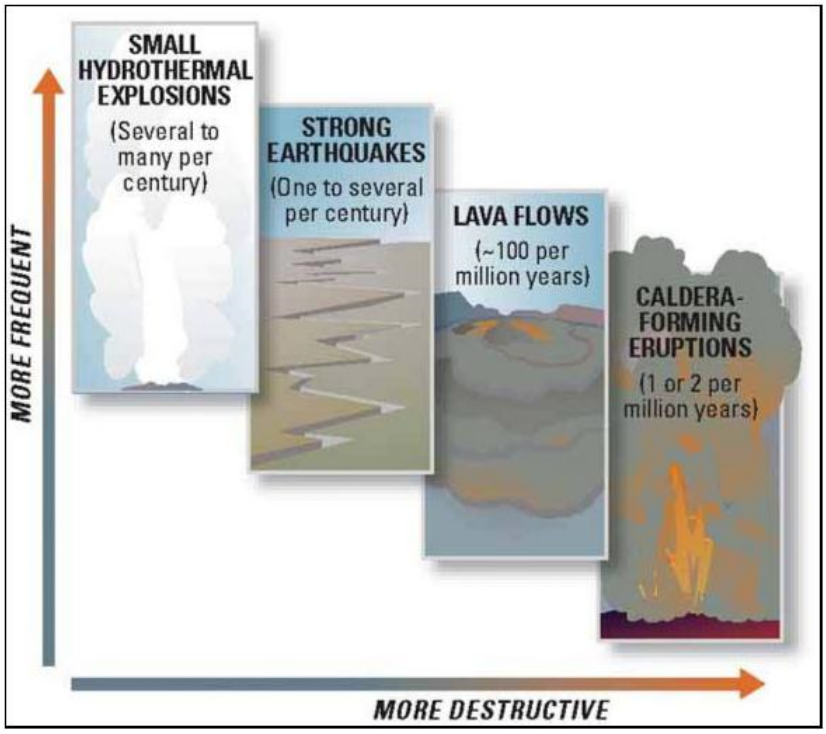


Figure 4-81. USGS Graphic Depicting Recurrence Intervals for Geological Events in Yellowstone National Gallatin

4.18.4 MAPPING

The areas affected by volcanic eruptions are dependent on the type of eruption and the prevailing wind direction. In an actual event, models would be used to predict the areas that would receive ash and other effects from the volcano. Therefore, mapping hazard areas would be broad generalizations and will not be completed here. The county is assumed to have the same risk countywide for a Cascade Range eruption and decreasing risk from south to north for a Yellowstone eruption.

4.18.5 ASSOCIATED HAZARDS AND OTHER FACTORS

Volcanoes, a geological feature, are closely related to earthquake activity. Often eruptions are preceded by earthquake activity as magma moves below the surface. The two events are usually closely linked and monitored. Other factors that become important during a volcanic eruption include wind speed, direction, and rainfall. The wind speed and direction will dictate when and where ash falls. Dry ash is manageable, but when combined with rainfall, the ash becomes glue-like and much more difficult to control.

4.18.6 VULNERABILITY

4.18.6.1 PROPERTY

All critical facilities are at risk from volcanic eruptions. The impact on the facilities will depend on the amount of ash that falls and the ability to remove it. Significant amounts of ash have the potential to clog air systems and shut down facilities. Given enough wet, heavy ash, the potential exists for roofs to fail. Infrastructure exposed to the ash fall, such as power systems, could be brought down by the ash as well. The removal of ash from government facilities and infrastructure could potentially create costs beyond the community's capabilities. Therefore, all critical facilities and vulnerable populations are vulnerable to ash fall.

During Mount St. Helens' 1980 eruption, the greatest costs came from the difficult task of removing volcanic ash. The greatest threat is not necessarily to people or residences but to property such as vehicles and equipment. The volcanic dust is corrosive to metals and without proper removal can certainly cause damages to public and private property. In a Yellowstone eruption, the potential for heavy, wet ash could threaten structures by collapsing roofs. The probability of an event of this magnitude is very low. The economy, particularly the tourist economy, could be severely affected should an eruption occur or be imminent.

4.18.6.2 POPULATION

Light ash fall does not significantly impact the population if those with respiratory sensitivities remain indoors. Ash fall conditions that exist for several days, however, could lead to significant health problems for many in Gallatin County. The extremely rare major Yellowstone eruption could lead to deaths to those close to the Park from pyroclastic flows and extreme amounts of falling ash. The degree of population impacts will greatly vary depending on the type of event.

4.18.6.3 ECONOMY

The tourist economy could be severely impacted should a volcanic eruption occur or become imminent. Ashfall may cause plane transportation services to be delayed or cancelled, further reducing tourism to the area. Significant ashfall cam harm crops and livestock and impact the local agricultural economy.

4.18.6.4 FUTURE DEVELOPMENT

Future development will have little to no effect on the volcano hazard. Any new development will be exposed to the volcano hazards of Gallatin County and increase the population and property values at risk.

4.18.7 DATA LIMITATIONS

Volcanic eruptions that affect Gallatin 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 emergency managers, to better understand this hazard.

4.18.8 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	Low	Moderate	Moderate	Moderate	Low
Belgrade	Low	High	High	Moderate	Low
Big Sky	Low	High	Moderate	High	Moderate
Bozeman	Low	Moderate	Moderate	Moderate	Low
Manhattan	Low	Moderate	Moderate	Moderate	Moderate
Three Forks	Low	Moderate	Moderate	Moderate	Moderate
West Yellowstone	Low	Moderate	Moderate	Moderate	Moderate

4.19 WILDFIRE

4.19.1 DESCRIPTION

Wildland fires are a part of nature in the mountainous, forested areas and arid grasslands of Montana. Gallatin County has both broad areas of National Forests and dry open fields. Forest fires can travel quickly through the crowns of trees or spread along the forest floor. Grass fires are common in non-irrigated fields and open areas scattered with sage brush and native grasses due to the arid climate during almost any season but winter. Both types of wildfires are often aggravated by the exceptionally windy conditions in parts of the county.

A wildland fire can be categorized as either an uncontrolled fire in a forested/heavily vegetated area or in a grass/brush area. Both types of wildfires have the potential to destroy structures and natural resources while producing heavy amounts of smoke. Wildfires can be caused by any flame source but are most often triggered by lightning, human carelessness, arson, or train sparks. Once triggered, the ambient conditions dictate whether the fire will spread. Moist, cool, calm conditions or low fuels will suppress the fire, whereas dry, warm, windy conditions or heavy fuels will contribute to fire spread. The natural environment has evolved to live with fire. New growth occurs in a matter of a few years and some species require fire to grow.

Problems with wildfire occur when combined with the human environment. People and structures near wildfires are threatened unless adequately protected through evacuation or mitigation. Most structures are flammable, and therefore, are threatened when wildfire approaches. In addition, a significant loss of life could occur with residents who do not evacuate, firefighters, and others who are in the wildfire area. Infrastructure such as electric transmission lines, fuel tanks, and radio transmission towers are not often equipped to withstand the heat from a wildfire. Timber resources, animal habitats, and waterways can all be damaged leading to negative economic and environmental impacts. The area where human development meets undeveloped, vegetative lands is called the wildland/urban interface (WUI).

Gallatin County is regularly threatened by wildfires because of the terrain, climate conditions, and fuels present. Gallatin County has a large area of government owned lands, national forests in particular. Parts of the Gallatin National Forest, and Yellowstone National Park are within the Gallatin County borders. The US Bureau of Land Management manages many parcels of land within the county as well.

Fuels in Gallatin County range from dense timber stands in varying terrain to native grasslands. Douglas fir, lodge pole pine, Engelmann spruce, sagebrush, rough fescue, and other grasses make up many of the wildland fuels in the county. Periods of drought, disease, insect infestations, and low fire activity or mitigation may all lead to an increase in hazardous fuels.

4.19.2 HISTORY

(update) Gallatin County has a long history of wildfires from small to large. The extent of damages often depends on the proximity to the human interface, fire spread rates, and the effectiveness of suppression and mitigation measures. The history of wildfires can be difficult to compile because the various firefighting entities involved and a variety of recordkeeping measures over the years. Below are listed several of the critical / severe wildfires.

1988. The Greater Yellowstone Fires of 1988, including some areas extending into Gallatin County, covered 2.3 million acres, employed an estimated 25,000 firefighters, and cost nearly $120 million for fire suppression. One firefighter and one pilot were killed and structure losses were estimated at $3 million, mostly within Yellowstone National Park.

August 2001. Lightning ignited the Fridley Fire on August 19 near Fridley Creek in the Gallatin National Forest. The fire doubled in size on August 22 and displayed "extreme" behavior on August 23, when high winds caused it to double in size again. Montana Executive Order 20-01, issued on August 25, 2001, declared a state of emergency in Gallatin County and other locations across the state and mobilized state resources and the National Guard to fight the wildfires. On August 31, three members of a firefighting helicopter crew were killed on a maintenance flight when a bucket line tangled with a rotor, causing the helicopter to crash three miles south of Emigrant in Park County. The Fridley Fire was contained on September 13, 2001. In all, 26,373 acres burned from this fire and firefighting costs totaled over $11 million with 1,261 personnel, 50 pieces of heavy equipment, and 14 helicopters used. Fortunately, no structures were lost. This was a significant fire for Gallatin County because the City of Bozeman Water Shed, the drinking water supply, was threatened.

4.19.3 PROBABILITY

The probability of wildland fires to occur in Gallatin County is considered to be high. As Gallatin County continues to grow and more and more of the population begins to recreate in our national forests, the potential for fire starts increases. Combine this with the normal natural causes of fire such as lightning, and Gallatin County can expect to see significant fires in the future.

4.19.4 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 produced by a wildfire can cause unhealthy air conditions that may affect 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 ground transportation or aircraft accidents. Besides air pollution, water pollution may also occur during and after a wildfire. Many watersheds in wildland areas serve as the public water supplies for area communities. Should a significant wildfire pass through the area, pollution of the watershed can occur. 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.

4.19.5 VULNERABILITY

4.19.5.1 PROPERTY

Critical facilities set in wildland areas can be particularly problematic during fires. Fortunately, none of the critical facilities identified for Gallatin County interface with the wildlands. Electric and communications infrastructure, however, including the major regional electric transmission lines and public safety communications sites, can be found in forested, wildland areas. This infrastructure is highly vulnerable to wildland fire without mitigation.

Wildfires have the greatest potential to substantially burn National Forests and National Park acreage, however, private residences become threatened when the fire enters the wildland/urban interface. Gallatin County has many wildland/urban interface areas that may be threatened should a wildfire encroach. The Community Wildfire Protection Plan, currently being written, will have an accurate assessment of the hazard areas and potential losses from this hazard.

A wildfire damage factor is rather difficult to determine because any actual losses will be highly dependent on the fire characteristics and its location. Not all areas will be affected by one wildfire. Losses in the area of the WUI fire, however, could have a high loss rate.

Although the primary concern is to structures and the interface residents, most of the costs associated with fires, come from firefighting efforts in suppression costs. Additional losses to natural resources, water supplies, air quality, and the economy are also typically found. As past events have shown, infrastructure such as power transmission lines can be threatened. Wildfires can also have a significant impact on the regional economy with the loss of timber, natural resources, recreational opportunities, and tourism, all of which are of particular importance in Gallatin County.

4.19.5.2 POPULATION

Using the estimate of 79 structures affected in a major wildfire from the Potential Losses section, roughly 150 people would live in the affected area (79 structures x 1.9 people/structure). In many cases, residents can be evacuated before the fire moves into their area. Some residents, however, may choose to remain in the evacuated area, or a rapidly spreading fire may not allow enough time for a formal evacuation. Firefighters can be particularly threatened during wildfires. Advances in firefighter safety and technology have improved firefighting efforts, however, the potential for loss of life and injuries still exists. For these reasons, the impact on the population can be considered moderate.

4.19.5.3 ECONOMY

Wildfire suppression and control can be extremely costly, depending on the nature of the fire. Additionally, fires can depress tourism, which is a significant economic driver in Gallatin County.

4.19.5.4 FUTURE DEVELOPMENT

The wildland/urban interface is a very popular place to live as national trends show. More and more homes are being placed in this interface, particularly in Montana, and Gallatin County is no exception. Development in the hazard areas has increased in recent years and has amplified the vulnerabilities in the unincorporated parts of Gallatin County significantly. Regulating growth in these areas is a delicate balance between protecting private property rights and promoting public safety. The county growth policy recognizes the wildfire threat and emphasizes defensible space, inspection of new development,

water supplies, fuels mapping, and Firewise type programs. These recommendations may be incorporated into the Gallatin County Subdivision Regulations in the future. The Gallatin County Fire Council is currently working toward revised fire regulations.

4.19.6 DATA LIMITATIONS

The wildland/urban interface can be defined in many ways to include areas of flammable grasses or steep slopes. For the purposes of this analysis, areas with the potential for crown fires defined the interface. A more detailed study, using field analysis techniques, would allow for better WUI and potential loss estimates. Fuels mapping would further define the areas at greatest risk. A comprehensive, countywide wildland fire digital historical database encompassing all firefighting agencies that includes data on start location, cause, area burned, suppression costs, and damages would prove highly beneficial in advancing the assessment of this hazard. Gallatin County is currently writing a Community Wildfire Protection Plan that will better outline the wildfire hazard.

4.19.7 OVERALL HAZARD PROFILE

Jurisdiction	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Overall Risk
Gallatin County	High	Moderate	Moderate	Moderate	High
Belgrade	High	Moderate	Moderate	Moderate	High
Big Sky	High	High	High	High	High
Bozeman	High	Moderate	Moderate	Moderate	High
Manhattan	High	Moderate	Moderate	Moderate	High
Three Forks	High	Moderate	Moderate	Moderate	High
West Yellowstone	High	High	High	High	High

4.20 RISK ASSESSMENT SUMMARY

This risk assessment represents an approximate history and estimated vulnerabilities to the communities from the hazards identified. As with any assessment involving natural or man-made 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 have different probabilities and magnitudes even within hazards. For example, a small earthquake will be different than a large earthquake and a moderate flood will be different from both of those. In an attempt to rate hazards and prioritize mitigation activities, a summary of the impacts from an event is presented in Table 4-1413. For more information on these determinations, see the individual hazard profiles.

Table 4-146. Gallatin County Hazard Summary

Hazard	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Relative Overall Risk
Wildfire	High	Moderate	Moderate	Moderate	High
Drought	High	Moderate	Moderate	Moderate	High
Earthquake	Moderate	Moderate	High	Moderate	High
Critical Infrastructure Disruption	Moderate	Moderate	High	Moderate	High
Severe Weather	Moderate	Moderate	Moderate	Moderate	High
Environmental Hazards	Moderate	Moderate	Moderate	Moderate	Moderate
Flooding	Moderate	Moderate	Moderate	Moderate	Moderate
Communicable Disease and Bioterrorism	Moderate	Low	Moderate	Moderate	Moderate
Hazardous Materials Release	Moderate	Low	Moderate	Moderate	Moderate
Ground Transportation Accident	High	Low	Low	Low	Moderate
Urban Conflagration	Moderate	Moderate	Moderate	Moderate	Moderate
Avalanche and Landslide	Moderate	Low	Low	Low	Moderate
Civil Unrest	Moderate	Low	Moderate	Moderate	Moderate
Dam Failure	Low	Moderate	Moderate	Moderate	Low
Terrorism	Low	Low	Moderate	Moderate	Moderate
Aviation Accident	Moderate	Low	Low	Low	Low
Violence	Moderate	Low	Low	Low	Low
Volcano	Low	Moderate	Moderate	Moderate	Low
Railroad Accident	Moderate	Low	Low	Low	Low

Table 4-157. Belgrade Hazard Summary

Hazard	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Relative Overall Risk
Drought	High	Moderate	High	Moderate	High
Severe Weather	High	Moderate	High	Moderate	High
Critical Infrastructure Disruption	Moderate	Moderate	High	High	High
Earthquake	Moderate	High	High	High	High
Environmental Hazards	High	Moderate	Moderate	Moderate	High
Wildfire	High	Moderate	Moderate	Moderate	High
Flooding	High	Moderate	Moderate	Moderate	High
Communicable Disease and Bioterrorism	Moderate	Low	High	Moderate	Moderate
Railroad Accident	Moderate	Low	Moderate	Low	Moderate
Hazardous Materials Release	Moderate	Low	Moderate	Moderate	Moderate
Aviation Accident	Moderate	Low	Low	Moderate	Moderate
Ground Transportation Accident	Moderate	Low	Low	Low	Moderate
Community Resilience	Low	Moderate	High	High	Moderate
Violence	Moderate	Low	Low	Low	Low
Dam Failure	Low	Moderate	Moderate	Moderate	Low
Avalanche and Landslide	Moderate	Low	Low	Low	Low
Urban Conflagration	Low	Low	Low	Moderate	Low
Civil Unrest	Low	Low	Moderate	Moderate	Low
Volcano	Low	High	High	Moderate	Low
Terrorism	Low	Low	Low	Low	Low

Table 4-168. Big Sky Hazard Summary

Hazard	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Relative Overall Risk
Wildfire	High	High	High	High	High
Limited Access	High	Moderate	High	High	High
Critical Infrastructure Disruption	Moderate	Moderate	High	Moderate	High
Ground Transportation Accident	High	Low	Moderate	Moderate	High
Mass Casualty Incident	High	Low	Moderate	Moderate	High
Drought	Moderate	Moderate	Moderate	Moderate	Moderate
Earthquake	Moderate	Moderate	Moderate	Moderate	Moderate
Urban Conflagration	Moderate	Moderate	Moderate	Moderate	Moderate
Severe Weather	Moderate	Low	Moderate	Low	Moderate
Hazardous Materials Release	High	Low	Moderate	Moderate	Moderate
Avalanche and Landslide	High	Low	Moderate	Moderate	Moderate

Hazard	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Relative Overall Risk
Communicable Disease and Bioterrorism	Moderate	Low	High	Moderate	Moderate
Environmental Hazards	Moderate	Moderate	Moderate	Moderate	Moderate
Flooding	Moderate	Low	Moderate	Moderate	Moderate
Civil Unrest	Moderate	Low	Moderate	Moderate	Moderate
Volcano	Low	High	Moderate	High	Moderate
Dam Failure	Moderate	Low	Moderate	Moderate	Moderate
Terrorism	Low	Low	Low	Moderate	Low
Aviation Accident	Moderate	Low	Low	Low	Low
Violence	Moderate	Low	Low	Low	Low

Table 4-179. Bozeman Hazard Summary

Hazard	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Relative Overall Risk
Drought	High	Moderate	High	Moderate	High
Severe Weather	High	Moderate	High	Moderate	High
Wildfire	High	Moderate	Moderate	Moderate	High
Critical Infrastructure Disruption	Moderate	Moderate	High	Moderate	High
Environmental Hazards	High	Moderate	High	Moderate	High
Communicable Disease and Bioterrorism	Moderate	Low	High	Moderate	High
Earthquake	Moderate	High	High	High	Moderate
Flooding	High	Moderate	Moderate	Moderate	Moderate
Cyber Security	Moderate	Low	Moderate	Moderate	Moderate
Hazardous Materials Release	Moderate	Low	Moderate	Moderate	Moderate
Ground Transportation Accident	High	Low	Low	Low	Moderate
Urban Conflagration	Moderate	Moderate	Moderate	Moderate	Moderate
Dam Failure	Low	Moderate	Moderate	Moderate	Moderate
Civil Unrest	Moderate	Low	Moderate	Moderate	Moderate
Avalanche and Landslide	High	Low	Low	Low	Moderate
Railroad Accident	Moderate	Low	Low	Low	Moderate
Channel Migration	Moderate	Low	Low	Low	Moderate
Mass Casualty Incident	Moderate	Low	Moderate	Low	Moderate
Volcano	Low	Moderate	Moderate	Moderate	Low
Violence	Moderate	Low	Low	Low	Low
Terrorism	Low	Low	Moderate	Moderate	Low
Aviation Accident	Moderate	Low	Low	Low	Low
Active Killer	Low	Low	Low	Low	Low

Table 4-20. Manhattan and Three Forks Hazard Summary

Hazard	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Relative Overall Risk
Drought	High	Moderate	Moderate	Moderate	High
Severe Weather	High	Moderate	Moderate	Moderate	High
Wildfire	High	Moderate	Moderate	Moderate	High
Flooding	High	Moderate	Moderate	Moderate	Moderate
Environmental Hazards	High	Moderate	Moderate	Moderate	Moderate
Earthquake	Moderate	Moderate	High	Moderate	Moderate
Critical Infrastructure Disruption	Moderate	Moderate	Moderate	Moderate	Moderate
Opioid Addiction	High	Low	Moderate	Low	Moderate
Hazardous Materials Release	Moderate	Moderate	Moderate	Moderate	Moderate
Violence	Moderate	Low	Moderate	Low	Moderate
Mental Health	High	Low	Low	Low	Moderate
Ground Transportation Accident	High	Low	Low	Low	Moderate
Communicable Disease and Bioterrorism	Moderate	Moderate	Moderate	Moderate	Moderate
Aviation Accident	Moderate	Low	Low	Low	Moderate
Urban Conflagration	Moderate	Moderate	Low	Low	Moderate
Active Shooter	Moderate	Low	Low	Low	Moderate
Dam Failure	Low	Moderate	Moderate	Moderate	Moderate
Railroad Accident	Moderate	Low	Low	Low	Moderate
Volcano	Low	Moderate	Moderate	Moderate	Moderate
Avalanche and Landslide	Moderate	Low	Low	Low	Low
Civil Unrest	Moderate	Low	Low	Low	Low
Terrorism	Low	Low	Moderate	Low	Low

Table 4-21. West Yellowstone Hazard Summary

Hazard	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Relative Overall Risk
Wildfire	High	High	High	High	High
Earthquake	High	High	High	High	High
Severe Weather	High	Moderate	High	Moderate	High
Critical Infrastructure Disruption	High	Moderate	High	High	High
Communicable Disease and Bioterrorism	Moderate	Low	High	High	Moderate
Hazard Materials Release	Moderate	Moderate	Moderate	Moderate	Moderate
Ground Transportation Accident	High	Low	Moderate	Moderate	Moderate
Cyber Security	High	Low	Moderate	Moderate	Moderate
Urban Conflagration	Moderate	Moderate	Moderate	Moderate	Moderate

Hazard	Probability of Major Disaster	Property Impact	Population Impact	Economic Impact	Relative Overall Risk
Terrorism	Moderate	Moderate	Moderate	High	Moderate
Drought	Moderate	Low	Moderate	Moderate	Moderate
Civil Unrest	Moderate	Moderate	Moderate	Moderate	Moderate
Environmental Hazards	Moderate	Moderate	Moderate	Moderate	Moderate
Violence	Moderate	Low	Low	Moderate	Moderate
Aviation Accident	Moderate	Low	Low	Low	Moderate
Volcano	Low	Moderate	Moderate	Moderate	Moderate
Avalanche and Landslide	Moderate	Low	Low	Low	Low
Dam Failure	Low	Moderate	Low	Moderate	Low
Flooding	Low	Low	Low	Low	Low

5.0 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. The development of a mitigation strategy allows the community 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 Gallatin County Mitigation Strategy is based on the results of the risk assessment and recommendations by knowledgeable community members through the All Hazards All Discipline Group and public meetings. The overarching mission of this mitigation strategy is to:

Reduce or prevent losses from disasters.

Rather than wait until a disaster occurs, Gallatin County, the City of Bozeman, the City of Belgrade, the City of Three Forks, the Town of West Yellowstone, and the Town Of Manhattan, have developed this strategy to move in a proactive direction in 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 and eventually save taxpayers' money. The mitigation actions were developed based on direct input from the community and prioritized through a multi-step process.

5.1 GOALS, OBJECTIVES, AND PROPOSED ACTIONS

Goal 1: Prevent losses from wildfires.

Objective 1.1: Reduce private losses in the wildland/urban interface.

- Promote Firewise type programs.
- Require defensible space and inspection of new development in the wildland urban interface.
- Revise subdivision regulations with a better focus on defensible space/maintenance and water supply requirements in the wildland/urban interface.
- Reduce fuels along ingress and egress roadways.
- Conduct fuels reduction along utility right-of-ways.

Objective 1.2: Increase understanding of the wildfire hazard areas.

- Develop fuels mapping for public and private lands.
- Develop and maintain a Community Wildfire Protection Plan.
- Develop a centralized, countywide wildfire history database.

Objective 1.3: Assist property owners in completing mitigation measures.

- Conduct individual WUI wildfire assessments.
- Encourage homeowners to reduce fuels around structures and create a fire defensible space.

Goal 2: Reduce potential losses from earthquakes.

Objective 2.1: Prevent earthquake losses to critical facilities, vulnerable populations, and infrastructure.

- Tie down/secure objects in critical facilities and vulnerable population locations that could fall during an earthquake.
- Retrofit critical government facilities for earthquakes.
- Inspect key bridges for seismic stability.
- Anchor or stabilize electric transformers and generators for seismic motion during maintenance and new installations.
- Install expansion joints in underground utilities during new or replacement construction.

Objective 2.2: Minimize private earthquake losses.

- Educate home and business owners on simple earthquake retrofits.
- Survey commercial structures for earthquake stability and recommend retrofits.
- Create a financial incentive program for major earthquake retrofits in the priority hazard areas.

Goal 3: Reduce damages from flooding.

Objective 3.1: Reduce losses to private property from flooding.

- Implement security measures at the dams to include early warning systems.
- Educate the public on flood insurance.
- Mitigate damages to critical infrastructure in the 100 year flood plain.

Objective 3.2: Maximize the protection of life and property through government resources and services.

- Remove woody debris, as needed to protect public safety, but not excessively as such debris is important to ecological health.
- Consider where more restrictive regulations or prohibition of development in the floodplain may be necessary.
- Map floodplain areas and join the National Flood Insurance Program in the City of Belgrade, Town Of Manhattan, City of Three Forks.

Objective 3.3: Provide the public with information and means to prevent private flood losses.

- Establish financial incentives for landowners to remove, modify, or replace obsolete and non-functioning flood control and bank stabilization structures.
- Conduct an analysis on the feasibility of a floodplain and floodway buyout and/or relocation program.
- Educate the public on flood insurance.

Objective 3.4: Improve understanding of the flood hazard and mitigation measures.

- Secure digital flood plain mapping for all substantial rivers and streams in Gallatin County.
- Study alternative flood mitigation measures.

Goal 4: Reduce losses from a transportation or hazardous materials accident.

Objective 4.1: Allow for emergency traffic and evacuation routes during a hazardous materials or ground transportation incident.

- Develop an emergency transportation plan that considers key roadways and intersections.
- Improve mapping of hazardous materials fixed site locations and common transportation routes.

Goal 5: Prevent significant loss of life and illness from communicable disease and bioterrorism

Objective 5.1: Improve ability to quickly identify communicable disease outbreaks or a bioterrorism incident

- Maintain surveillance system to rapidly identify communicable disease incidents and outbreaks
- Develop laboratory network contacts

Objective 5.2: Increase ability to provide communicable disease information during an outbreak or bioterrorism incident

- Maintain system to provide frequent and effective communications to health care providers and other partners during a communicable disease incident or outbreak
- Maintain system to provide adequate public communication during an outbreak or significant disease event

Objective 5.3: Reduce mortality and morbidity related to communicable disease

- Ensure communicable disease investigation and follow-up to contain communicable disease and limit mortality and morbidity
- Revise Chempack plan as needed
- Improve immunization rates for vaccine-preventable diseases

Goal 6: Promote all-hazard mitigation measures.

Objective 6.1: Ensure critical infrastructure is operational during disasters.

- Identify, prioritize, and harden infrastructure from damages during disasters.
- Install or designate back-up systems for critical infrastructure, including emergency communications systems.
- Install an uninterruptible power supplies on all Gallatin County Public Safety Communications Systems.

Objective 6.2: Improve warning capabilities.

- Become a National Weather Service Storm Ready Community in the incorporated cities and towns.
- Develop an Emergency Alert System plan.
- Put NOAA Weather Radios transmitter in the West Yellowstone area and receivers in critical facilities and schools.
- Put Early warning on Hyalite Dam
- Develop evacuation plans for all communities.

Objective 6.3: Increase emergency management and disaster service capabilities to prevent additional losses in a disaster.

- Develop a sheltering plan specific to utility failures.
- Install generators at critical facilities and vulnerable population locations.

Objective 6.4: Improve digital data for assessing all hazards.

- Develop GIS data that can be used with FEMA's HAZUS loss estimated models specifically the flood module.

5.2 ACTION PRIORITIZATION

Each of the proposed projects has value, however, time and financial constraints do not permit all of the proposed actions 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 (including management costs), feasibility (politically, socially, and environmentally), population benefit, property benefit, and hazard rating.

Each of the factors was ranked low, moderate, or high for each of the projects. The methods used to assign a category and the associated score can be generally defined as follows:

Cost:	3 Score:	Low, <$10,000
(including management)	2 Score:	Moderate, $10,000 to $50,000
	1 Score:	High, >$50,000
Feasibility:	3 Score:	High
(politically, socially, environmentally)	2 Score:	Moderate
	1 Score:	Low
Population Benefit:	3 Score:	High, >50% of population benefits
(existing or future)	2 Score:	Moderate, 5 to 50% of population benefits
	1 Score:	Low, <5% of population benefits
Property Benefit:	3 Score:	High, >50% of property benefits
(existing or future)	2 Score:	Moderate, 5 to 50% of property benefits
	1 Score:	Low, <5% of property benefits
Hazard Rating:	3 Score:	High
(from risk assessment summary)	2 Score:	Moderate
	1 Score:	Low

These scores and projects were updated during the January 9, 2012 public meeting. A summary of the scores for each of the proposed projects can be found in Table 5.1.

Goal 1: Prevent losses from Wildfire

Project	Cost	Feasibility	Population Benefit	Property Benefit	Hazard Rating	Score
Fire Wise Programs	3	3	2	2	3	13
Defensible Space Requirements	3	1	2	2	3	11
Subdivision Regulations for Wildfire	3	1	2	2	3	11
Fuels Reduction on Roadways	1	1	3	1	3	9
Fuels reduction for Utilities	1	1	3	2	3	10
Fuels Mapping	3	3	2	2	3	13
Community Wildfire Protection Plan	3	3	3	2	3	14
Wildfire History Database	3	3	3	2	3	14
Individual WUI Assessments	1	3	2	2	3	11
Homeowner Fuels Reduction	1	3	2	2	3	11

Goal 2: Reduce potential losses from earthquakes

Project	Cost	Feasibility	Population Benefit	Property Benefit	Hazard Rating	Score
Critical facilities tie downs	1	1	3	3	3	11
Critical facilities retrofits	1	1	3	3	3	11
Seismic bridges inspections	1	1	3	3	3	11
Anchor transformers and generators	2	3	3	2	3	13
Expansion joints for utilities	1	1	3	3	3	11
Earthquake retrofit education	3	3	3	3	3	15
Commercial structures seismic surveys	1	1	3	3	3	11
Earthquake retrofits financial incentives	3	1	3	3	3	13

Goal 3: Reduce damages from flooding

Project	Cost	Feasibility	Population Benefit	Property Benefit	Hazard Rating	Score
Dam Security	1	1	2	2	2	8
Flood Insurance Education	3	3	2	2	2	12
Critical Facilities Flood Mitigation	1	1	2	1	2	7
Woody Debris Removal from Rivers	1	1	2	1	2	7
Restrictive Floodplain Regulations	3	1	2	2	2	10

NFIP Mapping and Participation	3	3	2	2	2	12
Flood Control/Stabilization Improvement Incentives	1	1	2	2	2	8
Buyout/Relocation Feasibility Analysis	1	1	2	2	2	8
Alternative Flood Mitigation Measures Study	1	1	2	2	2	8
Goal 4: Reduce losses from a transportation or hazardous materials accident						
Project	**Cost**	**Feasibility**	**Population Benefit**	**Property Benefit**	**Hazard Rating**	**Score**
Emergency Transportation Plan	2	2	3	3	3	13
Fixed Site Mapping (TIER)	3	2	3	3	3	14
Goal 5: Prevent significant loss of life from communicable disease and bioterrorism						
Project	**Cost**	**Feasibility**	**Population Benefit**	**Population Benefit**	**Hazard Rating**	**Score**
Surveillance System	3	3	3	1	2	12
Medical Stakeholders Group	3	3	3	1	2	12
Healthcare Communication	3	3	3	1	2	12
Chempack Plan	3	3	3	1	2	12
Goal 6: Promote all-hazard mitigation measures						
Project	**Cost**	**Feasibility**	**Population Benefit**	**Population Benefit**	**Hazard Rating**	**Score**
Prioritize and Harden Infrastructure	1	2	3	3	2	11
Critical Infrastructure Backup Systems (Facility and Comms)	1	3	3	3	2	12
NWS Storm Ready Community/Severe Weather Preparedness	3	3	3	3	2	15
Emergency Alert System Plan	3	3	3	3	2	15
NOAA Weather Radios in Critical Facilities	3	3	3	3	2	15
Early Warning on Dams	1	2	2	2	2	9
Utility Failure Sheltering Plan	3	3	3	1	2	12
HAZUS GIS Data Development	3	2	3	3	2	13
Community Preparedness Program	2	3	3	3	2	13
Enhanced Weather Forecasting	1	2	3	3	2	11

Many of the projects in Goal 1 remained the same in the update. These activities are primarily ongoing projects that needs to be addressed on a reoccurring basis as fuels grow, houses are built, and new

incidents occur. While the Community Wildfire Protection Plan is complete, it is a living document that needs to be updated frequently along with the Wildfire History Database.

The projects is Goal 2 remained the same as we view this as an ongoing project with the age of the infrastructure and buildings in the county.

The Goal 6 projects had the most changes. Universal Power Supplies for Communications was removed as that has largely been resolved. Emergency Alert System Plan was retained, however a local area plan is now in place for Gallatin County. Early Warning on Hyalite Dam was broadened to all dams as an early system in now installed on Hyalite Dam. Community Preparedness Program was a new project added to encourage an all-encompassing public education program.

Enhanced Weather Forecasting was also added to address the areas lack of weather forecasting due to geography.

5.3 IMPLEMENTATION PLAN

Those actions that have received the highest scores will be given the highest priority. As funding or opportunities to initiate these projects come up, the higher priority activities can be prioritized even further with more detailed costs, benefits, and other criteria. The implementation strategy for the proposed actions can be found in TABLE.

Project Description	Jurisdiction	Responsible Department/Partner	Potential Funding	Priority Score	Notes
Earthquake Retrofit Education	Gallatin County and Incorporated Cities	Emergency Management	FEMA	15	/ Educational campaign on ReadyGallatin.com / Discussion topic at LEPC meetings to inform junior taxing districts of HMGP
Severe Weather Preparedness	Gallatin County and Incorporated Cities	Emergency Management, Weather Service	NWS, FEMA	15	/ Implementation of SkyWarn in Gallatin Gateway / All towns and the county are recognized Storm Ready communities
Emergency Alert System Plan	Gallatin County and Incorporated Cities	Emergency Management, 911, NWS, Broadcasters	FEMA	15	/ Developed local Area Plan in 2011 for Gallatin County / Implemented in-house ENDEC for local initiation of EAS for Gallatin County
NOAA Weather Radio Distribution	Gallatin County and Incorporated Cities	Emergency Management, NWS	FEMA, NWS	15	/ All schools and government buildings have been provided weather radios (Bozeman, Belgrade, Manhattan, Three Forks, West Yellowstone, and various rural locations)

Project Description	Jurisdiction	Responsible Department/Partner	Potential Funding	Priority Score	Notes
					/ Working on funding for new sites and replacement of broken units throughout the county / Add NOAA coverage to West Yellowstone and Big Sky
Fixed Site Mapping (TIER)	Gallatin County and Incorporated Cities	Emergency Management, DEQ	DOT, FEMA	14	/ City of Bozeman Mobile Data Terminal and Pre-Plan project for emergency responders / Gallatin County GIS/911 Structure Mapping project
Community Wildfire Protection Plan	Gallatin County and Incorporated Cities	County Fire, DNRC	DRNC	14	/ Gallatin County CWPP adopted by Gallatin County
Wildfire History Database	Gallatin County and Incorporated Cities	Fire Service, DNRC	DNRC	14	
Anchor Transformers and Generators	Gallatin County and Incorporated Cities	Facilities	FEMA	13	/ Gallatin County and West Yellowstone working on HMGP Generator Project
Earthquake Retrofit Incentives	Gallatin County and Incorporated Cities	Elected Officials	FEMA	13	
Fire Fuels Mapping	Gallatin County and Incorporated Cities	County Fire, DNRC, GIS	DNRC	13	
Fire Wise Programs	Gallatin County and Incorporated Cities	Fire Service, Emergency Management	DNRC, Fire Safe Montana	13	
Emergency Transportation Plan	Gallatin County and Incorporated Cities	Emergency Management	DOT	13	
HAZUS GIS Data Development	Gallatin County and Incorporated Cities	GIS	FEMA	13	
Community Preparedness Program	Gallatin County and Incorporated Cities	Emergency Management	FEMA	13	
Critical Infrastructure Backup	Gallatin County and Incorporated Cities	Facilities	FEMA	12	/ Continued buildout of communications backbone for high level of redundancy
Flood Insurance Education	Gallatin County and Incorporated Cities	Emergency Management, Planning	FEMA, NWS	12	/ Annual flood insurance education campaign in Bozeman, Belgrade, Manhattan, Three Forks, and West Yellowstone

Project Description	Jurisdiction	Responsible Department/Partner	Potential Funding	Priority Score	Notes
NFIP Mapping and Participation	Gallatin County and Incorporated Cities	Planning	FEMA	12	/ Gallatin County, Bozeman, Belgrade, and Three Forks are NFIP participants
Medical Surveillance System	Gallatin County and Incorporated Cities	Health Department	DPPHS	12	
Healthcare Communication	Gallatin County and Incorporated Cities	Health Department	DPPHS	12	/ Radio system has been expanded to support health related communications between Bozeman, Belgrade, Manhattan, and Three Forks / Ongoing effort to incorporate West Yellowstone / Radio system for communication with Bozeman Deaconess Hospital has been replaced and are working to enhance the usability of the new system
Chempack Plan	Gallatin County and Incorporated Cities	Health Department	DPPHS, CDC	12	/ Working on education of Chempack program within Gallatin County
Defensible Space Requirements	Gallatin County and Incorporated Cities	Planning, Fire Service	DNRC	11	
Subdivision Regulations for Wildfire	Gallatin County and Incorporated Cities	Planning, Fire Service	DNRC	11	
Individual WUI Assessments	Gallatin County and Incorporated Cities	Fire Service	DNRC	11	
Homeowner Fuels Reduction	Gallatin County and Incorporated Cities	Fire Service	DNRC	11	/ Several local wildfire mitigation organizations developed in West Yellowstone and Big Sky in concert with Fire Safe Montana / Annual wildfire mitigation education campaigns throughout the county
Critical Facility Tie Downs	Gallatin County and Incorporated Cities	Facilities	FEMA	11	
Critical Facility Retrofit	Gallatin County and Incorporated Cities	Facilities	FEMA	11	/ Working with Bozeman, Belgrade, Three Forks, and West Yellowstone to utilize retrofit funding in remodels

Project Description	Jurisdiction	Responsible Department/Partner	Potential Funding	Priority Score	Notes
Seismic Bridge Inspections	Gallatin County and Incorporated Cities	Road and Bridge	DOT	11	/ Gallatin County in process of developing bridge replacement program for out of specification bridges
Expansion Joint for Utilities	Gallatin County and Incorporated Cities	Public Works, Facilities	FEMA	11	
Prioritize and Harden Infrastructure	Gallatin County and Incorporated Cities	Facilities	FEMA	11	
Enhanced Weather Forecast	Gallatin County and Incorporated Cities	Emergency Management, NWS	NWS	11	

5.4 ENABLING LEGISLATION

The enabling legislation for the implementation of this plan specifically comes from Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, enacted by Section 104 of the Disaster Mitigation Act of 2000 (P.L. 106-390). The Interim Final Rule for this legislation was published in the Federal Register on February 26, 2002 at 44 CFR Part 201. Other legislation, orders, and plans that support the initiatives presented in this plan include:

- Presidential Executive Order 12898, Environmental Justice Presidential Executive Order 11988, Floodplain Management Presidential Executive Order 11990, Protection of Wetlands
-
- Montana Code Annotated, Title 10, Chapter 3, Disaster and Emergency Services Montana Code Annotated, Title 76, Chapter 5, Flood Plain and Floodway Management Montana Code Annotated, Title 50, Chapter 60, Building Construction Standards Montana Code Annotated, Title 76, Chapter 2, Planning and Zoning Gallatin County Growth Policy
- Gallatin County Subdivision Regulations
- Gallatin County and City of Bozeman Floodplain Ordinances City of Bozeman Building Code City-County Zoning Regulations
- City of Belgrade Subdivision Regulations
- City of Three Forks Zoning Regulations
- Town of West Yellowstone Zoning Regulations

5.5 EXISTING PROGRAMS

The approval of this plan shows that hazard mitigation is an important priority in Gallatin County, Bozeman, Belgrade, West Yellowstone, and Three Forks. As a priority, the hazard information and recommendations presented in this plan will be considered and incorporated into current and future planning initiatives, particularly growth policies, capital improvement plans, zoning regulations, and subdivision regulations.

The Local Emergency Planning Committee is already active in the promotion of hazard mitigation and will continue to do so with the member agencies represented.

Additional support for mitigation will be encouraged by the participating jurisdictions planning departments through building codes, subdivision review, and land use permits. The many organizations devoted to sustainable communities and the protection of natural resources will be encouraged to use this plan and support its goals.

6.0 PLAN MAINTENANCE PROCEDURES

As with all plans, the periodic plan updates are required to maintain relevance. The Gallatin County LEPC is ultimately responsible for ensuring this plan is kept up to date. The LEPC meets regularly and is responsible for coordinating emergency planning issues for the county and communities. Given the broad representation of agencies and jurisdictions, this committee is a good fit, has many members that participated in the plan development. All Local Emergency Planning Committee meetings are open to the public.

6.1 PLAN MONITORING, EVALUATION, AND UPDATES

This plan will be maintained by the Gallatin County LEPC. This committee has representatives from local public safety departments and private entities, all of whom were active in the development of this plan. A public LEPC meeting will be held annually in September to review the plan. During this meeting, the LEPC and public will review the goals, objectives, and projects, as needed, such as when a mitigation grant application opportunity exists, to determine if the actions for which funding exist are proceeding as planned and if new projects should be initiated. The LEPC will review any new risk information and modify the plan as indicated by the emergence of new vulnerabilities. Review of ongoing projects will be conducted to determine their status, their practicality, and which actions should be revised. If needed, site visits will be conducted and/or relevant state or federal program specialists will be invited to speak to the LEPC and local officials regarding mitigation opportunities. Should federal mitigation grants be received, it is the responsibility of the jurisdiction and/or agency receiving the grant to meet all reporting requirements, unless alternative arrangements have been made.

Annual updates should be made, and committee approval may then take place at the October meeting or subsequent meetings. As hazard information is added or updated, events occur, and projects are completed, the plan will be updated. Each year, a notice of approval will be sent to Montana Disaster & Emergency Services by the Gallatin County LEPC Chairperson, and if major changes take place, a revised version of the plan will also be submitted. Every five years, the plan will be submitted to Montana Disaster & Emergency Services and the Federal Emergency Management Agency Regional Office for their approval. The next formal submission will occur in 2023. To provide enough time for a full update before this plan expires, the following schedule is recommended:

- Pre-Disaster Mitigation Planning Grant Application Preparations: late 2021
- Pre-Disaster Mitigation Planning Grant Application: early 2022
- Contracting for Professional or Technical Services (if needed): July-August 2022
- Plan Reviews and Modifications: September 2015 - May 2023
- Montana DES and FEMA Reviews: June-July 2023
- Final Revisions and Adoption: August 2023
- Final Plan Approval: September 2023

To facilitate the update process, annual updates to the plan are recommended. Table 6-1 **Error! Reference source not found.** shows the schedule of plan updates. All jurisdictions must participate in the plan update process for the plan to remain approvable for each jurisdiction.

Table 6-1. Schedule of Plan Updates

Plan Section	Post-Disaster	Annually	Every 5
Annual Report to Montana DES		X	X
Adoption Documentation	X	X	X
Introduction			X
Planning Process	X	X	X
Hazard Identification	X		X
Critical Facilities			X
Buildings			X
Infrastructure			X
Economy			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
Implementation Plan	X	X	X
Plan Maintenance Procedures			X

6.2 PUBLIC INVOLVEMENT

Public involvement is an integral component of this plan. To encourage continued participation, comments can be directed to the Gallatin County All Hazards All discipline (AHAD) Chairperson. This committee can be reached through Gallatin County Emergency Management at:

Gallatin County Emergency Management
Box 1230
Bozeman, MT 59771
406-582-2350

Comments will be considered during the annual review of this plan. The public is also encouraged to attend the annual plan review meeting. If needed, a special AHAD subcommittee will be developed to hold public meetings and coordinate plan changes and comments.