

Benton County Natural Hazard Mitigation Plan



July 2016

Prepared by

Kaysinger Basin Regional Planning Commission

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Prerequisites

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.

Adoption resolutions for the participating jurisdictions are included in Appendix A.

Section 1: Introduction and Planning Process

1.1 Purpose and Background

Following the severe weather, tornado, and flood disaster that was declared in the spring of 2002 (DR-1412), Missouri's State Emergency Management Agency (SEMA) received flood buyout project proposals from 23 communities across the state. Fortunately, they were able to help some of these communities with federal mitigation grant funding provided through the Federal Emergency Management Agency (FEMA). After November 1, 2010, communities like these will still be eligible for federal disaster assistance and individual assistance, but will not be eligible for mitigation assistance unless they have an approved hazard mitigation plan on file. For the nearly 1,000 cities and 114 counties in Missouri, mitigation plans will be required for all federally declared disasters such as flood, earthquake, ice storm, tornado, and fire. Under the rules for federal mitigation funding, local governments will be required to have FEMA-approved hazard mitigation plans in place as a condition to receiving federal mitigation grant funding as of the 2010 deadline.

Under the initiative set forth by SEMA, the Missouri Association of Councils of Government (MACOG) agreed to meet the challenge of developing county and municipal plans throughout the state. The 19 regional planning commissions of MACOG provide an effective way for local governments to work together to share technical staff and address common problems in need of an area-wide approach. They also can effectively deliver programs that might be beyond the resources of an individual county or municipal government.

The intent of the regional planning commissions in Missouri is to be of service to their member counties and municipalities and to bring an organized approach to addressing a broad cross-section of area-wide issues. They also are available to assist their member entities in coordinating the needs of the area with state and federal agencies or with private companies or other public bodies. SEMA's initiative further states that, due to time and funding limitations, the plans developed by Missouri's regional planning commissions should cover natural hazards only. Manmade and/or technological hazards are not addressed in this plan, except in the context of cascading damages.

Citizens and public organizations have participated in the process. This effort will be sustainable over the long term because it enjoys grassroots support that stems from a sense of local and individual ownership.

Through SEMA's Scope of Work, Benton County contracted with Kaysinger Basin Regional Planning Commission and participated fully in the preparation of the plan. Once this plan is

approved, Benton County and cities within the county will be eligible for future mitigation assistance from FEMA and will be able to more effectively carry out mitigation activities to lessen the adverse impact of future disasters within the county.

Most of the rural regional planning commissions in Missouri were formed under Chapter 251 of the Revised Statutes of the State of Missouri. All regional councils in Missouri operate as “quasi-governmental” entities. In Missouri, regional planning commissions are advisory in nature, county, and municipal governments hold memberships on a voluntary basis.

The Benton County hazard mitigation Plan was prepared by the staff of the Kaysinger Basin Regional Planning Commission (KBRPC). KBRPC, a member of MACOG, was created October 14, 1968 by Governor Warren E. Hearnes. The commission serves the seven county areas of Bates, Benton, Cedar, Henry, Hickory, St. Clair, and Vernon counties.

The plan was developed in accordance with FEMA’s Mitigation Planning regulations under Code of Federal Regulations (CFR), Title 44, Part 201.6, *Local Mitigation Plans*. Relevant requirements from CFR §201.6 are highlighted throughout the plan.

1.2 History of the Benton County Hazard Mitigation Plan

In November 2004, a “current and approved” hazard mitigation plan became a FEMA eligibility requirement for local jurisdictions applying for pre-disaster mitigation grants and the mitigation portion of post-disaster grant funds.

Due to this change in FEMA grant requirements, the Missouri State Emergency Management Agency (SEMA) contracted with the Missouri Council of Governments for the Regional Planning Commissions to direct hazard mitigation planning for interested counties within their respective regions. Benton County, a member of the Kaysinger Basin Regional Planning Commission (KBRPC), contracted with the KBRPC to facilitate the development of a hazard mitigation plan for the county. The plan was approved by FEMA and adopted by the participating jurisdictions in the spring of 2005.

Maintenance of Hazard Mitigation Plan 2005-2015

The Benton County Hazard Mitigation Plan 2005 was written to be a working document to guide participating jurisdictions in the county in the work of mitigating potential hazards. To this effect, the plan will be publicly available on the website of the Kaysinger Basin Regional Planning Commission.

During the ensuing years, the Kaysinger Basin RPC has kept the jurisdictions informed of mitigation grant opportunities through letters and announcements at meetings of the RPC.

The maintenance plan in the original document called for an annual review of the plan by the

Benton County Hazard Mitigation Steering Committee, facilitated by the Kaysinger Basin RPC. These annual reviews did not take place; shortage of time and personnel and personnel changes all played a role in this omission.

This plan update lays out a clearly defined maintenance process with for review and concrete tools to be employed in the review. This process is found in Section 5 of the plan.

1.3 Participating Jurisdictions

Requirement

§201.6(a) (3): Multi-jurisdictional 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.

Kaysinger Basin Regional Planning Commission (KBRPC), on behalf of Benton County, invited incorporated cities, school districts, and private non-profit entities in the County to participate in the Benton County Multi-Jurisdictional Hazard Mitigation Plan update. DMA 2000 requires that jurisdictions represented by a multi-jurisdictional plan participate in the planning process and formally adopt the plan. Each participating jurisdiction was required to meet plan participation requirements as defined by KBRPC at the beginning of the planning process.

Minimum participation requirements are defined as follows:

- Provide information to support plan update through **at least one** of the following methods:
 - Completion of worksheets;
 - Attendance at public meetings;
 - Executed letters of authorization
 - Alternately scheduled meetings with KBRPC staff for data collection; or
 - Communicate with KBRPC staff through email concerning data collection.
- Formal adoption of the mitigation plan update.

All of the jurisdictions listed as participants in the plan update met the minimum participation requirements as indicated in the table below. Documentation in the form of people contacted, sign-in sheets for attendance at group meetings as well as time sheets for meetings with KBRPC staff is included in *Appendix D: Public Participation Documentation*.

The participating jurisdictions in the original plan (2005) and those participating to any degree in the updated plan (2015) are the same. The term “Planning Area” is used in the plan to indicate, as a whole, all of the jurisdictions which participated in the planning process to any degree.

Table 1.3-1 and 1.3-2 Participating Jurisdictions

2015 Hazard Mitigation Participation by Jurisdiction					
Participant	Worksheets	Public County Wide Meetings	Email	Formal plan adoption	Meetings with KBRPC staff
Benton County		X	X	X	X
City of Cole Camp	X		X	X	X
City of Lincoln	X	X	X	X	X
City of Warsaw	X	X	X	X	X
Village of Ionia	X	X	X	X	X
Cole Camp R-I School District	X	X	X	X	X
Lincoln R-II School District	X		X	X	X
Warsaw R-IX School District	X	X	X	X	X

Participating Jurisdictions	2005	2010
Benton County Commissioners	X	X
City of Cole Camp	X	X
City of Lincoln	X	X
City of Warsaw	X	X
Village of Ionia	X	
Cole Camp R-I School District		X
Lincoln R-II School District		X
Warsaw R-IX School District		X

The chart in Table 1.3-1 and 1.3-2 also tracks the completion of the criteria for inclusion as a participating jurisdiction in the plan. The column on the far right of the chart (“2010 Participating Jurisdictions”) indicates those jurisdictions which have completed the above requirements and are requesting approval of the plan prior to formal adoption.

The primary representatives for each jurisdiction participating to any degree in the update process are shown in Figure 1.3-3. The representative indicated had the primary contact with the Plan Author for purposes of participation in the plan. It should be noted, however, that there was wider participation in the planning process within each jurisdiction. Further information on the planning in each participating jurisdiction is given in Section 4.4.

Table 1.3-3 Representatives for each Jurisdiction who participated in the plan.

Jurisdiction	Title	Representative
Benton County	County Emergency Management Director	Bill Gant
City of Cole Camp	City Clerk, Police Chief, Cole Camp EMS	Ruth Eckoff, Stephen Philips, & Bob Meuschke
City of Lincoln	Mayor, City Clerk, & Public Works Dept.	John King, Barbara Johnson, & Dusty Koll
City of Warsaw	City Clerk, City Administrator, & Alderman	Tina Lomax, Randy Pogue, & Terry Marshall
Village of Ionia	Alderman	Bob Beeson
Cole Camp R-I School District	Superintendent & Principal	Tim Roling & Tyler Clark
Lincoln R-II School District	Superintendent	Kevin Smith
Warsaw R-IX School District	Superintendent & Assistant Superintendent	Scott Downing & Tim Thomas

1.4 The Update Process

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.

A Hazard Mitigation Plan must be updated and adopted by the participating jurisdictions every five years to be considered current. The update of the Benton County Hazard Mitigation Plan was directed by a planner from Kaysinger Basin RPC as specified in a Memorandum of Agreement (MOA) with the Missouri State Emergency Management Agency (SEMA). The general planning process along with significant dates were as follows:

1. MOA for Update of Benton County Hazard Mitigation Plan received from SEMA (December 2014).
2. Preliminary update of technical data in charts and graphs (e.g. storm history events, population statistics, etc.) by Kaysinger Basin RPC staff (January 2015-April 2016).
3. Several one on one individual jurisdictional meetings to educate, prepare paperwork, and update data (January 2015-April 2016).
4. NHMP information county wide public meeting April 21nd, 2016 Lincoln, Missouri.
5. NHMP kick off committee County wide public meeting April 22nd, 2016 Warsaw, Missouri.
6. NHMP Mitigation Strategy Work Plan Update County wide public meeting April 27th, 2016 Warsaw, Missouri.
7. Draft presented for 30-day public comment period and adoption by jurisdictions (May 2016).
8. Draft of update due at SEMA for review (June, 2016).

Technical Steering Committee

The Technical Steering Committee was formed with the intention of having a diversity of members who would represent the interests of all participating jurisdictions. Planners from the Kaysinger Basin RPC, which works with communities throughout Benton County, initiated the formation of the committee and participated in the committee meetings. A full list of people invited can be found in Appendix D.

The Technical Steering Committee consisted of the following individuals:

Table 1.4-1		
Jurisdiction	Title	Representative
Benton County	County Emergency Management Director	Bill Gant
City of Cole Camp	City Clerk, Police Chief, Cole Camp EMS	Ruth Eckoff, Stephen Philips, & Bob Meuschke
City of Lincoln	Mayor, City Clerk, & Public Works Dept.	John King, Barbara Johnson, & Dusty Koll
City of Warsaw	City Clerk, City Administrator, & Alderman	Tina Lomax, Randy Pogue, & Terry Marshall
Village of Ionia	Alderman	Bob Beeson
Cole Camp R-I School District	Superintendent & Principal	Tim Roling & Tyler Clark
Lincoln R-II School District	Superintendent	Kevin Smith
Warsaw R-IX School District	Superintendent & Assistant Superintendent	Scott Downing & Tim Thomas
KBRPC	Regional Planner	Cyndee Schmidt

Summary of Update of the Plan

The Technical Steering Committee decided that each section of the plan needed to be updated. The original plan was written early in FEMA's decision making cycle regarding requirements for Hazard Mitigation Plans. It contained useful but vague information so as the goal for this update was to be as specific as possible. The goal was to produce a plan which is relevant, useful, and readable.

The plan was also restructured from its original organization to promote readability and flow. A general description of changes and updates made to the plan are shown in Table 1.4-2.

A public comment period was held from May 2nd, 2016 to June 2nd, 2016 in which no suggestions or critiques of the plan were given.

Table 1.4-2

Plan Section	Update Review and Analysis
Section 1- Introduction and Planning Process	Updated the participants list to include new and deleted participating jurisdictions. The new meeting dates for the update process as well as the planning process, participation standards and time frame were added as well.
Section 2- Planning Area Profile & Capabilities	The list of critical facilities was brought up to date. All relevant community plans were addressed and reviewed by the public and hazard mitigation plan stakeholders. Listings of media relations and infrastructure were all made current and all city maps were updated.
Section 3 – Risk Assessment	All data pertaining to hazard occurrences brought up to 2015 events. All maps were updated.
Section 4 – Mitigation Strategy	Categories of mitigation reviewed and brought up to current categorization measures. All goals and actions were reviewed by the public, elected officials and emergency personnel to determine the best and most cost effective mitigation priorities in the County. Goals were analyzed and either remained, were deleted, revised or new goals were added. Jurisdictional specific goals and actions were also identified.
Section 5 – Mitigation Maintenance	Review of existing plans, particularly the County Master Plan and Emergency Operations Plan. County capabilities were reviewed for accuracy and relevance. Mitigation funding sources were also revised to reflect the main federal mitigation grants available. Jurisdictional development trends were also reviewed and made current on their status.
Section 6 – Maps	Section removed relevant maps were moved to corresponding sections.
Appendices	Additional appendices were added for acronyms, and definitions were added along with public participation documents.

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;

Public Officials and Community Leaders Meeting

Several individual and county wide meetings were held for cities, county, the public, and three meetings were held one for each participating school district. An introductory and informative power point about the county's Hazard Mitigation Plan by Kaysinger Basin Regional Planning Commission was presented at the Lincoln City Hall on April 21st, 2016 and at the Warsaw Ambulance Facility on April 22nd, 2016. The third meeting was held in the same location on April 27th, 2016 to go over the mitigation strategy goal by goal. Sign-in sheets for these meetings is included in Appendix D.

Public Meetings for Comment and Input

Seven meetings were held for public comment and input on the update of this plan. The plan was presented at Cole Camp, Lincoln, and Warsaw City Council meetings in May 2016 for public comment. Also at the May 2016 Cole Camp, Lincoln, and Warsaw School Board meetings. A copy of the plan was also made available at Cole Camp, Lincoln, and Warsaw City Halls for the public to view over a 30 day period. All meetings were held during the drafting stage and the rest prior to the plan being submitted for approval by FEMA. Public notice was given for the meetings in accordance with Missouri's "Sunshine Law" (Revised Statutes of Missouri 610.010, 610.020, 610.023, and 610.024.) The meetings were also announced through various media outlets.

Requirement

§201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

Many existing plans, studies, and reports were consulted in the development of this plan. These Include:

- Missouri State Hazard Mitigation Plan (2013), State Emergency Management Agency (SEMA)
- Benton County Emergency Operations Plan
- SEMA Situation Reports (<http://sema.dps.mo.gov/SitReps/Situation%20Reports.htm>)
- Long Range Transportation Plan (LRTP), Missouri Department of Transportation
- Regional Transportation Plan (2010), Kaysinger Basin Regional Planning Commission
- Atlas of Missouri Ecoregions, Missouri Department of Conservation
- Missouri Drought Plan (2002), Missouri Department of Natural Resources

Section 2: Planning Area Profile and Capabilities

2.1 History

Benton County was named after U.S. Senator Thomas Hart Benton. The county organized in 1835 but the county seat was not decided upon until 1837. Warsaw was selected due to its aesthetic looks and proximity to the Osage River. County officials first met in each other's homes and did not move into a permanent building until 1842. Part of the original brick building is still functional today. The building has been added onto, but architecturally little has changed.

2.2 Natural Hazard History

Benton County has been impacted by numerous natural hazards in the past including floods, tornadoes, thunderstorms, severe winter weather, and extreme heat.

In April 1994 there were several flash flood events costing over \$5 million worth of damages in structures and crops. In late July of 1998 the Missouri Governor declared a state of emergency for several counties including Benton. There was an estimated \$8.5 million loss in property and crop damages when flooding occurred severe enough to wash away several vehicles and bridges. Between May 7th and the 12th, in 2002, another state of emergency flooding occurred only this time decimating \$15 million of property and crop damage. In the spring of 2007, debris and lake levels were at their highest in years reaching over 22 feet above normal. Floods in Benton County that were significant enough for the National Weather Service to recognize included;

27 June 1999: A complex of thunderstorms produced 3 to 6 inches of rain over portions of central and west central Missouri which led to widespread flooding of low lying areas. The hardest hit area was in northern Benton County where some roads were washed out and damaged.

21 July 1996: Two young women drowned when their car was swept off a flooded low water bridge. The bridge was covered by 2 feet of water. The current took the car about a half-mile downstream.

10 Apr 1994: Several periods of thunderstorms pounded the county with heavy rain and triggered widespread flash flooding. Flooding was severe in Warsaw where several houses were evacuated. The Sheriff's Department received reports of flooding in many locations not normally prone to flooding. Several National Weather Service employees could not report to work since the heavy rain flooded so many roads.

Flooded roads included Highway 83 south of Warsaw and Highway 7 southeast of Warsaw. On Highway 7 several vehicles stalled on a bridge. One man left his car to find a telephone to call a tow truck. When he returned he discovered his car had been washed away by the strong current.

Figures 2.2-1 and figure 2.2-2 show storm some of the damage that occurred with these storms.

Figure 2.2-1 Local county creek overflowing from 2002 flooding.



Figure 2.2-2 Tornado damage produced from the winter, 2006.



2.3 Geography and Ecology

Benton County is located in central Missouri with an area covering 752 square miles. It is located 3 counties east of the Kansas line and 3 counties south of the Missouri River.

The county is bordered on the north by Pettis, on the west by Henry County, on the south by Hickory, on the southwest by St. Clair, on the east by Morgan and southeast by Camden County. The City of Warsaw is the county seat and most populous community.

Benton County consists of three main ecological land types according to the *Atlas of Missouri Ecoregions*, published by the Missouri Department of Conservation:

Ozark Highlands (Osage River Hills)

It includes lands associated with the Sac, Pomme de Terre, and Niangua Rivers, all of them major tributaries of the Osage, and also the Lake of the Ozarks, Truman Lake, and Pomme de Terre Lake. Its proximity to prairie-dominated Ecoregions to the west and north and the presence of extensive areas of shallow to moderately deep and droughty soils make the influence of prairie and open woodlands stronger here than in hill subsections in the Ozarks to the east.

It lies along the Osage River and its tributaries and comprises major portions of St. Clair, Benton, Morgan, Camden, and Miller Counties, and portions of Cole, Osage, Maries, Laclede, Dallas, Hickory, Polk, Henry, and Cedar Counties.

Osage Plains (Scarped Osage Plains)

The Scarped Osage Plains Subsection is a smooth plain interrupted by low, ragged escarpments trending southwest-northeast in which limestone bedrock is regularly exposed. Local relief reaches 150 feet in the escarpment zones but elsewhere averages less than 100 feet. Valley bottoms are exceptionally broad for the size of the streams.

The Scarped Osage Plains Subsection occupies a large area of west-central Missouri south of the Missouri River. It includes most of Jackson, Cass, Bates, Johnson, and Pettis Counties, and smaller portions of Lafayette, Saline, Cooper, Morgan, Benton, Henry, and Vernon Counties.

Osage Plains (Cherokee Plains)

The Cherokee Plains Subsection is one continuous plain of very low relief (usually less than 80 feet) mostly on Pennsylvanian sandstones and shale, but with associated thin-bedded limestone and coal. Streams have hardly dissected the surface, and valleys are topographically subdued. Wetlands are abundant throughout the wide, flat alluvial plains. Claypan soils add further distinction to the subsection.

This subsection lies in west-central Missouri, west of the Ozark Highlands. It comprises major portions of Henry, St. Clair, Bates, Vernon, and Barton Counties, and small portions of Pettis, Benton, Cedar, Dade, and Jasper Counties.

Public Land

Benton County has several state owned land areas (see Appendix A). These public lands are important to consider when working on mitigation efforts, especially when they contain hazards such as sinkholes and high fuel loads that could cause wildfires.

Incorporated Communities

Benton County consists of the following four incorporated communities:

Cole Camp
Ionia
Lincoln
Warsaw

Climate

Mean annual precipitation for Benton County is 40.9 inches. The wettest months are June-August; 63 percent of the annual precipitation occurs during the six warmer months of the year. Annual snowfall averages 18 inches. Mean January minimum daily temperature is 18°. Mean July maximum daily temperature is 90°.

Benton County lies in a Humid Temperate climate and is vulnerable to northern pressure systems in the winter and strong pressure and storm systems from the Gulf of Mexico and the Great Plains region of the central United States. While Benton County does have extreme variations in weather at times, there is a seasonal pattern, as demonstrated in table 2.3-1

Table 2.3-1**Monthly Averages & Records - °F | °C**

Date	Average Low	Average High	Record Low	Record High	Average Precipitation	Average Snow
January	18°	40°	-8° (2001)	71° (1997)	1.41"	NA
February	23°	46°	-11° (1996)	81° (1996)	1.94"	NA
March	33°	56°	3° (2002)	85° (1995)	2.98"	NA
April	42°	67°	21° (1987)	92° (2006)	4.17"	NA
May	53°	76°	32° (1989)	94° (1987)	5.12"	NA
June	63°	85°	44° (1988)	104° (1988)	3.88"	NA
July	68°	90°	53° (1997)	108° (1986)	3.89"	NA
August	65°	89°	44° (1986)	105° (2006)	3.8"	NA
September	57°	81°	29° (1989)	105° (2000)	3.7"	NA
October	45°	70°	26° (2006)	94° (2006)	3.37"	NA
November	34°	56°	5° (1991)	83° (1999)	3.75"	NA
December	24°	44°	-20° (1989)	76° (1998)	2.37"	NA

2.4 Form of Government

Benton County is considered a Class 3 county, with an assessed value of \$5,795,977. According to the US Census Bureau, the estimated population in 2014 was 18,806. The county government consists of the County Commission which oversees the following offices: Assessor, Auditor, Collector, Clerk, Public Administrator, Public Attorney, Recorder, Sheriff, and Treasurer.

The Benton County Commission has authority to administer county structures, infrastructures, and finances as well as a master plan, zoning codes, subdivision regulations, floodplain regulations and storm water regulations. The three-member County Commission generally is the final authority on county issues; the remaining bodies provide the information used by the County Commissioners to create policy.

2.5 Community Partnerships

Benton County has some working relationships with its towns and cities as well as neighboring counties. This is particularly evident in regard to the mutual aid agreements that exist between fire and police jurisdictions. A significant partnership exists between Benton County and the Cities of Warsaw and Lincoln with regard to Highway 65 widening.

Benton County jurisdictions have partnered successfully with Kaysinger Basin Regional Planning Commission (KBRPC) and seven surrounding counties on numerous grant applications. Local elected and appointed leaders provide the core board positions and committees established by the Regional Planning Commission.

2.6 Demographic Information

Randy Pogue, city planner for Warsaw, estimates Warsaw and Benton County will be the second most visited county and town in Missouri following Branson. A low cost of living, the presence of cultural amenities, and quality schools each contribute to the attractiveness of the county. Cole Camp R-I School was ranked 41 of 579 in “Best High Schools in America List”, has won the Gold Star School of Missouri for two consecutive years, in 2006 was the National Blue Ribbon School, and is also recognized by DESE in their “Distinction in Performance”.

Figure 2.6.1 and figure 2.6-2 portray some key demographic information about Benton County and how it compares to the rest of Missouri.

Figure 2.6-1			
	People Quick Facts	Benton County	Missouri
i	Population, 2014 estimate	18,806	6,063,589
i	Population, percent change, April 1, 2010 to July 1, 2014	-1.3%	1.2%
i	Population estimates base (April 1) 2000	19,056	5,988,923
i	Persons under 5 years old, percent, 2014	3.9%	6.2%
i	Persons under 18 years old, percent, 2014	17.6%	23.0%
i	Persons 65 years old and over, percent, 2014	28.8%	15.4%
i	Female persons, percent, 2014	49.7%	50.9%
i	White persons, percent, 2014 (a)	97.0%	83.5%
i	Black persons, percent, 2014 (a)	0.5%	11.8%
i	American Indian and Alaska Native persons, percent, 2014 (a)	0.6%	0.5%
i	Asian persons, percent, 2014 (a)	0.4%	1.9%
i	Native Hawaiian and Other Pacific Islander, percent, 2014 (a)	0.1%	0.1%
i	Persons reporting two or more races, percent, 2014	1.4%	2.1%
i	Persons of Hispanic or Latino origin, percent, 2014 (b)	1.8%	4.0%
i	White persons not Hispanic, percent, 2014	95.5%	80.1%

Source: U.S. Census Bureau

Figure 2.6-2
Annual Change in Population, 2000 to 2010
Benton County, MO

Year	Pop at Start of Yr	Pop at End of Yr	Population Change	% Chg
2000-2001	17,233	17,366	133	0.77
2001-2002	17,366	17,490	124	0.71
2002-2003	17,490	17,819	329	1.88
2003-2004	17,819	18,088	269	1.51
2004-2005	18,088	18,359	271	1.50
2005-2006	18,359	18,351	-8	-0.04
2006-2007	18,351	18,586	235	1.28
2007-2008	18,586	18,534	-52	-0.28
2008-2009	18,534	18,461	-73	-0.39
2010-2014	19,056	18,670	-386	-1.3%

Source: Missouri Census Data Center

2.7 Income

Households, 2010

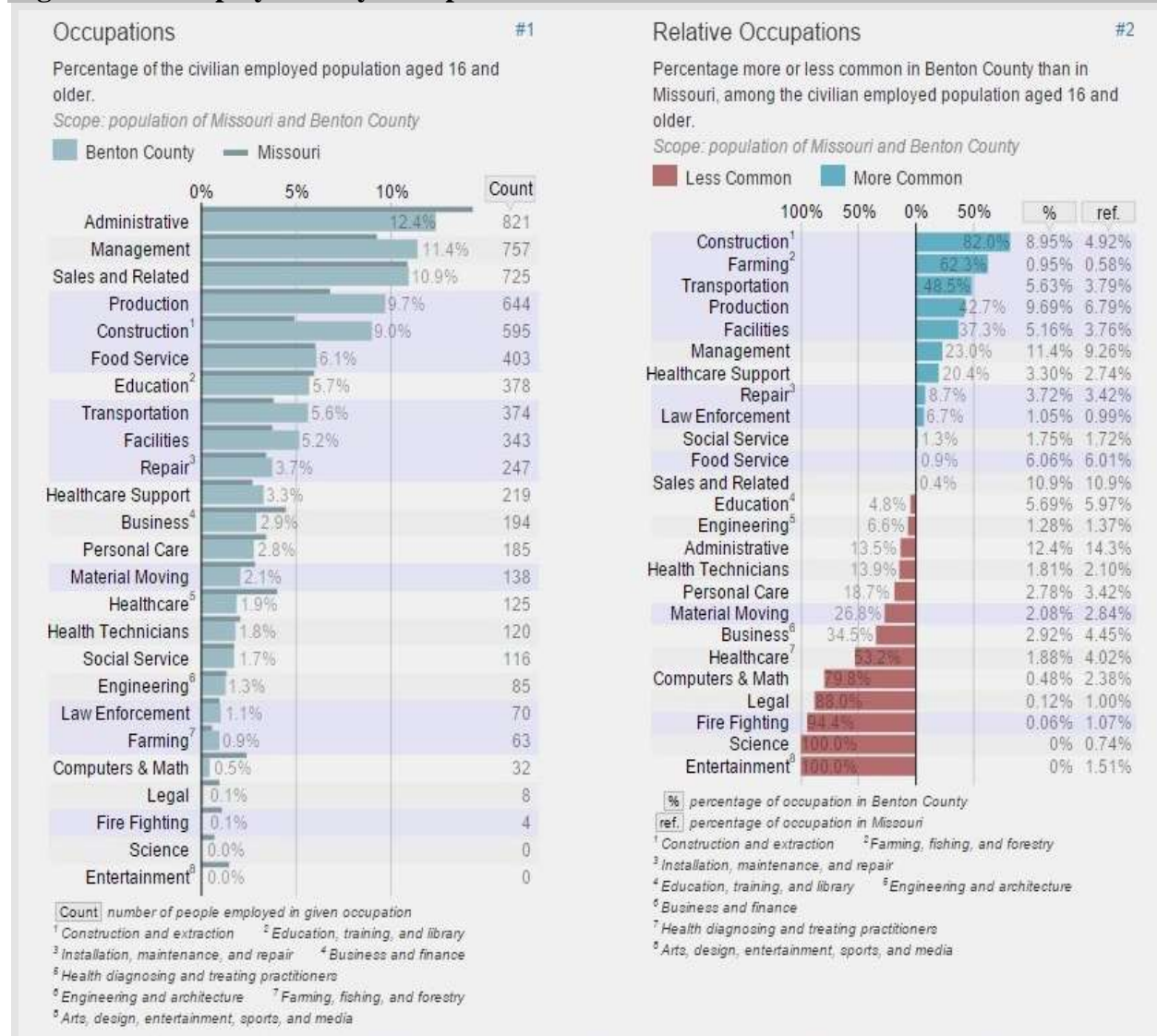
 Persons per household, 2009-2013	2.28	2.47
 Median household income, 2009-2013	\$32,951	\$47,380
 Per capita money income, 2009-2013	\$19,717	\$25,649
 Persons below poverty level, percent, 2009-2013	20.1%	15.5%

2.8 Economy, Industry, Employment

Benton County is considered a rural community with the largest town, Warsaw, reaching a population of 2,127. Warsaw is also the county seat.

Figure 2.8-1 depicts the principle types of employment found in Benton County.

Figure 2.8-1 Employment by Occupation



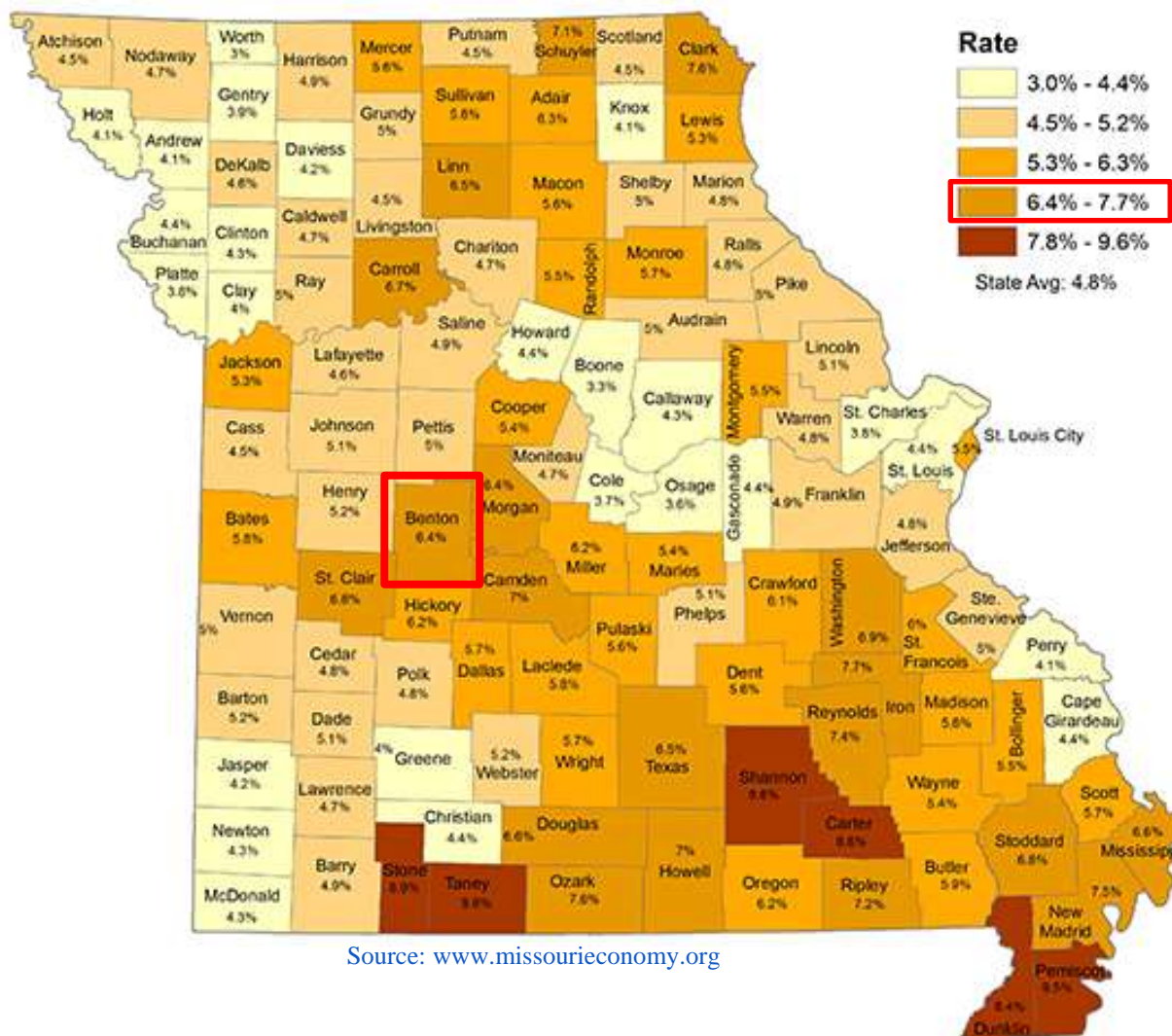
Data Source: <http://statisticalatlas.com/>

Listed below are business quickfacts from the U.S. Census Bureau that explain employment rates from 1990-2015 in Benton County.

Source: US Census Bureau

	Employment		Unemployment	
	Total	% Change Year Ago	Rate	Unit Change Year Ago
1990	5,050	-	8.2	-
1991	5,144	1.8	9.5	1.3
1992	5,131	-0.2	9.2	-0.3
1993	4,993	-2.7	10.6	1.4
1994	5,367	7.5	7.6	-3.0
1995	5,574	3.9	7.8	0.2
1996	5,906	6.0	6.6	-1.2
1997	5,980	1.2	6.1	-0.5
1998	5,762	-3.6	6.3	0.1
1999	5,773	0.2	5.3	-1.0
2000	7,363	27.5	5.0	-0.3
2001	7,539	2.4	6.2	1.2
2002	7,539	0.0	6.4	0.2
2003	7,716	2.4	6.6	0.2
2004	7,951	3.0	6.3	-0.2
2005	7,949	0.0	6.1	-0.2
2006	8,074	1.6	5.4	-0.7
2007	7,905	-2.1	5.9	0.5
2008	7,830	-0.9	6.8	0.9
2009	7,409	-5.4	10.0	3.2
2010	6,403	-13.58	12.1	2.1
2011	6,437	0.53	10.9	-1.2
2012	6,478	1.2	9.0	-1.9
2013	6,621	2.2	8.3	-0.7
2014	6,599	-0.33	7.7	-0.6
2015	6,901	4.4	5.6	-2.1

Unemployment Rates - March 2016 Not Seasonally Adjusted



Agriculture

Almost 244,000 acres, 47% of the county, is involved in agriculture. Soybeans, corn, and hay makeup the top three crops in Benton County. Other crops consist of wheat, sorghum, various types of nuts, and garden vegetables. Cattle used for beef and milk production are also a part of Benton County agricultural production.

2.9 Transportation and Commuting Patterns

Roadways

Benton County serves as a host for one of the state's major highway systems. Running north-south is U.S. Highway 65. This highway serves as a major route for transporting goods, providing access to work for many residents, and bringing many visitors to Lake of the Ozarks, Truman Lake, and Branson. The highway also provides access to the Lincoln Municipal Airport and Warsaw Municipal Airport along with the Harry S. Truman Dam and a State Hatchery with the Missouri Department of Conservation. State Highway 7 also crosses with U.S. 65 and allows Kansas City weekend traffic to travel from U.S. 71 to the lakes.

Air

Benton County has two airports, the Lincoln Municipal Airport and Warsaw Municipal Airport, which are both located west of Highway 65 between Warsaw proper and Lincoln.

The Lincoln Municipal Airport is owned and operated by the City of Lincoln. The airport board is made up of the mayor, the public works director, and five residents. The airport hangar capacity holds a humble six small aircrafts.

The Warsaw Municipal Airport is owned and operated by the City of Warsaw. The advisory board, (constructed of 7 members), makes recommendations to the Board of Alderman for the development and use of the airport. Airport operations are administered by the City Clerk and City Planner. The airport can hold a small variation in aircraft sizes and contains over 10 hangars. Regionally, there is a neighboring municipal airport located in Clinton, Henry County, just 24 miles west on Highway 7.

Commuting

Table 2.9-1 elaborates on the moderate population of county residents that commute outside the county with less than 30 minutes of travel time.

	Benton County		Missouri
Table 2.9-1			
Travel to Work/Commuting Patterns, 2000	Percent		
Total Workers Aged 16 and Over	6,006		2,629,296
Work Outside the county	2,531	39.0	33.4
Did Not Work at Home (commuters)	5,959	91.8	96.5
Commute time: less than 30 minutes	3,637	56.0	66.0
30 to 60 minutes	1,745	26.9	25.2
60 minutes or more	577	8.9	5.4
Worked at home	533	8.2	3.5

Source: UM Extension Social and Economic Profile

2.10 Education

Pre K-12

As of 2015, there are approximately 2,552 students and 205 teachers in four public schools districts. There is only one private school in Benton County. (See Figure 2.10-1).

Students are a vulnerable population as they are dependent on others for natural hazard information during the school day. A mitigation plan must take this into account. Often, this has been done by building schools out of floodplains and having safe areas within the school where the students can assemble in the event of a disaster. School buildings can also act as shelters during a natural disaster.

Table 2.10-1

Benton County Public Schools			
<u>School District</u>	<u>Number of Schools</u>	<u># Students</u>	<u># Teachers</u>
Cole Camp R-I	3	736	64
Lincoln R-II	2	556	43
Warsaw R-IX	4	1260	98
Total	9	2552	205

Benton County Private Schools			
<u>Community</u>	<u>School</u>	<u># Students</u>	<u># Teaches</u>
Cole Camp	Lutheran School Assoc.	88	5
Total Private and Public		2640	210

2.11 Major Employers

City of Cole Camp

Prominent Employers	Service	Total Employed	Union
Citizens Farmers Bank	Financial	50+	No
Good Samaritan Care Center	Elderly Care	100+	No
Cash's Thriftway	Food	30+	No
Ambrose Residential Care Facility	Elderly Care	30+	No
Cole Camp R-I School	Education	60+	No

City of Lincoln

Prominent Employers	Service	Total Employed	Union
Bristol Manor	Elderly Care	10+	No
Lincoln Nursing Home	Elderly Care	50+	No
Wenig Custom Gunstocks	Manufacturing	10+	No
Farmer's Bank	Financial	25	No
Lincoln R-II School	Education	100+	No

Source: www.lincolnmisouri.com

City of Warsaw

Prominent Employers	Service	Total Employed	Union
Warsaw R-IX Schools	Education	195	No
Hilty Quarries, Inc.	Rock Products	100	No
Leeson Manufacturing	Manufacturing	250	No
Warsaw Mfg/Elbeco	Manufacturing	71	UNITE
US Army Corps of Engineers	Tourism/Dam	53	No
State of Missouri	Government Office	85	No
Wal-Mart	Retail	220	No
Newman's Country Mart	Retail	60	No
Warsaw Health Care Center	Nursing Home	50	No

Source: www.welcometowarsaw.com

2.12 Capabilities Assessment

Many of the structures of County and municipal government are potentially involved in the mitigation of natural hazards. Private organizations also play an important role. Discussion of the capabilities present in Benton County are organized in the following manner:

- Staff /Organizational Capabilities and Community Profiles
- Technical Capability
- Political Willpower

2.12.1 Staff/Organizational Capabilities and Community Profiles

Each jurisdiction in the Planning Area has an administrative body composed of elected and/or paid staff. These public offices are directly involved with decision making in those jurisdictions and are integral to hazard mitigation planning. Jurisdictions and their administrative offices are listed in this section.

NOTE: Water, Sewer, and Road Districts are not participating jurisdictions in this plan.

Benton County

The County Commission is the administrative authority. It is an elected three-member governing body with a District I (Southern) Commissioner, a District II (Northern) Commissioner, and a Presiding Commissioner. The Commission establishes County policy; approves and adopts the annual budget for all County operations; approves actual expenditures for each department; supervises the operations of Public Works, Planning and Zoning, Building Codes, Human Resources, Purchasing, Facilities and Grounds Maintenance; ensures County-wide compliance with numerous statutory requirements; and acts as liaison with County boards, commissions, and other governmental entities.

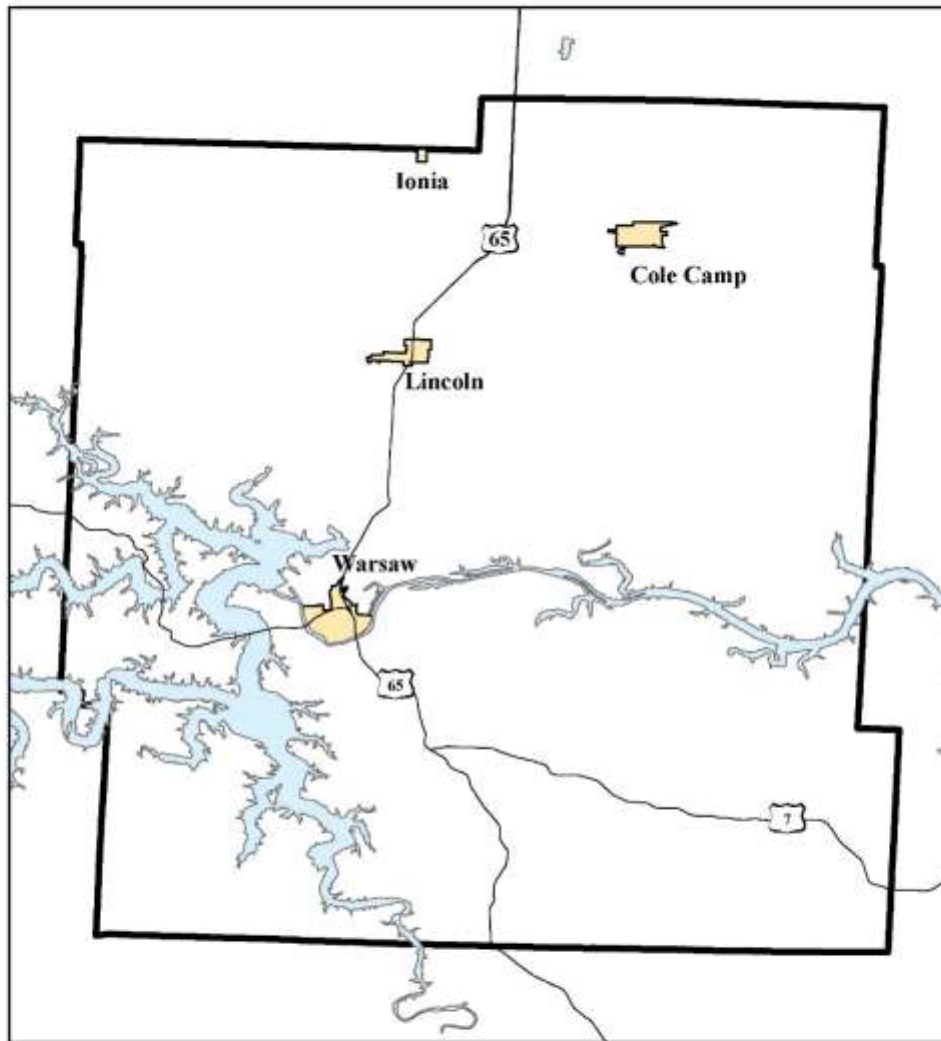
Benton County also has the following staff positions:

- Assessor
- Circuit Clerk
- Collector
- Coroner
- County Clerk
- Emergency Management Director
- Public Administrator
- Prosecuting Attorney
- Recorder
- Sheriff
- Surveyor
- Treasurer

Classification City	3 rd Class
Population	14,921
Median household income, 2013	\$33,145
Median owner-occupied housing value	\$105,400
Total housing units	14,011
Ambulance Service	Yes
Sewer Service	No
Fire Service	Yes
Master plan	Yes
Building Regulations	Yes
Storm water Regulations	Yes
Zoning Regulations	Yes
Subdivision regulations	Yes
Floodplain regulations	Yes

County website: www.bentoncomo.com

Benton County

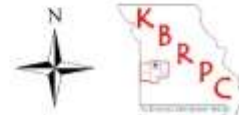


0 3,300 6,600 13,200 19,800 26,400 Meters

1 inch = 9,041 meters

Legend

- Roads
- Lakes
- City Boundary



Date: 3/3/2016

Cole Camp

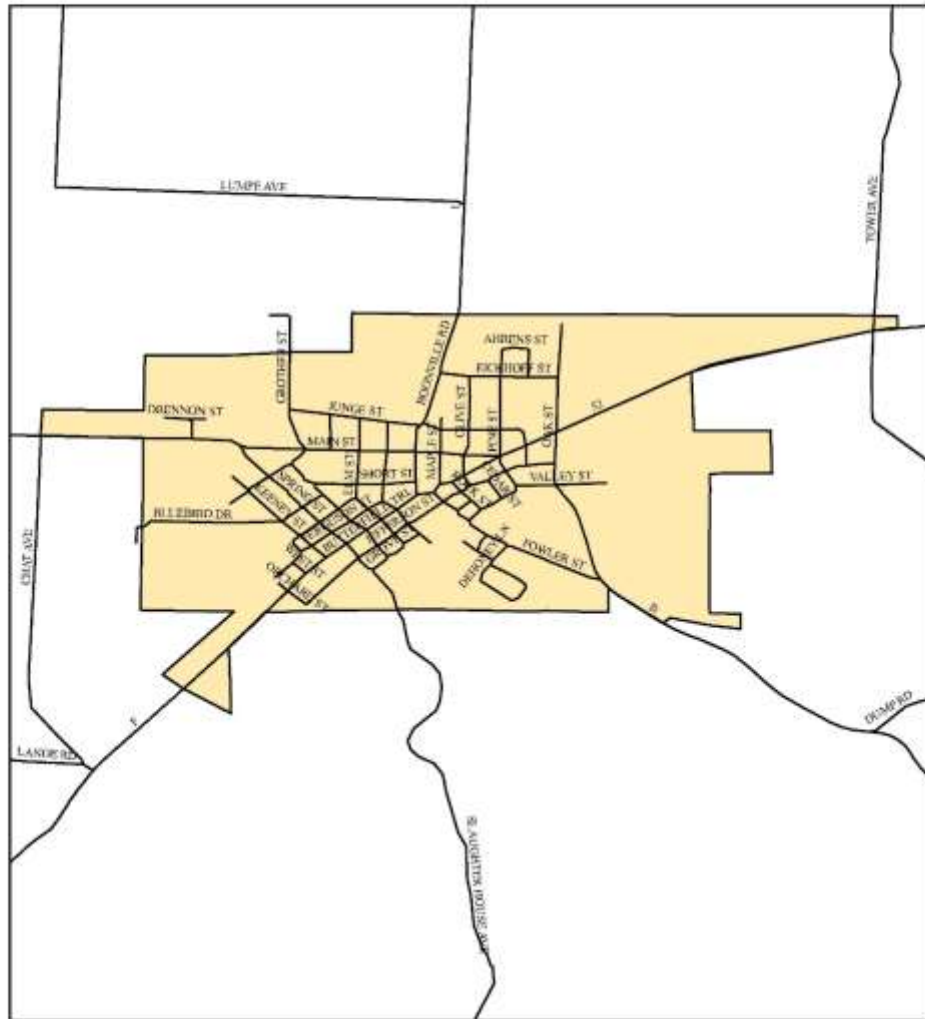
The Mayor and the Board of Aldermen are the policy making bodies in the city government. The city is divided into four wards and one Board of Aldermen member is elected from each ward for a two-year term. Cole Camp also has the following staff positions:

- City Clerk
- Public Works Director
- Police Chief
- City Collector
- Attorney
- Fire Chief
- Judge

Classification City	4th Class
Population	1,211
Median household income, 2013	\$33,335
Median owner-occupied housing value	\$89,934
Total housing units	658
Water Service	24.50 City Base Rate
Electric Service	KCP&L
Ambulance Service	Cole Camp Ambulance District
Sewer Service	\$34.69 City Base \$1.50/thousand/gal.
Fire Service	Cole Camp Rural Fire Dept.
Master plan	Yes
Building Regulations	Yes
Storm water Regulations	Yes
Zoning Regulations	Yes
Subdivision regulations	Yes
Floodplain regulations	No

City website: www.colecampmo.com

Cole Camp

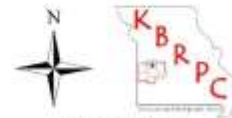


0 165 330 660 990 1,320 Meters

1 inch = 716 meters

Legend

- Roads
- City Boundary



Date: 2/4/2016

Ionia

The Mayor and the five member Board of Alderman are the policy making bodies in the city government. Officials are not elected but are voted on by the council. Ionia has the following offices and staff positions;

- City Clerk
- Mayor

Classification City	Village
Population	88
Median household income, 2013	\$21,668
Median owner-occupied housing value	\$56,391
Total housing units	46
Water Service	City Base Rates;\$12/thousand-\$2.00 after
Electric Service	KCP&L
Ambulance Service	Cole Camp
Sewer Service	City Base Rates;\$26.00/thousand and \$3.00 after
Fire Service	Lincoln Community Fire Department (Vol.)
Master plan	Yes
Building Regulations	No
Storm water Regulations	No
Zoning Regulations	No
Subdivision regulations	No
Floodplain regulations	No

Source; Village of Ionia

Ionia

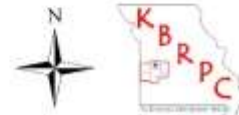


0 35 70 140 210 280 Meters

1 inch = 158 meters

Legend

- Roads
- City Boundary
- County Boundary



Date: 2/4/2016

Lincoln

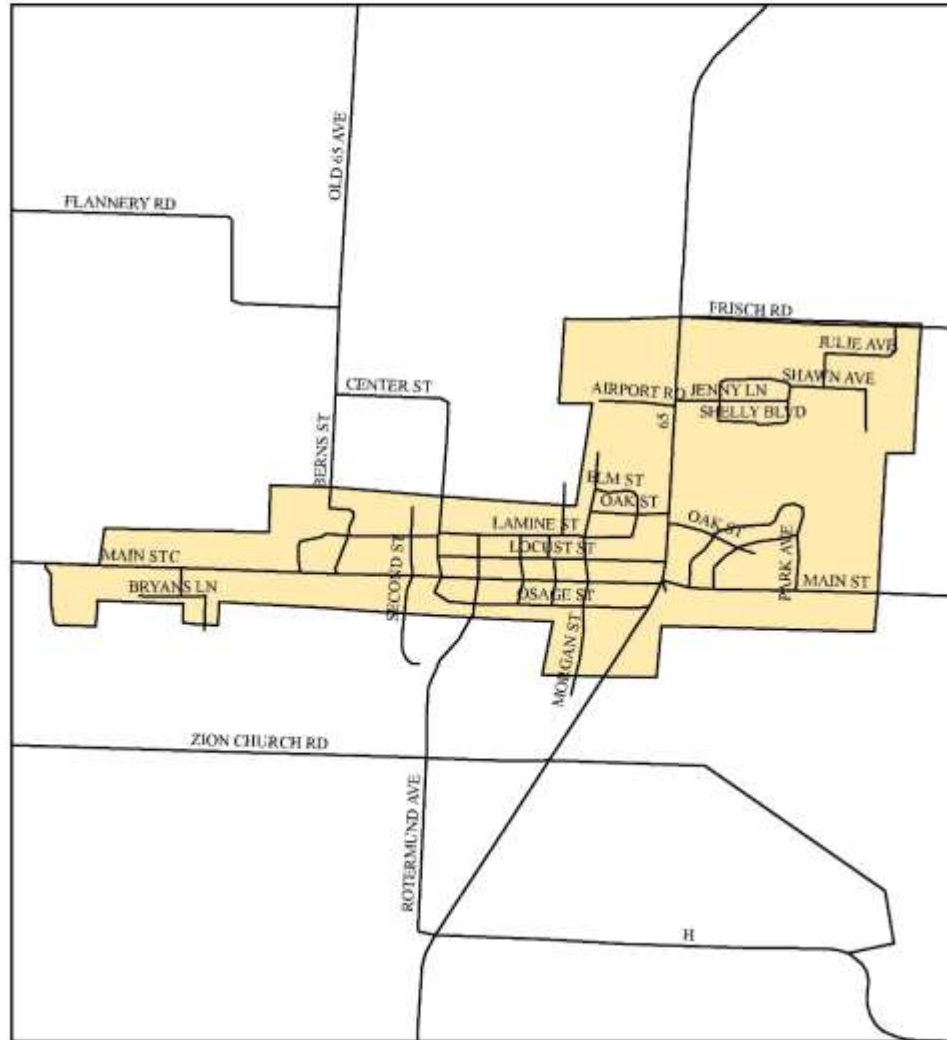
The Mayor and the four member Board of Alderman are the policy making bodies in the city government. Lincoln has the following offices and staff positions;

- City Clerk
- Collector
- Attorney
- Police Chief
- Street, Sewer, and Water Superintendent
- Municipal Judge

Classification City	4th Class
Population	1,192
Median household income, 2013	\$32,827
Median owner-occupied housing value	\$76,323
Total housing units	467
Water Service	City Base Rates;\$13/thousand-\$5.00 after
Electric Service	KCP&L
Ambulance Service	Warsaw/Lincoln Ambulance
Sewer Service	City Base Rates;\$6.85/thousand-\$6.85 after
Fire Service	Lincoln Community Fire Department (Vol.)
Master plan	Yes
Building Regulations	Yes
Storm water Regulations	No
Zoning Regulations	Yes
Subdivision regulations	No
Floodplain regulations	No

Source; City-data.com City website: www.lincolnmissouri.com

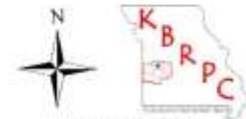
Lincoln



0 155 310 620 930 1,240 Meters
1 inch = 668 meters

Legend

- Roads
- City Boundary



Date: 2/4/2016

Warsaw

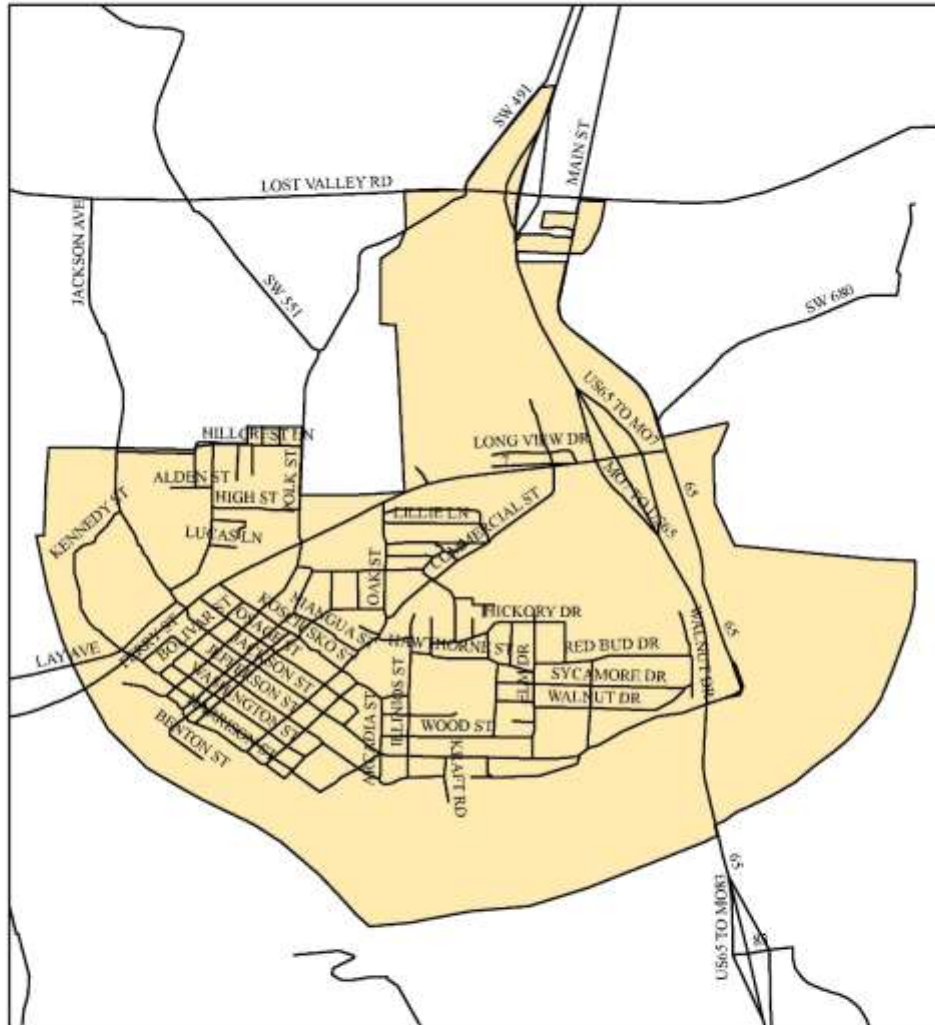
The Mayor and the six member Board of Alderman are the policy making bodies in the city government. Warsaw has the following offices and staff positions;

- City Clerk
- City Planner
- Attorney
- Police Chief
- Street Superintendent
- Sewer/Water Superintendent
- Municipal Judge

Classification City	4th Class
Population	2,133
Median household income, 2013	\$21,487
Median owner-occupied housing value	\$74,864
Total housing units	1,015
Water Service	City Base Rates;\$7.17/thousand-\$4.95 after
Electric Service	KCP&L
Trash Service	\$11.85/month
Ambulance Service	Warsaw/Lincoln Ambulance
Sewer Service	City Base Rates;\$12.74/thousand-\$5.33 after
Fire Service	Warsaw Fire Protection District
Master plan	Yes
Building Regulations	Yes
Storm water Regulations	Yes
Zoning Regulations	Yes
Subdivision regulations	Yes
Floodplain regulations	Yes

Source: City-data.com; City website: www.welcometowarsaw.com

Warsaw

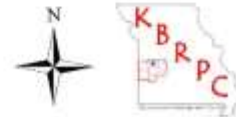


0 165 330 660 990 1,320 Meters

1 inch = 712 meters

Legend

- Roads
- City Boundary



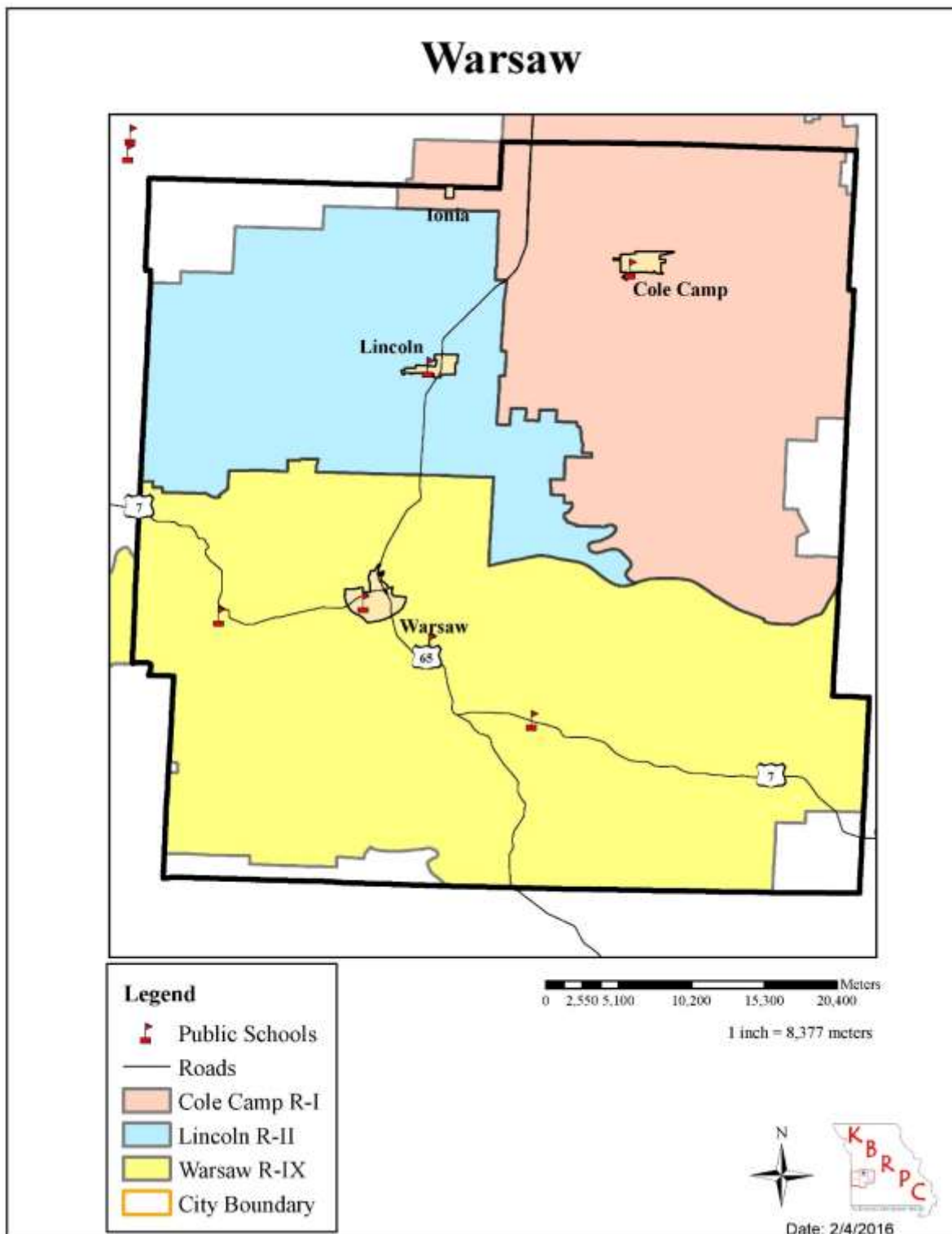
Date: 2/4/2016

Districts

School Districts

Benton County has three school districts that encompass 9 schools. Combined, the district schools hold more than 2,505 students and employ more than 335 teachers and support staff. Each district has an elected Superintendent and School Board along with several administrative staff. The three districts are:

- Cole Camp R-I
- Lincoln R-II
- Warsaw- IX



Benton County Water/Sewer Districts

There is only one Water District within the County that is responsible for distributing water throughout a small community on Truman Lake/Lake of the Ozarks; Benton County Sewer District #1. Each of the municipalities within the county is responsible for developing new water and sewer supply infrastructure and maintaining existing infrastructure.

Road District

The Missouri Department of Transportation Central District assesses and corrects all county problems with the exception of municipal roads.

Fire Protection Districts

Several fire departments serve in the Benton County Fire Protection District; the Cole Camp FPD, Deer Creek FPD, Lakeview Heights FPD, the Lincoln FPD, Macks Camp Volunteer FPD, Osage Valley FPD, Warsaw FPD, and Cross Timbers FPD.

While the municipal fire departments are run through the oversight of the city, the county fire districts are administered by an elected Board of Directors and the appointed Fire Chief. The capabilities of these districts will be expanded under Technical Capability.

2.12.2 Technical Capabilities

This section includes the technical capabilities of Benton County, Fire Protection, and Law Enforcement agencies and other organizations.

A note on cooperation and coordination: Intergovernmental and interagency coordination exists as needed. The agencies and offices listed below cooperate with one another as specific projects warrant cooperation. For instance, the Benton County Sheriff and the Benton County Fire Protection District both have mutual aid agreements in place with local police departments.

Benton County

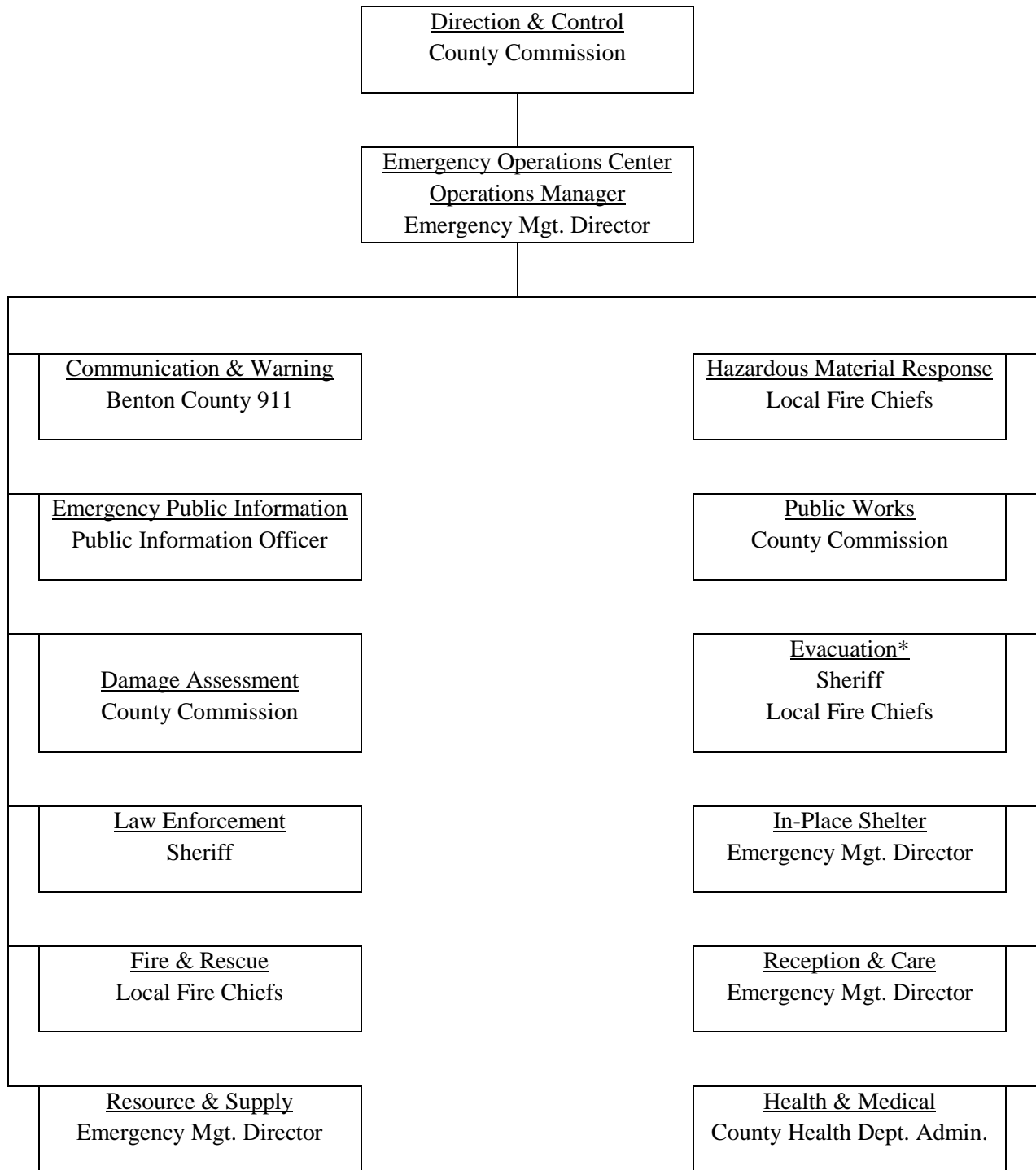
Benton County has limited full time emergency response staff that can help identify and guide hazard mitigation strategies. The staff is backed by some limited communication system and exchange of information from local cities, some GIS capabilities, and other associated tasks. Email, online databases, and user friendly websites provide a wide range of information both for citizens and county employees. There is also an inventory of trucks, earthmovers, and other vehicles. Solid coordination exists between agencies and local jurisdictions.

Emergency Management

- Benton County and the City of Warsaw share oversight of emergency management.
- There is a director of emergency management for Benton County who works closely with city officials to write and update the Emergency Operations Plan, conduct ongoing public education related to emergency information, and identify and fix gaps in emergency response, preparedness, and mitigation.
- Staff has had training from SEMA, FEMA, and other bodies in emergency response, preparedness, recovery, mitigation, and overall emergency management.

Emergency Management Diagram by Emergency Function

Benton County



*joint responsibility

Emergency Operations Plan

Benton County is in the process of updating their Emergency Operations Plan (EOP). The last version of the plan was created two years ago and is what this update is referring to. The EOP consists of specific directions for local government to undertake in the event of an emergency. While this is not considered mitigation, an EOP is an essential tool in helping reduce the threat of a natural hazard (or any other hazard). Furthermore, the EOP directs local authorities in cleaning up after a natural hazard. When this happens, these local authorities can use that as an opportunity to learn from the event and see what did and did not work in regard to effectiveness.

Copies of the EOP can be found with the Office of Emergency Management at 1231 Hirsh Pkwy., Warsaw, Missouri 65355, 660-438-8412 or e-mail them at cityclerk@welcometowarsaw.com.

The **Benton County Central E-911 Dispatch Center** can quickly and efficiently notify specific regions in Benton County in the event of a probable natural hazard. The Center also has systems in place to check that each warning siren and system works each time they are employed. The Center works closely with the City of Warsaw with subjects of maintenance and exercises. If a problem is found it is immediately repaired.

Media

Local and regional media outlets provide regular weather information including forecasts for potentially destructive weather. Broadcast media stations originating in or reaching Benton County are shown below.

Benton County Broadcast Media

<u>TV Station</u>	<u>Base City</u>	<u>FM Radio Stations</u>	<u>Base City</u>
KMOS Channel 6	Sedalia	KDKD 95.3	Clinton
<u>AM Radio Station</u>	<u>Base City</u>	KAYQ 97.1	Warsaw
KDKD 1280	Clinton	KLRQ 96.1	Clinton
KDRO 1490	Sedalia	KPOW 97.7	La Monte
KSIS 1050	Sedalia	KSDL 92.3	Sedalia

Fire Protection Districts

Several fire departments/districts serve Benton County including the Cole Camp Fire Department, Deer Creek FPD, Lakeview Heights FPD, Lincoln FPD, Osage Valley FPD, Warsaw FPD, and Cross Timbers FPD.

Law Enforcement Agencies

Benton County Sheriff's Office..... (660) 438-5252
Cole Camp Police Department..... (660) 668-2321
Lincoln Police Department..... (660) 547-2200
Warsaw Police Department..... (660) 438-5522

State Agencies (Missouri)

Missouri State Highway Patrol, Troop A, Lee's Summit (816) 622-0800
Missouri State Highway Patrol, General Headquarters, Jefferson City..... (573) 751-3313
Missouri State Water Patrol, Headquarters, Jefferson City..... (573) 751-3333
Missouri Department of Conservation Agents (Lost Valley Hatchery) (660) 438-4465
Department of Natural Resources, Park Rangers..... (573) 751-1000
State Fire Marshal's Office (arson, bombing), Jefferson City..... (573) 751-2930

Federal Agencies

U.S. Marshal, Federal Court Building, Jefferson City..... (573) 635-9708
Federal Bureau of Investigation, Hawthorne Building, Jefferson City..... (573) 636-8814

Section 3 Risk Assessment

3.1 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.

The following natural hazards have been identified as posing potential risk in Benton County:

- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Flood (includes ravine flooding, flash flooding, and storm water flooding)
- Levee Failure
- Land Subsidence/Sinkhole
- Severe Winter Weather (Snow, Ice, and Extreme Cold)
- Tornado and Thunderstorm (Lightning, Hail, and High Winds)
- Wildfire

The Missouri State Hazard Mitigation Plan (2013) indicates that expansive soils, landslides, and rock falls are recognized as hazards in Missouri but occur infrequently and with minimal impact. For this reason, those hazards were not profiled in the state plan nor will they be profiled in the Benton County Plan. However, earthquake induced landslide incidence will be discussed on page 86.

Avalanches and volcanoes have not been included in this plan as they do not pose a threat due to Benton County's topography and geology. Coastal erosion, coastal storms, hurricanes, and tsunamis do not pose a threat to the county due to its inland location.

3.2 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.

Each of the natural hazards being profiled in this plan has been studied, analyzed, and assessed for its potential impact on the Planning Area. Each hazard profile is organized in the following manner:

- General description
- Geographic location
- Previous occurrences
- Measures of Probability and Severity
- Existing mitigation strategies

Measures of Probability and Severity

The assessments of probability and severity included in each profile were based on the following definitions from the Missouri State Hazard Mitigation Plan (2007): **Measure of Probability** – The likelihood that the hazard will occur.

- Low: The hazard has little or no chance of happening (less than 1 percent chance of occurrence in any given year)
- Moderate: The hazard has a reasonable probability of occurring (between 1 and 10 percent chance of occurrence in any given year).
- High: The probability is considered sufficiently high to assume that the event will occur (between 10 and 100 percent chance of occurrence in any given year).

Measure of Severity – The deaths, injuries, or damage (property or environmental) that could result from the hazard.

- Low: Few or minor damage or injuries are likely; death is possible, but not likely.
- Moderate: Injuries to personnel and damage to property and the environment is expected; death is possible.
- High: Major injuries/death and/or major damage will likely occur

Existing Mitigation Strategies

There are few mitigation strategies already in place in the Planning Area. Most have been in place for several years prior to 2005. One of the new mitigation activities in the Planning Area has been with the City of Warsaw in a new ordinance with flood/storm management due to its close proximity to Truman Lake and Lake of the Ozarks.

Some of the current mitigation strategies are aimed at mitigating the effects of a specific hazard and are described under the specific hazard profile. The following mitigation strategies are applicable to many or all hazards:

- Basic Building codes are in place in Benton County and the following incorporated communities: Lincoln and Warsaw.

- Health care facilities in the county like the Health Department, Cole Camp Nursing Home, Warsaw Health and Rehab have a hookup for a generator and the Ambulance Facility in Warsaw are accessible and provided with backup power.
- Agreements are in place with local “shelters” in the county.
- General evacuation procedures are included in the Office of Emergency Management’s (OEM) Emergency Operation Plan.
- Alternative routes in case of severe weather are in place in all school districts in the county.
- Buses in all school districts have two-way radios on board.
- A public education hazard awareness program is in place through the EOP.
- Some businesses and municipalities have a weather radio in place.
- The county is continuously maintaining tree limb lines.
- Some brochures are provided in city hall and the courthouse for the National Flood Insurance Program.
- Publicize county or city-wide drills.

3.2.1 Dam Failure

Description of Hazard

A dam is defined by the National Dam Safety Act as an artificial barrier which impounds or diverts water and: (1) is more than 6 feet high and stores 50 acre feet or more, or (2) is 25 feet or more high and stores more than 15 acre feet.

Based on this definition, there are over 80,000 dams in the United States. Over 95% are non-federal, with most being owned by state governments, municipalities, watershed districts, industries, lake associations, land developers, and private citizens. Dam owners have primary responsibility for the safe design, operation and maintenance of their dams. They also have responsibility for providing early warning of problems at the dam, for developing an effective emergency action plan, and for coordinating that plan with local officials. The State has ultimate responsibility for public safety, and many states regulate construction, modification, maintenance, and operation of dams, and also ensure a dam safety program.

Dams can fail for many reasons. The most common are:

- **Piping:** internal erosion caused by embankment leakage, foundation leakage and deterioration of pertinent structures appended to the dam.
- **Erosion:** inadequate spillway capacity causing overtopping of the dam, flow erosion, and inadequate slope protection.
- **Structural Failure:** caused by an earthquake, slope instability or faulty construction.

These three types of failures are often interrelated. For example, erosion, either on the surface or internal, may weaken the dam or lead to structural failure. Similarly a structural failure may shorten the seepage path and lead to a piping failure.

Dam construction varies widely throughout the state. A majority of dams are of earthen construction. Missouri's mining industry has produced numerous tailing dams for the surface disposal of mine waste. These dams are made from mining material deposited in slurry form in an impoundment. Other types of earthen dams are reinforced with a core of concrete and/or asphalt. The largest dams in the state are built of reinforced concrete, and are used for hydroelectric power.

Dam Hazard Classification

Dams pose a hazard to human life and property through faulty operation and outright failure. Dams in Missouri have been classified according to both a federal and state system with regards to potential hazard posed.

The **federal classification system** is based upon the probable loss of human life and the impact on economic, environmental and lifeline interests from dam failure. It should be noted that there is always the possibility of loss of human life when a dam fails; this classification system does not account for the possibility of people occasionally passing through an inundation area which is usually unoccupied (e.g. occasional recreational users, daytime user of downstream lands, etc.)

The **state classification system** is based upon the type and number of structures downstream from a dam. An inventory of all the dams of the state was done in the late 1970s and early 1980s, according to Glenn Lloyd, Civil Engineer and Dam Safety Inspector with the Dam Safety Program of the MO Department of Natural Resources (DNR). All of the known dams were classified by the state at that time.

Dam Regulation in Missouri

According to the Association of State Dam Safety Officials, 5206 dams in Missouri have been classified and only 653 are regulated by the state. Pursuant to Chapter 236 of the Revised Statutes of Missouri, a dam must be 35 feet or higher to be state regulated; regulation makes a dam subject to permit and inspection requirements. For regulated dams, the state classification system dictates the required inspection cycle.

The inspection cycle for regulated dams allows for a regulated dam's classification to be updated when appropriate. Classification is a dynamic system; development can easily change the situation downstream. A regulated dam in Missouri would have its classification appraised at least once every 5 years.

One must use caution in assuming the classifications of unregulated dams is currently accurate; however. It is very probable that, for most of the unregulated dams, the classification does not take into account almost 30 years of development and change in Benton County. In addition, the DNR database of dams in Missouri reflects only the known dams; a dam less

than 35 feet in height which was built since the inventory was taken some 30 years ago may not appear in the database.

Classifications for: DNR and NID Dams

DNR: The Missouri Dam and Reservoir Safety Council Rules and Regulations uses three classes of downstream environmental zone when considering permits. The downstream environment zone is the area below the dam that would become inundated should the dam fail. Inundation is defined as water two feet or more over the submerged ground outside of the stream channel. These classes are based on the number of structures and types of development contained within the inundation area. The downstream environment zone classification is also used to prescribe the frequency of inspection.

Class I	The area downstream from the dam that would be affected by inundation contains ten (10) or more permanent dwellings or any public building. Inspection of these dams must occur every two years
Class II	The area downstream from the dam that would be affected by inundation contains one to nine permanent dwellings, or one (1) or more campgrounds with permanent water, sewer and electrical services or one (1) or more industrial buildings. Inspection of these dams must occur once every three years.
Class III	The area downstream from the dam that would be affected by inundation does not contain any of the structures identified for Class I or Class II dams. Inspection of these dams must occur once every five years

Source: <http://floodplain.sema.dps.mo.gov/MitPlan/docs.aspx?link=modamreg94>

The NID (US Army Corps of Engineers. Corps Map...National Inventory of Dams) consists of dams meeting at least one of the following criteria;

- 1) High hazard classification - loss of one human life is likely if the dam fails,
- 2) Significant hazard classification - possible loss of human life and likely significant property or environmental destruction,
- 3) Equal or exceed 25 feet in height and exceed 15 acre-feet in storage,
- 4) Equal or exceed 50 acre-feet storage and exceed 6 feet in height.

All Benton County dams are earthen construction. The mean dam height is 24 feet. The mean maximum storage capacity is 540 acre-feet. (An acre-foot is one acre of water that is one foot deep. For example, a 10-acre lake that is 10 feet deep would have a maximum storage capacity of 100 acre- feet.). All dams are less than 35 feet high and therefore not regulated by Missouri DNR. People living downstream of these smaller unregulated dams are virtually at the mercy of the dam owner's construction and maintenance practices.

There are currently 26 dams in Benton County according to the National Inventory of Dams and Missouri Department of Natural Resources. NID lists eight of the 26 dams as high hazard and three of the 26 dams are regulated. See Table 3.2-1.

Table 3.2-1 **NID/DNR TABLE OF DAMS**

ID Number	Location	Year Complete	Height (ft)	Length (ft)	Drainage Area (acre)	Lake Area (acre)	NID Hazard Class	DNR Hazard Class	Permit Number
BOCKELMAN LAKE DAM									
MO31526	S36 T42N R20W	1976	25.00	Unknown	620.00	6.00	Low	3	
CARLSON LAKE DAM									
MO31656	S04 T38N R20W	1800	25.00	Unknown	60.00	5.00	Low	3	
DR. A. J. LONG DAM									
MO30185	S03 T40N R21W	1958	12.00	Unknown	300.00	11.00	Low	3	
GATLIFF DEVELOPMENT COMPANY LAKE DAM									
MO20468	S21 T40N R22W	1968	28.00	Unknown	3,100.00	28.00	Low	3	
GOIN HIDDEN LAKE #1									
MO31885	S32 T41N R23W	1983	31.00	325.00	22.00	1.00	Low	3	346
GOIN HIDDEN LAKE #2									
MO31884	S32 T41N R23W	1983	31.00	Unknown	7.00	1.00	Low	3	
HARRY S TRUMAN DAM									
MO20725	S07 T40N R22W	1980	126.00	5,000.00	0.00	55,600.00	High	1	
HAYES, WILLIAM LAKE DAM									
MO31052	S14 T40N R21W	1975	32.00	Unknown	92.00	6.00	High	1	
JACKSON KELLER TRUST LAKE DAM-NORTH									
MO30253	S10 T40N R20W	1967	30.00	Unknown	275.00	7.00	High	2	
JACKSON+KELLER TRUST LAKE DAM-SOUTH									
MO31654	S10 T40N R20W	1970	25.00	Unknown	620.00	4.00	High	2	
JUNGLE LAKE DAM									
MO20080	S10 T41N R21W	1960	44.00	679.00	950.00	30.00	Low	3	R-333

ID Number	Location	Year Complete	Height (ft)	Length (ft)	Drainage Area (acre)	Lake Area (acre)	NID Hazard Class	DNR Hazard Class	Permit Number
KARR LAKE DAM									
MO20470	S15 T42N R22W	1967	20.00	Unknown	225	12.00	Low	3	
KNOTT 001									
MO50052		1979	24.00	1,200	0	1.00	Low		
KYLE LAKE DAM									
MO20458	S31 T42N R20W	1957	30.00	Unknown	70	6.00	High	2	
LAKE PLACID DAM									
MO30188	S25 T42N R20W	1937	30.00	Unknown	850.00	14.00	Low	3	
MIRROR LAKE #1									
MO31709	S06 T40N R23W	1800	32.00	Unknown	60.00	3.00	High		
MIRROR LAKE #2									
MO30318	S06 T40N R23W	1950	25.00	Unknown	90.00	6.00	Low	3	
MONONAME 4									
MO30042	S35 T41N R21W	1955	20.00	Unknown	132.00	5.00	Low	3	
MOSS LAKE DAM									
MO31358	S19 T42N R20W	1973	36.00	825	205.00	30.00	Low	3	Ag Exempt
PEEBLES LAKE DAM									
MO20456	S13 T41N R21W	1800	30.00	Unknown	230.00	12.00	Low	3	
REKUS LAKE DAM									
MO30252	S09 T42N R21W	1952	28.00	Unknown	100.00	13.00	Low	3	
SMARTT DAM									
MO20467	S25 T40N R22W	19760	38.00	440.00	142.00	13.00	Low	3	R-287
STERETT CREEK DIKE									
MO20729	S33 T41N R22W	1979	60.00	7,500.00	0.00	55,600.00	High	1	

ID Number	Location	Year Complete	Height (ft)	Length (ft)	Drainage Area (acre)	Lake Area (acre)	NID Hazard Class	DNR Hazard Class	Permit Number
TATGE LAKE DAM-SECT 29									
MO30153	S29 T40N R22W	1961	28.00	Unknown	93.00	10.00	High	2	
TIMBER LINE LAKE DAM									
MO30021	S26 T42N R22W	1959	30.00	Unknown	180.00	18.00	Low	3	
WRAY LAKE DAM									
MO20457	S34 T41N R21W	1800	25.00	Unknown	350.00	12.00	Low	3	

As of April 30, 2016, there have been no dam failures reported for Benton County.

Sterett Creek Dike is profiled in the Levee sections on page 120, and pages 192-193.

Statement of Future Probable Severity

Missouri DNR has defined three levels of hazard potential –high, significant, and low -as accepted by the Interagency Committee on Dam Safety. The definitions are:

- ☐ High: Failure or improper operation will probably cause loss of human life.
- ☐ Significant: Failure or improper operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
- ☐ Low: Failure or improper operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

The future probable severity of a dam failure in Benton County is shown below according to DNR's hazard potential levels.

Hazard Level	Future Probable Severity
High	catastrophic
Significant	critical
Low	negligible

Statement of Probable Risk

Of the total 26 dams, 3 are rated by Missouri DNR as “high” risk and 8 by the NID and the rest are considered “low.” The “high” risk category is based on the following conditions

- ☐ More than 30 years old;
- ☐ High ratio of maximum storage to dam height; and/or,
- ☐ High population density downstream.

These “high” risk dams represent the greatest risk of dam failure. The county’s risk of experiencing a dam failure is shown below according to DNR’s hazard levels.

Hazard Level	Probable Risk
High	These dams must be inspected every two years, if the area downstream from the dam that would be affected by inundation contains ten (10) or more permanent dwellings or any public building.
Significant	These dams must be inspected every three years, if the area downstream from the dam that would be affected by inundation contains one to nine permanent dwellings, or one (1) or more campgrounds with permanent water, sewer and electrical services or one (1) or more industrial buildings
Low	These dams must be inspected every five years, if the area downstream from the dam that would be affected by inundation does not contain any of the structures identified for Class I or Class II dams.

Measures of Probability and Severity

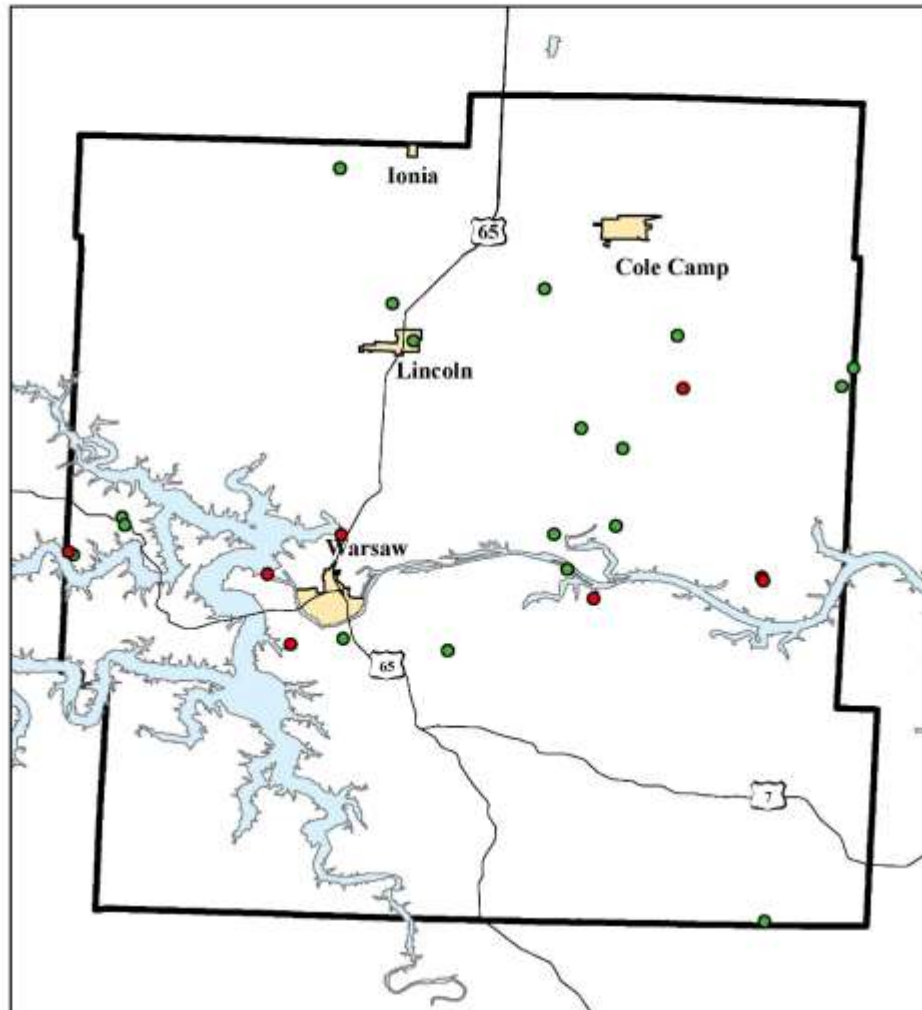
Probability: Moderate – Benton County, Warsaw
Not applicable – All other participating jurisdictions

Severity: Moderate – Benton County, Warsaw
Not applicable – All other participating jurisdictions

Existing Mitigation Strategies

There are currently none.

Benton County

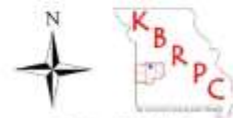


Legend

- High Hazard
- Low Hazard
- Roads
- Lakes
- City Boundary

0 3,300 6,600 13,200 19,800 26,400 Meters

1 inch = 9,041 meters



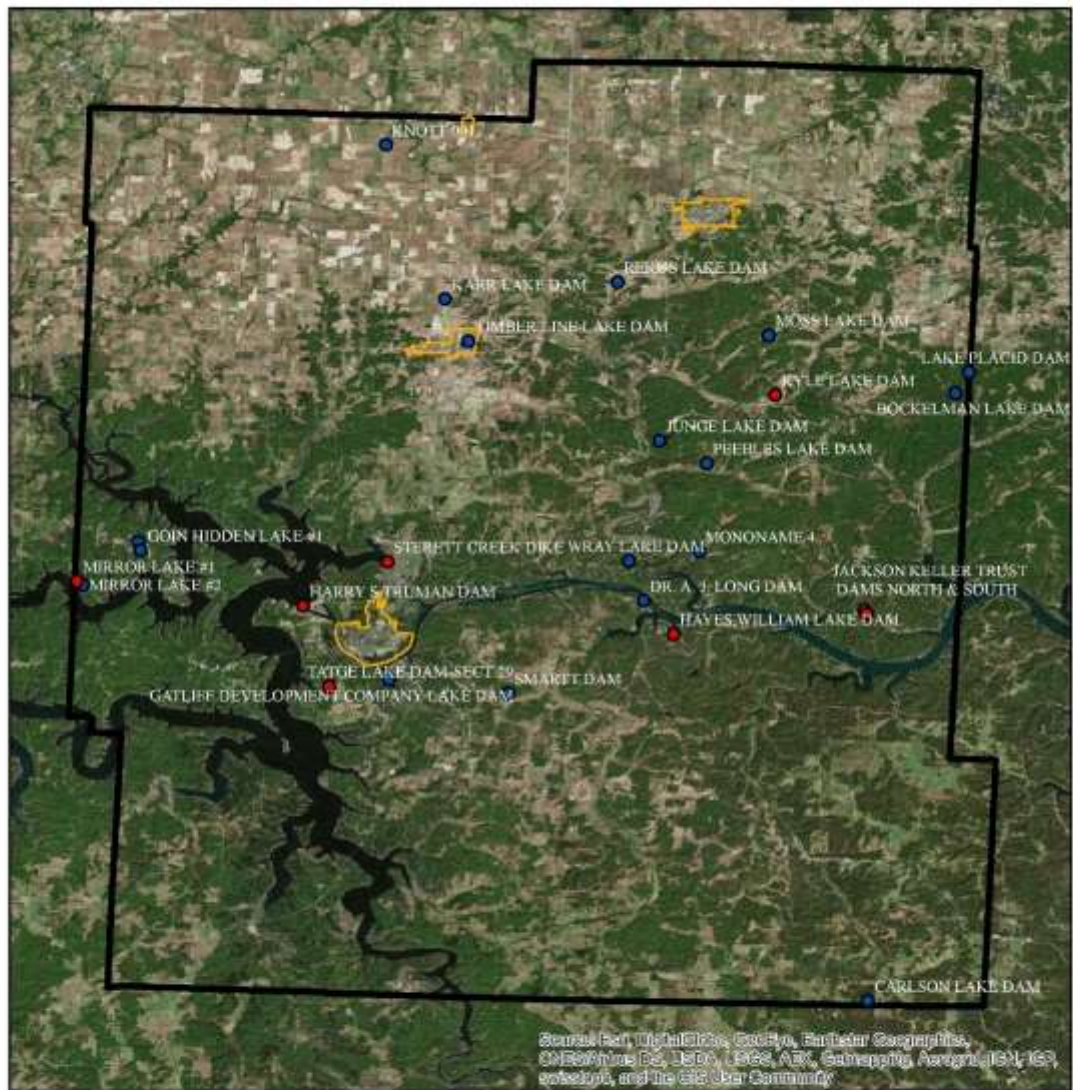
Date: 2/5/2016

Existing Mitigation Strategies

State regulated dams are inspected, according to classification, through the Dam Safety Program of the DNR.

**** NOTE: The NCDC tries to use the best available information, but because of time and resource constraints, information from these sources may be unverifiable. For this reason, the accuracy or validity of the information is not guaranteed by the NCDC. The damage amount information is received from a variety of sources, including those listed above. The NCDC Website cautions that property and crop damage information "should be considered as a broad estimate."****

Benton County

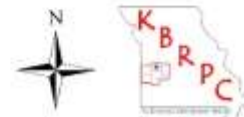


0 3,000 6,000 12,000 18,000 24,000 Meters

1 inch = 8,179 meters

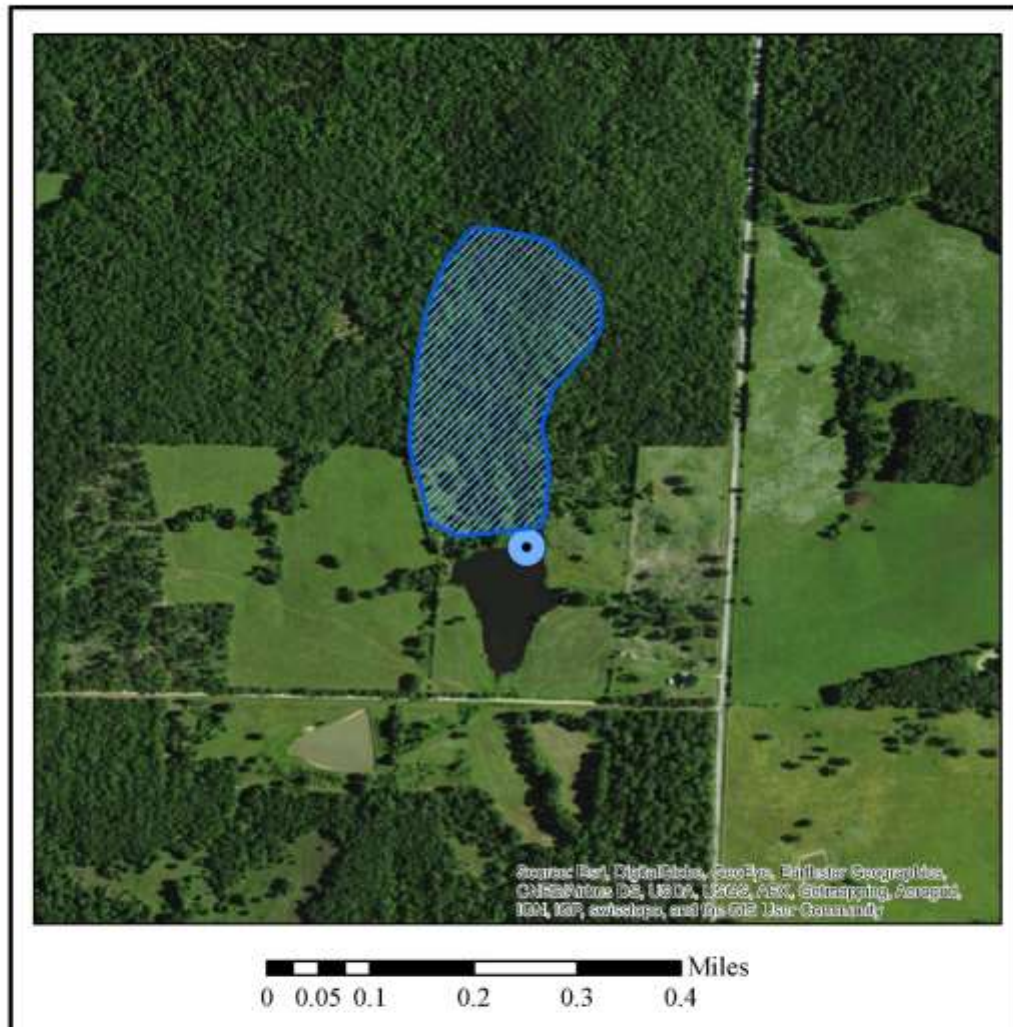
Legend

- High Hazard
- Low Hazard
- City Boundary



Date: 6/21/2016

Carlson Lake Dam



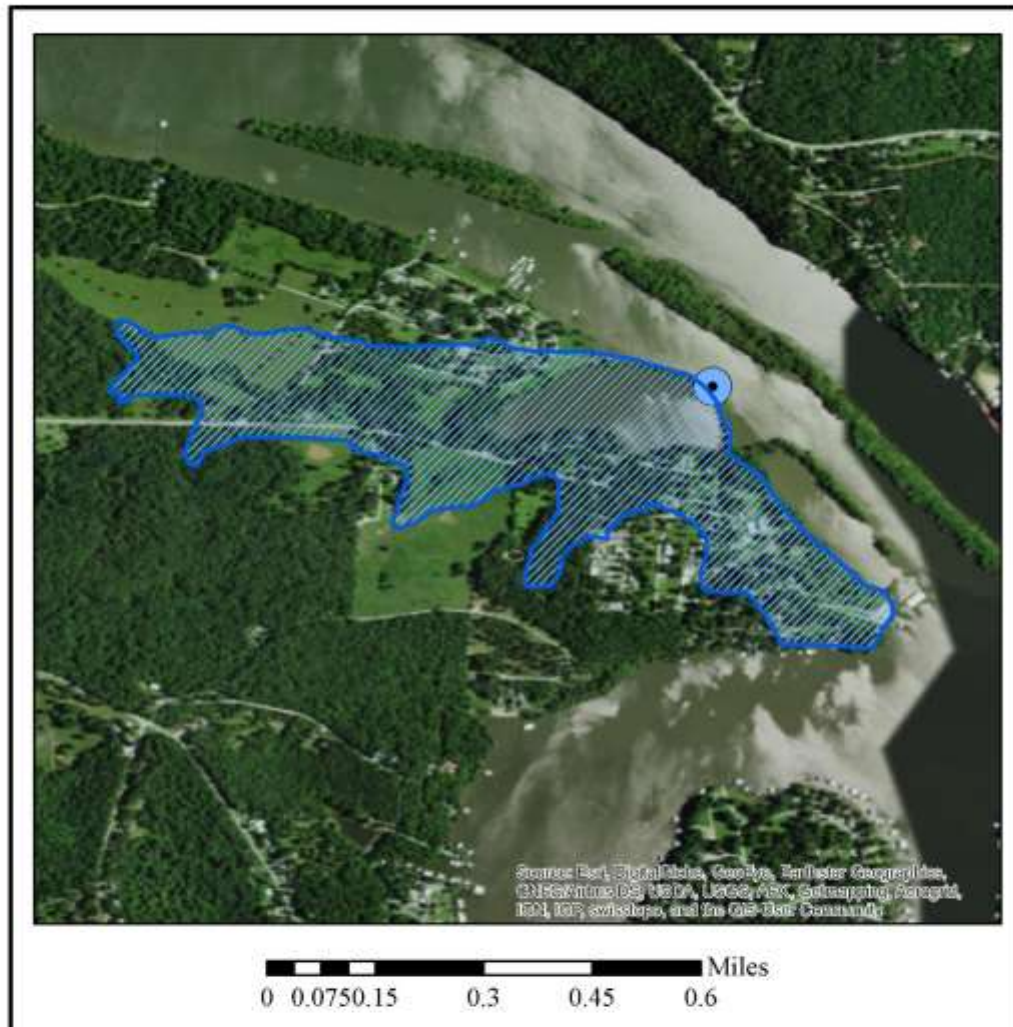
Legend

-  Dam
-  Estimated Flood From Dam Failure



Author: Cyn
Date: 6/29/2016

Dr. A.J. Long Dam



Legend



Dam



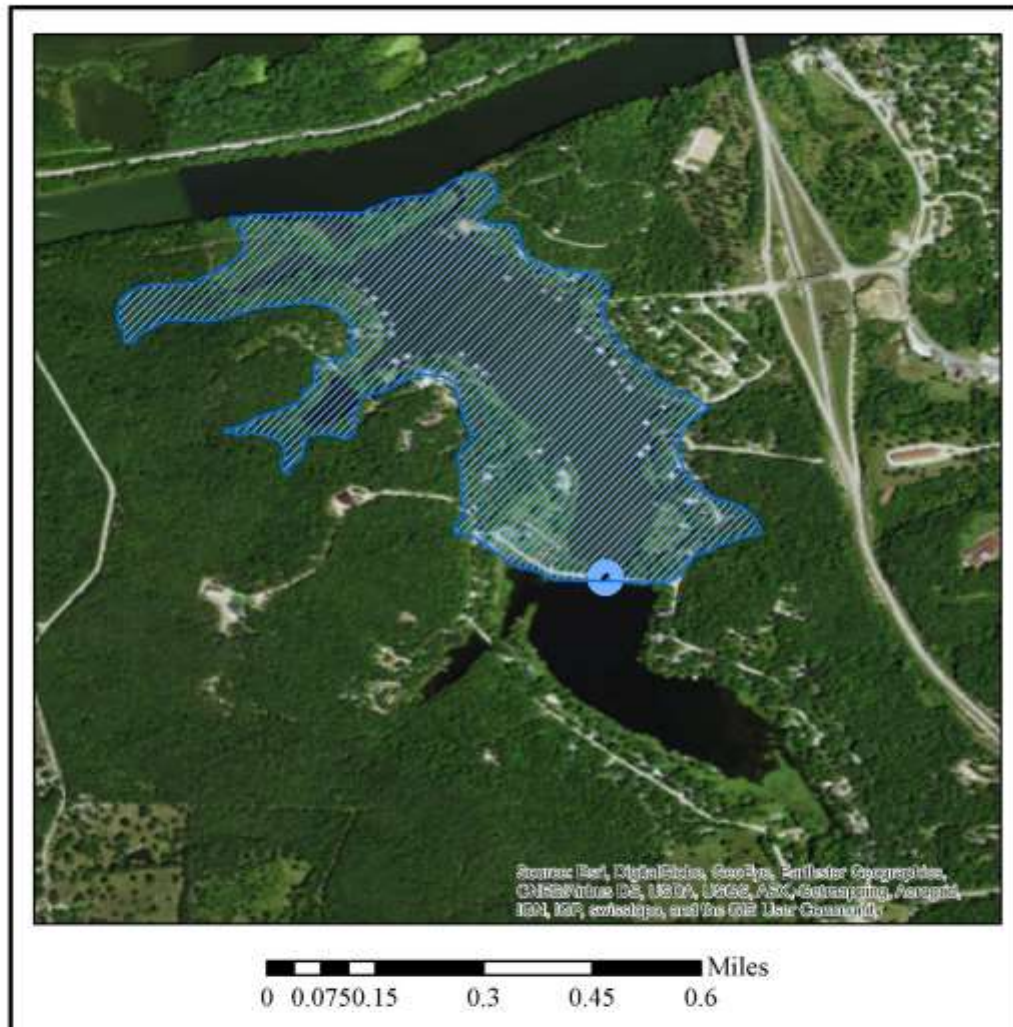
Estimated Flood From Dam Failure



Author: Cyn

Date: 6/29/2016

Gatliff Development Company Lake Dam



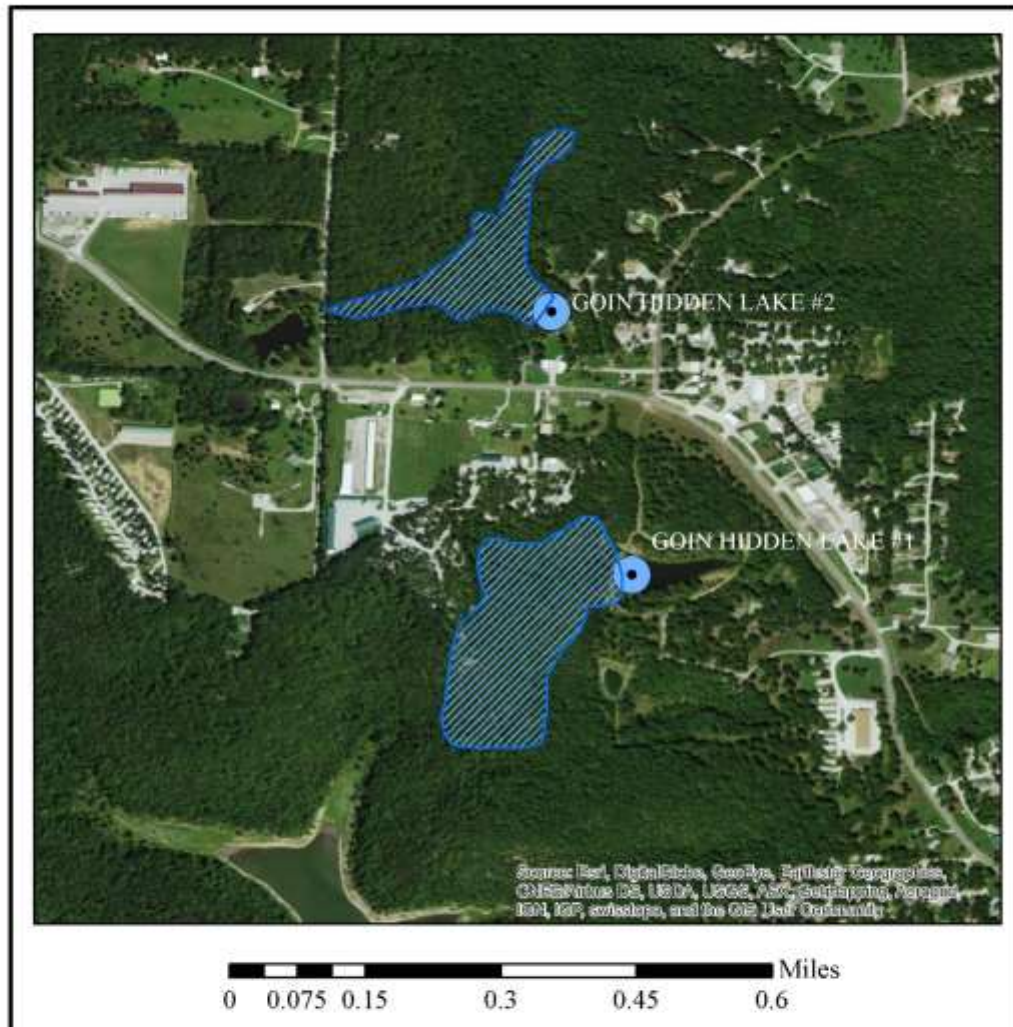
Legend

-  Dam
-  Estimated Flood From Dam Failure



Author: Cyn
Date: 6/29/2016

Goin Hidden Lake Dams 1 & 2



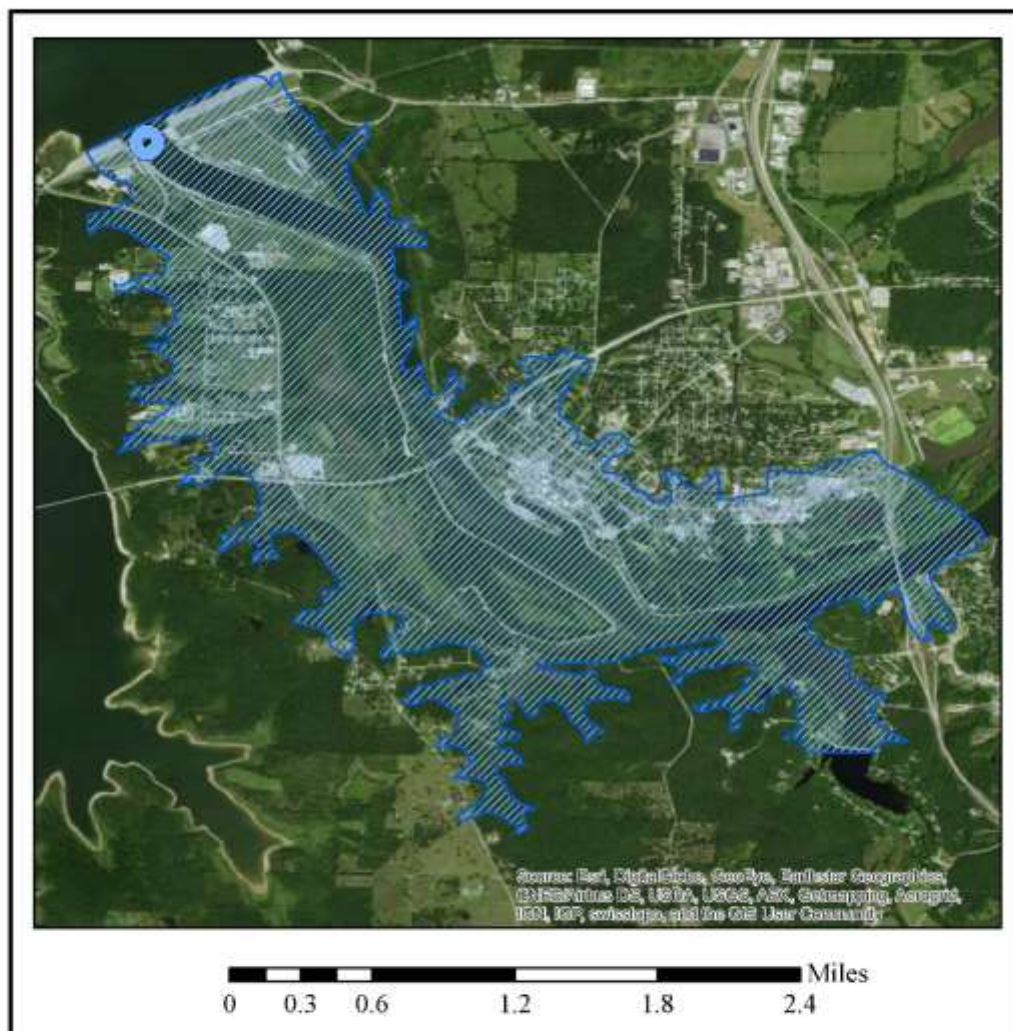
Legend

-  Dam
-  Estimated Flood From Dam Failure



Author: Cyn
Date: 6/29/2016

Harry S. Truman Reservoir



Author: Cyn

Date: 6/29/2016

Legend

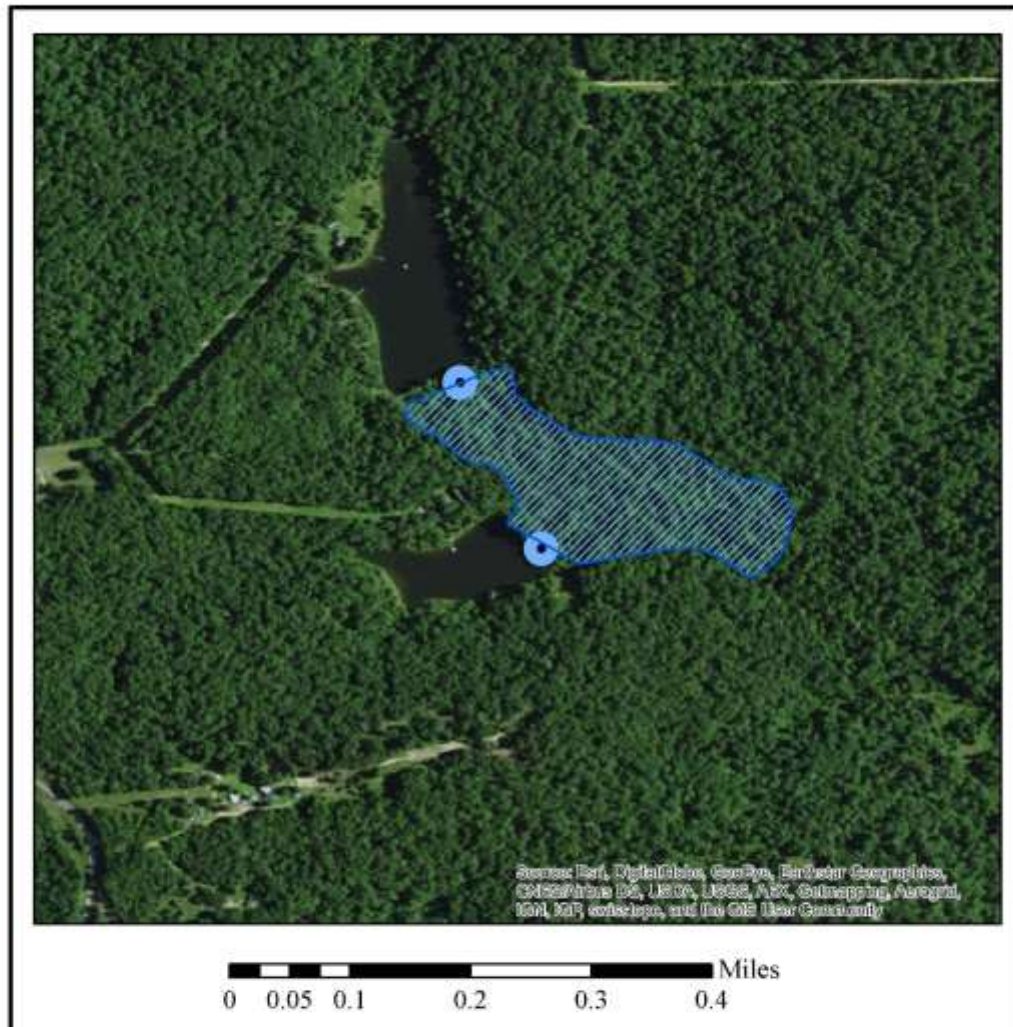


Dam



Estimated Flood From Dam Failure

Jackson Keller Trust Lake Dams



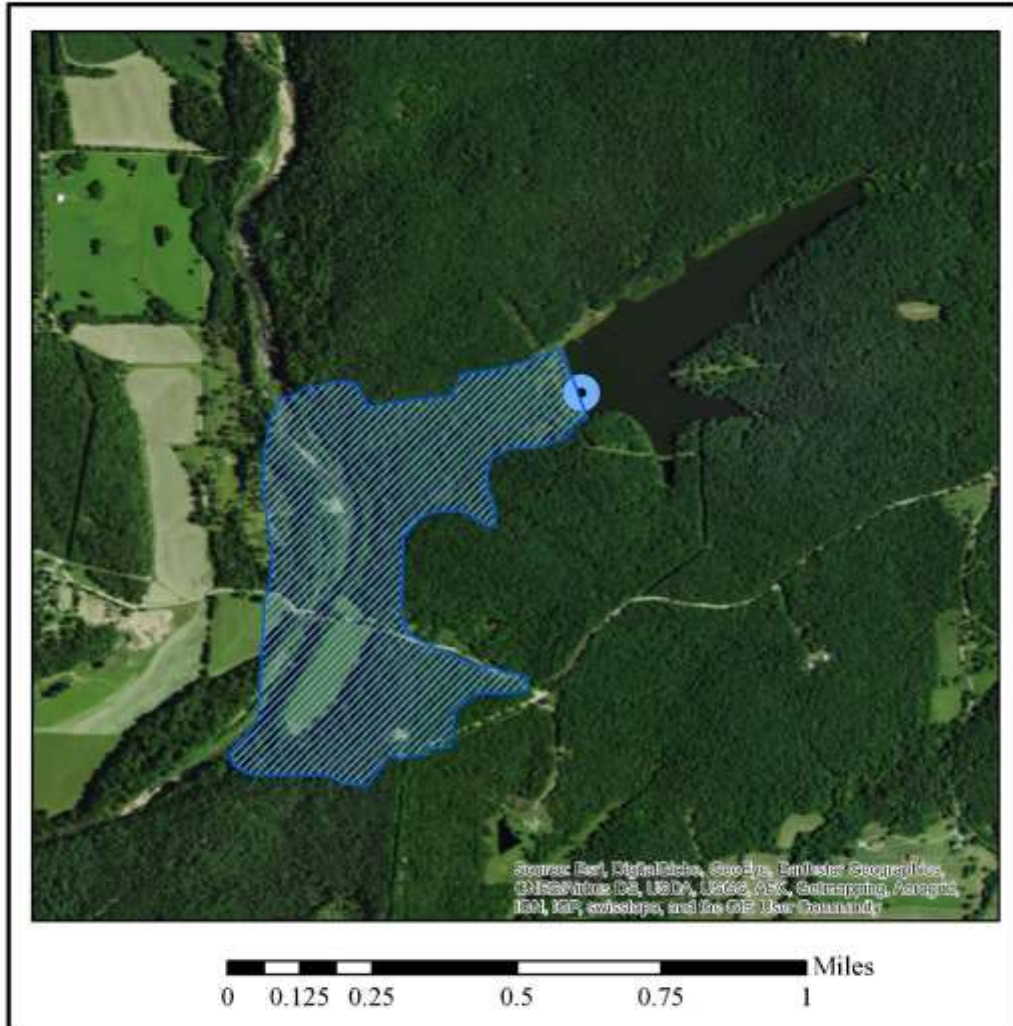
Legend

-  Dam
-  Estimated Flood From Dam Failure



Author: Cyn
Date: 6/29/2016

Junge Lake Dam



Author: Cyn

Date: 6/29/2016

Legend

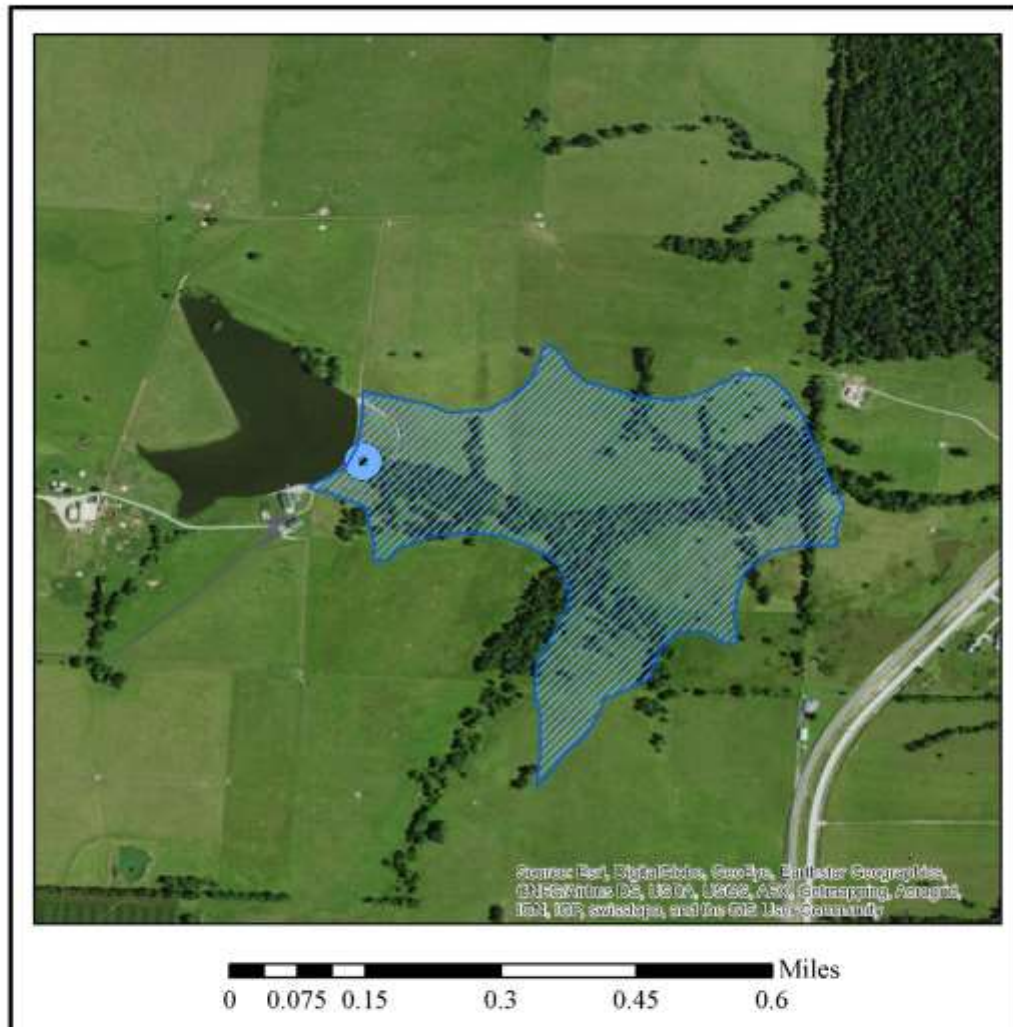


Dam



Estimated Flood From Dam Failure

Karr Lake Dam



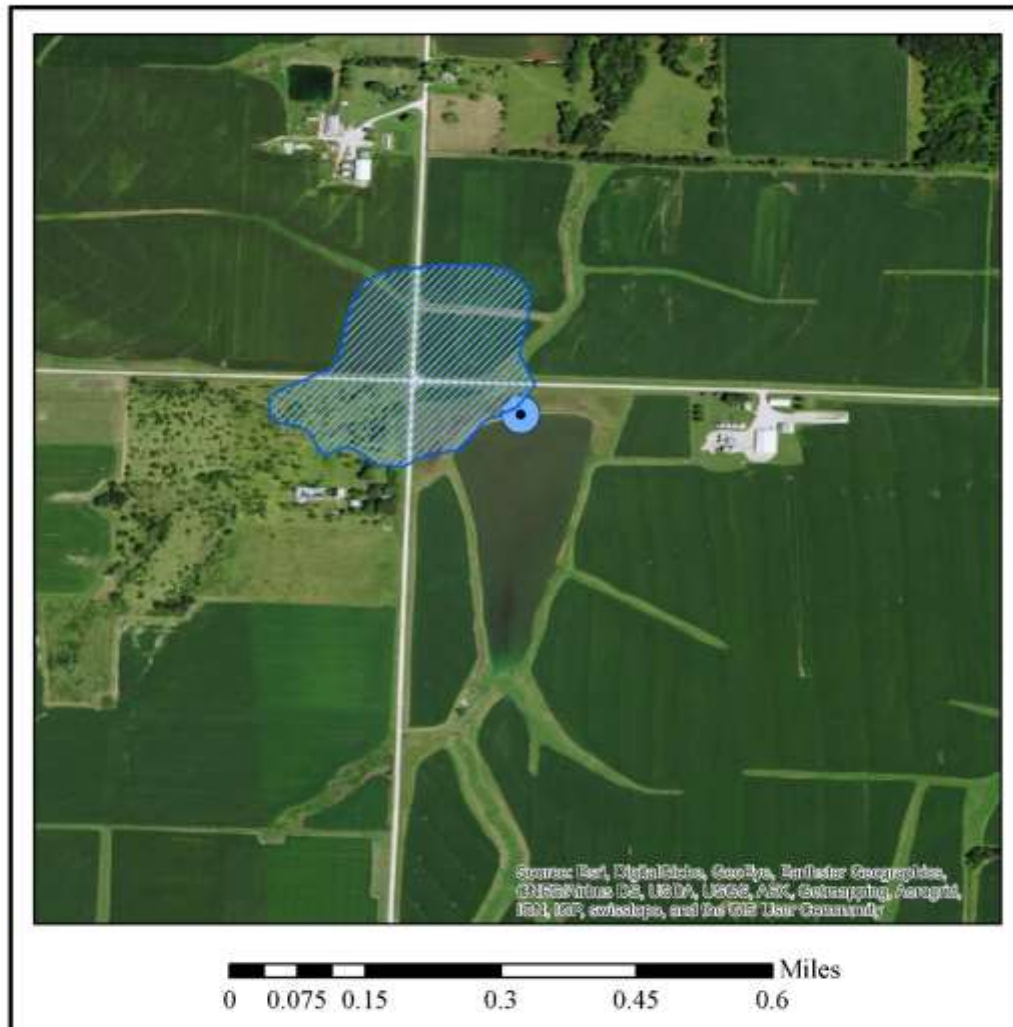
Legend

-  Dam
-  Estimated Flood From Dam Failure



Author: Cyn
Date: 6/29/2016

Knott 001 Dam



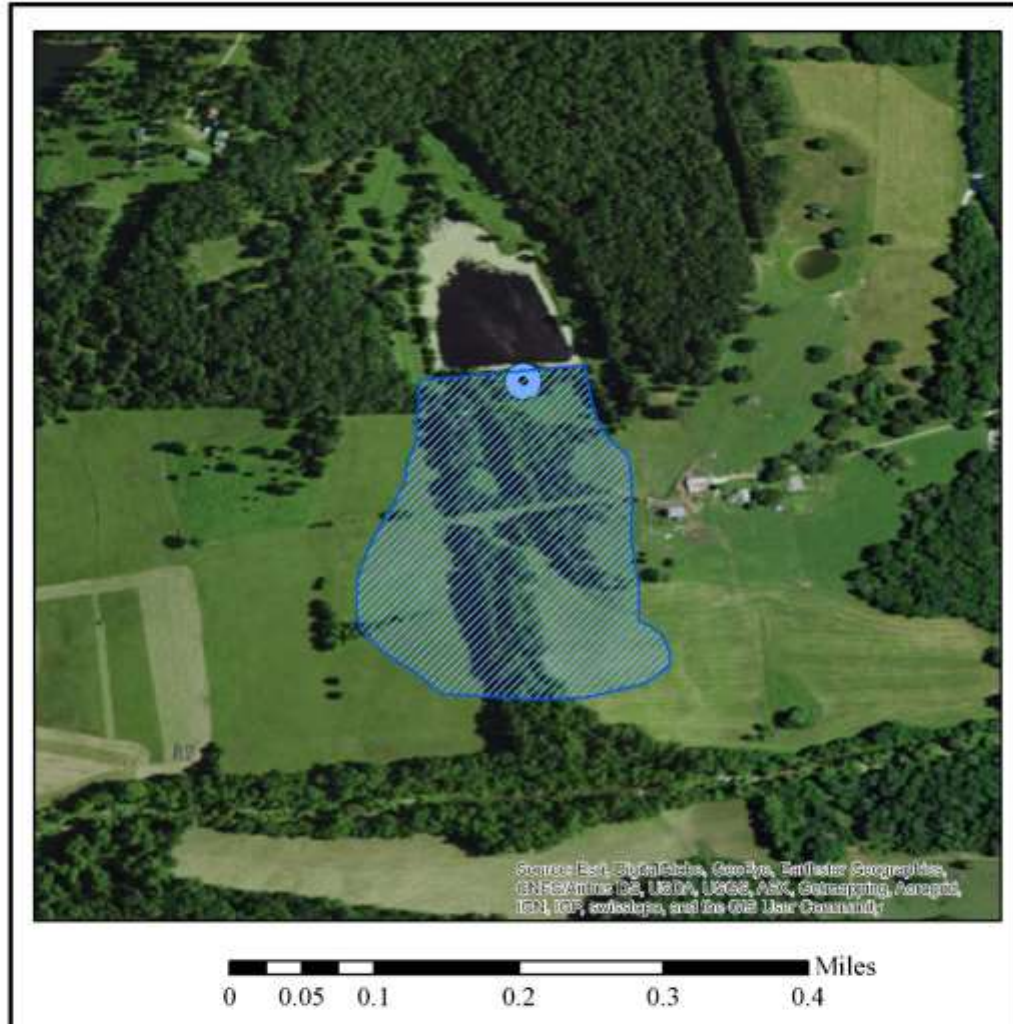
Legend

-  Dam
-  Estimated Flood From Dam Failure



Author: Cyn
Date: 6/29/2016

Kyle Lake Dam



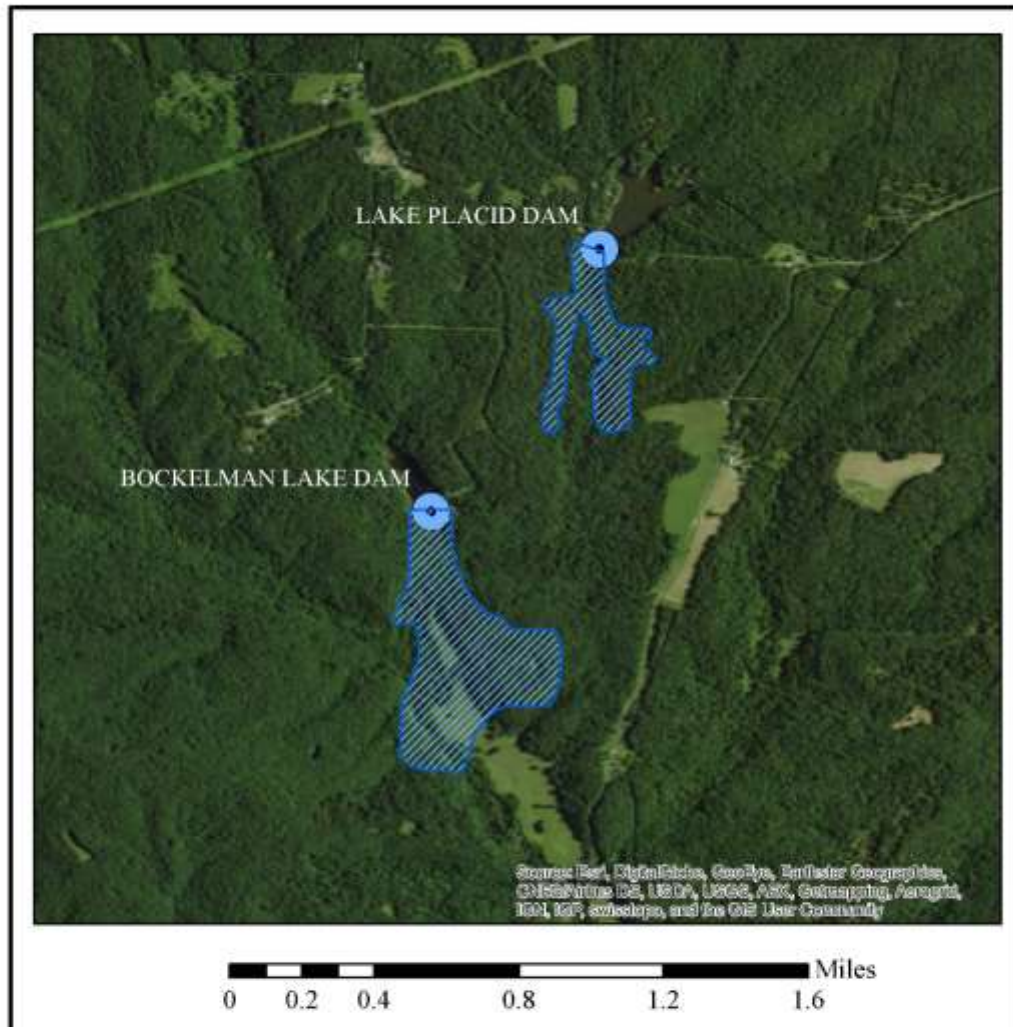
Legend

-  Dam
-  Estimated Flood From Dam Failure



Author: Cyn
Date: 6/29/2016

Lake Placid & Bockelman Lake Dam



Legend

-  Dam
-  Estimated Flood From Dam Failure



Author: Cyn
Date: 6/29/2016

Mirror Lake Dams 1 & 2



Legend



Dam



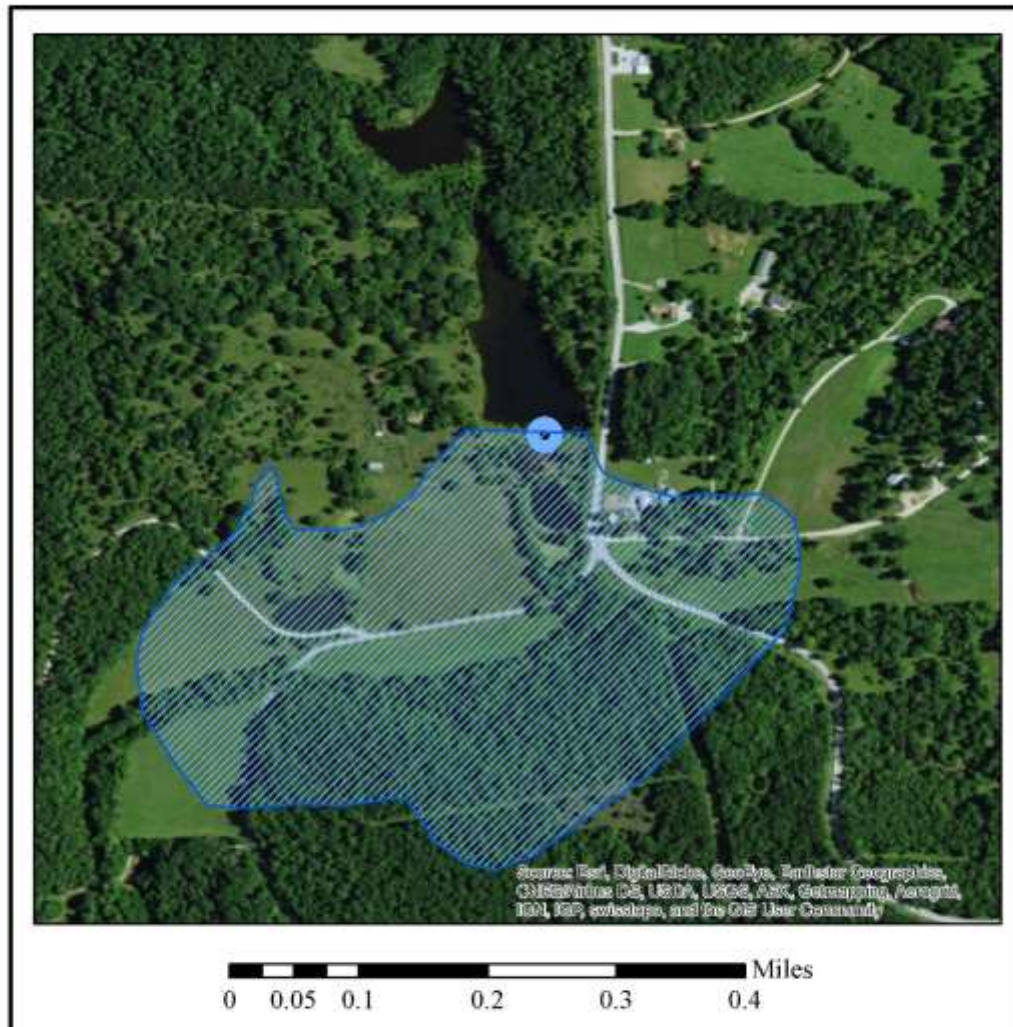
Estimated Flood From Dam Failure



Author: Cyn

Date: 6/29/2016

Mononame 4 Dam



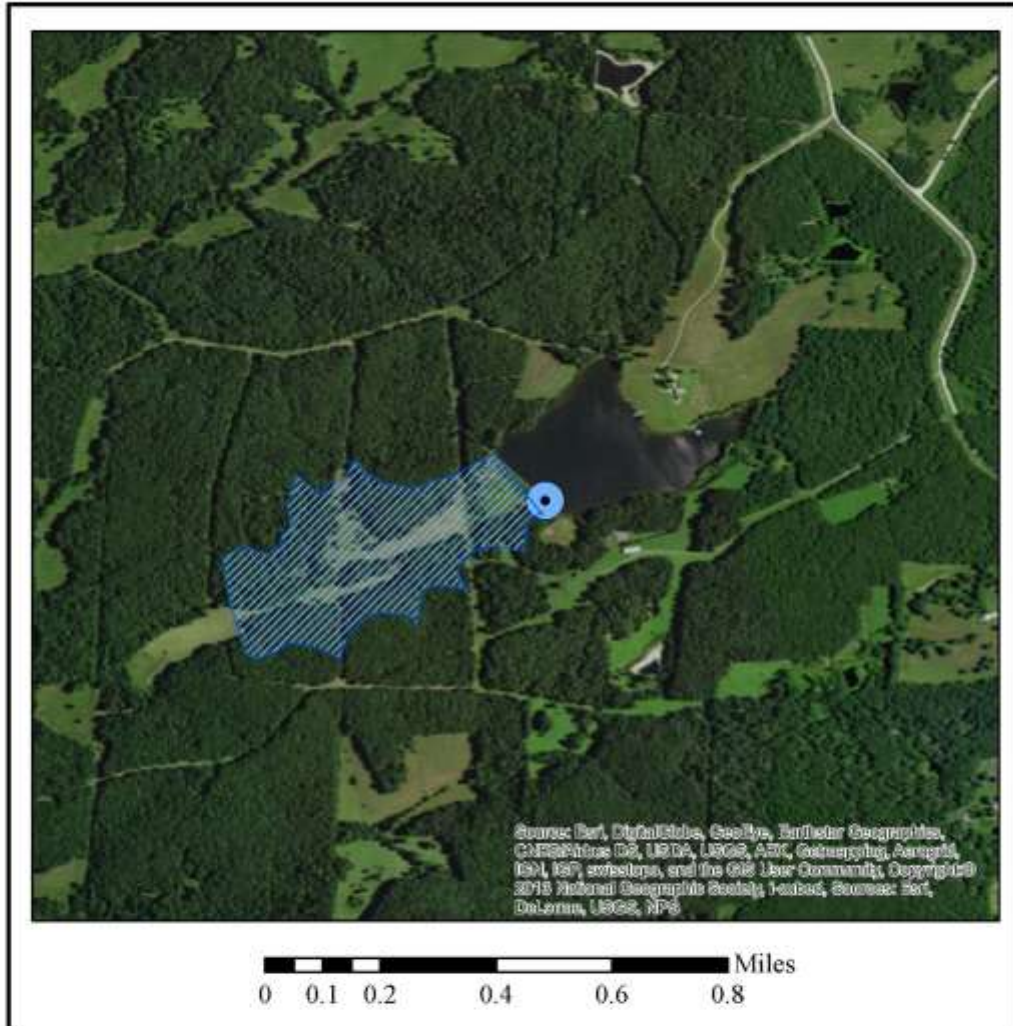
Legend

-  Dam
-  Estimated Flood From Dam Failure



Author: Cyn
Date: 6/29/2016

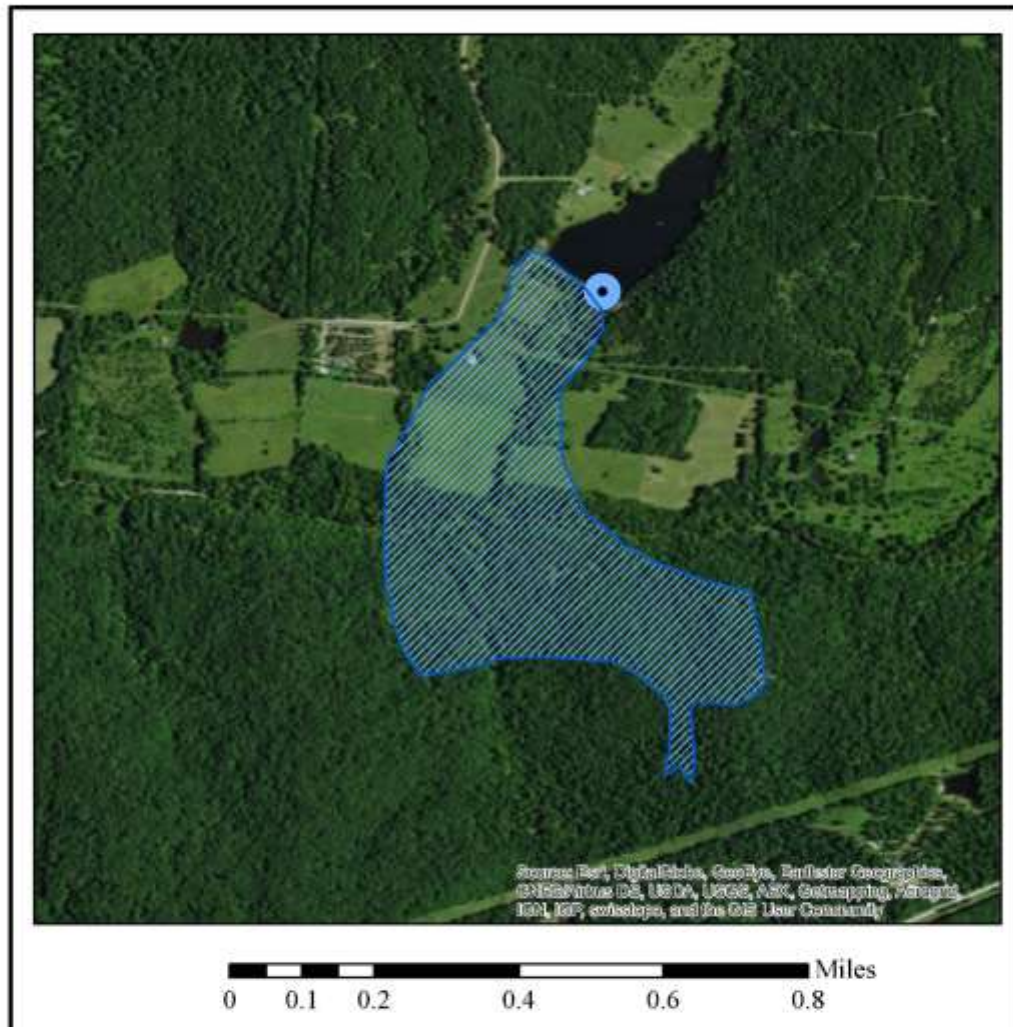
Moss Lake Dam



Author: Cyn

Date: 6/29/2016

Pebbles Lake Dam



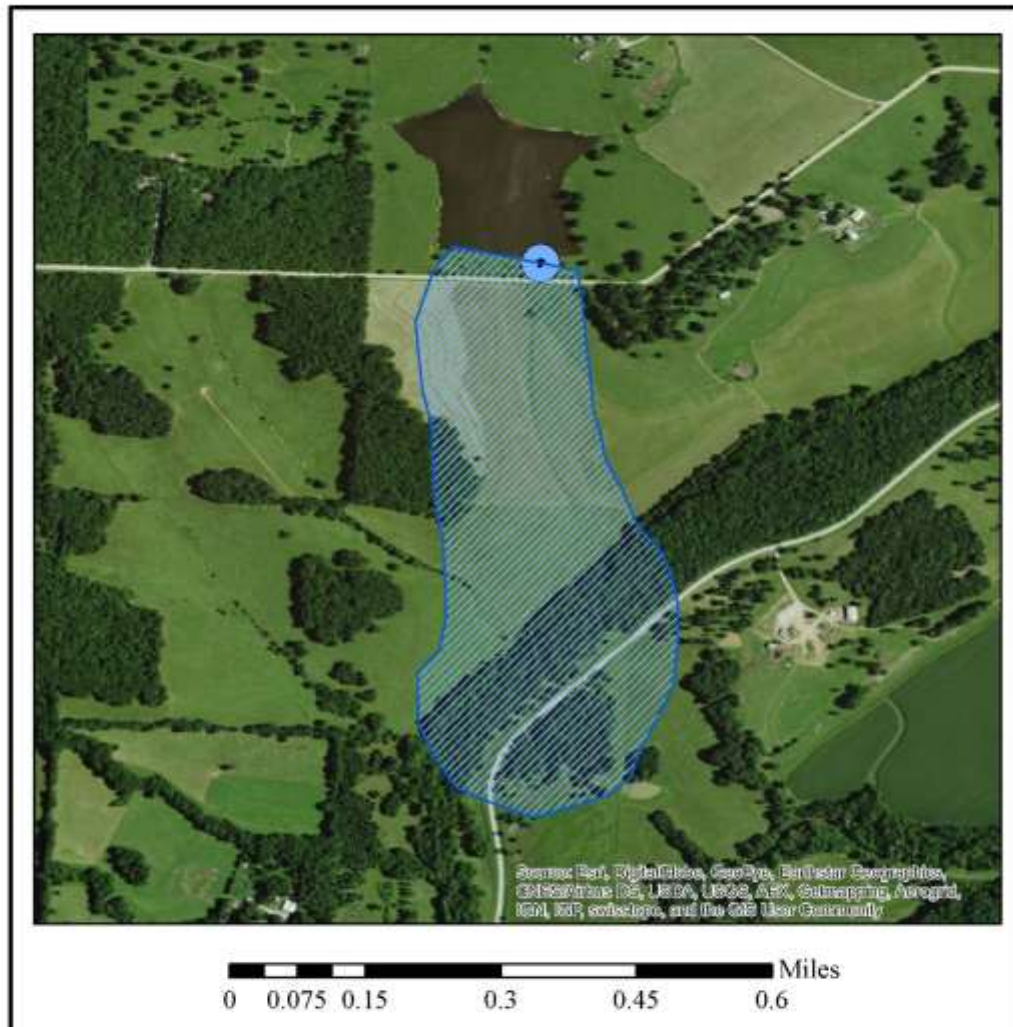
Legend

-  Dam
-  Estimated Flood From Dam Failure



Author: Cyn
Date: 6/29/2016

Rekus Lake Dam



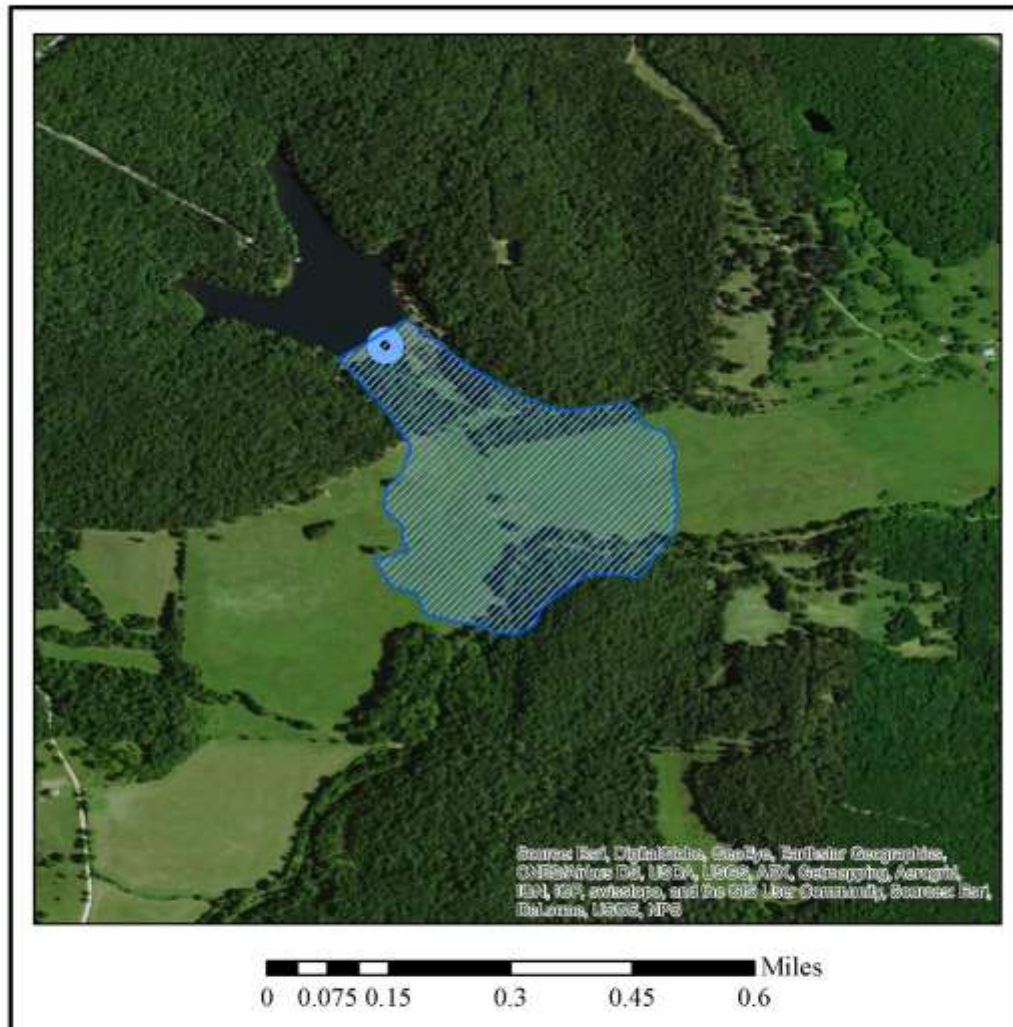
Legend

-  Dam
-  Estimated Flood From Dam Failure



Author: Cyn
Date: 6/29/2016

Smartt Dam



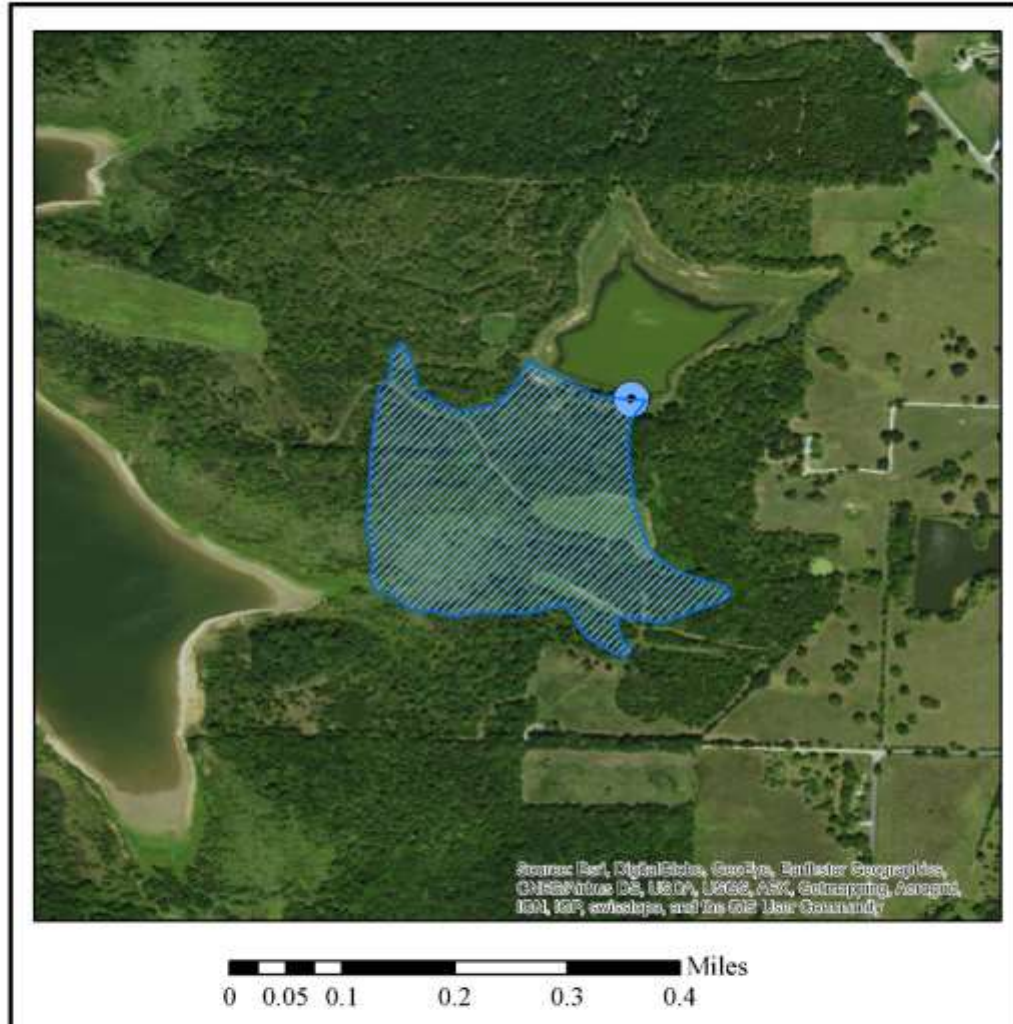
Legend

-  Dam
-  Estimated Flood From Dam Failure



Author: Cyn
Date: 6/29/2016

Tatge Lake Dam Sect. 29



Legend

-  Dam
-  Estimated Flood From Dam Failure



Author: Cyn
Date: 6/29/2016

Timber Line Lake Dam

This map shows the location of the Timber Line Lake Dam, marked with a blue dot and a blue circle. A large area surrounding the lake is shaded with blue diagonal lines, representing the estimated flood zone in the event of a dam failure. The map includes a scale bar from 0 to 1 mile and a north arrow. The legend identifies the dam and the estimated flood area. The map is titled 'Timber Line Lake Dam'.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNR/Satellite DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

0 0.125 0.25 0.5 0.75 1 Miles

Legend

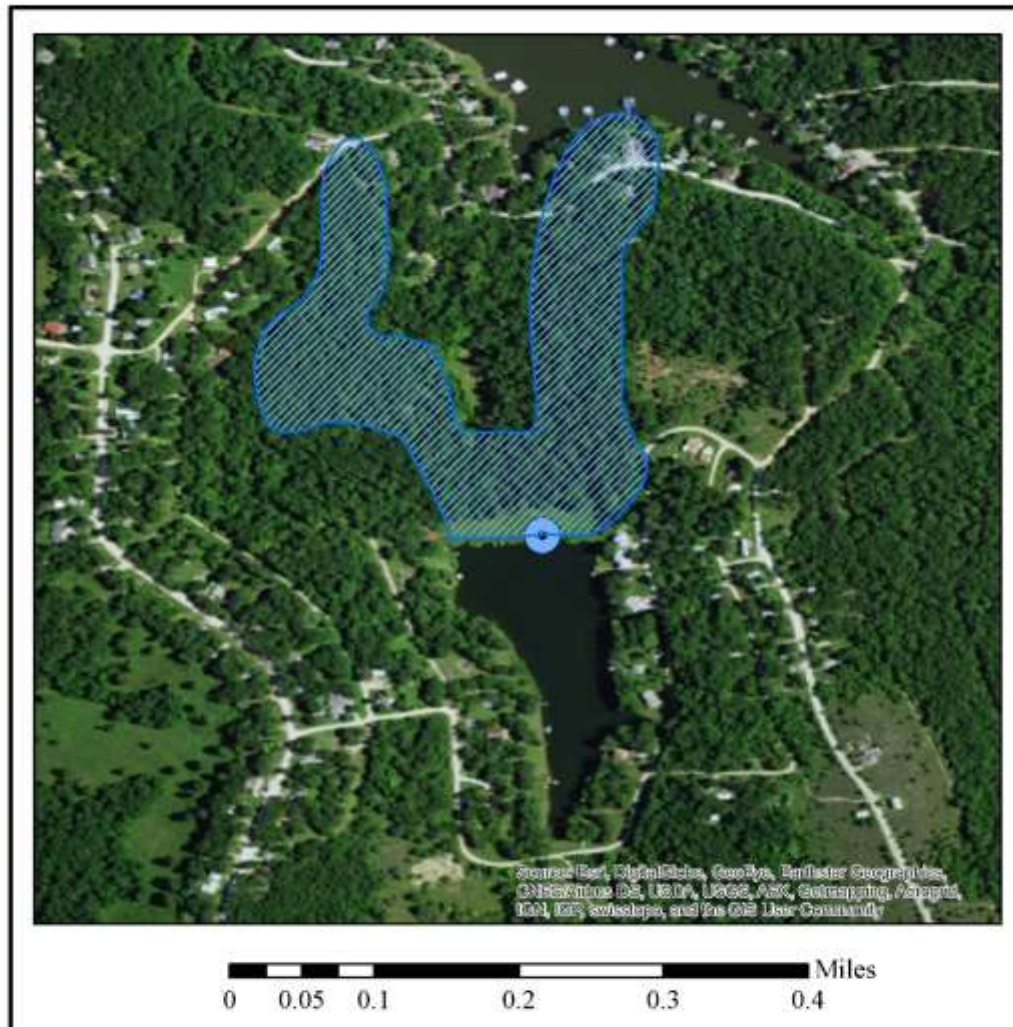
- Dam
- Estimated Flood From Dam Failure

N
W E
S

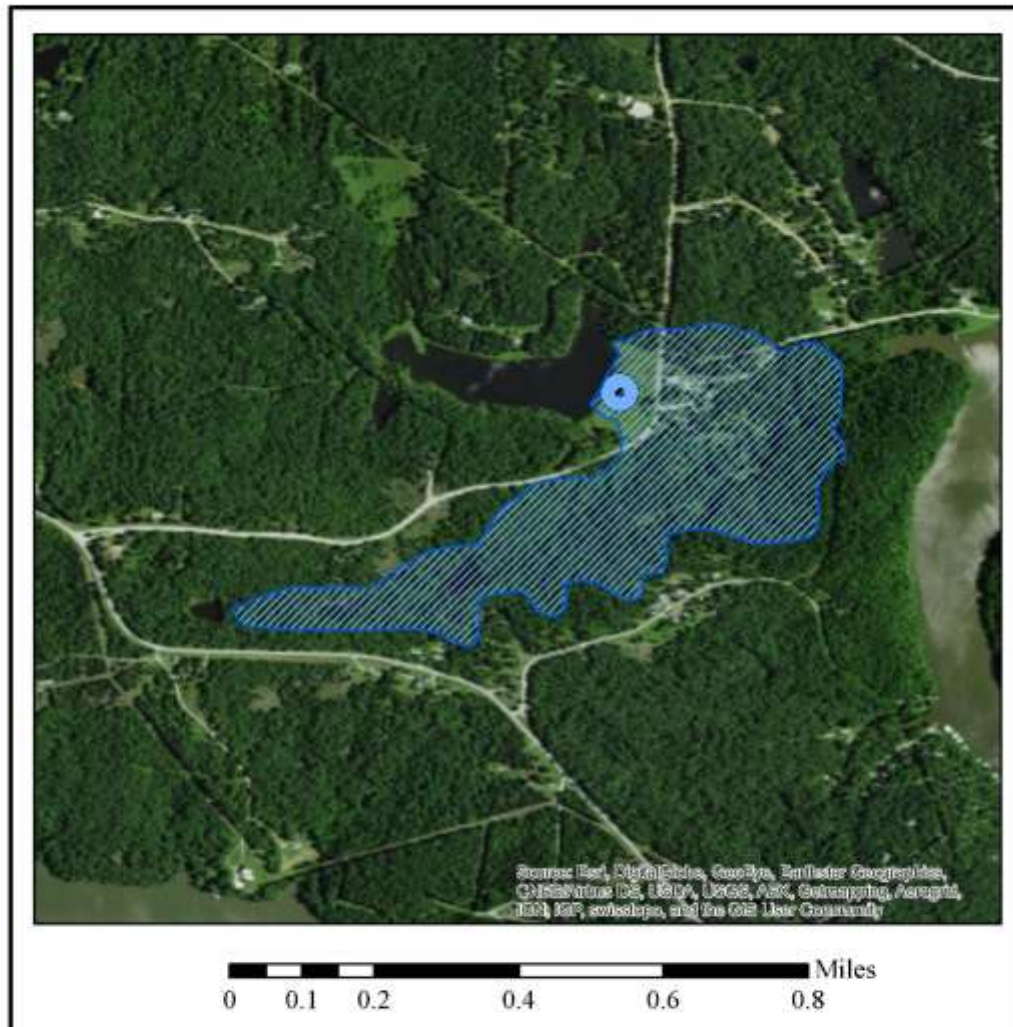
K B R P C

Author: Cyn
Date: 6/30/2016

Williams Hayes Lake Dam



Wray Lake Dam



Legend

-  Dam
-  Estimated Flood From Dam Failure



Author: Cyn
Date: 6/30/2016

3.2.2 Drought

Description of Hazard

The National Weather Service defines a drought as “a period of abnormally dry weather which persists long enough to produce a serious hydrologic imbalance (for example crop damage, water supply shortage, etc.) The severity of the drought depends upon the degree of moisture deficiency, and the duration and the size of the affected area.”

Droughts occur either through a lack of precipitation (supply droughts) or overuse of water (water use droughts). Supply droughts are natural phenomenon associated with lower than normal precipitation. Water use droughts are when the uses of water by humans outpace what the surrounding environment can naturally support. Water use droughts can theoretically happen anywhere but are generally seen in arid climates, not humid places such as Missouri. At the present time, Missouri is most vulnerable to supply droughts brought on by a lack of precipitation.

The period of lack of precipitation needed to produce a supply drought will vary between regions and the particular manifestations of a drought are influenced by many factors. As an aid to analysis and discussion, the research literature has defined different categories of drought (see Table 3.2.2-1).

The most common type of drought in Mid-Missouri is the agricultural drought which happens on average every five years. Widespread crop damage, particularly to corn, is associated with agricultural drought in Missouri. The socioeconomic consequences of a drought can reach far beyond those immediately damaged.

Table 3.2.2-1	
Drought Categories	
Agricultural drought	Defined by soil moisture deficiencies
Hydrological drought	Defined by declining surface and groundwater supplies
Meteorological drought	Defined by precipitation deficiencies
	Defined as meteorological drought in one
Hydrological drought and land use	area that has hydrological impacts in
	another area
Socioeconomic drought	Defined as drought impacting supply and demand of some economic commodity
Source: "Missouri Drought Plan," Missouri Department of Natural Resources – Geological Survey and Resource Assessment, Water Resources Report No. 69, 2002	

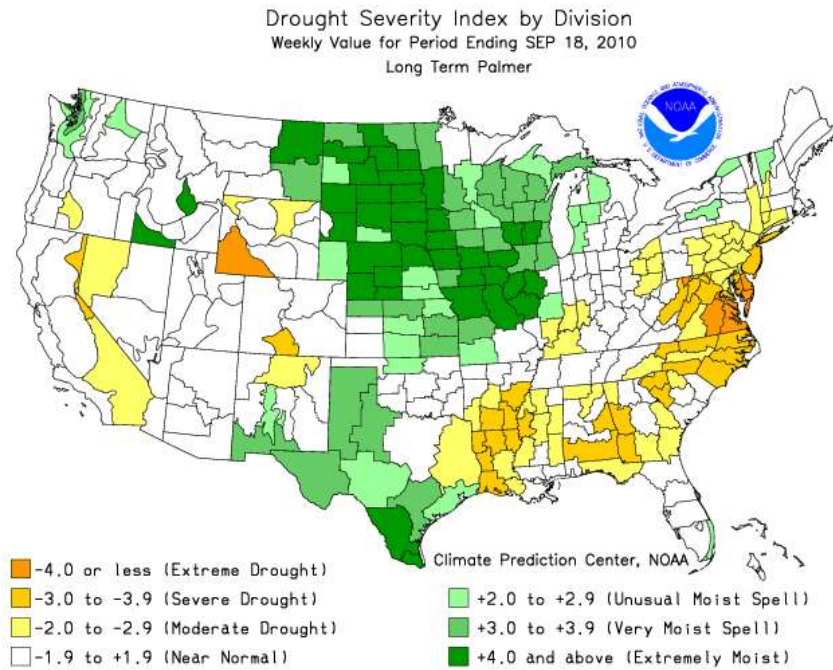
Table 3.2.2-2	
Palmer Drought Severity Index (PDSI)	
Score Characteristics	
Greater than 4	Extreme moist spell
3.0 to 3.9	Very moist spell
2.0 to 2.9	Unusual moist spell
1.0 to 1.9	Moist spell
.5 to .9	Incipient moist spell
.4 to -.4	Near normal conditions
-.5 to -.9	Incipient drought
-1 to -1.9	Mild drought
-2 to -2.9	Moderate drought
-3 to -3.9	Severe drought
Below -4	Extreme drought

Measuring Drought

Droughts vary in severity. Numerous indices have been developed to measure drought severity; each tool has its strengths and weaknesses.

One of the oldest and most widely used indices is the Palmer Drought Severity Index (PDSI, see Table 3.2.2-2), which is published jointly by NOAA and the U.S. Department of Agriculture (USDA). The PDSI measures the difference between water supply (precipitation and soil moisture) and water demand (amount needed to replenish soil moisture and keep larger bodies of water at normal levels.) The map below shows the present drought severity of the U.S. This map differs greatly from previous years. This exact time five years ago with the original hazard plan, Missouri was considered “near normal”. In 2000, Missouri was unusually dry.

Figure 3.2.2-1



Palmer Drought Severity Index

Missouri is divided into six regions of similar climactic conditions for PDSI reporting; Benton County is located in the West Central Plains Region 3 shown in Figure 3.2.2-1



Figure 3.2.2-1

The Missouri Department of Natural Resource's drought response system is based on the PDSI and has four phases of increasing severity:

- Phase 1: Advisory Phase - Water monitoring analysis indicates anticipated drought.
- Phase 2: Drought Alert - PDSI reads -10 to -20; and stream flow, reservoir levels and groundwater levels are below normal over a period of several months.
- Phase 3: Conservation Phase - PDSI reads between -2 to -4; stream flow, reservoir levels and groundwater levels continue to decline; and forecasts indicate an extended period of below-normal precipitation.
- Phase 4: Drought Emergency - PSDI reads lower than -4.

A newer index which is currently being used by The National Drought Mitigation Center (NDMC) is the Standardized Precipitation Index (SPI). This index is based on the probability of precipitation; the time scale used in the probability estimates can be varied and makes the tool very flexible. The SPI is able to identify emerging droughts months sooner than is possible with the PDSI.

Geographic Location

The entire Planning Area is potentially at risk for drought. However, since the most common drought in central Missouri is agricultural drought, the jurisdiction most at risk is the unincorporated agricultural area of Benton County. This is the area where farmers are at risk for crop failure from drought and would suffer the most immediate and severe economic loss.

Previous Occurrences

Even though Benton County averages about 40" of precipitation per year, it has been subject to droughts in the past.

Historical information concerning droughts prior to the 20th Century is difficult to find. According to the Missouri State Hazard Mitigation Plan (2007), research on tree-ring patterns at the University of Missouri indicates that Missouri experienced a severe drought in the years 1548 to 1558. The tree-ring patterns indicate a regular 18.6 year cycle of drought for the Midwest. More information is available for droughts in the 20th and current centuries. According to the Missouri Climate Center at the University of Missouri.

Missouri suffered drought in the 1930s and the early 1940s, along with most of the central United States. These were the Dust Bowl years in the southern plains. The years 1953-1957 were actually drier years in Missouri than the Dust Bowl years. Missouri was specifically hit in 1954 and 1956 by an extreme decrease in precipitation. Crop yields were down by as much as 50%, leading to negative impacts on the agricultural and regional economies of the region. The last major nationwide drought was in the late 1980's. The 1980's drought hit the Northern Great Plains and Northern Midwest particularly hard. Missouri suffered economic losses due to decreased barge traffic and low water in the Missouri and Mississippi Rivers. Furthermore, some municipalities suffered from very low water resources and in some instances exhausted all of their normal water sources, according to the Missouri Hazard Analysis (SEMA, August 1997).

Most of Missouri was in a drought condition during the last half of 1999, according to the Missouri State Hazard Mitigation Plan (2007). In September, the governor declared an agricultural emergency for the entire state. In October, all counties were declared agricultural disaster areas by the U.S. Secretary of Agriculture. By May of 2000, the entire state was under a Phase 2 Drought Alert. The drought continued through the summer of 2000 in various parts of the state.

Another drought hit Missouri in the years 2002 to 2004. Many crop and livestock producers suffered great financial hardship during this time. The droughts of 2005 and 2006 again caused great hardship for many crop and livestock producers in the state. In August, all 114 Missouri counties and the City of St. Louis were designated as natural disasters for physical and/or production loss loan assistance from the Farm Service Agency (FSA); conditions began to improve in late August/September 2005. Conditions began to improve with a large snowstorm in late November/early December.

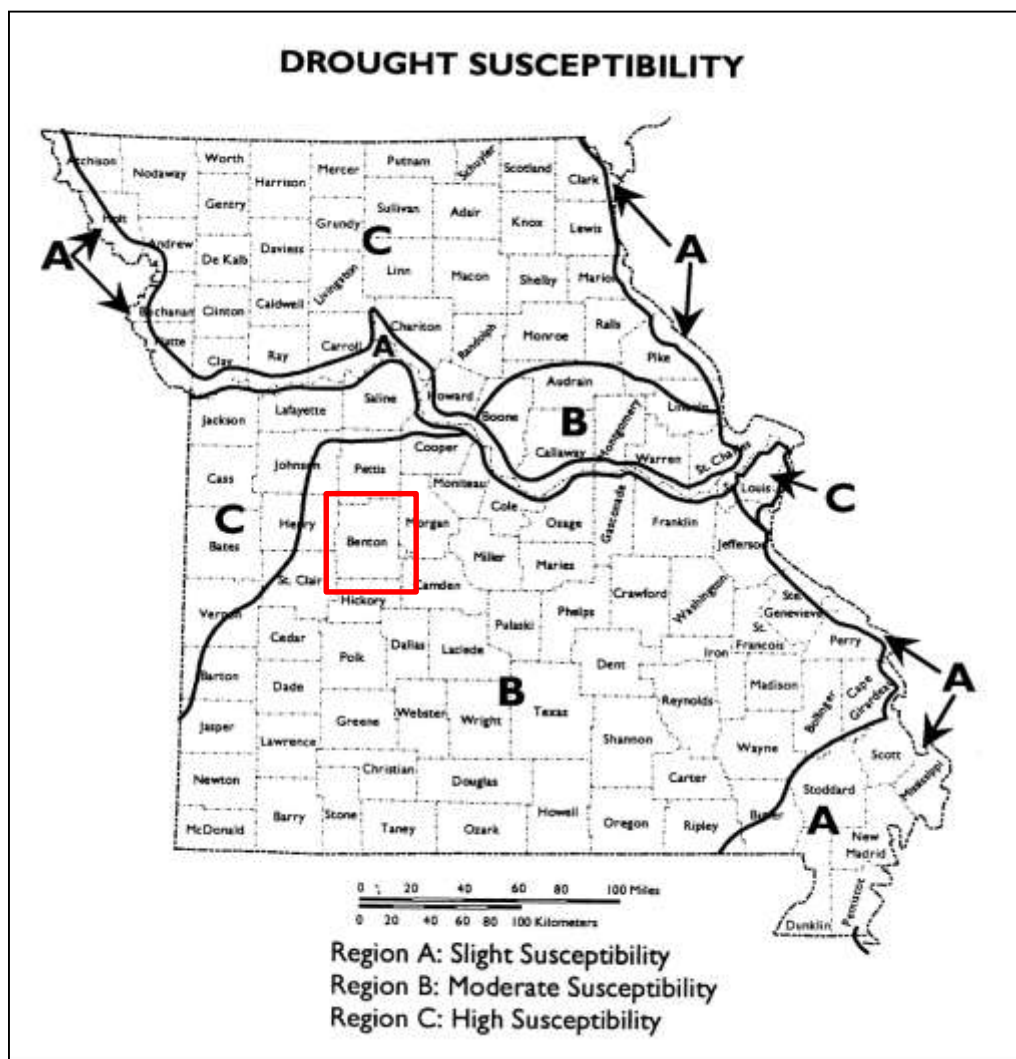
Measure of Probability and Severity

Probability: Moderate – Benton County
Low - all other participating jurisdictions

Severity: Moderate – Benton County
Low - all other participating jurisdictions

The Missouri Department of Natural Resources has defined different regions of drought susceptibility in the Missouri Drought Plan (2002). A map of the different regions is shown in Figure 3.2.2-2.

Figure 3.2.2-2



Benton County lies in Region B which is defined as "...moderate drought susceptibility.

Groundwater resources are adequate to meet domestic and municipal water needs, but due to required well depths, irrigation wells are very expensive. The topography generally is unsuitable for row-crop irrigation.”

Existing Mitigation Strategies

The Missouri Department of Natural Resources publishes a weekly map from The Drought Monitor on their website at: <http://www.dnr.mo.gov/env/wrc/drought/nationalcondition.htm>. The Drought Monitor is a comprehensive drought monitoring effort involving numerous federal agencies, state climatologists, and the National Drought Mitigation Center. It is located at the National Drought Mitigation Center in Lincoln, Nebraska. The new Drought Monitor Map, based on analysis of data collected, is released weekly on Thursday at 8:30 a.m. Eastern Time. The map focuses on broad-scale conditions and is linked to the data sets analyzed.

The University of Missouri Extension has a number of publications for both farmers and homeowners to help mitigate the effects of drought. They are available at: <http://extension.missouri.edu/main/DisplayCategory.aspx?C=257>

The National Drought Mitigation Center (NDMC) is located at the University of Nebraska-Lincoln. The following is a description of their activities from their website (<http://drought.unl.edu/>):

“The National Drought Mitigation Center (NDMC) helps people and institutions develop and implement measures to reduce societal vulnerability to drought, stressing preparedness and risk management rather than crisis management.

Most of the NDMC’s services are directed to state, federal, regional, and tribal governments that are involved in drought and water supply planning. The NDMC, established in 1995, is based in the School of Natural Resources at the University of Nebraska-Lincoln.

The NDMC’s activities include maintaining an information clearinghouse and drought portal; drought monitoring, including participation in the preparation of the U.S. Drought Monitor and maintenance of the web site (drought.unl.edu/dm); drought planning and mitigation; drought policy; advising policy makers; collaborative research; K-12 outreach; workshops for federal, state, and foreign governments and international organizations; organizing and conducting seminars, workshops, and conferences; and providing data to and answering questions for the media and the general public.

The NDMC is also participating in numerous international projects, including the establishment of regional drought preparedness networks in collaboration with the United Nations’ Secretariat for the International Strategy for Disaster Reduction.”

3.2.3 Earthquake

Background

The State of Missouri established the Missouri Seismic Safety Commission (MSSC) through the authority of the Seismic Safety Commission Act also known as (RSMo) Sections 44.225 through 44.237, the main office being within SEMA. The purpose of MSSC is to review Missouri's current preparedness for major earthquakes and to make recommendations to mitigate their impact. MSSC developed a 1997 plan titled *A Strategic Plan for Earthquake Safety* that documented successes, opportunities and concerns including recommendations: 1) that educational efforts continue to be developed and expanded and that the MSSC take the lead; 2) that continued and increased cooperation of State agencies with nationally funded programs (National Science Foundation funding the Mid-America Earthquake Center); 3) that stable State funding be provided for the Missouri earthquake mitigation and preparedness program; 4) that SEMA review and recommend hiring a person to train and tract the Community Emergency Response Teams [CERT]; and 5) to assess the impact of National Hazard Earthquake Reduction Program maps on the state and that scientific investigations be conducted to evaluate assumptions upon which maps are based.

The MSSC prepared the *A Strategic Plan for Earthquake Safety* as the result of a legislative mandate, Senate Bill No. 142 in 1993. The MSSC is similar to Utah's Seismic Safety Commission. This plan will aid in projecting goals, initiatives and priorities. The MSSC notes that preparation following the Strategic Plan will yield significant reduction in fatalities, casualties, damaged structures, business failures and state infrastructure losses from earthquakes and will reduce the impact from other hazards. Key issues identified by MSSC are: 1) Earthquake threat is real. Addressing the problem now will yield significant long-term benefits; 2) Reduction of earthquake risk required combined efforts of individuals, businesses, industry, professional and volunteer organizations and all levels of government [promote adoption and enforcement of appropriate building codes]; 3) Strategies identified in the report for reducing earthquake risk can be implemented through proactive, voluntary community participation; others will require legislation or funding, [promote community emergency response teams-CERTs, 4) MSSC accepts responsibilities to advance earthquake planning and mitigation in state at outlined in plan. Objectives include: 1) increase earthquake awareness and education, 2) reduce earthquake hazard through mitigation, 3) create response efforts that are well-coordinated, fast, efficient to reduce injury, loss of life and property destruction, 4) improve recovery from seismic event [identify earthquake resistant shelters], 5) assess earthquake hazard [develop response team to evaluate post-earthquake effects].

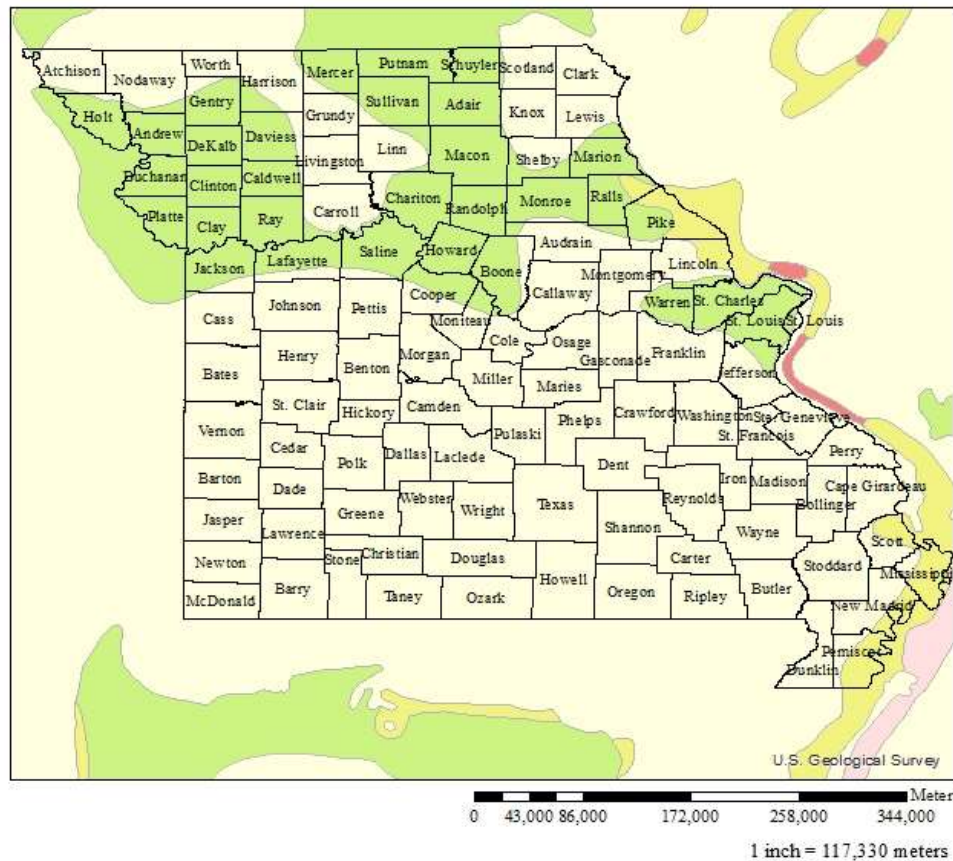
Description

Earthquake is a term used to describe both sudden slip on a fault and the resulting ground shaking and radiated seismic energy caused by the slip, or by volcanic or magmatic activity, or other sudden stress changes in the earth. The Earth's crust is made up of large plates, also known as tectonic plates. These plates are the large, thin, relatively rigid plates that move relative to one another on the outer surface of the Earth.

Plate tectonics involves the formation, lateral movement, interaction, and destruction of the lithosphere plates (The lithosphere is the outer solid part of the earth, including the crust and uppermost mantle. The lithosphere is about 100 km thick; although its thickness is age dependent (older lithosphere is thicker). The lithosphere below the crust is brittle enough at some locations to produce earthquakes by faulting, such as within a subducted oceanic plate). Much of Earth's internal heat is relieved through this process and many of Earth's large structural and topographic features are consequently formed. Continental rift valleys (the nearby New Madrid Fault Zone is considered a buried rift valley) and vast plateaus of basalt are created at plate break up when magma ascends from the mantle to the ocean floor, forming new crust and separating mid-ocean ridges. Plates collide and are destroyed as they descend at subduction zones to produce deep ocean trenches, strings of volcanoes, extensive transform faults, broad linear rises, and folded mountain belts. Earth's lithosphere presently is divided into eight large plates with about two dozen smaller ones that are drifting above the mantle at the rate of 5 to 10 centimeters (2 to 4 inches) per year. There are eight large plates; the New Madrid Fault Zone is located in the North American Plate.

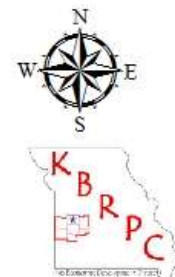
Earthquake induced landslides and dam failure/levee failure are secondary earthquake hazards that occur from ground shaking. Damage resulting from landslides is similar to that from earthquakes. Damage resulting from dam failure/levee failure is similar to that with flash flooding. The following map shows the locations of likely earthquake induced landslides.

Earthquake Induced Landslides Incidence and Susceptibility



Legend

- High landslide incidence (over 15% of the area is involved in landsliding)
- Moderate landslide incidence (1.5 - 15% of the area is involved)
- High susceptibility to landsliding and moderate incidence
- High susceptibility to landsliding and low incidence
- Moderate susceptibility to landsliding and low incidence
- Low landslide incidence (less than 1.5 % of the area is involved)
- No data



Date: 8/22/2016

Landslides constitute a major geologic hazard because they are widespread, occurring in all 50 states, and cause \$1-2 billion in damages and more than 25 fatalities on average each year. Landslides pose serious threats to highways and structures that support fisheries, tourism, timber harvesting, mining, and energy production as well as general transportation. Landslides commonly occur with other major disasters such as earthquakes and floods that exacerbate relief and reconstruction efforts and expanded development and other land use has increased the incidence of landslide disasters.

The enormous damages from landslides can be reduced. The primary objective of the Landslide Hazards Program is to reduce long-term losses from these hazards by improving our understanding of the causes of ground failure and suggesting mitigation strategies.

The term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes and shallow debris flows. Although gravity acting on an over steepened slope is the primary reason for a landslide, there are other contributing factors:

- erosion by rivers, glaciers, or ocean waves create over steepened slopes
- rock and soil slopes are weakened through saturation by snowmelt or heavy rains
- earthquakes create stresses that make weak slopes fail
- earthquakes of magnitude 4.0 and greater have been known to trigger landslides
- volcanic eruptions produce loose ash deposits, heavy rain, and debris flows
- excess weight from accumulation of rain or snow, stockpiling of rock or ore, waste piles, or from man-made structures may stress weak slopes to failure and other structures

Slope materials that become saturated with water may develop a debris flow or mud flow. The resulting slurry of rock and mud may pick up trees, houses, and cars, thus blocking bridges and tributaries causing flooding along its path. Features that might be noticed prior to major land sliding.

- Springs, seeps, or saturated ground in areas that have not typically been wet before.
- New cracks or unusual bulges in the ground, street pavements or sidewalks.
- Soil moving away from foundations.
- Ancillary structures such as decks and patios tilting and/or moving relative to the main house.
- Tilting or cracking of concrete floors and foundations.
- Broken water lines and other underground utilities.
- Leaning telephone poles, trees, retaining walls or fences
- Offset fence lines.
- Sunken or down-dropped road beds.
- Rapid increase in creek water levels, possibly accompanied by increased turbidity (soil content).
- Sudden decrease in creek water levels though rain is still falling or just recently stopped.
- Sticking doors and windows, and visible open spaces indicating jams and frames out of plumb.

Characteristics

The characteristics of earthquakes include the rolling or shaking of the surface of the ground, landslides, liquefaction and amplification. The severity of these hazards depends on several factors, including soil and slope conditions, proximity to the fault, earthquake magnitude and type of earthquake.

Likely Locations

Earthquakes occur all the time all over the world, both along plate edges and along faults. Most earthquakes occur along the edge of the oceanic and continental plates. It is unlikely that an earthquake will affect Benton County. Likely locations of earthquakes in Missouri are located near the New Madrid Fault Zone, the Wabash Valley Fault and the fault zones in the vicinity of Farmington (including Big River Fault and the St. Genevieve Fault Zone).

Type of Damage

Buildings on poorly consolidated and thick soils will typically have more damage than buildings located on consolidated soils and bedrock. Soils and soft sedimentary rocks near the earth's surface and landfills can modify ground shaking caused by earthquakes. One of these modifications is amplification. Amplification increases the magnitude of the seismic waves generated by the earthquake. The amount of amplification is influenced by the thickness of geologic materials and their physical properties. Buildings and structures built on soft and unconsolidated soils can face greater risk. Damage on buildings can range from minor foundation cracks to complete leveling of the structure. (See Figure 3.2.3-1 below). Building contents can be broken from being knocked onto the floor or being crushed by the ceiling, walls and floor failing. Dams and levees have the potential to fail, resulting in the flooding of downstream regions including residentially populated areas.

Liquefaction occurs when ground shaking causes wet granular soils to change from a solid state to a liquid state. This results in the loss of soil strength and the soil's ability to support weight. Buildings and their occupants are at risk when the ground can no longer support these structures. Damage from liquefaction can destroy the buildings and the foundations the buildings rest on. Liquefaction has been documented from the New Madrid Fault Zone earthquake activity.

Earthquakes and landslides have the potential to destroy roads, bridges, buildings (especially older buildings constructed of masonry or those buildings that are not designed to seismic standards), utilities (including those that are not designed to seismic standards) and other critical facilities (including those that are not designed to seismic standards). Earthquake induced landslides are secondary earthquake hazards that occur from ground shaking.

Damage resulting from landslides is similar to that from earthquakes.

Figure 3.2.3-1



Historical Statistics

Historic and recent earthquake activity in central United States, discussed in the Hazard Identification Section of this chapter, indicate that throughout this century, the region has not experienced a major earthquake that caused widespread damage or injuries. According to the magnitude-recurrence relation, the rate of earthquake activity for any particular seismic source usually remains stable for long periods of time (possibly thousands of years).

Many Midwestern communities are located near the New Madrid fault, an area with high seismic risk. Estimates of the recurrence intervals of the large 1811-1812 earthquakes are about 500 to 1000 years. Most residents are not aware of this risk because the last significant earthquake occurred in the early 19th century. However, small quakes along this fault continue to occur in Missouri about every 8 days.

Frequency of Occurrence

There has been no significant earthquake in Benton County.

Intensity or Strength

Earthquakes can be measured by intensity or by magnitude. The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included for the variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude 5.3 might be computed for a moderate earthquake, and a strong earthquake might be rated as magnitude 6.3. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale

corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value. The Richter Scale is not used to express damage. An earthquake in a densely populated area which results in many deaths and considerable damage may have the same magnitude as a shock in a remote area that does nothing more than frighten the wildlife. Large-magnitude earthquakes that occur beneath the oceans may not even be felt by humans.

The Mercalli Scale is based on observable earthquake damage. From a scientific standpoint, the Richter scale is based on seismic records while the Mercalli is based on observable data that can be subjective. Thus, the Richter scale is considered scientifically more objective and therefore more accurate. For example a level I-V on the Mercalli scale would represent a small amount of observable damage. At this level doors would rattle, dishes break and weak or poor plaster would crack. As the level rises toward the larger numbers, the amount of damage increases considerably. The higher number represents total damage. Refer to Table 3.2.3-1

Table 3.2.3-1

Modified Mercalli Scale

MODIFIED MERCALLI INTENSITY SCALE

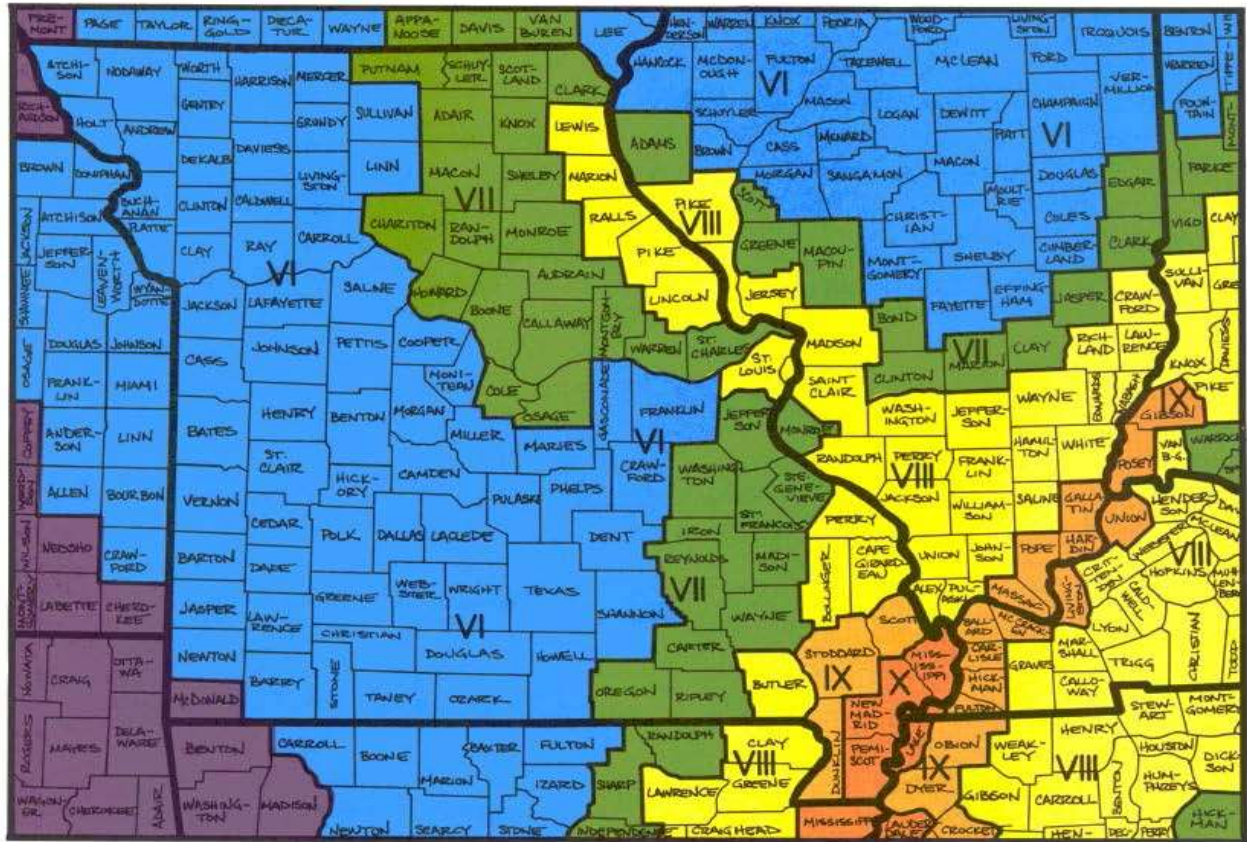
I	People do not feel any Earth movement.	IX	Most buildings suffer damage. Houses that are not bolted down move off their foundations. Some underground pipes are broken. The ground cracks conspicuously. Reservoirs suffer severe damage.
II	A few people might notice movement.	X	Well-built wooden structures are severely damaged and some destroyed. Most masonry and frame structures are destroyed, including their foundations. Some bridges are destroyed. Dams are seriously damaged. Large landslides occur. Water is thrown on the banks of canals, rivers, and lakes. Railroad tracks are bent slightly. Cracks are opened in cement pavements and asphalt road surfaces.
III	Many people indoors feel movement. Hanging objects swing.	XI	Few if any masonry structures remain standing. Large, well-built bridges are destroyed. Wood frame structures are severely damaged, especially near epicenters. Buried pipelines are rendered completely useless. Railroad tracks are badly bent. Water mixed with sand, and mud is ejected in large amounts.
IV	Most people indoors feel movement. Dishes, windows, and doors rattle. Walls and frames of structures creak. Liquids in open vessels are slightly disturbed. Parked cars rock.	XII	Damage is total, and nearly all works of construction are damaged greatly or destroyed. Objects are thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move. Lakes are dammed, waterfalls formed and rivers are deflected.
V	Almost everyone feels movement. Most people are awakened. Doors swing open or closed. Dishes are broken. Pictures on the wall move. Windows crack in some cases. Small objects move or are turned over. Liquids might spill out of open containers.		
VI	Everyone feels movement. Poorly built buildings are damaged slightly. Considerable quantities of dishes and glassware, and some windows are broken. People have trouble walking. Pictures fall off walls. Objects fall from shelves. Plaster in walls might crack. Some furniture is overturned. Small bells in churches, chapels and schools ring.		
VII	People have difficulty standing. Considerable damage in poorly built or badly designed buildings, adobe houses, old walls, spires and others. Damage is slight to moderate in well-built buildings. Numerous windows are broken. Weak chimneys break at roof lines. Cornices from towers and high buildings fall. Loose bricks fall from buildings. Heavy furniture is overturned and damaged. Some sand and gravel stream banks cave in.		
VIII	Drivers have trouble steering. Poorly built structures suffer severe damage. Ordinary substantial buildings partially collapse. Damage slight in structures especially built to withstand earthquakes. Tree branches break. Houses not bolted down might shift on their foundations. Tall structures such as towers and chimneys might twist and fall. Temporary or permanent changes in springs and wells. Sand and mud is ejected in small amounts.		

Intensity is a numerical index describing the effects of an earthquake on the surface of the Earth, on man, and on structures built by man. The intensities shown in these maps are the highest likely under the most adverse geologic conditions. There will actually be a range in intensities within any small area such as a town or county, with the highest intensity generally occurring at only a few sites. Earthquakes of all three magnitudes represented in these maps occurred during the 1811 - 1812 "New Madrid earthquakes." The isoseismal patterns shown here, however, were simulated based on actual patterns of somewhat smaller but damaging earthquakes that occurred in the New Madrid seismic zone in 1843 and 1895.

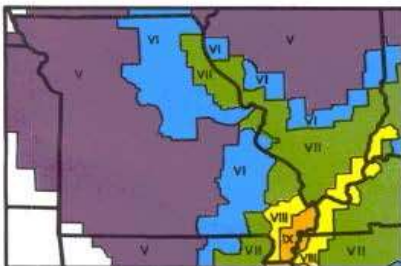
Prepared and distributed by
THE MISSOURI STATE
EMERGENCY MANAGEMENT AGENCY
P.O. BOX 116
JEFFERSON CITY, MO 65102
Telephone: 573-526-9100

Figure 3.2.3-2

PROJECTED EARTHQUAKE INTENSITIES

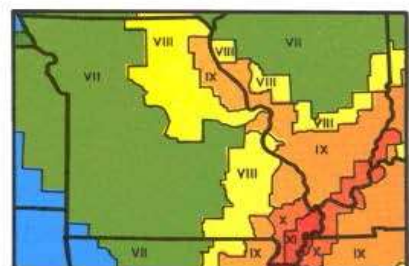


his map shows the highest projected Modified Mercalli intensities by county from a potential magnitude – 7.6 earthquake whose epicenter could be any-
here along the length of the New Madrid seismic zone.



This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude – 6.7 earthquake whose epicenter could be any-
where along the length of the New Madrid seismic zone.

This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude – 8.6 earthquake whose epicenter could be any-
where along the length of the New Madrid seismic zone.



Intensity scales, like the Modified Mercalli Scale measure the amount of shaking at a particular location. So the intensity of an earthquake will vary depending on where you are. Sometimes earthquakes are referred to by the maximum intensity they produce. Magnitude scales, like the Richter magnitude, measure the size of the earthquake at its source. They do not depend on where the measurement was made.

Lives Lost, Injuries, Property Damage, Economic Losses/Other Losses

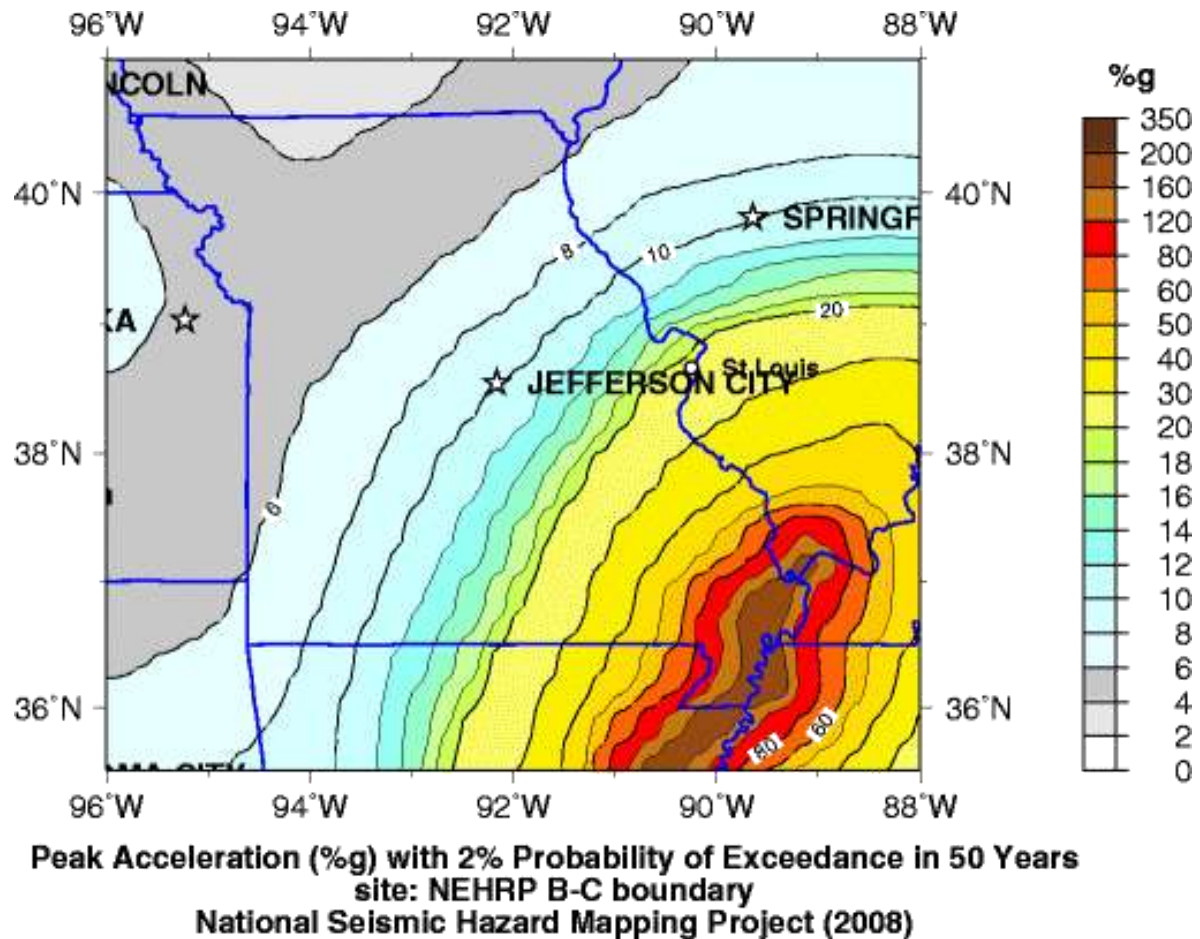
Another earthquake as powerful as the great quakes of 1811-12 may not occur for many years. Because of differences in the geology east and west of the Rocky Mountains, the effects of a magnitude 7 quake in the mid-continent United States could be far worse than those of the 1989 magnitude 7 Loma Prieta, California, earthquake. That quake, which struck the San Francisco Bay region during the World Series, killed 63 people and caused \$6 billion of property damage. Property damage could range from minor cracks in structures to complete destruction. Infrastructure including roads, bridges, water and gas lines may rupture, resulting in an abrupt halt to electricity, heat/cooling source, communication, transportation, rescue and emergency response services. Ruptured gas lines and power lines could potentially cause explosions and fires. Cascading emergencies such as these will compound the initial disaster. Lives lost, injuries, property damage and economic losses could potentially be in the same range as the earthquake that struck San Francisco.

Landslides constitute a major geologic hazard because they are widespread, occurring in all 50 states, and cause \$1-2 billion in damages and more than 25 fatalities on average each year. Landslides pose serious threats to highways and structures that support fisheries, tourism, timber harvesting, mining, and energy production as well as general transportation. Landslides commonly occur with other major disasters such as earthquakes and floods that exacerbate relief and reconstruction efforts and expanded development and other land use has increased the incidence of landslide disasters.

Locations/Areas Affected

Refer to Figure 3.2.3-3 below that depicts the Peak Acceleration (%g) with a 10% probability of exceedance within 50 years. As can be seen, Benton County lies in four peak acceleration zones running northeast to southwest ranging from a low of 7 in the northwestern corner to almost 15 %g of severity in the southeastern corner of Benton County.

Figure 3.2.3-3



Seasonal Pattern

There is no data that supports the relationship between the occurrence of earthquakes and seasonal weather patterns.

There is data that supports the relationship between the occurrence of landslides, sinkhole and mineshaft collapse and seasonal weather patterns. Rainfall events would introduce moisture into the earth and geologic strata, thus creating the potential for earth movement.

Speed of Onset and / Or Existing Warning Systems

Earthquake prediction is a future possibility. Just as the Weather Bureau now predicts hurricanes, tornadoes, and other severe storms, the National Earthquake Information Center (NEIC) may one day issue forecasts on earthquakes. Earthquake research was stepped up after the Alaska shock in 1964. Today, the U.S. Geological Survey (USGS) and other federal and state agencies, as well as universities and private institutions are conducting research.

Earthquake prediction may someday become a reality, but only after much more is learned about earthquake mechanisms. The speed of onset is immediate. See Table 3.2.3-2 below.

Table 3.2.3-2

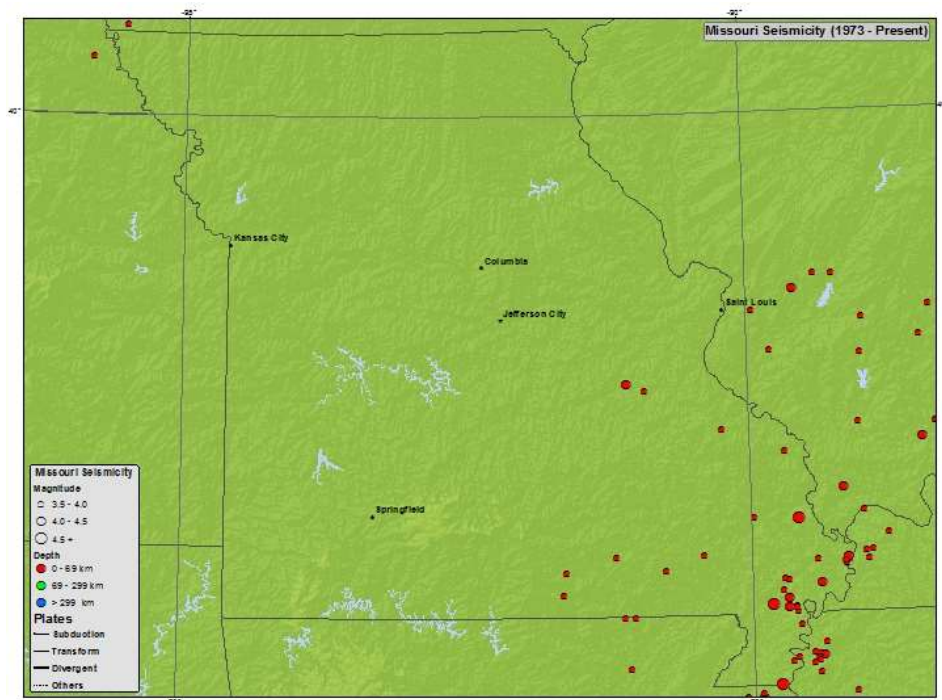
Descriptor	Magnitude	Annual Average
Great	8 and higher	1
Major	7 - 7.9	17
Strong	6 - 6.9	134
Moderate	5 - 5.9	1,319
Light (estimated)	4 - 4.9	13,000
Minor (estimated)	3 - 3.9	130,000
Very Minor (estimated)	2 - 2.9	1,333,00

The USGS estimates that several million earthquakes occur in the world each year. Many go undetected because they hit remote areas or have very small magnitudes. The NEIC now locates about 50 earthquakes each day, or about 20,000 a year.

Map of Hazards

Figure 3.2.3-4 shows earthquakes that have not occurred in the proximity of the Benton County area.

Figure 3.2.3-4



Source: USGS

Statement of Probable Severity

According to the SEMA map above, Benton County is at a risk for a Level VI impact on the Modified Mercalli Intensity Scale from a 7.6 earthquake. According to the Mercalli Scale, all in Benton County would feel a Level VI impact. People could have difficulty walking due to motion. Objects could fall from shelves and dishes, glassware and ceramics may be broken. Pictures could fall off walls. Furniture could move or be overturned. Weak plaster and masonry could crack. Slight damage could occur in poorly constructed buildings. Trees and bushes could shake visibly or be heard rustling. (See Table 3.2.3-3)

Probable Risk of Modified Mercalli Levels:

Table 3.2.3-3	
Modified Mercalli Levels I-V	Possible
Modified Mercalli Levels VI	Unlikely
Modified Mercalli Levels VII	Unlikely
Modified Mercalli Levels VII-XIII	Unlikely

Statement of Probable Risk/Likelihood of Future Occurrence

Many Midwestern communities are located near the New Madrid fault, an area with a high seismic risk. Estimates of the recurrence intervals of the large 1811-1812 earthquakes are about 500 to 100 years. Most residents are not aware of this risk because the last significant earthquake occurred in the early 19th century. However, small quakes along this fault continue to occur in Missouri about every 8 days.

Based on the history of the New Madrid Fault and the January 2003 estimates, Benton County stands a 25-40% chance of experiencing an earthquake of magnitude 6.0 or greater within the next 50 years. Since Benton County lies a good distance from the New Madrid Fault, small earthquakes usually are not noticeable. The more severe threat stems from an earthquake producing Modified Mercalli impact levels of VII-XIII.

Existing Mitigation Strategies

Multiple Jurisdictions

By law all schools in Benton County must provide training and exercises to students in preparation for a large earthquake. This is implemented in all the school districts in the county.

The Office of Emergency Management (OEM) maintains materials which address earthquake preparedness.

3.2.4 Extreme Heat

Description of Hazard

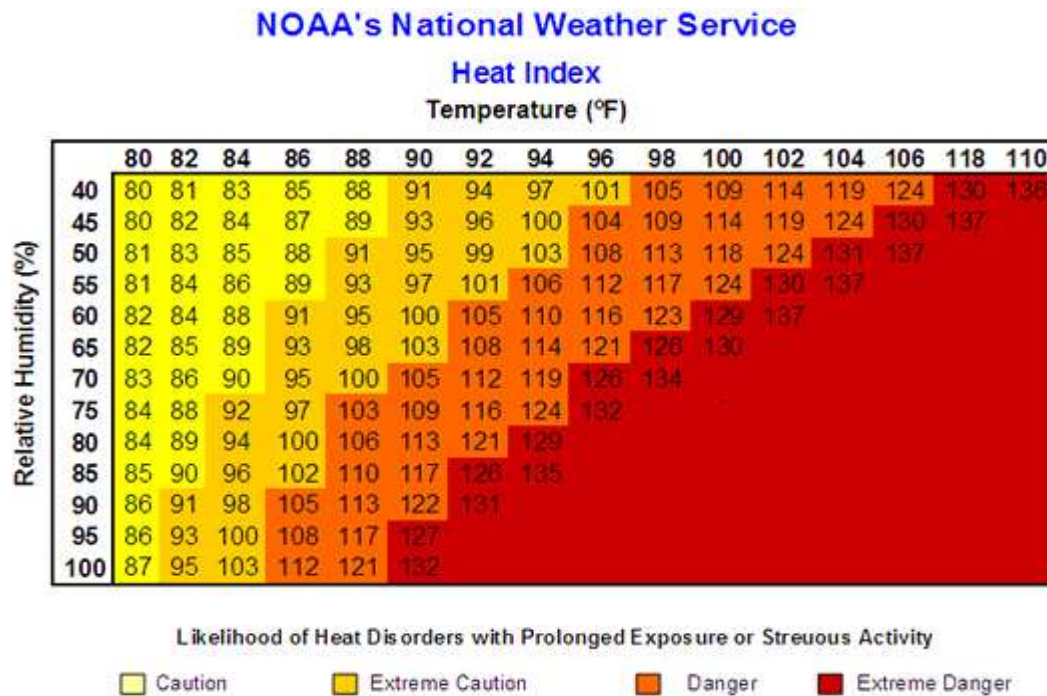
Extreme heat should be taken equally as serious as any other natural disaster such as floods, hurricanes, and tornadoes. According to NOAA, heat is the second killer among natural hazards following extreme cold temperatures.

The National Oceanic and Atmospheric Administration defines life threatening conditions when heat overloads the human body's capacity to cool itself. In the disastrous heat wave of 1980, more than 1,200 people died nationwide. In a normal year, about 175 Americans succumb to the bodily stress of summer heat.

Air temperature is not the only factor to consider when assessing the likely effects of a heat wave. High humidity often accompanies heat in Missouri and increases the danger. The human body cools itself by perspiring; the evaporation of perspiration carries excess heat from the body. High humidity makes it difficult for perspiration to evaporate and thus interferes with this natural cooling mechanism.

The Heat Index, devised by the National Weather Service, takes into account both air temperature and relative humidity (See Table 3.2.4-1). The Heat Index, also known as the apparent temperature, is a measure of how hot it really feels.

Table 3.2.4-1



Geographic Location

The entire Planning Area is at risk from heat events.

Previous Occurrences

Of the eight heat waves to hit Benton County from 1994 and 2002, six produced heat indices within the “Danger” range. The most intense heat waves causing death occurred in 1994, 1999-2001 totaling 16 deaths. (See Table 3.2.4-2)

Table 3.2.4-2

13 RECORDED TEMPERATURE EXTREMES event(s)
were reported in Benton County, Missouri between
01/01/1950 and 12/31/2015.

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 MOZ001>115	06/12/1994	0000	Heat	N/A	4	55	0	50K
2 MOZ055>058 - 068>070	07/12/1995	0600	Excessive Heat	N/A	0	0	0	0
3 MOZ055>058 - 066>071 - 077>083 - 088>098 - 101>106	07/23/1999	06:00 AM	Excessive Heat	N/A	6	0	0	0
4 MOZ055>058 - 066>071 - 077>083 - 088>098 - 101>106	08/01/1999	12:00 AM	Excessive Heat	N/A	2	0	0	0
5 MOZ055>058 - 066>071 - 077>083 - 088>098 - 101>106	08/27/2000	04:00 AM	Excessive Heat	N/A	1	0	0	0
6 MOZ055>058 - 066>071 - 077>083 - 088>098 - 101>106	09/01/2000	12:00 AM	Excessive Heat	N/A	0	0	0	0
9 MOZ055>058 - 066>071 - 077>083 - 088>098 - 101>106	07/17/2001	12:00 PM	Excessive Heat	N/A	1	0	0	0
10 MOZ055>058 - 066>071 - 077>083 - 088>098 - 101>106	08/01/2001	12:00 AM	Excessive Heat	N/A	2	0	0	0
11 BENTON (ZONE)	06/01/2012	00:00	Excessive Heat	Heat	0	0	0	0.00K
12 BENTON (ZONE)	07/01/2012	00:00	Excessive Heat	00:00	0	0	0	0.00K
13 BENTON (ZONE)	08/01/2012	00:00	Excessive Heat	00:00	0	0	0	0.00K
TOTALS:					16	55	125K	155K

Source: <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>

Measures of Probability and Severity

Probability: Moderate – Planning Area

Severity: Moderate – Planning Area

Existing Mitigation Activities

The following departments, agencies, and organizations all are involved in educating the public about the dangers of extremely hot weather and/ or issuing alerts when the threat of extreme heat is imminent:

The Benton County/City of Warsaw Health Department alerts the public on the dangers of extreme heat.

The Missouri State High School Activities Association (MSHSAA) provides coaches with educational pamphlets on the dangers of excessive heat.

The Missouri Department of Health and Senior Services announces statewide hot weather health alerts according to the following criteria:

- **Hot Weather Health Alert** – Heat indices of 105°F in a large portion of the state are first reached (or predicted).
- **Hot Weather Health Warning** – Heat indices have been 105°F or more for two days in a large portion of the state, or weather forecasts call for continued heat stress conditions for at least 24 to 48 hours over a large portion of the state.
- **Hot Weather Health Emergency** – When extensive areas of the state meet all of the following criteria:
 - High sustained level of heat stress (Heat Index of 105°F for 3 days)
 - Increased numbers of heat-related illnesses and deaths statewide
 - The NWS predicts hot, humid temperatures for the next several days for a large portion of the state.

Weather Forecast Offices of the National Weather Service (NWS) can issue the following warnings about excessive heat:

- **Excessive Heat Outlook:** Potential exists for an excessive heat event in the next 3 to 7 days. An outlook is used to indicate that a heat event may develop. It is intended to provide information to those who need considerable lead time to prepare for the event, such as public utilities, emergency management and public health officials.

- **Excessive Heat Watch:** Conditions are favorable for an excessive heat event in the next 12 to 48 hours. A watch is used when the risk of a heat wave has increased, but its occurrence and timing is still uncertain. It is intended to provide enough lead time so those who need to set their plans in motion can do so, such as established individual city excessive heat event mitigation plans.
- **Excessive Heat Warning/Advisory:** An excessive heat event is expected in the next 36 hours. The warning is used for conditions posing a threat to life or property. An advisory is for less serious conditions that cause significant discomfort or inconvenience and, if caution is not taken, could lead to a threat to life and/or property.

3.2.5 Flood

Description of Hazard

A flood is defined as a very large amount of water that has overflowed from a source such as a river or a broken pipe onto a previously dry area according to Encarta Dictionary.

Most floods are caused by heavy rainfall from storms or thunderstorms that generate excessive runoff. A ravine flood is a flood caused by precipitation, runoff or snowmelt over a relatively large watershed causing flooding over wide areas and cresting in over eight hours.

A flash flood is a flood caused by heavy precipitation or snowmelt over a limited watershed (typically less than 50 square miles), crests in eight hours or less, and generally occurs in hilly terrain.

Ravine floods have relatively low velocity, cover a large area of land, and take longer to recede, whereas flash floods have a higher velocity and may recede quickly. A flash flood can also occur when extreme amounts of precipitation fall on any terrain if the precipitation accumulates more rapidly than the terrain can allow runoff.

Floods are extremely dangerous because they destroy through inundation and soaking as well as the force of moving water. Flood damage is proportional to the volume and the velocity of the water. High volumes of water can move heavy objects and undermine roads and bridges.

Floods may occur without local precipitation as a result of precipitation accumulated upstream. Although rural flooding is dangerous to fewer people and may be less costly than urban flooding, it can cause great damage to agricultural operations and the environment. Flooding can also facilitate other hazards such as landslides.

The areas adjacent to rivers and stream banks that serve to carry excess floodwater during rapid runoffs are called floodplains. A floodplain is defined as the lowland and relatively flat areas adjoining rivers and streams. The term base flood, or 100-year flood, is the area in the floodplain that is subject to a one percent or greater chance of flooding in any given year, based upon historical records.

Local storm water flooding can result when tremendous flow of water occurs due to large rain events. Local flooding can create public safety issues due to flooded roadways and drainage structures. Event narratives in the NCDC for flash flooding which is a location-specific hazard, indicate repeated instances of roads and other areas flooded by high water at State Hwy T near Warsaw, Route V at Dear Creek near Hastain, Hwy H southeast of Lincoln, Hwy C near Lincoln, Hwy B near Cole Camp.

Table 3.2.5-1, indicates recorded flood events from 1950 until the present; (most flooding occurred in early spring May and June).

Table 3.2.5-1								
88 RECORDED FLOOD event(s) were reported in Benton County, Missouri between 01/01/1950 and 08/31/2015 .					Mag:	Magnitude		
					Dth:	Deaths		
					Inj:	Injuries		
					PrD:	Property Damage		
					CrD:	Crop Damage		
Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
Warsaw	04/10/1994	2300	Flash Flood	N/A	0	0	500K	0
Central And	04/11/1994	0000	River Flood	N/A	0	0	5.0M	5.0M
Warsaw	04/28/1994	0145	Flash Flood	N/A	0	0	0	0
BENTON	04/17/1995	1850	Flash Flood	N/A	0	0	0	0
BENTON	05/17/1995	0215	Flash Flood	N/A	0	0	0	0
WARSAW	7/21/1996	120	Flash Flood		2	0	10000	0
WARSAW	9/23/1996	1300	Flash Flood		0	0	0	0
EDWARDS	11/6/1996	1930	Flash Flood		0	0	0	0
WARSAW	5/17/1997	2100	Flash Flood		0	0	10000	0
WARSAW	6/25/1997	1900	Flash Flood		0	0	0	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
WARSAW	8/12/1997	1614	Flash Flood		0	0	0	0
FRISTOE	8/19/1997	600	Flash Flood		0	0	0	0
COUNTYWIDE	3/19/1998	1800	Flash Flood		0	0	0	0
COUNTYWIDE	4/28/1998	1030	Flash Flood		0	0	0	0
CENTRAL PORTION	5/9/1998	1700	Flash Flood		0	0	0	0
NORTHEAST PORTION	6/4/1998	1400	Flash Flood		0	0	0	0
EAST PORTION	6/8/1998	1500	Flash Flood		0	0	0	0
COUNTYWIDE	6/20/1998	100	Flash Flood		0	0	0	0
COUNTYWIDE	7/26/1998	1200	Flood		0	0	27000	0
COUNTYWIDE	10/5/1998	400	Flash Flood		0	0	0	0
COUNTYWIDE	3/8/1999	1130	Flash Flood		0	0	0	0
COUNTYWIDE	5/4/1999	1500	Flash Flood		0	0	0	0
COUNTYWIDE	6/27/1999	2240	Flash Flood		0	0	30000	0
COLE CAMP	7/9/1999	1835	Flash Flood		0	0	0	0
COUNTYWIDE	5/27/2000	300	Flash Flood		0	0	0	0
EDWARDS	5/20/2001	2331	Flash Flood		0	0	0	0
SOUTH PORTION	5/30/2001	2150	Flash Flood		0	0	0	0
WEST PORTION	6/4/2001	545	Flash Flood		0	0	0	0
COUNTYWIDE	6/6/2001	320	Flash Flood		0	0	0	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
FRISTOE	6/14/2001	1400	Flash Flood		0	0	0	0
COUNTYWIDE	6/14/2001	2000	Flash Flood		0	0	0	0
NORTH PORTION	6/20/2001	517	Flash Flood		0	0	0	0
SOUTH PORTION	7/10/2001	640	Flash Flood		0	0	0	0
SOUTH PORTION	7/12/2001	730	Flash Flood		0	0	0	0
NORTHWEST PORTION	8/30/2001	1930	Flash Flood		0	0	0	0
WARSAW	5/7/2002	1000	Flash Flood		0	0	0	0
COUNTYWIDE	5/8/2002	200	Flood		0	0	10000	0
COUNTYWIDE	5/12/2002	1800	Flood		0	0	0	0
EDWARDS	4/24/2003	2030	Flash Flood		0	0	0	0
LINCOLN	9/21/2003	1815	Flash Flood		0	0	0	0
WHITAKERVILLE	7/9/2004	901	Flash Flood		0	0	0	0
FRISTOE	8/24/2004	1120	Flash Flood		0	0	0	0
HASTAIN	8/24/2004	1400	Flash Flood		0	0	0	0
WARSAW	11/1/2004	330	Flash Flood		0	0	0	0
WARSAW	1/5/2005	500	Flash Flood		0	0	0	0
COUNTYWIDE	1/5/2005	1215	Flood		0	0	0	0
COUNTYWIDE	1/12/2005	2215	Flash Flood		0	0	0	0
COUNTYWIDE	1/12/2005	2255	Flood		0	0	0	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
WARSAW	8/25/2005	118	Flash Flood		0	0	0	0
LINCOLN	8/25/2005	1750	Flash Flood		0	0	0	0
COLE CAMP	3/30/2007	1745	Flash Flood		0	0	0	0
HASTAIN	4/14/2007	817	Flood		0	0	0	0
HASTAIN	6/30/2007	947	Flash Flood		0	0	0	0
KNOBBY	9/7/2007	1920	Flash Flood		0	0	0	0
SANTIAGO	3/3/2008	126	Flood		0	0	0	0
TACKNER	3/18/2008	615	Flash Flood		0	0	0	0
WARSAW	3/19/2008	600	Flood		0	0	0	0
LINCOLN	3/31/2008	1145	Flash Flood		0	0	0	0
BRANDON	4/10/2008	100	Flash Flood		0	0	0	0
KNOBBY	5/7/2008	1415	Flash Flood		0	0	0	0
RACKET	6/15/2008	1355	Flash Flood		0	0	0	0
ZORA	7/3/2008	400	Flash Flood		0	0	0	0
BRANDON	9/13/2008	2036	Flash Flood		0	0	0	0
SANTIAGO	2/11/2009	130	Flash Flood		0	0	0	0
WARSAW	3/24/2009	800	Flash Flood		0	0	0	0
BRANDON	4/27/2009	1319	Flash Flood		1	0	0	0
SANTIAGO	6/16/2009	20	Flash Flood		0	0	0	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
EDWARDS	2/21/2010	1525	Flash Flood		0	0	0	0
WARSAW	5/12/2010	149	Flash Flood		0	0	0	0
KNOBBY	5/12/2010	149	Flash Flood		0	0	0	0
EDWARDS	5/12/2010	300	Flash Flood		0	0	0	0
HASTAIN	5/20/2010	200	Flood		0	0	0	0
ZORA	5/20/2010	1100	Flood		0	0	0	0
COLE CAMP	7/11/2010	1337	Flash Flood		0	0	0	0
COLE CAMP	7/29/2010	1630	Flash Flood		0	0	0	0
COLE CAMP	7/29/2010	1630	Flash Flood		0	0	0	0
COLE CAMP	9/10/2010	2345	Flash Flood		0	0	0	0
COLE CAMP	9/11/2010	120	Flash Flood		0	0	0	0
COLE CAMP	9/22/2010	1100	Flood		0	0	0	0
KNOBBY	2/24/2011	1515	Flood		0	0	0	0
RACKET	6/16/2012	2336	Flash Flood		0	0	0	0
COLE CAMP	4/10/2013	1745	Flood		0	0	0	0
KNOBBY	4/10/2013	1921	Flood		0	0	0	0
HASTAIN	4/10/2013	2013	Flood		0	0	0	0
WARSAW	6/16/2015	1700	Flash Flood		0	0	0	0
HASTAIN	6/16/2015	1820	Flash Flood		0	0	0	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
LINCOLN	7/1/2015	228	Flash Flood		0	0	0	0
HASTAIN	7/1/2015	925	Flash Flood		0	0	0	0
HASTAIN	7/1/2015	930	Flash Flood		0	0	0	0
ZORA	7/1/2015	930	Flash Flood		0	0	0	0
LINCOLN	7/1/2015	2051	Flash Flood		0	0	0	0
WARSAW	7/1/2015	2246	Flash Flood		0	0	0	0
HASTAIN	8/10/2015	743	Flash Flood		0	0	0	0
TOTALS:					5	0	87K	11.410M

Source: <http://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=ALL&eventType=%28C%29+Flash+Flood>

RiskMAP

Through FEMA's flood hazard mapping program, RiskMAP definition is Mapping, Assessment and Planning (MAP); according to FEMA's July 2012 RiskMAP Fact Sheet. FEMA identifies flood hazards, assesses flood risks and partners with states and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. Flood hazard mapping is an important part of the National Flood Insurance Program (NFIP), as it is the basis of the NFIP regulations and flood insurance requirements. FEMA maintains and updates data through Flood Insurance Rate Maps (FIRMs) and risk assessments. FIRMs include statistical information such as data for river flow, storm tides, hydrologic/hydraulic analyses and rainfall and topographic surveys. FEMA uses the best available technical data to create the flood hazard maps that outline your community's flood risk areas. A variety of audiences ranging from homeowners to engineers and mapping professionals can benefit.

FEMA is working with federal, state, tribal and local partners across the nation to identify flood risk and help reduce that risk through the Risk MAP program. Risk MAP provides high quality flood maps and information, tools to better assess the risk from flooding and planning and outreach support to communities to help take action to reduce flood risk.

Benton County has been mapped and is currently in effective FIS/FIRM status. At the time of the 2015 NHMP update there is no DFIRM activity. In the next 2020 update for Benton County NHMP, the committee will review and look into incorporating Risk Map in to the mitigation actions.

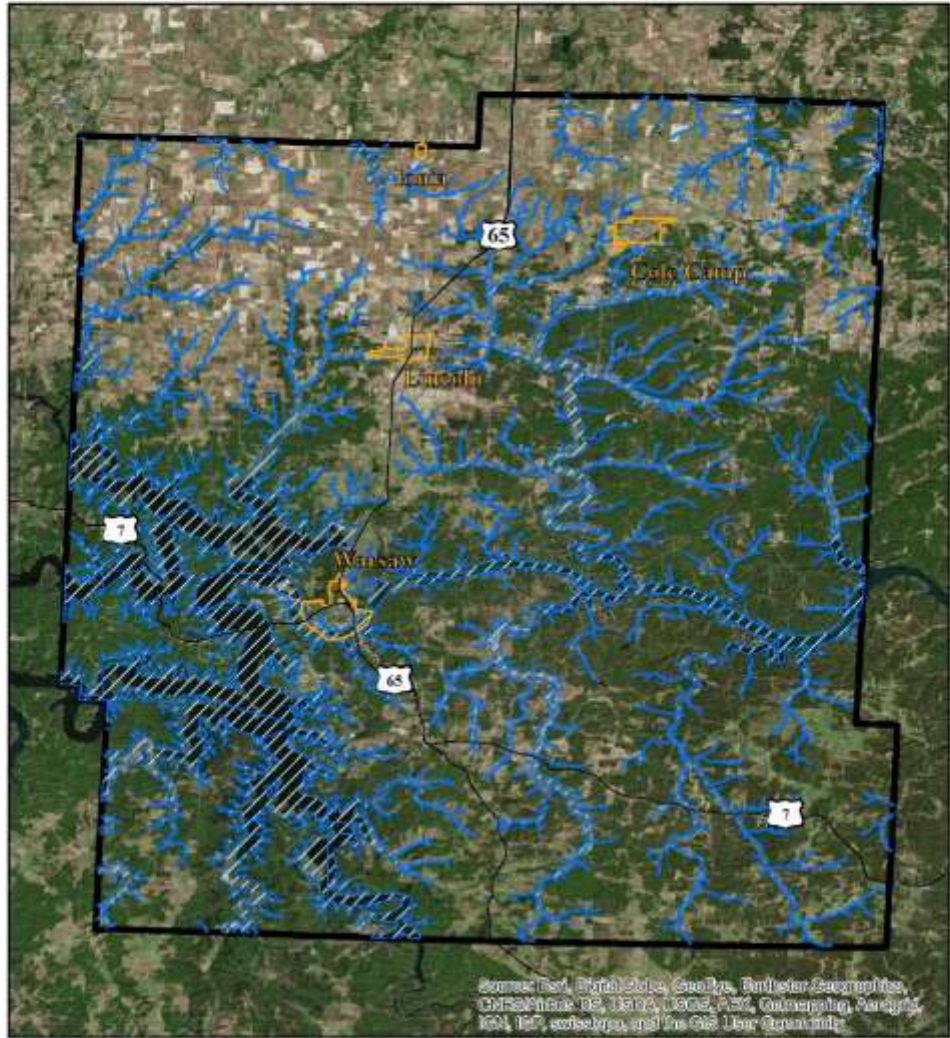


Geographic Location/Vulnerability

The entire Planning Area is at high risk from ravine and levee flooding. Warsaw and the unincorporated areas near Truman Lake and Lake of the Ozarks are in a highly vulnerable area subject to ravine and dam/levee flooding than the rest of the county. The Harry S. Truman Dam regulates two main bodies of water on city land; Truman Lake and the Osage River. If levees break or flash flooding occurs on either side of the dam, Warsaw will be a direct hit. The Flood Insurance Rate Map (FIRM) for Benton County shows the flood zones for this jurisdiction at greater risk.



Special flood hazard area maps are roughly provided on the following pages.

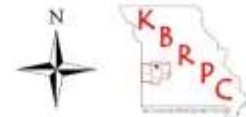
Benton County



1 inch = 9,041 meters

Legend

- Roads
 City Boundary
 Flood Zone



Date: 2/23/2016

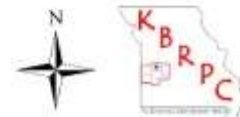
Cole Camp



0 250 500 1,000 1,500 2,000 Meters
1 inch = 679 meters

Legend

- City Boundary
- Flood Zone



Date: 2/23/2016

Ionia



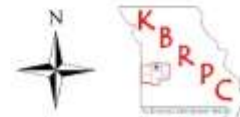
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNR/Airphoto, USDA, Landsat, Aerial, GeoEye, AeroGRID, IGN, SIA, sweco, and the 3Dx Bear Community

0 90 180 360 540 720 Meters

1 inch = 245 meters

Legend

- City Boundary
- Flood Zone



Date: 2/23/2016

Lincoln

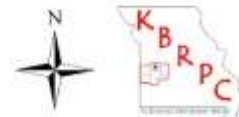


0 255 510 1,020 1,530 2,040 Meters

1 inch = 694 meters

Legend

- City Boundary
- Flood Zone



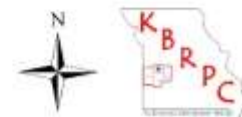
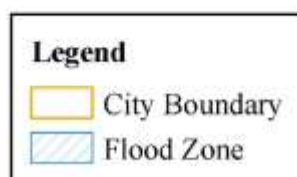
Date: 2/23/2016

Warsaw



0 255 510 1,020 1,530 2,040 Meters

1 inch = 692 meters



Date: 2/23/2016

Previous Occurrences

Flooding occurs every year in Warsaw, but no major flood events have occurred in the last 10 years.

FEMA Repetitive Losses in Benton County

SEMA checked the listing and none were found within the county.

Existing Mitigation Activities

National Flood Insurance Program

The U.S. Congress established the National Flood Insurance Program (NFIP) with the passage of the National Flood Insurance Act of 1968. The NFIP is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. Participation in the NFIP is based on an agreement between communities and the Federal Government. If a community adopts and enforces a floodplain management ordinance to reduce future flood risk to new construction in floodplains, the Federal Government will make flood insurance available within the community as a financial protection against flood losses. This insurance is designed to provide an insurance alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods.

Participation in the National Flood Insurance Program is a critical aspect of hazard mitigation planning for it provides communities with direct resources that can be used for controlling the potentially devastating impacts of floods. Furthermore, participation in the program helps communities more easily recover from flood impacts.

The following Benton County jurisdictions participate in the NFIP: Benton County and Warsaw. Detailed information on NFIP participation is shown in Table 3.2.5-2; (as of 04/11/2016) there are 50 NFIP policies in effect in Benton County:

Table 3.2.5-2

Benton County NFIP Participating Communities		
Government	Date of Entry	Effective Map
Benton County	3/10/1987	6/2/2009
Warsaw	8/4/1987	6/2/2009

Source: <http://www.fema.gov/fema/csb.shtm>

Currently the city of Cole Camp does not participate in the NFIP at this time. Limited resources and education on the program itself, make it difficult for the communities to comply with the regulations needed to be a NFIP participant. The city of Cole Camp SFHAs are mapped, and they are currently sanctioned because of nonparticipation in the NFIP.

SANCTIONS FOR NON-PARTICIPATION

A community that does not join the NFIP, has withdrawn from the program, or is suspended from it faces the following sanctions:

- ◆ Flood insurance will not be available. No resident will be able to purchase a flood insurance policy.
- ◆ If the community withdraws or is suspended, existing flood insurance policies will not be renewed.
- ◆ No Federal grants or loans for the acquisition or construction of buildings may be made in identified flood hazard areas under programs administered by Federal agencies such as HUD, EPA, and SBA.
- ◆ No Federal disaster assistance may be provided to repair insurable buildings located in identified flood hazard areas for damage caused by a flood.
- ◆ No Federal mortgage insurance or loan guarantees may be provided in identified flood hazard areas. This includes policies written by FHA, VA, and others.
- ◆ Federally insured or regulated lending institutions, such as banks and credit unions, must notify applicants seeking loans for insurable buildings in flood hazard areas that:
 - There is a flood hazard and
 - The property is not eligible for Federal disaster relief. These sanctions can be severe on any community with a substantial number of buildings in the floodplain. Most communities with a flood problem have joined the NFIP and are in full compliance with their regulatory obligations. (Source: SEMA)

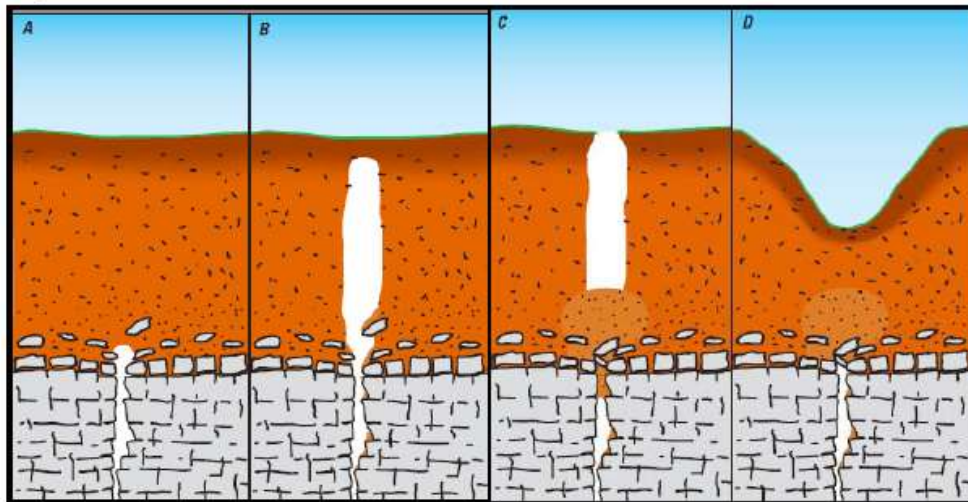
Participation in the NFIP, is currently one of the goals in the county's mitigation strategy in section four and is on the agenda for the next plan update in 2020. The other jurisdictions within the county, have either not been mapped or are not in a SFHAs like the Village of Ionia. As for the school districts while they do contain SFHA's within the district boundary, none of the school's direct assets such as land or buildings are directly in a SFHA.

3.2.6 Land subsidence/Sinkhole

Description of Hazard

Missouri State Hazard Mitigation Plan (2010) gives the following definition for land subsidence and sinkholes: “Land subsidence is sinking of the earth’s surface due to the movement of earth materials below the surface. In the case of sinkholes, the rock below the surface is limestone, carbonate rock, salt beds, or some other rock that can be naturally dissolved by circulating groundwater.” Figure 3.2.6-1 shows how a sinkhole can develop. According to the Missouri Department of Natural Resources (DNR), sinkholes can occur due to human activities such as construction excavation, well drilling, or mining operations. These activities can cause shifts in buoyancy and/or disturb subsurface voids. Sinkholes vary in size and can potentially cause damage to roads, water/sewer lines, buildings, and lagoons.

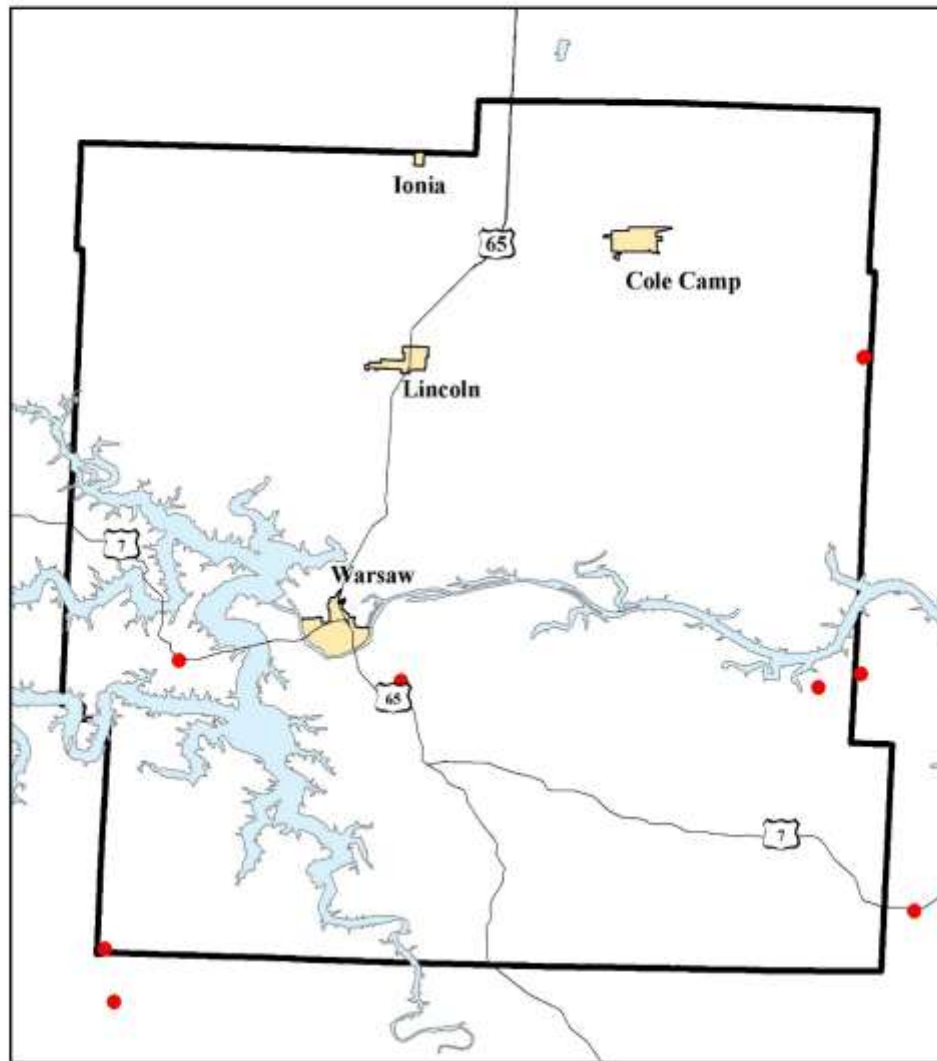
Figure 3.2.6-1



Formation of collapse—Soil bridges gap where sediment has been washing into a solution enlarged fracture, A. Over time, the void migrates upward through the soil, B. After the bridge thins, a sudden collapse, C, often plugs the drain and erosion will, after many years, transform the collapse into a more bowl-shaped sinkhole, D.

-By James E. Kaufmann
Source: US Geological Survey

Benton County



0 3,300 6,600 13,200 19,800 26,400 Meters

1 inch = 9,041 meters

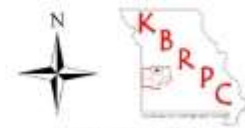
Legend

• Sinkholes

— Roads

■ Lakes

■ City Boundary



Date: 3/3/2016

Geographic Location

Sinkhole concerns are highlighted by the Missouri DNR, they are random throughout the county and seem to show no visible pattern of location.

Previous Occurrences

There have been no *recorded* recent occurrences of sinkhole collapse in the Planning Area. Just because no occurrences have been recorded does not mean that they are not happening. Most of the karst and bedrock in Benton County are either part of publicly owned land or in less developed areas.

Previous occurrences of sinkhole development in other parts of Missouri that have similar geologic features have proved to be a source of concern.

According to the Missouri DNR sewage lagoons in West Plains and Republic in Southern Missouri were drained of their contents due to the development of sinkholes. Sinkhole drainage goes directly into underground water sources and can impact or pollute area water sources. In the case of West Plains, sinkholes had drained the lagoon twice before and local officials tried to patch the collapses with cement and other materials.

According to the Missouri DNR, the final 1978 collapse resulted in sewage draining straight into underground water sources which resulted in the contamination of Mammoth Spring in Arkansas and more than 800 local residents reporting illness. While this occurred in Southern Missouri, the potential risk for a similar situation occurring in Benton County is high.

Measure of Probability and Severity

Probability: High – Benton County
Not applicable - All other participating jurisdictions

Severity: Low to High – Benton County
(depending on levels of contamination, if any)
Not applicable - All other participating jurisdictions

Existing Mitigation Strategies

There are no mitigation strategies in place throughout the county to plan for sinkhole incidences. This will be something the county addresses later in the plan.

3.2.7 Levee Failure

Description

A levee is defined by the National Flood Insurance Program as “a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding.”

Levee failure, according to FEMA, can occur by the following means:

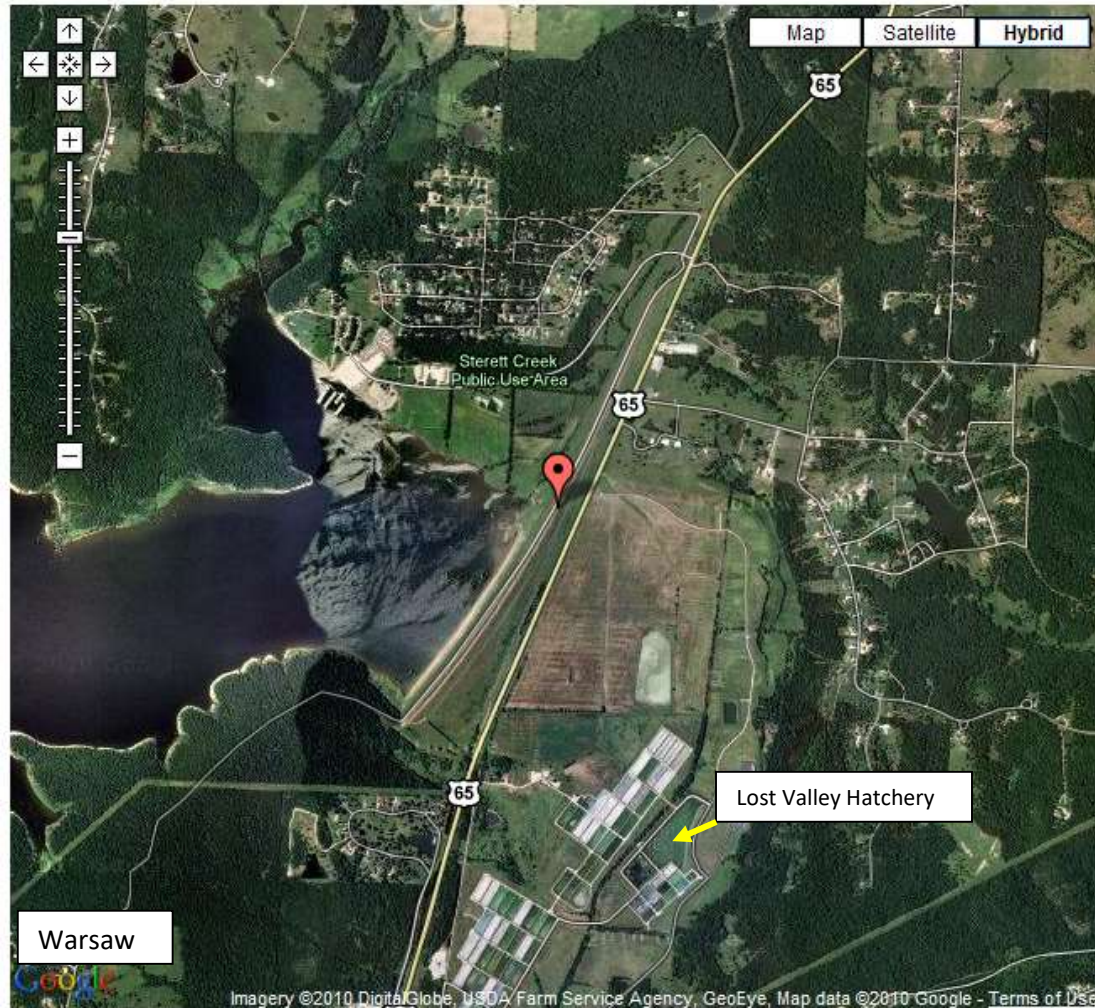
- **Overtopping** - When a large flood occurs, water can flow over a levee. The stress exerted by the flowing water can cause rapid erosion.
- **Piping** - Levees are often built over old stream beds. Flood waters will follow these sub grade channels causing a levee to erode internally thereby allowing flood waters to rupture the levee structure.
- **Seepage and Saturation** - If flood waters sit up against a levee for a long period, the levee may become saturated and eventually collapse.
- **Erosion** - Most levees are constructed of sand or soil which erodes easily under high velocity flood waters.
- **Structural Failures** - Lack of regular maintenance is a key reason levees fail at gates, walls or closure sites.

There is no single agency with responsibility for levee oversight. The US Army Corps of Engineers has specific and limited responsibilities for approximately 2,000 levees nationwide. Fortunately, Sterett Creek Dike is the only levee and is Army Corp owned.

Figure 3.2.7-1

Sterett Creek Dike, MO

Sterett Creek Dike is a Levee in Benton County, Missouri. It has an elevation of 228 meters, or 748 feet.



Federally authorized levees are typically designed and built by the Corps in cooperation with a local sponsor then turned over to a local sponsor to operate and maintain.

Non-federal levees are designed, built, and managed by a non-federal entity.

Geographic Location

The levee pictured in Figure 3.2.7-1 is along the major state Highway 65 which runs from state line to state line. The levee was named after the local creek along with the marina and suburb Sterett Creek. The levee is very visible from the highway and is directly across from the Missouri Department of Conservation- Lost Valley Fish Hatchery.

Previous Occurrences

This levee was built in the 1970's and has yet to fail under all conditions since its birth.

Measures of Probability and Severity

Probability: Moderate – Benton County, Warsaw
Not applicable – All other participating jurisdictions

Severity: Moderate – Benton County, Warsaw
Not applicable – All other participating jurisdictions

Existing Mitigation Strategies

There are currently none.

Sterrett Creek Dike

This aerial map displays the Sterrett Creek Dike, a linear structure running diagonally from the upper left towards the lower right. The dike is marked with a blue circle and a crosshair. A large, irregular area to the right of the dike is shaded with blue diagonal hatching, representing the estimated flood zone in the event of a dam failure. The surrounding landscape is a mix of green fields, forests, and some buildings. A scale bar at the bottom indicates distances from 0 to 1.6 miles. A legend in the bottom left corner identifies the symbols used. A compass rose and a small map of Georgia with the KBRPC logo are located in the bottom right corner.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNR/Satellite DS, USDA, USGS, Aero, Earthstar, Aero, 100, 100, 100, and the Google User Community

0 0.2 0.4 0.8 1.2 1.6 Miles

Legend

- Levee
- Estimated Flood From Dam Failure

N
W E
S

KBRPC

Author: Cyn
Date: 6/30/2016

3.2.8 Severe Winter Weather

Description of Hazard

Benton County seems to have some relatively random yet mild winter weather due to Harry S. Truman Lake and the Osage River. Winter storms in Benton County are variable between ice, severe cold, sleet, snow, and wind. Because of the high bluffs and uneven ground throughout the county, severe winter weather can disable towns, transportation, power lines, community infrastructure, and homes. All of Benton County can be considered rural and as such the citizens must deal with unplowed roads at certain times, facility, and home damages due to ice or snow.

Snowstorms do not generally impact the region for long periods of time but ice storms have shut down schools and businesses for extended periods. Ice is also the biggest threat to reliable power and phone service.

Geographic Location

The entire Planning Area is at risk from severe winter weather.

Previous Occurrences

Benton County experienced 26 officially recorded winter storms that included snow and ice with in the period Jan. 1, 1950 – June 30, 2010, according to data from NOAA. Table 3.2.8-1, summarizes available data for these storms including additional information from SEMA Situation Reports.

A SEMA situation report was submitted on December 9, 2007 regarding freezing rain. Benton County had 2,000 customers without power and an emergency shelter was opened at the community center in Warsaw.

Since 2006, there have been two Presidential Disaster Declarations for severe winter weather which included Benton County (#1676 and #1736). In all of these disasters, Public Assistance (PA) was made available to Benton County through FEMA.

There have also been two Presidential Emergency Declarations due to severe winter weather for the entire state of Missouri since 2006 (#3281 and #3303). Public Assistance, limited to direct Federal Assistance was made available during these Emergencies.

Since Benton County is so rural, minor damages are reported compared to a larger area like Columbia or Kansas City. No deaths were reported for winter weather within the given time period though.

A map of Missouri showing its 114 counties. Eleven counties are highlighted in yellow: Nodaway, Holt, Andrew, Buchanan, Platte, Worth, Harrison, Mercer, Putnam, Schuyler, Scotland, Clark, Gentry, Grundy, Sullivan, Adair, Knox, Lewis, DeKalb, Daviess, Linn, Macon, Shelby, Marion, Clinton, Caldwell, Livingston, Chariton, Randolph, Monroe, Ralls, Pike, Clay, Ray, Carroll, Howard, Boone, Andrain, Lincoln, Jackson, Lafayette, Saline, Cooper, Callaway, Montgomery, Warren, St. Charles, St. Louis, Cass, Johnson, Pettis, Morgan, Cole, Osage, Franklin, Jefferson, Bates, Henry, Benton, Miller, Marion, Gasconade, St. Clair, Hickory, Camden, Phelps, Crawford, Washington, Ste. Genevieve, St. Francois, Perry, Vernon, Cedar, Polk, Dallas, Laclede, Pulaski, Dent, Iron, Reynolds, Madison, Cape Girardeau, Barton, Dade, Greene, Webster, Wright, Texas, Bollinger, Scott, New Madrid, Jasper, Lawrence, Christian, Douglas, Howell, Oregon, Ripley, Butler, McDonald, Barry, Stone, Taney, Ozark, Pemiscot, and Dunklin. The highlighted counties are located in the western and central parts of the state. The map also shows the state boundaries with Iowa (IA) to the north, Arkansas (AR) to the south, Kentucky (KY) to the east, and Tennessee (TN) to the southeast. A compass rose is located in the bottom left corner.

Benton County Natural Hazard Mitigation Plan 2015
Kaysinger Basin Regional Planning Commission

Table 3.2.8-1,

32 SNOW & ICE event(s) were reported in Benton County, Missouri between 01/01/1950 and 12/31/2015.				Mag:	Magnitude			
				Dth:	Deaths			
				Inj:	Injuries			
				PrD:	Property Damage			
				CrD:	Crop Damage			
Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Central And Eastern M	04/05/1994	1500	Winter Storm	N/A	0	0	500K	0
2 MOZ055>058 - 068>070	02/14/1995	0900	Glaze	N/A	0	0	50K	0
3 MOZ055>058 - 066>071 - 077>083 - 088>096 - 101>104	01/08/1997	12:00 PM	Heavy Snow	N/A	0	0	670K	0
4 MOZ055>058 - 066>071 - 077>083 - 088>098 - 101>106	12/20/1998	02:00 AM	Winter Storm	N/A	0	0	0	0
5 MOZ055>058 - 066>071 - 077>083 - 088>098 - 102>106	01/01/1999	05:00 AM	Winter Storm	N/A	0	0	2.8M	0
6 MOZ055>058 - 066>071 - 077>083 - 088>098 - 101>106	12/12/2000	09:00 PM	Heavy Snow	N/A	0	0	450K	0
7 MOZ055 - 066>067 - 077	01/28/2001	04:00 AM	Ice Storm	N/A	0	0	0K	0
8 MOZ055>058 - 066>071 - 077>083 - 088>098 - 101 - 105>106	02/21/2001	03:30 PM	Ice Storm	N/A	0	0	25K	0
9 MOZ055>056 - 066>067	01/30/2002	05:00 AM	Ice Storm	N/A	0	0	475K	0
10 MOZ055>058 - 066>071 - 077>081 - 088>091 - 093>094 - 101>103	03/02/2002	02:00 AM	Winter Storm	N/A	0	0	0K	0
11 MOZ055>057 - 066>069 - 077>079 - 089	01/02/2003	01:00 AM	Winter Storm	N/A	0	0	0	0
12 MOZ055>058 - 067>071 - 077>083 - 088>098 - 101>106	02/23/2003	01:30 PM	Winter Storm	N/A	0	0	0	0
13 MOZ055>058 - 066>069 - 077>081	03/04/2003	11:00 PM	Winter Storm	N/A	0	0	0	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
14 MOZ055>056 - 066>069 - 077>081 - 088>091 - 093>095 - 101>103	12/10/2003	01:00 AM	Heavy Snow	N/A	0	0	0	0
15 MOZ055>058 - 067>071 - 079>083 - 091>092 - 098	01/25/2004	02:00 AM	Ice Storm	N/A	0	0	0	0
16 MOZ055>056	11/24/2004	01:00 PM	Winter Storm	N/A	0	0	0	0
17 MOZ055>058 - 066>071 - 077>081 - 088>091 - 093	11/30/2006	12:00 PM	Winter Storm	N/A	0	0	40K	0K
18 MOZ055 - 067 - 079>080 - 090 - 092 - 094>095 - 103	01/12/2007	18:00 PM	Ice Storm	N/A	0	0	1.0M	0K
19 MOZ055>058 - 066>071 - 077>083 - 088>098 - 101	01/20/2007	19:00 PM	Winter Storm	N/A	0	0	0K	0K
20 MOZ055>058 - 066>069 - 077>080 - 089 - 094	12/09/2007	03:00 AM	Ice Storm	N/A	0	0	2.5M	0K
21 MOZ055 - 069 - 092	02/21/2008	02:00 AM	Ice Storm	N/A	0	0	0K	0K
22 MOZ055 - 067>069 - 078 - 096	01/26/2009	15:00 PM	Ice Storm	N/A	0	0	40K	0K
23 MOZ055 - 067>069 - 078 - 096	01/26/2009	15:00 PM	Winter Storm	N/A	0	0	0K	0K
24 MOZ055 - 056	02/28/2009	05:30 AM	Winter Storm	N/A	0	0	0K	0K
25 MOZ055 - 068	12/25/2009	00:00 AM	Winter Storm	N/A	0	0	0K	0K
26 MOZ055 - 066 - 077	03/20/2010	08:00 AM	Winter Storm	N/A	0	0	0K	0K
27 County Wide	3/20/2010	800	Winter Storm	N/A	0	0	0	0
28 County Wide	2/1/2011	500	Blizzard	N/A	0	0	0	0
29 County Wide	2/21/2013	630	Winter Storm	N/A	0	0	0	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
30 County Wide	2/25/2013	1900	Winter Storm	N/A	0	0	0	0
31 County Wide	3/24/2013	400	Winter Storm	N/A	0	0	0	0
32 County Wide	12/20/2013	2200	Winter Storm	N/A	0	0	0	0
TOTALS:					0	0	8.520M	N/A

Measure of Probability and Severity

Probability: High – Planning Area

Severity: Moderate – Planning Area

Existing Mitigation Activities

The Office of Emergency Management is proactive in alerting the public to the dangers of winter storms. The Emergency Operations Procedures (EOP) includes a snowplowing plan whereby streets critical for emergency procedures and schools are cleared as a first priority.

National Weather Service and Local Media

The St. Louis Office of the National Weather Service coordinates with local jurisdictions and media outlets to disperse information regarding severe winter storm watches and warnings. Early warning allows the public to prepare for a severe storm. Should a storm reach catastrophic proportions and officials need to communicate directly with the public, the Emergency Alert System exists to spread that information.

The National Weather Service sets up winter weather warnings in stages of severity. These stages are shown in Table 3.2.8-2.

Table 3.2.8-2	National Weather Service Winter Warnings
Winter Weather Advisory	Winter weather conditions are expected to cause significant inconvenience and may be hazardous. I caution is exercised, these situations should not become life-threatening. The greatest hazard is often to motorists.
Winter Storm Watch	Severe winter conditions, such as heavy snow and/or ice, are possible within the next day or two.
Winter Storm Warning	Severe winter conditions have begun or about to begin in your area.
Blizzard Warning	Blowing snow (near zero visibility), deep drifts, and life-threatening wind chill. Seek refuge immediately!
Frost/Freeze Warning	Below freezing temperatures are expected and may cause significant damage to plants, crops, or fruit trees. In areas unaccustomed to freezing temperatures, people who have homes without heat need to take added precautions.

3.2.9 Tornado and Thunderstorm

Description of Hazard

A tornado is a violently rotating column of air, in contact with the ground, which is generated by a powerful thunderstorm.

The potential destruction posed by a tornado touching ground is well known.

Tornadoes can happen during any season yet in Missouri they tend to strike most in spring and summer. Most tornadoes happen in late afternoon and early evening, but this too is not always the case. The seasonal and spatial uncertainty of tornadoes makes year round preparedness essential.

Tornado winds may reach over 300 mph. Tornadoes can move in any direction, but often move from southwest to northeast. The average forward speed of a tornado is about 30 mph, but may vary from nearly stationary to 70 mph.

Tornadoes tend to dissipate as fast as they form. Unlike a hurricane, which can last for multiple hours, tornadoes are often in one place for no more than a few minutes.

Technological advances such as Doppler radar, computer modeling, and Emergency Warning Systems have increased the amount of time the general public has to respond to a tornado.

Despite these advances, tornadoes can still strike an area with little warning. Often people have no more than a few minutes to get to safety.

Being able to quickly get to a safe place is absolutely imperative in order to prevent loss of life.

The destructive effects of a tornado depend on the strength of the winds, proximity to people and structures, the strength of structures, and/or how well a person is sheltered. Tornadoes are classified by the most recent Enhanced Fujita scale, which ranks tornadoes according to wind speed and destruction (See Table 3.2.9-1).

Table 3.2.9-1

Enhanced F Scale for Tornado Damage

FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
F Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

Source: The National Weather Service, www.spc.noaa.gov/faq/tornado/ef_scale.html

Table 3.2.9-2

Enhanced F Scale Damage Indicators

NUMBER	DAMAGE INDICATOR	ABBREVIATION
<u>1</u>	Small barns, farm outbuildings	SBO
<u>2</u>	One- or two-family residences	FR12
<u>3</u>	Single-wide mobile home (MHSW)	MHSW
<u>4</u>	Double-wide mobile home	MHDW
<u>5</u>	Apt, condo, townhouse (3 stories or less)	ACT
<u>6</u>	Motel	M
<u>7</u>	Masonry apt. or motel	MAM
<u>8</u>	Small retail bldg. (fast food)	SRB
<u>9</u>	Small professional (doctor office, branch bank)	SPB
<u>10</u>	Strip mall	SM
<u>11</u>	Large shopping mall	LSM
<u>12</u>	Large, isolated ("big box") retail bldg.	LIRB
<u>13</u>	Automobile showroom	ASR
<u>14</u>	Automotive service building	ASB
<u>15</u>	School - 1-story elementary (interior or exterior halls)	ES
<u>16</u>	School - jr. or sr. high school	JHSH
<u>17</u>	Low-rise (1-4 story) bldg.	LRB
<u>18</u>	Mid-rise (5-20 story) bldg.	MRB
<u>19</u>	High-rise (over 20 stories)	HRB

Thunderstorms, in and of themselves, can do great damage even when a tornado is not involved.

Heavy rain, lightning, hail, and straight-line winds which often accompany thunderstorms each present their own particular concerns.

Geographic Location

The entire Planning Area is at risk from tornadoes and thunderstorms.

Tornadoes can strike anywhere. There is a greater chance of loss of life and destruction of property in population centers, especially with a large tornado path.

Thunderstorms can also develop anywhere in the county. Areas more susceptible to the flooding associated with heavy rain from thunderstorms are discussed under the flooding profile.

Previous Occurrences

Tornado

The county has experienced twenty-five tornado events since 1954, as officially recorded by NOAA (see Table 3.2.9-3). There have been five injuries and \$4.75 million in property damages associated with these twenty-four tornadoes.

Table 3.2.9-3

25 TORNADO(s) were reported in Benton County, Missouri between 01/01/1950 and 12/31/2015.					Mag: Magnitude Dth: Deaths Inj: Injuries PrD: Property Damage CrD: Crop Damage			
Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 BENTON	05/28/1954	1315	Tornado	F2	0	0	250K	0
2 BENTON	04/16/1960	1500	Tornado	F3	0	0	25K	0
3 BENTON	04/20/1973	1715	Tornado	F3	0	4	250K	0
4 BENTON	04/20/1973	1800	Tornado	F2	0	0	250K	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
5 BENTON	04/20/1973	1825	Tornado	F3	0	0	250K	0
6 BENTON	05/12/1980	1630	Tornado	F1	0	0	25K	0
7 BENTON	03/15/1982	2145	Tornado	F3	0	1	2.5M	0
8 BENTON	05/14/1982	1726	Tornado	F0	0	0	0K	0
9 BENTON	05/14/1982	1728	Tornado	F0	0	0	0K	0
10 BENTON	05/14/1982	1835	Tornado	F0	0	0	0K	0
11 BENTON	05/14/1982	1835	Tornado	F1	0	0	0K	0
12 BENTON	10/02/1986	2250	Tornado	F1	0	0	250K	0
13 BENTON	05/16/1990	1420	Tornado	F0	0	0	25K	0
14 BENTON	05/25/1990	2000	Tornado	F0	0	0	0K	0
15 BENTON	11/27/1990	1000	Tornado	F1	0	0	250K	0
16 Warsaw To	04/15/1994	0130	Tornado	F1	0	0	500K	0
17 Fristoe	05/17/1995	0945	Tornado	F0	0	0	0	0
18 Warsaw	06/08/1995	0325	Tornado	F0	0	0	0	0
19 Cole Camp	05/04/1999	01:45 PM	Tornado	F0	0	0	5K	0
20 Warsaw	05/06/2003	03:20 PM	Tornado	F0	0	0	0K	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
21 Bentonville	05/06/2003	03:40 PM	Tornado	F0	0	0	0K	0
22 Brandon	03/12/2006	03:52 PM	Tornado	F1	0	0	100K	0
23 Cole Camp	03/12/2006	11:25 PM	Tornado	F0	0	0	50K	0
24 Lincoln	01/07/2008	14:54 PM	Tornado	F0	0	0	20K	0
25 Racket	7/1/2015	2056	Tornado	EF1	0	0	500K	0
TOTALS:					0	5	5.250M	500K

Source: <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>

Statement of Severity

The level of tornado impact is generally predictable in regard to F-scale and distance from the path of the storm. Based on the twenty previous tornado events, the future probable severity is shown below.

Future Probable Severity by F-Scale:

EF0	negligible	EF3	critical
EF1	limited	EF4	catastrophic
EF2	limited	EF5	catastrophic

Statement of Probable Risk

Generally, the risk of tornadoes is relatively minimal in Benton County. Of 114 Missouri counties, Benton County experienced only 25 recorded tornadoes since 1954. Another 49 counties have 16 or fewer tornadoes. Therefore, Benton County falls within the lower 47% of tornado-affected counties. In the last ten years, a tornado outbreak across Missouri and the Midwest was record-setting and Benton County received approximately \$5.25 million in damage while being surrounded by numerous tornado, wind damage, and large hail events. The probable risk is calculated by dividing the number of events by the number of years, multiplying by 100 to create a risk percentage.

EF# Events Risk Probable Risk of Occurrence, By F-Scale

EF0	12	19% highly likely
EF1	7	11% highly likely
EF2	2	3% likely
EF3	4	6% likely possible
EF4	0	UNK% possible
EF5	0	UNK% possible
EF0-5	25	40% highly likely

***NOTE: UNK% stands for unknown %, while there are currently no recorded EF4 or EF5 tornados to date the an EF4 or EF5 tornado can occur at any given time if the conditions are correct.

Statement of Next Disaster's Probable Adverse Impact on the Community

The enormous power and destructive ability of tornadoes are beyond humankind's capabilities to control. Severity, risk of death, injuries, and property damages will continue to be high. However, technological advances will facilitate earlier warnings than previously available. This, combined with a vigorous public education program and improved construction techniques, provides the potential for significant reductions in the number of deaths and injuries, as well as a reduction in property damage. Based on the 62-year history, the likely adverse impact of future Benton County tornado and thunderstorm events without mitigation measures would likely be critical to life and property, as well as have a critical impact emotionally and financially. With mitigation measures the impact to life would be negligible, and limited to property as well as emotionally and financially. An effective mitigation program could reduce the adverse impact on life and emotional stress from critical to limited or better.

Statement of Next Disaster's Probable Adverse Impact by Jurisdiction

All jurisdictions within the county are equally susceptible to damage stemming from tornadic activity. Vulnerable structures, including critical facilities and mobile homes, exist in each jurisdiction. In the event of a tornado, 50-100% of any given jurisdiction may be at risk for damage. Since the passage of the original plan in 2004, no significant changes concerning building development or population shifts have taken place.

Recommendation

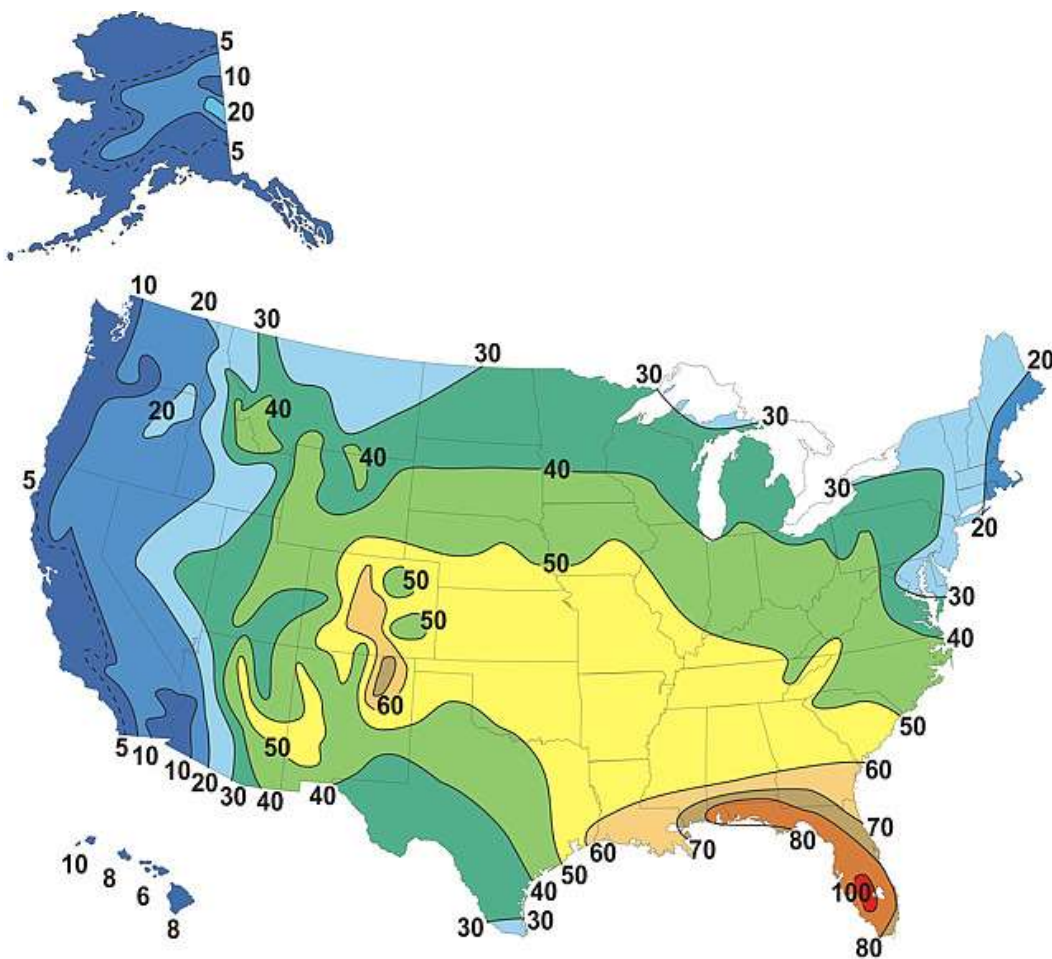
Recommend that the County:

- continues to encourage acquisition of the infrastructure to mitigate possible damage and help reduce the loss of life caused by tornadoes;
- continues to provide emergency preparedness information and resources related to all natural disasters to the public through active education and outreach programs.

Thunderstorm

A thunderstorm is a rainstorm with thunder and lightning present. The National Weather Service considers a thunderstorm “severe” when it includes one or more of the following: winds gusting in excess of 57.5 mph hail at least 0.75 inch in diameter, a tornado. National Weather Service data indicates that there are on average 50-60 thunderstorm days per year in Missouri (see Figure 3.2.9-1). Many of these thunderstorms are severe.

Figure 3.2.9-1 Average Number of Thunderstorm Days Annually in U.S.



Source: http://www.srh.noaa.gov/jetstream/tstorms/tstorms_intro.htm

High winds: According to NOAA, there have been 137 thunderstorm wind and other high wind. These events were reported in Benton County since 1964 (see Table 3.2.9-4). These storms resulted in at least 48 injuries and \$1.342 million in property damage in Benton County. Much of the damage caused by high winds in the area occurs because of falling trees; people, buildings, and vehicles may be damaged by falling branches. In some cases, roofs are directly blown off buildings and windows are shattered. Power lines may be blown down and people left without electricity.

Table 3.2.9-4

137 THUNDERSTORM WINDS event(s) were reported in **Benton County, Missouri** between **01/01/1950** and **12/31/2015**.

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 BENTON	04/12/1964	2035	Tstm Wind	0 kts.	0	0	0	0
2 BENTON	07/17/1968	1630	Tstm Wind	0 kts.	0	0	0	0
3 BENTON	05/23/1971	1553	Tstm Wind	60 kts.	0	0	0	0
4 BENTON	06/01/1977	1543	Tstm Wind	0 kts.	0	0	0	0
5 BENTON	09/26/1977	2100	Tstm Wind	0 kts.	0	0	0	0
6 BENTON	05/11/1978	1925	Tstm Wind	52 kts.	0	0	0	0
7 BENTON	07/09/1978	2000	Tstm Wind	0 kts.	0	0	0	0
8 BENTON	07/14/1978	1920	Tstm Wind	52 kts.	0	0	0	0
9 BENTON	05/10/1979	1600	Tstm Wind	0 kts.	0	0	0	0
10 BENTON	06/28/1979	0845	Tstm Wind	0 kts.	0	0	0	0
11 BENTON	08/22/1979	1600	Tstm Wind	0 kts.	0	0	0	0
12 BENTON	05/12/1980	1700	Tstm Wind	0 kts.	0	0	0	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
13 BENTON	09/01/1980	1915	Tstm Wind	0 kts.	0	0	0	0
14 BENTON	09/12/1980	1810	Tstm Wind	0 kts.	0	0	0	0
15 BENTON	09/16/1980	1530	Tstm Wind	52 kts.	0	0	0	0
16 BENTON	06/19/1981	2112	Tstm Wind	0 kts.	0	0	0	0
17 BENTON	04/02/1982	1520	Tstm Wind	0 kts.	0	0	0	0
18 BENTON	05/16/1982	1519	Tstm Wind	0 kts.	0	0	0	0
19 BENTON	09/13/1982	1720	Tstm Wind	52 kts.	0	0	0	0
20 BENTON	03/15/1984	1620	Tstm Wind	0 kts.	0	0	0	0
21 BENTON	04/29/1984	1600	Tstm Wind	0 kts.	0	0	0	0
22 BENTON	06/21/1985	2040	Tstm Wind	52 kts.	0	0	0	0
23 BENTON	06/21/1985	2041	Tstm Wind	55 kts.	0	0	0	0
24 BENTON	03/24/1988	1723	Tstm Wind	50 kts.	0	0	0	0
25 BENTON	11/15/1988	1705	Tstm Wind	0 kts.	0	0	0	0
26 BENTON	11/15/1988	1715	Tstm Wind	0 kts.	0	0	0	0
27 BENTON	06/28/1990	1900	Tstm Wind	0 kts.	0	0	0	0
28 BENTON	07/28/1990	1900	Tstm Wind	0 kts.	0	0	0	0
29 BENTON	05/04/1991	2145	Tstm Wind	0 kts.	0	0	0	0
30 BENTON	07/11/1991	1545	Tstm Wind	0 kts.	0	0	0	0
31 BENTON	07/10/1992	1600	Tstm Wind	52 kts.	0	0	0	0
32 Lincoln	04/19/1993	1645	Thunderstorm Winds	60 kts.	0	0	1K	0
33 Warsaw	04/15/1994	0150	Thunderstorm Winds	0 kts.	0	0	500K	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
34 Warsaw	04/28/1994	0200	Thunderstorm Winds	0 kts.	0	0	1K	0K
35 Truman Reservoir	06/08/1994	0500	Thunderstorm Winds	0 kts.	0	0	1K	0
36 Lincoln	06/08/1995	0320	Thunderstorm Winds	0 kts.	0	0	1K	0
37 Lakeview Heights	06/08/1995	0340	Thunderstorm Winds	0 kts.	0	0	0	0
38 Lincoln	09/30/1995	1810	Thunderstorm Winds	0 kts.	0	0	0	0
39 Lincoln	05/04/1996	04:05 AM	Tstm Wind	0 kts.	0	0	0K	0K
40 Warsaw	05/04/1996	05:00 AM	Tstm Wind	0 kts.	0	0	1K	0K
41 Cole Camp	05/26/1996	10:49 PM	Tstm Wind	0 kts.	0	0	0K	0K
42 Warsaw	07/29/1996	08:48 AM	Tstm Wind	0 kts.	0	0	5K	0K
43 Fristoe	05/25/1997	10:23 PM	Tstm Wind	0 kts.	0	0	15K	0K
44 Warsaw	05/21/1998	03:00 PM	Tstm Wind	0 kts.	0	0	0K	0
45 Edmonson	06/10/1998	03:15 AM	Tstm Wind	0 kts.	0	0	1K	0
46 Warsaw	06/13/1998	08:35 PM	Tstm Wind	0 kts.	0	0	1K	0
47 Warsaw	06/18/1998	06:30 AM	Tstm Wind	52 kts.	0	0	1K	0
48 Edmonson	06/19/1998	09:45 PM	Tstm Wind	0 kts.	0	0	2K	0
49 Cole Camp	04/08/1999	04:45 PM	Tstm Wind	60 kts.	0	0	0	0
50 Warsaw	04/08/1999	04:45 PM	Tstm Wind	58 kts.	0	0	0	0
51 Edwards	04/08/1999	04:55 PM	Tstm Wind	0 kts.	0	0	2K	0
52 Warsaw	06/27/1999	04:50 PM	Tstm Wind	0 kts.	0	0	5K	0
53 Lincoln	06/27/1999	10:20 PM	Tstm Wind	0 kts.	0	0	5K	0
54 Lincoln	04/20/2000	01:25 AM	Tstm Wind	0 kts.	0	0	0K	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
55 Cole Camp	06/25/2000	09:20 PM	Tstm Wind	0 kts.	0	0	3K	0
56 Warsaw	08/17/2000	05:00 PM	Tstm Wind	0 kts.	0	0	0K	0
57 Warsaw	09/11/2000	09:30 PM	Tstm Wind	0 kts.	0	0	0K	0
58 Lincoln	04/14/2001	10:00 PM	Tstm Wind	0 kts.	0	0	5K	0
59 Fristoe	05/20/2001	07:30 PM	Tstm Wind	0 kts.	0	0	0K	0
60 Warsaw	07/10/2001	04:05 AM	Tstm Wind	52 kts.	0	0	0K	0
61 Warsaw	09/07/2001	08:40 PM	Tstm Wind	52 kts.	0	0	5K	0
62 Edwards	03/09/2002	01:10 AM	Tstm Wind	58 kts.	0	0	0K	0
63 Warsaw	05/07/2002	12:40 AM	Tstm Wind	55 kts.	0	0	25K	0
64 Zora	07/04/2002	12:45 PM	Tstm Wind	62 kts.	0	0	50K	0
65 Cole Camp	03/12/2003	10:30 PM	Tstm Wind	80 kts.	0	0	30K	0
66 Warsaw	07/09/2003	09:57 PM	Tstm Wind	65 kts.	0	0	0	0
67 Edwards	08/05/2003	08:15 PM	Tstm Wind	60 kts.	0	0	0	0
68 Cole Camp	08/21/2003	09:05 PM	Tstm Wind	65 kts.	0	0	1K	0K
69 Warsaw	08/21/2003	09:35 PM	Tstm Wind	60 kts.	0	0	0	0
70 Warsaw	09/26/2003	04:50 PM	Tstm Wind	60 kts.	0	0	1K	0
71 Fristoe	09/26/2003	05:05 PM	Tstm Wind	60 kts.	0	0	0	0
72 Warsaw	06/12/2004	10:30 PM	Tstm Wind	70 kts.	1	0	0	0
73 Cole Camp	06/12/2004	10:45 PM	Tstm Wind	70 kts.	0	0	40K	0
74 Countywide	07/05/2004	05:30 AM	Tstm Wind	70 kts.	1	48	350K	0
75 Cole Camp	08/13/2005	01:50 PM	Tstm Wind	50 kts.	0	0	0	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
76 Warsaw	09/13/2005	01:30 PM	Tstm Wind	50 kts.	0	0	0	0
77 Lincoln	06/22/2006	01:25 PM	Tstm Wind	50 kts.	0	0	0	0
78 Cole Camp	06/22/2006	01:45 AM	Tstm Wind	50 kts.	0	0	0	0
79 Warsaw	08/07/2006	04:00 PM	Tstm Wind	50 kts.	0	0	0	0
80 Edwards	10/17/2007	21:30 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
81 Lincoln	05/30/2008	19:40 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
82 Warsaw	05/30/2008	20:36 PM	Thunderstorm Wind	50 kts.	0	0	5K	0K
83 Warsaw	06/03/2008	22:39 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
84 Cole Camp	06/08/2008	21:25 PM	Thunderstorm Wind	50 kts.	0	0	20K	0K
85 Lincoln	06/08/2008	21:25 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
86 Cole Camp	06/15/2008	13:39 PM	Thunderstorm Wind	52 kts.	0	0	5K	0K
87 Cole Camp	06/15/2008	13:42 PM	Thunderstorm Wind	61 kts.	0	0	0K	0K
88 Warsaw	06/15/2008	13:59 PM	Thunderstorm Wind	50 kts.	0	0	20K	0K
89 Warsaw	06/15/2008	14:00 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
90 Warsaw	06/15/2008	14:21 PM	Thunderstorm Wind	50 kts.	0	0	5K	0K
91 Warsaw	06/19/2008	19:05 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
92 Warsaw	07/02/2008	23:30 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
93 Warsaw	07/02/2008	23:30 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
94 Cole Camp	07/03/2008	01:00 AM	Thunderstorm Wind	50 kts.	0	0	0K	0K
95 Fristoe	03/08/2009	07:17 AM	Thunderstorm Wind	59 kts.	0	0	0K	0K
96 Cole Camp	03/24/2009	06:10 AM	Thunderstorm Wind	52 kts.	0	0	0K	0K

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
97 Cole Camp	03/24/2009	06:20 AM	Thunderstorm Wind	52 kts.	0	0	0K	0K
98 Ionia	06/15/2009	23:00 PM	Thunderstorm Wind	52 kts.	0	0	5K	0K
99 Lincoln	06/15/2009	23:00 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
100 Lincoln	06/15/2009	23:00 PM	Thunderstorm Wind	52 kts.	0	0	2K	0K
101 Cole Camp	06/15/2009	23:01 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
102 Cole Camp	06/15/2009	23:05 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
103 Cole Camp	06/15/2009	23:07 PM	Thunderstorm Wind	52 kts.	0	0	5K	0K
104 Crockerville	06/15/2009	23:12 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
105 Fristoe	06/16/2009	04:35 AM	Thunderstorm Wind	52 kts.	0	0	0K	0K
106 Fristoe	06/16/2009	05:20 AM	Thunderstorm Wind	52 kts.	0	0	0K	0K
107 Brandon	7/11/2010	1315	Thunderstorm Wind	52 kts.	0	0	3000	0
108 Warsaw	7/20/2010	1838	Thunderstorm Wind	52 kts.	0	0	0	0
109 Cole Camp	9/10/2010	2240	Thunderstorm Wind	52 kts.	0	0	0	0
110 Warsaw	9/10/2010	2318	Thunderstorm Wind	52 kts.	0	0	0	0
111 Ionia	9/18/2010	1905	Thunderstorm Wind	52 kts.	0	0	0	0
112 Crockerville	9/18/2010	1942	Thunderstorm Wind	52 kts.	0	0	0	0
113 Warsaw	10/25/2010	2335	Thunderstorm Wind	52 kts.	0	0	4000	0
114 Warsaw	10/25/2010	2335	Thunderstorm Wind	52 kts.	0	0	4000	0
115 Cole Camp	6/18/2011	205	Thunderstorm Wind	52 kts.	0	0	0	0
116 Lake Creek	8/19/2011	10	Thunderstorm Wind	61 kts.	0	0	0	0
117 Racket	6/16/2012	2150	Thunderstorm Wind	52 kts.	0	0	2000	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
118 Warsaw	9/6/2012	1203	Thunderstorm Wind	52 kts.	0	0	2000	0
119 Whitakerville	9/6/2012	1208	Thunderstorm Wind	52 kts.	0	0	0	0
120 Lakeview Hgt	9/6/2012	1208	Thunderstorm Wind	52 kts.	0	0	0	0
121 Whitakerville	5/20/2013	1820	Thunderstorm Wind	50 kts.	0	0	0	0
122 Lincoln	5/31/2013	635	Thunderstorm Wind	52 kts.	0	0	5000	0
123 Cole Camp	6/27/2013	2330	Thunderstorm Wind	56 kts.	0	0	0	0
124 Warsaw	6/27/2013	2337	Thunderstorm Wind	54 kts.	0	0	0	0
125 Warsaw	9/1/2013	800	Thunderstorm Wind	52 kts.	0	0	1000	0
126 Mora	4/3/2014	1522	Thunderstorm Wind	52 kts.	0	0	0	0
127 Fristoe	4/13/2014	1803	Thunderstorm Wind	52 kts.	0	0	0	0
128 Whitakerville	9/5/2014	1640	Thunderstorm Wind	52 kts.	0	0	0	0
129 Warsaw	9/5/2014	1653	Thunderstorm Wind	52 kts.	0	0	0	0
130 Cole Camp	10/2/2014	1516	Thunderstorm Wind	52 kts.	0	0	0	0
131 Warsaw	6/26/2015	240	Thunderstorm Wind	52 kts.	0	0	0	0
132 Warsaw	7/1/2015	115	Thunderstorm Wind	52 kts.	0	0	0	0
133 Ionia	7/1/2015	2015	Thunderstorm Wind	52 kts.	0	0	0	0
134 Cole Camp	7/1/2015	2015	Thunderstorm Wind	52 kts.	0	0	5000	0
136 Warsaw	7/1/2015	2100	Thunderstorm Wind	52 kts.	0	0	0	0
137 Warsaw	7/1/2015	2100	Thunderstorm Wind	52 kts.	0	0	0	0
TOTALS:					2	48	1.117M	50

Source: <http://www.ncdc.noaa.gov>

3 HIGH WINDS event(s) were reported in Benton County, Missouri between 01/01/1950 and 12/31/2015 with wind speed reaching 80 knots.

Mag:
Dth:
Inj:
PrD:
CrD:

Magnitude
Deaths
Injuries
Property Damage
Crop Damage

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 MOZ055>058 - 067>071 - 080>081 - 083 - 098 - 105	02/25/2001	12:00 AM	High Wind	0 kts.	0	0	125K	0
2 MOZ055>057 - 066 - 066>069 - 077 - 077>080 - 088 - 088>090 -	05/13/2003	01:30 PM	High Wind	60 kts.	0	0	5K	0
3 MOZ055 - 066 - 066 - 066>067 - 077>078 - 088 - 088 - 088 - 093 -	11/27/2005	05:30 PM	High Wind	80 kts.	0	0	95K	0
TOTALS:					0	0	225K	0

Source: <http://www.ncdc.noaa.gov>

Hail: Hail is formed when updrafts in thunderstorms carry raindrops up to very high and cold areas where they freeze into ice. Hail, especially large sized hail, can cause severe damage and presents a threat to automobiles, airplanes, roofs, crops, livestock, and even humans.

NOAA lists 142 reported hailstorm events (with hail of at least 0.75 inch in diameter) in Benton County since 1956 (See Table 3.2.9-6).

While the NOAA data only indicates \$94,000 of hail damage from these events in the county, the damage caused by hail is undoubtedly much higher. The NOAA data before 1993 is very general; the location is listed generally as Benton County and no damages are reported in that time period.

While hailstorms of the magnitude that caused such damage in 2006 do not occur every year in Benton County, hail is a costly hazard for the Planning Area.

Table 3.2.9-6

142 HAIL event(s) were reported in Benton County, Missouri between 01/01/1950 and 12/31/2015 .						Mag:	Magnitude	
						Dth:	Deaths	
						Inj:	Injuries	
						PrD:	Property Damage	
						CrD:	Crop Damage	
Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
BENTON CO.	8/30/1956	1900	Hail	1.5	0	0	0	0
BENTON CO.	4/22/1964	2100	Hail	1.75	0	0	0	0
BENTON CO.	4/22/1964	2251	Hail	1.75	0	0	0	0
BENTON CO.	4/20/1973	400	Hail	1.75	0	0	0	0
BENTON CO.	4/24/1975	1705	Hail	0.75	0	0	0	0
BENTON CO.	6/14/1975	1912	Hail	1.75	0	0	0	0
BENTON CO.	5/18/1981	1633	Hail	1	0	0	0	0
BENTON CO.	7/22/1981	700	Hail	1.75	0	0	0	0
BENTON CO.	3/15/1982	2140	Hail	0.75	0	0	0	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
BENTON CO.	4/2/1982	1520	Hail	1.5	0	0	0	0
BENTON CO.	5/14/1982	1715	Hail	2	0	0	0	0
BENTON CO.	5/14/1982	1745	Hail	2	0	0	0	0
BENTON CO.	5/14/1982	1816	Hail	0.75	0	0	0	0
BENTON CO.	5/16/1982	1519	Hail	1.5	0	0	0	0
BENTON CO.	4/29/1983	220	Hail	1.75	0	0	0	0
BENTON CO.	4/30/1983	1800	Hail	1	0	0	0	0
BENTON CO.	5/18/1983	1325	Hail	1.75	0	0	0	0
BENTON CO.	5/18/1983	1343	Hail	1.75	0	0	0	0
BENTON CO.	3/15/1984	1525	Hail	0.75	0	0	0	0
BENTON CO.	5/30/1985	2215	Hail	0.75	0	0	0	0
BENTON CO.	7/4/1985	1905	Hail	1	0	0	0	0
BENTON CO.	11/13/1985	2005	Hail	0.75	0	0	0	0
BENTON CO.	8/16/1987	1620	Hail	0.75	0	0	0	0
BENTON CO.	5/8/1988	1540	Hail	1.75	0	0	0	0
BENTON CO.	4/3/1989	905	Hail	0.75	0	0	0	0
BENTON CO.	5/25/1989	2010	Hail	1	0	0	0	0
BENTON CO.	5/16/1990	1118	Hail	0.75	0	0	0	0
BENTON CO.	5/25/1990	1934	Hail	2	0	0	0	0
BENTON CO.	6/8/1990	1850	Hail	1.75	0	0	0	0
BENTON CO.	2/14/1992	1855	Hail	0.75	0	0	0	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
BENTON CO.	4/9/1992	730	Hail	1.75	0	0	0	0
BENTON CO.	7/4/1992	1510	Hail	0.75	0	0	0	0
BENTON CO.	7/4/1992	1600	Hail	0.75	0	0	0	0
BENTON CO.	9/9/1992	1640	Hail	1.75	0	0	0	0
BENTON CO.	4/12/1993	1545	Hail	1.75	0	0	5000	0
BENTON CO.	4/12/1993	1605	Hail	1	0	0	5000	0
BENTON CO.	4/19/1993	1645	Hail	0.75	0	0	0	0
BENTON CO.	4/26/1994	1915	Hail	1	0	0	0	0
BENTON CO.	4/16/1995	1224	Hail	1.25	0	0	3000	0
BENTON CO.	4/14/1996	1515	Hail	1.75	0	0	1000	0
BENTON CO.	4/21/1996	1735	Hail	1.75	0	0	10000	0
BENTON CO.	5/4/1996	343	Hail	1.75	0	0	0	0
BENTON CO.	5/4/1996	405	Hail	1.5	0	0	0	0
BENTON CO.	4/20/1997	1650	Hail	0.75	0	0	0	0
BENTON CO.	5/17/1997	1920	Hail	0.75	0	0	0	0
BENTON CO.	5/17/1997	1938	Hail	1.75	0	0	0	0
BENTON CO.	5/17/1997	2016	Hail	0.75	0	0	0	0
BENTON CO.	5/17/1997	2045	Hail	0.75	0	0	0	0
BENTON CO.	5/17/1997	2245	Hail	0.75	0	0	0	0
BENTON CO.	7/17/1997	1824	Hail	0.75	0	0	0	0
BENTON CO.	4/15/1998	1242	Hail	1	0	0	0	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
BENTON CO.	6/18/1998	615	Hail	1	0	0	0	0
BENTON CO.	6/18/1998	643	Hail	1	0	0	0	0
BENTON CO.	6/18/1998	915	Hail	2	0	0	15000	0
BENTON CO.	1/21/1999	1631	Hail	1	0	0	0	0
BENTON CO.	3/26/2000	1840	Hail	1	0	0	0	0
BENTON CO.	3/26/2000	1850	Hail	1	0	0	0	0
BENTON CO.	5/8/2000	1820	Hail	1	0	0	0	0
BENTON CO.	5/8/2000	1902	Hail	1.25	0	0	0	0
BENTON CO.	5/8/2000	1920	Hail	1	0	0	0	0
BENTON CO.	6/4/2000	1652	Hail	1.75	0	0	0	0
BENTON CO.	8/17/2000	1545	Hail	1	0	0	0	0
BENTON CO.	4/3/2001	956	Hail	1	0	0	0	0
BENTON CO.	4/9/2001	1900	Hail	1.75	0	0	0	0
BENTON CO.	4/9/2001	2121	Hail	1	0	0	0	0
BENTON CO.	4/14/2001	2129	Hail	0.75	0	0	0	0
BENTON CO.	4/14/2001	2137	Hail	0.75	0	0	0	0
BENTON CO.	5/17/2001	1650	Hail	0.75	0	0	0	0
BENTON CO.	5/20/2001	1908	Hail	0.88	0	0	0	0
BENTON CO.	6/1/2001	1840	Hail	0.75	0	0	0	0
BENTON CO.	8/29/2001	1650	Hail	0.88	0	0	0	0
BENTON CO.	10/23/2001	1330	Hail	1	0	0	0	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
BENTON CO.	3/29/2002	719	Hail	0.75	0	0	0	0
BENTON CO.	4/21/2002	430	Hail	0.75	0	0	0	0
BENTON CO.	5/7/2002	30	Hail	0.75	0	0	5000	0
BENTON CO.	5/12/2002	1500	Hail	0.75	0	0	0	0
BENTON CO.	12/18/2002	105	Hail	0.88	0	0	0	0
BENTON CO.	12/18/2002	510	Hail	0.75	0	0	0	0
BENTON CO.	4/6/2003	1357	Hail	0.75	0	0	0	0
BENTON CO.	4/6/2003	1450	Hail	1.75	0	0	0	0
BENTON CO.	4/6/2003	1525	Hail	1	0	0	0	0
BENTON CO.	4/6/2003	1527	Hail	1.75	0	0	0	0
BENTON CO.	4/19/2003	2050	Hail	0.75	0	0	0	0
BENTON CO.	4/24/2003	1750	Hail	1	0	0	0	0
BENTON CO.	4/24/2003	1829	Hail	1	0	0	0	0
BENTON CO.	4/24/2003	1835	Hail	1	0	0	0	0
BENTON CO.	5/6/2003	1529	Hail	1.75	0	0	0	0
BENTON CO.	5/6/2003	1540	Hail	1.75	0	0	0	0
BENTON CO.	5/6/2003	1600	Hail	1.75	0	0	0	0
BENTON CO.	5/6/2003	1645	Hail	0.88	0	0	0	0
BENTON CO.	6/10/2003	545	Hail	0.75	0	0	0	0
BENTON CO.	6/10/2003	1330	Hail	0.75	0	0	0	0
BENTON CO.	7/11/2003	1658	Hail	1	0	0	0	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
BENTON CO.	7/11/2003	1720	Hail	1	0	0	0	0
BENTON CO.	8/5/2003	1915	Hail	1	0	0	0	0
BENTON CO.	8/5/2003	1934	Hail	1.75	0	0	0	0
BENTON CO.	8/5/2003	1955	Hail	1	0	0	0	0
BENTON CO.	9/26/2003	1800	Hail	0.75	0	0	0	0
BENTON CO.	5/13/2004	300	Hail	0.75	0	0	0	0
BENTON CO.	5/23/2004	1425	Hail	0.75	0	0	0	0
BENTON CO.	5/25/2004	1115	Hail	1	0	0	0	0
BENTON CO.	5/25/2004	1129	Hail	0.75	0	0	0	0
BENTON CO.	5/30/2004	1405	Hail	0.75	0	0	0	0
BENTON CO.	10/18/2004	1248	Hail	0.88	0	0	0	0
BENTON CO.	6/6/2005	1945	Hail	0.75	0	0	0	0
BENTON CO.	6/9/2005	1914	Hail	0.88	0	0	0	0
BENTON CO.	7/23/2005	1620	Hail	1	0	0	0	0
BENTON CO.	7/23/2005	1705	Hail	1	0	0	0	0
BENTON CO.	4/2/2006	1510	Hail	1	0	0	0	0
BENTON CO.	5/3/2006	723	Hail	0.88	0	0	0	0
BENTON CO.	3/22/2007	454	Hail	0.75	0	0	0	0
BENTON CO.	4/3/2007	1040	Hail	0.75	0	0	0	0
BENTON CO.	5/6/2007	1238	Hail	0.88	0	0	0	0
BENTON CO.	1/7/2008	1445	Hail	1	0	0	0	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
BENTON CO.	4/22/2008	445	Hail	0.75	0	0	0	0
BENTON CO.	4/22/2008	445	Hail	0.75	0	0	0	0
BENTON CO.	6/15/2008	1342	Hail	0.75	0	0	0	0
BENTON CO.	9/21/2009	1305	Hail	1	0	0	0	0
BENTON CO.	12/23/2009	1936	Hail	0.75	0	0	0	0
BENTON CO.	4/23/2010	1721	Hail	1	0	0	0	0
BENTON CO.	4/23/2010	1723	Hail	1.75	0	0	10000	0
BENTON CO.	4/23/2010	1725	Hail	0.88	0	0	0	0
BENTON CO.	4/23/2010	1725	Hail	1	0	0	0	0
BENTON CO.	4/23/2010	1725	Hail	0.88	0	0	0	0
BENTON CO.	7/11/2010	1336	Hail	0.88	0	0	0	0
BENTON CO.	9/18/2010	1910	Hail	1.5	0	0	0	0
BENTON CO.	5/25/2011	1110	Hail	1.75	0	0	10000	0
BENTON CO.	6/13/2011	813	Hail	0.88	0	0	0	0
BENTON CO.	8/7/2011	1617	Hail	1	0	0	0	0
BENTON CO.	8/7/2011	1621	Hail	0.75	0	0	0	0
BENTON CO.	4/17/2013	1425	Hail	1	0	0	0	0
BENTON CO.	4/17/2013	1430	Hail	1.75	0	0	0	0
BENTON CO.	4/17/2013	1433	Hail	1	0	0	0	0
BENTON CO.	5/31/2013	1631	Hail	0.75	0	0	0	0
BENTON CO.	3/27/2014	1534	Hail	1	0	0	0	0

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
BENTON CO.	4/3/2014	1300	Hail	1.75	0	0	0	5000
BENTON CO.	4/3/2014	1510	Hail	1.75	0	0	0	25000
BENTON CO.	4/3/2014	1522	Hail	1.75	0	0	0	0
BENTON CO.	10/1/2014	1737	Hail	1.75	0	0	0	0
BENTON CO.	7/1/2015	2015	Hail	0.75	0	0	0	0
BENTON CO.	7/1/2015	2015	Hail	0.88	0	0	0	0
BENTON CO.	7/1/2015	2030	Hail	1	0	0	0	0
TOTALS:					0	0	64K	30K

Source: <http://www.ncdc.noaa.gov>

Measure of Probability and Severity

Probability: High – Planning Area

Severity: High – Planning Area

Thunder storms, severe wind and hail events are a common occurrence in Benton County.

According to the NOAA, severe criteria for wind events constitutes winds over 58 mph and hail larger than ¾ inches in diameter. Non-severe criteria constitute heavy rainfall, which may cause flash flooding, and lightning occurrences. With most residents having knowledge and experience in thunderstorm and hail occurrences the severity to population remains fairly low. Using NOAA standards most hail occurrences in the county are classified as severe and almost all thunderstorm events are classified as not severe. Future high wind and hail events will likely have a critical impact on the county.

For the 62-year period 1954-2016, the average wind gust (measured and estimated) for damaging winds reported in Benton County (Table 3.2.9-4) was 52 kts. or 59.84 mph. The highest wind gusts recorded reached 80 kts. or 92.06 mph in November 2005 county wide. For the same period, the average measured diameter of severe hail reported in Benton County was 1.25 inches. The largest hail reported measured 2 inches in diameter in May 1982, May 1990 & June 1998). In total, there were 81 reports of hail of 1-inch diameter or larger during the recorded period.

Existing Mitigation Strategies

Recommend that the County Hazard Mitigation Planning Committee continues to provide emergency preparedness information and resources related to all natural disasters to the public through active education and outreach programs.

3.2.10 Wildfire

Description of Hazard

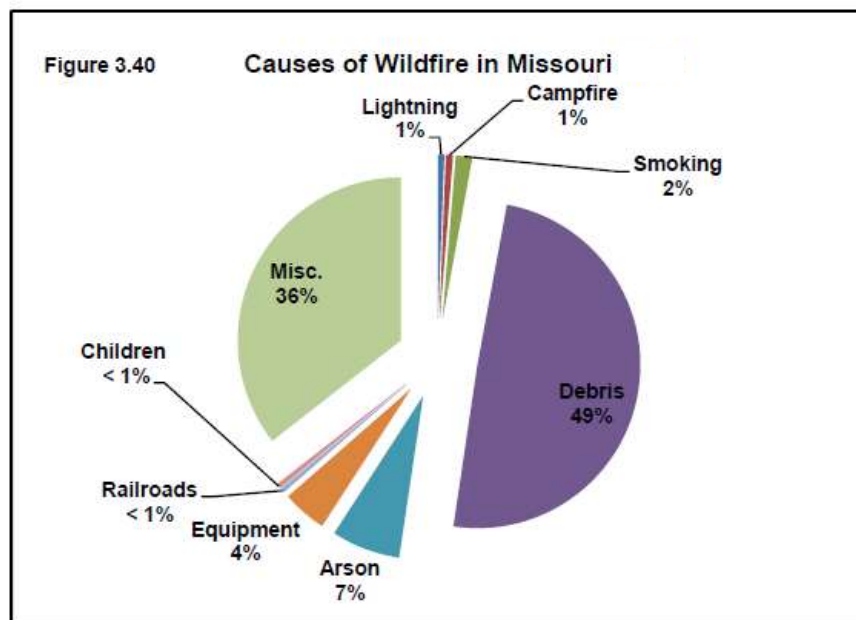
Forest, grassland, and natural cover fires can and have occurred at any time throughout the year in Missouri. In Benton County, the majority of the fires and the greatest acreage loss occur during the spring fire season (February 15 - May 10).

Spring is the time of the year when rural residents burn garden spots and brush piles. Many landowners also believe it is necessary to burn the woods in the spring to grow more grass, kill ticks, and get rid of brush. These factors, combined with low humidity and high winds, result in higher fire danger at this time of year. The spring fire season abates with the growth of the new season's grasses and other green vegetation.

Numerous fires also occur in October and November due to the dryness associated with fall in Missouri. Many rural residents use this time of year to burn leaves and debris thus raising the possibility of a fire which burns out of control.

The major causes of wildfires in Missouri are various human activities, according to statistics from the Missouri Department of Conservation (See Figure 3.2.10-1). From January, 2005 until the present, there have been 14,598 acres affected by wildlife according to the MDC's Forest Fire Reporting.

Figure 3.2.10-1



In addition to the risk faced by rural areas, there is an increased risk of Wildfire in areas called the WUI (Wildland Urban Interface). The WUI is defined by the NWCG (National Wildfire Coordinating Group) as, “the line, area, or zone where structures and other human development meet or intermingle with undeveloped Wildland or vegetative fuel.” More information on the WUI can be found at the NWCG website (<http://www.nwcg.gov/>).

Within the WUI there are three defined Community types that are vulnerable to Wildfire:

- **Interface Community**

Structures directly abut Wildland fuels. There is a clear line of demarcation between Wildland fuels and residential, business, and public structures. Wildland fuels do not generally continue into the developed area. The development density for an interface community is usually three or more structures per acre, with shared municipal services.

- **Intermix Community**

Structures are scattered throughout a Wildland area. There is no clear line of demarcation; Wildland fuels are continuous outside of and within the developed area. The development density in the intermix ranges from structures very close together to one structure per 40 acres.

- **Occluded Community**

Often found within a city, structures abut an island of Wildland fuels (e.g. park or open space). There is a clear line of demarcation between structures and Wildland fuels. The development density is usually similar to those found in the interface community, but the occluded area is usually less than 1,000 acres in size.

The Missouri Department of Conservation website keeps a record of all fire incidences within the state. The search can be narrowed via what kind of incident caused the fire, date, and county. From 2004-to present, there has been 15,122.16 acres burned. NOAA only lists two wildfires from 1950-2015.

Geographic Location

The rural areas of Benton County and the rural/urban interfaces are most at risk from wildfires. Debris burning is consistently the number one cause of wildfires in Missouri. Fires caused by lightning are rare despite 50 to 70 thunderstorm days per year.

Previous Occurrences

Large and widespread wildfires, such as occur in the western United States, have not been a problem in Benton County in recent history. However, the Fire Districts in Benton County fight smaller wildfires/natural cover fires every year.

There have been a record number of wildfires in the spring of the past 4-5 years; these have destroyed crops, hay fields, green space, and woods. Quick response from the Fire District(s) has limited the spread and loss involved with these fires.

Measure of Probability and Severity

Probability: Moderate – Benton County, Lincoln, Cole Camp, Ionia
Low – All other participating jurisdictions

Severity: Moderate – Benton County, Lincoln, Cole Camp, Ionia
Low – All other participating jurisdictions

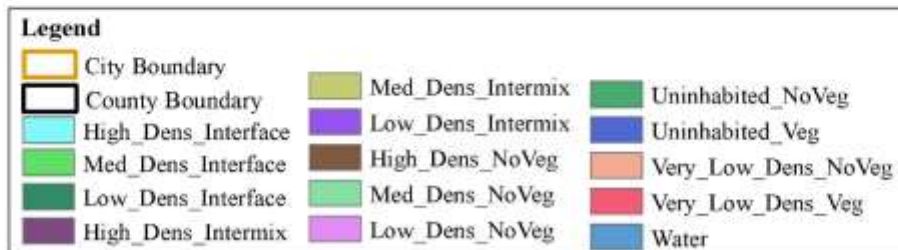
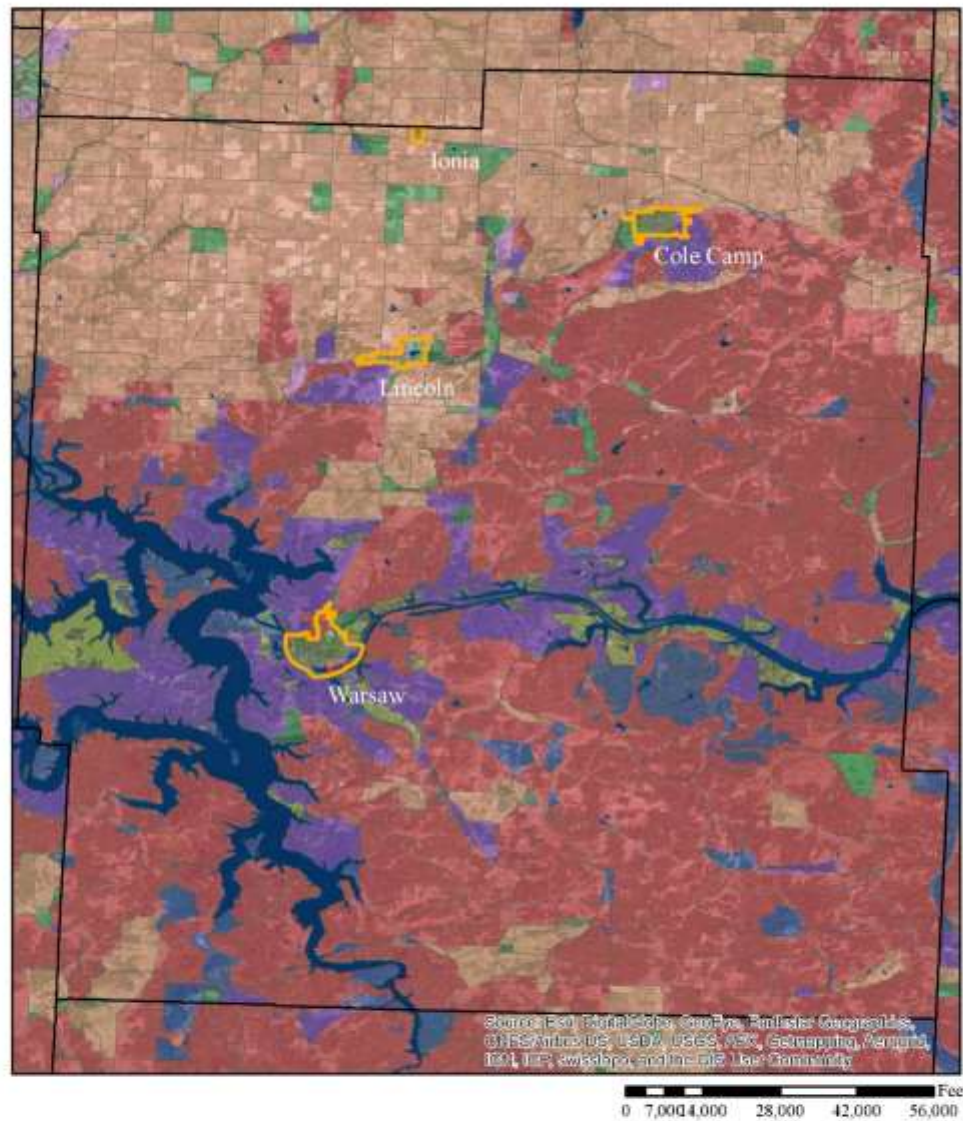
The Missouri State Hazard Mitigation Plan (2013) points out that the probability of wildfires may increase to high during conditions of excessive heat, dryness, and drought. The probability is also higher in spring and late fall

Existing Mitigation Activities

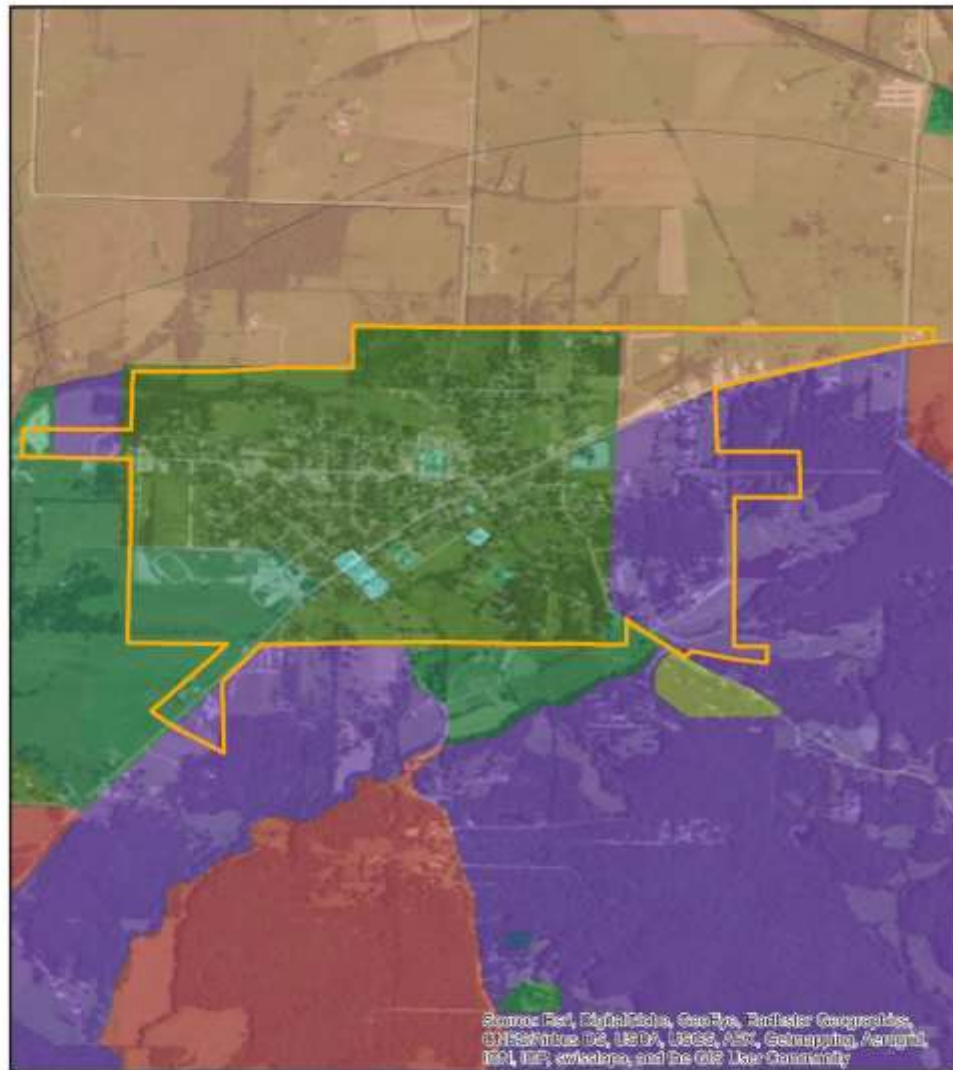
Emergency response systems, well trained fire departments, and numerous county roads improve response times to fire events, thus decreasing the chances of fire spread.

The Missouri Department of Conservation and the State Fire Marshal have published an informational booklet entitled “Living with Wildfire” which educates homeowners on assessing a property’s vulnerability to wildfire and making changes to decrease the risk. The publication is available online at: <http://mdc4.mdc.mo.gov/Documents/322.pdf>

Benton County - Wildfire Urban Interface



Cole Camp - Wildfire Urban Interface



0 550 1,100 2,200 3,300 4,400 Feet

Legend

City Boundary	Med_Dens_Intermix	Uninhabited_NoVeg
County Boundary	Low_Dens_Intermix	Uninhabited_Veg
High_Dens_Interface	High_Dens_NoVeg	Very_Low_Dens_NoVeg
Med_Dens_Interface	Med_Dens_NoVeg	Very_Low_Dens_Veg
Low_Dens_Interface	Low_Dens_NoVeg	Water
High_Dens_Intermix		



















Date: 3/4/2016

Ionia - Wildfire Urban Interface

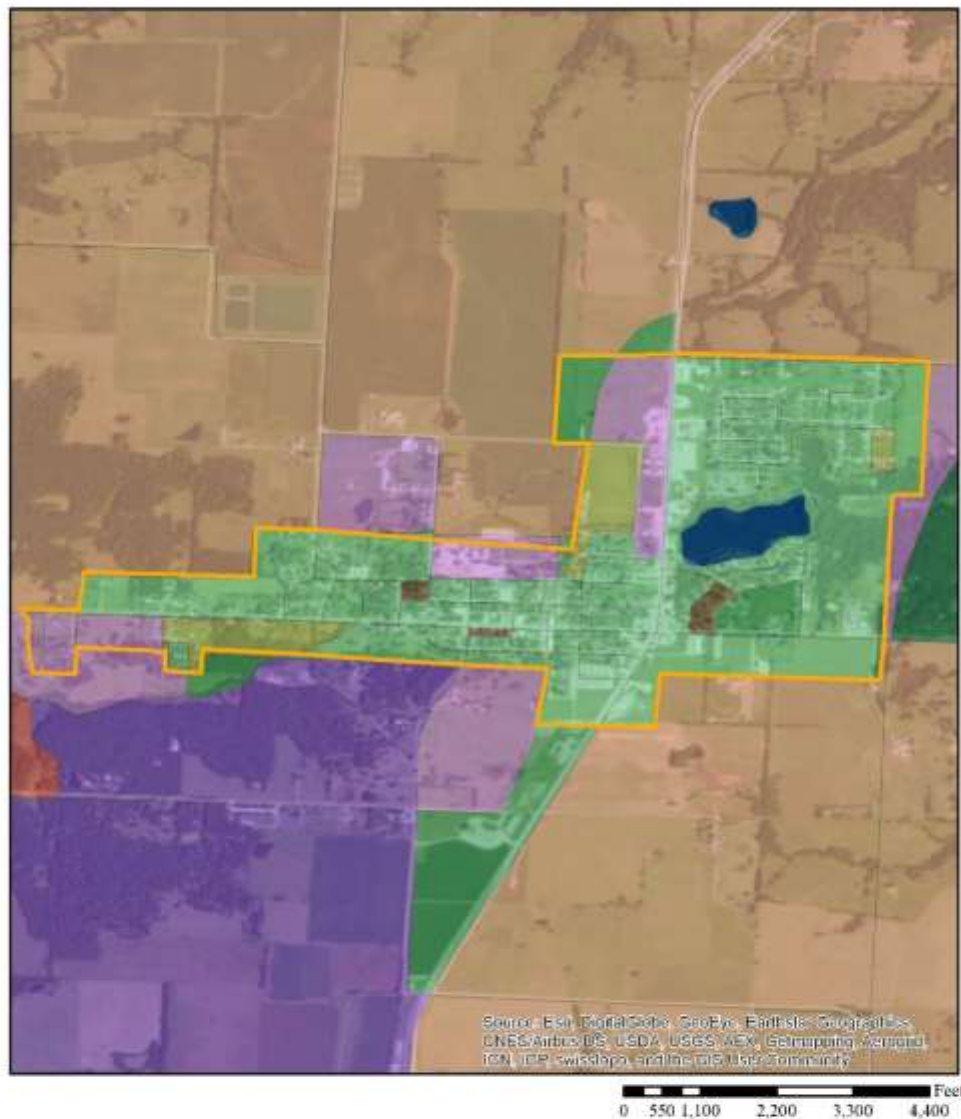


0 140 280 560 840 1,120 Feet

Legend		
	City Boundary	
	County Boundary	
	High_Dens_Interface	 Med_Dens_Intermix
	Med_Dens_Interface	 Low_Dens_Intermix
	Low_Dens_Interface	 High_Dens_NoVeg
	High_Dens_Intermix	 Med_Dens_NoVeg
		 Low_Dens_NoVeg
		 Uninhabited_NoVeg
		 Uninhabited_Veg
		 Very_Low_Dens_NoVeg
		 Very_Low_Dens_Veg
		 Water



Lincoln - Wildfire Urban Interface

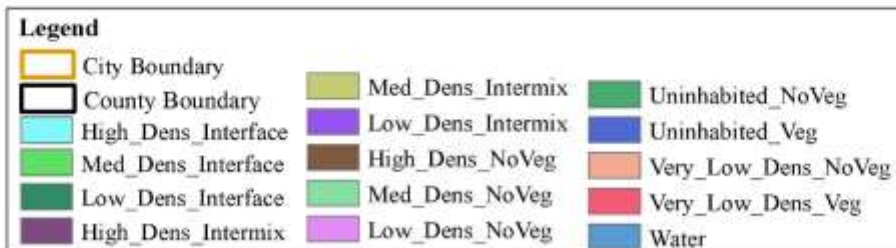
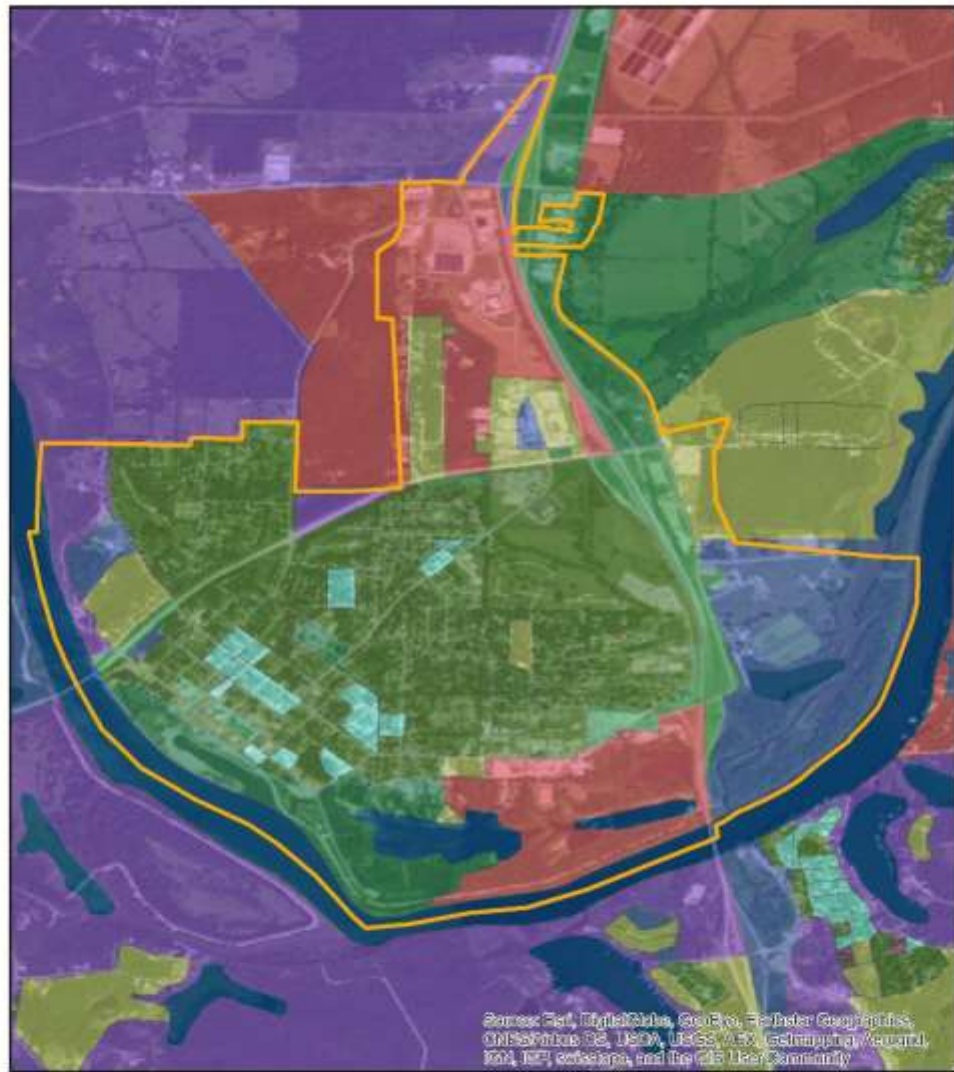


Legend

City Boundary	Med_Dens_Intermix	Uninhabited_NoVeg
County Boundary	Low_Dens_Intermix	Uninhabited_Veg
High_Dens_Interface	High_Dens_NoVeg	Very_Low_Dens_NoVeg
Med_Dens_Interface	Med_Dens_NoVeg	Very_Low_Dens_Veg
Low_Dens_Interface	Low_Dens_NoVeg	Water
High_Dens_Intermix		

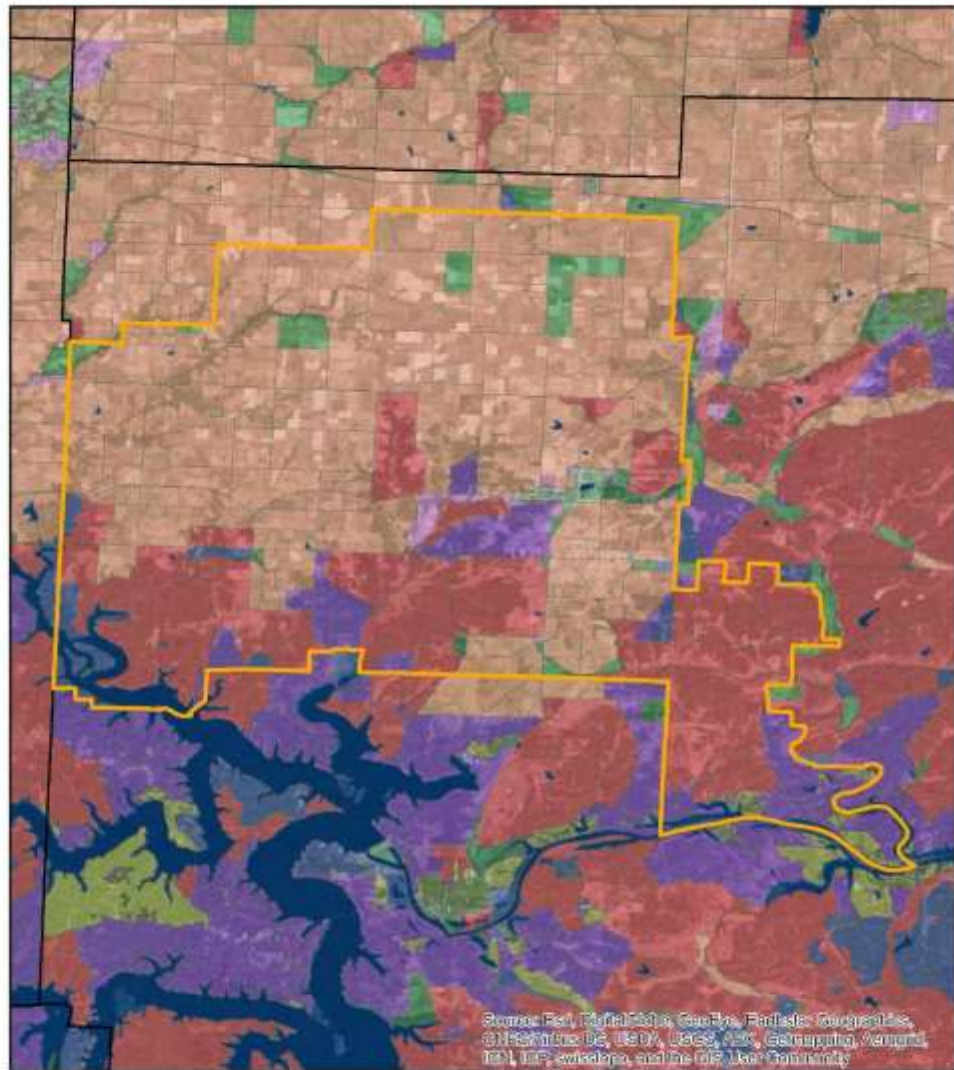


Warsaw - Wildfire Urban Interface

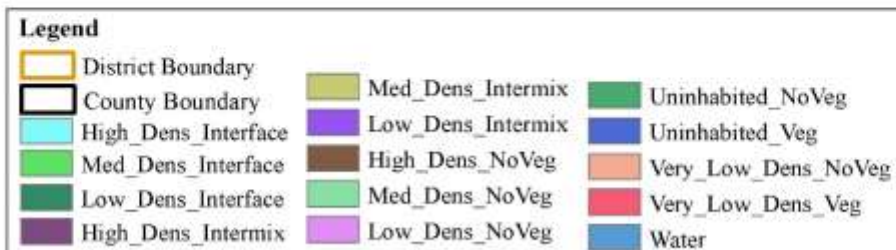


Date: 3/4/2016

Cole Camp R-I Schools - Wildfire Urban Interface



0 5,000 10,000 20,000 30,000 40,000 Feet



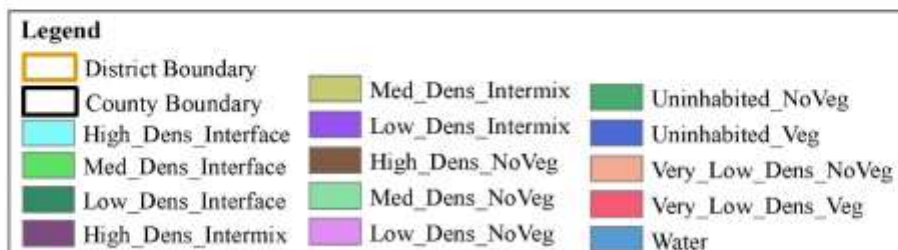
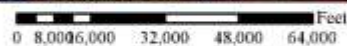
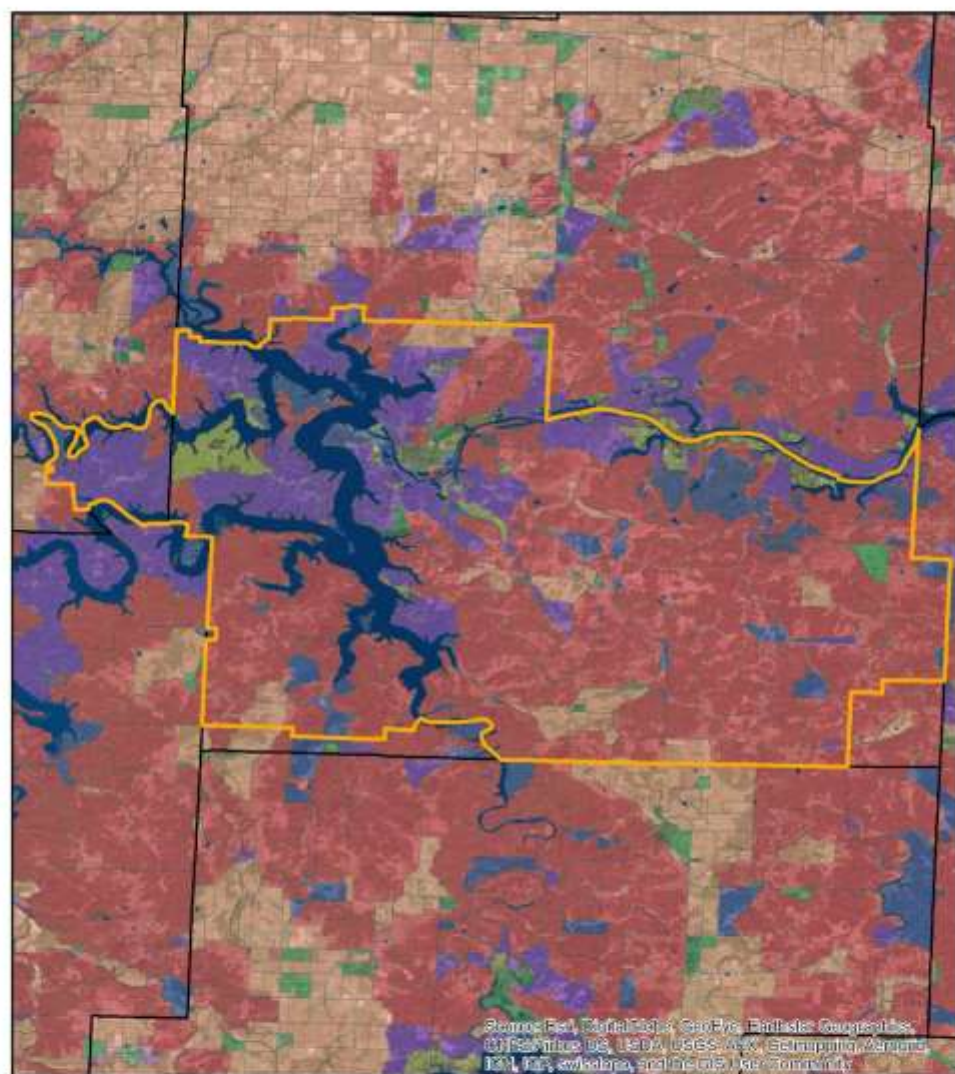
Sacramento-San Joaquin River Delta

Source: Esri, DigitalGlobe, GeoEye, The Terra Group, GeoEye, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Page 162

Warsaw R-IX Schools - Wildfire Urban Interface



Date: 4/26/2016

3.3 Vulnerability Assessment Overview

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....

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 (2) (11) (A) of this section and a description of the methodology used to prepare the estimate...

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.

This section will provide an inventory assessment of vulnerable structures, equipment, and populations within Benton County. As prescribed by FEMA guidelines, critical structures, building counts and assessed values will be included. All people, structures, and equipment are vulnerable to one or more hazards in Benton County. This assessment can be used to identify potential areas where mitigation activities are needed. (See Table 3.3.1-1)

***** Note: This section was not fully updated, data in the assessed values below and tables 3.3.1-1, 3.3.1-3 were not updated due to lack of documentation and cooperation from the County EMD.**

3.3.1 Benton County Inventory

Assessed Values

Benton County 2010 Assessed Values	
Residential	\$127,539,260
Commercial	\$27,017,880
Agricultural	\$9,788,720
Total Real Property	\$164,345,860
Total Personal Property	\$47,223,257
Total Utilities	\$11,658,711

Table 3.3.1-1 shows Benton County owned property and replacement costs as stated in the July 2010 insurance statement.

Benton County Owned Buildings and Replacement Costs	
Courthouse Building	\$1,935,600
Jail	\$798,000
Maintenance Shed #1	\$87,600
Courthouse Annex	\$133,200
Maintenance Shed #2	\$103,200
Storage Building	\$25,200
Maintenance Shed #3	\$58,800
Open Sided Frame Pole Barn	\$29,173
Courthouse Annex #2	\$252,000
911 Center	\$884,400
Extension Office	\$30,000
Total	\$4,337,173

Source: Benton County Commissioner's Office

Agriculture

Table 3.3.1-2 show value estimates for agricultural land in Benton County and estimates of crop and livestock sales. Since almost half of the land area of Benton County is farmland (52%), the impact of agricultural losses due to a natural hazard could be a potential threat to the economic stability of the region.

Table 3.3.1-2		
2012 Benton County Agricultural Census		
Number of Farms		800
Land In Farms		240,653 of 466,560
Market Value of Products Sold		\$62,697,000
	Crops Sales	\$13,012,000
	Livestock Sales	\$49,685,000

2012 Census of Agriculture, County Profiles;

http://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/Missouri/cp29015.pdf

Critical Facilities

FEMA defines “critical facilities” as *all manmade structures or other improvements that, because of their function, size, service area, or uniqueness, have the potential to cause serious bodily harm, extensive property damage, or disruption of vital socioeconomic activities if they are destroyed, damaged, or if their functionality is impaired.*

Critical facilities commonly include all public and private facilities that a community considers essential for the delivery of vital services and for the protection of the community. The adverse effects of damaged critical facilities can extend far beyond direct physical damage. Disruption of health care, fire, and police services can impair search and rescue, emergency medical care, and even access to damaged areas. Critical Medical Facilities are shown in Table 3.3.1-3.

Table 3.3.1-3

Critical Medical Facilities	
Facility	Town
Bothwell Health Center	Warsaw
Cole Camp Clinic	Cole Camp
Golden Valley Medical	Warsaw
Katy Trail Community Health	Warsaw
Lincoln Family Medicine	Lincoln
Ambrose Park Residential Care	Cole Camp
Good Samaritan Nursing Home	Cole Camp
Lakeside Manor	Warsaw
Lincoln Community Nursing Home	Lincoln
Warsaw Health and Rehab	Warsaw

Table 3.3.1-4 list **Critical Water, Wastewater Treatment and Storage Facilities**

Table 3.3.1-4

Wastewater Treatment Facilities		
Facility Name	City	Owner
Cole Camp Wastewater Treatment Facility	Cole Camp	Cole Camp
Lincoln WWTP	Lincoln	Lincoln
Warsaw Wastewater Treatment Facilities	Warsaw	Warsaw
Benton Co. Sewer Dist.	Warsaw	Benton Co.

Table 3.3.1-5 shows the location of Public Water Supply Towers.

Table 3.3.1-5			
Public Water Supply Towers			
Owner	Facility Name	People Served	# Tanks
Cole Camp	Cole Camp PWS	1,121	1
Lincoln	Lincoln PWS	420	1
Warsaw	Warsaw PWS	2,127	3
Warsaw R-IX High School	Warsaw R-IX High School	400	1

Population

Table 3.3.1-6 shows an age profile of the Benton County population. Age can be one factor that influences vulnerability when a natural hazard occurs as needs and abilities may vary widely between age groups.

Table 3.3.1-6	General Characteristics	Number	Percent
Total population		19,056	
Male		9,585	50.3
Female		9,470	49.7
Median age (years)		51	(X)
Under 18 years		3,353	17.6
18 years and over		15,702	82.4
65 years and over		4,522	28.8

Source: US Census Bureau

Table 3.3.1-7 list Historic Properties in Benton County

National Register Historic Property	Community
Central Cole Camp Historic District	Cole Camp
Rogers Shelter Archaeological Site	Warsaw
Augustus Sander House	Cole Camp
Upper Bridge	Warsaw

Source: <http://www.dnr.mo.gov/shpo/Benton.htm>

Development Trends

Future development in Benton County can and will be impacted by several natural hazards. Development plans can use the Benton County Hazard Mitigation Plan as a guide to possible problems that could come to light when building in certain areas and when building with certain materials.

City of Cole Camp

In 2008, the City of Cole Camp updated their water system by adding a new water tower, lines, and meters.

City of Lincoln

Since 2005, the City of Lincoln has added a new well, replaced and updated water lines, and helped support a new 4-H building and arena by one of their parks.

City of Warsaw

Since 2005, Warsaw has added and replaced water/sewer lines (\$2,661,866.89). They have also purchased a UV Water Disinfecting system (\$251,462.44) and added a boardwalk at Steamboat Landing (\$450,372.86).

3.3.2 School Districts

Table 3.3.2-1 shows Benton County school district populations

Table 3.3.2-1

Benton County School District Populations				
School District	School Name	Grades	Staff	Students
Cole Camp R-I	Cole Camp High	9-12	32	268
	Cole Camp Middle	6-8	25	212
	Cole Camp Elementary	K-5	24	256
Lincoln R-II	Lincoln High	7-12	30	226
	Lincoln Elementary	K-6	29	283
Warsaw R-IX	Warsaw High	9-12	47	379
	John Boise Middle	6-8	36	306
	North Elementary	PK-5	41	190
	South Elementary	PK-6	44	211
	Ruth Mercer Elementary	K-2	27	174

Table 3.3.2-2 lists the school districts Building Counts and Replacement Costs.

Table 3.3.2-2			
Benton County School Districts Assessed Values			
School District	Building Count	Building Replacement & Content Cost	Assessed Valuation
Cole Camp R-I	1	\$19,995,162	\$56,323,193
Lincoln R-II	2	\$17,067,146	\$43,541,000
Warsaw R-IX	5	\$38,308,951	\$147,162,421

Table 3.3.2-3 show a representation of the Benton County school districts development trends since the first plan was created in 2005.

Table 3.3.2-4	
Cole Camp R-I	Added the athletic complex, renovated the kitchen and bus barn.
Lincoln R-II	Added a new pre-school trailer, conference room, and offices.
Warsaw R-IX	Reconstructed classrooms into an office space and is renovating an elementary school

3.3.3. Community Jurisdictions

Assessed values for property in Benton County were calculated using data from the Benton County Assessor's Office and collected through the county assessor and the City of Lincoln. The "Total Incorporated Building Count" represents all buildings within the community's corporate limits. (See Table 3.3.3-1)

Table 3.3.3-1

Community	2015 Assessed Values	
Cole Camp	Residential	\$5,051,640
	Commercial	\$1,300,230
	Agricultural	\$11,340
	Total: Real Property	\$6,364,060
	Total: Personal Property	\$2,252,730
	Total: Railroads and Utilities	\$578,027
	Total:	\$9,194,817
Lincoln	Residential	\$4,924,310
	Commercial	\$1,690,230
	Agricultural	\$4,680
	Total: Real Property	\$6,583,320
	Total: Personal Property	\$1,845,180
	Total: Railroads and Utilities	\$210,538
	Total:	\$8,639,030
Warsaw	Residential	\$10,827,510
	Commercial	\$9,156,560
	Agricultural	\$1,220
	Total: Real Property	\$19,994,640
	Total: Personal Property	\$4,175,500
	Total: Railroads and Utilities	\$196,522
	Total:	\$24,366,662
Village of Ionia	Residential	\$185,850
	Commercial	\$200,030
	Agricultural	\$80
	Total: Real Property	\$385,960
	Total: Personal Property	\$140,740
	Total: Railroads and Utilities	\$87,418
	Total:	\$614,118

3.4 Vulnerability Summary and Impact

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.

This section gives a brief overview of each hazard and provides information about the potential impact that may be incurred on existing and future structures. Impact on future development is not addressed with every hazard because of the unpredictable nature of some hazards. Methodology used to estimate potential dollar losses was based off of previous estimates and statistics from the National Oceanic and Atmospheric Administration.

3.4.1 Dam Failure Vulnerability

Jurisdictions: unincorporated Benton County, Cole Camp, Warsaw, and all public school districts.

Overview

Many incorporated and unincorporated areas of Benton County are vulnerable to the effects of dam failure. A dam failure in Benton County could range from very minimal environmental damage to a significant loss of life and infrastructure. All impacts are dependent upon several variables: water, debris, people, and structures. A dam failure would include the breach of a dam wall or embankment allowing the water and/or debris to flow downstream from the dam.

The Dam Inventory for the state of Missouri was compiled in the late 1970's to early 1980's. The state has classified three of Benton County's dams as "High Hazard". Of the three High Hazard dams, all are unregulated by the state, but two are regulated by the U.S. Army Corps of Engineers. Of the 26 dams listed in Benton County, three are regulated by DNR.

State regulated dams are classified by what lies downstream of the dam and what will be impacted by the failure of that dam. Unregulated dams received their classifications nearly 30 years ago or more and development that occurs downstream is not monitored by any agency; this potentially puts the public at risk. Also, development upstream that might increase the contents held by the dam can cause failure. Because there is no entity in charge of unregulated dams, the original classifications for these dams may not be correct. Some dams may not exist anymore while others may pose a greater downstream threat than their classifications indicate.

Potential Impact on Existing Structures

Warsaw and Cole Camp have dams inside, or within a mile upstream of their corporate boundaries. All public school districts would not sustain any structural losses from this hazard. Structures downstream of these dam locations could potentially be at risk if a failure were to occur depending on the size of the reservoir behind the dam. Throughout the county several other dams lie upstream of structures that have the potential of being impacted.

The potential impact on structures and human life downstream from a dam failure directly correlates to the amount of water and/or debris that is behind the dam. As stated in the hazard profile, it is important to take into account the age of the data that has been compiled on state regulated and unregulated dams in the county and in the state. Because data on unregulated dams was collected in the late 1970's and early 1980's it is not necessarily reliable to use when looking at possible areas of impact.

Potential Impact on Future Development

Dam Failure has the potential to impact future development in the county and its jurisdictions. Because many dams in Benton County are privately owned and not regulated by the state the potential for development below aging or unsafe dams is an issue that needs to be addressed. If development occurs without knowledge of problem dam that may lie upstream, that development is put in jeopardy. Currently, all the dams located in a high risk area are regulated and maintained by the U.S. Army Corps of Engineers.

Future impacts may be addressed by inundation studies being done by the Natural Resources Conservation Service's Water Resources Center. The following is an excerpt from their website: "The Water Resources Center has developed a methodology to complete dam breach inundation studies and produce inundation maps downstream of regulated dams.

The Federal Emergency Management Agency (FEMA) has indicated that future funding of state dam safety programs will be linked to the completion of Emergency Action Plans (EAPs) for regulated dams. The WRC's Dam and Reservoir Safety program has prioritized Missouri counties for completion of mapping."

The mapping was begun in Missouri in September 2009; the timeframe for mapping all the regulated high hazards dams in the state is a little over three years. The mapping of the regulated high hazard dams in Benton County has been carried out in, according to inspectors from Dam Safety Program. After an inundation study on a dam is finished, it will be the responsibility of the dam owner to work with the County Emergency Management Director in developing an Emergency Action Plan for the dam.

The state regulated dams include Junge Lake Dam, Moss Lake Dam, and Smartt Dam. These are labeled in the dam maps in Section 3.5.

3.4.2 Drought Vulnerability

Jurisdictions: unincorporated Benton County

Overview

All jurisdictions in the Planning Area are vulnerable to the effects of drought; the unincorporated agricultural areas of Benton County are most vulnerable to the effects of drought because of crop loss. In addition to damage to crops, produce, livestock, and soil, and the resulting economic consequences, the arid conditions created by drought pose an increased risk of fire.

Potential Impact on Existing Structures

Structural impact in regard to this hazard is minimal to non-existent. Drought does, however, have far reaching economic consequences in regard to crop failure and high economic loss. The economic loss incurred would heavily impact the agricultural industry and those businesses dependent upon that industry for products.

Potential Impact on Future Development

Future development in the county can be at risk from the effects of drought. Good land management techniques are crucial in mitigating future impacts.

3.4.3 Earthquake Vulnerability

Jurisdictions: All Jurisdictions

Overview

An earthquake of sufficient magnitude in the New Madrid Seismic Zone has the potential to affect all jurisdictions in Benton County and the surrounding region. The State Emergency Management Agency (SEMA) has projected that a quake of 6.7 Magnitude anywhere along the New Madrid Seismic Zone would, at the strongest, result in Level V Intensity effects in Benton County, as measured on the MMI.

Statement of Next Disaster's Likely Adverse Impact on Community

The next disaster's likely adverse impact on Benton County could be critical in terms of amount of damage to infrastructure (utilities, communications) buildings, deaths and other cascading disasters including fire and explosions from natural gas and oil pipeline ruptures.

Potential Impact on Existing Structures

Level VI Intensity quake effects result in minimal damage. A 7.6 Magnitude quake along the New Madrid Seismic Zone would potentially result in Level V Intensity effects in Benton County. Level V Intensity quake effects are considered "strong" and can result in significant damage to poorly built structures.

<p>VI. Strong Felt by all; many frightened and run outdoors, walk unsteadily. Windows, dishes, glassware broken; books fall off shelves; some heavy furniture moved overturned; a few instances of fallen plaster. Damage slight.</p>
--

Potential Impact on Future Development

Impacts on future development may be mitigated by following more stringent earthquake resistant building codes. However, this type of mitigation activity may not be cost effective for most communities.

The potential impact of earthquakes on future development would be the same as for existing structures.

Recommendation

Increased education, concern and subsequent action can reduce the potential effects of earthquakes can be done in conjunction with preparations for other hazards. A program that recognizes the risk of flooding, landslides and other dangers that incorporate earthquake issues will be of most benefit to citizens. Individuals and government have roles in reducing earthquake hazards.

3.4.4 Extreme Heat Vulnerability

Jurisdictions: All Jurisdictions

Overview

All jurisdictions are vulnerable to the effects of extreme heat. While heat-related illness and death can occur due to exposure to intense heat in just one afternoon, heat stress on the body has a cumulative effect. The persistence of a heat wave increases the danger. Loss of life is the most significant consequence of extreme heat. The elderly and those active or employed in outdoor settings are most vulnerable. According to the World Health Organization, “elderly” is defined as those over the age of 65. Elderly are the most susceptible to complications from excessive and/or prolonged cold or heat.

According to the US Census Bureau website the estimated Benton County 2010 elderly population stands at 4,522. Residents without access to air conditioning, water and shade are most vulnerable.

In addition to the human toll, the Midwestern Climate Center, in a paper on the 1999 heat wave, points out other possible impacts such as electrical infrastructure damage and failure, highway damage, crop damage, water shortages, livestock deaths, fish kills, and lost productivity among outdoor-oriented businesses. These damages are also connected to **Drought** when there are prolonged and/or recurrent periods of excessive heat.

Potential Impact on Existing Structures

While loss of life is of the most concern with this hazard, structural impacts also exist. While impacts exist they are limited and dependent on how prolonged the heat wave is. Failure of road surfaces, electrical infrastructure, and crop damage may all occur.

Potential Impact on Future Development

Potential impact on future development is not quantifiable with the resources available.

3.4.5 Flood Vulnerability

Jurisdictions: unincorporated Benton County, Cole Camp, Warsaw excluding all school districts.

Overview: Benton County is more vulnerable to dam failure than other flood types but both are distinct possibilities. Because of Warsaw's close proximity to Truman Reservoir and the Osage River, flooding will usually occur in the late spring and fall. Once the river and reservoir are full, locals can expect to see streams and other small tributaries backup. The entire Planning Area is at high risk from ravine and levee flooding. Warsaw and the unincorporated areas near Truman Lake and Lake of the Ozarks are in a highly vulnerable area subject to ravine and dam/levee flooding than the rest of the county. The Harry S. Truman Dam regulates two main bodies of water on city land; Truman Lake and the Osage River. If levees break or flash flooding occurs on either side of the dam, Warsaw will be a direct hit. The Flood Insurance Rate Map (FIRM) for Benton County shows the flood zones for this jurisdiction at greater risk.

Potential Impact on Existing Structures

Benton County residents, structures, and infrastructure lying in or near the Osage River Floodplain and Harry S. Truman Reservoir are all vulnerable to the effects of a major flood. All public school district structures in Benton County are not vulnerable to the effects of this hazard. While ravine flooding does not pose a direct threat to educational and other jurisdictions there is a low, indirect threat to access of structures and to populations during times of flash flooding. Other structures not within designated floodplains are also vulnerable to the effects of flash flooding brought on by storm water or sheet flooding.

Potential Impact on Future Development

Impact on future development is directly related to floodplain management and regulations set forth by the county and individual communities. Currently, there is no knowledge of any future development by any public school districts that would be vulnerable to this hazard.

National Flood Insurance Program Repetitive Loss Properties

Requirement

§201.6(c) (2) (ii):

[The risk assessment] must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged by floods.

The NFIP defines a repetitive loss property as “any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978.” A repetitive loss property may or may not currently be insured by the NFIP.

A **Severe Repetitive Loss (SRL)** property is defined as a **residential property** that is covered under an NFIP flood insurance policy and:

- (a) Has at least four NFIP claim payments (including building and contents) over \$5,000 each, and the cumulative amount of such claims payments exceeds \$20,000; or
- (b) For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

For both (a) and (b) above, at least two of the referenced claims must have occurred within any ten-year period, and must be greater than 10 days apart.

Benton County currently does not have any Severe Repetitive Losses listed. Benton County and Warsaw are the only members of the National Flood Insurance Program.

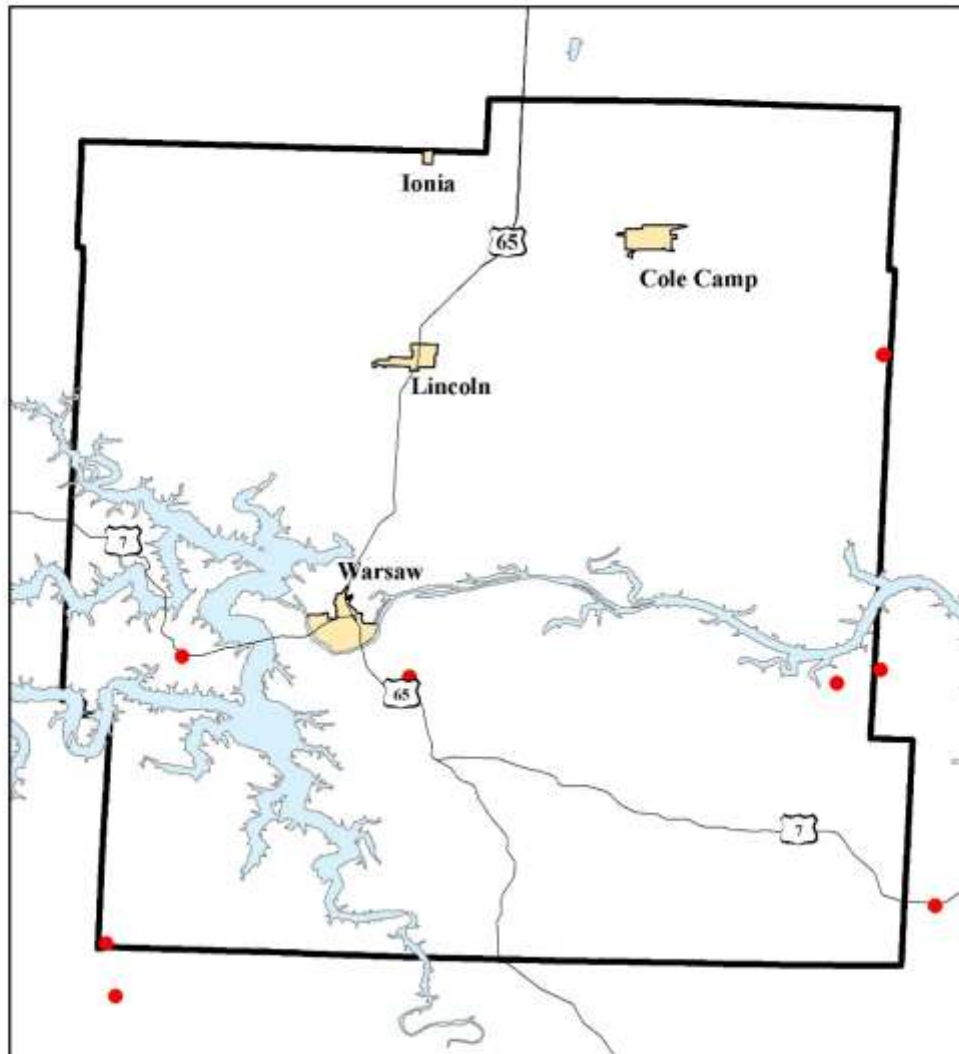
3.4.6 Land Subsidence/Sinkhole Vulnerability

Jurisdictions: Unincorporated Benton County

Overview

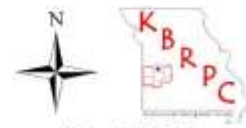
Missouri State Hazard Mitigation Plan (2013) gives the following definition for land subsidence and sinkholes: “Land subsidence is sinking of the earth’s surface due to the movement of earth materials below the surface. In the case of sinkholes, the rock below the surface is limestone, carbonate rock, salt beds, or some other rock that can be naturally dissolved by circulating groundwater.” There are several random areas throughout the county where sinkholes are a concern

Benton County



Legend

- Sinkholes
- Roads
- Lakes
- City Boundary



Date: 3/3/2016

Potential Impact on Existing Structures

Because sinkhole collapse is not predictable there is no direct way to assess a cost impact for this hazard. Vulnerable structures, roads, or property could potentially be impacted by a sudden and usually localized drop in elevation. The resulting damage incurred from the sinkhole could result in broken roads, building collapse, compromises to water sources, environmental impacts, and/or loss of life. While loss of life could occur, it would most likely be minimal. Areas vulnerable to the effects of sinkholes will be assessed more in Section 3.5 for parts of unincorporated Benton County.

Potential Impact on Future Development

It is difficult to assess whether or not a sinkhole will have an effect on future development. Many of the sinkhole areas in Benton County occur within public land the potential threat is minimized. Inversely, it should be noted that future development can affect the impact of this hazard. Construction of septic tanks, lagoons, and structures can cause shifts in soil and may plug or disturb karst areas allowing for the formation of a sinkhole. Also, soil disturbance can cause the drainage pattern to change, which may lead to blockage of a sinkhole and can cause flooding.

3.4.7 Levee Failure Vulnerability

Jurisdictions: Benton County and Warsaw

Overview

A levee as defined by the National Flood Insurance Program is defined as, “a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding.” Levee failure would include the walls or interior of a levee allowing water to inundate the area that the levee is meant to protect.

Potential Impact on Existing Structures

Structures in Benton County that would be vulnerable to the effects of levee failure would include those areas lying in or near the Osage River floodplain and its tributaries and the Truman Reservoir. All public schools in the county are not subject to this hazard. Some of the Warsaw downtown area would be subject to flooding including city hall.

Potential Impact on Future Development

Impact on future development is directly related to floodplain management and regulations set forth by the county and individual communities and levee management and regulations which are not clearly defined. Because most levees in Benton County are not regulated or inspected by

any one agency it is difficult to predict what path future development will follow. It is important to note that levees in Benton County are located in designated floodplains. Currently Benton County does not have any zoning and building regulations to prevent anyone from building within this floodplain area. Also, there is no knowledge of any future development by any public school districts that would be vulnerable to this hazard.

3.4.8 Severe Winter Weather Vulnerability

Jurisdictions: All jurisdictions

Overview

Benton County sometimes suffers from heavy damage due to severe winter storms and therefore most winter storms impact the community only temporarily. It is not uncommon for a severe winter storm to leave a long lasting mark on the community by inflicting heavy financial damage on the area but storms of this magnitude are rare.

Potential Impact on Existing Structures

A series of small winter storms can impact several jurisdictions. This increases the financial burden on communities and can have a more far reaching economic impact. Below are listed the many impacts severe winter storms can have on Benton County.

- **Life and Property-** Many deaths from winter storms are a result of traffic accidents caused by a combination of poor driving surfaces and driving too fast for the conditions. Accidents during winter storms can be particularly devastating for often multiple cars are involved. There are also specific sections of the community that are more vulnerable than others to the complications caused by Severe Winter Weather such as the elderly. Elderly are the most susceptible to complications from excessive and/or prolonged cold or heat. According to the US Census Bureau website the estimated 2010 elderly population for Benton County stands at 5,488. The 2008 elderly population was unavailable for this area.

- **Roads and Bridges-** Roads and bridges serve as vital arteries for all residents. Winter storms often limit the effectiveness of transportation by making driving conditions difficult and unsafe. Emergency vehicles also have trouble operating in these conditions that slow down response times thus limiting their effectiveness in an emergency.

- **Power Lines-** Ice storms often adversely impact consistent power supplies. The ice can build up on the wires causing them to fall or the ice can lead to falling tree limbs which then knock down power lines. Fallen wires and limbs can damage vehicles and pedestrians. When this occurs power outages can be dangerous. For instance, if the population relies on electricity for heat and the electricity does not work for a long time, people run the risk of hypothermia. This is a particular concern for more vulnerable populations such as the elderly.

- **Water Lines-** Winter storms and their associated cold weather lead to the ground freezing and thawing. As the ground freezes and thaws, pipes in the ground shift and sometimes break causing a lack of potable water. Also, when a pipe breaks, damage to property can be extensive and expensive with the cost falling on the property owner, not the city.

Currently, there is not a reliable or accurate way to estimate costs associated with winter storms. Too many variables exist to accurately portray how much damage would be incurred by a winter storm. For instance, the cost of a snowstorm that dropped 20 inches would be different than an ice storm that causes different types of damage and challenges to infrastructure. Locations of heavier snow accumulation, time of day, and other characteristics would all play a role in determining the cost of a winter storm. There have been 15 ice/snow storms since the previous plan was published in 2004/2005.

Potential Impact on Future Development

Potential impacts of this hazard on future development are not quantifiable with the resources available.

3.4.9 Tornado/Thunderstorm Vulnerability

Jurisdictions: All jurisdictions

Overview

All jurisdictions in Benton County are vulnerable to the effects of tornadoes and thunderstorms. All above ground structures are vulnerable to the effects of a tornado or thunderstorm and all other hazards associated with them (hail, rain, flooding, flying debris, etc.) According to NOAA, a tornado is a violently rotating column of air extending from a thunderstorm to the ground. Tornadoes may appear nearly transparent until dust and debris are picked up or a cloud forms within the funnel. The average tornado moves from southwest to northeast, but tornadoes have been known to move in any direction. Currently, none of the municipalities in Benton County have FEMA 361 standard storm shelters.

Other hazards associated with tornadoes include;

- Hail
- Downbursts
- Heavy Rains
- Lightning
- Flash Flooding
- Straight-Line Winds

Benton County has been hit by 25 tornadoes since 1950 with none causing significant loss of life. In 1982 a tornado touched down causing 2.5 million dollars in damages. Overall, Benton County has had 4.8 million dollars shifted to tornado events. That is not to say that the prevention of just one loss of life shouldn't be a high priority.

Potential Impact on Existing Structures

While past impacts have been relatively minimal, future disasters can cause extensive damage. There is a wide range of impact possible from a tornado or thunderstorm and wind speeds effect all structure types differently. Non-permanent and wood framed structures are very vulnerable to high winds in terms of destruction. While high winds are the force behind damage, it is the windblown debris that causes the most damage and deaths from a tornado.

Potential Impact on Future Development

Because of the random nature of this hazard, potential impacts of this hazard on future development is not quantifiable with the resources available.

3.4.10 Wildfire Vulnerability

Jurisdictions: All jurisdictions

Overview

Wildfires in Benton County tend to be limited in their spatial extent thus minimizing their impact. According to the Missouri Department of Conservation, 49% of all wildfires in Missouri result from debris burning that gets out of hand and starts a wildfire. People and structures in the path of a wildfire are all at risk of minimum to extensive damage. Wildfire is defined as an uncontrolled fire that destroys forests and many other types of vegetation, as well as animal species.

Potential Impact on Existing Structures

Currently, there is not a reliable or accurate way to estimate costs associated with a wildfire event. Too many variables exist to accurately portray how much damage would be incurred by a wildfire. For instance, the cost of a wildfire that strikes structures versus cropland versus forestland would all be different. Locations of the fire, time of day, and other characteristics would all play a role in determining the cost of a wildfire. Fire suppression methods also vary depending on existence of structures. Some wildfires are allowed to burn themselves out which means minimal cost for suppression. There have been two “reported” wildfires since 1999.

Potential Impact on Future Development

Potential impacts of this hazard on future development are not 100% quantifiable with the resources available.

3.5 Jurisdictional Vulnerability Variations

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.

Vulnerability is defined by FEMA as the extent to which people will experience harm and property will be damaged from a hazard.

Table 3.5.1 shows the vulnerability ratings for the Planning Area as a whole and for each participating jurisdiction. Vulnerability was assessed by averaging probability and severity measurements for each hazard (see Section 3.2). Numeric values were given to each rating as follows: Low = 1, Moderate/Medium = 2, High = 3. The ratings for probability and severity were added and averaged, then rounded up to arrive at the vulnerability rating. The rating scale used for vulnerability is located within Table 3.5-1.

Below the measures of Probability and Severity have been restated.

Measure of Probability – The likelihood that the hazard will occur.

- Low – The hazard has little or no chance of happening (less than 1 percent chance of occurrence in any given year)
- Moderate – The hazard has a reasonable probability of occurring (between 1 and 10 percent chance of occurrence in any given year).
- High – The probability is considered sufficiently high to assume that the event will occur (between 10 and 100 percent chance of occurrence in any given year).

Measure of Severity – The deaths, injuries, or damage (property or environmental) that could result from the hazard.

- Low – Few or minor damage or injuries are likely; death is possible, but not likely.
- Moderate – Injuries to personnel and damage to property and the environment is expected; death is possible.
- High – Major injuries/death and/or major damage will likely occur
A vulnerability rating highlighted in yellow indicates where the vulnerability in a Jurisdiction varies from the overall vulnerability of the Planning Area.

Table 3.5-1

Participating Jurisdictions' Vulnerability										
	Property Damage					Injury and Death				
N/A	Not Applicable					Not Applicable				
L	0-5%					Little or None				
M	5-10%					Injuries Possible				
H	10-100%					Major Injuries and Death Likely				
	Dam Failure	Drought	Earthquake	Extreme Heat	Flood	Land Subsidence/ Sinkhole	Levy Failure	Severe Winter Weather	Tornado and Thunderstorm	Wildfire
Planning Area	M	M	L	M	H	L	M	M	H	M
Benton County	M	M	L	M	H	L	M	M	H	M
Cole Camp	L	M	L	M	M	L	M	M	H	L
Lincoln	L	M	L	M	L	L	L	M	H	L
Warsaw	M	L	L	M	H	L	H	M	H	L
Cole Camp R-1 School District	L	N/A	L	M	N/A	L	N/A	M	H	L
Lincoln R-II School District	L	N/A	L	M	N/A	L	N/A	M	H	L
Warsaw IX School District	L	N/A	L	M	N/A	L	N/A	M	H	L

The following portion of this section assesses variations in vulnerability and provides information on structures exposed to potential hazards in jurisdictions that vary from the overall Planning Area. Data was provided by participating jurisdiction's insurance information, the Benton County Assessor's office, US Army Corps of Engineers, HAZUS MH, and the State Emergency Management Agency (SEMA).

Variations in vulnerability are based on data found throughout this plan. Vulnerable structures were calculated by applying the maximum percentage correlating with the vulnerability rating as seen in the following figure.

Note that ratings for dam failure are based on estimates of homes that lie within a half mile downstream of a high hazard dam. Due to the current lack of inundation studies, dam failure estimates are not exact and may change when proper inundation data is collected.

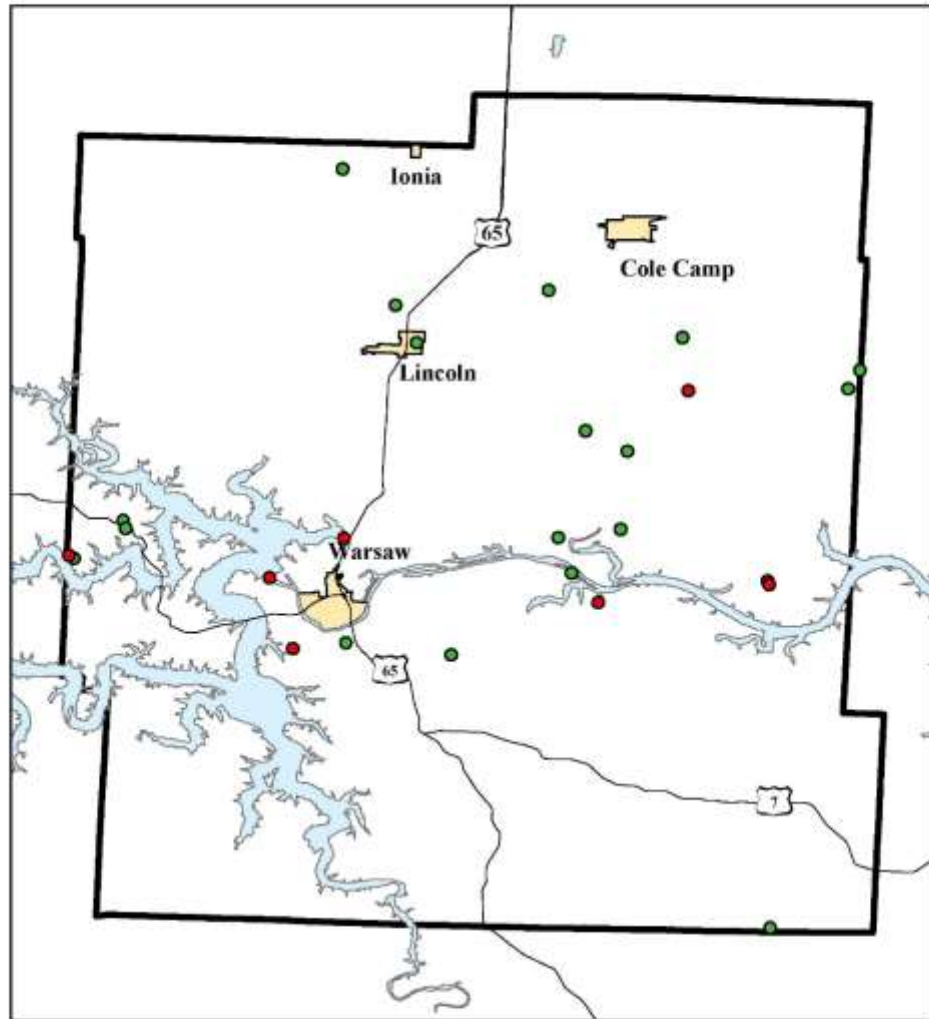
Dam Failure

Parcel data for areas downstream of high hazard dams is shown in Section 3.4.1. Warsaw and Hartsburg received “Medium” vulnerability ratings due to the number of High Hazard dams as compared to possible affected area. Again, inundation information is not available to accurately quantify vulnerability.

Jurisdictions at greater risk:

Benton County and Warsaw

Benton County



Legend

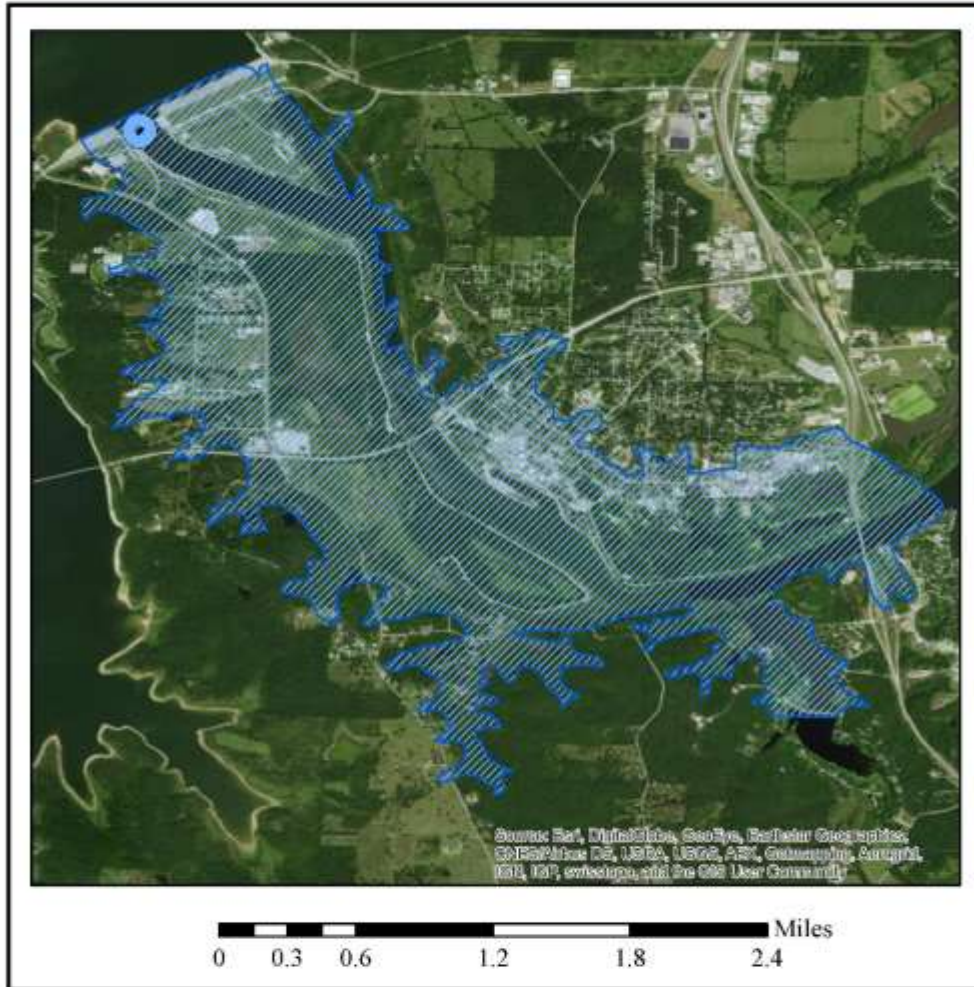
- High Hazard
- Low Hazard
- Roads
- Lakes
- City Boundary

0 3,300 6,600 13,200 19,800 26,400 Meters
1 inch = 9,041 meters



Date: 2/5/2016

Harry S. Truman Reservoir



Author: Cyn
Date: 6/29/2016

Harry S. Truman Lake is the largest concern for the entire county. All other dam maps are listed in Section 3.

Drought

According to the 2007 US Census of Agriculture, 47% of Benton County land use is tied to farming activities. The Missouri State Drought Plan states that rural areas in the state are more vulnerable to the effects of drought. Incorporated jurisdictions are less vulnerable to the effects of drought due to suburban infrastructure.

Jurisdictions at greater risk:

Benton County

Flooding

Portions of Warsaw lay within the 100 year flood plain. Specific value assessment data for these communities is addressed in Section 3.4.5. An updated DFIRM for Benton County is available and included. In addition to those communities that are at high risk for ravine flooding, all other jurisdictions experience some type of complication associated with flash flooding due to storm water runoff or sheet flooding. These other jurisdictions were given a rating a low vulnerability because probability and severity were also low for these areas.

Jurisdictions at greater risk:

Warsaw and unincorporated Benton County

Warsaw

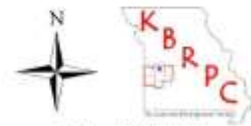


0 255 510 1,020 1,530 2,040 Meters

1 inch = 692 meters

Legend

- City Boundary
- Flood Zone



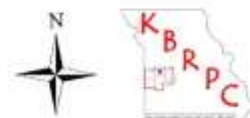
Date: 2/23/2016

Lincoln



0 255 510 1,020 1,530 2,040 Meters
1 inch = 694 meters

- Legend**
- City Boundary
 - Flood Zone



Date: 2/23/2016

Levee Failure

Warsaw lies behind levees that are part of the Army Corps of Engineers Rehabilitation Program. There are no formal levee districts but rather a few owned privately and there are two levees in the National Levee Database (NLD) by the USACE. Most areas behind these levees are in designated floodplains. Privately owned levees are maintained by their owners. Official data on the locations of private levees is not available. Figure 3.5-2 depicts general levee locations around the jurisdictions of Warsaw.

Jurisdictions at greater risk:

Warsaw and unincorporated Benton County

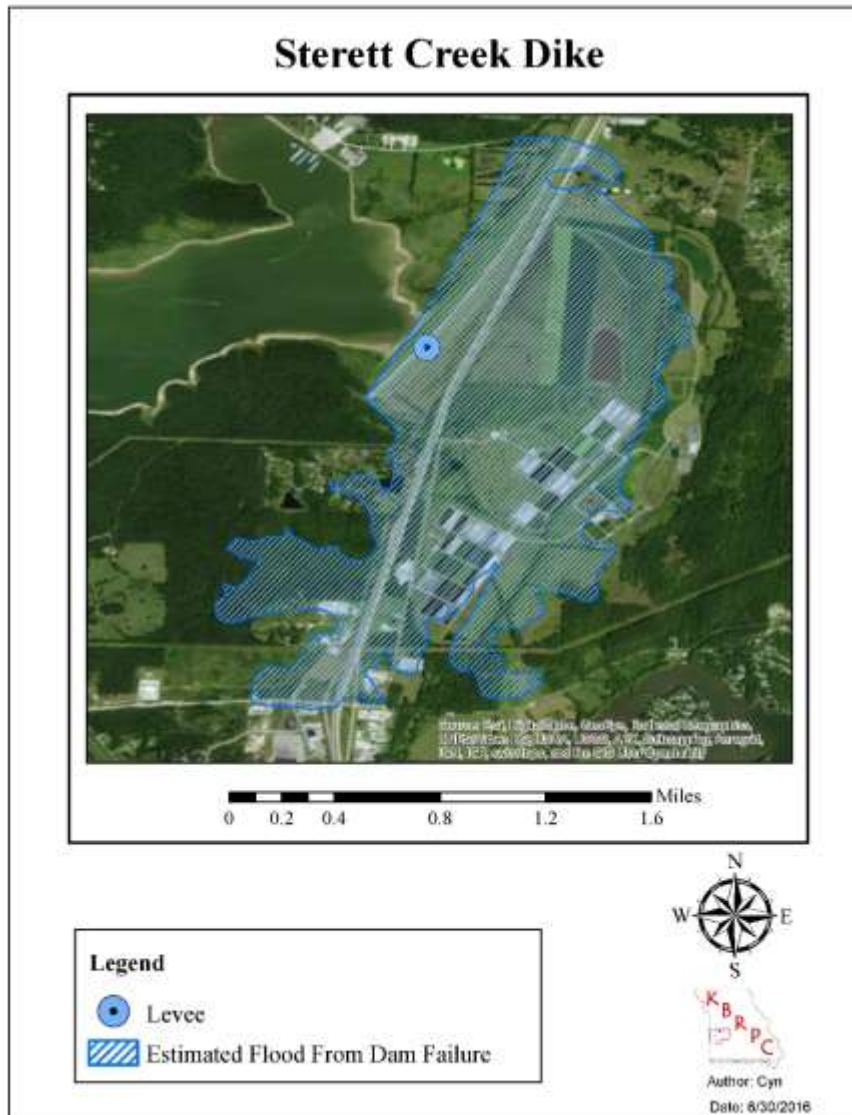


Figure 3.5-2 Depicts major levees in comparison to Warsaw proper.



Wildfire

As stated in Section 3.2.10, Wildfire in Benton County generally stems from human activities such as burning garden plots, trash, and brush. Because these activities occur more frequently in rural, unincorporated areas of Benton County those areas at greater risk.

According to statistics from the Missouri Department of Conservation (see Section 3.2.10, Figure 3.41), rural areas of Benton County and the rural/urban interfaces are most at risk from wildfires. From January, 2005 until the present, there have been 14,598 acres affected by wildfire according to the MDC's Forest Fire Reporting.

















The jurisdiction of Warsaw are placed in a higher risk category due to the WUI (Wildland Urban Interface) in those communities. More information on the WUI can be found in Section 3.2.10.

Jurisdictions at greater risk:

Benton County

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, SIA, and the 3D User Community

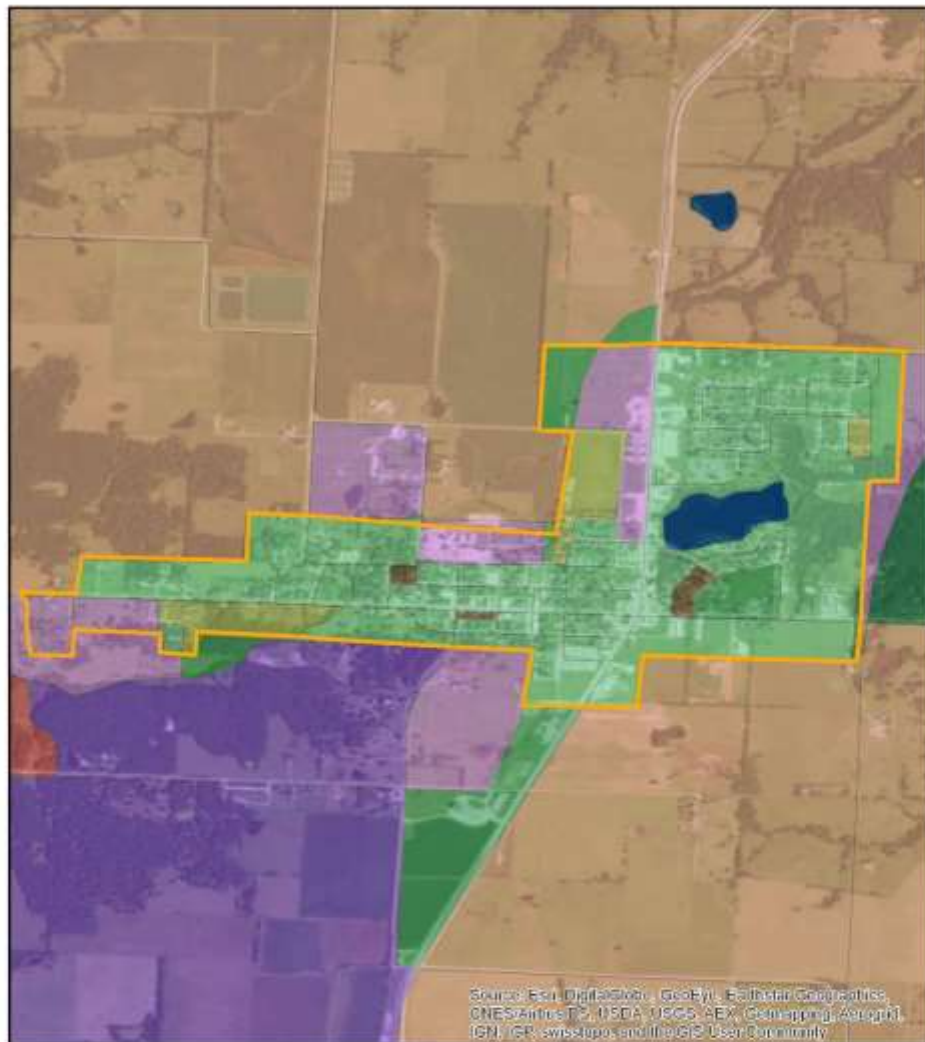
Legend

	City Boundary		Med_Dens_Intermix		Uninhabited_NoVeg
	County Boundary		Low_Dens_Intermix		Uninhabited_Veg
	High_Dens_Interface		High_Dens_NoVeg		Very_Low_Dens_NoVeg
	Med_Dens_Interface		Med_Dens_NoVeg		Very_Low_Dens_Veg
	Low_Dens_Interface		Low_Dens_NoVeg		Water
	High_Dens_Intermix				



Kaysinger Basin Regional Planning Commission

Lincoln - Wildfire Urban Interface



0 550 1,100 2,200 3,300 4,400 Feet

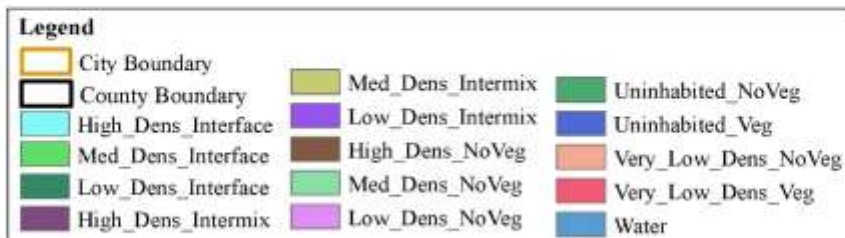
Legend

City Boundary	Med_Dens_Intermix	Uninhabited_NoVeg
County Boundary	Low_Dens_Intermix	Uninhabited_Veg
High_Dens_Interface	High_Dens_NoVeg	Very_Low_Dens_NoVeg
Med_Dens_Interface	Med_Dens_NoVeg	Very_Low_Dens_Veg
Low_Dens_Interface	Low_Dens_NoVeg	Water
High_Dens_Intermix		



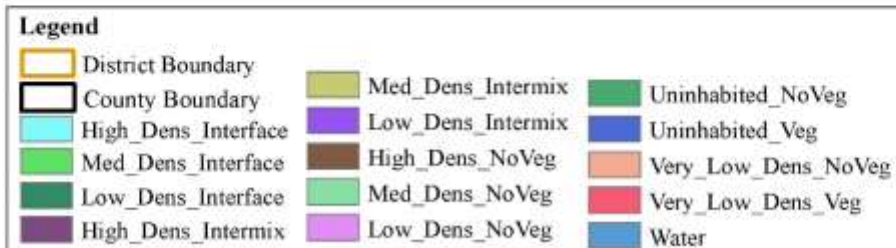
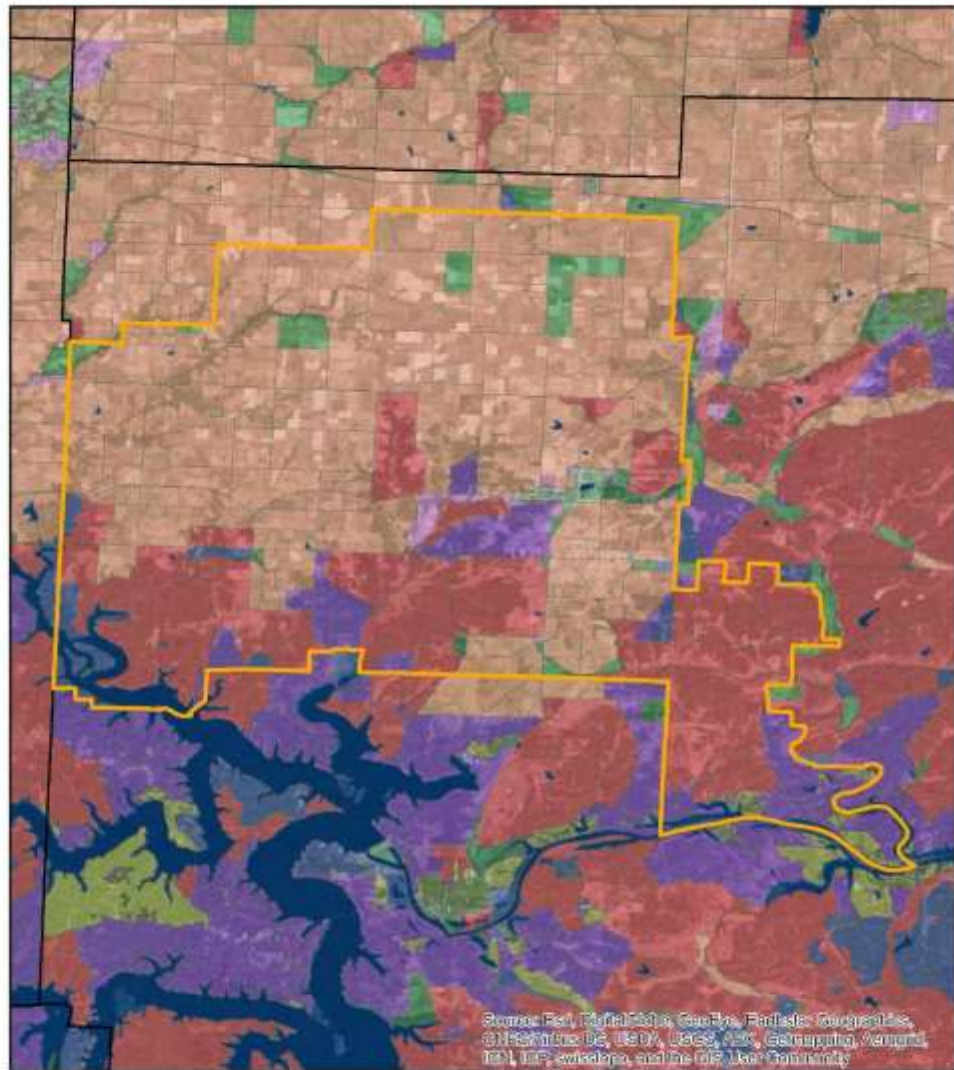
Source: Bart, Donald, *San Joaquin Hills*, Center for Geographic Information, Los Angeles, 1999. Map is a composite of aerial photos, 1954, 1967, and the 2000 Census.

0 600 1,200 2,400 3,600 4,800 Feet

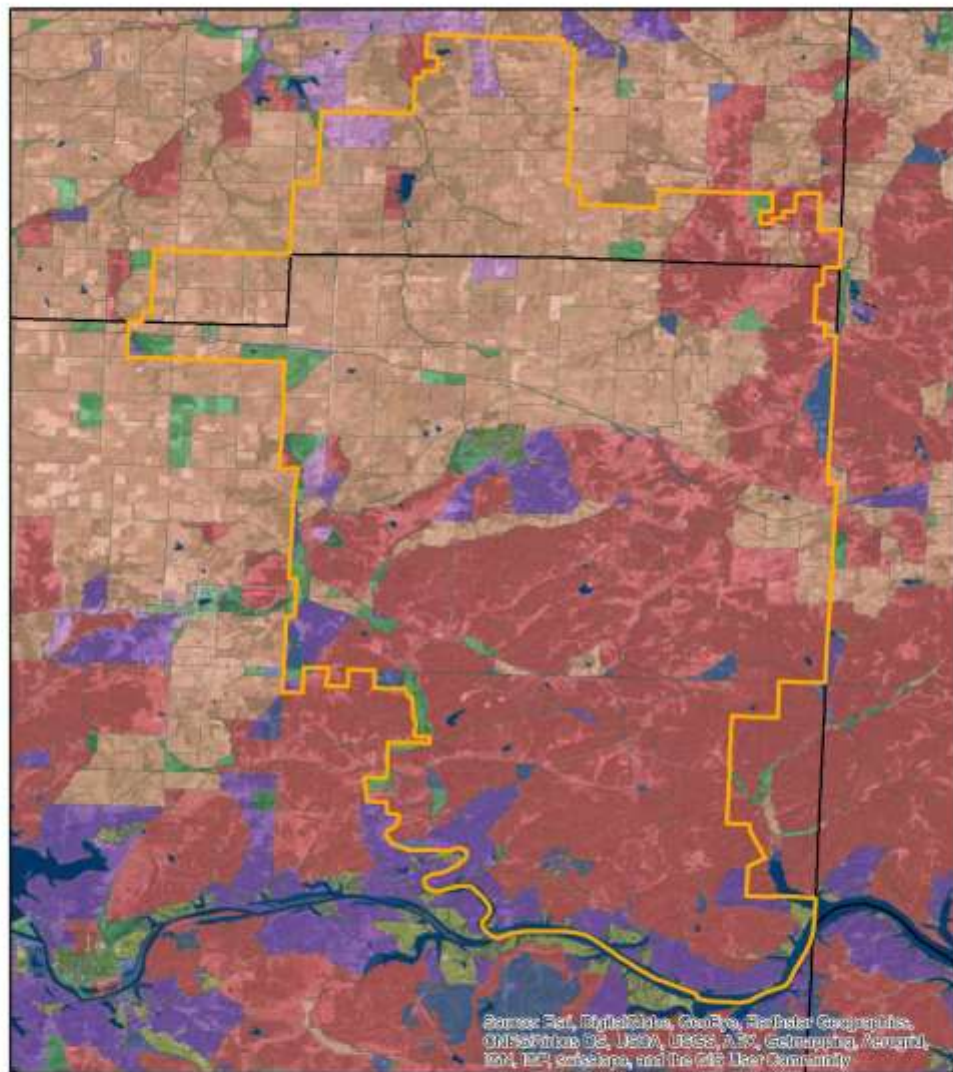



 Date: 3/4/201

Cole Camp R-I Schools - Wildfire Urban Interface



Lincoln R-II Schools - Wildfire Urban Interface



0 5,500 11,000 22,000 33,000 44,000 Feet

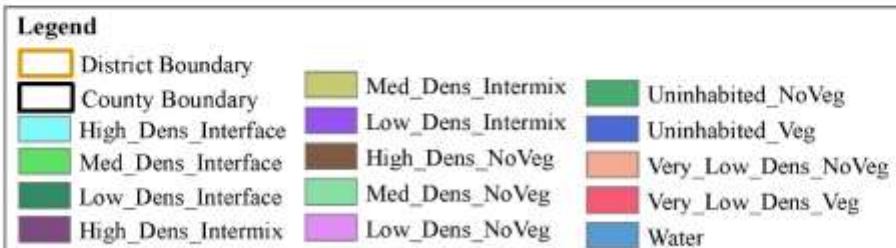
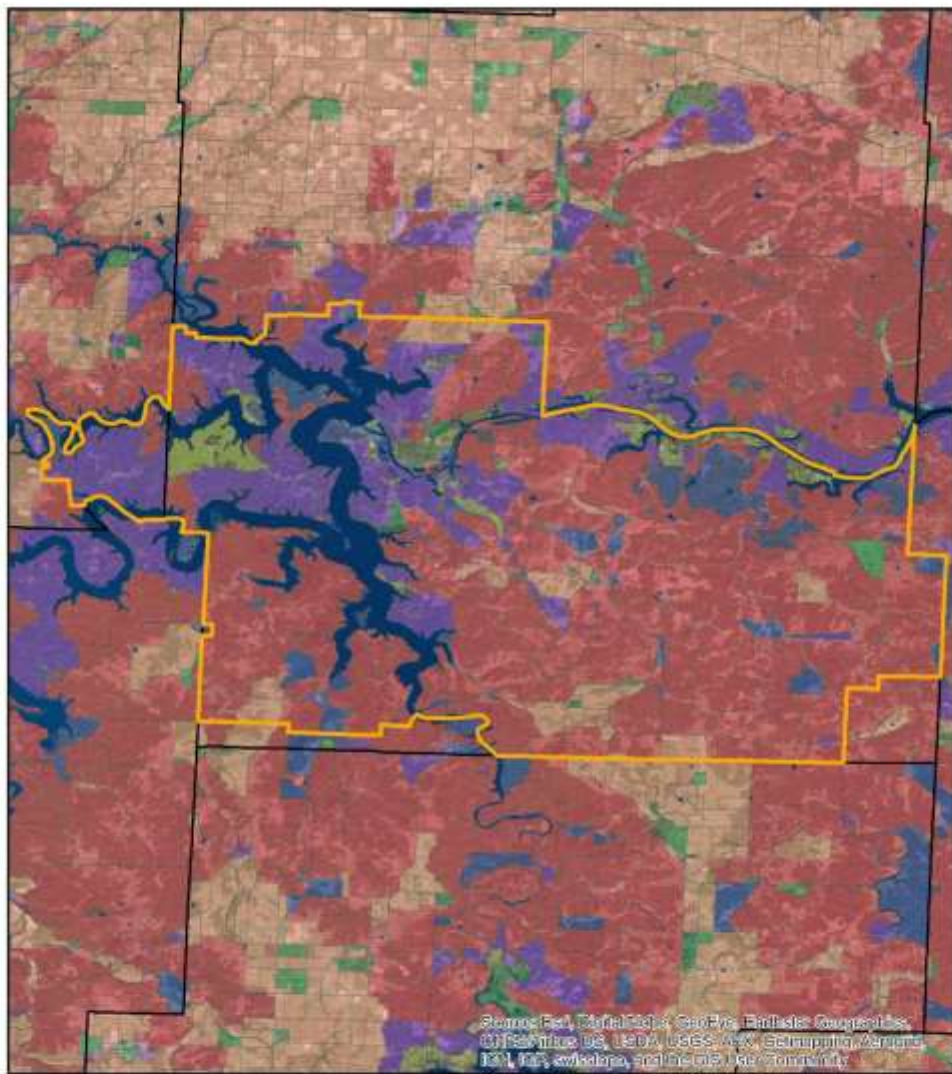
Legend

District Boundary	Med_Dens_Intermix	Uninhabited_NoVeg
County Boundary	Low_Dens_Intermix	Uninhabited_Veg
High_Dens_Interface	High_Dens_NoVeg	Very_Low_Dens_NoVeg
Med_Dens_Interface	Med_Dens_NoVeg	Very_Low_Dens_Veg
Low_Dens_Interface	Low_Dens_NoVeg	Water
High_Dens_Intermix		



Date: 4/26/2016

Warsaw R-IX Schools - Wildfire Urban Interface



Date: 4/26/2016

Section 4 Mitigation Strategies

4.1 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.

Hazard mitigation goals were developed during the planning process for the original Benton County Hazard Mitigation Plan in 2004. For the current update, the Hazard Mitigation Technical Steering Committee reviewed these goals; language changes were made for clarification while retaining the essential focus of the original goals.

The Six county hazard mitigation goals for the Benton County Hazard Mitigation Plan (2015) are:

- Goal 1: Prevention-Reduce risks and vulnerabilities of people in hazard-prone areas
- Goal 2: Property Protections-Reduce the potential impact of natural disasters on new and existing properties and infrastructure and the local economy.
- Goal 3: Natural Resource Mitigation-Promote education, outreach, research, and development programs to improve the knowledge and awareness among the citizens and industry about natural hazards they may face.
- Goal 4: Emergency Services-Strengthen communication and coordinate participation between public agencies, citizens, non-profit organizations, business, and industry to create a widespread interest in mitigation.
- Goal 5: Structural Hazard Mitigation-Establish priorities for reducing risks to the citizens/ business owners and their property with emphasis on long-term and maximum benefits to the public.
- Goal 6: Resources-Secure resources for investment into hazard mitigation.

4.2 Update 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.

The original Project Steering Committee (2004-2005) was charged with developing a comprehensive range of mitigation actions to promote the agreed upon mitigation goals. Objectives were defined under each goal and the mitigation actions were then developed to promote each objective. The following six categories of mitigation were considered in developing the mitigation actions:

- **Prevention tools** - regulatory methods such as planning and zoning, building regulations, open space planning, land development regulations, and storm water management.
- **Property protection measures** - acquisition of land, relocation of buildings, modifying at-risk structures, and flood proofing at-risk structures.
- **Natural resource protection** - erosion and sediment control or wetlands protection.
- **Emergency services measures** – warning systems, response capacity, critical facilities protection and health and safety maintenance.
- **Structural mitigation** - reservoirs, levees, diversions, channel modifications and storm sewers.
- **Public information** - providing hazard maps and information, outreach programs, real estate disclosure, technical assistance and education.

No mitigation actions were eliminated from consideration when the original plan was written in 2004-2005. The 2005 plan therefore contained a comprehensive list of mitigation actions which served as a starting point for update discussions.

The Technical Steering Committee for the update (2015) reviewed and discussed all the mitigation actions from the original plan. The current status of all of the existing mitigation actions from the original plan were evaluated.

In order to ensure that there was a comprehensive mitigation approach to each hazard, there was a discussion of each hazard and the existing actions focused on its mitigation. This approach was useful in developing appropriate new actions, when deemed important.

The existing actions were divided into the three categories of completed, deleted, or new.

Descriptions of the three categories are as follows:

- **Completed** – Actions have been completed; these actions have been included in the appropriate “Existing Mitigation Strategies” in Section 3.2 Profiling Hazards.
- **Deleted** – Actions were deemed unrealistic or inappropriate for the jurisdictions involved.
- **New** - Actions not included in the original plan but deemed important and appropriate for the updated plan; these were added to the plan.

The actions in each of these categories, along with explanatory information, can be seen in Tables 4.2-1 – 4.2-3. The charts for completed and deleted actions use the goal language of the original plan; the deferred and new action charts use the updated language for the goals. Not all of the new actions originated with the Hazard Mitigation Technical Steering Committee. There was a separate Educators Meeting (in the 2010 update) where three of the four actions pertaining to the school districts was written. In addition, some of the communities which are participating jurisdictions added new actions specific to their communities.

Mitigation Actions Completed by Benton County Hazard Mitigation Plan Since 2005			
Goals, Objectives, and Actions	Priority Rank/Target Date	Evaluation	Outcome
Goal # 1: Reduce risks and vulnerabilities of people in hazard-prone areas			
Objective 1.1: Advise the public about health and safety precautions to guard against injury and loss of life from natural hazards			
Education program on personal emergency preparedness (turning off utilities, preparing emergency medical kits for homes and businesses)	High	Task Force Formed Emergency drills incorporated monthly at schools	The City of Warsaw now has flood regulations and the local health dept. has (ready-in-3) pamphlets
Secure Funding for early warning systems, improve communications systems, GIS/GPS systems and mitigation projects.	Medium	MOSWIN communication system installed	The City of Warsaw now has MOSWIN radio communications system in place.
Objective 1.2: Use the latest technology to provide adequate warning, communication, and mitigation of hazardous events			
Assist communities with securing funding for early warning systems, improved communication systems, and mitigation projects	High	City Formed	Some cities have purchased weather radios to place in city halls and law enforcement offices, as well as purchased radios in bulk to sell at discounted price for the public.

Objective 1.3: Reduce danger to and enhance protection of dangerous areas during hazardous events			
Assist communities/county in securing funding for road and bridge improvements	Medium	TIGER funding for bridge upgrades secured.	Benton County is members of KBRPC and thus is part of the Regional Transportation Plan to identify problem roads/bridges.
Goal # 2: Reduce the potential impact of natural disasters on new and existing properties and infrastructure and the local company.			
Objective 2.3: Use regulation to ensure that development will not put people in harm's way or increase threats to existing properties			
Encourage minimum building standards for building codes in all cities	High	County Commission	All three cities have minimal building codes in place
Goal # 3: Reduce the potential impact of natural disasters on new and existing properties and infrastructure and the local company.			
Objective 3.2: Publicize and encourage the adoption of appropriate hazard mitigation measures by county and city governments.			
Cities/counties will continually re-evaluate the hazard mitigation plan and merge with other community planning	High	County Commission	City of Warsaw completed a comprehensive community plan with codes and regulations in 2015.
Goal # 4: Strengthen communication and coordinate participation between public agencies, citizens, non-profit organizations, business, and industry to create a widespread interest in mitigation.			
Objective 4.1: Build and support local partnerships to continuously become less vulnerable to hazards.			

Encourage joint meetings of different organizations/agencies for emergency planning	Medium/Ongoing	City/County EMD	One of the meetings KBRPC held involved the local Health Dept., 911, Fire, EMT's, City mayors, county commissioners.
Goal # 5: Establish priorities for reducing risks to the people and their property with emphasis on long term and maximum benefits to the public rather than short term benefit of special interest.			
Objective 5.1: Incorporate hazard mitigation into the long range planning and development activities of the county and each jurisdiction			
Encourage communities to budget for enhanced warning systems	Revision	City/County EMD	The Village of Ionia recently purchased a tornado siren.
Examine potential road and bridge upgrades that would reduce danger to residents during occurrences of natural disasters	Medium	City/County EMD	While updating this plan, the county listed problem roads
All communities need to develop storm water management plans	Medium	County Commission/ City Government	The City of Cole Camp has established storm water management plans.

Mitigation Actions Deleted for 2010 Updates Benton County Hazard Mitigation Plan 2005

Goals, Objectives, and Action	Reason for Deletion
Goal # 2: Reduce the potential impact of natural disasters on new and existing properties and infrastructure and the local economy.	
<i>Objective 2.1: Implement cost-effective activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards</i>	
Encourage a self-inspection program at critical facilities to assure that the building infrastructure is earthquake and tornado resistant.	This was deemed a low priority and is difficult to influence this action.
Goal # 3: Promote education, outreach, research and development programs to improve the knowledge and awareness among citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.	
<i>Objective 3.2: Provide information on tools, partnership, opportunities, and funding resources to assist in implementing mitigation activities</i>	
Ask SEMA specialist to present information to city councils, county commissions, KBRPC, and Benton County Emergency Planning Committee	This was deemed a high priority, but is not the responsibility of SEMA and is difficult to implement with the work loads.
Encourage local residents to purchase weather radios through press releases and brochures	Redundant, this was mention earlier in Goal 1, Objective 1.2
Goal # 6: Secure resources for investment in hazard mitigation	
<i>Objective 6.2: Encourage participation of property owners in investing in hazard mitigation projects on their own properties</i>	
Encourage cities and counties to implement cost sharing programs with private property owners for hazard mitigation projects that benefit the community as a whole.	This was deemed a low priority and is unrealistic.

New Mitigation Actions for 2010 Benton County Hazard Mitigation Plan

Goal # 3: Promote education, outreach, research and development programs to improve the knowledge and awareness among citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.

Objective 3.4: Educate the public on actions they can take to prevent or reduce the loss of life and property from all natural hazards

Review and formalize relationships with warming and cooling centers in each community.

Goal # 5: Establish priorities for reducing risks to the people and their property with emphasis on long term and maximum benefits to the public rather than short term benefit of special interest.

Objective 5.1: Incorporate hazard mitigation into the long range planning and development activities of the county and each jurisdiction

Add sinkhole regulations to stream water and/or storm water ordinances

Mitigation Actions Deleted for 2015 Updates Benton County Hazard Mitigation Plan 2005

Goals, Objectives, and Action	Reason for Deletion
Goal # 1: Reduce risks and vulnerabilities of people in hazard prone areas.	
<i>Objective 1.3: Reduce danger to and enhance protection of, dangerous areas during hazardous events.</i>	
Tree trimming programs and dead tree removal.	This was deemed a low priority and is difficult to influence this action, also due to programs already in place by utility companies.
Goal # 5: Establish priorities for reducing risks to the people and their property with emphasis on long term and maximum benefits to the public rather than short term benefits of special interest.	
<i>Objective 5.1: Incorporate hazard mitigation into the long range planning and development activities of the county and each jurisdiction</i>	
Add sinkhole regulations to stream water ordinances if not already in place	DNR, MDC, EPA and other entities already have regulations that require permits, committee see this goal as already enforced.

New Mitigation Actions for 2015 Benton County Hazard Mitigation Plan

Goal # 1: Reduce risks and vulnerabilities of people in hazard prone areas.

Objective 1.3: Reduce danger to and enhance protection of, dangerous areas during hazardous events.

Action Step 1.3.1 Use and promote social media and smart phone applications, to inform county residents of impending disasters.

Goal # 4: Strengthen communication and coordinate participation between public agencies, citizens, non-profit organizations, business, and industry to create a widespread interest in mitigation.

Objective 4.2: Encourage active participation and responsibility of chief elected officials in mitigation planning and activities.

Improve overall communications on a local and multijurisdictional level.

4.3 Mitigation Goals, Objectives, and Actions

A comprehensive list of the goals, objectives, and mitigation actions for the Benton County Hazard Mitigation Plan (2016) follows. The mitigation actions listed are for the entire Planning Area; participating jurisdictions will differ in the specific actions undertaken in their jurisdictions. The mitigation actions for each participating jurisdiction are included under Prioritization, Implementation, and Administration (Section 4.4).

Actions which address reducing the effects of hazards on new and/or existing buildings and infrastructure are indicated as such in parentheses following the actions (i.e. New, Existing, Both).

For some of the actions, one or more participating jurisdictions slightly altered the language of the action written by the Technical Steering Committee to make it more specifically relevant.

Goal 1: Reduce risks and vulnerabilities of people in hazard prone areas.

Objective 1.1 Advise the public about health and safety precautions to guard against loss of life from natural hazards.

- 1.1.1 Education programs on personal emergency preparedness

Objective 1.2 Use the latest technology to provide adequate warning, communications, and mitigation of hazard events.

- 1.2.1 Secure funding for early warning systems, improved communications systems, GIS/GPS systems and mitigation projects
- 1.2.2 Promote the purchase of weather radios by local residents to ensure advanced warning about threatening weather or disasters
- 1.2.3 Partner with local radio stations to assure that appropriate warning is provided to county residents of impending disasters

Objective 1.3 Reduce danger to and enhance protection of, dangerous areas during hazardous events.

- 1.3.1 Use and promote social media and smart phone applications, to inform county residents of impending disasters.
- 1.3.2 Secure funding for road and bridge improvements

Goal 2: Reduce the potential impact of natural disasters on new and existing properties and infrastructure and the local economy.

Objective 2.1 Implement cost-effective activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.

2.1.1. Educate and assist businesses to develop emergency plans

Objective 2.2 Discourage new development and encourage preventative measures for existing development in areas vulnerable to natural hazards, thereby reducing repetitive losses to the NFIP.

2.2.1 Educate residents about the dangers of floodplain development and the benefits of the National Flood Insurance Program

Objective 2.3 Use regulations to ensure that development will not put people in harm's way or increase threats to existing properties.

2.3.1 Educate and assist communities in developing minimum building standards for building codes in all cities

2.3.2 Develop and implement regulations for the securing of hazardous materials, tanks, and mobile homes

Goal 3: Promote education, outreach, research and development programs to improve the knowledge and awareness among citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.

Objective 3.1 Heighten public awareness of the full range of natural hazards by developing education and outreach programs.

3.1.1 Distribute SEMA brochures at public facilities and events

3.1.2 Regular press releases from county and city EMD offices concerning hazards, where they strike, frequency, and preparation

Objective 3.2 Publicize and encourage the adoption of appropriate hazard mitigation measures by county and city governments.

3.2.1 Cities/counties will continually re-evaluate the hazard mitigation plan and merge with other community planning

3.2.2. Press releases by cities/county regarding adopted mitigation measures to keep public abreast of changes and/or new regulations

Objective 3.3 Educate the public on actions they can take to prevent or reduce the loss of life and property from all natural hazards.

3.3.1 Publicity campaigns by county health department and local American Red Cross chapter that make residents aware of proper measures to take during times of extreme heat or cold

3.3.2 Increase the number of relationships with the warming and cooling centers in each community

3.3.3 Publicize county or city-wide drills

Goal 4: Strengthen communication and coordinate participation between public agencies, citizens, non-profit organizations, business, and industry to create a widespread interest in mitigation.

Objective 4.1 Build and support local partnerships to continuously become less vulnerable to hazards.

4.1.1 Develop joint meetings with different organizations/agencies for emergency planning

4.1.2 Joint training or drills between agencies, public and private entities including schools and businesses

4.1.3 Develop a database & pool different agency resources to achieve widespread results

Objective 4.2 Encourage active participation and responsibility of chief elected officials in mitigation planning and activities.

4.2.1 Hold meetings between city, county EMD's, and elected officials to familiarize everyone with mitigation planning, implementation, and budgeting for mitigation projects

4.2.2 Improve overall communications on a local and multijurisdictional level.

Goal 5: Establish priorities for reducing risks to the people and their property with emphasis on long term and maximum benefits to the public rather than short term benefits of special interest.

Objective 5.1 Incorporate hazard mitigation into the long range planning and development activities of the county and each jurisdiction

5.1.1. Secure resources for enhanced warning systems

5.1.2 Road and bridge upgrades that would reduce danger to residents during occurrences of natural disasters

5.1.3 Develop storm water management plans for all communities

5.1.4 Coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures

5.1.5 Require contractor storm water management plans in all new development both residential and commercial properties

Objective 5.2 Promote beneficial uses of hazardous areas while expanding open space and recreational opportunities.

5.2.1 Local governments to purchase properties in the floodplain as funds become available and convert that land into public/recreational space

5.2.2 Zone areas in floodplain as open space as needed

Goal 6: Secure resources for investment in hazard mitigation.

Objective 6.1 Research the use of outside sources for funding.

6.1.1 Work with SEMA coordinator to learn about new mitigation funding opportunities

6.1.2 Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns can be met

6.1.3 Work with state/local/federal agencies to include mitigation in all economic and community development projects

Objective 6.2 Encourage participation of property owners in investing in hazard mitigation projects on their own properties.

6.2.1 Implement public awareness program about the benefits of hazard mitigation projects, both public and private

Objective 6.3 In the event of a disaster declaration be prepared to apply for hazard mitigation with prioritized projects.

6.3.1 Prioritize mitigation projects, based on cost effectiveness and largest threatened population/property

Overview of Mitigation Actions by Hazards Addressed and Participating Jurisdictions

An overview of the mitigation actions, the hazards addressed, and the participating jurisdictions to which they apply is shown in the following table. The following abbreviations have been used for hazards:

DF – Dam Failure
D – Drought
EQ – Earthquake
H – Extreme Heat
F – Flood
SK – Land Subsidence/Sinkhole
LF – Levee Failure
W – Severe Winter Weather
T – Tornado and Thunderstorm
WF - Wildfire

Note: Starting on page 217 and going to page 237, is a strategic plan for the county. In the responsible parties and partner’s columns, it lists names and at the bottom of the cell is letters i.e. “A, CC, L, UA” which corresponds to the table legend at the bottom of each page. The legend lists all the responsible parties.

NEED: Natural Hazard Mitigation						Strategy: <div><div></div> Existing</div> <div><div></div> New</div>				
Goal 1: Reduce risks and vulnerabilities of people in hazard-prone areas.										
Objectives:						Targets Achieved				
1.1-Advise the public about health and safety precautions to guard against loss of life from natural hazards.						Qtr. 1 4	Qtr. 2	Qtr. 3	Qtr.	
1.2-Use the latest technology to provide adequate warning, communication and mitigation of hazard events.										
1.3-Reduce the danger to, and enhance protection of, dangerous areas during hazard events.										
Action Steps	Responsible Parties	Anticipated Start Date	Anticipated End Date	Status	Priority	Hazards Addressed and Effects	Potential Funding Sources	Projected Cost	Benefits	Partners
1.1.1 Education program on personal emergency preparedness.	County and Local EMD A	1-5 yrs.	Ongoing	Monthly drills started at schools	High	All 4	State and Local Funding	Low	High	Jurisdictional EMD; Emergency Personnel
1.2.1 Secure funding for early warning systems, improved communications systems, GIS/GPS systems and mitigation projects.	County and Local EMD; School Officials A	1-5 yrs.	Ongoing	Phase 1 of MOSWIN in place at Warsaw	Medium	T;F;W ; E; D 4	Federal and State program funding	Low	High	County Commissioners, KBRPC
Table Key:										
Hazards Addressed: A- All Hazards, T- Tornado and Thunderstorm, F- Flood, W- Severe Winter Weather, D- Drought, H- Extreme Heat, EQ- Earthquake, DF- Dam Failure, SK- Land Subsidence/Sinkhole, LF- Levee Failure, WF- Wildfire										
Effect on Buildings: 1- New Buildings, 2- Existing Buildings, 3- New and Existing Buildings, 4- Neither New or Existing Buildings										
Responsible Parties: A- All Participating Jurisdictions, CC- Cole Camp, L- Lincoln, W- Warsaw, CR1- Cole Camp R-I, LR2- Lincoln R-II, WR- Warsaw R-IX, C-County, UA- Unincorporated area, DED- Department of Economic Development, FD- Fire Department, DHSS- Department of Health & Senior Services, RD- Road Districts, KBRPC- Kaysinger Basin Regional Planning Commission										

Action Steps	Responsible Parties	Anticipated Start Date	Anticipated End Date	Status	Priority	Hazards Addressed	Potential Funding Sources	Projected Cost	Benefits	Partners
1.2.2 Promote the purchase of weather radios by local residents to ensure advanced warning about threatening weather or disasters.	County and Local EMD A	1-5 Yrs.	Ongoing	Purchased at cost	High	All 4	State program funding and local funds	Low	High	Media; Local Officials
1.2.3 Partner with regional radio stations to assure that appropriate warning is provided to county residents of impending disasters.	County and Local EMD; School Officials A	1-5 Yrs.	Ongoing		High	T;F;W ;H;E; D 4	Local Funding	Low	High	Regional Radio Stations
1.3.1 Use and promote social media and smart phone applications, to inform county residents of impending disasters.	A	1-5 Yrs.	Ongoing		High	A 4	Local Funding	Low	High	All
1.3.2 Secure funding for road and bridge improvements.	A	1-5 yrs.	Ongoing	Grant written 2016	Medium	All 4	Federal and State program funding	Low	High	MoDOT, KBRPC

Table Key:

Hazards Addressed: A- All Hazards, T- Tornado and Thunderstorm, F- Flood, W- Severe Winter Weather, D- Drought, H- Extreme Heat, EQ- Earthquake, DF- Dam Failure, SK- Land Subsidence/Sinkhole, LF- Levee Failure, WF- Wildfire

Effect on Buildings: 1- New Buildings, 2- Existing Buildings, 3- New and Existing Buildings, 4- Neither New or Existing Buildings

Responsible Parties: A- All Participating Jurisdictions, CC- Cole Camp, L- Lincoln, W- Warsaw, CR1- Cole Camp R-I, LR2- Lincoln R-II, WR- Warsaw R-IX, C-County, UA- Unincorporated area, DED- Department of Economic Development, FD- Fire Department, DHSS- Department of Health & Senior Services, RD- Road Districts, KBRPC- Kaysinger Basin Regional Planning Commission

NEED: Natural Hazard Mitigation						Strategy: <input checked="" type="checkbox"/> Existing <input type="checkbox"/> New				
Goal 2: Reduce the potential impact of natural disasters on new and existing properties and infrastructure and the local economy.										
Objectives: 2.1- Implement cost-effective activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards. 2.2- Discourage new development and encourage preventive measures for existing development in areas vulnerable to natural hazards, thereby reducing repetitive losses to the National Flood Insurance Program. 2.3- Use regulation to ensure that development will not put people in harm’s way or increase threats to existing properties.						Targets Achieved				
						Qtr. 1	Qtr. 2	Qtr. 3	Qtr. 4	
Action Steps	Responsible Parties	Anticipated Start Date	Anticipated End Date	Status	Priority	Hazards Addressed	Potential Funding Sources	Projected Cost	Benefits	Partners
2.1.1 Educate and assist businesses to develop emergency plans.	County and local EMD C, CC, L, W, UA	1-5 Yrs.	Ongoing		Medium	T;F;W; H;E;D 3	State and Private funding programs	Low	High	Area business owners, Media
2.2.1 Educate residents about the dangers of floodplain development and the benefits of the National Flood Insurance Program.	County, Local EMD, Flood Plain Admin C, CC, L, W, UA	1-5 Yrs.	Ongoing	Started 2002	High	F 1	Local Funding	Low	Medium	County Commissioners, Local Officials, KBRPC, SEMA; Red Cross, Media
Table Key: Hazards Addressed: A- All Hazards, T- Tornado and Thunderstorm, F- Flood, W- Severe Winter Weather, D- Drought, H- Extreme Heat, EQ- Earthquake, DF- Dam Failure, SK- Land Subsidence/Sinkhole, LF- Levee Failure, WF- Wildfire Effect on Buildings: 1- New Buildings, 2- Existing Buildings, 3- New and Existing Buildings, 4- Neither New or Existing Buildings Responsible Parties: A- All Participating Jurisdictions, CC- Cole Camp, L- Lincoln, W- Warsaw, CR1- Cole Camp R-I, LR2- Lincoln R-II, WR- Warsaw R-IX, C-County, UA- Unincorporated area, DED- Department of Economic Development, FD- Fire Department, DHSS- Department of Health & Senior Services, RD- Road Districts, KBRPC- Kaysinger Basin Regional Planning Commission										

Action Steps	Responsible Parties	Anticipated Start Date	Anticipated End Date	Status	Priority	Hazards Addressed	Potential Funding Sources	Projected Cost	Benefits	Partners
2.3.1 Educate and assist communities in developing minimum building standards for building codes in all cities.	County and Local EMD C, CC, L, W, UA	1-5 Yrs.	Ongoing	Started 2012	High	T;F;W; E 1	Local funding	Low	Medium	County Commissioners; local officials
2.3.2 Develop and implement regulations for the securing of mobile homes.	County and Local EMD C, CC, L, W, UA	1-5 Yrs.	Ongoing		High	All 3	Local funding	Low	Medium	County Commissioners; local officials
<p align="center">Table Key:</p> <p>Hazards Addressed: A- All Hazards, T- Tornado and Thunderstorm, F- Flood, W- Severe Winter Weather, D- Drought, H- Extreme Heat, EQ- Earthquake, DF- Dam Failure, SK- Land Subsidence/Sinkhole, LF- Levee Failure, WF- Wildfire</p> <p>Effect on Buildings: 1- New Buildings, 2- Existing Buildings, 3- New and Existing Buildings, 4- Neither New or Existing Buildings</p> <p>Responsible Parties: A- All Participating Jurisdictions, CC- Cole Camp, L- Lincoln, W- Warsaw, CR1- Cole Camp R-I, LR2- Lincoln R-II, WR- Warsaw R-IX, C-County, UA- Unincorporated area, DED- Department of Economic Development, FD- Fire Department, DHSS- Department of Health & Senior Services, RD- Road Districts, KBRPC- Kaysinger Basin Regional Planning Commission</p>										

NEED: Natural Hazard Mitigation						Strategy: <input checked="" type="checkbox"/> Existing <input type="checkbox"/> New				
Goal 3: Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identify hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.										
Objectives: 3.1- Heighten public awareness of the full range of natural hazards by developing education and outreach programs. 3.2- Publicize and encourage the adoption of appropriate hazard mitigation measures by county and city governments. 3.3- Educate the public on actions they can take to prevent or reduce the loss of life or property from all natural hazards.						Targets Achieved				
						Qtr. 1	Qtr. 2	Qtr. 3	Qtr. 4	
Action Steps	Responsible Parties	Anticipated Start Date	Anticipated End Date	Status	Priority	Hazards Addressed	Potential Funding Sources	Projected Cost	Benefits	Partners
3.1.1 Distribute SEMA brochures at public facilities and events.	County and Local EMD; School Officials A	1-5 Yrs.	Ongoing	Started 2014	High	All 4	Local Funding	Low	Medium	SEMA; Red Cross, KBRPC
3.1.2 Regular press releases from county and city EMD offices concerning hazards, where they strike, frequency and preparation.	County and Local EMD A	1-5 Yrs.	Ongoing	Started 2014	High	All 4	Local funding	Low	High	Area news agencies
Table Key: Hazards Addressed: A- All Hazards, T- Tornado and Thunderstorm, F- Flood, W- Severe Winter Weather, D- Drought, H- Extreme Heat, EQ- Earthquake, DF- Dam Failure, SK- Land Subsidence/Sinkhole, LF- Levee Failure, WF- Wildfire Effect on Buildings: 1- New Buildings, 2- Existing Buildings, 3- New and Existing Buildings, 4- Neither New or Existing Buildings Responsible Parties: A- All Participating Jurisdictions, CC- Cole Camp, L- Lincoln, W- Warsaw, CR1- Cole Camp R-I, LR2- Lincoln R-II, WR- Warsaw R-IX, C-County, UA- Unincorporated area, DED- Department of Economic Development, FD- Fire Department, DHSS- Department of Health & Senior Services, RD- Road Districts, KBRPC- Kaysinger Basin Regional Planning Commission										

Action Steps	Responsible Parties	Anticipated Start Date	Anticipated End Date	Status	Priority	Hazards Addressed	Potential Funding Sources	Projected Cost	Benefits	Partners
3.2.1 Cities/Counties will continually re-evaluate the hazard mitigation plan and merge with other community planning.	County and Local EMD C, CC, L, W, UA	1-5 Yrs.	Ongoing	Warsaw completed a new plan 2015	High	All 3	Local Funding	Low	High	County Commissioners; Local Officials, DED, KBRPC
3.2.2 Press releases by cities/county regarding adopted mitigation measure to keep public abreast of changes and/or new regulations.	County and Local EMD; School Officials; DHSS A	1-5 Yrs.	Ongoing		High	All 4	Local Funding	Low	High	Area news agencies
<p>Table Key:</p> <p>Hazards Addressed: A- All Hazards, T- Tornado and Thunderstorm, F- Flood, W- Severe Winter Weather, D- Drought, H- Extreme Heat, EQ- Earthquake, DF- Dam Failure, SK- Land Subsidence/Sinkhole, LF- Levee Failure, WF- Wildfire</p> <p>Effect on Buildings: 1- New Buildings, 2- Existing Buildings, 3- New and Existing Buildings, 4- Neither New or Existing Buildings</p> <p>Responsible Parties: A- All Participating Jurisdictions, CC- Cole Camp, L- Lincoln, W- Warsaw, CR1- Cole Camp R-I, LR2- Lincoln R-II, WR- Warsaw R-IX, C-County, UA- Unincorporated area, DED- Department of Economic Development, FD- Fire Department, DHSS- Department of Health & Senior Services, RD- Road Districts, KBRPC- Kaysinger Basin Regional Planning Commission</p>										

Action Steps	Responsible Parties	Anticipated Start Date	Anticipated End Date	Status	Priority	Hazards Addressed	Potential Funding Sources	Projected Cost	Benefits	Partners
3.3.1 Publicity campaigns by county health department and local American Red Cross chapter that make residents aware of proper measures to take during times of extreme heat or cold.	County and Local EMD; School Officials A	1-5 Yrs.	Ongoing		High	W;H 4	Local Funding	Low	High	County Health Director
3.3.2 Increase the number of relationships with the warming and cooling centers in each community.	County, local officials and Local EMD; C, CC, L, W	1-5 Yrs.	Ongoing		High	H, W 4	Local Funding	Low	High	All
3.3.3 Publicize county or city-wide drills	All A	1-5 Yrs.	Ongoing		High	All 4	Local funding	Low	Medium	Emergency Response Personnel
Table Key: Hazards Addressed: A- All Hazards, T- Tornado and Thunderstorm, F- Flood, W- Severe Winter Weather, D- Drought, H- Extreme Heat, EQ- Earthquake, DF- Dam Failure, SK- Land Subsidence/Sinkhole, LF- Levee Failure, WF- Wildfire Effect on Buildings: 1- New Buildings, 2- Existing Buildings, 3- New and Existing Buildings, 4- Neither New or Existing Buildings Responsible Parties: A- All Participating Jurisdictions, CC- Cole Camp, L- Lincoln, W- Warsaw, CR1- Cole Camp R-I, LR2- Lincoln R-II, WR- Warsaw R-IX, C-County, UA- Unincorporated area, DED- Department of Economic Development, FD- Fire Department, DHSS- Department of Health & Senior Services, RD- Road Districts, KBRPC- Kaysinger Basin Regional Planning Commission										

NEED: Natural Hazard Mitigation						Strategy: <input checked="" type="checkbox"/> Existing <input type="checkbox"/> New				
Goal 4: Strengthen communication and coordinate participation between public agencies, citizens, non-profit organizations, business and industry to create a widespread interest in mitigation.										
Objectives:						Targets Achieved				
4.1- Build and support local partnerships to continuously become less vulnerable to hazards.						Qtr. 1	Qtr. 2	Qtr. 3	Qtr. 4	
4.2- Encourage active participation and responsibility of chief elected officials in mitigation planning and activities.										
Action Steps	Responsible Parties	Anticipated Start Date	Anticipated End Date	Status	Priority	Hazards Addressed	Potential Funding Sources	Projected Cost	Benefits	Partners
4.1.1 Develop joint meetings with different organizations / agencies for emergency planning	County and Local EMD; School Officials	1-5 Yrs.	Ongoing		High	All 4	Local funding	Low	High	SEMA; Emergency Response Personnel
4.1.2 Joint training (or drills) between agencies, public and private entities (including schools and businesses).	County and Local EMD; School Officials A	1-5 Yrs.	Ongoing		High	All 4	SEMA; local funding	Low	High	County Commissioners; Local Officials, KBRPC
4.2.2 Improve overall communications on a local and multijurisdictional level	County and Local EMD; Schools A	1-5 Yrs.	Ongoing		High	All 4	SEMA; local funding	Low	High	County Commissioners; Local Officials, KBRPC
Table Key: Hazards Addressed: A- All Hazards, T- Tornado and Thunderstorm, F- Flood, W- Severe Winter Weather, D- Drought, H- Extreme Heat, EQ- Earthquake, DF- Dam Failure, SK- Land Subsidence/Sinkhole, LF- Levee Failure, WF- Wildfire Effect on Buildings: 1- New Buildings, 2- Existing Buildings, 3- New and Existing Buildings, 4- Neither New or Existing Buildings Responsible Parties: A- All Participating Jurisdictions, CC- Cole Camp, L- Lincoln, W- Warsaw, CR1- Cole Camp R-I, LR2- Lincoln R-II, WR- Warsaw R-IX, C-County, UA- Unincorporated area, DED- Department of Economic Development, FD- Fire Department, DHSS- Department of Health & Senior Services, RD- Road Districts, KBRPC- Kaysinger Basin Regional Planning Commission										

Action Steps	Responsible Parties	Anticipated Start Date	Anticipated End Date	Status	Priority	Hazards Addressed	Potential Funding Sources	Projected Cost	Benefits	Partners
4.1.3 Develop a database & pool different agency resources to achieve widespread results.	County and Local EMD; School Officials A	1-5 Yrs.	Ongoing		High	All 4	Local Funding	Low	High	County Commissioners; Local Officials, Emergency Response Personnel, KBRPC
4.2.1 Hold meetings between city and county EMD's, and county/city officials to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.	County and Local EMD; School Officials C, CC, L, W	1-5 Yrs.	Ongoing		High	All 4	SEMA; local funding	Low	High	County Commissioners; Local Officials, KBRPC
<p>Table Key: Hazards Addressed: A- All Hazards, T- Tornado and Thunderstorm, F- Flood, W- Severe Winter Weather, D- Drought, H- Extreme Heat, EQ- Earthquake, DF- Dam Failure, SK- Land Subsidence/Sinkhole, LF- Levee Failure, WF- Wildfire Effect on Buildings: 1- New Buildings, 2- Existing Buildings, 3- New and Existing Buildings, 4- Neither New or Existing Buildings Responsible Parties: A- All Participating Jurisdictions, CC- Cole Camp, L- Lincoln, W- Warsaw, CR1- Cole Camp R-I, LR2- Lincoln R-II, WR- Warsaw R-IX, C-County, UA- Unincorporated area, DED- Department of Economic Development, FD- Fire Department, DHSS- Department of Health & Senior Services, RD- Road Districts, KBRPC- Kaysinger Basin Regional Planning Commission</p>										

NEED: Natural Hazard Mitigation						Strategy: <input checked="" type="checkbox"/> Existing <input type="checkbox"/> New				
Goal 5: Establish priorities for reducing risks to people and their property with emphasis on long-term and maximum benefits to the public rather than short term benefit of special interest.										
Objectives: 5.1- Incorporate hazard mitigation into the long-range planning and development activities of the county and each jurisdiction. 5.2- Promote beneficial uses of hazardous areas while expanding open space and recreational opportunities.						Targets Achieved				
						Qtr. 1	Qtr. 2	Qtr. 3	Qtr. 4	
Action Steps	Responsible Parties	Anticipated Start Date	Anticipated End Date	Status	Priority	Hazards Addressed	Potential Funding Sources	Projected Cost	Benefits	Partners
5.1.1 Secure resources for enhanced warning systems.	County and Local EMD; School Officials A	1-5 Yrs.	Ongoing		High	All 4	SEMA; FEMA; Local funding	Low	High	Local Officials; County Commissioners
5.1.2 Road and bridge upgrades that would reduce danger to residents during occurrences of natural disasters.	County and Local EMD C, CC, L, W, UA	3-5 Yrs.	Ongoing		Medium	T;F;W; E;D 3	MoDOT program funding; DED program funding	Low	High	MoDOT; County Commissioners
Table Key: Hazards Addressed: A- All Hazards, T- Tornado and Thunderstorm, F- Flood, W- Severe Winter Weather, D- Drought, H- Extreme Heat, EQ- Earthquake, DF- Dam Failure, SK- Land Subsidence/Sinkhole, LF- Levee Failure, WF- Wildfire Effect on Buildings: 1- New Buildings, 2- Existing Buildings, 3- New and Existing Buildings, 4- Neither New or Existing Buildings Responsible Parties: A- All Participating Jurisdictions, CC- Cole Camp, L- Lincoln, W- Warsaw, CR1- Cole Camp R-I, LR2- Lincoln R-II, WR- Warsaw R-IX, C-County, UA- Unincorporated area, DED- Department of Economic Development, FD- Fire Department, DHSS- Department of Health & Senior Services, RD- Road Districts, KBRPC- Kaysinger Basin Regional Planning Commission										

Action Steps	Responsible Parties	Anticipated Start Date	Anticipated End Date	Status	Priority	Hazards Addressed	Potential Funding Sources	Projected Cost	Benefits	Partners
5.1.3 Develop storm water management plans for all communities.	County and Local EMD A	3-5 Yrs.	Ongoing		Medium	F, LF 3	Local Funding	Low	High	Local Officials
5.1.4 Coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.	County and Local EMD; School Officials A	3-5 Yrs.	Ongoing		Medium	All 3	Local Funding	Low	High	County and Local Officials, KBRPC
5.1.5 Require contractor storm water management plans in all new development- both residential and commercial properties.	County and Local EMD C, CC, L, W	1-5 Yrs.	Ongoing		Medium	F 1	Local Funding	Low	High	Local Officials
<p align="center">Table Key:</p> <p>Hazards Addressed: A- All Hazards, T- Tornado and Thunderstorm, F- Flood, W- Severe Winter Weather, D- Drought, H- Extreme Heat, EQ- Earthquake, DF- Dam Failure, SK- Land Subsidence/Sinkhole, LF- Levee Failure, WF- Wildfire</p> <p>Effect on Buildings: 1- New Buildings, 2- Existing Buildings, 3- New and Existing Buildings, 4- Neither New or Existing Buildings</p> <p>Responsible Parties: A- All Participating Jurisdictions, CC- Cole Camp, L- Lincoln, W- Warsaw, CR1- Cole Camp R-I, LR2- Lincoln R-II, WR- Warsaw R-IX, C-County, UA- Unincorporated area, DED- Department of Economic Development, FD- Fire Department, DHSS- Department of Health & Senior Services, RD- Road Districts, KBRPC- Kaysinger Basin Regional Planning Commission</p>										

Action Steps	Responsible Parties	Anticipated Start Date	Anticipated End Date	Status	Priority	Hazards Addressed	Potential Funding Sources	Projected Cost	Benefits	Partners
5.2.1 Local governments to purchase properties in the floodplain as funds become available and convert that land into public/recreational space.	County and Local EM C, CC, L, W	3-5 Yrs.	Ongoing		Medium	F 1	State and Local Funding	Low	High	County and Local EMD
5.2.2 Zone areas in the floodplain as open space as needed.	County and Local EMD C, CC, L, W	3-5 Yrs.	Ongoing		Medium	F 1	State and Local Funding	Low	High	County and Local EMD
<p align="center">Table Key:</p> <p>Hazards Addressed: A- All Hazards, T- Tornado and Thunderstorm, F- Flood, W- Severe Winter Weather, D- Drought, H- Extreme Heat, EQ- Earthquake, DF- Dam Failure, SK- Land Subsidence/Sinkhole, LF- Levee Failure, WF- Wildfire</p> <p>Effect on Buildings: 1- New Buildings, 2- Existing Buildings, 3- New and Existing Buildings, 4- Neither New or Existing Buildings</p> <p>Responsible Parties: A- All Participating Jurisdictions, CC- Cole Camp, L- Lincoln, W- Warsaw, CR1- Cole Camp R-I, LR2- Lincoln R-II, WR- Warsaw R-IX, C-County, UA- Unincorporated area, DED- Department of Economic Development, FD- Fire Department, DHSS- Department of Health & Senior Services, RD- Road Districts, KBRPC- Kaysinger Basin Regional Planning Commission</p>										

NEED: Natural Hazard Mitigation						Strategy: <div><div></div> Existing</div> <div><div></div> New</div>				
Goal 6: Secure resources for investment in hazard mitigation										
Objectives: 6.1- Research the use of outside sources of funding. 6.2- Encourage participation of property owners in investing in hazard mitigation projects on their own properties. 6.3- In the event of a disaster declaration be prepared to apply for hazard mitigation with prioritized projects.						Targets Achieved				
						Qtr. 1	Qtr. 2		Qtr. 3	
Action Steps	Responsible Parties	Anticipated Start Date	Anticipated End Date	Status	Priority	Hazards Addressed	Potential Funding Sources	Projected Cost	Benefits	Partners
6.1.1 Work with SEMA coordinator to learn about new mitigation funding opportunities.	County and Local EMD; School Officials A	1-5 Yrs.	Ongoing		High	All 4	Local Funding	Low	High	SEMA
6.1.2 Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.	County and Local EMD C, CC, L, W	1-5 Yrs.	Ongoing	Started 2015	Low	All 3	Local Funding	Low	High	MoDOT
Table Key: Hazards Addressed: A- All Hazards, T- Tornado and Thunderstorm, F- Flood, W- Severe Winter Weather, D- Drought, H- Extreme Heat, EQ- Earthquake, DF- Dam Failure, SK- Land Subsidence/Sinkhole, LF- Levee Failure, WF- Wildfire Effect on Buildings: 1- New Buildings, 2- Existing Buildings, 3- New and Existing Buildings, 4- Neither New or Existing Buildings Responsible Parties: A- All Participating Jurisdictions, CC- Cole Camp, L- Lincoln, W- Warsaw, CR1- Cole Camp R-I, LR2- Lincoln R-II, WR- Warsaw R-IX, C-County, UA- Unincorporated area, DED- Department of Economic Development, FD- Fire Department, DHSS- Department of Health & Senior Services, RD- Road Districts, KBRPC- Kaysinger Basin Regional Planning Commission										

Action Steps	Responsible Parties	Anticipated Start Date	Anticipated End Date	Status	Priority	Hazards Addressed	Potential Funding Sources	Projected Cost	Benefits	Partners
6.1.3 Work with state/local/federal agencies to include mitigation in all economic and community development projects.	County and Local EMD C, CC, L, W, UA	3-5 Yrs.	Ongoing		Medium	All 1	Local Funding	Low	High	DED; SEMA; MoDOT; FEMA; EDA
6.2.1 Implement public awareness programs about the benefits of hazard mitigation projects, both public and private.	County and Local EMD; School Officials A	1-5 Yrs.	Ongoing		Low	All 4	Local Funding	Low	High	County and Local Officials, Road Districts, EMD; School Officials, KBRPC
6.3.1 Prioritize mitigation projects, based on cost effectiveness and largest threatened population/property.	County and Local EMD; School Officials A	1-5 Yrs.	Ongoing		High	All 3	Local Funding	Low	High	County and Local Officials, Road Districts, EMD; School Officials, KBRPC
<p align="center">Table Key:</p> <p>Hazards Addressed: A- All Hazards, T- Tornado and Thunderstorm, F- Flood, W- Severe Winter Weather, D- Drought, H- Extreme Heat, EQ- Earthquake, DF- Dam Failure, SK- Land Subsidence/Sinkhole, LF- Levee Failure, WF- Wildfire</p> <p>Effect on Buildings: 1- New Buildings, 2- Existing Buildings, 3- New and Existing Buildings, 4- Neither New or Existing Buildings</p> <p>Responsible Parties: A- All Participating Jurisdictions, CC- Cole Camp, L- Lincoln, W- Warsaw, CR1- Cole Camp R-I, LR2- Lincoln R-II, WR- Warsaw R-IX, C-County, UA- Unincorporated area, DED- Department of Economic Development, FD- Fire Department, DHSS- Department of Health & Senior Services, RD- Road Districts, KBRPC- Kaysinger Basin Regional Planning Commission</p>										

Requirement

§201.6(c) (3) (ii):

[The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance program (NFIP), and continued compliance with NFIP requirements, as appropriate.

Benton County had their FIRM updated and digitized in 2009.

The jurisdictions of Benton County and the county itself have very limited GIS, engineering, and planning capabilities.

The importance of current and accurate FIRM maps in a locale highly susceptible to flooding events, such as Benton County, cannot be stated strongly enough. Benton County has seen moderate growth and development since the 1984 FIRM was published.

Accurate flood maps are the basis of the NFIP. Appropriate and effective mitigation begins with accurate information. Benton County and the City of Warsaw are currently the only two participating jurisdictions in the NFIP.

4.4 Prioritization, Implementation, and Administration

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.

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.

Prioritization by Technical Steering Committee

After the comprehensive list of mitigation actions for the entire Planning Area had been developed by the Hazard Mitigation Technical Steering Committee, a general cost estimate was developed for each action using the following scale:

- Minimum – Little or no cost to the jurisdiction involved
- Moderate – A definite cost involved but this cost could likely be worked into the operating budget of the jurisdiction involved
- Significant – A cost that may be above and beyond most operating budgets; would require some type of extra appropriation to finance or to meet matching funds for a grant

These cost estimates were developed in order to help clarify and emphasize the benefit/cost of each action during the prioritization process.

The Hazard Mitigation Technical Steering Committee then looked at each hazard and its associated mitigation actions in order to make a preliminary prioritization of the actions for the Planning Area as a whole. Each action was discussed with a view toward feasibility, jurisdictions to be involved, benefit/cost ratio, and timeframe. Discussion proceeded until a consensus was reached on the preliminary priority rating of each action, according to the following scale:

- High – Work should begin as soon as possible; action should be accomplished in the next 5 years
- Medium – Work could begin within the next 5 years, if time and resources allow
- Low – Long-range goal, if time and resources allow; work within the next 5 years is possible, but not probable

After each hazard and its associated mitigation actions had been assigned a preliminary priority, the mitigation actions were looked at as a whole and the preliminary priorities reviewed a final time. Any needed changes were discussed until consensus was once again reached.

Prioritization by Participating Jurisdictions

The prioritization of the suggested mitigation actions by the Hazard Mitigation Technical Steering Committee was a preliminary overall prioritization for the entire Planning Area.

Educational Institutions

In the case of the educational institutions, the representatives from the school districts were given the opportunity to develop mitigation actions specific to their institutions. This was accomplished through a fax and emails sent to the superintendents of the three school districts. None of the schools responded so mitigation actions per educational institution are not labeled within the plan.

All Other Participating Jurisdictions

After the preliminary overall prioritization by the Hazard Mitigation Technical Steering Committee, the mitigation actions suggested for the specific participating jurisdictions were handed over to the representatives or governing bodies of those jurisdictions for final prioritization, implementation, and administration decisions.

It was recognized that participating jurisdictions might choose to exclude some suggested mitigation actions based on current specifics of time, resources, and capabilities or add new mitigation actions based on specific issues. Finally, there was the possibility that participating jurisdictions might choose to make changes to the preliminary prioritization.

An information sheet (“Information and Guidelines for Assessing Mitigation Actions for Your Jurisdiction”) was given to each participating jurisdiction. This sheet gave the following guidance:

- Explanation of the scales used for the preliminary prioritization and the cost/benefit assessment
- Instruction that the preliminary prioritization needed to be reviewed and either accepted or changed
- Instruction that benefit vs. cost must be taken into consideration in the prioritization process.

A questionnaire regarding the process used in finalizing the mitigation actions for the jurisdiction was included with the information sheet. Follow-up calls and/or emails were made to representatives of the participating jurisdictions by the Plan Author to clarify the process and decisions made regarding the mitigation actions.

4.4.1 Individual Jurisdiction Mitigation Actions

Note: the action numbers in these tables may be found in section 4.3, Mitigation Goals, Objective and Actions beginning on page 212 of that section. The Hazard Addressed definitions may also be found on page 216 of that section. Neither the City of Warsaw nor the County had any new mitigation actions.

Mitigation Action for Lincoln	
Contact: Barbara Johnson	Position: City Clerk
Who was involved in reviewing the mitigation actions?	Police Chief and City Clerk
What process did you use to prioritize the actions for your community? The "Information and Guidelines for Assessing Mitigation Actions for Your Jurisdiction" sheet provided by Kaysinger Basin was reviewed by the Staff and Department Heads. These reviewers then looked at each proposed mitigation action and its preliminary prioritization, using the previous mitigation actions to assess if this priority needed to be changed for Lincoln. There were informal discussions on the matter, taking into account existing emergency plans. The final decisions of the reviewers were arrived at by consensus. 1. Create at least one high wind resistant shelter; high priority 2. Update storm warning system for tornados; medium priority 3. Update public safety joint communications staff of earthquake safety; medium priority <i>All other priority ratings suggested by the Hazard Mitigation Technical Steering Committee were deemed appropriate for Lincoln and approved as the final priority rating by consensus.</i>	
How was benefit vs. cost taken into account during prioritization?	It wasn't.

Mitigation Action for Cole Camp	
Contact: Stephen Phillips	Position: Police Chief
Who was involved in reviewing the mitigation actions? Police Chief and City Clerk	
<p>What process did you use to prioritize the actions for your community?</p> <p>The "Information and Guidelines for Assessing Mitigation Actions for Your Jurisdiction" sheet provided by Kaysinger Basin was reviewed by the Staff and Department Heads. These reviewers then looked at each proposed mitigation action and its preliminary prioritization, using the previous mitigation actions to assess if this priority needed to be changed for Cole Camp. There were informal discussions on the matter, taking into account existing emergency plans. The final decisions of the reviewers were arrived at by consensus.</p> <ol style="list-style-type: none"> 1. Create at least one high wind/tornado resistant shelter; high priority 2. Update and create local city response plan; medium priority 3. Update EMD position, the city currently does not have an EMD; high priority 4. Improve overall communications on a local and multijurisdictional level. <p><i>All other priority ratings suggested by the Hazard Mitigation Technical Steering Committee were deemed appropriate for Cole Camp and approved as the final priority rating by consensus.</i></p>	
<p>How was benefit vs. cost taken into account during prioritization? In this case, the highest benefit has the highest cost. It probably cannot be completed without outside funding.</p>	

Mitigation Actions for Benton County-Lincoln											
Action #	Mitigation Action	Hazard Addressed	Priority	Plan for Implementation	Lead Agency	Partners	Potential Funding	Projected Cost	Benefits	Completion Date	Criterion for Completion
1	Create Safe Room	T	High	Meet w/ KBRPC for grant app.	Police Dept.	KBRPC	Grant/Internal Funds	Moderate	Less loss of life	2020	Apply w/ FEMA-PDM grant
1.2	Update storm warning system	T	Medium	Grant from USDA	Public Works		Grant	Minimal	Property Protection	2012	Plan Adopted
3.1.3	Update Public Safety Joint Communications staff knowledge of earthquake safety.	EQ	Medium	Attend LEPC Meeting/Trainings	Police Dept.	LEPC	Internal Funds/Homeland Security Grants	Minimal	Enhanced Safety/ less injury and life	2011	Training Attended
Mitigation Actions for Benton County-Cole Camp											
1	Create Safe Room within City Hall	T	High	Grant	FEMA and City	None	SEMA Grants	Expensive	Protect Life, Support recovery	2020	Shelter Operation
3.2.1	Update city emergency plan	All	Medium	Review county plan w/ Dept. Heads	Mayor and Chief of Police	FEMA	Internal local fund	Minimal	Improve services to citizens during emergency	2011	Published document containing city plan
3.1	Appoint new EMD Division		High	At earliest point a candidate volunteers	FEMA and Mayor	None	Internal	Minimal	Coordinate activities with county, state, and FEMA	2011	Volunteer with training
4.2.2	Improve communication	All	High		Police	All	Internal/Grant	Minimal			

4.5 Funding Sources

There are numerous ways which local mitigation projects can be funded.

Local Funds

These funds come predominantly from property and sales tax revenues; they are generally allocated directly to school, public works, and other essential government functions. While there may be little room for mitigation funding within this revenue stream, mitigation activities frequently will be a part of essential government functions. For example, money that is allocated for a new school can fund stronger than normal roofs to help the school in the event of a tornado.

Non-Governmental Funds

Another potential source of revenue for local mitigation efforts are contributions of nongovernmental organizations such as churches, charities, community relief funds, the Red Cross, hospitals, businesses, and nonprofit organizations. A variety of these local organizations can be tapped to help carry out local hazard mitigation initiatives.

Federal Funds

The bulk of federal funding for mitigation is available through the FEMA Mitigation Grants Programs; another possible funding source is Community Development Block Grants (CDBG) after a Presidential Disaster Declaration.

FEMA MITIGATION GRANTS PROGRAMS - Jurisdictions which have adopted a FEMA approved Hazard Mitigation Plan are eligible for hazard mitigation funding through FEMA grant programs. The following five FEMA grant programs currently provide hazard mitigation funding:

- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)

Mitigation activities which are eligible for funding vary between the programs. All potential projects must match the stated goals and objectives of the Benton County Hazard Mitigation Plan and the State of Missouri Hazard Mitigation Plan.

Eligible Activities	HMGP	PDM	FMA
1. Mitigation Projects	✓	✓	✓
Property Acquisition and Structure Demolition	✓	✓	✓
Property Acquisition and Structure Relocation	✓	✓	✓
Structure Elevation	✓	✓	✓
Mitigation Reconstruction	✓	✓	✓
Dry Floodproofing of Historic Residential Structures	✓	✓	✓
Dry Floodproofing of Non-residential Structures	✓	✓	✓
Generators	✓	✓	
Localized Flood Risk Reduction Projects	✓	✓	✓
Non-localized Flood Risk Reduction Projects	✓	✓	
Structural Retrofitting of Existing Buildings	✓	✓	✓
Non-structural Retrofitting of Existing Buildings and Facilities	✓	✓	✓
Safe Room Construction	✓	✓	
Wind Retrofit for One- and Two-Family Residences	✓	✓	
Infrastructure Retrofit	✓	✓	✓
Soil Stabilization	✓	✓	✓
Wildfire Mitigation	✓	✓	
Post-Disaster Code Enforcement	✓		
Advance Assistance	✓		
5 Percent Initiative Projects	✓		
Miscellaneous/Other ⁽¹⁾	✓	✓	✓
2. Hazard Mitigation Planning	✓	✓	✓
Planning Related Activities	✓		
3. Technical Assistance			✓
4. Management Cost	✓	✓	✓

⁽¹⁾ Miscellaneous/Other indicates that any proposed action will be evaluated on its own merit against program requirements. Eligible projects will be approved provided funding is available.

Additional information regarding eligible projects for **HMGP** is included in Part VIII, A.11 and A.12, and for **FMA**, in Part VIII, C.1.

Costs for eligible activities must be reasonable, allowable, allocable, and necessary as required by 2 CFR Part 200 Subpart E, applicable program regulations, and this guidance.

Source: www.fema.gov/library/viewRecord.do?id=3648

Application and Cost Share Requirements:

The application process for the FEMA Mitigation Grant Programs includes a Benefit Cost Analysis (BCA). A potential project must have a Benefit Cost Ratio of at least 1.0 to be considered for funding; a ratio of 1.0 indicates at least \$1 benefit for each \$1 spent on the project.

A BCA is the first step in assessing if a project has the potential to be funded. The BCA for a potential project is run on FEMA's BCA Software; a planner at Kaysinger Basin RPC is trained on this software.

Application for most of the mitigation grant programs must be made through eGrants, FEMA's web-based, electronic grants management system. HMGP has a paper application. Cost share requirements and the application format for these five programs are shown. Contributions of cash, in-kind services or materials, or any combination thereof, may be accepted as part of the non-Federal cost share. For FMA, not more than one half of the non-Federal contribution may be provided from in-kind contributions.

Programs	Mitigation Activity	Grantee Management Costs	Subgrantee Management Costs
	(Percent of Federal / Non-Federal Share)	(Percent of Federal / Non-Federal Share)	(Percent of Federal / Non-Federal Share)
HMGP	75/25	100/0	—/— ⁽¹⁾
PDM	75/25	75/25	75/25
PDM – subgrantee is small impoverished community	90/10	75/25	90/10
PDM – Tribal Grantee is small impoverished community	90/10	90/10	90/10
FMA – insured properties and planning grants	75/25	75/25	75/25
FMA – repetitive loss property ⁽²⁾	90/10	90/10	90/10
FMA – severe repetitive loss property ⁽²⁾	100/0	100/0	100/0

(1) Subapplicants should consult their State Hazard Mitigation Officer (SHMO) for the amount or percentage of HMGP subgrantee management cost funding their State has determined to be passed through to subgrantees.

(2) To be eligible for an increased Federal cost share a FEMA-approved State or Tribal (Standard or Enhanced) Mitigation Plan that addresses repetitive loss properties must be in effect at the time of grant award, and the property that is being submitted for consideration must be a repetitive loss property.

Details of each program are discussed below.

Hazard Mitigation Grant Program (HMGP)

The Hazard Mitigation Grant Program (HMGP) was created in November 1988 through Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The HMGP assists states and local communities in implementing long-term mitigation measures following a Presidential disaster declaration. After a major disaster, communities may be able to identify additional areas where mitigation can help prevent losses in the future.

HMGP funding is allocated using a “sliding scale” formula based on the percentage of the funds

spent on Public and Individual Assistance programs for each Presidential Disaster Declaration.

The HMGP can be used to fund projects to protect either public or private property; the proposed projects must fit within the state and local government's overall mitigation strategy for the disaster area, and comply with program guidelines.

Eligibility for funding under the HMGP is limited to state and local governments, certain private nonprofit organizations or institutions that serve a public function, Indian tribes and authorized tribal organizations.

Applicants work through their state which is responsible for setting priorities for funding and administering the program.

More information on this program is available at: www.fema.gov/government/grant/hmgrp/

Pre-Disaster Mitigation Program (PDM)

With the Disaster Mitigation Act of 2000, Congress approved the creation of a national program to provide a funding mechanism that is not dependent on a Presidential Disaster Declaration.

The Pre-Disaster Mitigation (PDM) Program provides funding for cost-effective hazard mitigation activities that complement a comprehensive mitigation program, and reduce injuries, loss of life, and damage and destruction of property. The PDM grant funds are provided to the state which then provides sub-grants to local governments for eligible mitigation activities.

More information on this program is available at: www.fema.gov/government/grant/pdm/

Flood Mitigation Assistance Program (FMA)

FMA was created as part of the National Flood Insurance Reform Act of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the NFIP. Applicants must be participants in good standing in NFIP and properties to be mitigated must have flood insurance.

States administer the FMA program and are responsible for selecting projects for funding from the applicants submitted by all communities within the state. The state forwards selected applications to FEMA for an eligibility determination. Although individuals cannot apply directly for FMA funds, their local government may submit an application on their behalf.

FMA funding for the state depends on the number of repetitive losses in the state. The frequency of flooding in Missouri in recent years, coupled with the losses incurred, has caused Missouri's funding to rise. This is a good program for smaller projects like low water crossings, according to Sheila Huddleston, Missouri State Hazard Mitigation Officer.

For FMA, not more than one half of the non-Federal may be provided from in-kind contributions. More information on this program is available at:

www.fema.gov/government/grant/fma/

COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG)

The objective of the CDBG program is to assist communities in rehabilitating substandard dwelling structures and to expand economic opportunities, primarily for low-to-moderate-income families. After a Presidential Disaster Declaration CDBG funds may be used for long-term needs such as acquisition, reconstruction, and redevelopment of disaster-affected areas. There is no low-to-moderate income requirement after a Presidential Disaster Declaration.

Section 5 Plan Maintenance Process

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.

5.1 Plan Monitoring and Evaluation

Benton County has developed a method to ensure regular review and update of the Hazard Mitigation Plan. The County Commissioners, municipal public officials, members of the Benton County Emergency Management Committee (fire, law enforcement, emergency medical, and public health officers), and the County EMA director are responsible for various objectives in the plan. Hazard mitigation objectives will be an agenda item, as needed, at monthly meetings of the Benton County Emergency Management Committee meetings. As planning begins the public will be encouraged to participate by way of media coverage and published reminders.

Kaysinger Basin Regional Planning Commission and the Benton County EMD will be responsible for contacting all hazard mitigation stakeholders' quarterly. KBRPC will request quarterly reports by agencies, departments, or organization responsible for implementing the mitigation action/project. KBRPC will also conduct site visits or periodic meetings to discuss the progress. Annually KBRPC and the Benton County EMD will organize and hold a meeting. Committee members will be responsible for monitoring and evaluating the progress of the mitigation strategies in the plan. The committee will review each goal and objective to determine their relevance to changing situations in the county, as well as changes in State or Federal policy, and to ensure that they are addressing current and expected conditions. The committee also will review the risk assessment portion of the plan to determine if this information should be updated or modified. The parties responsible for the various implementation actions will report on the status of their projects and will include which implementation processes worked well, any difficulties encountered, how coordination efforts were proceeding, and which strategies should be revised. KBRPC and the Benton County EMD will compile all the data quarterly and annually, for the next plan update.

KBRPC will then have three months to update and make changes to the plan before submitting

it to the committee members and the State Hazard Mitigation Officer at the time of the next update. The plan will be posted with the Benton County Emergency Operations Plan on the county web site (<http://www.bentoncomo.com>). If no changes are necessary, the State Hazard Mitigation Officer will be given a justification for this determination. The general public will be encouraged to attend Hazard Mitigation meetings through media coverage, published notices, reminders or announcements at civic meetings, and possibly public speaking engagements. KBRPC will continue to host any hazard mitigation announcements or information, as well as a copy of the latest plan, on the KBRPC website (www.kaysinger.com). When reviewing and updating the plan, the previously approved plan's procedures for monitoring was reviewed and determine to be inadequate. Due to schedules, lack of funding and jurisdictional turnover; the procedures for monitoring the plan between updates were not upheld. Causing difficulty in conjunction with the current update. Participating parties had to research and compile data for the entire past five years at once, making it difficult and stressful to locate all required documentation. Therefore, limiting the data for the 2015 plan update. With the new monitoring procedure, the goal is the information will be collected and compiled quarterly, by KBRPC and reviewed annually by the committee over the next five years for the next update. Thus maximizing jurisdictional participation and data collection. A complete list of key stakeholders contacted to participate in the technical steering committee, is located in Appendix D.

Figure 5.1

Yearly Survey of Mitigation Actions for (Sample)								
Action #	Mitigation Action	Priority	Plan for Implementation and Administration	Lead Department or Agency	Projected Completion Date	Criterion for Completion	Current Status of Mitigation Action	Comments
1.2.2	Encourage underground utilities in improvements and new development.	High	This is being done and will continue.	City Administrator	Ongoing	Utilities are underground in new developments		
2.1.6	Develop policy and enforcement regulations concerning burning permits.	Medium	Will write regulations for adoption by City Council	Dept of Public Works	2017	Policy is in place and enforced		
5.0.1	Adopt procedures for review of subdivision plans to minimize flood problems.	High	Adoption will come before Council in 2010	City Administrator	2010	Procedures are adopted.		
Please indicate the current status of each mitigation action on the above chart. Please note any change to the priorities of actions.								
Are there any changes in your jurisdiction which may affect the content of the Boone County Hazard Mitigation Plan? If so, please describe.								

5.2 Plan Updating

FEMA requirements state a hazard mitigation plan must be updated and reapproved by FEMA every five years; the five years is counted from when the first participating jurisdiction adopts the approved plan.

Assuming approval and adoption of the current plan occurs in the summer of 2016, the Benton County Hazard Mitigation Plan will need to be updated and reapproved by FEMA in the summer of 2020. A proposed schedule for the update is shown in Table 5.2.

Proposed Schedule for 5-year Update of Hazard Mitigation Plan PED=Plan Expiration Date		
Activity	Timeline to Begin	Responsible Party
Preliminary update of data	Yearly during maintenance review	KBRPC
Prepare cost estimates for update of plan to submit to SEMA	PED 13 months	KBRPC
Receive MOA from SEMA for update	PED 11 months	SEMA
Review data for any additional updates	PED 11 months	KBRPC
Contact participating jurisdictions re: technical steering committee officials	PED 10 months	KBRPC
Survey to participating jurisdictions re: capabilities, vulnerable assets, future development	PED 10 months	KBRPC
Meetings to conduct preliminary review and update	PED 9 months	Technical Steering Committee
Draft of plan put out for public comment and input.	PED 7 months	KBRPC/TSC
Participating jurisdictions adopt plan	PED 6 month	Participating jurisdictions
1 st Draft of update due at SEMA	PED 6 months	KBRPC
Plan reviewed by SEMA	PED 4 months	SEMA
Required changes made to plan	PED 3.5 months	KBRPC
Plan submitted to FEMA	PED 3 months	SEMA

The ongoing yearly maintenance and evaluation of the plan, as described previously, will be of great value when undertaking the five year update. Continuity of personnel on the Hazard Mitigation Technical Steering Committee throughout the five year process would be highly beneficial in taking mitigation planning to the next level.

The following data gaps in the current plan should be examined during the 2020 update process:

Dam Failure

Information from the mapping of the high hazards dams in the county was completed before 2015. Emergency Action Plans (EAPs) may have been written for some, or all, of the regulated dams in the county by this time. The following sites may be helpful in obtaining current information on the progress of this work: DNR's Dam Safety Program (<http://www.dnr.mo.gov/env/wrc/damsft/damsfthp.htm>) and DamSafetyAction.org,

Levee Failure

There are some data gaps in assessing vulnerability to levee failure which, while not critical to gaining an overall perspective on vulnerability, would increase accuracy if available. Inundation information is not readily available for areas protected by levee districts and areas protected by non-district or private levees are not known.

The US Army Corps of Engineers, working with the FEMA and other federal, state, and local agencies, assembled a Regional Interagency Levee Task Force (ILTF) in 2008 to provide a uniform approach across the area impacted by flooding in the Midwest. Data is currently being updated and made more available through this task force. The following website may be helpful in providing the most current information on levee failure during the 2020 update: <http://www.iwr.usace.army.mil>

5.3 Integration of Hazard Mitigation into Other 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.

The Benton County Hazard Mitigation Plan will be partly integrated into the Benton County Emergency Operations Plan when it is updated each April. The EOP update is the responsibility of the Emergency Management Director and staff. The Emergency Operations Plan covers all jurisdictions within Benton County.

Specific information on integration of the plan into other planning mechanisms in the participating jurisdictions is shown in Table 5.3-1 This information was verbally collected after meeting with each city clerk and Cole Camp's Chief of Police.

Table 5.3-1 depicts each town's idea of implementing this HMP into other plans.

Jurisdiction	Plan of Implementation of HMP into Other Plans
Cole Camp	As soon as a new EMD is hired, the local EOP will be integrated into this HMP.
Lincoln	This plan will eventually be incorporated into the Master Plan and local EOP.
Warsaw	This plan will be integrated into the local EOP. December of 2015 The City completed a comprehensive community plan, which include new zoning and code regulations.

Since the last plan update the City of Warsaw, is the only jurisdiction at this time that has incorporated the HMP plan in to the local EOP. As of December of 2015 the City completed a comprehensive community plan, which includes new zoning and code regulations.

5.4 Public Participation in Plan Maintenance

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.

The Benton County Hazard Mitigation plan will be remain continually available on the website of the Kaysinger Basin Regional Planning Commission (www.kaysinger.com) for public review and comment. Either the plan itself or links to the plan will also be posted on as many websites of participating jurisdictions as possible.

The Benton County Emergency Management Director will facilitate presenting the entire plan to interested groups within the county such as:

- Health Department Personnel
- City Fire and Rural Fire Protection Districts
- City Elected Officials/Administrators
- Educational Personnel
- Local Emergency Planning Committees
- Local Police/Sheriff Department Personnel
- Public Safety Joint Communications Committee Meeting

Public notice of the upcoming yearly review and maintenance of the plan will be given via postings on the Kaysinger Basin RPC website and through the KBRPC newsletter. Notice of any public meetings concerning the maintenance of the plan will be given in accordance with Missouri's "Sunshine Law" (Revised Statutes of Missouri 610.010, 610.020, 610.023, and 610.024.)

Appendix A: Formal Adoption Resolutions

COUNTY OF BENTON, MISSOURI

RESOLUTION NO. 2016-2

A RESOLUTION OF THE COUNTY OF BENTON ADOPTING THE BENTON
COUNTY REGIONAL ALL-HAZARD MITIGATION PLAN (UPDATED 2016)

WHEREAS, the County of Benton recognizes the threat that natural hazards pose to people and property within the County of Benton; and

WHEREAS, the County of Benton has participated in the preparation of a multi-hazard mitigation plan, hereby known as the *Benton County Regional All-Hazard Mitigation Plan (Updated 2016)*, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS, the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the County of Benton from the impacts of future hazards and disasters; and

WHEREAS, the County of Benton recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the County of Benton will endeavor to integrate the Plan into the comprehensive planning process and

WHEREAS, adoption by the County of Benton demonstrates their commitment to hazard mitigation and achieving the goals outlined in the Plan

NOW THEREFORE, BE IT RESOLVED BY THE COUNTY OF BENTON, IN THE STATE OF MISSOURI, THAT:

Section 1. In accordance with (local rule for adopting resolutions), the County of Benton adopts the final FEMA-approved plan.

ADOPTED by a vote of 3 in favor and 0 against, and 0 abstaining, this 5th day of July, 2016.

By (Sig): Michelle Kreisler
Michelle Kreisler, Presiding Commissioner

ATTEST:
By (Sig): Susan Porterfield
Susan Porterfield, County Clerk

CITY OF COLE CAMP, MISSOURI

RESOLUTION NO. 501

A RESOLUTION OF THE CITY OF COLE CAMP ADOPTING THE BENTON COUNTY REGIONAL ALL-HAZARD MITIGATION PLAN (UPDATED 2016)

WHEREAS, the City of Cole Camp recognizes the threat that natural hazards pose to people and property within the City of Cole Camp; and

WHEREAS, the City of Cole Camp has participated in the preparation of a multi-hazard mitigation plan, hereby known as the *Benton County Regional All-Hazard Mitigation Plan (Updated 2016)*, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS, the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the City of Cole Camp from the impacts of future hazards and disasters; and

WHEREAS, the City of Cole Camp recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the City of Cole Camp will endeavor to integrate the Plan into the comprehensive planning process and

WHEREAS, adoption by the City of Cole Camp demonstrates their commitment to hazard mitigation and achieving the goals outlined in the Plan

NOW THEREFORE, BE IT RESOLVED BY THE CITY OF COLE CAMP, IN THE STATE OF MISSOURI, THAT:

Section 1. In accordance with (local rule for adopting resolutions), the City of Cole Camp adopts the final FEMA-approved plan.

ADOPTED by a vote of 4 in favor and 0 against, and 0 abstaining, this 19th day of MAY, 2016.

By (Sig): Burton Berman
Print name: BURTON BERMAN, MAYOR

ATTEST:
By (Sig): Ruth Eckhoff
Print name: RUTH ECKHOFF, CITY CLERK

APPROVED AS TO FORM:

By (Sig.): _____
Print name: _____

VILLAGE OF IONIA, MISSOURI
RESOLUTION NO. 68

**A RESOLUTION OF THE VILLAGE OF IONIA ADOPTING THE BENTON COUNTY
REGIONAL ALL-HAZARD MITIGATION PLAN (UPDATED 2016)**

WHEREAS, the Village of Ionia recognizes the threat that natural hazards pose to people and property within the Village of Ionia; and

WHEREAS, the Village of Ionia has participated in the preparation of a multi- hazard mitigation plan, hereby known as the *Benton County Regional All-Hazard Mitigation Plan (Updated 2016)*, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS, the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the Village of Ionia from the impacts of future hazards and disasters; and

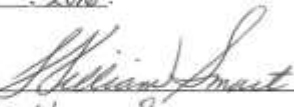
WHEREAS, the Village of Ionia recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the Village of Ionia will endeavor to integrate the Plan into the comprehensive planning process and

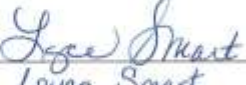
WHEREAS, adoption by the Village of Ionia demonstrates their commitment to hazard mitigation and achieving the goals outlined in the Plan

NOW THEREFORE, BE IT RESOLVED BY THE VILLAGE OF IONIA, IN THE STATE OF MISSOURI, THAT:

Section 1. In accordance with (local rule for adopting resolutions), the Village of Ionia adopts the final FEMA-approved plan.

ADOPTED by a vote of 5 in favor and 0 against, and _____ abstaining, this 12th day of May, 2016.

By (Sig): 
Print name: William Smart

ATTEST:
By (Sig): 
Print name: Loyce Smart

APPROVED AS TO FORM:
By (Sig.): _____
Print name: _____

CITY OF LINCOLN, MISSOURI

RESOLUTION NO. 5-9-2016

**A RESOLUTION OF THE CITY OF LINCOLN ADOPTING THE BENTON COUNTY
REGIONAL ALL-HAZARD MITIGATION PLAN (UPDATED 2016)**

WHEREAS, the City of Lincoln recognizes the threat that natural hazards pose to people and property within the City of Lincoln; and

WHEREAS, the City of Lincoln has participated in the preparation of a multi- hazard mitigation plan, hereby known as the *Benton County Regional All-Hazard Mitigation Plan (Updated 2016)*, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS, the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the City of Lincoln from the impacts of future hazards and disasters; and

WHEREAS, the City of Lincoln recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the City of Lincoln will endeavor to integrate the Plan into the comprehensive planning process and

WHEREAS, adoption by the City of Lincoln demonstrates their commitment to hazard mitigation and achieving the goals outlined in the Plan

NOW THEREFORE, BE IT RESOLVED BY THE CITY OF LINCOLN, IN THE STATE OF MISSOURI, THAT:

Section 1. In accordance with (local rule for adopting resolutions), the City of Lincoln adopts the final FEMA-approved plan.

ADOPTED by a vote of 3 in favor and 0 against, and 1 ABSENT 9th day of May, 2016

By (Sig.): [Signature]
Print name: JOHN E. KING

ATTEST:
By (Sig.): [Signature]
Print name: Barb Johnson

APPROVED AS TO FORM:

By (Sig.): _____
Print name: _____

CITY OF WARSAW, MISSOURI

RESOLUTION NO. 2016-4

A RESOLUTION OF THE CITY OF WARSAW ADOPTING THE BENTON COUNTY
REGIONAL ALL-HAZARD MITIGATION PLAN (UPDATED 2016)

WHEREAS, the City of Warsaw recognizes the threat that natural hazards pose to people and property within the City of Warsaw; and

WHEREAS, the City of Warsaw has participated in the preparation of a multi-hazard mitigation plan, hereby known as the *Benton County Regional All-Hazard Mitigation Plan (Updated 2016)*, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS, the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the City of Warsaw from the impacts of future hazards and disasters; and

WHEREAS, the City of Warsaw recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the City of Warsaw will endeavor to integrate the Plan into the comprehensive planning process and

WHEREAS, adoption by the City of Warsaw demonstrates their commitment to hazard mitigation and achieving the goals outlined in the Plan

NOW THEREFORE, BE IT RESOLVED BY THE CITY OF WARSAW, IN THE STATE OF MISSOURI, THAT:

Section 1. In accordance with (local rule for adopting resolutions), the City of Warsaw adopts the final FEMA-approved plan.

ADOPTED by a vote of 6 in favor and 0 against, and 0 abstaining, this 16th day of May, 2016.

By (Sig.): [Signature]
Print name: Eddie Sanders

ATTEST:
By (Sig.): [Signature]
Print name: Tina Lomax, City Clerk

APPROVED AS TO FORM:
By (Sig.): [Signature]
Print name: Cale B. Haddock

**COLE CAMP R-I SCHOOL DISTRICT
BENTON COUNTY, MISSOURI**

RESOLUTION NO. 2016

**A RESOLUTION OF COLE CAMP R-I SCHOOL DISTRICT ADOPTING THE
BENTON COUNTY REGIONAL ALL-HAZARD MITIGATION PLAN (UPDATED 2016)**

WHEREAS, the Cole Camp R-I School District recognizes the threat that natural hazards pose to people and property within the Cole Camp R-I School District; and

WHEREAS, the Cole Camp R-I School District has participated in the preparation of a multi-hazard mitigation plan, hereby known as the *Benton County Regional All-Hazard Mitigation Plan (Updated 2016)*, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS, the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the Cole Camp R-I School District from the impacts of future hazards and disasters; and

WHEREAS, the Cole Camp R-I School District recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the Cole Camp R-I School District will endeavor to integrate the Plan into the comprehensive planning process and

WHEREAS, adoption by the Cole Camp R-I School District demonstrates their commitment to hazard mitigation and achieving the goals outlined in the Plan

NOW THEREFORE, BE IT RESOLVED BY THE COLE CAMP R-I SCHOOL DISTRICT, IN THE STATE OF MISSOURI, THAT:

Section 1. In accordance with (local rule for adopting resolutions), the Cole Camp R-I School District adopts the final FEMA-approved plan.

ADOPTED by a vote of 6 in favor and 0 against, and 0 abstaining, this 17th day of May, 2016.

By (Sig): 
Print name: Marty Doogs

ATTEST:
By (Sig.): 
Print name: TIM Boling

APPROVED AS TO FORM:

By (Sig.): _____
Print name: _____

**LINCOLN R-II SCHOOL DISTRICT
BENTON COUNTY, MISSOURI
RESOLUTION NO. ____**

**A RESOLUTION OF LINCOLN R-II SCHOOL DISTRICT ADOPTING THE BENTON
COUNTY REGIONAL ALL-HAZARD MITIGATION PLAN (UPDATED 2016)**

WHEREAS, the Lincoln R-II School District recognizes the threat that natural hazards pose to people and property within the Lincoln R-II School District; and

WHEREAS, the Lincoln R-II School District has participated in the preparation of a multi-hazard mitigation plan, hereby known as the *Benton County Regional All-Hazard Mitigation Plan (Updated 2016)*, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS, the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the Lincoln R-II School District from the impacts of future hazards and disasters; and


WHEREAS, the Lincoln R-II School District recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the Lincoln R-II School District will endeavor to integrate the Plan into the comprehensive planning process and

WHEREAS, adoption by the Lincoln R-II School District demonstrates their commitment to hazard mitigation and achieving the goals outlined in the Plan

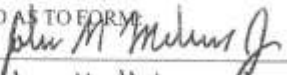
NOW THEREFORE, BE IT RESOLVED BY THE LINCOLN R-II SCHOOL DISTRICT, IN THE STATE OF MISSOURI, THAT:

Section 1. In accordance with (local rule for adopting resolutions), the Lincoln R-II School District adopts the final FEMA-approved plan.

ADOPTED by a vote of 5 in favor and 0 against, and 0 abstaining, this 19th day of May, 2016.

By (Sig.): 
Print name: John M. Mehrens Jr.

ATTEST:
By (Sig.): _____
Print name: _____

APPROVED AS TO FORM:
By (Sig.): 
Print name: John M. Mehrens Jr.

**WARSAW R-IX SCHOOL DISTRICT
BENTON COUNTY, MISSOURI
RESOLUTION NO. ____**

**A RESOLUTION OF WARSAW R-IX SCHOOL DISTRICT ADOPTING THE BENTON
COUNTY REGIONAL ALL-HAZARD MITIGATION PLAN (UPDATED 2016)**

WHEREAS, the Warsaw R-IX School District recognizes the threat that natural hazards pose to people and property within the Cole Camp R-I School District; and

WHEREAS, the Warsaw R-IX School District has participated in the preparation of a multi-hazard mitigation plan, hereby known as the *Benton County Regional All-Hazard Mitigation Plan (Updated 2016)*, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS, the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the Warsaw R-IX School District from the impacts of future hazards and disasters; and

WHEREAS, the Warsaw R-IX School District recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the Warsaw R-IX School District will endeavor to integrate the Plan into the comprehensive planning process and

WHEREAS, adoption by the Warsaw R-IX School District demonstrates their commitment to hazard mitigation and achieving the goals outlined in the Plan

NOW THEREFORE, BE IT RESOLVED BY THE WARSAW R-IX SCHOOL DISTRICT, IN THE STATE OF MISSOURI, THAT:

Section 1. In accordance with (local rule for adopting resolutions), the Warsaw R-IX School District adopts the final FEMA-approved plan.

ADOPTED by a vote of 7 in favor and 0 against, and 0 abstaining, this 23rd day of June, 2016.

By (Sig.):

Print name:

ATTEST:

By (Sig.):

Print name:

APPROVED AS TO FORM:

By (Sig.):

Print name:

Appendix B: Acronyms

- ASM Archaeological Survey of Missouri
- BFE Base Flood Elevation
- BLM Bureau of Land Management
- CDBG Community Development Block Grant
- CEDS Comprehensive Economic Development Strategy
- CERl Center for Earthquake Research and Information at the University of Memphis
- CFR Code of Federal Regulations
- CPC Climate Prediction Center
- CRS Community Rating System
- DMA 2000 Disaster Mitigation Act of 2000
- EDA Economic Development Administration
- EPA Environmental Protection Agency
- FEMA Federal Emergency Management Agency
- FIRM Flood Insurance Rate Map
- FMA Flood Mitigation Assistance (FEMA Program)
- FTE Full Time Equivalent
- GIS Geographic Information System
- HMGP Hazard Mitigation Grant Program
- HMST Hazard Mitigation Survey Team
- HUD Housing and Urban Development (United States, Department of)
- ICC Increased Cost of Compliance
- KBRPC Kaysinger Basin Regional Planning Commission
- LMI Labor Market Information
- MACOG Missouri Association of Councils of Governments
- MCC Midwestern Climate Center
- MoDOT Missouri Department of Transportation
- MPA Missouri Press Association
- NCDC National Climate Data Center
- NEHRP National Earthquake Hazards Reduction Program
- NFIP National Flood Insurance Program
- NFPA National Fire Protection Association
- NHMP Natural Hazard Mitigation Plan
- NIBS National Institute of Building Sciences
- NID National Inventory of Dams
- NIFC National Interagency Fire Center
- NOAA National Oceanic and Atmospheric Administration
- NRHP National Register of Historic Places
- NRCS Natural Resources Conservation Service
- NWS National Weather Service
- PDM Pre-Disaster Mitigation Program
- PDSI Palmer Drought Severity Index

- SBA Small Business Administration
- SEMA Missouri State Emergency Management Agency
- SHMO State Hazard Mitigation Officer
- SPC Storm Prediction Center
- USACE United States Army Corps of Engineers
- USDA United States Department of Agriculture
- USFA United States Fire Administration
- USFS United States Forest Service
- USFWS United States Fish and Wildlife Service
- USGS United States Geological Survey

Appendix C: Definitions

Base Flood Elevation (BFE):

An elevation, usually determined by an engineer, that represents the minimum elevation required for protection from flooding on a specific site.

Drought:

The dictionary definition of drought is a period of prolonged dryness. Current drought literature commonly distinguishes between three categories of drought:

- Agricultural drought, defined by soil moisture deficiencies;
- Hydrological drought, defined by declining surface water and groundwater supplies; and
- Meteorological drought, defined by precipitation deficiencies.

Dam failure assessment levels:

- **High:** Failure or mis-operation will probably cause loss of human life.
- **Significant:** Failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
- **Low:** Failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

Mitigation:

According to FEMA's "Report on Costs and Benefits of Natural Hazard Mitigation," hazard mitigation is defined as "sustained action taken to reduce or eliminate the long-term risk to people and property from hazards and their effects."

Sustainable:

Policies, projects or actions that "meet the needs of the present without compromising the ability of future generations to meet their needs." (*U.N. World Commission of Environment and Development*)

Interface:

A surface regarded as the common boundary of two bodies, spaces, or phases or a common boundary or interconnection between systems, equipment, concepts, or human beings.

Intermix:

To mix together; intermingle.

Appendix D: Public Participation Documents



March 29th, 2018

Dear Stakeholder:

You may or may not be aware that Benton County and all the jurisdictions within are involved in a Natural Hazard Mitigation Plan (NHMP). A NHMP requires and declares all susceptible areas, assets, and hazards that are associated with each county in case of a natural disaster. Every five years the plan is updated for Benton County. Since your county has a NHMP, you are eligible for financial funding from the Federal Emergency Management Agency (FEMA) for both pre and post-disaster mitigation.

Benton County's NHMP update is due in June. The NHMP is designed to help the participating communities become more sustainable and disaster-resilient through selecting the most appropriate mitigation measures.

Kaysinger Basin Regional Planning Commission will be conducting an informational meeting in Warren on April 12th at 1:00 pm at the Warren-Lambda, Lambda-Delta District Building, located at 1200 Maple Dr., Warren, MO 65758. At this meeting, I will discuss the importance of the county's hazard mitigation plan, who is affected, what concerns you may have, and how to get involved. Please invite the Aldermen, Assistant Fire Chief, Assistant Principal, Board Trustees, Chairman of the Board, City Attorney, City Clerk, City Staff, Collector, Emergency Management Director, Fire Chief, Mayor, Municipal Judge, Police Chief/Department, Principal, Public Works, Road District, School Superintendent, Sheriff/Staff, Senior Superintendent, Sheriff/Department, Street Superintendent, Treasurer, Village Clerk, Village Staff, and Water Superintendent. I will try to meet with each jurisdiction personally before the meeting. Communities are encouraged to be a part of the planning process. To be eligible for disaster relief and disaster funding in the event of a disaster, you are required to have a mitigation plan, participate in the Hazard Mitigation Plan in accordance.

If you have any questions or would like to speak directly to me, my contact information is found above. I will be happy to meet with you in person or by phone.

Sincerely,

Cynthia Schmitt
Cynthia Schmitt
Regional Planner

Please RSVP to cschmitt@kbrpc.com or call 468-880-1381
By 5:00 pm on April 12th, 2018.

Priority serving the counties of Benton, Boone, Carter, Henry, Hickory, St. Clair, and Vernon since 1988

Stakeholder Letter Recipient

County	City/Town/Village	Address	Phone	Email
Benton	Warren	1200 Maple Dr.	468-880-1381	cschmitt@kbrpc.com
Boone	Boone	1000 N. Main St.	468-880-1381	cschmitt@kbrpc.com
Carter	Carter	1000 N. Main St.	468-880-1381	cschmitt@kbrpc.com
Henry	Henry	1000 N. Main St.	468-880-1381	cschmitt@kbrpc.com
Hickory	Hickory	1000 N. Main St.	468-880-1381	cschmitt@kbrpc.com
St. Clair	St. Clair	1000 N. Main St.	468-880-1381	cschmitt@kbrpc.com
Vernon	Vernon	1000 N. Main St.	468-880-1381	cschmitt@kbrpc.com



PRESS RELEASE - FOR IMMEDIATE RELEASE

Workshop - Meeting Notice Date - April 12, 2018
Time - 1:00 PM
Location - Warren-Lambda, Lambda-Delta District Building
Address - 1200 Maple Dr., Warren, MO 65758

SPONSORED BY: Kaysinger Basin Regional Planning Commission
PRESENTED BY: Cynthia Schmitt, Regional Planner
SUBJECT: Benton County Hazard Mitigation Plan Update

The Missouri State Emergency Management Agency (SEMA) requests all counties to update their Hazard Mitigation Plan every five years. The updates are to address changes in development, progress in local mitigation efforts and changes in priorities. SEMA is working with Kaysinger Basin Regional Planning Commission (KBRPC) to coordinate and prepare the Hazard Mitigation Plan update for Benton County.

To begin this process, we are holding a meeting to discuss the current plan, the update requirements and to develop a Technical Steering Committee. Your input is needed to coordinate the plan completion.

We have scheduled our first meeting for April 12th, 2018 at 1:00 PM in Warren-Lambda District 1 Building located at 1200 Maple Dr., Warren, MO 65758. At this meeting, we will discuss the planning process, we will identify the hazards, and all for community participation.

Please meeting to attend as a Aldermen, Assistant Fire Chief, Assistant Principal, Board Trustees, Director of the Board, City Attorney, City Clerk, City Staff, Collector, Emergency Management Director, Fire Chief, Mayor, Municipal Judge, Police Chief/Department, Principal, Public Works, Road District, School Superintendent, School Staff, Senior Superintendent, Sheriff/Department, Street Superintendent, Treasurer, Village Clerk, Village Staff, and Water Superintendent, who may be interested in our planning efforts from your community. Community participation and input will play a valuable role in the completion of the plan. It is also very important that we have a good representation from across the county to ensure that we have the support for the plan update in each jurisdiction.

Communities are encouraged to be a part of this planning process. To be eligible for disaster relief and disaster funding in the event of a disaster in the pre-disaster mitigation funds provided in the Hazard Mitigation Plan is mandatory.

The Hazard Mitigation plan will be reviewed by FEMA and submitted to FEMA for approval. Since the plan is submitted every five years, participation in this planning process will be subject to funding when the plan is updated. If you would like to review the updated plan, please visit our website at www.kbrpc.com.

The task force is developing a comprehensive and effective Hazard Mitigation plan to serve our local needs.

Priority serving the counties of Benton, Boone, Carter, Henry, Hickory, St. Clair, and Vernon since 1988

Stakeholder Letter Recipient

County	City/Town/Village	Address	Phone	Email
Benton	Warren	1200 Maple Dr.	468-880-1381	cschmitt@kbrpc.com
Boone	Boone	1000 N. Main St.	468-880-1381	cschmitt@kbrpc.com
Carter	Carter	1000 N. Main St.	468-880-1381	cschmitt@kbrpc.com
Henry	Henry	1000 N. Main St.	468-880-1381	cschmitt@kbrpc.com
Hickory	Hickory	1000 N. Main St.	468-880-1381	cschmitt@kbrpc.com
St. Clair	St. Clair	1000 N. Main St.	468-880-1381	cschmitt@kbrpc.com
Vernon	Vernon	1000 N. Main St.	468-880-1381	cschmitt@kbrpc.com



PRESS RELEASE - FOR IMMEDIATE RELEASE

Workshop - Meeting Room 100
Location: Warner Lincoln Ambulance District Building
Address: 1206 Medix Dr., Warner, MO 65355

SPONSORED BY: Kaysinger Basin Regional Planning Commission
ARRANGED BY: Cyndee Schmidt, Regional Planner
Source: Hazard Mitigation Planning Meeting

Kaysinger Basin will be hosting a second hazard mitigation planning meeting this last week in April. This meeting will be held at the Warner Lincoln Ambulance District's Building located at 1206 Medix Dr., Warner, MO 65355. It will address the Hazard Mitigation goals/work plan for Benton County. Those interested or who have useful information for the plan update are invited to attend. Cyndee Schmidt of Kaysinger Basin said "This plan is vital for Benton County. Not only is it a federal requirement to apply to receive federal funding, it is a plan designed to assist FEMA in responding to hazards in our county. Public input helps us to better assess the needs of our county, and to cover that in the plan update." For more information about the meeting contact Cyndee Schmidt by email at cschmidt@kbrpc.com.

ENTERPRISE

Thursday, April 22, 2010

www.BentonCountyEnterprise.com

Hazard Mitigation Planning Meeting

Kaysinger Basin will be hosting a second hazard mitigation planning meeting this last week in April. This meeting will be held at the Warner Lincoln Ambulance District's Building located at 1206 Medix Dr., Warner, MO 65355. It will address the Hazard Mitigation goals/work plan for Benton County. Those interested or who have useful information for the plan update are invited to attend. Cyndee Schmidt of Kaysinger Basin said "This plan is vital for Benton County. Not only is it a federal requirement to apply to receive federal funding, it is a plan designed to assist FEMA in responding to hazards in our county. Public input helps us to better assess the needs of our county, and to cover that in the plan update." For more information about the meeting contact Cyndee Schmidt by email at cschmidt@kbrpc.com.

Proudly serving the counties of Bates, Benton, Cedar, Henry, Hickory, St. Clair, and Warren since 1959

8 The Lincoln New Era Friday, April 22, 2010

Kaysinger Basin Hazard Mitigation Planning Meeting

Submitted by Cyndee Schmidt
Kaysinger Basin will be hosting a second hazard mitigation planning meeting this last week in April. This meeting will be held at the Warner Lincoln Ambulance District's Building located at 1206 Medix Dr., Warner, MO 65355. It will address the Hazard Mitigation goals/work plan for Benton County. Those interested or who have useful information for the plan update are invited to attend. Cyndee Schmidt of Kaysinger Basin said "This plan is vital for Benton County. Not only is it a federal requirement to apply to receive federal funding, it is a plan designed to assist FEMA in responding to hazards in our county. Public input helps us to better assess the needs of our county, and to cover that in the plan update." For more information about the meeting contact Cyndee Schmidt by email at cschmidt@kbrpc.com.

8 Cedar Camp Creek, Benton County, Ark. Friday, April 22, 2010

Kaysinger Basin Hazard Mitigation Planning Meeting

Submitted by Cyndee Schmidt
Kaysinger Basin will be hosting a second hazard mitigation planning meeting this last week in April. This meeting will be held at the Warner Lincoln Ambulance District's Building located at 1206 Medix Dr., Warner, MO 65355. It will address the Hazard Mitigation goals/work plan for Benton County. Those interested or who have useful information for the plan update are invited to attend. Cyndee Schmidt of Kaysinger Basin said "This plan is vital for Benton County. Not only is it a federal requirement to apply to receive federal funding, it is a plan designed to assist FEMA in responding to hazards in our county. Public input helps us to better assess the needs of our county, and to cover that in the plan update." For more information about the meeting contact Cyndee Schmidt by email at cschmidt@kbrpc.com.

Friday, April 22, 2010 The Lincoln New Era 3

Lincoln City Council

City Clerk: The clerk has provided the March meeting's report and budget report to the council. The council will discuss the upcoming Council and Office with Kaysinger Basin Regional Planning Commission. The council will also discuss the needs of the communities in the county and when they KBRPC could provide to those from goals. The report the department heads were working with KBRPC to update the Benton County Natural Hazard Mitigation Plan is the coming week.



Public Notice

PUBLIC COMMENTS

Over the past twelve months, the Kaysinger Basin Regional Planning Commission (KBAPC) has been working with area municipalities to update the county's Hazard Mitigation Plan. Throughout this process, participants have worked to identify the type of natural hazards occurring within Benton County, analyze the monetary and physical impacts of these hazards, and identify action items to reduce the county's vulnerability to these hazards. The planning team has identified a Mitigation Strategy, a list of action steps taken today to reduce the loss of life and property in the future, to be reviewed in the county's next planning meeting. With input considered from a wide range of Benton County residents, a draft version of the Benton County Hazard Mitigation Plan 2016 has been completed. The planning team invites all interested Benton County residents to review the draft plan, available at Cole Camp City Hall, Lincoln City Hall, Warsaw City Hall, Benton County Emergency Management Office, and the KBAPC office. The draft version of the Benton County Hazard Mitigation Plan 2016 is also available for public viewing and comment. Residents of Benton County are encouraged to review the plan and direct any comments to Cynthia Schmidt, KBAPC Regional Planner, at cschmidt@kaysinger.com. KBAPC would like to thank all those that have participated in the planning process. The input gained during the public meetings and from public comments has been extremely helpful. These organizations believe the Benton County Hazard Mitigation Plan draft represents a strong strategy for reducing the county's vulnerability to natural hazards.

Please contact Cynthia Schmidt at cschmidt@kaysinger.com or at 860-885-3363 if any special accommodations are needed for review of the plan.

• Proudly serving the counties of Benton, Boone, Carter, Henry, Hickory, St. Clair, and Warren since 1988 •

ENTERPRISE

Public Comments Needed For Hazard Mitigation Plan

Over the past twelve months, the Kaysinger Basin Regional Planning Commission (KBAPC) has been working with area municipalities to update the county's Hazard Mitigation Plan. Throughout this process, participants have worked to identify the type of natural hazards occurring within Benton County, analyze the monetary and physical impacts of these hazards, and identify action items to reduce the county's vulnerability to these hazards. The planning team has identified a Mitigation Strategy, a list of action steps taken today to reduce the loss of life and property in the future, to be reviewed in the county's next planning meeting. With input considered from a wide range of Benton County residents, a draft version of the Benton County Hazard Mitigation Plan 2016 has been completed. The planning team invites all interested Benton County residents to review the draft plan, available at Cole Camp City Hall, Lincoln City Hall, Warsaw City Hall, Benton County Emergency Management Office, and the KBAPC office. The draft version of the Benton County Hazard Mitigation Plan 2016 is also available for public viewing and comment. Residents of Benton County are encouraged to review the plan and direct any comments to Cynthia Schmidt, KBAPC Regional Planner, at cschmidt@kaysinger.com. KBAPC would like to thank all those that have participated in the planning process. The input gained during the public meetings and from public comments has been extremely helpful. These organizations believe the Benton County Hazard Mitigation Plan draft represents a strong strategy for reducing the county's vulnerability to natural hazards.

8 Cole Camp Courier Lincoln New Era Friday, May 13, 2016

Kaysinger Basin RPC Hazard Mitigation Plan Available At Local City Facilities

Submitted by Cynthia Schmidt
Over the past twelve months, the Kaysinger Basin Regional Planning Commission (KBAPC) has been working with area municipalities to update the county's Hazard Mitigation Plan. Throughout this process, participants have worked to identify the type of natural hazards occurring within Benton County, analyze the monetary and physical impacts of these hazards, and identify action items to reduce the county's vulnerability to these hazards. The planning team has identified a Mitigation Strategy, a list of action steps taken today to reduce the loss of life and property in the future, to be reviewed in the county's next planning meeting. With input considered from a wide range of Benton County residents, a draft version of the Benton County Hazard Mitigation Plan 2016 has been completed. The planning team invites all interested Benton County residents to review the draft plan, available at Cole Camp

City Hall, Iowa City Hall, Lincoln City Hall, Warsaw City Hall, Benton County Emergency Management Office, and the KBAPC office. The draft version of the Benton County Hazard Mitigation Plan 2016 is also available for public viewing and comment.

Residents of Benton County are encouraged to review the plan and direct any comments to Cynthia Schmidt, KBAPC Regional Planner, at cschmidt@kaysinger.com. KBAPC appreciates all those that have participated in the planning process. The input gained during the public meetings and from public comments has been extremely helpful. These organizations believe the Benton County Hazard Mitigation Plan draft represents a strong strategy for reducing the county's vulnerability to natural hazards.

Please contact Cynthia Schmidt at cschmidt@kaysinger.com or at 860-885-3363 if any special accommodations are needed for review of the plan.

8 Cole Camp Courier Lincoln New Era Friday, May 13, 2016

Kaysinger Basin RPC Hazard Mitigation Plan Available At Local City Facilities

Submitted by Cynthia Schmidt
Over the past twelve months, the Kaysinger Basin Regional Planning Commission (KBAPC) has been working with area municipalities to update the county's Hazard Mitigation Plan. Throughout this process, participants have worked to identify the type of natural hazards occurring within Benton County, analyze the monetary and physical impacts of these hazards, and identify action items to reduce the county's vulnerability to these hazards. The planning team has identified a Mitigation Strategy, a list of action steps taken today to reduce the loss of life and property in the future, to be reviewed in the county's next planning meeting. With input considered from a wide range of Benton County residents, a draft version of the Benton County Hazard Mitigation Plan 2016 has been completed. The planning team invites all interested Benton County residents to review the draft plan, available at Cole Camp

City Hall, Iowa City Hall, Lincoln City Hall, Warsaw City Hall, Benton County Emergency Management Office, and the KBAPC office. The draft version of the Benton County Hazard Mitigation Plan 2016 is also available for public viewing and comment.

Residents of Benton County are encouraged to review the plan and direct any comments to Cynthia Schmidt, KBAPC Regional Planner, at cschmidt@kaysinger.com. KBAPC appreciates all those that have participated in the planning process. The input gained during the public meetings and from public comments has been extremely helpful. These organizations believe the Benton County Hazard Mitigation Plan draft represents a strong strategy for reducing the county's vulnerability to natural hazards.

Please contact Cynthia Schmidt at cschmidt@kaysinger.com or at 860-885-3363 if any special accommodations are needed for review of the plan.

Kaysinger Basin RPC Hazard Mitigation Plan Available At Local City Facilities

Scheduled by
Cynthia Schmidt

Over the past month, the Kaysinger Basin Regional Planning Commission (KBSPC), has been working with nine participating cities to update the county's Hazard Mitigation Plan. Throughout this process, participants have worked to identify the type of natural hazards occurring within Benton County, analyze the community and physical impacts of these hazards, and identify action items to reduce the county's vulnerability to these hazards.

The planning team has identified a Mitigation Strategy, a plan of action upon which to reduce the loss of life and property in the future. It includes planning mitigation events. With input considered from a wide range of Benton County residents, a draft version of the Benton County Hazard Mitigation Plan 2016 has been completed.

The planning team solicited input from Benton County residents to review the draft plan, available at City Camp

City Hall, Benton City Hall, Lincoln City Hall, Warsaw City Hall, Benton County Emergency Management District, and the KBSPC office. The draft version of the Benton County Hazard Mitigation Plan 2016 is also available for public viewing and comment.

Residents of Benton County are encouraged to review the plan and direct any comments to Cynthia Schmidt, KBSPC Regional Planning Commission. Residents are also encouraged to participate in the planning process. The plan will be presented at public meetings and town public meetings. The plan will be presented at public meetings and town public meetings.

Please contact Cynthia Schmidt at 660-651-5300 if you need to review the plan or need to review the plan.

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Please contact Cynthia Schmidt at 660-651-5300 if you need to review the plan or need to review the plan.

Please Print Clearly

MEETING SIGN-IN SHEET				
Project: Benton County Hazard Mitigation Plan Update				
Facilitator: Cynthia Schmidt				
Name	City	Address/Phone	Meeting Date	Meeting Time
1. Cynthia Schmidt	Benton	660-651-5300	April 27, 2016	10:00 AM
2. Cynthia Schmidt	Benton	660-651-5300	April 27, 2016	10:00 AM
3. Cynthia Schmidt	Benton	660-651-5300	April 27, 2016	10:00 AM
4. Cynthia Schmidt	Benton	660-651-5300	April 27, 2016	10:00 AM
5. Cynthia Schmidt	Benton	660-651-5300	April 27, 2016	10:00 AM
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MEETING SIGN-IN SHEET					
Project: Benton County Natural Hazard Mitigation Plan Update			Date: 4-6-16		
Facilitator: Celia Camp & David			Time: 8:00 am - 4:30 pm		
Name	Title	Attendance/Topic	Phone	E-Mail	Notes/Travelled
1) Sarah Alford	Chair	City Camp	505-255-1111	camp@benton.gov	
2) Nathan Smith	Board	"	"	"	
3) Dana East	HS S&S	City Camp	"	"	
4) Donna Spang	Fire District	City Camp	"	"	
5) Pauline Jackson	Public Health	City Camp	"	"	
6) Lisa Brown	Public Health	City Camp	"	"	
7) Barbara	Public Health	City Camp	"	"	
8) Barbara Wilkins	Public Health	City Camp	"	"	
9) Rick Gaudin	Public Health	City Camp	"	"	
10) David Spang	Public Health	City Camp	"	"	
11) John Jackson	Public Health	City Camp	"	"	
12) David Wilkins	Public Health	City Camp	"	"	

Please Print Clearly

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7) Barbara	Public Health	City Camp	"	"	
8) Barbara Wilkins	Public Health	City Camp	"	"	
9) Rick Gaudin	Public Health	City Camp	"	"	
10) David Spang	Public Health	City Camp	"	"	
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10) David Spang	Public Health	City Camp	"	"	
11) John Jackson	Public Health	City Camp	"	"	
12) David Wilkins	Public Health	City Camp	"	"	

Please Print Clearly

Multi-Jurisdictional
Hazard Mitigation Plan

Data Collection Questionnaire
For School Districts and Educational Institutions

County: Benton County
School District / Educational Institution Name: Lincoln R-2 School
Return to: Cynthia Schmidt

Please complete this data collection questionnaire as accurately and completely as possible as the information will appear in the mitigation plan. A data collection questionnaire must be completed for each "jurisdiction" that wishes to be included in the plan. According to FEMA's definition a jurisdiction is any local government, including counties, municipalities, cities, towns, school districts, special districts, councils of government, and tribal organizations. Any of these entities as well as publicly funded colleges and universities that do not participate in the planning process will not be eligible applicants for FEMA mitigation funding programs.

*****Required*****

Prepared by: Kevin Smith
Title: Super
Jurisdiction/Town: Lincoln
Phone: 505-547-3501
Email: ksmith@lincoln.k12.or.us
Date: 6-2-15
Time Taken to Complete: 30 min

Please return questionnaires to:

Cynthia Schmidt
221 N. Second Street
Clenton, MO 64735
cschmidt@kaysinger.com

By mail, email, or fax to: 1-800-885-4166

Or

Drop off to Bill Gant at the 911 Dispatch
Office/Emergency Management Office
1231 Hersh Pkwy, Warsaw, Mo. 65559

$5 \text{ sheets} \times \$21.31 = \$106.55$

04/22/2015 1:50:31 L:\BENTON\2015

CITY OF COLE CAMP

PAGE 10/11

Multi-Jurisdictional
Hazard Mitigation Plan

Data Collection Questionnaire
For Local Governments

County: Benton County
Jurisdiction: City of Cole Camp
Return to: Cynthia Schmidt

Please complete this data collection questionnaire as accurately and completely as possible as the information will appear in the mitigation plan. A data collection questionnaire must be completed for each "jurisdiction" that wishes to be included in the plan. According to FEMA's definition a jurisdiction is any local government, including counties, municipalities, cities, towns, school districts, special districts, councils of government, and tribal organizations. Any of these entities as well as publicly funded colleges and universities that do not participate in the planning process will not be eligible applicants for FEMA mitigation funding programs. Please note: School Districts and other Educational Institutions should complete the Data Collection Questionnaire indicated "For School Districts and Educational Institutions".

*****Required*****

Prepared by: Kevin Smith
Title: Super
Jurisdiction/Town: Lincoln
Phone: 505-547-3501
Email: ksmith@lincoln.k12.or.us
Date: 6-2-15
Time Taken to Complete: 30 min

Please return questionnaires to:

Cynthia Schmidt
221 N. Second Street
Clenton, MO 64735
cschmidt@kaysinger.com

By mail, email, or fax to: 1-800-885-4166

Or

Drop off to Bill Gant at the 911 Dispatch
Office/Emergency Management Office
1231 Hersh Pkwy, Warsaw, Mo. 65559

$5.5 \text{ sheets} \times \$21.31 = \$117.21$

Sign-In Sheet

Benton County Natural Hazard Mitigation Plan Update
Kaysinger Basin Regional Planning Commission (KRC) Meeting

5/6/15 1:50:31
Draft Delivery

TIME	Affiliation/Town	Phone	E-Mail	C
1:00 PM	City of Cole Camp			
1:05 PM	Super	Col Camp MO		
1:10 PM	Super	Lincoln R-2		
1:15 PM	City of Cole Camp			
1:20 PM	City of Cole Camp			
1:25 PM	Super	Winnemucca		
1:30 PM	City of Cole Camp			
1:35 PM	City of Cole Camp			

$5 \text{ sheets} = 4 \text{ sheets} \times \$21.31 = \$85.24$

Please Print Clearly

Multi-Jurisdictional
Hazard Mitigation Plan

Data Collection Questionnaire
For Local Governments

County: Benton County
Jurisdiction:
Return to: Cynthia Schmidt

Please complete this data collection questionnaire as accurately and completely as possible as the information will appear in the mitigation plan. A data collection questionnaire must be completed for each "jurisdiction" that wishes to be included in the plan. According to FEMA's definition a jurisdiction is any local government, including counties, municipalities, cities, towns, school districts, special districts, councils of government, and tribal organizations. Any of these entities as well as publicly funded colleges and universities that do not participate in the planning process will not be eligible applicants for FEMA mitigation funding programs. Please note: School Districts and other Educational Institutions should complete the Data Collection Questionnaire indicated "For School Districts and Educational Institutions".

*****Required*****

Prepared by: Kevin Smith
Title: Super
Jurisdiction/Town: Lincoln
Phone: 505-547-3501
Email: ksmith@lincoln.k12.or.us
Date: 6-2-15
Time Taken to Complete: 30 min

Please return questionnaires to:

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Clenton, MO 64735
cschmidt@kaysinger.com

By mail, email, or fax to: 1-800-885-4166

Or

Drop off to Bill Gant at the 911 Dispatch
Office/Emergency Management Office
1231 Hersh Pkwy, Warsaw, Mo. 65559

$6.5 \text{ sheets} \times \$21.31 = \$138.55$

Multi-Jurisdictional
Hazard Mitigation Plan

Data Collection Questionnaire
For School Districts and Educational Institutions

County: Benton County
School District / Educational Institution Name: Wagon R. H. School District
Return to: Cynthia Schmitt

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*****Required*****
Prepared by: Tina Thacker
Title: Director of Administration & Finance
Jurisdiction: City of Warsaw
Phone: 662-488-2444
Email: thacker@cityofwarrior.com
Date: 5-15-2015
Time Taken to Complete: 2 hours

Please return questionnaires to:

Cynthia Schmitt
221 N. Second Street
Clinton, MO 64735
cschmitt@kaysinger.com

By mail, email, or fax to: 1-800-885-4188

Or

Drop off to Bill Gant at the 911 Dispatch Office/Emergency Management Office:
1231 High Pkwy, Warsaw, Mo. 65355

3.5 hrs @ \$21.31 = \$74.60

1 SIGN-IN SHEET

Benton County Natural Hazard Mitigation Plan Update			
Kaysinger Basin Regional Planning Commission (Cynthia Schmitt)			
Meeting Date:		April 22, 2015 at 1:00pm	
Place/Room:		1200 Main St. Warsaw, Mo	
Title	Attention	Phone	E-Mail
Cynthia Schmitt	City of Warsaw	723-1342	TJH124@benton.com
Gary E. H.	Benton C	723-1342	lgames22@benton.com
Jason Schmitt	City of Warsaw	723-1342	jschmitt@cityofwarrior.com
Emily City Clerk	City of Warsaw	435-5572	cityclerk@cityofwarrior.com
Rene Hoyer	City of Warsaw	723-1342	rehoyer@cityofwarrior.com
John Schmitt	City of Warsaw	723-1342	jschmitt@cityofwarrior.com
James Childs	City of Warsaw	435-5572	jchilds@cityofwarrior.com
Bill Gant	City of Warsaw	435-5572	bgant@cityofwarrior.com
John Schmitt	City of Warsaw	723-1342	jschmitt@cityofwarrior.com
John Schmitt	City of Warsaw	723-1342	jschmitt@cityofwarrior.com

11.5 @ \$21.31 = \$245.10
1.0 @ \$21.31 = \$21.31
Total = \$266.41

Please Print Clearly

Multi-Jurisdictional
Hazard Mitigation Plan

Data Collection Questionnaire
For Local Governments

County: Benton County
Jurisdiction: City of Warsaw
Return to: Cynthia Schmitt

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*****Required*****
Prepared by: Tina Thacker
Title: Director of Administration & Finance
Jurisdiction: City of Warsaw
Phone: 662-488-2444
Email: thacker@cityofwarrior.com
Date: 5-15-2015
Time Taken to Complete: 2 hours

Please return questionnaires to:

Cynthia Schmitt
221 N. Second Street
Clinton, MO 64735
cschmitt@kaysinger.com

By mail, email, or fax to: 1-800-885-4188

Or

Drop off to Bill Gant at the 911 Dispatch Office/Emergency Management Office:
1231 High Pkwy, Warsaw, Mo. 65355

Randy Pogue 1 hour
Meeting w/ Staff 3 hours
(3.5 hrs)
(1 hr each) 6 hours

Blues total 6

Multi-Jurisdictional
Hazard Mitigation Plan

Data Collection Questionnaire
For School Districts and Educational Institutions

County: Benton County
School District / Educational Institution Name: City of Warsaw
Return to: Cynthia Schmitt

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Title: Director of Administration & Finance
Jurisdiction: City of Warsaw
Phone: 662-488-2444
Email: thacker@cityofwarrior.com
Date: 5-15-2015
Time Taken to Complete: 2 hours

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cschmitt@kaysinger.com

By mail, email, or fax to: 1-800-885-4188

Or

Drop off to Bill Gant at the 911 Dispatch Office/Emergency Management Office:
1231 High Pkwy, Warsaw, Mo. 65355

2 hrs @ \$21.31 = \$42.62

[illegible][illegible]

1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 2680, 26

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Allegretti, M. 2000. *Shoreland Use*. New York: McGraw-Hill.

Type of Abuse	Number of People
Sex Abuse	2
Drugs	3
Exploitation	2
Exposure to...	3
Force	3
Feeling (Fear and...)	3
Limit	2
Limit Failure	2
Physical assault (G...)	4
Torture	3
Wife (Heard or seen...)	3

3/20/2016 SurveyMonkey Analysis - Public Survey - Benton County

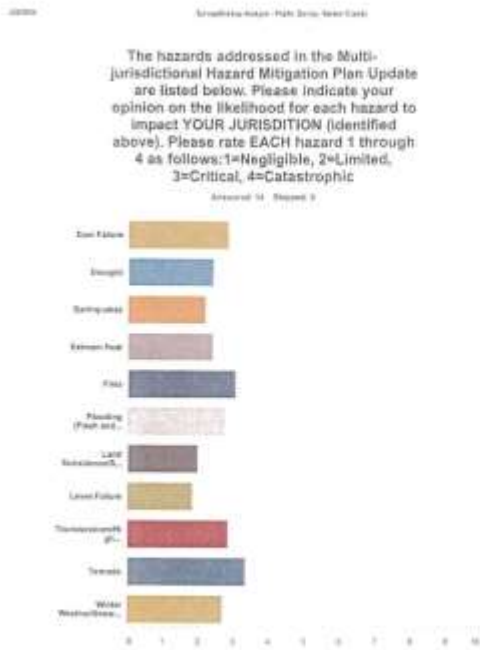
	Negligible	Limited	Critical	Catastrophic	Total	Response Rate (%)
Open Failure	42.86%	42.86%	7.14%	7.14%	100	100%
Drought	14.29%	57.14%	21.43%	14.29%	100	100%
Earthquake	21.43%	21.43%	7.14%	5.24%	100	100%
Extreme Heat	7.14%	28.57%	50.00%	14.29%	100	100%
Flood	14.29%	14.29%	21.43%	14.29%	100	100%
Flooding (Flash and River)	21.43%	14.29%	21.43%	42.86%	100	100%
Land Subsidence/Settlement	50.00%	35.71%	14.29%	0.00%	100	100%
Leaves Failure	42.86%	28.57%	28.57%	0.00%	100	100%
Thunderstorms/High Winds/Lightning/Fall	0.00%	7.14%	21.71%	21.19%	100	100%
Tornado	7.14%	21.43%	21.43%	50.00%	100	100%
Water Shortage/Drought/Severe Cold	0.00%	14.29%	42.86%	42.86%	100	100%

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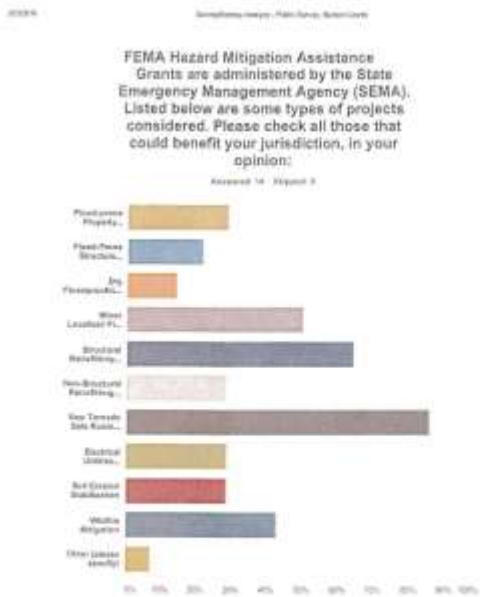
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	Negligible	Limited	Critical	Catastrophic	Total	Response Rate (%)
Open Failure	21.43%	14.29%	21.43%	42.86%	100	100%
Drought	21.43%	28.57%	28.71%	14.29%	100	100%
Earthquake	21.43%	50.00%	14.29%	14.29%	100	100%
Extreme Heat	14.29%	21.71%	42.86%	7.14%	100	100%
Flood	7.14%	14.29%	42.86%	25.71%	100	100%
Flooding (Flash and River)	14.29%	21.43%	21.71%	28.57%	100	100%
Land Subsidence/Settlement	21.43%	27.14%	21.43%	0.00%	100	100%
Leaves Failure	42.86%	28.57%	19.87%	0.00%	100	100%
Thunderstorms/High Winds/Lightning/Fall	0.00%	28.57%	27.14%	14.29%	100	100%
Tornado	0.00%	14.29%	21.71%	50.00%	100	100%
Water Shortage/Drought/Severe Cold	0.00%	28.57%	27.14%	7.14%	100	100%

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