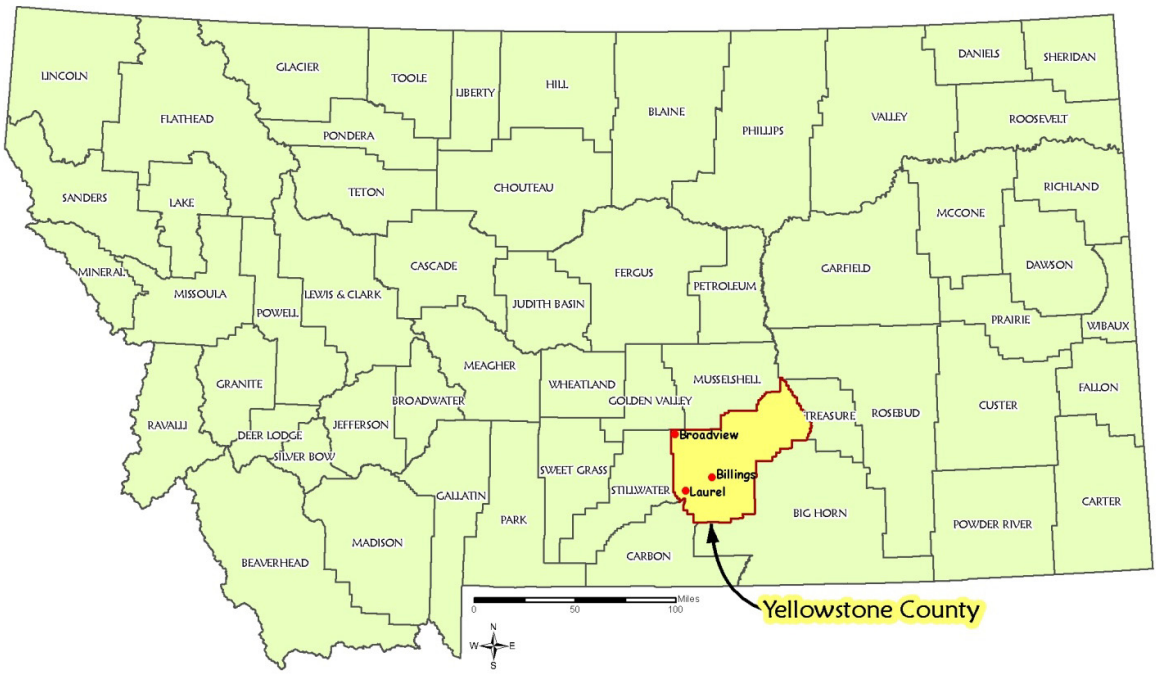
MULTI-JURISDICTIONAL PRE-DISASTER MITIGATION PLAN, UPDATE 2011

Yellowstone County
City of Billings
City of Laurel
Town of Broadview



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EXECUTIVE SUMMARY

Yellowstone County is not immune from the possibility of a serious hazard event of emergency or catastrophic proportions. Natural and manmade hazards pose an ongoing potential threat to the health, welfare, and security of our citizens, properties and infrastructure. The Yellowstone County multi-jurisdictional Pre-Disaster Mitigation Plan (PDM) Update represents a coordinated effort and ongoing commitment to reduce or eliminate potential hazard-related losses and damages before they occur or recur. Additionally, successful completion and subsequent updates of the multi-jurisdictional PDM will ensure Yellowstone County's continued eligibility to apply for grants to fund planning efforts and thorough evaluation of potential mitigation activities.

The 2011 PDM Update builds on the original 2004 PDM Plan with updated data on risks posed by hazards and updated list of projects that can mitigate those hazards. These updates were reviewed by the Local Emergency Planning Committee (LEPC) PDM Task Force and presented in community planning session, to obtain and reflect the wishes of the community on the best means to reduce impacts from natural and man-caused hazards. In addition to the meetings, historical hazard data was researched to make sure that no potential hazards were missed in the initial process. HAZUS (the latest FEMA August 2009 data) and other Geographical Information Systems data was collected and examined in the identification process.

Each identified natural hazard was profiled, including information about its characteristics, history, probability, magnitude, mapping, vulnerabilities, data limitations, and other key documentation as available. Where applicable, the vulnerabilities to jurisdictions in terms of property damage and potential for casualties were quantified based on historic recorded losses. The losses were converted to an average annual loss based on either the historic record or on models that estimate future potential losses. Below is a summary of each natural hazard displaying the frequency of a major event, estimated annualized losses, potential for casualties, and a risk factor based on a sum of these three factors. This is compared to the priorities set for these same hazards in the 2004 PDM Plan.

Risk Assessment Summary for Natural Hazards

Hazard	Frequency w/ Major Damages[1]	Estimated Annualized Losses[2]	Potential Casualties	Risk Factor	2004 Rank
Flooding	25 years	$1,116,000	high	13	1
Weather- Extreme Wind & Thunderstorms	10 years	$657,000	high	13	3
Tornado	25 years	$1,260,000	moderate	11	4
Wildfire	20 years	$548,000	moderate	10	2
Severe Winter Storms	10 years	$37,000	moderate	8	5
Flooding - Major Dam Failure	500 years	$250,000	moderate	7	7
Landslide	10 years	$50,000	low	7	9
Volcano	100 years	$5,000	low	4	11
Earthquake	50 years	$0	low	4	10
Drought	25 year (cycles)	na	low	--	6
Expansive Soils	na	na	low	--	8

Plan Mission

The mission of the Yellowstone County multi-jurisdictional PDM is to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from potential hazards. This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide Yellowstone County towards building safer, more sustainable communities.

Goals and Objectives

The plan goals describe the overall direction that Yellowstone County agencies, organizations, and citizens will take to work toward mitigating risk from hazards. The goals and objectives of this PDM are to create a disaster resistant county by reducing the threat of hazards to life, property, emergency response capabilities, economic stability, and infrastructure while encouraging the protection and restoration of natural resources and the environment. The goals are stepping-stones between the broad direction of the plan mission and the specific recommendations outlined in the action items.

Protection of Life and Property: Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to losses from hazards. Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards. Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to hazards.

Public Awareness: Develop and implement education and outreach programs to increase public awareness of the risks associated with hazards. Provide information on tools, partnerships opportunities, and funding resources to assist in implementing mitigation activities.

Natural Systems: Balance watershed planning, natural resource management, and land use planning with hazard mitigation to protect life, property, and the environment. Preserve, rehabilitate, and enhance natural systems to serve hazard mitigation functions.

Partnerships and Implementation: Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation. Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

Emergency Services: Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure. Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, business and industry. Coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

Action Plan

The Yellowstone County PDM includes resources and information to assist county residents, public and private sector organizations, and other interested in participating in planning for hazards. The mitigation plan provides a list of activities that may assist Yellowstone County in reducing risk and preventing loss from future natural hazard events. The action items for each mitigation goal address

multi-hazard issues, as well as activities for flood, landslide, severe winter storms, severe summer storms, windstorms, wildfire, earthquake, and volcanic eruption hazards. The 2011 updates to each of the objectives/action items listed under the eight major goals set by Yellowstone County in 2004 are provided in Section 5.0, Multi-Jurisdictional Hazard Mitigation Strategy.

Specific Pre-Disaster Mitigation Objectives

- Increase Hazard Awareness
- Reduce Impacts of Flooding
- Reduce the Impact of Wildfires and Structure Fires on the Community
- Improve Emergency Communications
- Enhance Hazard Mitigation through Improved Countywide Mapping and Zoning
- Protection of Public Health and Property from Disasters
- Grow and Develop Partnerships
- Enhance Emergency Services

Mitigation Actions

Proposed projects to mitigate hazards in Yellowstone County are quite diverse. At the preliminary public meetings and at committee meetings areas of concern were identified and ranked according to which were the most urgent mitigation concerns for Yellowstone County. These projects all fit with the overall goals of the Yellowstone County PDM Plan.

Construction Projects

- West Billings Flood Mitigation Project: Construction of two small storage features on Cove and Little Cove Creeks and improving flood conveyance through the West Billings area.
- Arrow Island Weir Project: Bank Stabilization project north of Huntley.

Feasibility Studies

- Highway 3 Stormwater Controls: Study options for mitigating stormwater runoff from Highway 3 near the Airport.
- Riverside Park Levee Repair: Study to assess options for controlling bank erosion and protection of buried pipelines near Riverside Park in Laurel.
- Zoo Montana Flood Mitigation: Assess potential for flooding zoo and address options for managing zoo animals in the event of a flood.
- Purchase of Knife River Pit: Examine the option for creating stormwater retention basin in the Knife River Pit to mitigate potential flooding downstream of the West Billings area.

Public Education

- Floodplain Awareness: Continued community outreach on the potential for flooding in flood prone areas.
- Firewise Demonstrations: Continued community outreach on wise building practices in the wildland urban interface.
- Severe Storm Education: Continued community outreach on preparation and safety during severe storms.
- School Safety: Interaction with public safety officials and schools on school population planning for emergencies.

Hazard Preparedness

- Wildland Fire Mapping
- Public Alert System
- Enhanced Rural Communication/Montana Interoperability Project
- Modification of floodplain regulations to require property setbacks

Plan Maintenance

The PDM Plan shall be reviewed annually by the LEPC to track the progress of PDM projects and make additions or changes to the Mitigation Plan portion of the PDM Plan. Every 5 years the PDM Plan shall be updated to reassess the risks posed by hazards and complete a thorough review of PDM projects.

(INSERT SIGNED **Commissioner's Resolutions: Four Jurisdictions**)

PREFACE

1 Commissioner's Resolutions: Four Jurisdictions

The Yellowstone County Board of County Commissioners (BOCC) will be responsible for adopting the Yellowstone County Pre-Disaster Mitigation Plan. This governing body has the authority to promote sound public policy regarding hazards. The following Yellowstone County jurisdictions will also sign updated resolutions stating they have met, read and accepted the PDM for their respective locations: City of Billings – Billings City Council, City of Laurel – City Council of the City of Laurel, Town of Broadview – Broadview Town Council.

The signed resolutions for the 2011 PDM Update are provided in the preceding pages, following the Executive Summary.

2 Acknowledgements

The Pre Disaster Mitigation Plan Task Force was made up of the following people and agencies:

- Duane Winslow – Yellowstone County, Director of Emergency and General Services; Pre-Disaster Mitigation Project Manager,
- Joe Marcotte – Deaconess Billings Clinic, Safety Director,
- Dianne Lehm, Big Sky Economic Development Authority,
- Gregory Neil, Riverstone Health,
- Wyeth Friday, Yellowstone County Planning and Community Services,
- Patrick O'Neil, St. Vincent Healthcare,
- Maggie Lough, Lockwood Fire Council,
- Charlie Vandam, Atkins (formerly PBS&J).

The Yellowstone County PDM Plan Update was prepared by Atkins with direct input from the PDM Task Force, a subcommittee of the Yellowstone County LEPC. Funding for the 2011 PDM Update was made possible through a FEMA Pre-Disaster Mitigation Planning Grant administered through Yellowstone County and the Disaster and Emergency Services Division of the Montana Department of Military Affairs. The LEPC is responsible for the review and annual updates to the PDM Plan.

Once the Plan has been adopted, the County Disaster and Emergency Services Director will be responsible for submitting it to the State Hazard Mitigation Officer for review. This review will address the federal criteria outlined in FEMA Interim Final Rule 44 CFR Part 201. Upon acceptance by FEMA, Yellowstone County will gain eligibility for Hazard Mitigation Grant Program funds.

3 Authority

The 1988 Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 100-707, amended the Disaster Relief Act of 1974, Public Law 93-288. The Stafford Act constitutes the statutory authority for most Federal disaster response activities especially as they pertain to FEMA and FEMA programs. The Disaster Mitigation Act of 2000, Public Law 106-390 (DMA), amends the Stafford Act, placing new emphasis on coordinated mitigation planning and implementation efforts among state, local and Indian Tribal entities. The requirement for a state risk-based mitigation plan is continued as a condition of pre-

and post-disaster assistance, while the new requirement for a local risk-based PDM is incentivized by grant funding for plan development made available through several hazard mitigation assistance programs. The requirements and procedures of 2007 Interim Final Rule can be found in the Code of Federal Regulations at Title 44, Chapter 1, Part 201 (44 CFR Part 201).

The Governor has the leadership role in the issuance of guidance to all state agencies to minimize the effects of hazards on the citizens of Montana. In state and federal recovery agreements following a Presidentially declared disaster, the Governor initiates updating of the state and local mitigation plans based on federal requirements or state and local needs. Montana's Disaster and Emergency Services (MTDES) administers mitigation guidance and funding to state and local applicants following a Presidentially declared disaster.

Local governments play an essential role in implementing effective mitigation, both before and after disaster events. Local government will review all damages, losses, and related impacts to determine the need or requirement for mitigation action and planning whenever seriously affected by disaster, or when applying for state or federal recovery assistance. The Yellowstone County Board of County Commissioners and its appointees will be responsible for carrying out plans and policies related to the PDM. Local government must be prepared to participate in the post-disaster hazard mitigation process and the pre-mitigation planning as outlined in this document.

4 Caveats and Data Limitations

The data and figures in the 2011 Plan Update were derived from multiple sources. Care was taken in the compilation of data and preparation of maps to best reflect historic conditions or areas of potential risks but shall not be used to depict specific boundaries nor specific values or costs. This is a planning document intended to provide guidance to local jurisdictions on means to mitigate hazards, more detailed studies are needed to develop actual costs and define precise boundaries.

Final population figures from the recently conducted 2010 U.S. Census were only available county geographic area not for smaller subdivisions of the county. The city population data will be incorporated in future plan updates as the data become available. Where applicable, 2009 U.S. Census Bureau estimates have been incorporated into the 2011 PDM update.

General note: direct comparisons among various sources of the same information can yield varying results. Contributing factors to the differences among data sources include: geographical information datasets vary in terms of scale, spatial and attribute accuracy, completeness and currency of information. Additional factors that can influence results include cartographer queries and the methodology used for data analysis (trends and calculated estimates).

Abbreviations

BOCC	Board Of County Commissioners
CRP	Conservation Reserve Program
CWPP	Community Wildfire Protection Plan
DES	Disaster and Emergency Services
DMA	Disaster Mitigation Act
DNRC	Montana Department of Natural Resources and Conservation
DOI	U.S. Department of the Interior
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GIS	Geographic Information Systems
HAZUS	HAZard United States
HUD	U.S. Department of Housing and Urban Development
LEPC	Local Emergency Planning Committee
MBMG	Montana Bureau of Mines & Geology
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resource Conservation Service
NWS	National Weather Service
MTDES	Montana Disaster and Emergency Services
PDM	Pre-Disaster Mitigation
SHELDUS™	Spatial Hazard Events and Losses Database
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WUI	Wildland Urban Interface

Glossary of Terms

Acceleration: The rate of change of velocity with respect to time. Acceleration due to gravity at the earth's surface is 9.8 meters per second squared; i.e., every second that something falls toward the surface of earth, its velocity increases by 9.8 meters per second.

Asset: Any manmade or natural feature that has value, including, but not limited to people; buildings; infrastructure like bridges, roads, and sewer and water systems; lifelines like electricity and communication resources; or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks.

Base Flood Elevation (BFE): Elevation of the base flood in relation to a specified datum, such as the National Geodetic Vertical Datum of 1929. The Base Flood Elevation is used as the standard for the National Flood Insurance Program.

Base Flood: Flood that has a 1 percent probability of being equaled or exceeded in any given year; also known as the 100-year flood.

Bedrock: The solid rock that underlies loose material, such as soil, sand, clay, or gravel.

Bio-Terrorism: Intentional, criminal, malicious acts using biological agents to cause harm to large numbers of people.

Building: A structure that is walled and roofed, principally above ground and permanently affixed to a site. The term includes a manufactured home on a permanent foundation on which the wheels and axles carry no weight.

Community Rating System: An NFIP program that provides incentives for communities to complete activities that reduce flood hazard risk. Upon completing specified activities, the insurance premiums of policyholders in these communities are reduced.

Computer-Aided Design And Drafting (CADD): A computerized system enabling quick and accurate electronic 2-D and 3-D Drafting (CADD) drawings, topographic mapping, site plans, and profile/cross-section drawings.

Contour: A line of equal ground elevation on a topographic (contour) map.

Critical Facility: Facilities that are critical to the health and welfare of the population and that are especially important following hazard events. Critical facilities include, but are not limited to, shelters, police and fire stations, and hospitals.

Debris: The scattered remains of assets broken or destroyed in a hazard event. Debris caused by a wind or water hazard event can cause additional damage to other assets.

Digitize: To convert electronically points, lines, and area boundaries shown on maps into x, y coordinates (e.g., latitude and longitude, universal transverse mercator (UTM), or table ordinates) for use in computer applications, such as Geographical Information Systems.

Displacement Time: The average time (in days) which the building's occupants typically must operate from a temporary location while repairs are made to the original building due to damages resulting from a hazard event.

Duration: How long a hazard event lasts.

Earthquake: A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of earth's tectonic plates.

Erosion Hazard Area: Anticipated shoreline retreat/loss area over a given period of time. The projected inland extent of the area is measured by multiplying the average annual long-term recession rate by the number of years desired.

Erosion: Wearing away of the land surface by detachment and movement of soil and rock fragments, during a flood or storm or over a period of years, through the action of wind, water, or other geologic processes.

Essential Facility: Elements that are important to ensure a full recovery of a community or state following a hazard event. These would include; government functions, major employers, banks, schools, and certain commercial establishments, such as grocery stores, hardware stores, and gas stations.

Extent: The size of an area affected by a hazard or hazard event.

Fault: A fracture in the continuity of a rock formation caused by a shifting or dislodging of the earth's crust, in which adjacent surfaces are differentially displaced parallel to the plane of fracture.

Federal Emergency Management Agency (FEMA): Independent agency created in 1978 to provide a single point of accountability for all Federal activities related to disaster mitigation and emergency preparedness, response and recovery. This agency is now included with the office of Homeland Security as of 2003.

Fire Potential Index (FPI): Developed by USGS and USFS to assess and map fire hazard potential over broad areas. Based on geographic information, national policy makers and on-the-ground fire managers established priorities for prevention activities in the defined area to reduce the risk of managed and wildfire ignition and spread. Prediction of fire hazard shortens the time between fire ignition and initial attack by enabling fire managers to pre-allocate and stage suppression forces to high fire risk areas.

Flash Flood: A flood event occurring with little or no warning where water levels rise at an extremely fast rate.

Flood Depth: Height of the floodwater surface above the ground surface.

Flood Elevation: Elevation of the water surface above an established datum, e.g. National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988, or Mean Sea Level.

Flood Hazard Area: The area shown to be inundated by a flood of a given magnitude on a map.

Flood Insurance Rate Map (FIRM): Map of a community, prepared by the Federal Emergency Management Agency that shows both the special flood hazard areas and the risk premium zones applicable to the community.

Flood Insurance Study (FIS): A study that provides an examination, evaluation, and determination of flood hazards and, if appropriate, corresponding water surface elevations in a community or communities.

Flood: A general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation or runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.

Floodplain: Any land area, including watercourse, susceptible to partial or complete inundation by water from any source.

Frequency: A measure of how often events of a particular magnitude are expected to occur. Frequency describes how often a hazard of a specific magnitude, duration, and/or extent typically occurs, on average. Statistically, a hazard with a 100-year recurrence interval is expected to occur once every 100 years on average, and would have a 1 percent chance – its probability – of happening in any given year. The reliability of this information varies depending on the kind of hazard being considered.

Fujita Scale of Tornado Intensity: Rates tornadoes with numeric values from F0 to F5 based on tornado wind speed and damage sustained. An F0 indicates minimal damage such as broken tree limbs or signs, while and F5 indicated severe damage sustained.

Functional Downtime: The average time (in days) during which a function (business or downtime service) is unable to provide its services due to a hazard event.

Geographic Area Impacted: The physical area in which the effects of the hazard are experienced.

Geographic Information Systems (GIS): A computer software application that relates physical features on earth to a database to be used for mapping and analysis.

Ground Motion: The vibration or shaking of the ground during an earthquake. When a fault ruptures, seismic waves radiate, causing the ground to vibrate. The severity of the vibration increases with the amount of energy released and decreases with distance from the causative fault or epicenter, but soft soils can further amplify ground motions.

Hazard Event: A specific occurrence of a particular type of hazard.

Hazard Mitigation: Sustained actions taken to reduce or eliminate long-term risk from hazards and their effects.

Hazard Profile: A description of the physical characteristics of hazards and a determination of various descriptors including magnitude, duration, frequency, probability, and extent. In most cases, a community can most easily use these descriptors when they are recorded and displayed as maps.

Hazard: A source of potential danger or adverse condition. Hazards in this how-to series will include naturally occurring events such as floods, earthquakes, tornadoes, tsunami, coastal storms, landslides, and wildfires that strike populated areas. A natural event is a hazard when it has the potential to harm people or property.

Hazard: The process of identifying hazards that threaten an area.

HAZUS: Abbreviation for HAZards United States. A GIS-based nationally standardized earthquake loss (and other hazard parameters) estimation tool developed by FEMA.

Hydrology: The science of dealing with the waters of the earth. A flood discharge is developed by a hydrologic study.

Infrastructure: Refers to the public services of a community that have a direct impact on the quality of life; includes communication technology such as phone lines or Internet access, vital services such as public water supplies and sewer treatment facilities, and includes an area's transportation system such as airports, heliports; highways, bridges, tunnels, roadbeds, overpasses, railways, bridges, rail yards, depots; and waterways, canals, locks, seaports, ferries, harbors, drydocks, piers and regional dams.

Intensity: A measure of the effects of a hazard event at a particular place.

Landslide: Downward movement of a slope and materials under the force of gravity.

Lowest Floor: Under the NFIP, the lowest floor of the lowest enclosed area (including basement) of a structure.

Magnitude: A measure of the strength of a hazard event. The magnitude (also referred to as severity) of a given hazard event is usually determined using technical measures specific to the hazard.

Mitigate: To cause to become less harsh or hostile; to make less severe.

Mitigation Plan: A systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in the state and includes a description of actions to minimize future vulnerability to hazards.

National Flood Insurance Program (NFIP): Federal program created by Congress in 1968 that makes flood insurance available in communities that enact minimum flood plain management regulations in 44 CFR §60.3.

National Geodetic Vertical Datum of 1929 (NGVD): Datum established in 1929 and used in the NFIP as a basis for measuring flood, ground, and structural elevations, previously referred to as Sea Level Datum or Mean Sea Level. The Base Flood Elevations shown on most of the Flood Insurance Rate Maps issued by the Federal Emergency Management Agency are referenced to NGVD.

National Weather Service (NWS): Prepares and issues flood, severe weather, and coastal storm warnings and can provide technical assistance to Federal and state entities in preparing weather and flood warning plans.

Planimetric: Describes maps that indicate only man-made features like buildings.

Planning: The act or process of making or carrying out plans; the establishment of goals, policies and procedures for a social or economic unit.

Probability: A statistical measure of the likelihood that a hazard event will occur.

Recurrence Interval: The time between hazard events of similar size in a given location, based on the probability that the given event will be equaled or exceeded in any given year.

Repetitive Loss Property: A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least $1000 each have been paid within any 10-year period since 1978.

Replacement Value: The cost of rebuilding a structure. This is usually expressed in terms of cost per square foot, and reflects the present-day cost of labor and materials to construct a building of a particular size, type and quality.

Richter Scale: A numerical scale of earthquake magnitude devised by seismologist C.F. Richter in 1935.

Risk: The possibility of loss or injury; the estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate or low likelihood of sustaining damage above a particular threshold due to a specific type of hazard event. It also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Riverine: Of or produced by a river.

Scale: A proportion used in determining a dimensional relationship; the ratio of the distance between two points on a map and the actual distance between the two points on the earth's surface.

Scarp: A steep slope.

Scour: Removal of soil or fill material by the flow of flood waters. The term is frequently used to describe storm-induced, localized conical erosion around pilings and other foundation supports where the obstruction of flow increases turbulence.

Seismicity: Describes the likelihood of an area being subject to earthquakes.

Special Flood Hazard Area (SFHA): An area within a floodplain having a 1 percent or greater chance of flood occurrence in any given year (100-year floodplain); represented on Flood Insurance Rate Maps with shaded zone designations that include the letter A or V.

Stafford Act: The Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-107 was signed into law November 23, 1988 and amended the Disaster Relief Act of 1974, PL 93-288. The Stafford Act is the statutory authority for most Federal disaster response activities, especially as they pertain to FEMA and its programs.

State Hazard Mitigation Officer (SHMO): State government representative; is the primary point of contact with FEMA, other state and Federal agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities.

Structure: Something constructed. (See Building.)

Substantial Damage Hazard: Damage of any origin sustained by a structure in a Special Flood Area whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage.

Surface Faulting: The differential movement of two sides of a fracture; the location where the ground breaks apart; characterized by length, width, and displacement of the ground.

Technological Hazards Terrorism: Incidents that can arise from human activities such as the manufacture, transportation, storage, and use of hazardous materials. Intentional, criminal, malicious acts including biological, chemical, nuclear, and radiological weapons, arson, incendiary, explosive, and armed attacks, industrial sabotage and intentional hazardous materials releases.

Tectonic Plate: Torsionally rigid, thin segments of the earth's lithosphere that may be assumed to move horizontally and adjoin other plates. It is the friction between plate boundaries that cause seismic activity.

Topographic: Characterizes maps that show natural features and indicate the physical shape of the land using contour lines. These maps may also include manmade features.

Tornado: A violently rotating column of air extending from a thunderstorm to the ground.

Vulnerability Assessment: The extent of injury and damage that may result from a hazard event of a given intensity in a given area. The vulnerability assessment should address impacts of hazard events on the existing and future build environment.

Vulnerability: Describes how exposed or susceptible to damage an asset is; depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one community element is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power – if an electric substation is flooded, it will affect not only the substation, but a number of businesses as well. Indirect effects can be much more widespread and damaging than direct effects.

Wildfire: An uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures.

Zone: A geographical area shown on a Flood Insurance Rate Map (FIRM) that reflects the severity or type of flooding in the area.

1.0 INTRODUCTION

Yellowstone County is not immune from the possibility of a serious hazard event of emergency or catastrophic proportions. Natural, technological, and manmade hazards pose an ongoing potential threat to the health, welfare, and security of our citizens, properties and infrastructure. The Yellowstone County multi-jurisdictional PDM represents a coordinated effort and ongoing commitment to mitigate potential hazard-related losses and damages before they occur or recur. Additionally, successful completion and subsequent updates of the multi-jurisdictional PDM qualifies Yellowstone County to apply for grants to fund planning efforts and thorough evaluation of potential mitigation activities.

Mitigation activities normally occur before an emergency or disaster, or directly on the heels of a disaster. Mitigation plans can include action items such as building dikes, adopting flood plain and/or zoning regulations, and requiring a water supply for homes built in wildland fire areas. The primary purpose for mitigation is to eliminate or reduce the probability and/or effects of a disaster, based on a risk-based analysis of each identified hazard. Mitigation strategies consist of short- and long-term actions to postpone, reduce or eliminate the negative impacts of a natural or manmade hazard event

It is important to note that while mitigation planning can convey an estimation of potential economic, social and infrastructural damages and losses to a community, there may be other intangible losses (such as cultural, historic, environmental) that are difficult to quantify. Furthermore, other post-disaster costs such as response and recovery costs are not addressed through pre-disaster mitigation planning

In compliance with FEMA requirements, the following PDM updates the previous Yellowstone PDM of 2004, and consists of a multi-jurisdictional assessment of each identified hazard, and updated recommendations for hazard mitigation planning actions moving forward. The 2011 PDM Update identifies opportunities and suggestive actions, which could reduce the impact of future disasters or emergencies. County agencies with an emergency assignment in the Emergency Operations Plan (see http://www.co.yellowstone.mt.gov/des for more information) have general responsibility for mitigation planning and implementation.

1.1 Purpose

The purpose of this multi-jurisdictional PDM is to systematically identify potential hazards in Yellowstone County, Montana and use this information in developing proactive and post-hazard event strategies to minimize suffering, loss of life, and damage to property resulting from hazardous or potentially hazardous conditions. The PDM has been prepared in compliance with federal, state and local hazard mitigation planning requirements published under 44 CFR Part 201 in order to be eligible to apply for and to receive hazard mitigation assistance.

Requirements under the FEMA Disaster Mitigation Act of 2000 include: identifying and describing potential hazards and impacts upon the county; developing programs, activities, strategies, and recommendations for mitigation; monitoring and promoting pre- and post-disaster mitigation measures; and eliminating or minimizing conditions which would have an undesirable impact on our citizens, the economy, environment, and well-being in Yellowstone County.

The scope of the Yellowstone County PDM Update is county-wide, including the jurisdictions of the cities of Billings and Laurel and the town of Broadwater. The PDM Update does not include the Crow

Reservation within Yellowstone County. The PDM is not necessarily limited to Federal, State, or locally declared disasters or emergencies. If or when local situations and incidents of hazard events produce a requirement for mitigation actions, activities, and strategies, they will be developed and incorporated into the PDM. This plan does not intend to replace existing preparedness and operational documents, nor does it address the costs associated with response to hazard events and subsequent recovery efforts. Rather, the PDM provides a risk-based assessment of mitigation strategies, goals, objectives and priorities, which can serve to strengthen and improve the effectiveness of local operational procedures.

1.2 Project Area Location, Land Use, Economy, Population

Located in south central Montana, Yellowstone County is Montana's most populous county with 147,972 residents, according to the 2010 census. This represents a population density estimated at 55 persons per square mile. Since the 2000 census, Yellowstone County's population grew by 18,620, a 14.4 percent increase.

Established in 1883, Yellowstone County derives its name from the Yellowstone River, which is an English translation of "*Roche Jaune*", the name used by the early French trappers. The Yellowstone River roughly bisects the county, flowing from southwest to northeast. Of the fifty-six counties in Montana, Yellowstone County is the largest farm producing area, with the main products including sugar beets, wheat, beans and livestock.

Land Use: Yellowstone County is located in the Great Plains province of Montana but the topography of the county is characterized by breaks and drainages feeding the Yellowstone River. Rangeland is the predominant land use covering over 50 percent of the county comprised of brush, grass and mixed rangelands. Agricultural lands for crops, pasture and confined feed areas reflect about one-quarter, or 26 percent of the total acres in the county. Forested lands comprise 16.7 percent of the land use group types, while all residential and commercial/industrial uses in combination make up less than 2 percent of the county-wide total.

Table 1. Land Use in Yellowstone County

Yellowstone County Grouped Land Uses	Acres	Percent of Total Acres
Rangeland: Brush, Grass, Mixed	921,124	54.4
Agriculture: Crop, Pasture, Feed	441,022	26.0
Forest: Evergreen, Deciduous	283,543	16.7
Residential: Urban, Mixed Urban	18,840	1.1
Water: Stream, Reservoir, Wetland, Lake	16,853	1.0
Transportation/Utilities	6,581	0.4
Commercial/Industrial/Mine/Quarry	5,961	0.4
Total Acres:	***1,693,923***	***100***

Source: Montana Natural Resource Information System (http://maps2.nris.mt.gov).

Urban and residential development within the County is focused along the Yellowstone River Valley, with very low residential densities located outside the valley. Billings has the highest concentration of development with potential future growth occurring in the suburban and exurban areas near Billings and Laurel.

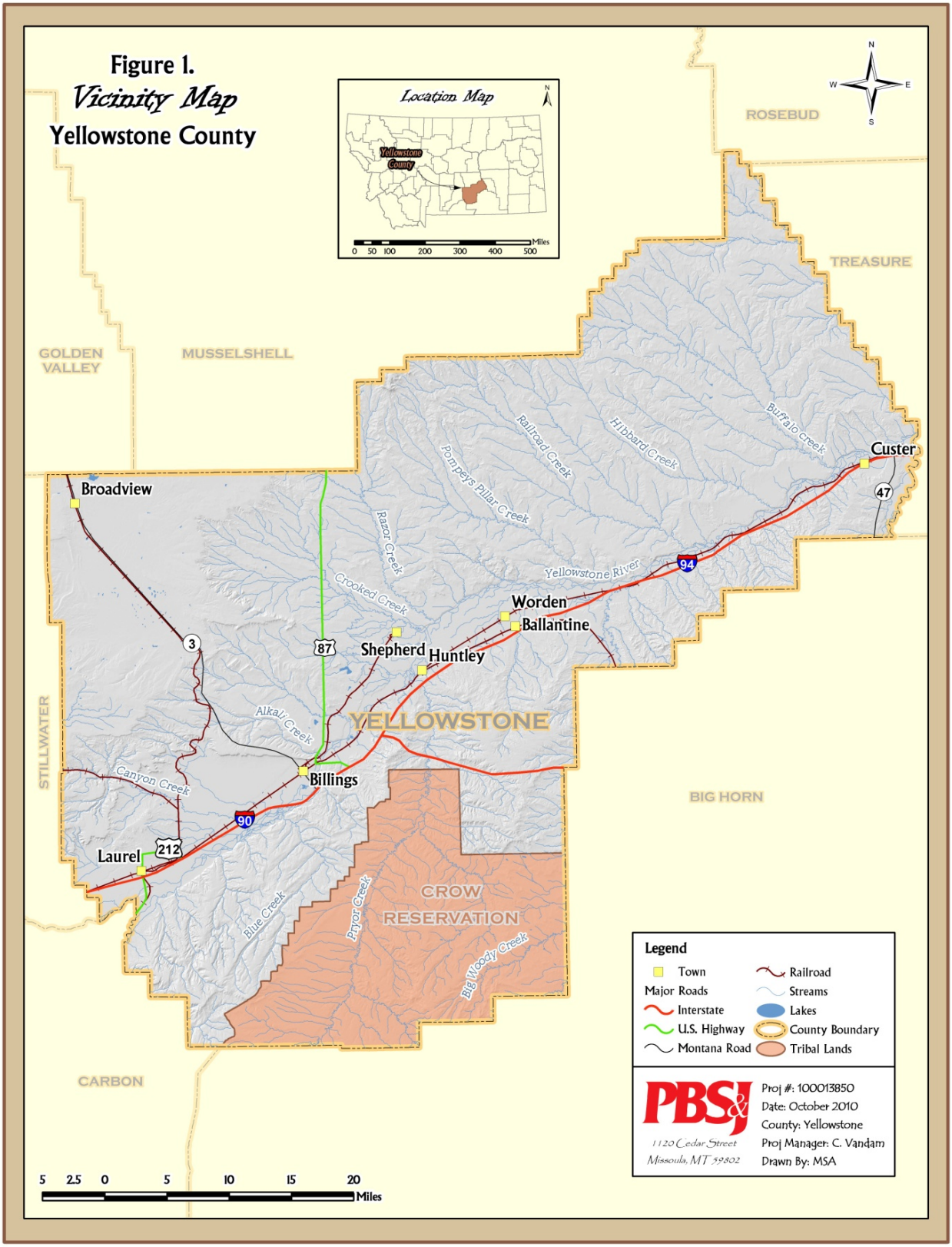

Figure 1. Vicinity Map Yellowstone County

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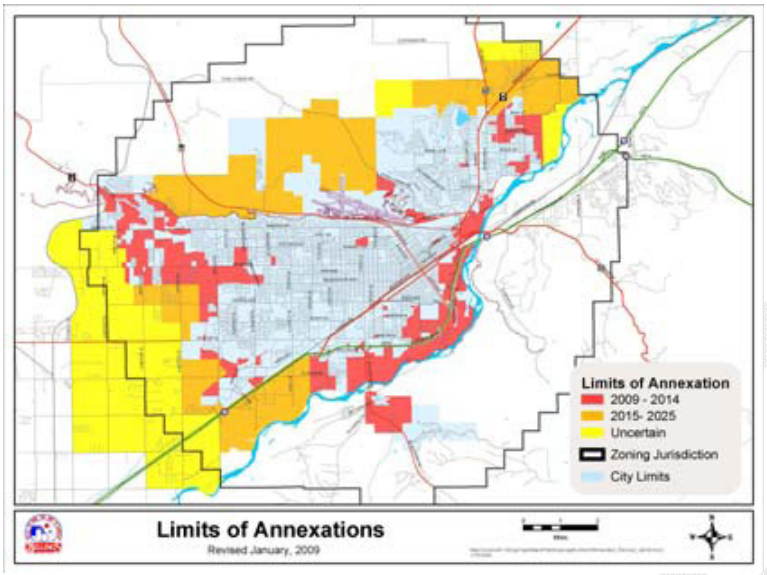

Land Use Trends: Residential, commercial and industrial growth will be dependent on water and sewer availability. Existing development is concentrated along the Yellowstone River with the majority of the development in the southwest portion of the County in and around the City of Billings. As of 2007, 73 percent of the population lived within the City of Billings, while the City only contained 1.5 percent of the land area (Yellowstone County, 2008). Yellowstone County and City of Billings 2008 Growth Policy Update estimates land use patterns for the next 20 year will continue in and around Billings at an expected growth rate of 1.5 percent annually. Projected annexations by the City of Billings will be to the south and west in the near term and primarily to the north and southwest in the longer term (through 2025) (Yellowstone County, 2008).

Land Use controls shall identify areas of vulnerability to natural hazards and prohibit new construction or place controls that can mitigate the potential hazard. Floodplains boundaries and regulations are in place are already designated and channel migration zones

Economy: Yellowstone County has one the nation's largest regional trade areas extending over 125,000 square miles and serving almost 400,000 people. Retail trade represents about 14 percent of labor income within the County, second only to manufacturing labor income at 19 percent (BBER, 2009). Major employers include the three oil refineries in the county: ConocoPhillips in Billings, ExxonMobil in Lockwood and the CHS Refinery in Laurel. A Western Sugar Cooperative refinery that manufactures sugar from sugar beet crops is also located in Billings. About 350 Montana farmers supply sugar beets to the refinery, which has a direct impact of $50 million per year on the County's economy (Yellowstone County, 2008).

Billings is also the medical and educational center for the region. The two hospitals employ over 3,400 people and have almost 560 beds. Health care labor income represents about 13 percent of basic industries in the County. Other significant labor industries include: federal government (13 percent), mining (9 percent) transportation (7 percent), and state government and higher education (6 percent) (BBER, 2009).

In 2008, Yellowstone County had a total personal income of $5.6 billion, accounting for 16.6 percent of total income in the state. This represents a 178 percent increase in the $3.1 billion total person income total in 1998 (BEA, 2010). Per capita personal income for Yellowstone County households in 2008 was $38,927, 5th highest county in the state. The 1998-2008 average annual growth rate of per capita personal income was 4.8 percent comparable average annual growth rate for Montana (4.9 percent) but higher than the nation growth rate of 4.0 percent (BEA, 2010).

Population: The 2010 population count of 147,972 represents a 14.4 percent growth from the 2000 census counts. **Table 2** shows the population estimates for each of the incorporated communities within the county and population estimates for the entire county. Growth rates for Billings (15 percent) exceeded the county rate, while Laurel's population grew by 7 percent, and Broadview stayed about the same as the 2000 population census count. **Figure 2** displays the relative density of population throughout the county based on 2000 population census at the census tract level.

Table 2. Census Estimates by Year for Yellowstone County and Incorporated Communities

Total Population	Yellowstone County	Billings	Broadview	Laurel
2010 (Census 2010)	147,972	na	na	na
2009	144,797	105,845	153	6,750
2008	142,602	103,959	152	6,654
2007	140,047	101,798	151	6,539
2006	138,239	100,185	151	6,446
2005	136,493	98,656	150	6,356
2004	134,559	96,894	150	6,361
2003	133,054	95,332	150	6,351
2002	131,771	94,037	150	6,339
2001	130,608	92,916	150	6,330
2000	129,527	91,950	150	6,298
April 1, 2000 (Est. Base)	129,348	91,777	150	6,294
April 1, 2000 (Census 2000)	**129,352**	**89,847**	**150**	**6,255**

US Census, 2010, annual estimates for each year, the 2010 population is actual population count from 2010 census, the city and subdivision level data was not available at the time of writing.
na: not available

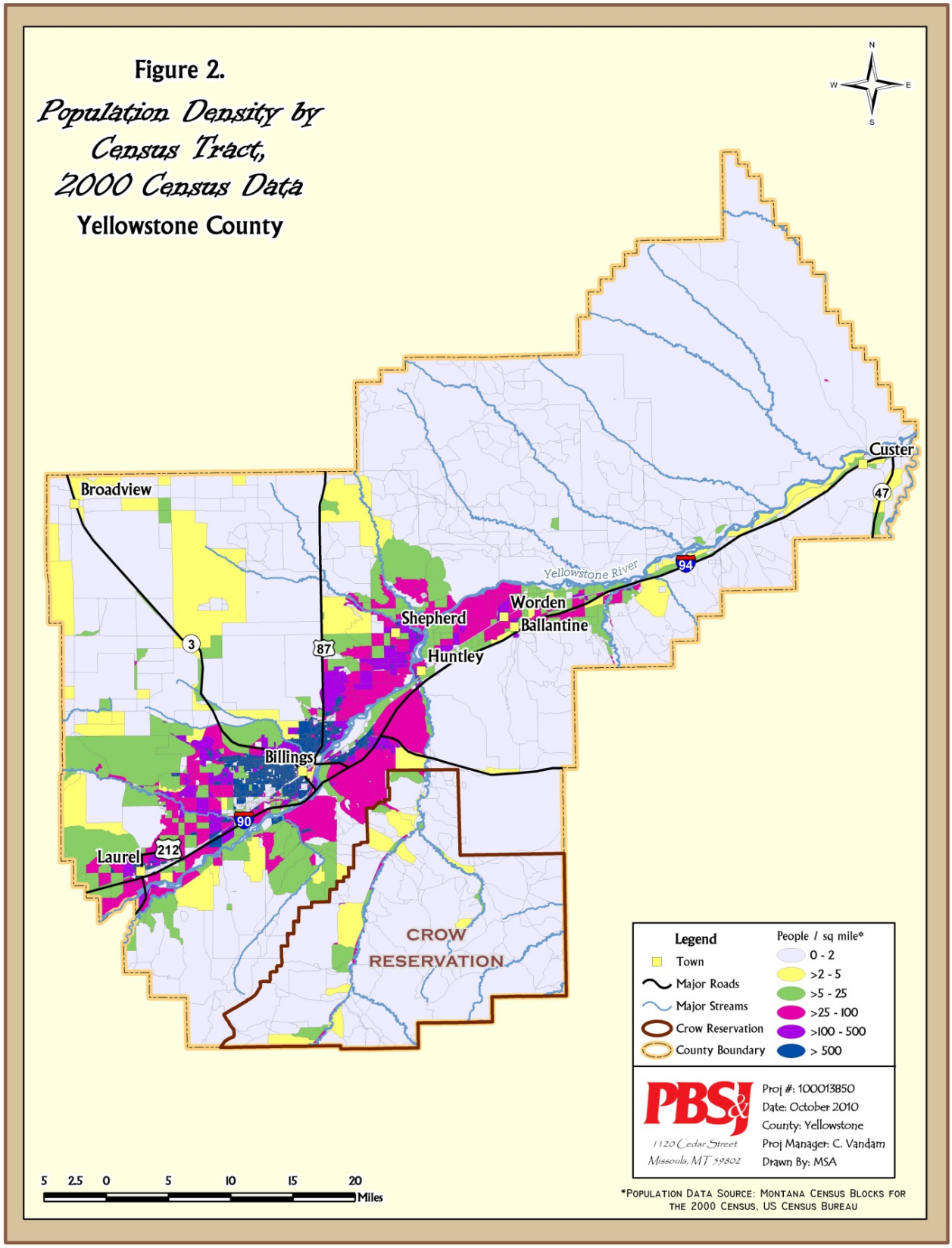

Figure 2. Population Density by Census Tract, 2000 Census Data Yellowstone County

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1.3 Infrastructure and Facilities

Buildings and Improvements

Table 3 provides a snapshot of the built environment throughout Yellowstone County. There is over $10 billion in improvement value and almost $5 billion in property value, based on the Department of Revenue market value of property. The average improvement value will be used to assess potential losses, where property types can be identified within hazard zones, such as floodplains.

Table 3. Improvements and Property Value by Land Type

		Improvement Value			Land Value			Property
Property Type	Properties	Value	Average	% of Total	Value	Average	% of Total	Total $
agricultural	5,724	8,737,602	$1,526	0.09%	96,306,630	$16,825	2.07%	$105,045,958
commercial	5,734	2,409,286,759	$420,176	23.46%	1,197,030,776	$208,760	25.70%	$3,607,061,700
condominium	4,876	660,652,705	$135,491	6.43%	118,577,238	$24,319	2.55%	$779,452,563
exempt	2,768	858,656,078	$310,208	8.36%	711,882,964	$257,183	15.29%	$1,570,849,250
industrial	160	210,315,869	$1,314,474	2.05%	95,082,391	$594,265	2.04%	$308,116,039
residential	47,502	6,039,311,918	$127,138	58.81%	1,949,285,506	$41,036	41.86%	$7,989,291,007
vacant	8,280	4,267,074	$515	0.04%	392,097,342	$47,355	8.42%	$396,365,440
other	459	78,797,979	$171,673	0.77%	96,792,080	$210,876	2.08%	$175,762,862
Totals	**75,503**	**10,270,025,984**	**$136,021**		**4,657,054,927**	**$61,680**		**$14,931,944,818**

Source: MDOR, 2010

Critical Facilities

Critical facilities are of great concern because they provide the immediate services and products that are vital to preserve the well being of the community including public safety, emergency response, and/or disaster recovery actions.

Critical facilities include 911 centers, emergency operations centers, police stations, fire stations, public works facilities, sewer and water facilities, hospitals, roads and bridges, and emergency shelters. Critical facilities also include those facilities that are vital to the continued delivery of community services (such as law enforcement buildings, public services buildings, courthouses and juvenile service buildings), or facilities that house large vulnerable populations (such as jails, nursing homes, primary and secondary schools).

Critical facilities have been mapped to identify whether these facilities could be located with hazard zones (see **Figure 3**). Facilities located within hazard zones are discussed within the Hazard Assessment section of the PDM Update. A list of critical facilities is included in **Appendix D**.

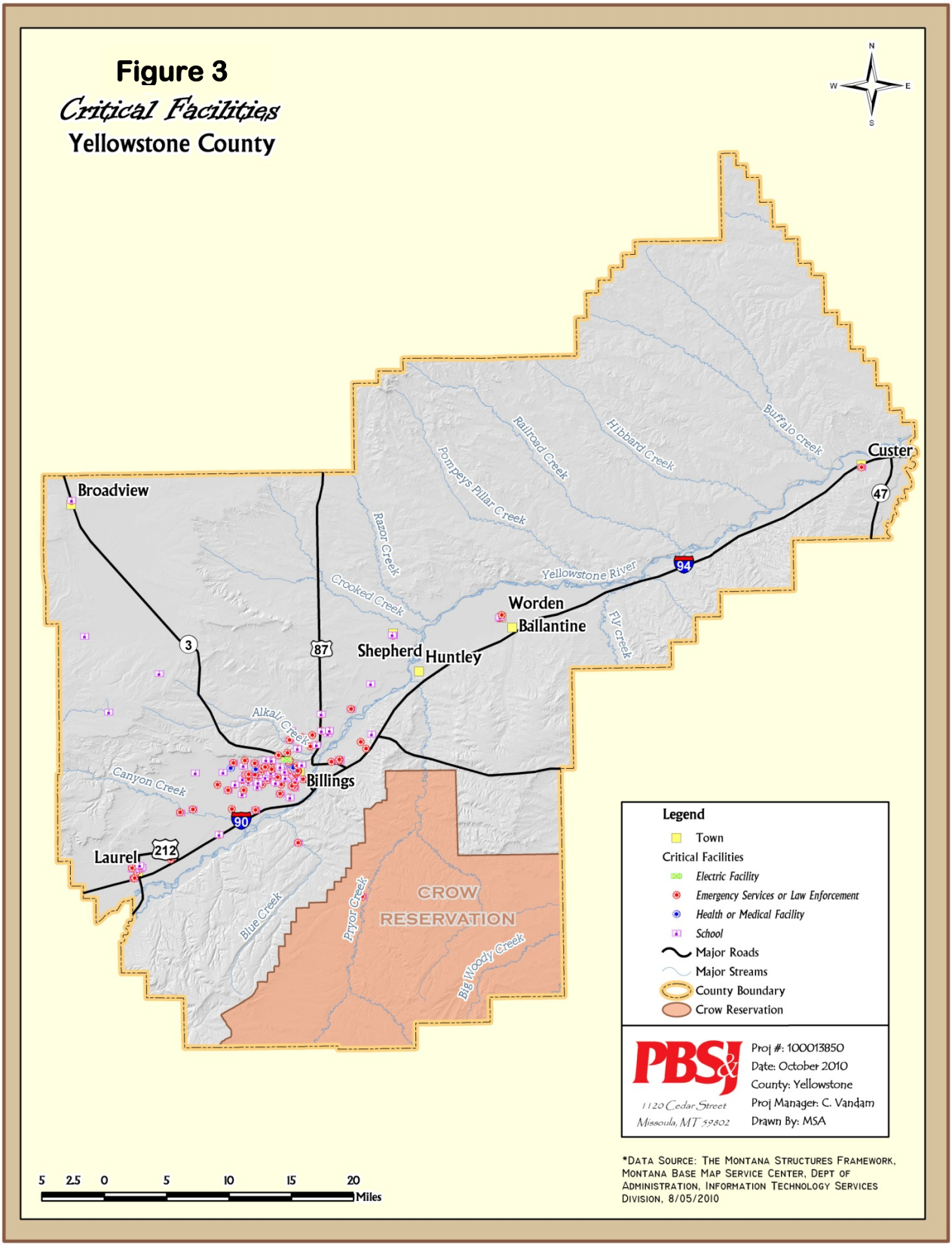

Figure 3. Critical Facilities, Yellowstone County

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1.4 Plan Organization

The Yellowstone County multi-jurisdictional PDM follows the planning guidance requirements and recommendations of the Federal Emergency Management Agency and consists of five major components:

1. Preface/Introduction, FEMA requirement §201.6(c)(5): The executive summary and various preface materials found at the beginning of this PDM document describe the purpose, scope, and authority under which the multi-jurisdictional plan was prepared. The introduction provides an overview of the jurisdictions assessed in the PDM as well as a brief description of each major component of FEMA's mitigation planning guidance requirements. Copies of the signed resolution adopted by each jurisdiction are included, with PDM resolution updates to occur every five years.

2. Planning Process, FEMA requirements §201.6(a)(3), §201.6(b), §201.6(c)(1): This section documents the steps taken to elicit and provide opportunities for multi-jurisdictional public participation (through meetings, planning sessions, web presence, community newspaper articles, etc.), defines participating/contributing individuals and agencies, and includes information on existing plans/reports/studies as well as any updated information sources that were reviewed and incorporated into the PDM (**Appendix D**).

3. Assessments, Vulnerabilities, FEMA requirements §201.6(c)(2)(i and ii), §201.6(c)(2)(ii) (A, B, and C): This portion of the document is comprised of three major areas: the first identifies potential hazards and describes each in terms of magnitude/severity, duration, frequency, probability and extent. The second is an inventory of assets, including structures, critical facilities, population and infrastructure. The third section compares the first two data sets and prior occurrences of hazard events to estimate potential losses. Maps are provided to graphically depict data.

4. Mitigation Strategies, FEMA requirements §201.6(c)(3)(i, ii, iii, and iv): This section describes mitigation goals and objectives developed as part of the planning process and further refined by the assessments and vulnerabilities analysis. Specific actions and projects under consideration are targeted towards reducing the effects of each hazard to existing and new building and infrastructure. A benefits-cost review is conducted to prioritize, implement and administer mitigation strategies, including descriptions for any actions unique to a particular jurisdiction.

5. Maintenance: FEMA requirements §201.6(c)(4)(i, ii, and iii): The Plan Maintenance Section of this document details the formal process that will ensure that the Yellowstone County PDM remains an active and relevant document. This includes a schedule for monitoring and evaluating the PDM annually and producing a plan revision every five years. Yellowstone County is dedicated to involving the public directly in the continual review and updates of the PDM. Copies of the plan will be catalogued and kept at the Billings Public Library, the Yellowstone County Clerk and Recorders Office, and the Yellowstone Disaster and Emergency Services (DES) Office. The plan will also include the address, email address, and phone number of Yellowstone County DES which will be responsible for keeping track of public comments on the plan.

Finally, the plan maintenance section includes an explanation of how Yellowstone County government intends to incorporate the mitigation strategies outlined in this Plan into existing planning mechanisms such as the County Comprehensive Land Use Plan, Capital Improvement Plans, and Building Codes.

Other Documentation: In addition to the five major pre-disaster mitigation planning components described above, numerous tables, figures and appendices are included to provide supporting documentation for the planning process, such as prior resolutions, planning participation, meeting notes, related plans reviewed by the task force in preparation of this document, and a glossary of terms. Maps are provided in the flow of text to facilitate easy understanding of each hazard, variously illustrating features such as the location of potential higher risk areas, population density, etc.

2.0 MULTI-JURISDICTIONAL PLANNING PROCESS AND PUBLIC INVOLVEMENT

2.1 Documentation of Planning Process

Pre-Disaster Mitigation Planning is an ongoing and collaborative process, with the various stages of planning operating concurrently. At any given time, planning to plan, risk analysis, updating the situation assessment, research, coordinating, disaster response or other activity is occurring. Documentation of the process provides a clearer guide to successful planning and future plan updates, offering Yellowstone County a consolidated review of mitigation measures that have been successfully implemented over time, as well as updating or reworking those mitigation strategies that may require modification.

The planning process initiated in 2004 consisted of a core team of individuals working on development of the plan. The core team collaborative effort included local, state, and federal agency representatives, as well as community representatives, local business leaders, and educators. In addition to the core team preparing the plan, residents, businesses, and other interested parties were kept apprised of the progress through open public meetings and the Yellowstone County Pre-Disaster Mitigation website. The 2004 PDM Plan established the foundation for pre disaster mitigation planning within the county.

The PDM Plan was reviewed at least once per year. The Plan is discussed in LEPC meetings provide an opportunity to discuss the progress of the action items and maintain the partnerships that are essential for the sustainability of the mitigation plan. Yellowstone County addresses statewide planning goals and legislative requirements through its Comprehensive Land Use Plan, Capital Improvement Plans, and Montana Building Codes. The Pre-Disaster Mitigation Plan provides a series of recommendations that are closely related to the goals and objectives of these existing planning programs.

The planning process continued between 2004 and 2010, and consisted of annual reviews of the PDM by members of the LEPC to determine the effectiveness of programs, and to reflect changes in land development or programs that may affect mitigation priorities. The evaluation process included a schedule and timeline, and identified the local agencies and organization participating in the plan evaluation. In 2009, Yellowstone County received grant funding to update the PDM Plan and selected Atkins to complete the Plan Update in 2010. Through the Yellowstone County LEPC, a PDM task force was established to assist Atkins in the development of risk assessment and mitigation strategies in the Plan. In the summer of 2010, an LEPC task force (members listed in **Section 1.2**) held meetings with a planning consultant (Atkins) to review the 2004 PDM in anticipation of the 2011 update process. Available meeting notes are provided in **Appendix C**.

Federal Emergency Mitigation Agency guidance documents were collected and reviewed by the consultant, and updated population, structural, infrastructure and hazard events datasets were collected and revised maps were prepared for integration into the 2011 Yellowstone County PDM update. FEMA crosswalk recommendations from the 2004 PDM were also reviewed and incorporated. Several new studies and news of recent hazard-related events) were collected, reviewed and incorporated into the PDM update.

The LEPC task force participants held a teleconference in October 2010 to discuss loss estimation methodologies and additional data collection sources. The LEPC task force reviewed results of the risk assessment portion of the updated draft plan in November 2010. A draft PDM Plan was prepared in

January 2011 and reviewed by the Task Force and the LEPC. Following advertised notices, the draft final PDM Update was presented in public input sessions in communities of Billings, Laurel and Broadview. After incorporating the input from the jurisdictional meetings and public participation, the LEPC task force will then review the preliminary update of the 2011 PDM before forwarding it on to FEMA's State Hazard Mitigation Officer (SHMO) for review.

2011 Plan Development Participation: Atkins held meetings with the task force members of the Yellowstone County LEPC (see task force participants list, **Section 1.2**), to open a dialogue with those involved with disaster and emergency services, government officials, first responders, neighboring communities and counties, collaborating agencies, nonprofit organizations, private sector, and individuals. Areas addressed by the 2010 plan development update process included the following:

- Evaluate potential natural and manmade disasters in Yellowstone County and its jurisdictions to include a revised hazard assessment,
- Recommend and prioritize hazard mitigation measures,
- Determine necessary updates to the existing Yellowstone County Pre-Disaster Mitigation Plan,
- Incorporate all suggestions from FEMA's Plan Crosswalk, make consistent with the Montana Multi-Hazard Mitigation Planning Guidance, and incorporate all new FEMA requirements for PDMs,
- Follow any requirements of the Local Multi-Hazard Mitigation Planning Guidance,
- Incorporate the West Billings flood control, stormwater and groundwater recharge measures into the plan as a component of the plan document.

Atkins, in cooperation with the City-County Planning Division, Yellowstone County LEPC, and the LEPC task force participants, shall develop a schedule for hosting and completing the community input sessions throughout the planning process. Atkins will schedule, advertise and conduct all public meetings necessary to complete the plan revisions.

2.2 Public Involvement

The Draft PDM Update was presented in three public meetings located in each jurisdiction covered by the plan. These meetings were publicized through local newspapers and on the Yellowstone County web site to encourage participation. In each meeting, displays were set up that showed the results of the risk assessment and estimated annualized losses from high priority hazards. Atkins presented the results of the risk assessment and identified the proposed mitigation plan. Participants were encouraged to ask questions and offer suggestions for mitigating potential disasters. Public comment cards were distributed to all meeting participants and were encouraged to write down comments or suggestions. In addition, Yellowstone County posted the PDM update on the County's website and offered means for the public to comment electronically through the website.

The Public Meetings were held in the following locations:

- Billings Community Center, Tuesday February 1, 2011, 7:00-9:00
- Laurel School District Administration Building, Wednesday February 2, 2011, 7:00-8:00
- Broadview Community Center, Thursday February 3, 2011, 7:00-8:00

3.0 MULTI-JURISDICTIONAL HAZARD RISK ASSESSMENT

In accordance with §201.6(c)(2) of the Rule a risk-based assessment was conducted to evaluate local risks to vulnerable populations and also examine the risk presented by natural and manmade hazards. The risk assessment includes a detailed description of each hazard that could affect Yellowstone County and its jurisdictions along with an analysis of the vulnerability to the hazard. Hazards that were identified as unique to a particular jurisdiction are also addressed. The goal of the risk assessment process is to determine which hazards present the greatest risk and what areas are cumulatively the most vulnerable to hazards.

3.1 Hazard Profile: Historic Occurrence, Risks, Estimated Losses

The hazard risk assessment requires collecting and analyzing information about what hazards have historically impacted the community and what hazards may present risks in the future. Identifying historical and possible future hazards was accomplished through interviewing local officials, local emergency planning and response staff, the general public, researching historical data, and FEMA/GIS-based datasets and mapping.

Damage and casualties, in both location and severity, will vary between hazards. Hazards were identified and profiled through several different means. A history of past events and their impacts was compiled to assess the potential for future events. Where possible, hazard zones are mapped to demonstrate specific areas where risks are greatest. Where loss data or forecast models are available, loss estimates are calculated. These losses have been adjusted to an annual average, or annualized loss, to be able to make relative comparisons of economic impact of the hazards. The loss estimates are crude numbers and the intent is to make relative comparisons between hazards rather than identifying precise annual cost from the hazard.

The hazards considered in the Plan Update, the background sources for past occurrences and damage, along with loss estimation methodology is shown in **Table 4.** The PDM Task Force concluded there were no new additions to the list of potential hazards.

Table 4. Potential Hazards, Rank, Data Sources, Methods

Hazard Type	Hazard Event	Data Sources	Location Specific	Loss Estimation Methods
WATER	Flooding	*Preliminary Flood Insurance Study (FEMA)2010*	*yes*	*Structures within 100-year or mapped flood prone zones, FEMA Loss Estimation Models*
	Dam Failure	*2004 PDM Plan/Dept Natural Resources & Conservation (DNRC)*	*yes*	*Not Assessed*
WILDFIRE	Wildfire	*Community Wildfire Protection Plan*	*yes*	*Structures within medium and high treatment areas*
WEATHER	Wind and Hail Storm	*Spatial Hazard Events & Losses Database (SHELDUS)*	*county*	*SHELDUS Storm Event Data*
	Tornado	*SHELDUS*	*county*	*SHELDUS Storm Event Data*
	Winter Storm	*SHELDUS*	*county*	*SHELDUS Storm Event Data*
	Drought/ Insect Infestation	*Montana DNRC*	*county*	*Not Assessed*
GEOLOGIC	Expansive Soil	*Montana Bureau of Mines & Geology (MBMG)*	*yes*	*Not Assessed*
	Landslide	*MBMG*	*yes*	*Not Assessed*
	Earthquake	*HAZUS*	*county*	*HAZUS Simulation Model*
	Volcanic Ash	*US Geological Survey (USGS)*	*county*	*Not Assessed*
MANMADE	Urban Fire	*2004 PDM Plan*	*county*	*Not Assessed*
	Transportation/ Mobile Incident	*US Department of Transportation (USDOT)*	*county*	*Not Assessed*
	Hazardous Materials Incident/ Accident-Fixed	*US Environmental Protection Agency (EPA) Triexplor Database*	*county*	*Not Assessed*
	Terrorism/ Bio-Terrorism	*2004 PDM Plan*	*county*	*Not Assessed*
	Civil Disturbance/ Riot/Labor Unrest	*2004 PDM Plan*	*county*	*Not Assessed*
	Enemy Attack	*2004 PDM Plan*	*county*	*Not Assessed*

3.1.1 Flooding: Regional, Flash, Ice Jams

Flooding is an overflow of water onto land that is normally dry and is a natural event for rivers and streams. Excess water from snowmelt and/or rainfall can accumulate and overflow the riverbanks onto adjacent floodplains. Floods are the result of a multitude of naturally occurring and human-induced factors, but they all can be defined as the accumulation of too much water in too little time in a specific area.

Floodplains are lowlands, adjacent to rivers, streams and lakes. Typically dry, floodplains are the defined areas that are covered with water during flood events and are subject to recurring floods. Floodplains are cited based on the probability an area can be flooded, such as the 100-year floodplain

refers to the 1 percent chance each year an area along a stream or river can be flooded. Where mapped, the 100-year floodplain is often regulated prohibiting or conditioning the type of development that can be built within the 100-year floodplain. Buildings or other structures placed in these 100-year floodplains have a 1 percent or greater potential to be damaged by floods each year. Development in the floodplain can also change the pattern of water flow and increase flooding and flood damage on adjacent property by blocking the flow of water and increasing the width, depth, or velocity of flood waters (Source: FEMA, 2003).

During the 20th century, floods were the number-one natural disaster in the United States in terms of the number of lives lost and property damage. They can occur at any time of the year, in any part of the country, and at any time of the day or night (USGS, 2000). As much as 90 percent of the damage related to all natural disasters (excluding drought) is caused by floods and associated debris flows. From 1992 to 2001**,** floods cost the nation, on average, more than $4.1 billion annually. Between 1972 and 2001, on average, 127 people a year were killed by floods (mostly by flash floods) (NDEC, 2010).

Most injuries and deaths occur when people are swept away by flood currents and most property damage results from inundation by sediment-laden water. Faster moving floodwater can wash buildings off their foundations and sweep vehicles downstream. Pipelines, bridges, and other infrastructure can be damaged when high water combines with flood debris. Basement flooding can cause extensive damage.

Types of floods include regional floods, flash floods, ice-jam floods, storm-surge floods, dam- and levee-failure floods (see **Section 3.1.8**), and landslides (see **Section 3.1.10**) including debris and mudflow floods. The following descriptions of flood types were provided by the USGS (2000).

Regional Floods: Some regional floods occur seasonally when winter or spring rains coupled with melting snow fill river basins with too much water too quickly. Two key contributing factors are rainfall intensity and duration; topography, soil conditions and ground cover also play important roles. Urban development and frozen ground can reduce infiltration into the soil and thereby increasing runoff. Extended wet periods during any part of the year can create saturated soil conditions, after which any additional rain runs off into streams and rivers, until river capacities are exceeded.

Flash Floods: Flash floods can occur within several seconds to several hours, with little warning. Flash floods can be deadly because they produce rapid rises in water levels and have devastating flow velocities. A flash flood generally results from a torrential (short duration) rain or cloudburst on a relatively small drainage area. Chinook winds, warm dry winds that can gust to 100 mph and that are typical to the area, often lead to the rapid melting of snow and cause flooding.

Ice Jam Floods: Ice-jam floods occur on rivers that are totally or partially frozen. A rise in stream stage will break up a frozen river and create ice flows that can pile up on channel obstructions such as shallow riffles, log jams, or bridge piers. The jammed ice creates a dam across the channel over which the water and ice mixture continues to flow. This allows more jamming to occur, causing backwater upstream from the ice dam to rise and overflow the channel banks. Flooding moves downstream when the ice dam fails, and the water stored behind the dam is released. At this time the flood takes on the characteristics of a flash flood, with the added danger of ice floes that, when driven by the energy of the flood wave, can inflict major damage on structures. An additional danger of being caught in an ice-jam flood is hypothermia, which can cause death.

History of Flood Events: Yellowstone County has experienced major flooding of the Yellowstone River in 1918, 1943, 1944, 1967, 1974, 1975, 1991, 1996 and 1997 with total damages totaling conservatively $25,000,000 during that period. Community impact due to flooding is typically widespread, affecting large areas. Major floods of record occurred on Alkali Creek, Canyon Creek, and Cove Creek in 1937 and 1923. Blue Creek and Pryor Creek flooded severely in 1978. The 1978 and 1997 flood events were declared Presidential disasters. Yellowstone County historic flood events are profiled in **Table 5** with short descriptions of events from available information.

Table 5. Summary of Yellowstone County Historic Flood Events

Date	Hazard Type	Location	Hazard Event Description: Severity/Damages, Costs
June 1918	Flooding	Yellowstone River	Yellowstone River peak flow of 80,000 cfs.
June 11-12, 1937	Flooding	Billings	Flooding-hail-rainfall (2.78") event covered 60% of the City of Billings. One life lost, 300 people homeless, 2664 homes damaged, $3 million cost ($45m in 2010 $), $50,000 worth of records lost in Federal building, 8,000 acres of cropland lost at a cost of $250,000, $150,000 in road damage, $200,000 in damage to fairgrounds, irrigation ditch damage at $100,000 due to Billings Bench Water Association (BBWA) canal break by Highlands Golf Course, and BBWA flume broke at Alkali Creek. The population of Billings was 20,000 at the time.
August 22, 1965	Flooding	Laurel	Rain, hail, flooding in Laurel. Water from a cloudburst broke irrigation ditches above Laurel. Costs included $113, 000 damage to business district, $56,000 damage to streets, $106,000 damage to residential areas, with total damage of $274,750. Rural area damage was $55,000. ($2.3m in 2010$)
June 16, 1974	Flooding	County Wide	Flood Yellowstone River. $20,000 road damage, 50 farms and 2640 acres of crop damage, six homes flooded, $1.1 million total loss ($4.9m in 2010$), emergency declaration by county disaster committee. Peak flow for the Yellowstone River at Billings on June 19 = 69,500 cfs.
June 14, 1975	Flooding	Along River	Flooding Yellowstone River. Peak flow for the Yellowstone River at Billings on July 7 = 67,600 cfs.
May 1978	Flooding	County Wide	Flooding, tributaries of Yellowstone River. Over 7" rain fell in Yellowstone and Big Horn Counties. County, State, and Federal Disaster declaration (FDAA-558-DR-3). 62 public projects including 8 bridges over Blue Creek and Pryor Creek washed out. Total cost $1.445 million: $1.274 million reimbursed by federal government, total county cost was $181,000 (total $9.7m in 2010$). Agricultural damage and private damage not included in cost. Several Blue Creek subdivisions flooded. Peak flow for the Yellowstone River at Billings on May 19 = 50,200 cfs.
June 17 & 21, 1991	Flash Flood	County Wide	Flash Flooding. Flooding between Billings and Roundup on HWY 87 North. County bridge washed out on Razor Creek. 1 death—woman in vehicle was washed away. Water poured off rims and homes below; Zimmerman Trail flooded, had rockslides. Basements in West Billings flooded. $200,000 estimated damage to homes/businesses, $41,000 damage to crops. ($387K in 2010$)
January 2-3, 1997	Urban/Small Stream	Worden	Flooding due to ice jams, Yellowstone River. Quick Chinook melted ice and caused ice to break, causing jams and flooding. Several farmsteads in Worden and residences in the Blue Creek areas

Table 5. Summary of Yellowstone County Historic Flood Events

Date	Hazard Type	Location	Hazard Event Description: Severity/Damages, Costs
			received damage. City County drain in south Billings backed up from the river causing minor flooding.
01/03/97	Flash Flood	Billings	No information available
02/02/97	Urban/Small Stream	Laurel	No information available
June 6-12, 1997	Flood-Yellowstone River	County Wide	Flooding on Yellowstone River and Clarks Fork due to heavy snowpack and rains. County, State, and Federal Disaster declaration (FEMA 1183-DR-MT) for all counties along river drainage. $1.4 million in damage: $388,000 public damage, $1 million in irrigation head gate system damage. Huntley dike damaged. River was 2 feet over flood stage (100-year flood) and prior protection (diking) was given to the water plant in Laurel and Lockwood. Storm on June 10 dropped 3" rain flooding a south side Billings subdivision (Kings Green). On July 20th, another 1.6" rain caused $170, 000 in county road damage including Zimmerman Trail. Airport closed; 60 mph winds and hail recorded. Sixth Street underpass flooded. County resolution 97-39 on July 29, 1997. Total expenses for the 1997 flooding were $2,213,982 ($3m in 2010). Peak flow for the Yellowstone River at Billings on June 12 = 82,000 cfs.
07/08/97	Flood-Yellowstone River	County Wide	Two and a half feet of water near Metra Park at intersection of main and first streets. No recorded losses (NCDC).
07/30/98	Urban/Small Stream	Billings	A strong thunderstorm produced street flooding on 14th street between Lewis and Clark. No recorded losses (NCDC).
07/31/98	Urban/Small Stream	Billings	Street flooding was reported throughout Billings. Several underpasses were flooded and about a dozen manhole covers were flooded off. No recorded losses (NCDC).
10/02/98	Urban/Small Stream	Billings	Localized street flooding was reported in downtown Billings between 30th and 27th streets on Montana Avenue and between 1st and 2nd streets on 27th avenue. No recorded losses (NCDC).
07/04/04	Urban/Small Stream	Billings	Street flooding was observed in downtown Billings with the 6th street underpass flooded overnight. Heavy rain caused rock slides along the Rimrocks and some basements were also flooded. 1.2 to 1.8 inches of rain fell across Billings on the evening of July 4th. No recorded losses (NCDC).
07/07/07	Urban/Small Stream	Billings Laurel	Two thunderstorm complexes moved across portions of South Central Montana during the early and late evening hours of the 7th. The hardest hit areas were Billings and Laurel where street flooding along with very strong winds were reported. No recorded losses (NCDC).

Participation in the Flood Insurance Program: Yellowstone County, the City of Billings, and the City of Laurel all participate in the National Flood Insurance Program (NFIP). The town of Broadview does not have a FEMA regulatory floodplain within its boundaries and therefore does not participate. **Table 6** shows the NFIP claims filed since the effective status of the program November, 1981. Since 1981 there have been 107 NFIP claims for flood damage, three of the claims have been for repetitive losses (DNRC, 2010a).

Table 6. National Flood Insurance Claims

NFIP Participants	Policies	Insured Amount	Claims/(Repetitive)	Losses Paid
Yellowstone County	136	$30,070,300	56 / (3)	$314,036
City of Billings	72	$16,615,500	39 / (0)	$199,163
City of Laurel	9	$1,616,000	10 / (0)	$97,490
Totals	**217**	**$48,301,800.00**	**107 / (3)**	**$610,689.00**

Mapped Floodplains and Flood Prone Areas

FEMA's Flood Insurance Rate Maps (FIRM) identify where there is a 1 percent occurrence of flooding (100-year floodplain) to impact property relative to a locale's major rivers and streams. Within Yellowstone County, the 100-year floodplain is mapped on the following rivers/streams:

Alkali Creek	Duck Creek Tributary
Blue Creek	Fivemile Creek
Canyon Creek	Italian Ditch
Clarks Fork Yellowstone River	Main Street Overflow
Cove Creek	Nutting Ditch
Dry Creek	West Main Street Overflow
Duck Creek	Yellowstone River

Source: Preliminary National Flood Insurance Study Yellowstone County (FEMA, 2010)

The probability of future flooding in Yellowstone County and its jurisdictions is very high. While most of the affected area is non-developed farm and ranch land, the communities of Laurel and Billings have experienced most of the damage to buildings and infrastructure. As the urban area expands more structures are built in areas potentially susceptible to flooding, reducing permeable land surface and further exacerbating stormwater runoff.

Yellowstone County, the City of Billings and the City of Laurel have completed preliminary Digital Flood Insurance Rate Maps (DFIRMs) for these communities. The DFIRMs were completed to update the flood hazard areas and to continue compliance with the NFIP. The 2010 Preliminary Flood Insurance Study identifies the following susceptible areas:

- Yellowstone River and Clarks Fork of the Yellowstone related to development within the floodplain and uncertified levees throughout the river's floodplain,
- Cove Creek and Little Cove Creek in West Billings, due to undefined flood channels and intersecting irrigation and drain ditches,
- Italian Ditch and Main Street in Laurel due to intersecting ditches and undersized culverts and crossings for roadways.

The weather patterns in the region suggest a continued propensity toward receiving large amounts of moisture over short periods of time, and rapid snow melt resulting from dramatic temperature changes. With the Yellowstone River running through Yellowstone County and the large number of smaller tributary streams feeding into the Yellowstone River, future flooding events will be inevitable.

Critical Facilities in Floodplain: Below is the list of critical facilities that are mapped within the 100-year floodplain or flood prone zones within the County:

- Emergency Shelter/School: Blue Creek School
- Airport: Wilcox (private, turf)
- Emergency Shelter: 48th Street Church of Christ
- Fire: Billings Fire Department Station 7

Figure 4 displays the FEMA mapped floodplain areas. **Figure 5** displays the flood prone zones in the Cove Creek and Little Cove Creek area.

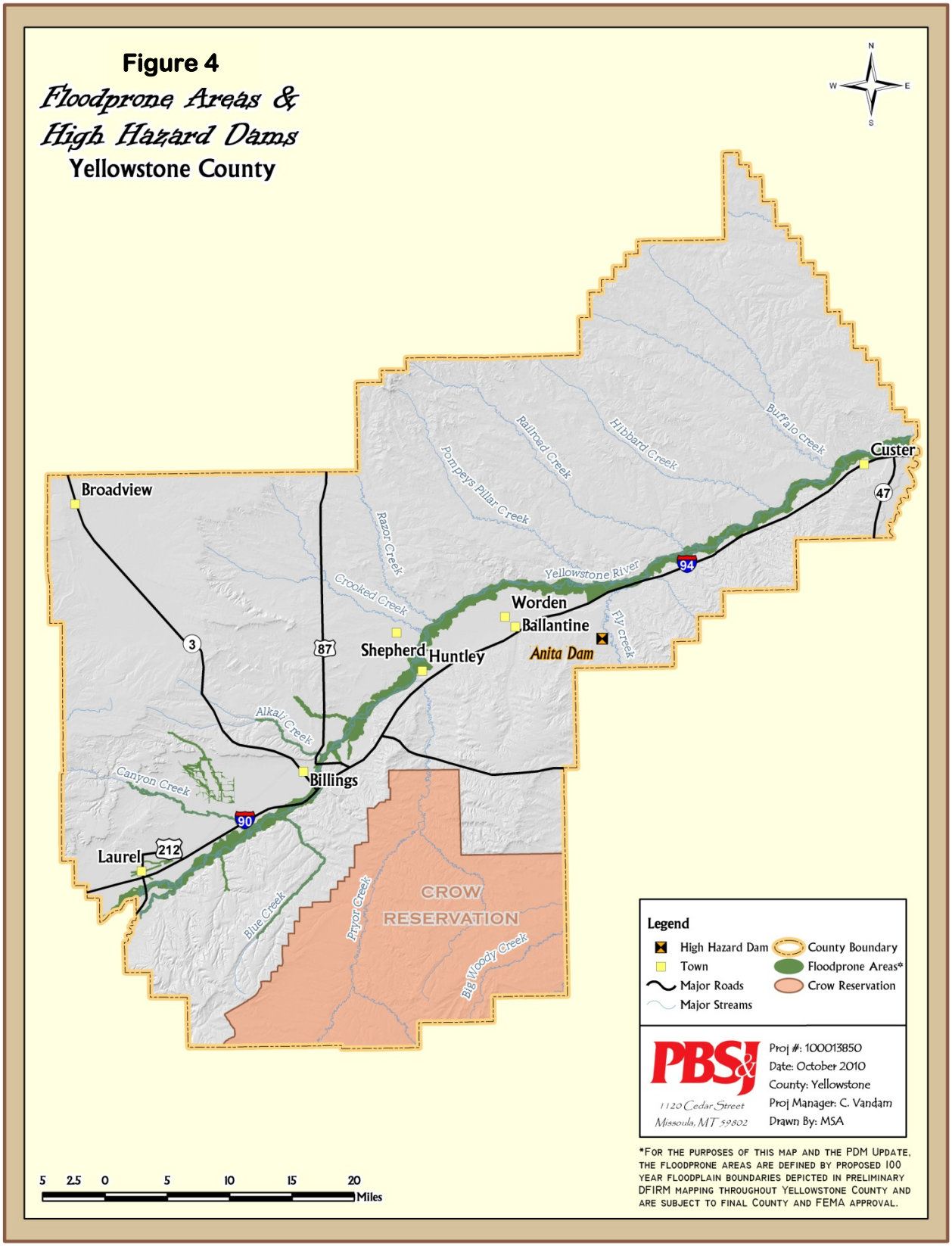

Figure 4. Flood Prone Areas and High-Hazard Dams, Yellowstone County

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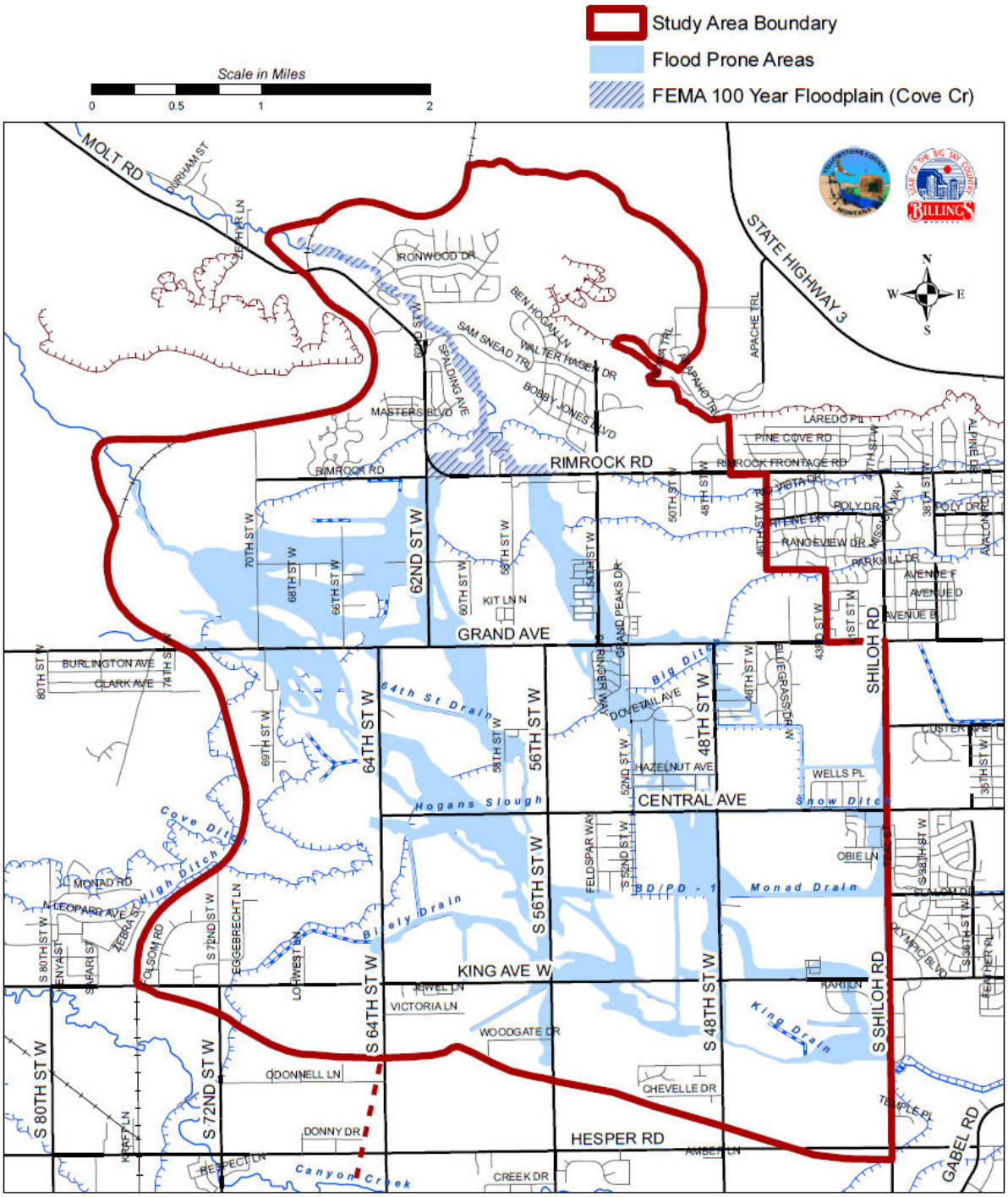

Figure 5. Flood Prone Areas in the West Billings Study Area

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Estimated Future Losses

The sum of the documented flooding losses shown in **Table 7** exceeds $65 million. Even though these losses are adjusted to 2010 dollars, these losses underestimate the potential loss if a 100-year flood event were to occur today. The urban area footprint has expanded, development has occurred within flood prone zones, and Billings has five times the population in 2010 as it did during the 1937 floods. The NFIP has $48m in property insured under that program, but a 1 percent flood event is expected to exceed the insured value of these properties and may exceed the cumulative losses from flooding to date.

Losses from flooding were estimated by counting parcels within the 100-year floodplain or mapped flood prone area on the Yellowstone River and select tributaries of the Yellowstone (see **Figure 5**). The boundaries for floodplain and flood prone zones were taken from draft DFIRMs for Yellowstone County and mapped flood prone zones in the West Billings area (PBS&J 2007). The flood prone areas were related to the State of Montana's Structures database that identifies locations of structures and type of structures. These points within the flood prone zones were assumed to be exposed to floodwaters in the event of a 100-year flood.

Table 7 shows the number of property types at risk to flooding and estimated losses. The loss estimate was based on FEMA guidance for losses in the event of a flood and an average of 3 feet of water inside structures. Total exposed value of property (both public and private) is $172million, with estimated damages of $116m from a 1 percent flood event. Assuming the flood event occurs once every 100 years, the annualized losses $1.12m.

Table 7. Number of Property Types at Risk to Flooding and Estimated Losses

Property Type	# Properties in 100-year floodplain	Average Improvement Value by Type	Value of Improvements in Floodplain	Estimated Structural Loss[1]	Estimated Content Loss[2]	Total Estimated Loss
Residential	1003	127,138	127,519,414	34,430,242	51,645,363	86,075,604
Commercial/ Industrial	100	420,176	42,017,600	11,344,752	17,017,128	28,361,880
Exempt Properties	3	930,624	2,791,872	753,805	1,130,708	1,884,514
Total	**1,106**		**172,328,886**	**46,528,799**	**69,793,199**	**116,321,998**
Annualized Loss Estimate at 1% interval				**465,288**	**697,932**	**1,116,322**

[1] Estimated at 27% of Improvement Value Residential & Commercial Uses
[2] Estimated at 40.5% of Improvement Value Residential & Commercial Uses

3.1.2 Wildfire

Yellowstone County adopted a Community Wildfire Protection Plan (CWPP) in January 2005 (amended in February 2006) to identify the hazards and risks from wildfire and make recommendations for mitigation of wildfire hazards. The CWPP was prepared in response to the Healthy Forest Restoration Act (HFRA) in 2003 allowing the County to prioritize and receive federal assistance for fuel reduction projects within designated Wildland Urban Interface (WUI) zones. The CWPP is a more thorough and detailed analysis of the risks from wildfire and identifies where fuel reduction, on both private and public lands, could best mitigate impacts from wildland fires. This Plan Update incorporates the hazard/risk analysis and recommended mitigation plan from the CWPP by reference.

Community impact due to wildfire can vary greatly on the location of the event. Yellowstone County has very diverse terrain; some areas with sparse vegetation and others with an abundance of trees, scrub pine, and wild grasses. Wildfires impact farm and ranch land, livestock, structures, individuals and utilities.

Whether natural or human-influenced, wildfire is a raging, rapidly spreading fire. Wildland fires often begin unnoticed, and can spread quickly igniting grass, brush/scrub, trees and homes. Severe wildfire conditions have historically represented a threat of potential destruction within Montana. Negative impacts of wildfire include loss of life, property and resource damage or destruction, severe emotional crisis, widespread economic impact, disrupted and fiscally impacted government services, and environmental degradation.

Lightning can present particularly difficult problems when dry thunderstorms move across an area suffering from seasonal drought. In northeast Montana, the railroad is a relatively common ignition source of wildfires. Multiple fires can be started simultaneously, as is often the case in Montana. In dry fuel areas, these fires can cause massive damage before containment. Dry grass, associated with farmland in CRP, is the primary fuel for Montana wildfires. The rate of spread of a fire varies directly with wind speed.

Because we live in wildfire dominant environments, wildfires are common occurrences and occur each year in various forms of severity. Drought and weather often combine to produce conditions that create sever wildfire events in which structures are threatened and lost. Some of the more significant fires events are presented below:

- August/September, 1984: **Hawk Creek Fire** in Northern Yellowstone County and Musselshell County burned 145,000 acres of range and timberland and destroyed 44 homes. The fires were related to extreme drought conditions throughout the county. County disaster declaration August 28, 1984, followed by a State declaration and a Federal agricultural designation (for rancher assistance only). County response cost $51,000, City $1,800.

- July, 2006: The **Pine Ridge Complex** and **Bundy Railroad Fire** ignited in July and together burned over 230,000 acres in eastern Yellowstone and extreme northern Big Horn Counties. These fires spread rapidly due to strong thunderstorm winds on July 12th. The Bundy Railroad Fire affected areas north of Pompey's Pillar, whereas the Pine Ridge Complex burned nearby south of Interstate 94. The **Emerald Hills Fire** in Lockwood burned 3800 acres in August, threatening several homes and causing evacuations.

Mapped Wildfire Hazard Areas

With more people choosing to build in woodland settings, forests, and remote mountain sites, increasing numbers of people are occupying areas prone to wildland fires, otherwise known as the Wildland Urban Interface (WUI). WUI's are defined as the zone where structures and other human development are in close proximity to undeveloped wildland or vegetative fuel. The Yellowstone County CWPP defines the WUI by four conditions: interface condition where high density development abuts wildland fuels; intermix condition where wildland fuels are scattered amongst and around low to high density development; occluded conditions where small islands of wildland fuels are located within developments, and rural conditions where very low densities exist (ranches, resorts) within an area of wildland fuels (YCCWPPC, 2006). **Figure 6** depicts the mapped WUIs within Yellowstone County.

Figure 7 depicts proposed treatment areas within WUIs where for community projects and Bureau of Land Management fuel treatments. The CWPP is the result of analyses, professional cooperation and collaboration, assessments of wildfire risks and other factors considered with the intent to reduce the potential for wildfires to threaten people, structures, infrastructure, and unique ecosystems in Yellowstone County, Montana. This multi-jurisdictional 2010 PDM update was prepared to be compatible with the 2006 Wildfire Plan and its recommendations for mitigation projects and implementation strategies. A copy of the 2006 Wildfire Plan Executive Summary can be found in **Appendix B**.

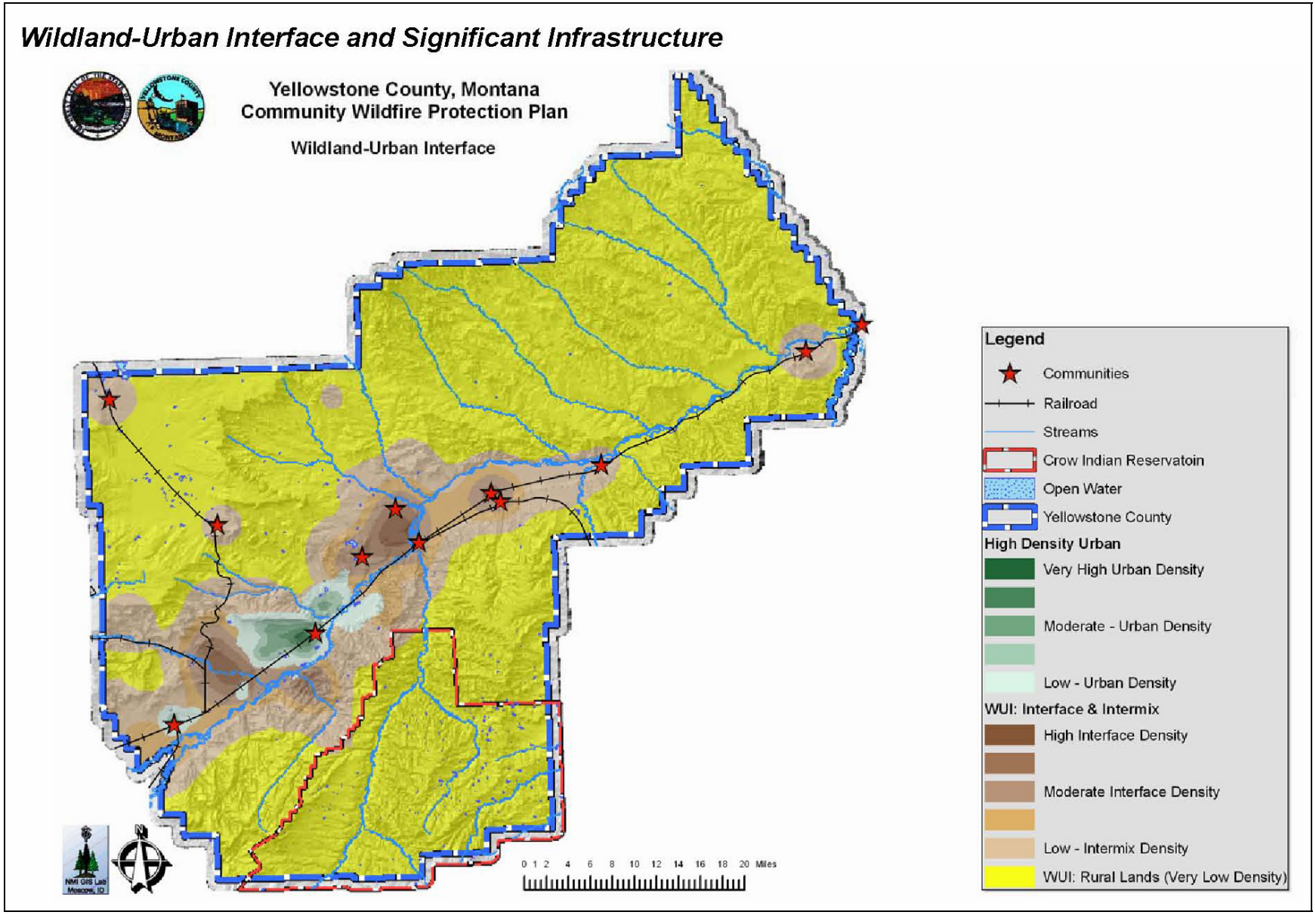

Figure 6. Wildland-Urban Interface and Significant Infrastructure

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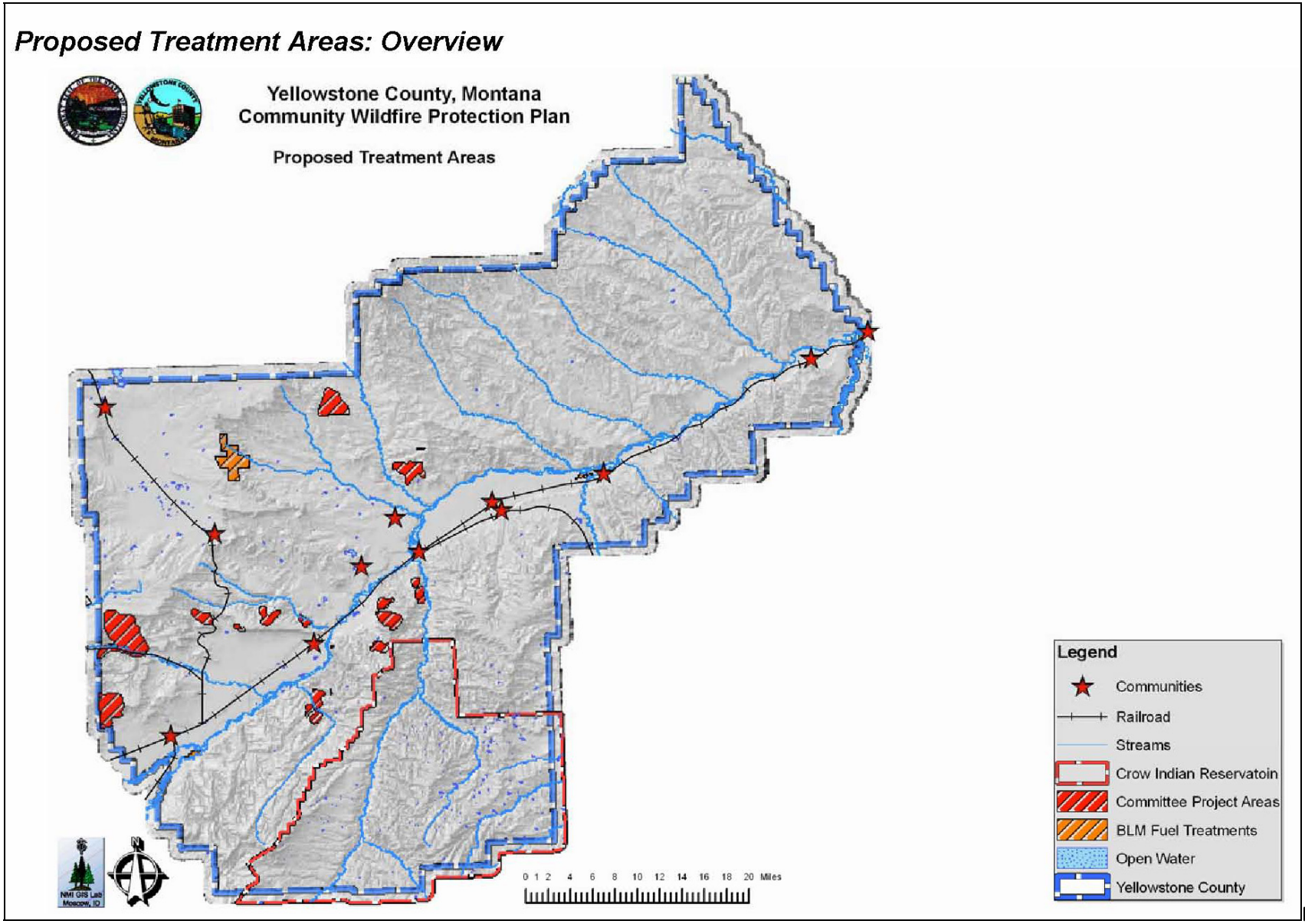

Figure 7. Yellowstone County Proposed Treatment Areas

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Estimated Future Losses

The CWPP identifies areas of high and moderate risk to wildfires. Most are concentrated residential development located in areas of high fuels. The CWPP makes recommendation for fuel treatment and protecting structures with a defensible space. A list of the areas and number of residences identified in the 2006 CWPP is shown on **Table 8** (YCCWPPC, 2006). The average value of a residential structure is taken from **Table 8**. The content is estimated to be equivalent to the structure value; therefore a loss to wildfire is estimated to be two times the average structure value ($254,276).

Total exposed value of structures and content is $274 million. Assuming that in an extreme fire year, there may be 4 percent of the structures burned, resulting in an estimated loss of 44 structures (similar to the Hawk Fire) or $2.7 million. Whiles fires occur every year, a severe fire resulting in structure loss is estimated to occur once every 20 years.

Table 8. Proposed Treatment Areas Yellowstone CWPP

Areas	Residential Structures	Project Priority	Ave Structure & Content Value	Total Value
Rehberg Ranch	92	H	$254,276	$23,393,392
Clapper Flats	55	M	$254,276	$13,985,180
Alkali Creek	245	H	$254,276	$62,297,620
Hills Estates	13	M	$254,276	$3,305,588
Buffalo Trails	138	M	$254,276	$35,090,088
Indian Cliffs	100	H	$254,276	$25,427,600
Pleasant Hollow	86	M	$254,276	$21,867,736
Cedar Ridge	47	M	$254,276	$11,950,972
White Buffalo	22	M	$254,276	$5,594,072
High Trails	25	M	$254,276	$6,356,900
Emerald Hills	234	H	$254,276	$59,500,584
Shadow Canyon	20	M	$254,276	$5,085,520
Totals	**1077**			**$273,855,252**
Annualized Loss Based 4% Damage on 20 Year Occurrence				**$547,710**

Source: Yellowstone County CWPP (2006)

3.1.3 Weather: Thunderstorms, Severe Wind, Hail

A thunderstorm is a rain shower during which thunder is audible; since thunder comes from lightning, all thunderstorms have lightning. Of the estimated 100,000 thunderstorms that occur each year in the U.S., about 10 percent are classified as 'severe'. A thunderstorm is classified as 'severe' when it produces one or more of the following: tornado (discussed in **Section 3.1.4**), winds gusting in excess of 50 knots (57.5 mph), and/or hail three-quarter inch or greater. Structural wind damage may imply the occurrence of a severe thunderstorm; wind speeds can reach up to 100 mph and can produce a damage path extending for hundreds of miles.

A thunderstorm wind equal to or greater than 40 mph (35 knots) and/or hail of at least ½ inch is defined as 'approaching severe'. Damaging winds (storm in which trees are uprooted, considerable damage

occurs) are classified as those exceeding 55-63 mph (48-55 knots). Wind with a speed from 64-73 mph (56-63 knots) is considered a violent storm that can cause widespread damage, according to the land Beaufort scale (NOAA, 2010).

Hail can form inside a thunderstorm, where there are strong updrafts of warm air and downdrafts of cold air. If water droplets are picked up by the updrafts, they freeze and then fall back down, repeating this cycle until ultimately falling to the ground as hail. Most hail is usually less than 2 inches in diameter; however, even small hail can cause significant damage to crops. Large stones fall at speeds faster than 100 mph (NOAA, 2010).

On a nation-wide basis, lightning causes an average of 80 fatalities and 300 injuries each year. Tornados cause an average of 70 fatalities and 1,500 injuries each year, produce wind speeds in excess of 250 mph, can be one mile wide and stay on the ground over 50 miles. Strong winds can exceed 100 mph, and can cause damage equal to a tornado. Hail causes more than $1 billion in crop and property damage nation-wide each year (NOAA, 2010).

Atkins compiled storm losses from the Spatial Hazard Events and Losses Database (SHELDUS™) developed by the University of South Carolina's Hazards & Vulnerability and Research Institute at the. SHELDUS™ is a county-level hazard data set for the U.S. for 18 different natural hazard events types such as thunderstorms, hurricanes, floods, wildfires, and tornados. For each event the database includes the beginning date, location (county and state), property losses, crop losses, injuries, and fatalities that affected each county. **Table 9** displays storm events where there were documented injuries or fatalities and/or estimated damages to property and crops within Yellowstone County since 1960.

Table 9. Storm Events with Estimated Damages Since 1960

Date	Hazard Type	County	Injuries	Fatalities	Property Damage	Crop Damage
7/1/1960	Hail - Wind	Yellowstone	0	0	$0	$37,142
5/20/1961	Hail	Yellowstone	0	0	$0	$3,714
5/30/1961	Hail - Severe Storm/Thunder Storm	Yellowstone	0	0	$790	$7,902
6/29/1961	Hail - Severe Storm/Thunder Storm - Wind	Yellowstone	0	0	$790	$7,902
5/20/1962	Hail - Severe Storm/Thunder Storm - Wind	Yellowstone	0	0	$3,466,685	$0
7/16/1962	Hail - Severe Storm/Thunder Storm	Yellowstone	0	0	$8,667	$86,667
6/6/1963	Hail - Severe Storm/Thunder Storm	Yellowstone	0	0	$34,667	$346,669
6/20/1963	Hail	Yellowstone	0	0	$0	$346,669
8/19/1963	Lightning	Yellowstone	0	0	$1,156	$11,556
4/24/1964	Severe Storm/Thunder Storm	Yellowstone	0	0	$346,669	$0
6/16/1965	Hail - Severe Storm/Thunder Storm - Tornado	Yellowstone	0	0	$34,667	$3,467
7/11/1965	Hail - Wind	Yellowstone	0	0	$34,667	$346,669

Table 9. Storm Events with Estimated Damages Since 1960

Date	Hazard Type	County	Injuries	Fatalities	Property Damage	Crop Damage
7/12/1965	Hail - Severe Storm/Thunder Storm - Wind	Yellowstone	0	0	$8,667	$8,667
8/22/1965	Hail - Severe Storm/Thunder Storm	Yellowstone	0	0	$346,669	$346,669
7/8/1966	Lightning	Yellowstone	0	0	$0	$154,758
7/25/1966	Hail - Severe Storm/Thunder Storm - Wind	Yellowstone	0	0	$3,249,919	$324,992
6/13/1968	Hail - Severe Storm/Thunder Storm - Wind	Yellowstone	0	0	$30,589	$0
7/25/1968	Hail	Yellowstone	0	0	$0	$382,357
5/27/1970	Hail - Wind	Yellowstone	0	0	$27,369	$0
6/27/1970	Hail - Wind	Yellowstone	0	0	$58,231	$58,231
6/2/1971	Tornado - Wind	Yellowstone	0	0	$26,000	$0
10/1/1971	Severe Storm/Thunder Storm - Winter Weather	Yellowstone	0	0	$18,571	$18,571
6/30/1973	Hail - Wind	Yellowstone	0	0	$75	$750
7/26/1974	Severe Storm/Thunder Storm - Wind	Yellowstone	0	0	$722	$0
8/7/1975	Hail - Wind	Yellowstone	0	0	$417	$4,167
7/27/1983	Hail - Wind	Yellowstone	0	0	$108,333	$1,083
9/18/1983	Severe Storm/Thunder Storm - Winter Weather	Yellowstone	0	0	$5,702	$570
8/29/1985	Hail - Severe Storm/Thunder Storm	Yellowstone	0	0	$50,000	$0
7/16/1986	Hail - Severe Storm/Thunder Storm - Wind	Yellowstone	0	0	$245	$24,528
6/17/1987	Hail	Yellowstone	0	0	$95	$94,545
9/17/1989	Severe Storm/Thunder Storm - Wind	Yellowstone	0	0	$86,667	$0
6/25/1990	Lightning	Yellowstone	0	0	$82,540	$825
5/19/1991	Hail	Yellowstone	0	0	$78,787	$0
6/24/1991	Hail	Yellowstone	0	0	$78,787	$7,879
7/14/1991	Hail - Severe Storm/Thunder Storm - Wind	Yellowstone	0	0	$78,787	$78,787
6/28/1993	Lightning	Yellowstone	0	1	$7,429	$0
8/21/1993	Lightning	Yellowstone	0	0	$74,285	$0
7/9/1994	Severe Storm/Thunder Storm - Wind	Yellowstone	0	0	$72,222	$0
7/4/1998	Hail	Yellowstone	0	0	$7,898,686	$1,974,672
7/4/1998	Severe Storm/Thunder Storm - Wind	Yellowstone	0	0	$1,316	$0
7/27/1998	Severe Storm/Thunder Storm - Wind	Yellowstone	1	0	$0	$0

Table 9. Storm Events with Estimated Damages Since 1960

Date	Hazard Type	County	Injuries	Fatalities	Property Damage	Crop Damage
7/31/1998	Hail	Yellowstone	0	0	$10,531,582	$1,316,448
10/2/1998	Lightning	Yellowstone	1	0	$13,164	$0
6/21/1999	Severe Storm/Thunder Storm - Wind	Yellowstone	0	0	$6,500	$0
7/23/2006	Lightning	Yellowstone	1	0	$0	$0
7/4/2009	Lightning	Yellowstone	0	1	$0	$0
Total Losses All Wind/Hail/Lightning Events			**3**	**2**	**$26,871,118**	**$5,996,854**
Annualized Losses based on 50 Years of Storm Data					**$537,422**	**$119,937**

Source: SHELDUS 2010

Estimated Future Losses

Thunderstorms, wind and hail storms are a yearly occurrence in Yellowstone County. There is a high probability of severe weather to occur throughout the county, but most storms either cause no damage or the damage is not recorded. Based on data from the last 30 years and adjusted for inflation, there has been $27 million in property and $6 million in crop damage. Annualized losses are expected to be $537,422 in property and $119,937 in crop damage with an estimated fatality rate of 1 per every 25 years.

3.1.4 Tornado

A tornado is a rotating column of air ranging in width from a few yards to more than a mile and whirling at destructively high speeds, usually accompanied by a funnel-shaped downward extension of a cumulonimbus cloud. Tornados can occur at any time of the year, but they are most frequent east of the Rocky Mountains during the spring and summer months. The average forward speed is 30 mph, but can vary from nearly stationary to 70 mph; the strongest tornados have rotating winds of more than 250 mph (NOAA, 2010).

Yellowstone County has experienced 32 tornadoes in the past 48 years, which reflects a frequency of 0.66 per year. Tornadoes will impact urban structures, farm and ranch land, private and public structures, utilities, and individuals. Since 1990, there have been six confirmed tornadoes and eight funnel clouds reported.

The first recorded tornado to touch down in Billings was on June 2, 1958. This tornado was rated as an F2 tornado and there was an estimated $19 million in damages (inflation adjusted). On June 20, 2010, another F2 tornado touched down in Billings' Heights and Downtown Core sections with heavy hail up to softball size, dangerous cloud to ground lightning, and dangerous heavy winds.

The 2010 tornado was classified as an EF-2 on the Enhanced Fujita Scale. Wind speeds within an EF-2 tornado range from 111-135 mph, with 120 yards wide damage path approximately ½ mile in length. The tornado touched ground for an estimated 12 minutes. The damage assessment and eyewitness accounts indicate that the tornado developed near the intersection of Lake Elmo Drive and Main Street in the Billings Heights at approximately 4:24 pm, with significant EF-2 damage to several nearby

businesses. Damage included rooftops being blown off of three structures, windows blown out, power poles downed, business signs and billboards blown down along with several trees uprooted.

Significant property damage occurred at the Rimrock Auto Arena and at Metrapark where the roof was blown off the arena and there was damage to the exterior of the building. Debris from the arena impacted other nearby businesses creating additional damage, mainly in the form of broken windows. Debris from the arena was reported to land as far away as a mile from the tornado touchdown.

Table 10. Documented Tornados and Funnel Clouds

Date	Location	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
7/6/1955	Yellowstone Co, not specified	Tornado	F	0	0	204K	0
7/2/1958	Yellowstone Co, not specified	Tornado	F2	0	2	19M	0
8/12/1958	Yellowstone Co, not specified	Tornado	F	0	1	23K	0
6/7/1964	Yellowstone Co, not specified	Tornado	F	0	0	0	0
6/16/1965	Yellowstone Co, not specified	Tornado	F	0	0	174K	0
6/2/1971	Yellowstone Co, not specified	Tornado	F0	0	0	135K	0
7/6/1979	Yellowstone Co, not specified	Tornado	F0	0	0	0	0
5/24/1990	Yellowstone Co, not specified	Tornado	F1	0	0	0	0
6/19/1991	Yellowstone Co, not specified	Tornado	F0	0	0	5K	0
6/21/1991	Yellowstone Co, not specified	Tornado	F1	0	0	0	0
6/18/1997	Lockwood	Funnel	N/A	0	0	0	0
7/20/1997	Laurel	Tornado	F0	0	0	0	0
5/13/1998	Billings	Funnel	N/A	0	0	0	0
7/4/1998	Laurel	Funnel	N/A	0	0	0	0
7/4/1998	Billings Heights	Funnel	N/A	0	0	0	0
7/4/1998	Worden	Funnel	N/A	0	0	0	0
7/4/1998	Billings Heights	Tornado	F0	0	0	0	0
6/5/1999	Billings	Funnel	N/A	0	0	0	0
8/15/1999	Billings	Funnel	N/A	0	0	0	0
7/26/2003	Billings	Tornado	F0	0	0	0	0
5/20/2005	Pompey's Pillar	Funnel	N/A	0	0	0	0
8/11/2005	Acton	Tornado	F0	0	0	0	0
7/3/2009	Rimrock	Funnel	N/A	0	0	0	0
6/20/2010	Billings	Tornado	F2	0	0	ND	ND
	Totals			**0**	**3**	**19.5m**	**0**

Source: National Climate Data Center (2010)

Estimated Future Losses

Total recorded losses from tornado events over a 55 year period through 2009 were $19.5 million (inflation adjusted) with an annualized estimated loss of $355 thousand. There are no complete estimates from the 2010 tornado but it is anticipated to be in the tens to hundreds of millions in losses, significantly increasing the estimated annualized loss. Assuming losses were approximately $50 million, the estimated annualized losses from tornado events is $1.26 million.

3.1.5 Winter Hazards: Storms, Cold Spells

Winter storms are an atmospheric disturbance manifested in strong winds accompanied by freezing rain, sleet, or heavy snowfall or blizzards. They take place during the coldest season of the year, occurring between autumn and spring, extending in the Northern Hemisphere from the winter solstice to the vernal equinox. These seasonal storms have the potential to destroy property and kill livestock and people.

Winter storms may be categorized as sleet, ice storms or freezing rain, heavy snowfall or blizzards. Blizzards are characterized by low visibility caused by high winds and blowing and drifting snow. A severe winter storm is generally a prolonged event involving snow or ice and extreme cold. The characteristics of severe winter storms are determined by the amount and extent of snow or ice, air temperature, wind speed, and event duration. Severe winter storms create conditions that disrupt essential regional systems such as public utilities, telecommunications, and transportation routes. Ice storms accompanied by high winds can have destructive impacts, especially to trees, power lines, and utility services. Winter storms are frequently the precursors to spring flooding due to snow melt runoff from the nearby mountains into the area rivers and tributary streams.

Atkins compiled winter storm losses from the SHELDUS™ developed by the University of South Carolina's Hazards & Vulnerability and Research Institute at the SHELDUS™. The SHELDUS™ is a county-level hazard data set for the U.S. for 18 different natural hazard events types such as thunderstorms, hurricanes, floods, wildfires, and tornados. For each event the database includes the beginning date, location (county and state), property losses, crop losses, injuries, and fatalities that affected each county. Yellowstone County faces winter storms of varying degrees each year. While most storms are not acknowledged as a major event, Yellowstone County residents must cope with these storms each year. Yellowstone County storm events are summarized below in **Table 11**.

Table 11. Winter Storm Events with Estimated Property or Crop Loss

Date	Hazard Type	County	Injuries	Fatalities	Property Damage	Crop Damage
2/22/1962	Wind - Winter Weather	Yellowstone	0	0	$68	$0
2/1/1963	Wind - Winter Weather	Yellowstone	0.04	0	$128	$0
12/15/1964	Wind - Winter Weather	Yellowstone	0	0	$60,819	$0
1/1/1969	Winter Weather	Yellowstone	0	0	$507	$0
3/23/1973	Winter Weather	Yellowstone	0	0	$118	$0
4/18/1973	Winter Weather	Yellowstone	0	0	$51,588	$0
4/7/1975	Winter Weather	Yellowstone	0	0	$41,667	$0
2/4/1978	Wind - Winter Weather	Yellowstone	0	0	$773,815	$773,815
10/15/1980	Winter Weather	Yellowstone	0	0	$6,500	$0
9/13/1982	Winter Weather	Yellowstone	0	0	$6,147	$6,147
2/1/1989	Winter Weather	Yellowstone	0	0	$152,048	$152
10/28/1989	Winter Weather	Yellowstone	0	0	$5,778	$0
4/27/1990	Winter Weather	Yellowstone	0	0	$2,663	$0
4/11/1991	Winter Weather	Yellowstone	0	0	$4,635	$0
10/31/1991	Winter Weather	Yellowstone	0	0	$113	$0
12/1/1991	Wind - Winter Weather	Yellowstone	0	0	$11,255	$0
8/25/1992	Winter Weather	Yellowstone	0	0	$0	$1,342
2/23/1994	Winter Weather	Yellowstone	0	0	$12,671	$0
9/22/2000	Winter Weather	Yellowstone	0	0	$1,754	$0
Totals					**$1,071,257**	**$781,456**
Annualized Losses for 50 Years of Winter Storm Data					**$21,425**	**$15,629**

Source: SHELDUS 2010

Estimated Future Losses

Based on estimated losses of $1.85 m from 50 years of storm data, the expected annualized losses from winter storms is $37,000.

3.1.6 Drought and Insect Infestation

A drought is a long period of abnormally low rainfall, especially one that adversely affects growing or living conditions. Drought is a special type of disaster because its occurrence does not require evacuation of an area nor does it constitute an immediate threat to life or property. People are not suddenly rendered homeless or without food and clothing. The basic effect of a drought is economic hardship, but it does, in the end, resemble other types of disasters in that victims can be deprived of their livelihoods and communities can suffer economic decline.

The effects of drought become apparent with a longer duration because moisture related industries are affected more severely. Non-irrigated croplands are most susceptible to moisture shortages. Rangeland and irrigated agricultural lands do not feel the effects as quickly as the non-irrigated, cultivated acreage, but their yields can also be greatly reduced due to drought. Reductions in yields due to moisture shortages are often aggravated by wind-induced soil erosion. In periods of severe drought, range fires can destroy the economic potential of the livestock industry, as well as wildlife habitat in/adjacent to

the areas impacted by fire. Under extreme drought conditions, lakes, reservoirs, and rivers can be subject to severe water shortages, which greatly restrict the use of their water supplies.
Insect infestations tend to coincide with drought, creating a double impact to the County. They have a large impact on farming and ranching, as well as creating health concerns for residents. Insect Infestations are characterized as a large abundance of insects in a concentrated area that primarily occur during drought years, and are destructive in nature.

From 2005 through 2009 the annual precipitation has averaged 13.93 inches, which is a little less than 1 inch below the normal of 14.77 inches annually (1970-2009 average). Currently, Yellowstone County is in a normal moisture pattern and has not been in a severe drought status since September 2006. (DNRC, 2010 http://nris.mt.gov/drought/status/status2010.asp). Chart 1 shows average annual precipitation at the Billings Wastewater Treatment Plant and departure from normal from 1905 through 2009.

Chart 1. Average Annual Precipitation at the Billings Wastewater Treatment Plant

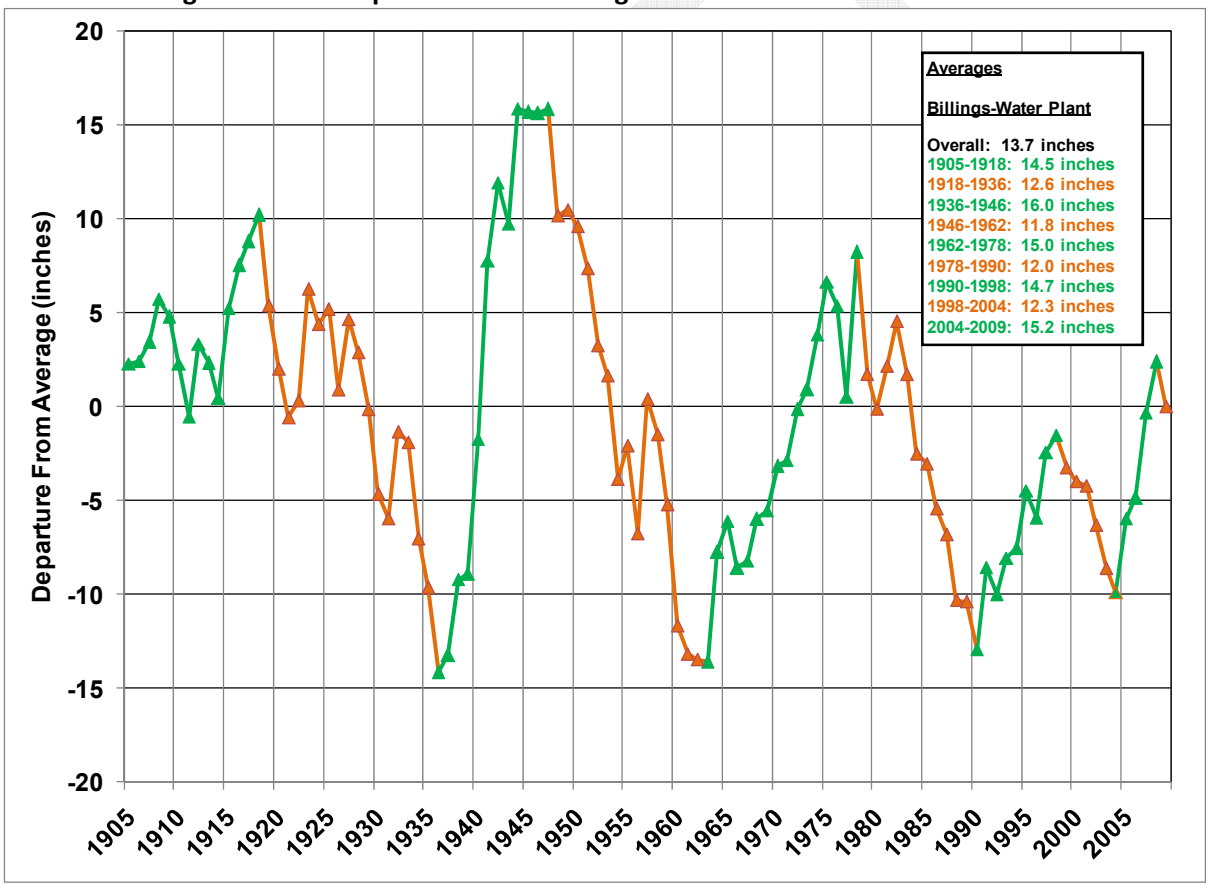

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Table 12. Drought Events Summary

Date	Hazard Event	Description/Costs
August 26 – September 2, 1984	Drought	Drought conditions became extreme throughout the county. Wildfire event in Northern Yellowstone County and Musselshell County. 44 homes lost, 145,000 acres of range and timberland burned. County declaration August 28, 1984, followed by a State declaration and a Federal agricultural designation (for rancher assistance only). County response cost $51,000, City $1,800.
Summer 1985	Drought	24,000 acres impacted with 26 producers. Secretary of Ag. designation to assist ranchers with spraying grasshoppers that became problematic during the drought.
Summer 1986	Drought	48,000 acres infested with 65 producers. County declaration resolution 86-37, July 2, 1986 and 86-50, August 11, 1986. No direct County costs. Secretary of Ag. designation to assist ranchers with spraying grasshoppers that became problematic during the drought.
Summer 1987	Drought	May 25, County declared emergency, State declared June 1. State paid $32,847 and the County paid $109,793 to farmers and ranchers to reimburse spraying costs. 48,000 acres sprayed. 159 producers, total rancher costs to spray $223,000. County reimbursed $2.30/acre and state reimbursed $.68/acre spraying costs. County resolution 87-55 adopting a revenue budget to pay costs. Secretary of Ag. designation to assist ranchers with spraying grasshoppers that became problematic during the drought.
Summer 1988	Drought	Drought. Aphid infested acres—16,500; Hopper infestation—21,000 acres. $206,000 spraying costs by 78 producers. County resolution 88-27, May 9. County reimbursed $49,404 spraying costs for aphids and $21,174 spraying costs for grasshoppers for a total of $70,578. Secretary of Ag. designation to assist ranchers with spraying grasshoppers that became problematic during the drought.

As **Table 12** suggests, drought occurs in cycles and current trends suggest a period of normal moisture for central and eastern Montana. During drought cycles, there will be an increase in insect infestation, increase in wildfire occurrence, and decrease in water supplies. The expected losses on annualized basis have not been calculated because impacts from drought can be manifested in many ways.

3.1.7 Urban Fire

Urban fires are unpredictable, but often cause an economic loss to individuals, damaging private and public structures, utilities, and loss of life. An urban fire is the uncontrolled ignition and burning of materials on a large scale in a city environment.

Table 13. Significant Urban Fire Events Summary

Date	Location	Description/Costs
1940	Northern Hotel	Fire
1960's	James Hotel	
January 17, 1963	Miracle Gas Company at 421 N. 20th Street in Billings	The building fire occurred in the afternoon as children were just getting out of school for the day one block away. This caused an extremely hazardous situation with the storage of gas on the premises. It was the largest fuel explosion in Billings history at that time.
1970's	Yellowstone Country Club	Clubhouse fire
1980's	Super 8 Motel	Explosion and fire
2003	Country Inn and Suites	Fire consumed building while under construction.
May 24, 2006	Hi Mountain Recreation	The largest fire of the year occurred in a downtown building during the afternoon of May 24th at Hi Mountain Recreation, 14 North 30th Street, with an estimated $1,000,000 in damages.

Table 14. Annual Fire Losses City of Billings

Year	Dollar Losses	Fatalities
2000	$2,296,780	na
2001	$4,722,283	na
2002	$4,147,132	na
2003	na	na
2004	$2,697,798	2
2005	$6,332,397	4
2006	$4,210,406	0
2007	$3,018,839	1
2008	$10,336,159	1
2009	$2,198,423	1

Source: City of Billings Annual Fire Report 2009

3.1.8 Dam Failure

Dams and levees are engineered to withstand a flood with a computed risk of occurrence. For example, a dam or levee may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If a larger flood occurs, then that structure will be overtopped. Dam failure is the cessation of proper functioning or performance of a barrier constructed across a waterway to control the flow or raise the level of water. If, during the overtopping the dam or levee fails or is washed out, the water behind it is released to become a flash flood. Failed dams or levees can create floods that are catastrophic to life and property because of the tremendous energy of the released water (coupled with debris carried in its path). (Source: http://ks.water.usgs.gov/pubs/fact-sheets/fs.024-00.html). High Hazard Dams are those that pose an immediate threat of fatalities in the event of a dam failure.

Anita Dam is the only High Hazard Dam located within Yellowstone County. The Anita Dam was constructed in 1937 to augment the Huntley Irrigation Project near Pompey's Pillar. The dam is an earth

structure, 42 feet high with a volume of 143,000 cubic yards, located 1 mile southeast of the Anita Railroad Station. Failure of Anita dam has the potential to jeopardize as many as 100 lives along a 7-mile reach of the Fly Creek floodplain between the dam and the Yellowstone River. This area includes several private residences, the community of Pompey's Pillar, county roads in Fly Creek floodplain, sections of I90, U.S. Highway 312 and sections of the Burlington Railroad main line in the Yellowstone Floodplain.

Cooney Dam and Reservoir are located on Red Lodge Creek in Carbon County, approximately seven miles west of the Town of Boyd. The dam is owned by the Montana Department of Natural Resources and Conservation. The earth-fill dam is 102 feet in height, has a crest length of 2,369 feet, and impounds 28,230 acre-feet of water at full pool. The water is used for supplemental irrigation on approximately 20,000 acres. The original dam was completed in 1937 and rehabilitated in 1982 to meet current dam safety standards. Cooney Dam is classified as a high-hazard dam with potential to inundate portions of Laurel and Billings in both a probable maximum flood and clear weather breach scenario (DNRC, 2010b). Inundation maps and Emergency Action plan for Cooney Dam is available at the Yellowstone County Disaster and Emergency Services office.

3.1.9 Expansive Soil

Expansive soil is defined as a fine-grained clay (composed of rocks and mineral particles mixed with organic matter) which occurs naturally and is generally found in areas that historically were a flood plain or lake area, but can occur in hillside areas also. Expansive soil is subject to swelling and shrinkage of the soil, varying in proportion to the amount of moisture present in the soil.

Mapped Expansive Soil Zones

The wetting and drying of expansive soils can impact the community by affecting the soundness of private and public structures built in these areas; the urban area around Billings has several areas that are affected by this condition, see **Figure 8** (the rest of the County has not been mapped). Buildings built in these areas have had numerous problems with shifting foundations, cracks, and ground movement problems. Utilities may be affected greatly as the ground continues to shift causing damage to underground pipes and lines. While the damage might not occur quickly, expansive soils have the potential to cause significant damage to roads, railways and bridges.

3.1.10 Landslide

The term landslide as used here includes all types of gravity-caused mass movements of earth material, ranging from rock falls to mud slides, and debris flows. Landslides occur in all fifty of the United States; in the conterminous United States, the region's most seriously affected are the Pacific Coast, the Rocky Mountains, and the Appalachian Mountains (USGS, 2001).

FEMA notes that landslides can be large or small, rapid or slow. They can occur following storms and flooding, earthquakes, volcanic eruptions, fires causing burned areas, alternating freezing and thawing, and steepening of slopes by erosion or human modification. Mud flows consist of rock, earth, and other debris saturated with water that has accumulated from heavy rainfall or rapid snowmelt. Landslides can flow rapidly, striking with little or no warning at avalanche speeds. Depending on slope and magnitude, they have the potential to travel several miles from their source, growing in size as they pick up trees, boulders, cars, and other materials. (Source: http://www.fema.gov/hazard/landslide/index.shtm).

Mapped Landslide Areas

The terrain in Yellowstone County has some potential for landslides as shown on **Figure 9** for the Billings urban area and **Figure 10** for the rest of the county. These figures show that quaternary landslide areas represent a very small portion of the county. The greatest area of concerns is in the Billings area below the Rims. A rockfall destroyed a house at the base of the rims in Billings on October 9, 2010.

Figure 8. Private and Public Structures Affected by Landslides

The areal extent of landslide zones is limited in the county, but the development at the base of the rims increases the exposure.

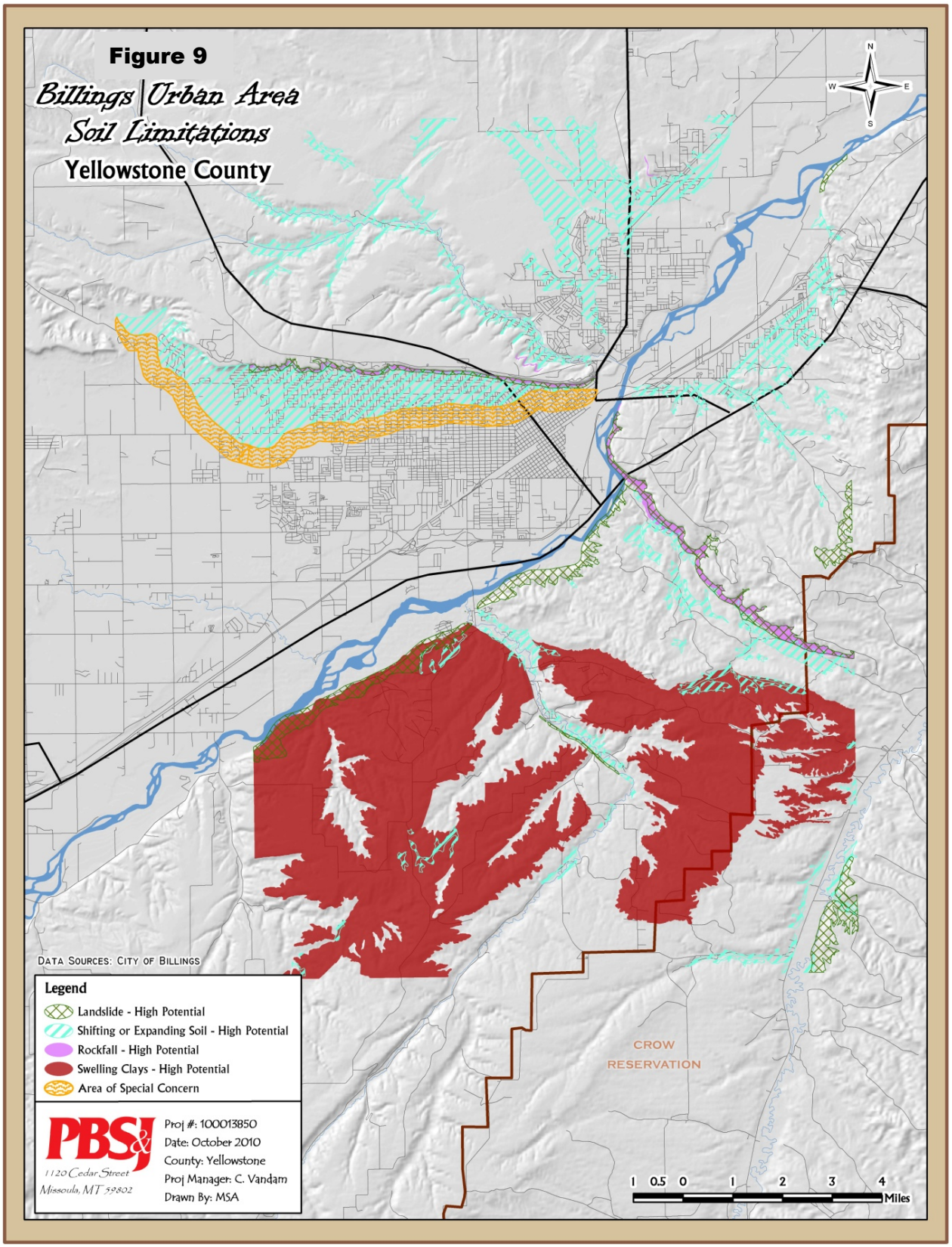

Figure 9. Billings Urban Area Soil Limitations, Yellowstone County

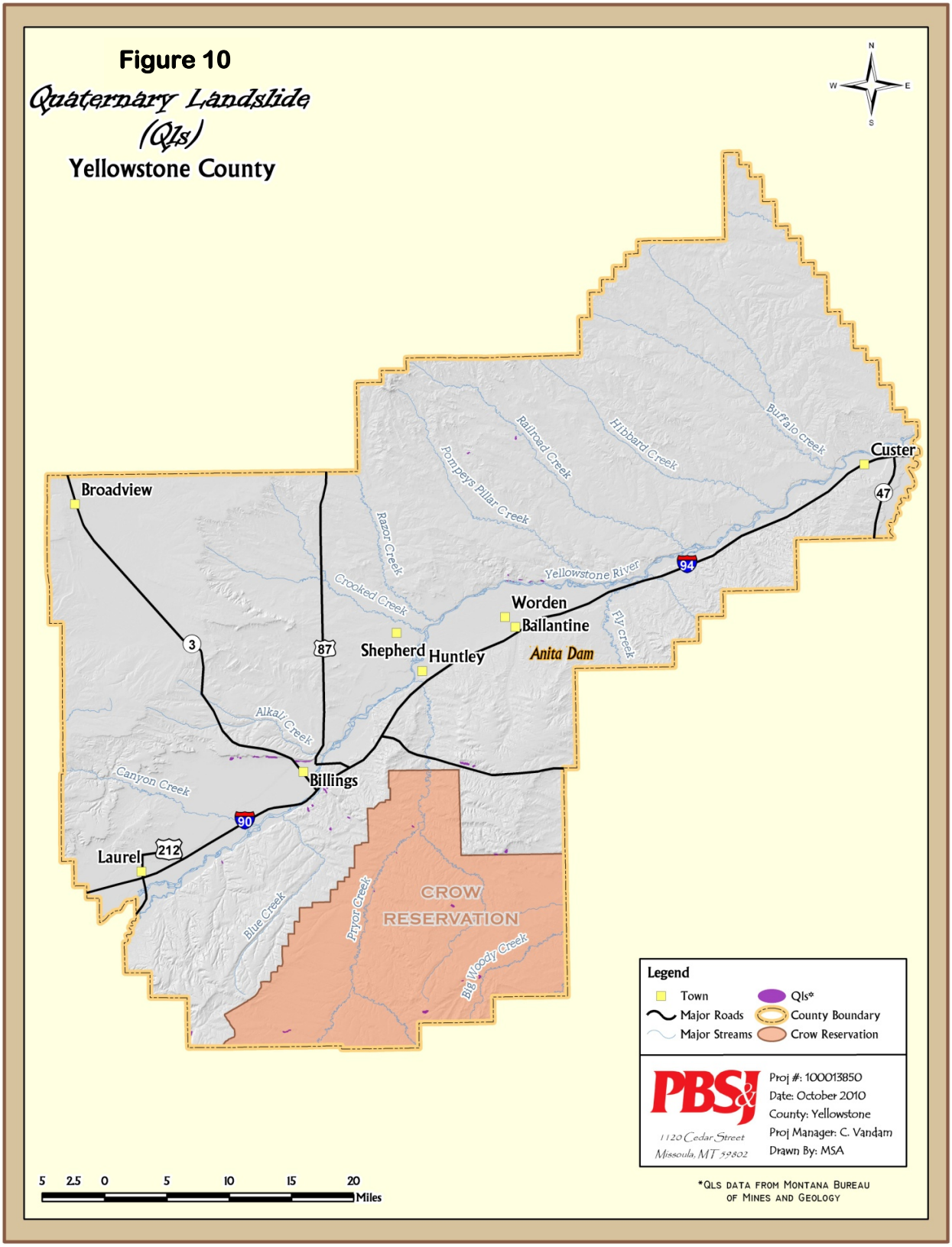

Figure 10. Quaternary Landslides (QLs) Yellowstone County

3.1.11 Earthquake

An earthquake is ground shaking and radiated seismic energy caused most commonly by a sudden slip on a fault, volcanic or magmatic activity, or other sudden stress changes in the earth. An earthquake of magnitude 8 or larger on the Richter Scale is termed a great earthquake. Montana is seismically active but has not experienced a great earthquake of this magnitude in the past 100 years. The greatest seismic exposure for Montana is along the Intermountain Seismic Belt and Centennial Tectonic Belt found in the western portions of the state.

Earthquake magnitude and intensity are used to describe seismic activity from earthquakes. Magnitude is a measure of the total energy released. Each earthquake has one magnitude, usually measured on the Richter Scale. Intensity is used to describe the effects of the earthquake at a particular place. Intensity differs throughout the area and is given a value on the Modified Mercalli Scale.

Scientists continue to study faults in Montana to determine future earthquake potential. Faults are cracks in the earth's crust along which movement occurs. Thousands of faults have been mapped in Montana, but scientists think only about 95 of these have been active in the past 1.6 million years (the Quaternary Period). Although it has been over four decades since the last destructive earthquake in Montana, small earthquakes commonly occur at an average rate of 7-10 earthquakes per day with the majority of events taking place unnoticed by area residents.

While many earthquakes have occurred in Montana, there have been no substantial earthquakes recorded in Yellowstone County. The largest earthquake in Montana, the Hebgen Lake event on August 18, 1959, caused more than $11 million (per USGS: in 2007 terms, $78.6 million) in damage and 28 people died from the landslide it generated. The second most-damaging earthquakes were the October 1935 Helena earthquake clusters, which caused four deaths and more than $4 million in damage (per USGS: in 2007 terms, $60.7 million). The probability of future earthquake events occurring somewhere in Montana (particularly along the Intermountain Seismic Belt in western Montana – see **Figure 11**) is not only high, but is also inevitable and unpredictable.

The probability of damage from future earthquakes in Yellowstone County is relatively low (see **Figure 13** showing an overview of Yellowstone County hazard zones). This figure depicts the locations of three zones of peak horizontal acceleration (%g) covering Yellowstone County that have a 10 percent probability of occurring over a period of fifty years. The %g interval is a measure of ground acceleration that indicates how hard the earth shakes, where 'g' is the acceleration due to earth's gravity. Generally, the interval between 1 and 4 reflects a perceived shaking as 'weak' or 'light' and 'no potential damage'; interval 5 corresponds with a 'moderate' perception of shaking and 'potentially very light damage'; all three of the zones covering Yellowstone County reflect %g intervals that do not exceed 4.

Figure 12 depicts the probability of an earthquake with a magnitude greater than 5.0 within 100 years and within a 50 kilometer radius from Billings (Source: 2009 USGS Probabilistic Seismic Hazards Assessment Model).

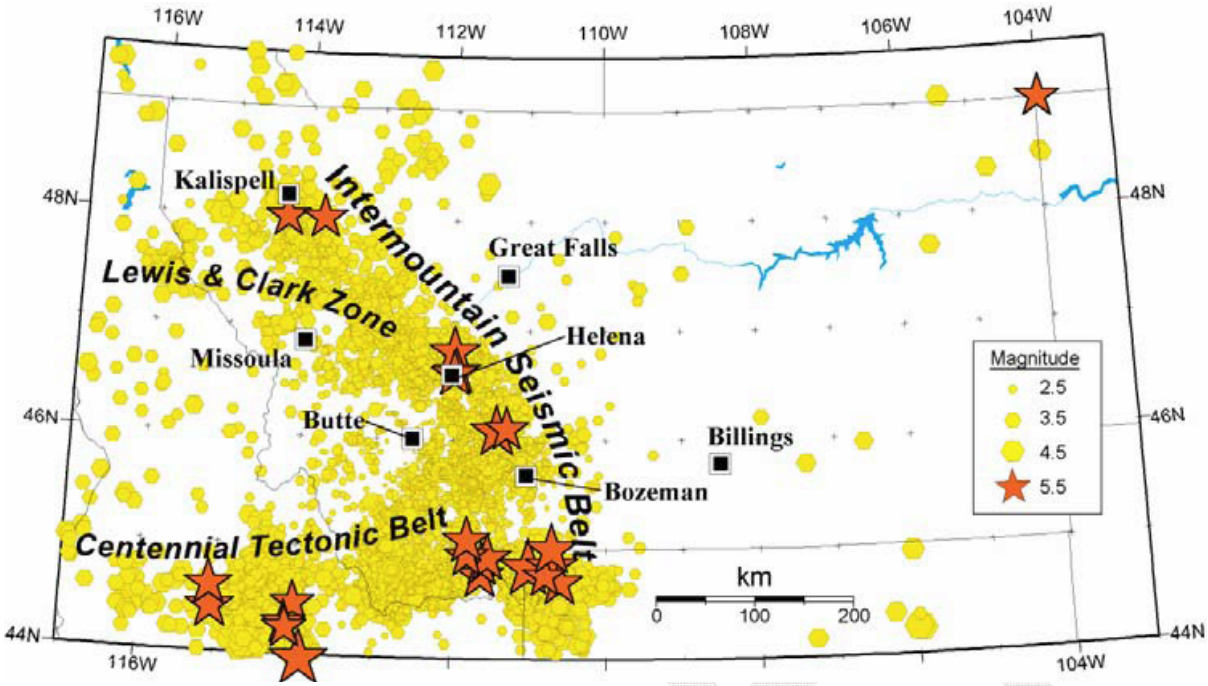

Figure 11. Intermountain Seismic Belt, Region Seismicity 1982-99 (Source: MBMG 2004)

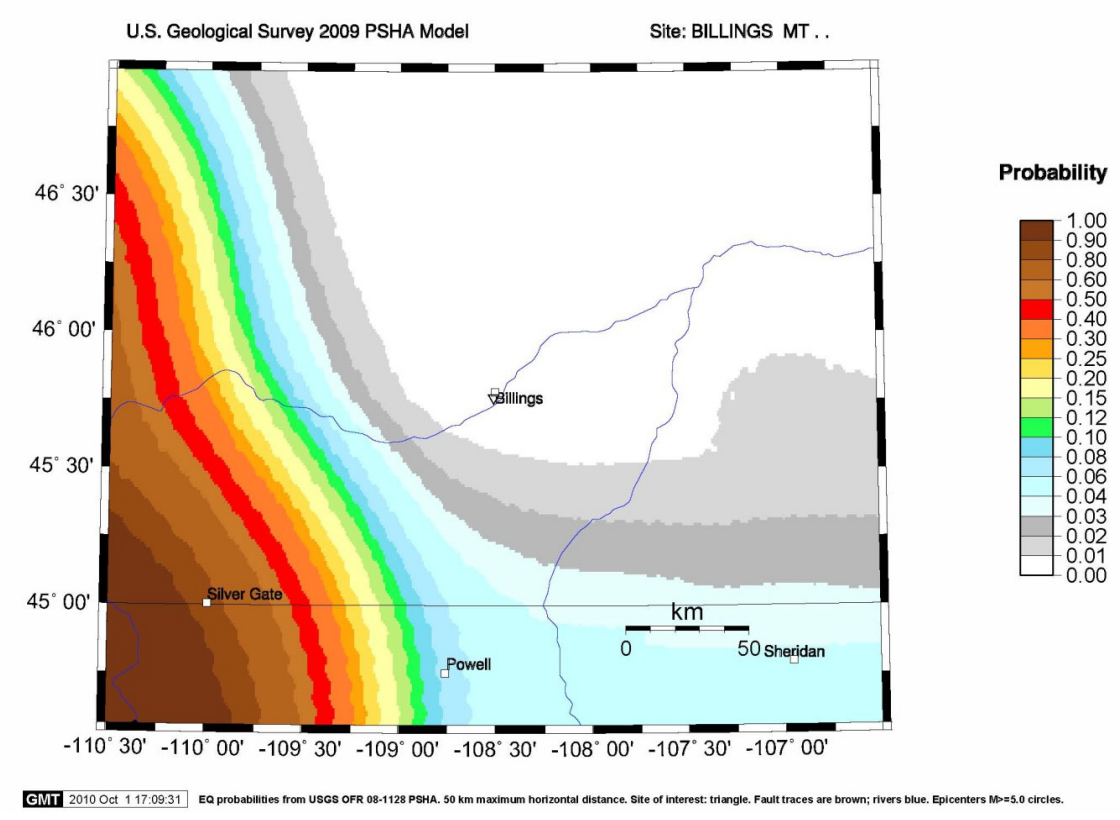

Figure 12. Probability of an Earthquake with M >5.0 within 100 years and 50 km from Billings

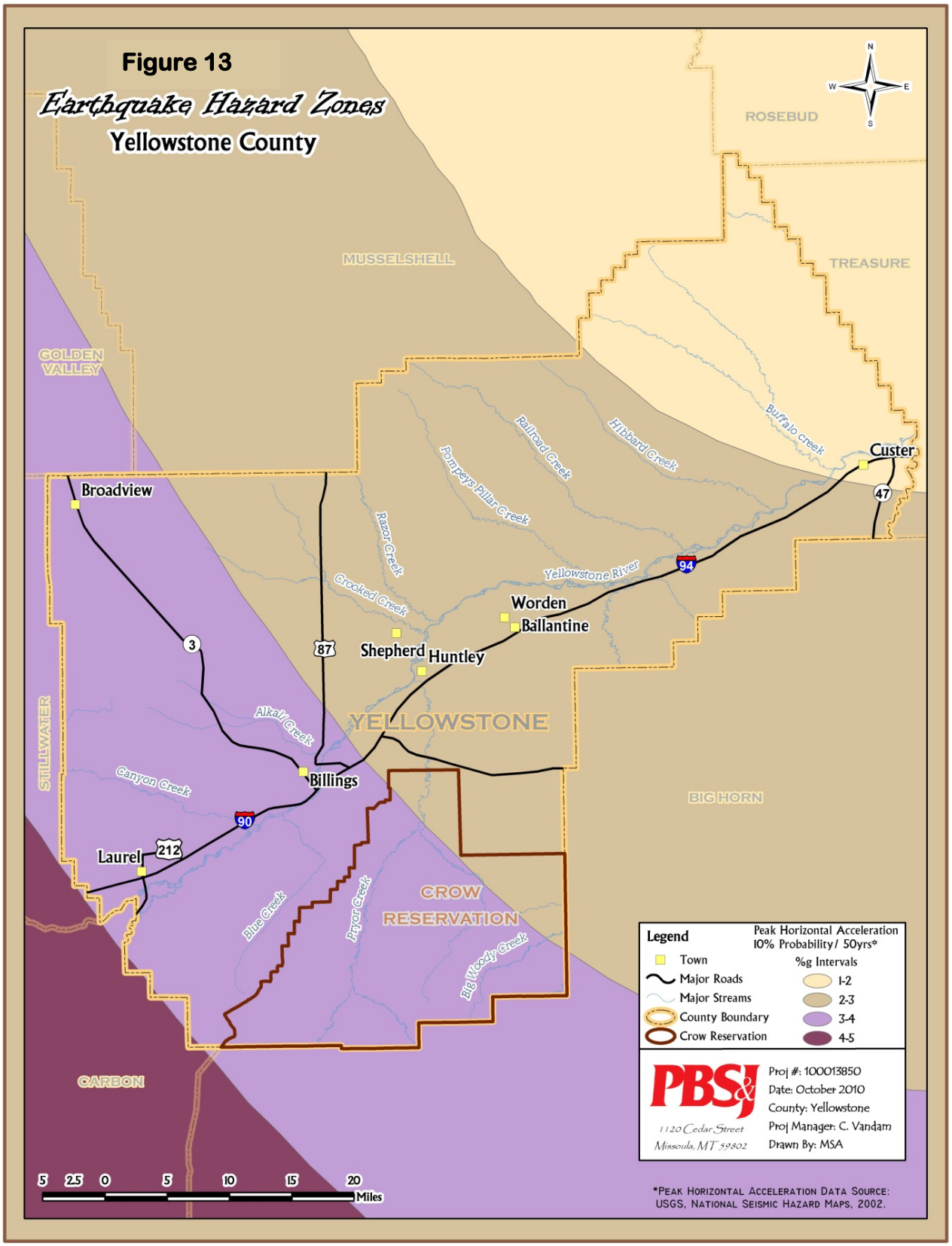

Figure 13. Earthquake Hazard Zones, Yellowstone County

3.1.12 Volcanic Ash

When the violent energy of a volcano is released, the results can be catastrophic. Lava flows, debris avalanches, and explosive blasts have invaded communities, swept people to their deaths, choked major riverways, destroyed bridges, and devastated huge tracts of forest. Noxious volcanic gas emissions have caused widespread lung problems. Airborne ash clouds have disrupted the health, lives, and businesses of hundreds of thousands of people; caused millions of dollars of aircraft damage; and nearly brought down passenger flights. The risks to life, property, and infrastructure from volcanoes continue to increase as more and more people live, work, play, and travel in volcanic regions.

An explosive volcanic eruption blasts solid and molten rock fragments (tephra) and gases into the air with tremendous force. The largest rock fragments (bombs) usually fall back to the ground within 2 miles of the vent. Small fragments (less than about 0.1 inch across) of volcanic glass, minerals, and rock (ash) rise high into the air, forming a huge, billowing eruption column. Eruption columns can grow rapidly and reach more than 12 miles above a volcano in less than 30 minutes, forming an eruption cloud. The volcanic ash in the cloud can pose a serious hazard to aviation. Large eruption clouds can extend hundreds of miles downwind, resulting in ash fall over enormous areas; the wind carries the smallest ash particles the furthest. (Source: http://pubs.usgs.gov/fs/2006/3014/).

Volcanic ash, either from volcanic activity in Yellowstone National Park (approximately 90 miles to the west of Yellowstone County) or further to the west in Washington and Oregon, would impact the entire county causing health concerns for humans and livestock, and damaging equipment and utilities. Ash from the May 18, 1980, eruption of Mount St. Helens, Washington, fell over an area of 22,000 square miles in the Western United States. Heavy ash fall can collapse buildings, and even minor ash fall can damage crops, electronics, and machinery. Montana's Governor declared "State of Emergency" and closed all schools, businesses, and government offices. Western Montana was hardest hit with the ash, receiving 0.5-1 inch in places. Yellowstone County received a dusting of volcanic ash from the Mt. St. Helens eruption.

The Yellowstone Caldera is one of the largest and most active calderas in the world. The spectacular geysers, boiling hot springs, and mud pots that have made Yellowstone famous are surface manifestations of a magma chamber at depth. Cataclysmic eruptions 2.0, 1.3, and 0.6 million years ago ejected huge volumes of rhyolite magma; each eruption formed a caldera and extensive layers of thick pyroclastic-flow deposits. If another 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. 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 (USGS, 2005).

The Cascade Range includes 27 volcanoes, many of which have been active in the last 10,000 years. The only threat these volcanoes pose to Montana is ash fall. The likely extent of such ash fall can be estimated on the basis of past eruptions. Volcanoes in Washington and Oregon that have erupted in the last 200 years include: Mount Hood, Mount St. Helens, Mount Rainier, and Mount Baker. Eruptions from any of these volcanoes are likely to occur in the next 100 years, the expected impacts to Yellowstone County will be similar to the Mount St. Helens event.

3.1.13 Transportation/Mobile Incident

The impact of a transportation/mobile incident is high relative to other areas of Montana because of the relatively large population and industrial base in the County and because both the interstate highways and railways are major east west shipping routes. Both interstate highways I-90 and I-94 are used heavily by commercial vehicles hauling chemicals, petroleum products, and farm products and more. An incident would block all east-west traffic and detain large numbers vehicles and individuals. In addition to interstate travel, rail lines run through Yellowstone County that provides the only means of rail travel across this region.

A transportation/mobile incident is any incident that occurs for which the exact location cannot be predetermined. Any incident involving a mode of transportation including car, truck, rail, pipeline, air, or mass transit is classified as a mobile incident. These can include incidents involving the transport of hazardous materials.

Several transportation incidents have occurred in Yellowstone County. The two described here are the most significant incidents to date:

- December 18, 1992: Aircraft Crash/Structural Fire. Twin engine Cessna Citation with eight WAPA employees on board crashed into the School District 2 warehouse. All individuals were killed and the warehouse was destroyed, which stored school records, books, supplies, food, and vehicles for School District 2. $4 million in damage.
- A train derailment in 1999 caused evacuation of downtown Billings.

Yellowstone County has a high probability of occurrences of transportation/mobile incidents. With a major rail line running through downtown Billings in Yellowstone County, the largest airport in the state located in close proximity to downtown Billings, and a large section on Interstate 90 and Interstate 94 within the county's jurisdiction, it would be expected that more events could happen in the future. Risks will increase as the population of the county continues to increase. Additionally, damaging impacts to transportation infrastructure by the secondary effects of other potential hazards (storms, flooding, earthquakes, landslides, etc.) could also contribute to increased risks of future transportation/mobile incidents.

3.1.14 Hazardous Materials Incident

Yellowstone County is home to three major refineries and several chemical businesses that manage large amounts of hazardous materials. Any of these facilities could cause a major incident and some have occurred in the past. A hazardous materials incident could impact a large area of the county and gases release from the event could affect even more.

Hazardous Materials Incident/Accident-Fixed is any incident involving potentially hazardous materials or at a location where there is a predetermined expected level of an incident occurring. These are distinct from natural hazards primarily in that they originate from human activity. The term "technological hazards" refers to the origins of incidents that can arise from human activities such as the manufacture, transportation, storage, and use of hazardous materials. Technological emergencies are accidental and their consequences are unintended. Examples of technological hazards are industrial accidents at either fixed facilities or transportation, and failure of a critical infrastructure component.

The history of hazardous materials incidents in Yellowstone County was compiled by participants in the identification process and by research. It is not, however, an exhaustive list of all prior events in Yellowstone County. Yellowstone County has experienced hazardous material incidents in 1989, 1991, 1992, 1993, 1998, 1999, and 2001. These incidents originated from refineries, railroad tank cars, highway tankers and pipelines. Within the county limits, there are three refineries, three pipelines, US Interstate 90 and Burlington Northern Rail Line. **Table 15** summarizes major known incidents from 1963 to present.

Table 15. Hazardous Materials Incidents

Date	Hazard Event	Location	Description/Injuries/Costs
January 17, 1963	Miracle Gas Company	421 N. 20th Street, Billings	The building fire occurred in the afternoon as children were getting out of school one block away. This caused an extremely hazardous situation with the storage of gas on the premises. It was the largest fuel explosion in Billings history at that time.
1980's	Super 8 Motel		Gas explosion
September 4, 1986	Cenex pipeline rupture	Lockwood	8" pipeline lost 30,000 gal of gasoline in Coulson irrigation ditch. A 40" long gash on pipe caused by a backhoe caused it to rupture. Lockwood Water User wells were tested; no contamination was found. During the event 12 businesses and 50 people were evacuated due to fumes.
January 28 – February 3, 1989	Cenex pipeline rupture	Huntley	8" pipeline ruptured with 8-10,000 gal of gasoline recovered from frozen creek. 4 homes evacuated, road closed, MRL Railroad closed. Estimated damage and cleanup $15,000.
February 21 – 25, 1989	Explosion at home	Custer Avenue, Billings	Entire home destroyed due to bottled propane gas in home. 1 death, 1 injury, 7 homes in neighborhood damaged by concussion and debris. Estimated cost $1.5 million.
July 1, 1992	Tanker truck rolled over leaking LPG (propane)	Lockwood	Farstad Oil Company truck with 9,000 gal of LPG. 3000 people evacuated along with ExxonMobil Refinery, I-90 closed, electricity shut off to homes due to danger of ignition. Six and one half hours to contain.
June 22-24, 1993	Railroad tank car leaked LPG	Lockwood	Local area in Lockwood evacuated, I-90 and MRL railroad closed. Owned by Gas Supply Co., railroad tank car leaked LPG due to structural defect in metal. Clean up expenses $30,000.
March 24, 1994	Tanker truck rollover	Lockwood	Farstad Oil Company tanker truck with diesel fuel rolled over in Lockwood. I-90 closed and 3,000 gallons of fuel lost. Response costs $2,900.
October 22, 1998	Cenex refinery explosion	Laurel	Hydrogen gas line ruptured causing explosion and fire. No injuries. $2.5 million in damage to refinery.
July 20, 1999	Train derailment	downtown Billings	Six MRL cars derailed, 2 cars carried 72K gal of LPG. 16 blocks evacuated as a precaution. It was a 16-hour incident with $22,641 response costs.
October 7, 2002	Orchard School	Billings	Gasoline spill caused the temporary evacuation of students. The Fire Department ventilated the building.
October 30, 2002	Gas explosion	V-1 Propane, Frontage Rd., Billings	Gas Explosion and fire forced the evacuation of surrounding businesses and an elementary school and shut down Interstate 90 for about an hour before fire crews extinguished the blaze.
November 24, 2002	Train Derailment	Huntley	40 LB of Ammonium Nitrate released upon the derailment of 9 railroad cars due to a broken rail.

Table 15. Hazardous Materials Incidents

Date	Hazard Event	Location	Description/Injuries/Costs
January 1, 2008	Tanker Truck Rollover	Billings	Truck drift down the shoulder, rolling and striking a power pole releasing 1520 LGA of Corrosive Liquid.
September 21, 2008	Tanker Truck Rollover	Billings	3800 LG of High Temperature Liquid Asphalt released in turnover of trailer when truck negotiated turn.
December 12, 2008	Overfill	Worden	350 gallons of diesel fuel released from overfill of storage tank.
June 30, 2009	Railroad Car Spill	Laurel	Sulfuric Acid (10 gal) spilled onto locomotive engineer causing two injuries, one resulting in hospitalization.
July 15, 2009	Overfill	Billings	Aviation Fuel released when high alarm failed to operate on storage tank causing a release of 1100 gallons .

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Yellowstone County has a high probability of occurrences of hazardous material incidents. With two rail yards in Yellowstone County, the largest airport in the state located in close proximity to downtown Billings, three refineries, and many associated chemical industries, it is anticipated that more events will happen in the future and will affect a population that continues to grow.

3.1.15 Terrorism, Bio-Terrorism

A Terrorism or Bio-Terrorism event has the potential to impact a large area of the County or a small but significant number of people depending on the location and type of event.

Terrorism/Bio-Terrorism is the use of biological agents, such as pathogenic organisms or agricultural pests, for terrorist purposes. The term "terrorism" refers to intentional, criminal, malicious acts. Terrorism hazards include the use of Weapons of Mass Destruction such as, Chemical, Biological, Radiological, Nuclear, Explosive weapons, and armed attacks, industrial sabotage and "cyber terrorism". Whether intentional or accidental, human-caused disasters involve the application of one or more modes of harmful force or destruction. These modes are defined as contamination (chemical, biological, radiological, or nuclear hazards), energy (explosives, arson, and electromagnetic waves), or failure or denial of service (sabotage, infrastructure breakdown, and transportation service disruption). The greatest human-caused hazard risk is the large quantities of propane, anhydrous ammonia, and petroleum stored in various locations.

Participant discussions provided insight into the events that have occurred in Yellowstone County. The most noteworthy were recent hoaxes of anthrax, bomb threats to schools and government buildings including Post Offices, Federal Building, Courthouse, congressional buildings, and college campuses. In addition, participants mentioned anthrax mailbox incidents and the freemen incident (below).

While the probability of an event of this sort in Yellowstone County, Montana is relatively low compared to major cities in the United States, the county must be prepared. As the largest populated county in Montana, if an event were to occur in Montana the probability is high that it would occur in Yellowstone County.

3.1.16 Civil Disturbance, Riot, Labor Unrest

Impact from a civil disturbance, riot, or labor unrest would probably affect the more populated areas of the County including the cities of Billings, Laurel, or Broadview. This could impact utilities, critical facilities, individuals, and business.

An incident of civil disturbance/riot/labor unrest is characterized here as a group of highly agitated individuals causing injury to persons and/or property. Civil unrest in not a common hazard affecting Montana; however, Garfield County made national news during the Montana Freemen crisis. In the early spring of 1996, hundreds of FBI agents surrounded the Ralph Clark ranch complex near Jordan, Montana for a siege lasting 81 days. The government claimed that the nearly thirty people inside were of a radical anti-government and racist religious sect who had written bad checks and threatened judges, among other things. Billings and Yellowstone County were impacted by these events as a staging area for law enforcement, housing suspects in the County Jail, and during the Federal trial.

Within the last twenty-years there have been two teachers' strikes that had incidents of violence against those who crossed the picket lines and those that were vocal about their opinions. Within the last ten-years two union-trucking industry strikes have had incidents of violence. While the history is not inclusive, these events stood out in participant's minds or were found during research for this plan.

3.1.17 Enemy Attack

An enemy attack is defined here as a planned assault against an area or individual(s) for the sole purpose of inflicting harm. Although the historic occurrence of an enemy attack on American soils is very low, the September 11, 2001 terrorist attack in New York is an example of our societal vulnerability to such events and a reminder to maintain an informed vigilance. The Nuclear Powers and other potentially adversarial Nations are continually being evaluated by the U.S. Defense Department as potential threats to the United States of America.

Yellowstone County has not specifically been the target of an enemy attack to date. However, with the events of September 11, 2001 and the potential for dangerous groups or individuals using Montana as a base for their operations, Yellowstone County must consider these threats. The impact of an enemy attack on Yellowstone County would impact the more populated areas of the County causing harm to individuals, disrupting utilities, and halting business activities.

The probability of future enemy attack is low in Yellowstone County. However, the threat cannot be entirely dismissed because Yellowstone County reflects the largest population base in Montana, and has a number of potential targets (many refineries, a large airport, large entertainment complex, and many government agencies) if these groups were determined to disable the region.

3.1.18 Other Hazards

Infectious/Natural Disease: An infectious or natural disease in humans or animals is defined as a pathogenic microorganism or agent capable of being transmitted by humans and/or animals, characterized by an identifiable group of adverse signs or symptoms. Infectious or communicable diseases can cause major disruption to communities ranging from norovirus and gastroenteritis to West Nile virus. Education and awareness on conditions to prevent the spread and proliferation of diseases will always be the best means to minimize impacts to the community.

Utility Outage: A utility outage is a disruption in a commodity or service, such as electricity, water, or public transportation that is provided by a public utility. Utility outages can cause life threatening conditions during severe winters and especially impact sensitive populations that may have limited mobility and resources.

Risk Assessment Summary

The Risk Assessment identified the vulnerability of Yellowstone County and all jurisdictions within the county. Vulnerability is a factor on the frequency of the hazard, potential losses to property and infrastructure, and potential for casualties. These factors are used to provide a vulnerability quotient for a particular hazard such that mitigation efforts can be prioritized based on the relative risk of the hazard. The vulnerability quotient is estimated for natural hazards only. While man caused hazards may have a greater impact on our communities, such as urban/structure fires and hazardous material releases, these hazards can be addressed at the cause. Whereas, we have little ability to control the cause of natural hazards and shall invest in mitigation projects to reduce the impacts of natural hazards.

The vulnerability quotient is a sum of the values assigned to the factors shown below:

Factor	5	4	3	2	1
Frequency (Years Between Major Event)	0-5	>5-15	>15-45	>40-100	>100
Annualized Property Loss ($)	>1m	>500K-1m	>250K-500K	>50K-250K	0-50K
Casualties/Injuries	very high	high	moderate	low	very low

Table 16. Risk Assessment/Vulnerability Quotient for Natural Hazards

Hazard	Frequency w/ Major Damages[1]	Estimated Annualized Losses[2]	Potential Casualties	Vulnerability Quotient	2004 Rank
Weather- Extreme Wind & Thunderstorms	10 years	$657,000	very high	13	3
Flooding	25 years	$1,116,000	high	12	1
Tornado	25 years	$1,260,000	high	12	4
Wildfire	20 years	$548,000	moderate	10	2
Severe Winter Storms	10 years	$37,000	high	9	5
Landslide	10 years	$50,000	low	8	9
Flooding - Major Dam Failure	>500 years	<$250,000	moderate	6	7
Earthquake	50 years	$0	low	5	10
Volcano	>100 years	$5,000	very low	3	11
Drought	25 year (cycles)	na	very low	--	6
Expansive Soils	na	na	very low	--	8

4.0 MULTI-JURISDICTIONAL HAZARD MITIGATION STRATEGY

The mitigation strategy is the course of action Yellowstone County and the incorporated communities of Billings, Broadview and Laurel plan on taking to prevent losses from disasters in the future. Rather than wait until a disaster occurs, these communities have developed this strategy to move in a proactive direction in disaster prevention. Losses cannot be fully mitigated, but actions can be taken as funding and opportunities become available to reduce the impacts of disasters which will save taxpayer dollars.

The 2004 PDM Plan conducted a thorough community involvement process to assess the communities ranking of all hazards that could impact the County's jurisdictions. The ranking was reviewed in the early phases of the Plan Update and the PDM Task Force recommended keeping the rankings. The ranking of natural and man-made hazards shown in **Table 17** and **Table 18** still reflects the priorities of Yellowstone County and the affected jurisdictions.

Table 17. Community Ranking of Natural and Man-made Hazards

Natural Hazard Priority Ranking for Yellowstone County (2004 PDM)			
Hazard	**Probability of Disastrous Event (chance in any given year)**	**Magnitude (severity/impact to community)**	**Priority Rank**
Flooding	Moderate	High	1
Wildfire	Moderate-High	Moderate	2
Wind and Hail Storms	Moderate	Moderate-High	3
Tornado	Moderate-High	Moderate	4
Winter Storms	High	Moderate-High	5
Drought	Moderate-High	Moderate-High	6
Insect Infestations	Moderate	Moderate-High	7
Urban Fire	Moderate	Moderate	8
Dam Failure	Low-Moderate	Low-Moderate	9
Expansive Soil	Moderate	Moderate	10
Landslides	Low-Moderate	Moderate-High	11
Earthquake	Low	Low	12
Volcanic Ash	Low	Low	13
Manmade Hazard Priority Ranking for Yellowstone County			
Transportation/Mobile Incident	Moderate	High	1
Hazardous Materials Incident/Accident-Fixed	Moderate-High	Moderate	2
Terrorism/Bio-Terrorism	Low-Moderate	Moderate-High	3
Civil Disturbance/Riot/Labor Unrest	Moderate	Moderate	4
Enemy Attack	Low	Low-Moderate	5

Table 18. Priorities Established in the Original 2004 PDM Plan

Natural Hazard Vulnerability Ranking for Yellowstone County					
Hazard	**History**	**Vulnerability**	**Maximum Threat**	**Probability**	**Rank**
Flooding	High	High	High	High	1
Wildfire	High	High	High	High	2
Wind and Hail Storms	High	High	High	High	3
Tornado	Moderate	Moderate	Moderate	Moderate	4
Winter Storms	High	Moderate	Moderate	Moderate	5
Drought	High	Low	Moderate	Moderate	6
Insect Infestations	Moderate	Moderate	Moderate	Moderate	7
Urban Fire	Low	Low	Moderate	Low	8
Dam Failure	Low	Moderate	Moderate	Low	9
Expansive Soil	Moderate	Low	Low	Moderate	10
Landslides	Moderate	Low	Low	Low	11
Earthquake	Low	Low	Low	Low	12
Volcanic Ash	Low	Low	Low	Low	13
Manmade Hazard Vulnerability Ranking for Yellowstone County					
Transportation/Mobile Incident	Moderate	Moderate	High	High	1
Hazardous Materials Incident/ Accident-Fixed	Moderate	Moderate	High	High	2
Terrorism/ Bio-Terrorism	Low	Moderate	High	Low	3
Civil Disturbance/ Riot/Labor Unrest	Moderate	Moderate	Moderate	Moderate	4
Enemy Attack	Low	Moderate	High	Low	5

4.1 Review of Goals from 2004 PDM Plan

Plan goals identify how local agencies and concerned citizens can take action to mitigate the risk from natural and manmade disasters. Goals and objectives were identified through the planning and development process and by looking at specific projects that were referenced frequently. **Table 19** identifies the progress made with the goals and objectives set in the 2004 PDM Plan and provides recommendations on whether specific projects should be continued or eliminated.

Table 19. 2004 Yellowstone County Mitigation Plans, Updated 2011

Goal and Objectives	Jurisdiction	City/County Dept	Progress Report: 2011 Update
Goal #1 Increase Hazard Awareness			
Floodplain Awareness	All	Co. DES, LEPC, NWS	Ongoing Education
Firewise	All	Co. DES, LEPC, Fire Depts	Ongoing Fire Council Project Activities
High Winds Awareness	All	NWS, DES	Ongoing Education
Weather Awareness	All	NWS, DES	Ongoing Education
Goal #2 Reduce Impacts of Flooding			
Highway 3 Storm Water Runoff Management	County		Need to add Airport Road runoff, damage from constructed roundabout

Table 19. 2004 Yellowstone County Mitigation Plans, Updated 2011

Highway 87/Alkali Creek Crossing Improvement	County		Project Completed: New pedestrian underpass addresses flooding problems
Storm Drain-Laurel	Laurel	City of Laurel	2002 Mitigation Plan addressed problems
Rimrock Road/Molt Road Flooding	County	City/County Planning, DES	In Progress West Billings Flooding Feasibility Study
Billings West End Retention Pond/Diversion Channel	Billings & County	City/County Planning, DES	In Progress West Billings Flooding Feasibility Study
Feasibility Study for irrigation canal unloading structures/linear parks	County		Will be Addressed in West Billings Flooding Feasibility Study
Repetitive Loss Structure Buyout	County	DES	Little interest from homeowners, program was discontinued
Stream Restoration	County		Various levee issues along the Yellowstone River need to be addressed
Echo Canyon/Zephyr Lane Flooding	County		Not a Priority Flood Issue
Goal #3 Reduce Impacts of Wildfire and Structure Fires on the Community			
Rural Dry Hydrants	County	City/Co. Planning, DES	County Subdivision regulations modified to require dry hydrants in areas lacking central water systems with fire pressure
Wildland Fire Mapping	County	CWPP completed by DES, LEPC	Addressed in CWPP, continues to monitor development and new areas of risk
Firewise Demonstration Houses	All	DES	Three Firewise Demonstration Homes Completed, none scheduled for work at this time
Older Building Sprinkler Installations	All	City/Co Planning, DES	Not implemented
Wise Building Practices	All	City/Co Planning, DES	Literature available in Big Sky Economic Development Business Library, and Public Library
Goal #4 Improve Emergency Communications			
Public Alerting System Maintenance & Upgrade	All	County DES, LEPC	Continual maintenance required, upgrades with funds from Refineries, LEPC
Rural Communication Systems	County	County DES, Big Sky 11	Replacing and improving repeater sites, working with state on statewide com strategy, upgrade portable and mobile radios for rural fire response, sat radio for DES, EOC
Alerting System Expansion	All		Address in Public Alerting project above
Goal #5 Countywide Mapping and Zoning			
Resolution of Clarks Camp problem	County	DES, Floodplain Manager	Completed
Floodplain Mapping	County	DES, Floodplain Manager	Map Modernization Complete, being adopted
New Floodplain Regulations	All		See Floodplain Mapping Above
Goal #6 Protection of Public Health and Property from Disasters			
Enemy Attack/Terrorism plan update	All	DES	To be addressed in the Emergency Operations Plan

Table 19. 2004 Yellowstone County Mitigation Plans, Updated 2011

12-Mile Creek-Dam Failure on Box Spring Road	County		No Longer a Community priority will be dropped
Special Population Emergency Planning	All	DES, United Way, LEPC, CAER	Ongoing planning, organization, and training,
Subdivision Disaster Planning	All	DES, United Way, LEPC, CAER	Subdivision Regulations have been modified to address ingress/egress issues.
Animals in Disaster	All	DES with HSUS	Continue Zoo Montana to address flooding issues
Safety Window Film Installation	All	DES and school districts	No activity, recommendation to discontinue
Goal #7 Grow and Develop Partnerships			
School Safety Education	All	School Districts, DES and LEPC	Ongoing Education: School district participate in table top and full scale disaster drills with LEPC
School Violence Prevention	All	Police & Sheriff Departments	Ongoing Education
Wise Building Practices	All	Planning	Literature available in Big Sky Economic Development Business Library, and Public Library
Countywide Building District	County	Planning	No Progress
Goal #8 Enhance Emergency Services			
Hazard Identification/Comprehensive Planning/GIS	County	DES, LEPC	PDM plan, review yearly, update as needed
Emergency Shelters	All	DES	Mapping of Shelters is Complete

4.2 Mitigation Actions

Proposed projects to mitigate hazards in Yellowstone County are quite diverse. Areas of concern were identified and ranked according to which were the most urgent mitigation concerns for Yellowstone County. These concerns were reviewed and discussed in PDM Task Force, LEPC and public meetings and at committee meetings. A list of projects for the PDM Update was compiled and includes ongoing projects from the 2004 PDM Plan and new projects identified in this planning cycle. These projects are grouped into the four types of projects: construction, feasibility studies, public education, and hazard awareness. These projects all fit with the overall goals of the Yellowstone County PDM Plan.

Construction Projects

- West Billings Flood Mitigation Project: Construction of two small storage features on Cove and Little Cove Creeks and improving flood conveyance through the West Billings area.
- Arrow Island Weir Project: Bank Stabilization project north of Huntley.

Feasibility Studies

- Highway 3 Stormwater Controls: Study options for mitigating stormwater runoff from Highway 3 near the Airport.

- Riverside Park Levee Repair: Study to assess options for controlling bank erosion and protection of buried pipelines near Riverside Park in Laurel.
- Zoo Montana Flood Mitigation: Assess potential for flooding zoo and address options for managing zoo animals in the event of a flood.
- Purchase of Knife River Pit: Examine the option for creating stormwater retention basin in the Knife River Pit to mitigate potential flooding downstream of the West Billings area.

Public Education

- Floodplain Awareness: Continued community outreach on the potential for flooding in flood prone areas.
- Firewise Demonstrations: Continued community outreach on wise building practices in the wildland urban interface.
- Severe Storm Education: Continued community outreach on preparation and safety during severe storms.
- School Safety: Interaction with public safety officials and schools on school population planning for emergencies.

Hazard Preparedness

- Wildland Fire Mapping
- Public Alert System
- Enhanced Rural Communication/Montana Interoperability Project
- Modification of floodplain regulations to require property setbacks

4.3 West Billings Flood and Stormwater Mitigation Study

The West Billings area is one of the fastest growing areas of Billings and Yellowstone County and there are several major transportation routes through the area. Potential flooding in this area is a limiting factor for growth. In 2006, a flood study mapped the 100-year floodplain within a 20-square mile area west of Billings and corroborated an historic flood event that occurred in 1937 which inundated downtown Billings.

As growth in the area has proceeded, flood irrigation use has declined. Flood irrigation has been identified as the main source of groundwater recharge in this area. Many of the existing developments in the County rely on groundwater for domestic drinking water and as irrigation is eliminated, the groundwater source for domestic wells is compromised. There is a distinct need to identify options that would allow continued development without jeopardizing safety and ensuring a sustainable groundwater resource. The flood mitigation and groundwater recharge are both addressed through a comprehensive feasibility study (PBSJ 2011).

4.4 Mitigation Prioritization Plan

Yellowstone County will implement the above mitigation actions by creating partnerships with local government, businesses, and individuals. Mitigation projects will be selected based on priority ranking, public support, and where/when project funding becomes available. When funding becomes available, the higher priority activities can be prioritized even further with more detailed costs, benefits, and other criteria. Project funding shall include state and federal grant programs and local funding. The LEPC has the capacity to organize resources, prepare grant applications, and oversee project implementation,

monitoring and evaluation. Coordinating organizations may include local, county, or regional agencies that are capable of or responsible for implementing activities and programs. The DES Director will be responsible for mitigation project administration.

Project prioritization on specific projects was determined by evaluating the following criteria:

- Vulnerability Quotient (V_Q): represent s the risk factor generated in **Table 20**, in the Risk Assessment.
- Benefit to Cost (B_C): A ratio representing the estimated costs for a project against the resulting benefits of property/structure saved, reduction in economic loss, and reduction in casualties. This is typically a gross estimate unless a project has completed a specific benefit to cost analysis.
- Protect Property (S_P): Value of property/structures protected from mitigation actions. This is a gross estimate unless specific project numbers are calculated.
- Reduce Casualties (C_R): Qualitative estimate on the impact of the project in reducing injuries and loss of life.

Each of these factors were scored according to the table below to generate a Priority Value (P_V). The Priority Value was calculated based on the following equation:

$$P_V = V_Q (B_C + S_P + C_R)$$

Table 20. Priority Value Factors

Factor	5	4	3	2	1
Vulnerability Quotient	11-13	9-10	7-8	5-6	<5
Benefit to Cost (est.)	>10:1	5-10:1	3-5:1	1-3:1	<1:1
Protect Property (Structure Value in $)	>$5m	$1m-5m	$500K-1m	$100K-500K	<$100K
Reduce Casualties	very high	high	moderate	low	very low

The 2004 Community Priority Rank is displayed in table but not used in the Priority Value equation.

Table 21. Proposed PDM Update Mitigation Projects and Activities

Projects	Vulnerability Quotient	Benefit to Cost	Protect Structures	Prevent Casualties	Community Priority	Priority Value	City/County Dept	Possible Funding Sources
Construction Projects								
West Billings Flood Mitigation Project	5	4	5	3	1	60	Yellowstone County Planning	FEMA PDM
Arrow Island Weir Project	5	2	3	2	1	35	Yellowstone County Parks	FEMA PDM
Planning/Feasibility Studies								
Highway 3 Storm Water Runoff Management	5	2	2	2	1	30	City of Billings Public Works	Transportation Planning /City of Billings Stormwater
Riverside Park Levee Repair	5	2	2	2	2	30	City of Laurel	Corp of Engineers FEMA PDM
Zoo Montana Flood Mitigation	5	2	1	1	1	20	Yellowstone County DES	Not Determined
Create Flood Storage in Knife River Gravel Pit	5	4	5	3	1	60	Yellowstone County Planning	FEMA PDM
Public Education								
Floodplain Awareness	5	3	1	3	1	35	DES, LEPC	Not Determined
Firewise Demonstrations	4	3	1	3	2	28	DES, LEPC	Not Determined
School Safety Emergency Planning	5	3	1	4	3	40	DES, LEPC	Not Determined
Severe Storm Education	5	3	1	4	3	40	DES, LEPC	Big Sky Economic Development
Hazard Preparedness								
Wildland Fire Mapping	4	2	3	2	2	28	DES, LEPC	DNRC
Rural Communication Systems	4	3	1	3	3	28	DES, LEPC	LEPC, Montana DES
Public Alert System Enhancement	4	2	1	3	3	24	DES, LEPC	DNRC, Montana DES
Modification of Floodplain Regulations (require setbacks)	5	3	3	1	1	35	Yellowstone County Planning	City-County Planning Division

Economic Analysis of Mitigation Projects

The Federal Emergency Management Agency's approach to identify costs and benefits associated with hazard mitigation strategies or projects fall into two general categories: benefit/cost analysis and cost-effectiveness analysis. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster related damages later. Cost effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating hazards can provide decision makers with an understanding of the potential benefits and cost of an activity, as well as a basis upon which to compare alternative projects.

Implementation through Existing Programs

Yellowstone County addresses statewide planning goals and legislative requirements through its Comprehensive Land Use Plan, Capital Improvement Plans, and Montana Building Codes. The Pre-Disaster Mitigation Plan provides a series of recommendations that are closely related to the goals and objectives of these existing planning programs. Yellowstone County will have the opportunity to implement recommended mitigation action items through existing programs and procedures. Upon adoption of the Pre-Disaster Mitigation Plan it will be used as the baseline of information on the hazards that impact the county.

5.0 MULTI-JURISDICTIONAL PLAN MAINTENANCE

The plan maintenance section of this document details the formal process that will ensure that the Yellowstone County Pre-Disaster Mitigation Plan remains an active and relevant document. The plan maintenance process includes a schedule for monitoring and evaluating the Plan and producing a revised plan every year and in accordance with the Disaster Mitigation Act of 2000. Additionally, if a disaster occurs, or substantial changes occur within the County, the plan will be reviewed and revised if necessary. This section describes how the county will integrate public participation throughout the plan maintenance process. Finally, this section includes an explanation of how Yellowstone County government intends to incorporate the mitigation strategies outlined in this Plan into existing planning mechanisms such as the County Comprehensive Land Use Plan, Capital Improvement Plans, and Building Codes.

5.1 Monitoring, Evaluating, and Updating

The Yellowstone County Pre-Disaster Mitigation Plan will be evaluated on a yearly basis to determine the effectiveness of programs, and to reflect changes in land development or programs that may affect mitigation priorities. The evaluation process will be done yearly in conjunction with an LEPC meeting. Participants from all jurisdictions, local agencies, and the public will participate in plan evaluation and update. The convener (the Director of the Yellowstone County Disaster Emergency and Emergency Services) will be responsible for contacting the Pre-Disaster Mitigation Plan Committee members and organizing the public meeting. Committee members will be responsible for monitoring and evaluating the progress of the mitigation strategies in the Plan.

5.2 Incorporation into Existing Plans

Yellowstone County addresses statewide planning goals and legislative requirements through its Comprehensive Land Use Plan, Capital Improvement Plans, and Montana State Building Codes. The Pre-Disaster Mitigation Plan provides a series of recommendations that are closely related to the goals and objectives of these existing planning programs. Yellowstone County will have the opportunity to implement recommended mitigation action items through existing programs and procedures.

Upon adoption of the Pre-Disaster Mitigation Plan, Yellowstone County will assist local municipalities in developing their natural hazard mitigation goals and actions by providing the Yellowstone County Pre-Disaster Mitigation Plan as a baseline of information on the hazards that impact the County.

Within six-months of formal adoption of the Pre-Disaster Mitigation Plan, the recommendations listed above will be incorporated into the process of existing planning mechanisms at the county level. The meetings of the Pre-Disaster Mitigation Plan Committee will provide an opportunity for committee members to report back on the progress made on the integration of mitigation planning elements into the county planning documents and procedures.

5.3 Implementation Schedule

The mitigation projects in **Table 22** are categorized into the following types of projects: construction projects, feasibility studies, public education, and hazard preparedness. As funding and opportunities

arise, the costs and benefits to the project can be refined. The implementation for some of the higher priority projects are shown in **Table 22**. The table provides a description of the project, the jurisdiction responsible for the project, the agency or department responsible for implementing the project, and its potential funding sources.

Table 22. Implementation Plan for Yellowstone County, City of Billings, City of Laurel

Project Description	Jurisdiction/Department	Implementation Schedule	Funding Source (s)	Priority Score
West Billings Flood Improvement Plan	Yellowstone County/ Planning Public Works	Design 2013 Build 2014-15	Pre-Disaster Mitigation Grants, Hazard Mitigation Grants	60
Create Flood Storage in Knife River Gravel Pit	Yellowstone County/ Planning Public Works	Feasibility Study 2012	Pre-Disaster Mitigation Planning Grant	60
Arrow Island Weir	Yellowstone County/ Parks	Build 2012-2013	Pre-Disaster Mitigation Grants	35
Riverside Park	City of Laurel Public Works	Feasibility Study 2012	Pre-Disaster Mitigation Planning Grant	30

The approval of this plan shows that hazard mitigation is a high priority for Yellowstone County, City of Billings, City of Laurel, and Town of Broadview. Any current or future planning will incorporate these goals, objectives, and disaster mitigation projects into the decision making process. Incorporating these objectives and projects into growth plans, subdivision regulations, floodplain regulations, and other land use tools can help reduce exposure and losses from natural hazards and reduce public costs for response and disaster assistance.

5.4 Continued Public Involvement in Plan Maintenance Process

Yellowstone County, Billings, Laurel, and Broadview are dedicated to involving the public directly in the review and updates of the Pre-Disaster Mitigation Plan. The PDM Committee of the LEPC and the Disaster and Emergency Services office are responsible for reviewing and updating the plan every year or sooner if necessary.

The public will also have the opportunity to provide feedback about the Plan. Copies of the Plan will be catalogued and kept at the Yellowstone County DES office and Clerk and Recorders office, and the Billings Public Library. The plan also includes the address and the phone number of the County Disaster and Emergency Services office responsible for keeping track of public comments on the Plan. In addition, copies of the plan and any proposed changes will be posted on the Yellowstone County website. This site will also contain an email address and phone number to which people can direct their comments and concerns.

A public meeting will also be held in conjunction with the evaluation and revision or when deemed necessary by the PDM Committee. The meetings will provide the public a forum for which they can express concerns, opinions, or ideas about the Plan. The DES Director will be responsible for using county resources to publicize the meetings and maintain public involvement through the County website, newspapers, and other media.

6.0 REFERENCES

BEA, 2010, Bearfacts Regional Economic Analysis, Yellowstone County. Prepared by the US Department of Commerce, Bureau of Economic Analysis, Washington D.C, URL: http://www.bea.gov/regional/bearfacts/action.cfm?fips=30111&areatype=30111

BBER, 2009. Montana Business Quarterly/Spring 2009 Economic Profile of Yellowstone County. Prepared by the Bureau of Business and Economic Research, University of Montana, Missoula, Montana.

DNRC, 2010a. NFIP Claim Report, Yellowstone County. Provided by Traci Sears, Montana Department of Natural Resources and Conservation, October 1, 2010.

DNRC, 2010b. Cooney Dam Emergency Action Plan. Prepared by the Water Resources Division of the Montana Department of Natural Resources and Conservation, Helena, MT. February, 2010.

DPHHS, 2010. West Nile Virus Activity Reports, 2004-2009. Prepared by the Montana Department of Public Health and Human Services. URL: http://www.dphhs.mt.gov/PHSD/

FEMA, 2003. Floods and Flash Floods Fact Sheet. Prepared by the Federal Emergency Management Agency. http://www.fema.gov/hazards/floods/floodf.shtm

FEMA, 2010. Preliminary Flood Insurance Study, Yellowstone County. Prepared by the Federal Emergency Management Agency, March 8, 2010.

MDOA, 2010. The Montana Structures Framework. Montana Base Map Service Center, Information Technology Services Division, Department of Administration.

MDOR, 2010. Computer Aided Mass Appraisal (CAMA) database. Montana Department of Revenue property appraisal database system, Helena, Montana.

Montana NRIS, 2010. Montana Natural Resource Information System. URL: http://maps2.nris.mt.gov

NDEC, 2010. The National Disaster Education Council. URL: http://www.disastereducation.org.

NOAA, 2010. Sources: NOAA National Severe Storms Laboratory. Website prepared and maintained by the National Oceanic and Atmospheric Administration. http://www.nssl.noaa.gov/primer/wind/wind_basics.html#

PBS&J, 2007. West Billings Flood Hazard Study. Prepared by PBS&J for Yellowstone County, 2007.

SHELDUS, 2010. Spatial Hazard Events and Losses Database. Prepared by the University of South Carolina's Hazards & Vulnerability and Research Institute, URL: http://www.cas.sc.edu/geog/hrl/SHELDUS.html

U.S. Census, 2010. American Factfinder Population Estimates, Yellowstone County, Montana. US Census Bureau American Factfinder website. URL: http://factfinder.census.gov/home/saff/main.html

USGS 2000. Significant Floods in the United States During the 20th Century - USGS Measures a Century of Floods. USGS Fact Sheet 024-00. March 2000. http://ks.water.usgs.gov/Kansas/pubs/fact-sheets/fs.024-00.html

USGS, 2005. Steam Explosions, Earthquakes and Volcanic Eruptions, What is in Yellowstone's Future? US Geological Survey Fact Sheet 2005-3024, 2005. URL: http://pubs.usgs.gov/fs/2005/3024

Yellowstone County, 2008. Yellowstone County and City of Billings 2008 Growth Policy Update. Prepared by Planning and Community Services Department, Billings, Montana.

YCCWPPC, 2006. Yellowstone County Wildfire Protection Plan. Developed by the Yellowstone County Community Wildfire Protection Plan Committee in cooperation with Northwest Management, Inc.

Appendix A

PRIOR JURISDICTIONAL RESOLUTIONS AND ANNUAL REVIEWS

Yellowstone County
Multi-Jurisdictional Pre-Disaster Mitigation Plan,
Update 2011

Appendix B

YELLOWSTONE COUNTY, MONTANA, COMMUNITY WILDFIRE PROTECTION PLAN EXECUTIVE SUMMARY

Yellowstone County
Multi-Jurisdictional Pre-Disaster Mitigation Plan,
Update 2011

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Appendix C

LEPC MEMBERS LIST,
MEETING NOTES,
RECORDS OF PUBLIC PARTICIPATION

Yellowstone County
Multi-Jurisdictional Pre-Disaster Mitigation Plan,
Update 2011

Appendix D

CRITICAL FACILITIES AND INFRASTRUCTURE

Yellowstone County
Multi-Jurisdictional Pre-Disaster Mitigation Plan,
Update 2011

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UPDATED Table D-1. Critical Facilities - Emergency Responders (fire, medical, law)

Critical Structure Type	Name	Community	Address	Zip
Emergency Response/Fire/Medical	Billings Fire Department Station 1 Headquarters	Billings	2305 8th Avenue North	59101-1018
Emergency Response/Fire/Medical	Billings Fire Department Station 2	Billings	501 South 28th Street	59101-4143
Emergency Response/Fire/Medical	Billings Fire Department Station 3	Billings	1928 17th Street West	59102-2907
Emergency Response/Fire/Medical	Billings Fire Department Station 4	Billings	475 6th Street West	59101-2716
Emergency Response/Fire/Medical	Billings Fire Department Station 5	Billings	605 South 24th Street West	59102-6246
Emergency Response/Fire/Medical	Billings Fire Department Station 6	Billings	1601 Saint Andrews Drive	59105-3863
Emergency Response/Fire/Medical	Billings Fire Department Station 7	Billings	1501 54th Street West	59106
Emergency Response/Fire/Medical	Billings Logan International Airport Crash Fire Rescue	Billings	2281 Overlook Drive	59105
Emergency Response/Fire/Medical	Blue Creek Volunteer Fire Department	Billings	2144 Santiago Boulevard	59101-9759
Emergency Response/Fire/Medical	Conoco Phillips Emergency Response Team	Billings	401 South 23rd Street	59101-4337
Emergency Response/Fire/Medical	ExxonMobil Emergency Response Team	Billings	700 Exxon Mobile Road	59101
Emergency Response/Fire/Medical	ExxonMobil Emergency Response Team	Billings	700 Exxon Mobile Road	59101
Emergency Response/Fire/Medical	Lockwood Rural Fire District 8	Billings	3329 Driftwood Lane	59101-6913
Emergency Response/Fire/Medical	Broadview Volunteer Fire Department	Broadview	16530 Donald Avenue	59015
Emergency Response/Fire/Medical	Custer Volunteer Fire Department	Custer	511 3rd Avenue	59024
Emergency Response/Fire/Medical	Worden Volunteer Fire Department Station 2 Huntley	Huntley	82 Northern Avenue	59037
Emergency Response/Fire/Medical	Cenex Harvest State Fire Brigade	Laurel	803 US Highway 212 South	59044
Emergency Response/Fire/Medical	Laurel Volunteer Fire Department	Laurel	215 West 1st Street	59044-3003
Emergency Response/Fire/Medical	Worden Volunteer Fire Dept. Station 3 Pompey's Pillar	Pompe'ys Pillar	3510 3rd Street South	59064
Emergency Response/Fire/Medical	Shepherd Volunteer Fire Dept. Station Headquarters	Shepherd	5453 Carey Avenue	59079
Emergency Response/Fire/Medical	Shepherd Volunteer Fire Dept. Storage Facility	Shepherd	8015 Wade Street	59079
Emergency Response/Fire/Medical	Worden Volunteer Fire Dept. Station 1 Headquarters	Worden	2463 3rd Street	59088
Emergency Response/Medical	AAA Advanced Air Ambulance	Billings	Overlook Drive	59105

UPDATED Table D-1. Critical Facilities - Emergency Responders (fire, medical, law)

Critical Structure Type	Name	Community	Address	Zip
Emergency Response/Medical	American Medical Response	Billings	711 4th Avenue North	59101
Emergency Response/Medical	American Medical Response, Central Stn	Billings	115 5th Street West	59101
Emergency Response/Medical	American Medical Response, West Stn	Billings		59102
Emergency Response/Medical	Billings Clinic	Billings	2800 10th Avenue North	59101
Emergency Response/Medical	Deaconess Hospital "Air Methods"	Billings	2401 Overlook Drive	59105
Emergency Response/Medical	Highgate Senior Living	Billings	3980 Parkhill Drive	59102
Emergency Response/Medical	Saint Vincent Hospital	Billings	1233 North 30th Street	59101
Emergency Response/Medical	South Central Regional Mental Health Center	Billings	1245 North 29th	59101
Emergency Response/Medical	St Vincent Healthcare	Billings	1233 30th Street	59102
Emergency Response/Medical	St Vincent Healthcare Airport Hangar	Billings	1234 30th Street	59105
Emergency Response/Medical	Westpark Village	Billings	2351 Solomon Avenue	59102
Emergency Response/Medical	Laurel Safety Complex	Laurel		59044
Emergency Response/Medical	Lockwood ambulance	Lockwood		
Emergency Response/Medical	Worden Ambulance	Worden		59088
Emergency Services/Law Enforcement	American Red Cross EOC	Billings		59101
Emergency Services/Law Enforcement	Billings Logan International Airport Police	Billings	1901 Terminal Circle	59105-1990
Emergency Services/Law Enforcement	Billings Police Department	Billings	220 North 27th Street	59101-1938
Emergency Services/Law Enforcement	Bureau of Land Management Billings Tanker Base	Billings	1299 Rimtop Drive	59105
Emergency Services/Law Enforcement	City/County Emergency Operations Center	Billings	2300 9th Avenue North	59101
Emergency Services/Law Enforcement	Dept. of Homeland Security Federal Protective Service	Billings	306 North 26th Street	59101
Emergency Services/Law Enforcement	Dispatch Center 9-1-1	Billings		59101
Emergency Services/Law Enforcement	Federal Bureau of Investigation Billings Office	Billings	2929 3rd Avenue North	59101-1944
Emergency Services/Law Enforcement	Internal Revenue Service Criminal Investigation Division	Billings	2900 4th Avenue North	59101-1266
Emergency Services/Law Enforcement	Lockwood Sheriff's Office	Billings	3329 Driftwood Lane	59101-6913
Emergency Services/Law	Montana Highway Patrol District	Billings	615 South 27th	59101-

UPDATED Table D-1. Critical Facilities - Emergency Responders (fire, medical, law)

Critical Structure Type	Name	Community	Address	Zip
Enforcement	IV Office		Street	4569
Emergency Services/Law Enforcement	Montana Narcotics Bureau	Billings	615 South 27th Street	59101-4569
Emergency Services/Law Enforcement	Montana State University Billings Police Department	Billings	1500 University Drive	59101-0245
Emergency Services/Law Enforcement	United States Drug Enforcement Administration	Billings	2929 3rd Avenue North	59101-1944
Emergency Services/Law Enforcement	United Way Volunteer Center	Billings	2920 2nd Ave N	59101
Emergency Services/Law Enforcement	Yellowstone County Sheriff's Office	Billings	219 North 26th Street	59101-2246
Emergency Services/Law Enforcement	Laurel City Police Department	Laurel	215 West 1st Street	59044-3003

UPDATED Table D-2. Critical Facilities - Government, Airport, Utility

Critical Structure Type	Name	Community	Address	Zip
Government - Military, National Guard	Billings AFRC	Billings	2915 Gabel Rd	59101
Government - Military, National Guard	Billings Organizational Maintenance Shop	Billings	5403 Neibauer Rd	59101
Government - State	Billings Phone Claims	Billings	624 N 24th St	59101
Government - State	DPHHS Leased - 6931 & 8037	Billings	2121 Rosebud Dr	59101
Government - State	MDT 24-Stall Equipment Storage	Billings	424 Morey St	59101
Government - State	MDT Office & Shop	Billings	424 Morey St	59101
Government - State	Region 5 Headquarters	Billings	2300 Lake Elmo Dr	59101
Government - State	Technical & Southern Field Office	Billings	2535 St John Ave	59101
Transportation Infrastructure - Airport	BILLINGS LOGAN INTL	Billings	1901 Terminal Circle	59101
Transportation Infrastructure - Airport	HAYNES	Billings		59101
Transportation Infrastructure - Airport	WILCOX	Billings	1812 66th St W	59101
Transportation Infrastructure - Airport	RUFF	Custer		59024
Transportation Infrastructure - Airport	COTTONWOOD	Laurel	Park City	59044
Transportation Infrastructure - Airport	LAUREL MUNI	Laurel	9470 Laurel Airport Rd	59044
Utility	Physical Plant	Broadview	324 N Rim Rd	59015

UPDATED Table D-3. Critical Facilities - Emergency Shelters (schools, churches)

Name	Community	Address	Zip
First Assembly of God Church Life Ctr			
SENIOR School			
West Side Baptist Church			
1st Congregational Church	Billings	310 N 27th St	59101
48th Street Church of Christ	Billings	14 48th St W	59101
ALKALI CREEK School	Billings	681 Alkali Creek Road	59101
ALTERNATIVE School	Billings		59101
American Red Cross Shelter	Billings		59101
ARROWHEAD School	Billings	2510 38th St. W	59101
BEARTOOTH School	Billings	1345 Elaine Street	59101
BENCH School	Billings	505 Milton Road	59101
BIG SKY School	Billings	3231 Granger Ave E	59101
Billings First United Methodist Church	Billings		59101
BITTERROOT School	Billings	1801 Bench Blvd	59101
Blue Creek School	Billings	3652 Blue Creek Rd	59101
BOULDER School	Billings	2202 32nd Street West	59101
BROADWATER School	Billings	415 Broadwater	59101
BURLINGTON School	Billings	2135 Lewis Avenue	59101
Canyon Creek School	Billings	3139 Duck Creek Rd	59101
CAREER EDUCATION CENTER	Billings		59101
CASTLE ROCK School	Billings	1441 Governor's Blvd	59101
CENTRAL HEIGHTS School	Billings	120 Lexington	59101
EAGLE CLIFF School	Billings	1201 Kootenai	59101
Elder Grove School	Billings	1532 South 64th Street West	59101
ELYSIAN School	Billings	6416 Elysian Road	59101
Emmanuel Baptist Church	Billings	328 Shiloh Rd	59101
Faith Evangelical Church	Billings	3145 Sweet Water Dr	59101
Fellowship Baptist Church	Billings	423 Westgate Dr	59101
First Alliance Church	Billings	1835 Central Ave	59101
First Baptist Church	Billings	218 N 34 St	59101
First Presbyterian Church	Billings	2420 13th St W	59101
Grace United Methodist Church	Billings	1935 Avenue B	59101
Heights Baptist Church	Billings	810 Garnet Ave	59101
HIGHLAND School	Billings	729 Parkhill Drive	59101
Independent Elementary School	Billings	2907 Roundup Road	59101
LEWIS & CLARK School	Billings	1315 Lewis Ave	59101
LINCOLN CENTER School	Billings		59101
Lockwood Evangelical Church	Billings		59101
LOCKWOOD INTERMEDIATE School	Billings	1932 US Hwy 87 E	59101
LOCKWOOD MIDDLE School	Billings	1932 US Hwy 87 E	59101
Lockwood School	Billings	1932 US Hwy 87 E	59101
Lutheran Church of The Good Shepherd	Billings	1108 24th St W	59101

UPDATED Table D-3. Critical Facilities - Emergency Shelters (schools, churches)

Name	Community	Address	Zip
MCKINLEY School	Billings	820 North 31st Street	59101
MEADOWLARK School	Billings	221 29th St W	59101
MILES AVENUE School	Billings	1601 Miles Ave	59101
MORIN School	Billings	8824 Pryor Road	59101
NEWMAN School	Billings	605 South Billings Blvd	59101
ORCHARD School	Billings	120 Jackson Street	59101
Parkhill Assembly of God Church	Billings	1707 Parkhill Dr	59101
Peace Lutheran Church	Billings	1301 Avenue D	59101
Pilgrim Congregational Church	Billings	409 S 36th St	59101
PIONEER School	Billings	1937 Dover Rd	59101
POLY School	Billings	2410 Poly Drive	59101
PONDEROSA School	Billings	4188 King Avenue East	59101
Rimrock Baptist Church	Billings		59101
RIMROCK School	Billings		59101
RIVERSIDE School	Billings	3700 Madison Ave	59101
ROSE PARK School	Billings	1812 19th Street West	59101
SANDSTONE School	Billings	1440 Nutter Blvd	59101
SKYVIEW School	Billings	1775 High Sierra Blvd	59101
St Bernard Church	Billings	226 Wicks Ln	59101
Trinity Baptist Church	Billings	1145 Nutter Blvd	59101
Trinity Lutheran School	Billings	2802 Belvedere Drive	59101
Unsell Activity Center, Central Acres Christian School	Billings	3204 Broadwater Ave	59101
WASHINGTON School	Billings	1044 Cook Ave	59101
WILL JAMES School	Billings	1200 30th St W	59101
Yellowstone Baptist College	Billings	1515 S Shiloh Rd	59101
Yellowstone Boys & Girls Ranch	Billings	1732 South 72nd Street West	59106
YWCA of Billings	Billings	909 Wyoming Avenue	59101
Broadview School	Broadview	13935 1st Street	59015
Custer Public School	Custer	304 4th Avenue	59024
Fred W Graff School	Laurel	417 East Sixth Street	59044
Laurel Baptist Church	Laurel	2920 Outfitter Trl	59044
Laurel High School	Laurel	203 E 8th St	59044
Laurel Middle School	Laurel	410 Colorado Ave	59044
South Elementary School	Laurel	606 South 5th Street	59044
West Elementary School	Laurel	502 8th Avenue	59044
WEST School	Laurel	502 8th Avenue	59044
Phys Ed Building at MSU-B	MSU Billings	1500 N 30th St	59101
SHEPHERD School	Shepherd	7842 Shepherd Rd	59079
Bethlehem Congregational Church UCC	Worden	4th St & Lewis Ave	59088
HUNTLEY PROJECT ELEMENTARY School	Worden	1477 Ash Street	59088
HUNTLEY PROJECT HIGH School	Worden	2436 North 15 Road	59088
HUNTLEY PROJECT MIDDLE School	Worden	1477 Ash Street	59088

UPDATED Table D-4. Critical Facilities - Primary/Secondary Education (source? GIS date?)

Name	Community	Address	Zip
Academic Support Center	MSU Billings	1500 N 30th St	59101
Adelphi Christian Academy	Billings	3212 1st Ave South	59101
Alkali Creek School	Billings	681 Alkali Creek Road	59101
Apostle Lutheran School	Billings	3140 Broadwater Ave	59102
Apsaruke Hall	MSU Billings	1500 N 30th St	59101
Arrowhead School	Billings	2510 38th St. W	59102
Base Line School	Yellowstone		
Beartooth School	Billings	1345 Elaine Street	59105
Bench School	Billings	505 Milton Road	59105
Big Sky Elementary	Billings	3231 Granger Ave E	59102
Billings Career Center	Billings	3723 Central Ave	59102
Billings Central Catholic High School	Billings	3 Broadwater Ave	59101
Billings Christian School	Billings	4525 Grand Ave	59106
Billings Senior High School	Billings	425 Grand Ave	59101
Billings West High School	Billings	2201 St. Johns Ave	59102
Bitterroot School	Billings	1801 Bench Blvd	59105
Blue Creek School	Billings	3652 Blue Creek Rd	59101
Boulder School	Billings	2202 32nd Street West	59102
Broadview Schools	Broadview	13935 1st Street	59015
Broadwater School	Billings	415 Broadwater	59102
Burlington School	Billings	2135 Lewis Avenue	59102
Canyon Creek Schools	Billings	3139 Duck Creek Rd	59101
Castle Rock 7-8	Billings	1441 Governor's Blvd	59105
Central Acres School	Billings	3204 Broadwater Ave	59102
Central Heights School	Billings	120 Lexington	59102
Cisel Hall	MSU Billings	1500 N 30th St	59101
College of Education and Human Services Building	MSU Billings	1500 University Dr	59101
College of Technology	MSU Billings	3803 Central Ave	59101
Crossroads Alternative High School	Billings	1320 Grand Ave	59102
Custer Schools	Custer	304 4th Avenue	59024
Eagle Cliffs Elementary	Billings	1201 Kootenai	59105
Elder Grove Schools	Billings	1532 South 64th Street West	59106
Elysian Schools	Billings	6416 Elysian Road	59101
Fairview School	Yellowstone		
Fred W Graff School	Laurel	417 East Sixth Street	59044
Hawthorn School	Billings		59105
Highland School	Billings	729 Parkhill Drive	59102

UPDATED Table D-4. Critical Facilities - Primary/Secondary Education (source? GIS date?)

Name	Community	Address	Zip
Huntley Project 7-8	Worden	2427 North 15 Road	59088
Huntley Project High School	Worden	2436 North 15 Road	59088
Huntly Project Elementary K-6	Worden	1477 Ash Street	59088
Independent Elementary School	Billings	2907 Roundup Road	59105
Laurel High School	Laurel	203 E 8th St	59044
Laurel Middle School	Laurel	410 Colorado Ave	59044
Lewis & Clark 7-8	Billings	1315 Lewis Ave	59102
Liberal Arts Building	MSU Billings	1500 N 30th Ave	59101
Lincoln Center	Billings	415 North 30 Street	59101
Lockwood Intermediate School	Billings	1932 US Hwy 87 E	59101
Lockwood Middle School	Billings	1932 US Hwy 87 E	59101
Lockwood Primary	Billings	1932 US Hwy 87 E	59101
McDonald Hall	MSU Billings	1236 N Broadway	59101
McKinley School	Billings	820 North 31st Street	59101
McMullen Hall	MSU Billings	1500 N 30th St	59101
Meadowlark School	Billings	221 29th St W	59102
Miles Avenue School	Billings	1601 Miles Ave	59101
Montana State University - Billings	MSU Billings	1500 University Drive	59101
Morin School	Billings	8824 Pryor Road	59101
MSU - Billings College of Technology	MSU Billings	3803 Central Ave	59102
Newman School	Billings	605 South Billings Blvd	59101
North Park Head Start Center	Billings	615 19th Street	59501
Old Rimrock School	Billings	Rimrock Rd	59101
Orchard School	Billings	120 Jackson Street	59101
Petro/Rimrock/SUB Complex	MSU Billings	1500 N 30th St	59101
Physical Education Building	MSU Billings	1500 N 30th St	59101
Pine Hill School	Billings	Pine Hills Rd	59101
Pioneer School	Billings	1937 Dover Rd	59105
Pleasant Valley School	Yellowstone		
Poly Drive School	Billings	2410 Poly Drive	59102
Ponderosa School	Billings	4188 King Avenue East	59101
Progressive School	Billings	4100 McGirl Rd	59105
Rimrock School	Billings	2802 13th Street West	59102
Riverside 7-8	Billings	3700 Madison Ave	59101
Rocky Mountain College	Billings	1511 Poly Drive	59102
Rose Park School	Billings	1812 19th Street West	59102
Sandstone School	Billings	1440 Nutter Blvd	59105
Scandia School	Shepherd	Scandia Rd	59079
Science Building	MSU Billings	1500 N 30th Ave	59101

UPDATED Table D-4. Critical Facilities - Primary/Secondary Education (source? GIS date?)

Name	Community	Address	Zip
Shepherd Elementary	Shepherd	7842 Shepherd Rd	59079
Shepherd Jr/Sr High Schools	Shepherd	7842 Shepherd Rd	59079
Shiloh Christian Pre-School	Billings	328 S Shiloh Rd	59106
Skyview High School	Billings	1775 High Sierra Blvd	59105
South Elementary School	Laurel	606 South 5th Street	59044
St Francis Intermediate School	Billings	1734 Yellowstone Ave	59102
St Francis Primary School	Billings	511 Custer Ave	59101
St Francis Upper School	Billings	205 N 32nd St	59101
Trinity Lutheran School	Billings	2802 Belvedere Drive	59102
Two Pine School	Molt	Molt Rd	59057
Walla Walla Univ., School of Social Work/Sociology	Billings	2520 5th Ave So	59101
Washington School	Billings	1044 Cook Ave	59102
West School	Laurel	502 8th Avenue	59044
Will James 7-8	Billings	1200 30th Street West	59102
Yellowstone Baptist College	Billings	1515 S Shiloh Rd	59106
Yellowstone Boys & Girls Ranch	Billings	1732 South 72nd Street West	59106
Yellowstone Valley Christian	Laurel	400 7th Ave	59044

Appendix E

LIST OF PLANS REVIEWED

Yellowstone County
Multi-Jurisdictional Pre-Disaster Mitigation Plan,
Update 2011

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List of Existing Study/Reference/Guidance Documents

Existing Study/Reference/Guidance	Date	Cited by
FEMA Preliminary Flood Insurance Study, Yellowstone County	2010	
FEMA Local Multi-Hazard Mitigation Planning Guidance	2008	CV-Scope B
New Flood Study Data from US Army Corps of Engineers		CV-Scope B
Flood Hazard Mitigation Plan for Laurel		CV-Scope B
FEMA Crosswalk Plan from 2004 PDM	2004	CV-Scope B
West Billings Flood Control, Stormwater and Ground Water Recharge Measures (Scope A deliverables)		CV-Scope B
Yellowstone County 2004 Pre-Disaster Mitigation Plan	2004	CV-Scope B
Yellowstone County Community Wildfire Protection Plan	2006	CV-Scope B
Yellowstone County Emergency Operations Plan		CV-Scope B
State of Montana Multi-Hazard Mitigation Plan and Statewide Hazard Assessment	2010	CV-Scope B
Yellowstone County and City of Billings Growth Policy	2008	
Yellowstone County Wildfire Protection Plan	2006	
West Billings Flood Hazard Study	2007	
Cooney Dam Emergency Action Plan		Yellowstone 2004
Anita Dam Emergency Action Plan and Inundation Map		Yellowstone 2004
Billings Housing Needs Assessment, Community Development Division	2010	
Seismic Hazard Susceptibility in Southwestern Montana: Comparison at Dillon and Bozeman	1999	
Hazus-MH: Earthquake Event Report, Scenario Hebgen – Normal – 7.3	2010	
Billings Clinic Vulnerability Analysis Matrix	2009	
Montana Pre Disaster Mitigation Plan- Draft	2010	

Appendix F

PROPOSED PRE DISASTER MITIGATION PROJECT SUMMARIES

Yellowstone County
Multi-Jurisdictional Pre-Disaster Mitigation Plan,
Update 2011

West Billings Flood Mitigation Feasibility Study

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Arrow Island Weir Project

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Riverside Park Project

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Appendix G

Crosswalk

Yellowstone County
Multi-Jurisdictional Pre-Disaster Mitigation Plan,
Update 2011

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LOCAL MITIGATION PLAN REVIEW SUMMARY

The plan cannot be approved if the plan has not been formally adopted. Each requirement includes separate elements. All elements of the requirement must be rated "Satisfactory" in order for the requirement to be fulfilled and receive a score of "Satisfactory." Elements of each requirement are listed on the following pages of the Plan Review Crosswalk. A "Needs Improvement" score on elements shaded in gray (recommended but not required) will not preclude the plan from passing. Reviewer's comments must be provided for requirements receiving a **"Needs Improvement"** score.

Prerequisite(s) (Check Applicable Box)	**NOT MET**	**MET**
1. Adoption by the Local Governing Body: §201.6(c)(5) OR		
2. Multi-Jurisdictional Plan Adoption: §201.6(c)(5) **AND**		
3. Multi-Jurisdictional Planning Participation: §201.6(a)(3)		

Planning Process	**N**	**S**
4. Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)		

Risk Assessment	**N**	**S**
5. Identifying Hazards: §201.6(c)(2)(i)		
6. Profiling Hazards: §201.6(c)(2)(i)		
7. Assessing Vulnerability: Overview: §201.6(c)(2)(ii)		
8. Assessing Vulnerability: Addressing Repetitive Loss Properties. §201.6(c)(2)(ii)		
9. Assessing Vulnerability: Identifying Structures, Infrastructure, and Critical Facilities: §201.6(c)(2)(ii)(B)		
10. Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)		
11. Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)		
12. Multi-Jurisdictional Risk Assessment: §201.6(c)(2)(iii)		

*States that have additional requirements can add them in the appropriate sections of the *Local Multi-Hazard Mitigation Planning Guidance* or create a new section and modify this Plan Review Crosswalk to record the score for those requirements.

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SCORING SYSTEM

Please check one of the following for each requirement.

N – Needs Improvement: The plan does not meet the minimum for the requirement. Reviewer's comments must be provided.
S – Satisfactory: The plan meets the minimum for the requirement. Reviewer's comments are encouraged, but not required.

Mitigation Strategy	**N**	**S**
13. Local Hazard Mitigation Goals: §201.6(c)(3)(i)		
14. Identification and Analysis of Mitigation Actions: §201.6(c)(3)(ii)		
15. Identification and Analysis of Mitigation Actions: NFIP Compliance. §201.6(c)(3)(ii)		
16. Implementation of Mitigation Actions: §201.6(c)(3)(iii)		
17. Multi-Jurisdictional Mitigation Actions: §201.6(c)(3)(iv)		

Plan Maintenance Process	**N**	**S**
18. Monitoring, Evaluating, and Updating the Plan: §201.6(c)(4)(ii)		
19. Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)		
20. Continued Public Involvement: §201.6(c)(4)(iii)		

LOCAL MITIGATION PLAN APPROVAL STATUS

PLAN NOT APPROVED	
See Reviewer's Comments	
PLAN APPROVED	

Local Mitigation Plan Review and Approval Status Jurisdiction: Yellowstone County, Montana	**Title of Plan:** Yellowstone County PDM Plan Update	**Date of Plan:**
Local Point of Contact: Duane Winslow		**Address:** Yellowstone County Courthouse Room 312 217 N. 27th Ave Billings, MT 59101
Title: Emergency and General Services Director		
Agency: Office of Emergency Management		
Phone Number: (406) 256-2775		**E-Mail:** DWinslow@co.yellowstone.mt.gov

State Reviewer:	**Title:**	**Date:**

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

Date Approved	

Jurisdiction:	DFIRM		NFIP Status*			
	In Plan	NOT in Plan	Y	N	N/A	CRS Class
1. Yellowstone County			X			
2. City of Billings			X			
3.City of Laurel			X			
4.Town of Broadview				X		
5. [ATTACH PAGE(S) WITH ADDITIONAL JURISDICTIONS]						

*** Notes:** **Y = Participating** **N = Not Participating** **N/A = Not Mapped**

PREREQUISITE(S)

1. Adoption by the Local Governing Body

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

Element	Location in the Plan	Reviewer's Comments	SCORE	
			NOT MET	MET
A. Has the local governing body adopted the **new or updated** plan?	*vii-x*			
B. Is supporting documentation, such as a resolution, included?	*vii-x*			
		SUMMARY SCORE		

2. Multi-Jurisdictional Plan Adoption

***Requirement §201.6(c)(5)*:** *For multi-jurisdictional plans, each jurisdiction requesting approval of the plan **must** document that it has been formally adopted.*

Element	Location in the Plan	Reviewer's Comments	SCORE	
			NOT MET	MET
A. Does the **new or updated** plan indicate the specific jurisdictions represented in the plan?	Preface, Page *xi*			
B. For each jurisdiction, has the local governing body adopted the **new or updated** plan?	*vii-x*			
C. Is supporting documentation, such as a resolution, included for each participating jurisdiction?	*vii-x*			
		SUMMARY SCORE		

3. Multi-Jurisdictional Planning Participation

***Requirement §201.6(a)(3)*:** *Multi-jurisdictional plans (e.g., watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process … Statewide plans will not be accepted as multi-jurisdictional plans.*

Element	Location in the Plan	Reviewer's Comments	SCORE NOT MET	SCORE MET
A. Does the **new or updated** plan describe **how** each jurisdiction participated in the plan's development?	Section 2.0, Pages 11-12			
B. Does the updated plan identify all participating jurisdictions, including new, continuing, and the jurisdictions that no longer participate in the plan?	Preface, Page *x*			
		SUMMARY SCORE		

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

4. Documentation of the Planning Process

***Requirement §201.6(b):** In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process **shall** include:*

(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;

(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and

(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

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

Element	Location in the Plan	Reviewer's Comments	SCORE N	SCORE S
A. Does the plan provide a narrative description of the process followed to prepare the **new or updated** plan?	Section 2.0, Pages 11-12			
B. Does the **new or updated** plan indicate who was involved in the **current** planning process? (For example, who led the development at the staff level and were there any external contributors such as contractors? Who participated on the plan committee, provided information, reviewed drafts, *etc.*?)	Section 2.0, Pages 11-12			
C. Does the **new or updated** plan indicate how the public was involved? (Was the public provided an opportunity to comment on the plan during the drafting stage and prior to the plan approval?)	Section 2.0, Pages 11-12			
D. **Does the new or updated plan discuss the** opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process?	Section 2.0, Pages 11-12			
E. Does the planning process describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information?	Appendix F			
F. Does the updated plan document how the planning team reviewed and analyzed each section of the plan and whether each section was revised as part of the update process?	Appendix C			
		SUMMARY SCORE		

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RISK ASSESSMENT: *§201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.*

5. Identifying Hazards

Requirement §201.6(c)(2)(i): *[The risk assessment **shall** include a] description of the type … of all natural hazards that can affect the jurisdiction.*

Element	Location in the Plan	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan include **a description** of the types of **all natural hazards** that affect the jurisdiction?	Table 4 Page 14			
		SUMMARY SCORE		

6. Profiling Hazards

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

Element	Location in the Plan	Reviewer's Comments	SCORE N	SCORE S
A. Does the risk assessment identify the **location** (*i.e.*, geographic area affected) of each natural hazard addressed in the **new or updated** plan?	Section 3.0, Figures 4, 7, 9, 10			
B. Does the risk assessment identify the **extent** (*i.e.*, magnitude or severity) of each hazard addressed in the **new or updated** plan?	Section 3.0 Pages 13 - 49			
C. Does the plan provide information on **previous occurrences** of each hazard addressed in the **new or updated** plan?	Section 3.0 Pages 13 - 49			
D. Does the plan include the **probability of future events** (*i.e.*, chance of occurrence) for each hazard	Section 3.0			

addressed in the **new or updated** plan?	Pages 13 - 49			
		SUMMARY SCORE		

7. Assessing Vulnerability: Overview

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

Element	Location in the Plan	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan include an **overall summary** description of the jurisdiction's **vulnerability** to each hazard?	Table 16, Pages 50-51			
B. Does the **new or updated** plan address the **impact** of each hazard on the jurisdiction?	Table 16, Pages 50-51			
		SUMMARY SCORE		

8. Assessing Vulnerability: Addressing Repetitive Loss Properties

Requirement §201.6(c)(2)(ii): *[The risk assessment] **must** also address NFIP insured structures that have been repetitively damaged floods.*

Element	Location in the Plan	Reviewer's Comments	SCORE N	SCORE S
A. Does the new or updated plan describe vulnerability in terms of the types and numbers of *repetitive loss properties* located in the identified hazard areas?	Table 6, Pages 17-18	***Note: This requirement becomes effective for all local plans approved after October 1, 2008.***		
		SUMMARY SCORE		

9. Assessing Vulnerability: Identifying Structures

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

Element	Location in the Plan	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan describe vulnerability in terms of the **types and numbers** of **existing** buildings, infrastructure, and critical facilities located in the identified hazard areas?	Section 3.1.1, Page 19 Table 7, Page 22	***Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.***		
B. Does the **new or updated** plan describe vulnerability in terms of the **types and numbers** of **future** buildings, infrastructure, and critical facilities located in the identified hazard areas?	No	***Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.***		
		SUMMARY SCORE		

10. Assessing Vulnerability: Estimating Potential Losses

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

Element	Location in the Plan	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan estimate **potential dollar losses** to vulnerable structures?	Table 7, Page 22 Table 8, Page 27	***Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.***		
B. Does the **new or updated** plan describe the **methodology** used to prepare the estimate?	Table 4 Page 14	***Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.***		
		SUMMARY SCORE		

11. Assessing Vulnerability: Analyzing Development Trends

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

Element	Location in the Plan	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan describe land uses and development trends?	Section 1.2, Page 2	***Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.***		
		SUMMARY SCORE		

12. Multi-Jurisdictional Risk Assessment

Requirement §201.6(c)(2)(iii): *For multi-jurisdictional plans, the risk assessment **must** assess each jurisdiction's risks where they vary from the risks facing the entire planning area.*

Element	Location in the Plan	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan include a risk assessment for each participating jurisdiction as needed to reflect unique or varied risks?	Figure 5, Page 21 Sections 3.1.9 & 3.1.10 , Pages 37-40			
		SUMMARY SCORE		

MITIGATION STRATEGY: *§201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.*

13. Local Hazard Mitigation Goals

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

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Element	Location in the Plan	Reviewer's Comments	SCORE	
			N	S
A Does the **new or updated** plan include a description of mitigation **goals** to reduce or avoid long-term vulnerabilities to the identified hazards?	Section 4.1 Page 52 - 54			
		SUMMARY SCORE		

14. Identification and Analysis of Mitigation Actions

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan identify and analyze a **comprehensive range** of specific mitigation actions and projects for each hazard?	Section 4.2 Page 54-55			
B Do the identified actions and projects address reducing the effects of hazards on **new** buildings and infrastructure?	Section 4.2 Page 54-55			
C. Do the identified actions and projects address reducing the effects of hazards on **existing** buildings and infrastructure?	Section 4.2 Page 54-55			
		SUMMARY SCORE		

15. Identification and Analysis of Mitigation Actions: NFIP Compliance

Requirement: §201.6(c)(3)(ii): *[The mitigation strategy] must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.*

Element	Location in the Plan	Reviewer's Comments	SCORE N	SCORE S
A. Does the new or updated plan describe the jurisdiction (s) participation in the NFIP?	Section 3.1, Pages 17-18	***Note: This requirement becomes effective for all local mitigation plans approved after October 1, 2008.***		
B. Does the mitigation strategy identify, analyze and prioritize actions related to continued	Section 3.1, Page 18	***Note: This requirement becomes effective for all local mitigation plans approved after***		

compliance with the NFIP?		***October 1, 2008.***		
		SUMMARY SCORE		

16. Implementation of Mitigation Actions

Requirement: §201.6(c)(3)(iii): *[The mitigation strategy section **shall** include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization **shall** include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.*

Element	Location in the Plan	Reviewer's Comments	SCORE	
			N	S
A. Does the **new or updated** mitigation strategy include how the actions are **prioritized**? (For example, is there a discussion of the process and criteria used?)	Section 4.5, Pages 56-57			
B. Does the **new or updated** mitigation strategy address how the actions will be implemented and administered, including the responsible department, existing and potential resources and the timeframe to complete each action?	Section 5.3, Pages 58-59			
C. Does the **new or updated** prioritization process include an emphasis on the use of a **cost-benefit review** to maximize benefits?	Section 4.5, Pages 56-58			
D. Does the **updated** plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (*i.e.*, deferred), does the updated plan describe why no changes occurred?	Section 4.2 Pages 52-54			
		SUMMARY SCORE		

17. Multi-Jurisdictional Mitigation Actions

Requirement §201.6(c)(3)(iv): *For multi-jurisdictional plans, there **must** be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.*

Element	Location in the Plan	Reviewer's Comments	SCORE N	SCORE S
A Does the **new or updated** plan include identifiable **action items** for each jurisdiction requesting FEMA approval of the plan?	Section 5.3, Page 59			
B. Does the **updated** plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (*i.e.*, deferred), does the updated plan describe why no changes occurred?	Section 4.2 Pages 52-54			
		SUMMARY SCORE		

PLAN MAINTENANCE PROCESS

18. Monitoring, Evaluating, and Updating the Plan

Requirement §201.6(c)(4)(i): *[The plan maintenance process **shall** include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.*

Element	Location in the Plan	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan describe the method and schedule for **monitoring** the plan, including the responsible department?	Section 5.1, Page 59			
B. Does the **new or updated** plan describe the method and schedule for **evaluating** the plan, including how, when and by whom (*i.e.* the responsible department)?	Section 5.1, Page 59			
C. Does the **new or updated** plan describe the method and schedule for **updating** the plan within	Section 5.1, Page 59			

the five-year cycle?				
		SUMMARY SCORE		

19. Incorporation into Existing Planning Mechanisms

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

Element	Location in the Plan	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan identify other local planning mechanisms available for incorporating the mitigation requirements of the mitigation plan?	*Section 5.2, Page 59*			
B. Does the **new or updated** plan include a process by which the local government will incorporate the mitigation strategy and other information contained in the plan (*e.g.*, risk assessment) into other planning mechanisms, when appropriate?	*Section 5.2, Page 59*			
C. Does the **updated** plan explain how the local government incorporated the mitigation strategy and other information contained in the plan (*e.g.*, risk assessment) into other planning mechanisms, when appropriate?	*Section 5.2, Page 59*			
		SUMMARY SCORE		

Continued Public Involvement

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

Element	Location in the Plan	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan explain how **continued public participation** will be obtained? (For example, will there be public notices, an on-going mitigation plan committee, or annual review	Section 5.4, Page 60			

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meetings with stakeholders?)				
		SUMMARY SCORE		

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MATRIX A: PROFILING HAZARDS

This matrix can assist FEMA and the State in scoring each hazard. Local jurisdictions may find the matrix useful to ensure that their plan addresses each natural hazard that can affect the jurisdiction. **Completing the matrix is not required**.

Note: First, check which hazards are identified in requirement §201.6(c)(2)(i). Then, place a checkmark in either the N or S box for each applicable hazard. An "N" for any element of any identified hazard will result in a "Needs Improvement" score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk.

To check boxes, double click on the box and change the default value to "checked."

Hazard Type	Hazards Identified Per Requirement §201.6(c)(2)(i)	A. Location		B. Extent		C. Previous Occurrences		D. Probability of Future Events	
	Yes	N	S	N	S	N	S	N	S
Avalanche	☐	☐	☐	☐	☐	☐	☐	☐	☐
Coastal Erosion	☐	☐	☐	☐	☐	☐	☐	☐	☐
Coastal Storm	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dam Failure	☐	☐	☐	☐	☐	☐	☐	☐	☐
Drought	☐	☐	☐	☐	☐	☐	☐	☐	☐
Earthquake	☐	☐	☐	☐	☐	☐	☐	☐	☐
Expansive Soils	☐	☐	☐	☐	☐	☐	☐	☐	☐
Levee Failure	☐	☐	☐	☐	☐	☐	☐	☐	☐
Flood	☐	☐	☐	☐	☐	☐	☐	☐	☐
Hailstorm	☐	☐	☐	☐	☐	☐	☐	☐	☐
Hurricane	☐	☐	☐	☐	☐	☐	☐	☐	☐
Land Subsidence	☐	☐	☐	☐	☐	☐	☐	☐	☐
Landslide	☐	☐	☐	☐	☐	☐	☐	☐	☐
Severe Winter Storm	☐	☐	☐	☐	☐	☐	☐	☐	☐

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Tornado	☐	☐	☐	☐	☐	☐	☐	☐	☐
Tsunami	☐	☐	☐	☐	☐	☐	☐	☐	☐
Volcano	☐	☐	☐	☐	☐	☐	☐	☐	☐
Wildfire	☐	☐	☐	☐	☐	☐	☐	☐	☐
Windstorm	☐	☐	☐	☐	☐	☐	☐	☐	☐

§201.6(c)(2)(i) Profiling Hazards

A. Does the risk assessment identify the location (*i.e.*, geographic area affected) of each hazard addressed in the **new or updated** plan?

B. Does the risk assessment identify the extent (*i.e.*, magnitude or severity) of each hazard addressed in the **new or updated** plan?

C. Does the plan provide information on previous occurrences of each natural hazard addressed in the **new or updated** plan?

D. Does the plan include the probability of future events (*i.e.*, chance of occurrence) for each hazard addressed in the plan?

MATRIX B: ASSESSING VULNERABILITY

This matrix can assist FEMA and the State in scoring each hazard. Local jurisdictions may find the matrix useful to ensure that the new or updated plan addresses each requirement. **Completing the matrix is not required**.

*Note: First, check which hazards are identified in requirement §201.6(c)(2)(i). Then, place a checkmark in either the N or S box for each **applicable** hazard. An "N" for any element of any identified hazard will result in a "Needs Improvement" score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk. Note: Receiving an N in the shaded columns will not preclude the plan from passing.*

To check boxes, double click on the box and change the default value to "checked."

Hazard Type	Hazards Identified Per Requirement §201.6(c)(2)(i)	Assessing Vulnerability:	A. Overall Summary Description of Vulnerability		B. Hazard Impact		Vulnerability:	A. Types and Number of Existing Structures in Hazard Area (Estimate)		B. Types and Number of Future Structures in Hazard Area (Estimate)		Vulnerability: Estimating	A. Loss Estimate		B. Methodology	
	Yes		N	S	N	S		N	S	N	S		N	S	N	S
Avalanche	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Coastal Erosion	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Coastal Storm	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Dam Failure	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Drought	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Earthquake	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Expansive Soils	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Levee Failure	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Flood	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Hailstorm	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Hurricane	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Land Subsidence	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Landslide	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Severe Winter Storm	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Tornado	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐

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Tsunami	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Volcano	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Wildfire	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Windstorm	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Other _____	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Other _____	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Other _____	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐

Legend:
§201.6(c)(2)(ii) Assessing Vulnerability: Overview
A. Does the **new or updated** plan include an overall summary description of the jurisdiction's vulnerability to each hazard?
B. Does the **new or updated** plan address the impact of each hazard on the jurisdiction?
§201.6(c)(2)(ii)(A) Assessing Vulnerability: Identifying Structures
A. Does the **new or updated** plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?
B. Does the **new or updated** plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas?
§201.6(c)(2)(ii)(B) Assessing Vulnerability: Estimating Potential Losses
A. Does the **new or updated** plan estimate potential dollar losses to vulnerable structures?
B. Does the **new or updated** plan describe the methodology used to prepare the estimate?

MATRIX C: IDENTIFICATION AND ANALYSIS OF MITIGATION ACTIONS

This matrix can assist FEMA and the State in scoring each hazard. Local jurisdictions may find the matrix useful to ensure consideration of a range of actions for each hazard. **Completing the matrix is not required.**

*Note: First, check which hazards are identified in requirement §201.6(c)(2)(i). Then, place a checkmark in either the N or S box for each **applicable** hazard. An "N" for any identified hazard will result in a "Needs Improvement" score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk.*

Hazard Type	Hazards Identified Per Requirement §201.6(c)(2)(i)	A. Comprehensive Range of Actions and Projects	
	Yes	N	S
Avalanche	☐	☐	☐
Coastal Erosion	☐	☐	☐
Coastal Storm	☐	☐	☐

To check boxes, double click on the box and change the default value to "checked."

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Hazard Type	Hazards Identified Per Requirement §201.6(c)(2)(i)	A. Comprehensive Range of Actions and Projects	
	Yes	N	S
Dam Failure	☐	☐	☐
Drought	☐	☐	☐
Earthquake	☐	☐	☐
Expansive Soils	☐	☐	☐
Levee Failure	☐	☐	☐
Flood	☐	☐	☐
Hailstorm	☐	☐	☐
Hurricane	☐	☐	☐
Land Subsidence	☐	☐	☐
Landslide	☐	☐	☐
Severe Winter Storm	☐	☐	☐
Tornado	☐	☐	☐
Tsunami	☐	☐	☐
Volcano	☐	☐	☐
Wildfire	☐	☐	☐
Windstorm	☐	☐	☐

Legend:

§201.6(c)(3)(ii) Identification and Analysis of Mitigation Actions
A. Does the **new or updated** plan identify and analyze a comprehensive range of specific mitigation actions and projects for each hazard?