Henry County Natural Hazard Mitigation Plan

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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.

Examples of adoption resolutions for the participating jurisdictions are included in Appendix A.

(NOTE: ADOPTION WILL COME AT THE END OF THE PROCESS AFTER FEMA HAS APPROVED THE PLAN.)

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, 2004, communities like these will still be eligible for federal disaster public 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 new 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 2004 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, Henry County contracted with Kaysinger Basin Regional Planning Commission and participated fully in the preparation of the plan. Once this plan is approved, Henry 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, and county and municipal governments hold membership on a voluntary basis.

The Henry 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 Plan*s. Relevant requirements from CFR §201.6 are highlighted throughout the plan.

1.2 History of the Henry 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. Henry 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 November of 2004.

Maintenance of Hazard Mitigation Plan 2004-2010

The Henry County Hazard Mitigation Plan 2004 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 Henry County Hazard Mitigation Steering Committee, facilitated by the Kaysinger Basin RPC. These annual reviews did not take place; lack of a defined time table for the reviews, 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 a timetable 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.

The Henry County Hazard Mitigation Plan is a multi-jurisdictional plan. Planners from the Kaysinger Basin RPC adopted the following criteria from Mid-MO RPC for a jurisdiction to qualify as a participating jurisdiction:

1. Completion of a survey regarding capabilities, vulnerable assets, and future development
2. Review of a draft of the plan and provision of feedback, if warranted
3. Review of mitigation actions suggested for the jurisdiction; prioritization of actions deemed feasible for the jurisdiction based on benefit/cost and time/resources available for implementation and administration
4. Formal adoption of the plan by resolution if a criterion was met by the first three criteria.

The 'participating jurisdiction' needed to meet all three requirements or notify a KBRPC staff that paperwork was unavailable or meeting times did not work in their schedule. 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. (See Table 1.3-1)

Table 1.3-1 **Record of Participating Jurisdictions**

Jurisdiction	Plan Update Status	Attended Meetings	Review & Comment on Draft	Submitted Required Paperwork
Henry County	Continuing	X	X	X
Municipalities				
City of Blairstown	No longer participating	-	-	-
Village of Brownington	No longer participating	-	-	-
City of Calhoun	Continuing	X	X	X
City of Clinton	Continuing	X	X	X
City of Deepwater	Continuing	X	X	X
City of Montrose	Continuing	X	X	X
City of Urich	Continuing	X	X	X
City of Windsor	Continuing	X	X	X
School Districts				
Calhoun R-VIII	New		X	X
Clinton 124	New		X	X
Davis R-XII	New	X	X	X
Henry County R-I	New		X	X
Leesville R-IX	No participation	-	-	-
Montrose R-XIV	No participation	-	-	-
Shawnee R-III	New	X	X	X

The primary representatives for each jurisdiction participating to any degree in the update process are shown in Figure 1.3-2. 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 1.3-2 **Jurisdiction Representatives**

Jurisdiction	Representative
Henry County Commissioner	Jim Talley
City of Calhoun	Tina Redding, City Clerk
City of Clinton	Sam Gibbons, Mayor
City of Deepwater	Steven T. Wright, Mayor
City of Montrose	Anna Hill, City Clerk
City of Urich	Frank Charles, Mayor
City of Windsor	Sandra Underwood, City Clerk
Calhoun R-VIII School District	Ragena Mize, Superintendent
Clinton School District 124	Craig Eaton, Superintendent
Shawnee Mound R-III School District	Nancy Akert, Superintendent
Henry County R-I	Kevin Sandlin, Superintendent
Davis R-XII	Deborah Day, Superintendent

The following jurisdictions have participated in the planning process and have been in further communication with the Plan Author but have ***not*** completed all of the preliminary requirements for consideration as participating jurisdictions:

- City of Blairstown
- Village of Brownington
- Leesville R-IX
- Montrose R-XIV

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 Henry 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 was as follows:

1. Preliminary update of technical data in charts and graphs (e.g. storm history events, population statistics, etc.) by Kaysinger Basin RPC staff in expectation of an MOA from SEMA for the update (June-Aug. 2010)
2. Preliminary discussions with new regional planner from Kaysinger Basin and SEMA regarding the update of the Henry County Hazard Mitigation Plan (July 2010)

3. MOA for Update of Henry County Hazard Mitigation Plan received from SEMA (May 2009)
4. Formation of a Technical Steering Committee to prepare preliminary draft of the update and provide input throughout the update process (Aug. 2010)
5. Draft of update due at SEMA for review (August, 2010)
6. Survey to officials of participating jurisdictions on capabilities, vulnerable assets, and future development (August-October. 2010)
7. Presentation of update draft to officials of participating jurisdictions, neighboring jurisdictions, the public, interested agencies, businesses, and non-profits (Dec. 8, 2010)
8. Feedback from participating jurisdictions on mitigation actions and their prioritization decisions for their jurisdictions (Dec. 2010-Jan. 2011)
9. Incorporation of survey information and mitigation actions feedback from participating jurisdictions into update draft (Dec. 2010-Jan. 2011)
10. Presentation of final draft for public comment before submission for SEMA/FEMA final approval (Jan. 19, 2010)
11. Final plan due at SEMA for submission to FEMA (Jan. 30, 2010)
12. Presentation of the approved plan for participating jurisdictions' approvals (after approval by FEMA)

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 Henry County, initiated the formation of the committee and participated in the committee meetings.

The Technical Steering Committee consisted of the following individuals: Samantha Dingfelder, (Kaysinger Basin Regional Planning Commission) Darla Conner (City of Urich), and Tina Redding (City of Calhoun).

Summary of Plan Update

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 thus contained much information of little relevance to hazard mitigation. The committee decided to remove this superfluous material from the plan. The goal was to produce a plan which is relevant, useful, and readable. Therefore the entire HMP format and all page numbers are different from the 2004 plan.

Table 1.4-1 Henry County Changes from 2004 Plan		
Description	**Revised**	**Pages of Original Plan**
Section 1 was reworded, rearranged, and had more detailed information per section. Basic format stayed the same.	Yes	#1-7
Section 2 Community profile removed and updated. Updated all charts and graphs to reflect more recent data. Historic properties and the NFIP information were moved to Section 3. Subsection titles were changed and some were merged and/or eliminated.	Yes	#11--44
Section 3 Reviewed all charts and graphs and updated; edited text to reflect new information; changed rating system of each hazard to "Measure of Probability and Severity" using the same rating system as in the Missouri State HMP 2007. Reorganized hazard profiles and made specific changes. Removed all vulnerability assessment charts to update data and reformat per FEMA guidelines.	Yes	#45-94
Section 4 Hazard identification is moved to Section 3 and has been updated with the most recent community concerns.	Yes	#95-113
Section 5 Updated the Mitigation Goals, Objectives, and Actions to reflect decisions made by the participating jurisdictions, added documentation of changes to Mitigation Actions; added mitigation action matrix for each participating jurisdiction. This section is Section 4 in the update.	Yes	#115-118
Section 6 Goals and Strategies changed very little but were moved to another section.	Yes	#120-127
Section 7 Removed and replaced in Section 6	Yes	#128-145
Replaced Appendices with update maps and figures, the current outline is now in the following order; **Section 1** Introduction and Planning **Section 2** Planning Area Profile and Capabilities **Section 3** Risk Assessment **Section 4** Mitigation Strategy **Section 5** Plan Maintenance Process **Section 6** Maps Appendices with other maps	Yes	#141-151

Requirement

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

One meeting was held per city, county, and school district officials for a one-time introductory and informational meeting about the county's Hazard Mitigation Plan and services offered by Kaysinger Basin Regional Planning Commission. Sign-in sheets for all meetings are included in Appendix B.

Public Meetings for Comment and Input

Eight meetings were held for public comment and input on the update of this plan. The first meeting was held on August 3, 2010 at Clinton City Hall. The second meeting was held at the Urich City Hall on August 10, 2010. The third meeting was held September 8, 2010 at Deepwater City Hall. The fourth meeting was held in Calhoun on September 13, 2010, the fifth meeting was conducted in Windsor on September 14, 2010, with the next meeting being held at the Blairstown city hall on September 21, 2010. The seventh meeting was held in Brownington near the first of October, 2010. All meetings were held during the updating process of the current Henry County Hazard Mitigation plan, prior to the revised 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 including local radio stations and newspapers.

The eighth meeting, a county-wide meeting was also held on July 13, 2011 at Kaysinger Basin RPC Offices. An overview of the previous plan and informational PowerPoint was presented with an opportunity for feedback, comments, and questions. It was emphasized at the meeting that the previous draft (and eventually updated plan) will be available online at: www.kaysinger.com (Hazard Mitigation Plan Section). A sign-in sheet for this meeting is included in Appendix B. Letters were mailed out to all schools and participating jurisdictions prior to this meeting.

All meetings mentioned above had opportunities for public comment.

First Meeting for Public Comment and Input

The first meeting was held on August 3, 2010 at Clinton City Hall. A brief overview of the purpose and content of the update of the Henry County Hazard Mitigation plan was presented to all in attendance.

Press release went to:

- Clinton Daily Democrat

Second Meeting for Public Comment

A second meeting for public comment and input on the plan was held on August 10, 2010 as part of the Urich City Council meeting. An overview of the previous plan was presented with an opportunity for feedback, comments, and questions. It was emphasized at the meeting that the previous plan (and eventually updated plan) will be available online at www.kaysinger.com (Hazard Mitigation Plan Section). A sign-in sheet for this meeting is included in Appendix B.

Third Meeting for Public Comment

The third meeting was held September 8, 2010 at Deepwater City Hall. An overview of the mitigation plan process was provided; with accompany worksheets asking for information about the community to be included in the final updated Henry County Hazard Mitigation plan.

Fourth Meeting for Public Comment

The fourth meeting was held in Calhoun on September 13, 2010. This meeting was in conjunction with the regular Calhoun City Council meeting. Comment was sought from both city council members and members of the public that attended.

Fifth Meeting for Public Comment

The fifth natural hazard mitigation meeting was conducted in Windsor on September 14, 2010. An overview of the plan update process was presented as well as a request for the completion of needed hazard mitigation plan worksheets.

Sixth Meting for Public Comment

The sixth mitigation update process meting was presented at the Blairstown city hall on September 21, 2010.

Seventh Meeting for Public Comment

The seventh meeting was held in Brownington near the first of October, 2010.

Eighth Meting for Public comment

The eighth public comment meeting was conducted on July 13, 2011 at Kaysinger Basin RPC Offices. An overview of the previous plan and informational PowerPoint was presented with an opportunity for feedback, comments, and questions.

It was emphasized at the meeting that the previous draft (and eventually updated plan) will be available online at: www.kaysinger.com (Hazard Mitigation Plan Section).

A sign-in sheet for this meeting is included in Appendix B. Letters were mailed out to all schools and participating jurisdictions prior to this meeting. The previous plan and updated plan will be available online at www.kaysinger.com (Hazard Mitigation Plan Section).

Requirement
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. §201.6(b):

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

- Missouri State Hazard Mitigation Plan (2010), State Emergency Management Agency (SEMA)
- Henry County Emergency Operations Plan
- SEMA Situation Reports (http://sema.dps.mo.gov/SitReps/Situation%20Reports.htm)
- Regional Transportation Plan (2009), 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

Henry County, A county in the central western part of Missouri, seventy miles southeast of Kansas City, bounded on the north by Johnson County, on the east by Pettis and Benton Counties, on the south by St. Clair County, and on the west by Bates and Cass Counties. Its area is 740 square miles, of which less than one-fourth is untilled. The surface is undulating prairie with a productive sandy loam, and a small proportion of broken woodland, bearing the native hard woods. The principal water course is Grand River, passing diagonally through the county from the northwest to a point southeast of the center, whence it courses meanderingly to the east. It receives, just north of Browning, Deepwater Creek, originally on the west, and fed by Camp Branch, Brush, and Bear Creeks, and from the northwest, Big Creek, fed by numerous tributaries. Tebo Creek, with many feeders, drains the northeast, and the Osage River indents the county in the extreme southeast. The county is underlain with coal, with is profitably mined near Clinton, at Deepwater, and at Brownington. Fine pottery, brick and tile clays are found and utilized by various extensive works. Iron has been found, but remains undeveloped. In 1898 the chief surplus products were:

Wheat, 36,715 bushels; corn, 49,169 bushels; oats, 11,316 bushels; flax, 87,746 bushels; hay, 4,628,500 pounds; flour, 21,407,340 pounds; cornmeal, 253,350 pounds; shipstuff, 8,358,850 pounds; grass seed, 146,485 pounds; poultry, 1,891,808 pounds; eggs, 624,420 dozen; butter 103,695 pounds; vegetables, 27,220 pounds; nursery stock, 146,800 pounds; broom corn, 545,318 pounds; cattle, 17,196 head; hogs, 50,750 head; sheep, 2,306 head; horses and mules, 2,187 head; lumber and logs, 156,900 feet; coal, 26,448 tons; bricks, 738,000; tile and sewer pipe, 290 cars; clay, 233 cars. There were 116 schools, 180 teachers, and 9,364 pupils; the permanent school fund was $34,128.75. The population in 1900 was 28,054. Railways are the Kansas City & Springfield branches of the St. Louis & San Francisco and the Kansas City, Fort Scott & Memphis Railways, passing southeastwards, and the Missouri, Kansas & Texas Railway, passing diagonally through the county from the northeast.

American hunters traversed Henry County in 1828. The first permanent settlements were made inn what is now Windsor Township, in the extreme northeast part of the county.

Thomas Arbuckle and Thomas Kimsey are regarded as the pioneers; Arbuckle is said to have built the first cabin in 1830, about four miles west of the present town of Windsor; some contend that he was preceded in 1829 by Kimsey, who came from Johnson County, where others of his family had previous located. He made his home two miles south of Arbuckle. Matthew and James Arbuckle and Isom Burnett also came in 18309. In 1831 came David McWilliams, and his sons James and Jesse, Jesse Hill, William Simpson, Fielding A. Pinnell, and Mason Fewell. Thomas Anderson, who located in this neighborhood, was the first blacksmith in the county. Here also occurred what was probably the first death in the county, that of Joseph Bogarth, who was killed by lighting while returning home from Pettis County. Thomas Collins located about 1830 in the northwest part of the county; he was a justice of the peace for Davis Township under the Lafayette County organization. Tebo Township, adjoining that of Windsor on the west, is historic. Among the earliest settlers was Henry Avery, who came in 1831, having visited the place and staked a claim the previous year.

He was a man of strong character, and lived a most useful life. Others who came to the neighborhood were Colby S. Stevenson, who taught a school in 1833; Richard Wade, the first physician, and Addison Young, a Cumberland Presbyterian minister, who is said to have delivered the first sermon, followed soon afterward by Abraham Millice, a Methodist circuit rider, and Thomas Kenney, a Baptist preacher. In 1835 a log schoolhouse was built and a school was taught by Benjamin L. Durrett. The same year Thomas and Charles Waters opened a store not far from Avery's house. The first births in the county occurred in Tebo Township, the first was a colored girl, whose mother belonged to Mr. Avery; the second was Susan, afterward Mrs. Henry Roberts, daughter of Mr. Avery. A few miles west of the Tebo settlement, in the central north of the present county, Ezekiel Blevins located in 1831, and there was born his son Preston, the first male while child in the county. William Goff located in the northeast part of the county, about one and one-half miles south of Calhoun. The present Field's Creek Township, adjoining Clinton, the county seat, on the northwest was settled in 1831-32 by Joseph Fields, first sheriff, and others.

The southern portions of the county were not settled until 1835 and later. Nearly all the settlers were from Kentucky and Tennessee, with a few from Virginia and North Carolina. Beginning in 1835, a number of country stores and horse gristmills were established. In 1840 Henry County (which then included St. Clair County) had a population of 4,090, including four Negroes; it is estimated that 2,220 belonged to Henry County proper. June 18, 1843 occurred the death of William Baylis, who had severed as lieutenant in a Kentucky regiment during the Revolutionary War. About 100 men from Henry County took part in the war with Mexico, and nearly the same number went to California in 1849. The opening of the Civil War found the people almost unanimously Southern in sympathy. The county afforded about 500 men to the Confederate Army, while it is estimated that less than one-tenth this number took up arms for the Union. The county suffered little material damage during the struggle, but industry and trade practically ceased. At one time General "Jim" Lane entered Clinton and threatened to destroy the county records, but was dissuaded from doing so; another alarm led to the records being taken by Judge J. G. Dorman to Sedalia for safe keeping. On the restoration of peace the people devoted themselves earnestly to the improvement of their fortunes. Coal was found a various points, and mines were opened up. Beginning in 1869, numerous fairs were held, and a Farmers" Club proved a stimulus to effort. During the same years schools and churches were founded in all the various townships, or those of an earlier date were resuscitated. In 1870 the first railway into the county was completed and the population began to increase rapidly.

Until 1834 Henry County was included in the territory belonging to the county of Lillard, afterwards known as Lafayette, and was then constructively a portion of Lexington Township, which extended southward to the Osage River. In 1830 it was included in Davis Township and in 1832 in Tebo Township, which included all of the present counties of Johnson and Henry, and all that portion of St. Clair County lying north of the Osage River. James McWilliams was the first constable in Tebo Township, whose home was then within the present county of Henry. December 13, 1834, Rives County was created, named in honor of William C. Rives, of Virginia. To it was attached St. Clair County, then unorganized, for civil and military purposes, which was designated as a township, March 21, 1835, and was separated as a county, February 15, 1841. William C. Rives, for whom Rives County was named, having become a Whig, the General Assembly, by act of October 15, 1841, changed the name to Henry County, in honor of Patrick Henry, the great patriot orator. The first county court sat May 4, 1835, at the house of Henry Avery. The justices appointed by Governor Dunklin were Thomas Arbuckle and William Goff, who appointed Jonathan T, Berry as clerk. The next session was held at the home of William Goff, and then Joseph Montgomery presented his commission as an associate county justice, and sat with those previously named. Joseph Fields was appointed sheriff; he died soon afterward, and Robert Allen succeeded him. In 1836 Berry resigned his clerkship, and was succeeded by Fielding A. Pinnell, who served for several years. In November, 1836, Peyton Parks, commissioner appointed to locate a permanent county seat, reported the site of Clinton, and the necessary land was preempted from the government. The sale of lots amounted to $2,500. The county court appropriated $2,500 for building a courthouse, and a two-story brick edifice was erected under the superintendence of John E. Sharp and Thomas R. Wallace. The bricks were burned upon the public square, and were noted as darkly tinctured with iron existing in the clay. Pending the completion of the building, court sessions were held at the house of James B. Sears, and afterward in a building rented from Littlebury Kinsey.

The present courthouse was occupied in 1893; for a few years previous rented rooms were used for court purposes. In 1856 a jail building was erected at a cost of $3,844. In 1879 this was replaced with a larger structure built at a cost of nearly $10,000. In 1871 an attempt was made to create a new county by detachment of portions of Pettis, Johnson, Henry, and Benton Counties, under the name of Meadow County, of which Windsor was to be the county seat. The bill was favorably reported in the General Assembly, but was defeated, mainly through the influence exerted by residents of Clinton.

Another attempt was made in the session of 1872-73, but this too was futile. March 30, 1900, the bonded debt of the county was $32,000 on account of the courthouse, and $498,000 on railroad indebtedness, the latter being a compromise issue on a basis of 75 per cent upon the original principal and defaulted interest. Henry County was, in 1900, in the Sixth Congressional District, the Sixteenth Senatorial District, and the Twenty-Ninth Judicial, Circuit. http://tacnet.missouri.org/history/encycmo/towns.html#HenryCounty

2.2 Natural Hazard History

Henry County. Flooding, wild fires, droughts, severe storms, tornadoes, and even earthquakes have exposed Henry County residents and businesses to the financial and emotional costs of recovering after natural disaster. Henry County has experienced over 255 weather related natural disasters in the last 50 years. Almost half of these disasters are due to flooding that has occurred after the Harry S. Truman Dam was completed, and much of the bottomlands surrounding Truman Lake are subject to frequent wild fires during the dry seasons.

The inevitability of natural hazards, and the growing population and activity within the county create an urgent need to develop strategies, coordinate resources, and increase public awareness to reduce risk and prevent loss from future natural hazard events. Identifying risks posed by natural hazards, and developing strategies to reduce the impact of hazard event can assist in protecting life and property of citizens and communities. Local residents and businesses can work together with the county to create a natural hazards mitigation plan that addresses the potential impacts of hazard events.

Between 1953 and 2011 there have been a total of 11 tornados that occurred in Henry County, ranging from F1 to F4 on the Fujita scale.

2.3 Geography and Ecology

Henry County is located in the west-central part of the State. It is bounded on the north by Johnson County; east by Benton County, south by St. Clair County and Bates County on the west. Henry County includes portions of three different watershed basins: Harry S. Truman Reservoir, South Grand River, and a small portion of the Osage River.

Henry County is an inland-border county. Inland, in that it is two counties east of Kansas and three south of the Missouri River, border, in that it lies at the point where prairie lands adjoin the foothills of the Ozark. Osage River divides it in twain.

North of the river lies land in prairie stretches or long sloping hills; south of the river in precipitous bluffs, timber covered hills and mountain flat woods. There are 740 miles of surface, or 417,680 acres, of which less than one-fourth is untilled. Farming is the main enterprise in the county. Livestock, livestock products, and cash crops are manor sources of income. The principal crops are corn, wheat, and soybeans. The surface is undulating prairie with a productive sandy loam, and a small proportion of broken woodland, bearing the native hard woods. The principal water source is the Grand River, which stretches for 100 miles. Raising in Kansas the Grand River flows to Missouri and passes diagonally through the county from the northwest to a point southeast of the center, then makes it's meanderingly to the east. It receives, just north of Browning, Deepwater Creek, originally on the west, and fed by Camp Branch, Brush, and bear Creeks, and from the northwest, Big Creed, fed by numerous tributaries. Tebo Creek, with many feeders, drains to the northeast, and the Osage River indents the county in the extreme southeast. The county is underlain with coal, and iron has been found, but remains undeveloped. Henry County has a long growing season and mild temperatures, which lead to a wide range of agricultural activities.

Public Land

Henry 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.

Henry County Incorporated Communities

Henry County consists of the following communities:

- Blairstown – 4th class
- Brownington- Village
- Calhoun – 4th class
- Clinton – 3rd class
- Deepwater – 4th class
- Montrose – 4th class
- Urich – 4th class
- Windsor – 4th class

Climate

Mean annual precipitation for Henry County is 43.57 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°.

Henry 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 Henry 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 **Henry County Temperature Averages**

Monthly Averages & Records - °F | °C

Date	Average Low	Average High	Record Low	Record High	Average Precipitation	Average Snow
January	16°	38°	-22° (1959)	78° (1950)	1.57"	NA
February	21°	45°	-21° (1951)	83° (1930)	2.04"	NA
March	31°	56°	-12° (1960)	91° (1929)	3.22"	NA
April	41°	67°	10° (1920)	96° (1930)	4.03"	NA
May	51°	76°	28° (1989)	105° (1934)	5.51"	NA
June	62°	84°	40° (1956)	111° (1936)	5.11"	NA
July	67°	90°	45° (1972)	118° (1936)	3.83"	NA
August	64°	89°	43° (1988)	116° (1936)	4.08"	NA
September	55°	81°	29° (1989)	107° (1936)	4.57"	NA
October	43°	70°	15° (1952)	97° (1963)	3.76"	NA
November	32°	55°	0° (1991)	87° (1950)	3.69"	NA
December	21°	43°	-31° (1989)	77° (1948)	2.16"	NA

http://www.intellicast.com/Local/History.aspx?location

2.4 Form of Government

Henry County is one of 22 counties in Missouri with a township form of government. , with an assessed value of $284,677,161. According to the US Census Bureau, the estimated population in 2010 was 22,272. The county government consists of the County Commission which oversees the following offices:

- Prosecuting Attorney
- Public Administrator
- Coroner
- Sheriff
- County Collector/Treasurer
- County Assessor
- Recorder of Deeds
- Circuit Clerk And Recorder

To learn more about Township Government in Missouri please visit this site: http://extension.missouri.edu/explore/commdm/dm4001.htm.

The Henry 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 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

Henry County has some working relationships with its towns and cities as well as neighboring counties. Henry 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

Henry County is one of 115 counties in Missouri. It is not part of a Metropolitan Area and its 2010 population of 22,272, ranked 50th in the State. Table 2.6.1 and Table 2.6-2 portray some key demographic information about Henry County and how it compares to the rest of Missouri.

Table 2.6-1 **Henry County Demographic Information**

People QuickFacts	Henry County	Missouri
Population, 2010	22,272	5,988,927
Population, percent change, 2000 to 2010	1.3%	7.0%
Population, 2000	21,997	5,596,684
Persons under 5 years old, percent, 2009	6.0%	6.7%
Persons under 18 years old, percent, 2009	22.4%	23.9%
Persons 65 years old and over, percent, 2009	19.5%	13.7%
Female persons, percent, 2009	50.9%	51.1%
White persons, percent, 2010 (a)	96.4%	82.8%
Black persons, percent, 2010 (a)	1.0%	11.6%
American Indian and Alaska Native persons, percent, 2010 (a)	0.5%	0.5%
Asian persons, percent, 2010 (a)	0.2%	1.6%
Native Hawaiian and Other Pacific Islander, percent, 2010 (a)	Z	0.1%
Persons reporting two or more races, percent, 2010	1.5%	2.1%
Persons of Hispanic or Latino origin, percent, 2010 (b)	1.7%	3.5%
White persons not Hispanic, persons, 2010	95.3%	81.0%

Source: http://quickfacts.census.gov/qfd/states/29/29083.html

Table 2.6-2 **Henry County Demographic Information**

		Starting & Ending Values				Change Over Period			
		Start		End		Actual		Annualized	
Demographic Category	Time Period	Count	%	Count	%	Change	%	Change	%
Henry MO									
Total Population	2000 to 2009	22,089	100.0	22,176	100.0	87	0.39	10	0.04
White	2000 to 2009	21,605	97.8	21,578	97.3	-27	-0.12	-3	-0.01
White non-hispanic	2000 to 2009	21,427	97.0	21,267	95.9	-160	-0.75	-18	-0.08
Black	2000 to 2009	261	1.2	339	1.5	78	29.89	9	2.95
American Indian, Etc	2000 to 2009	164	0.7	188	0.8	24	14.63	3	1.53
Asian or Pac Islndr	2000 to 2009	59	0.3	71	0.3	12	20.34	1	2.08
Hispanic	2000 to 2009	201	0.9	338	1.5	137	68.16	15	5.94
Non-hispanic	2000 to 2009	21,888	99.1	21,838	98.5	-50	-0.23	-6	-0.03
Pop Aged 0 to 17	2000 to 2009	5,236	23.7	4,975	22.4	-261	-4.98	-29	-0.57
Pop Aged 18 to 24	2000 to 2009	1,730	7.8	1,596	7.2	-134	-7.75	-15	-0.89
Pop Aged 25 to 44	2000 to 2009	5,674	25.7	5,074	22.9	-600	-10.57	-67	-1.23
Pop Aged 45 to 64	2000 to 2009	5,427	24.6	6,216	28.0	789	14.54	88	1.52
Pop Aged 65+	2000 to 2009	4,022	18.2	4,315	19.5	293	7.28	33	0.78

Source: Missouri Census Data Center

2.7 Income

Table 2.7-1 **Median Household Income**

Total households	**9,454**	**+/-221**	**9,454**	**(X)**
Less than $10,000	1,152	+/-206	12.2%	+/-2.1
$10,000 to $14,999	677	+/-127	7.2%	+/-1.3
$15,000 to $24,999	1,516	+/-224	16.0%	+/-2.3
$25,000 to $34,999	1,277	+/-195	13.5%	+/-2.1
$35,000 to $49,999	1,497	+/-207	15.8%	+/-2.1
$50,000 to $74,999	1,614	+/-194	17.1%	+/-2.1
$75,000 to $99,999	895	+/-147	9.5%	+/-1.6
$100,000 to $149,999	509	+/-117	5.4%	+/-1.2
$150,000 to $199,999	204	+/-94	2.2%	+/-1.0
$200,000 or more	113	+/-63	1.2%	+/-0.7
Median household income (dollars)	36,250	+/-3,117	(X)	(X)

Source: http://factfinder.census.gov/servlet/ADPTable?_bm=y&-geo_id=05000US29083&-qr_name=ACS_2009_5YR_G00_DP5YR3&-ds_name=ACS_2009_5YR_G00_&-_lang=en&-_sse=on

2.8 Economy, Industry, Employment

Henry County is considered a rural community reaching a population of 21,094. Clinton is the county seat.

Table 2.8-1 depicts personal and industry employment overviews of Henry County.

Table 2.8-1 **Henry County Employment Overview**

OCCUPATION	
Employed persons 16 years and over	**2,367,395**
Executive, administrative, and managerial occupations	262,108
Professional specialty occupations	311,810
Technicians and related support occupations	84,770
Sales occupations	275,368
Administrative support occupations, including clerical	386,811
Private household occupations	8,446
Protective service occupations	34,104
Service occupations, except protective and household	280,873
Farming, forestry, and fishing occupations	73,871
Precision production, craft, and repair occupations	262,488
Machine operators, assemblers, and inspectors	177,415
Transportation and material moving occupations	107,045
Handlers, equipment cleaners, helpers, and laborers	102,286
INDUSTRY	
Employed persons 16 years and over	**2,367,395**
Agriculture, forestry, and fisheries	79,764
Mining	5,796
Construction	136,352
Manufacturing, nondurable goods	180,794
Manufacturing, durable goods	258,857
Transportation	123,645
Communications and other public utilities	68,971
Wholesale trade	107,238
Retail trade	407,433
Finance, insurance, and real estate	149,271
Business and repair services	101,645
Personal services	70,370
Entertainment and recreation services	26,319
Health services	218,280
Educational services	189,452
Other professional and related services	141,234
Public administration	101,974

Source:
http://factfinder.census.gov/servlet/QTTable?_bm=n&_lang=en&qr_name=DEC_1990_STF3_DP3&ds_name=DEC_1990_STF3_&geo_id=04000US29

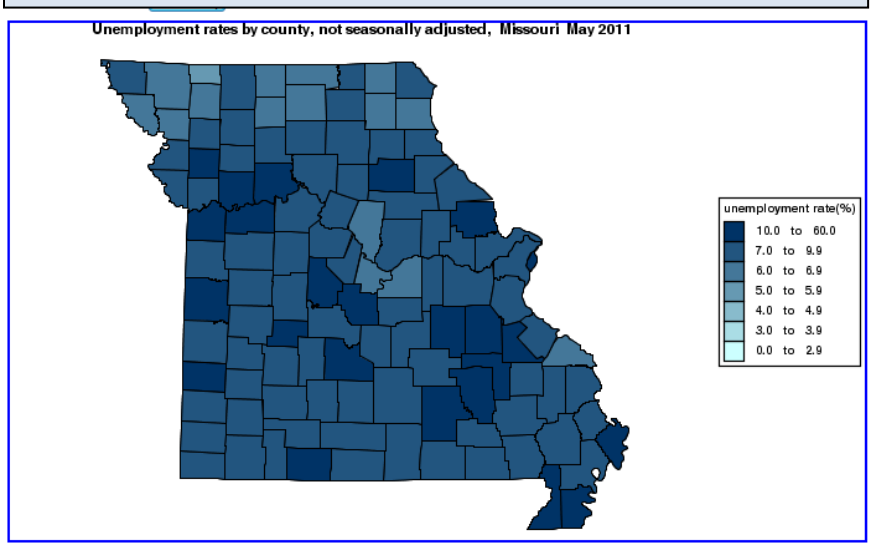
Table 2.8-2 **Henry County Employment Status**

Selected Economic Characteristics	Estimate	Margin of Error	Percent	Margin of Error
EMPLOYMENT STATUS				
Population 16 years and over	17,846	+/-101	17,846	(X)
In labor force	10,680	+/-305	59.8%	+/-1.8
Civilian labor force	10,621	+/-307	59.5%	+/-1.8
Employed	9,727	+/-354	54.5%	+/-2.0
Unemployed	894	+/-186	5.0%	+/-1.0
Armed Forces	59	+/-46	0.3%	+/-0.3
Not in labor force	7,166	+/-329	40.2%	+/-1.8

Source: http://factfinder.census.gov/servlet/ADPTable?_bm=y&-geo_id=05000US29083&-qr_name=ACS_2009_5YR_G00_DP5YR3&-ds_name=ACS_2009_5YR_G00_&-_lang=en&-redoLog=false&-_sse=on

The unemployment map below shows that as of May, 2011 the unemployment rate for Henry County was 9.3 %.

Figure 2.8-1 **County Unemployment Rates May 2011**



Source: http://data.bls.gov/map/MapToolServlet

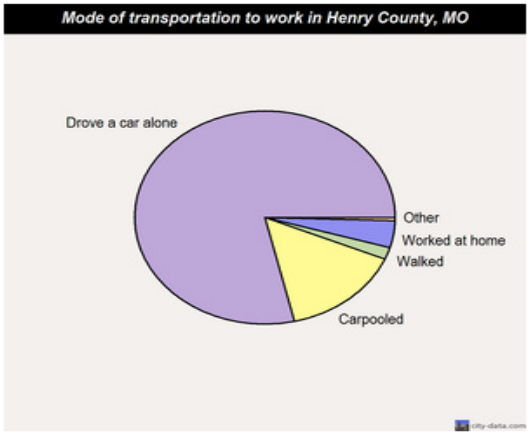
Agriculture in Henry County

Table 2.8-3 **Henry County Agriculture**

Average size of farms	335 acres
Average value of agricultural products sold per farm	$44484
Average value of crops sold per acre for harvested cropland	$88.75
The value of livestock, poultry, and their products as a percentage of the total market value of agricultural products sold	68.83%
Average total farm production expenses per farm	$45151
Harvested cropland as a percentage of land in farms	46.70%
Average market value of all machinery and equipment per farm	$49174
The percentage of farms operated by a family or individual	93.17%
Average age of principal farm operators	56 years
Average number of cattle and calves per 100 acres of all land in farms:	19.69
Milk cows as a percentage of all cattle and calves	1.51%
Corn for grain	21348 harvested acres
All wheat for grain	16116 harvested acres
Soybeans for beans	51047 harvested acres
Vegetables	38 harvested acres
Land in orchards	75 acres

Source: http://www.city-data.com/county/Henry_County-MO.html#ixzz17SB50RI4

2.9 Transportation and Commuting Patterns



Means of transportation to work
- Drove a car alone: 7,734 (79%)
- Carpooled: 1,477 (15%)
- Bus or trolley bus: 6 (0%)
- Taxi: 4 (0%)
- Motorcycle: 5 (0%)
- Bicycle: 9 (0%)
- Walked: 175 (2%)
- Other means: 22 (0%)
- Worked at home: 406 (4%)

http://www.city-data.com/county/Henry_County-MO.html

Public Transportation

Clinton offers an ATS (Area Transportation Service) to citizens of Clinton. Citizens whom are disabled, elderly, or are unable to drive can use this system to get to their destination within Clinton.

Air

The Clinton Memorial Airport is the only public airport located in Henry County and is located about 4 miles east of Clinton. It currently has two asphalt runways, with dimensions of 4,001 feet long by 60 feet wide, but an airport runway expansion project is currently in process.

Henry County has three other private airports as demonstrated in Table 2.9-1

Table 2.9-1 **Henry County Airports**

Clinton Memorial Airport - GLY Clinton, Missouri Facility Usage: Public	City Of Clinton 105 E Ohio Clinton, MO 64735 (660) 885-6121
Ferros Ranch-Aero Airport - 0MO0 Clinton, Missouri Facility Usage: Private	Lawrence Ferro P.O. Box 261 Clinton, MO 64735 (816) 885-5757
Golden Valley Memorial Hospital Heliport - 90MO Clinton, Missouri Facility Usage: Private	Golden Valley Meml Hospital 1600 North Second Clinton, MO 64735 (816) 885-5511
Brownsberger Airport - MO75 Montrose, Missouri Facility Usage: Private	Leroy Brownsberger Or Walter Rt 3 Box 111 Montrose, MO 64770 (816) 693-4703

http://www.tollfreeairline.com/missouri/henry.htm

2.10 Education

Schools Pre K - 12

As of 2010, there are approximately 3,404 students and 326 teachers in seven public schools districts. (See Table 2.10-1). There are four private schools located in Henry County.

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 or not building schools in 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 safe rooms and shelters during a natural disaster.

Table 2.10-1 **Henry County School Districts**

School District	Number of Schools	Number of Students	Certified Staff
Calhoun R-VIII	2	162	33
Clinton 124	3	1,753	155
Davis R-XII	1	37	11
Henry County R-1	2	692	65
Leesville R-IX	1	81	11
Montrose R-XIV	2	95	33
Shawnee R-III	1	60	12
Total	**12**	**2,880**	**320**

Source: Missouri Department of Elementary and Secondary Education: http://dese.mo.gov/directory/050010.html: as of January 11, 2011

2.11 Prominent Employers

Calhoun

Table 2.11-1 **Calhoun Prominent Employers**

Prominent Employers	Service	Total Employed	Union
Calhoun R-VIII	Education	33	No

Source: http://dese.mo.gov/directory/042117.html

Clinton

Table 2.11-2 **Clinton Prominent Employers**

Prominent Employers	Service	Total Employed	Union
Schreiber Foods, Inc.	Cheese Manufactures	773	No
Golden Valley Memorial Heath Care	Health Care	638	No
Wal-Mart	Retail	300	No
Clinton School District	Education	250	No
Tracker Marine, LP	Boats and Seats	200	No
Pathways	Health Care	150	No
Hawthorn Bank	Financial	80	No
Champion Brands, LLC	Lubrication / Solvents	60	No
Henry County Industries	Packaging / Assembly	40	No
American Power and Process	Custom metal dampers	32	No
Aviation Fabricators	Aircraft Parts	19	No

Source: Henry County Chamber of Commerce

Deepwater

The city of Deepwater has no employers that currently employ more that 4 persons.

Montrose

Table 2.11-3 **Montrose Prominent Employers**

Prominent Employers	Service	Total Employed	Union
Montrose Power Plant	Electricity	145	No
Montrose R-XIV	Education	33	No

Source: power plant and Missouri Department of Education

Urich

There are no major employers in Urich.

Windsor

Table 2.11-4 **Windsor Prominent Employers**

Prominent Employers	Service	Total Employed	Union
Farmers Cooperative	Animal Feed	15	no
Myer Metalcraft Specialties	Conveyors/food equipment	31	no
Windsor School System	Education	30	No

Source: Windsor City Hall, Missouri Department of Education

2.12 Community Assessments

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 Henry County are organized in the following manner:

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

2.12.1 Staff/organization Assessments 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.

Henry County

The Henry County Commission is the executive body of Henry County operating under guidelines established in the Revised Statutes of the State of Missouri. Within that authority the commission approves the annual county budget, appoints various county board members, and approves all bills, payroll and any grants brought before the commission.

The County Commissioner oversees the Henry County Bridge Department, which includes the C.A.R.T. rock and brush cutting programs. Also included are inspection of county roads and bridges, and the hiring of bridge department employees. Passports are available through the County Commissioner's Office.

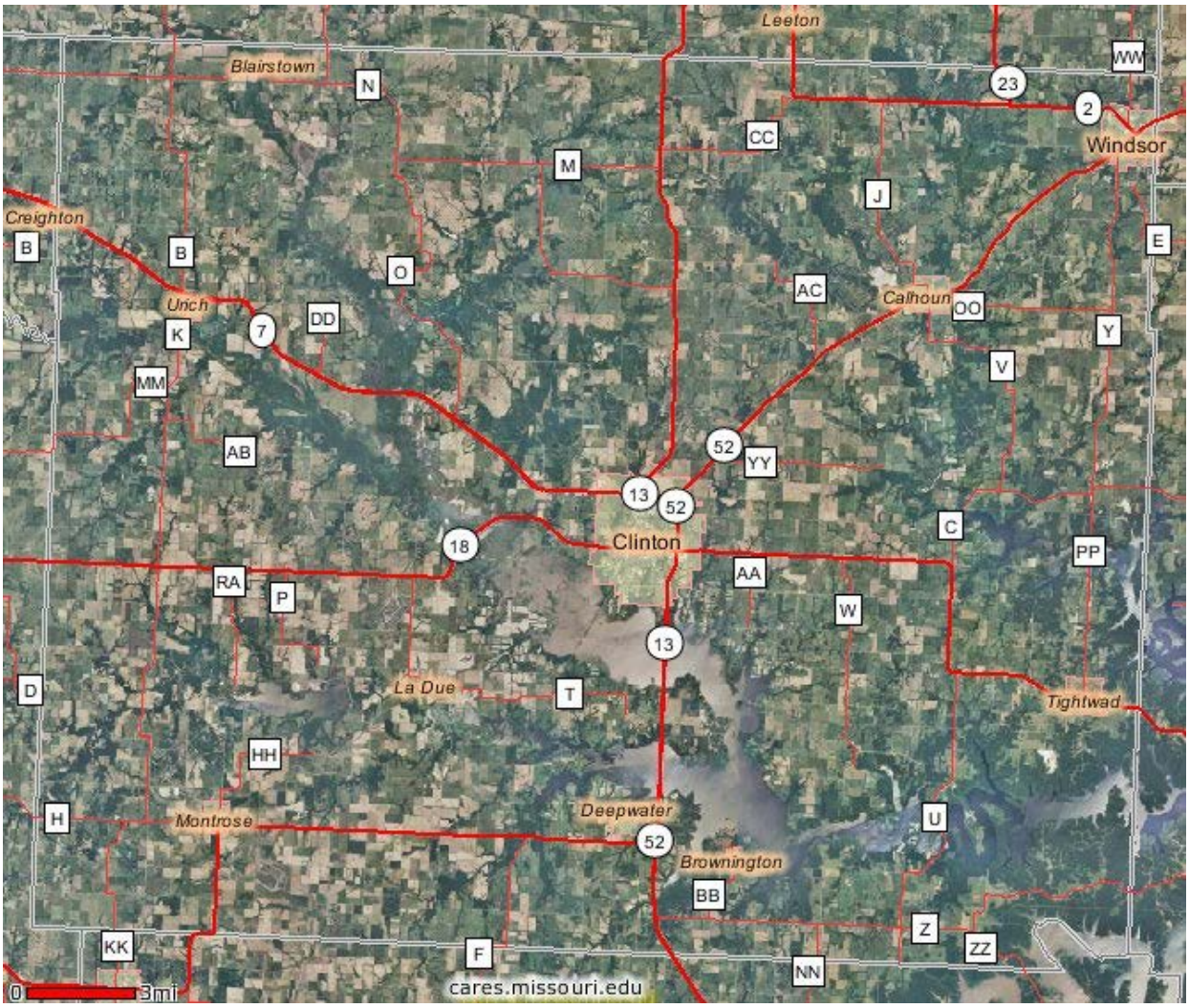
The County Commissioners are elected to four year terms. The Presiding Commissioner is elected by voters of the entire county, while the associate commissioners are elected by the voters of their respective township districts.

Henry County also has the following eleven staff positions:

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

County website: http://www.henrycomo.com/

Figure 2.12.1-1 **Map of Henry County**



MoDOT Roads and Highways, 2007

- Interstate
- U.S. Highway
- State Numbered Highway
- State Lettered Highway

County Boundaries, 2007

Incorporated Areas, 2007

- City
- Town
- Village
- Census Designated Place
- Other

2010 Aerial Photos (NAIP)

2010 Aerial Photos (NAIP)

Calhoun Profile

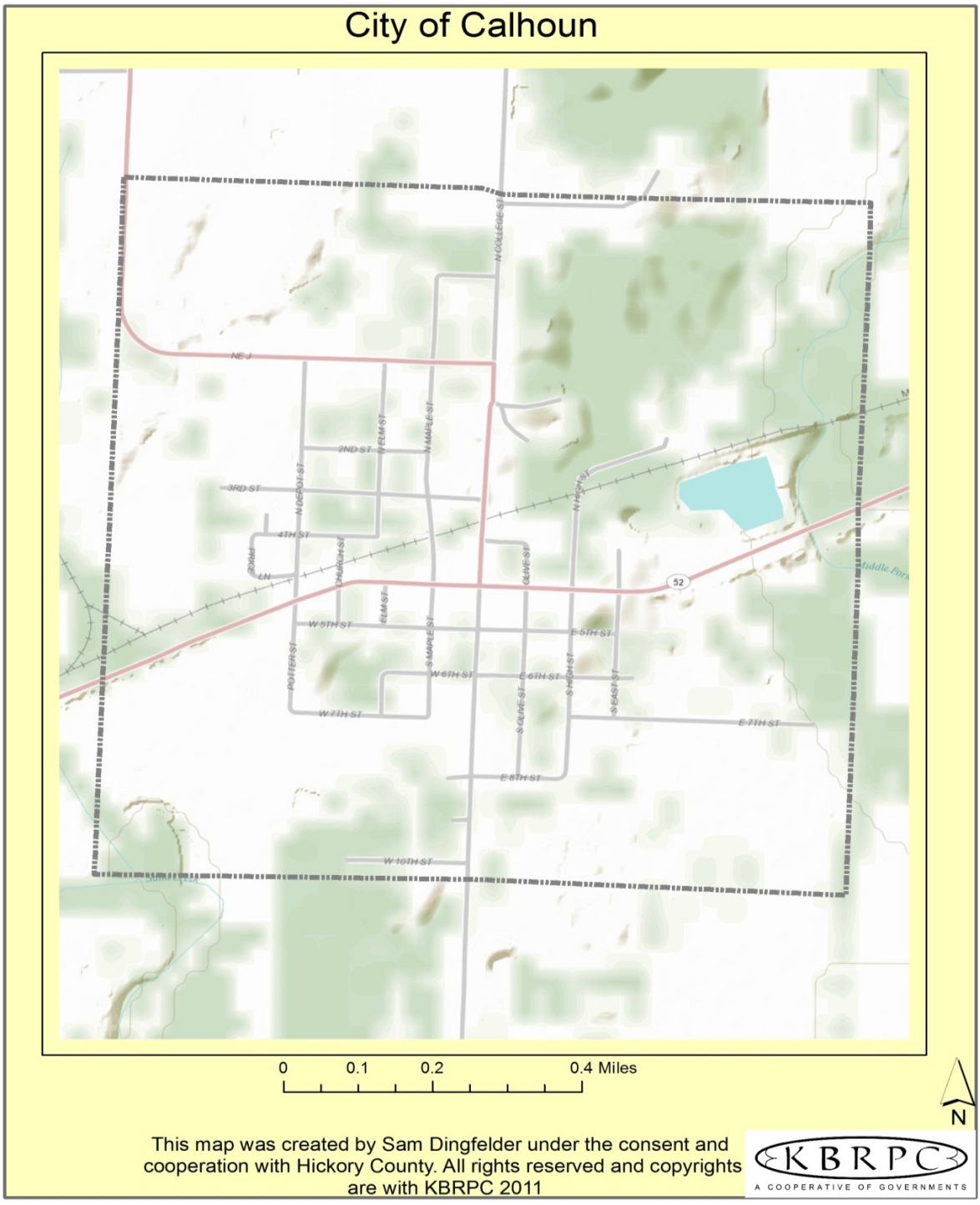
The Mayor and the Board of Aldermen are the policy making bodies in the city government. The City of Calhoun also has the following staff positions:

- City Clerk
- City Treasurer
- City Attorney
- Fire Chief
- Sewer and Water Superintendent

Table 2.12.1-1 **Calhoun Profile**

Classification City	4th Class
Ambulance Service	Golden Valley/Windsor Ambulance
Building Regulations	No
Electric Service	KCP& L
Fire Service	Calhoun Vol. Fire Dept.
Floodplain regulations	Yes
Master plan	Yes
Median household income, 2008	$25,417
Median owner-occupied housing value	$41,000
Population	469
Sewer Service	$13.00 City Base $2.50/thousand/gal.
Storm water Regulations	No
Subdivision regulations	No
Total housing units	232
Water Service	$13.00 first 1,000 gal. $7.95 per 1,000 gal. after first 1,000 gallons
Zoning Regulations	No

Figure 2.12.1-2 Map of Calhoun



Clinton

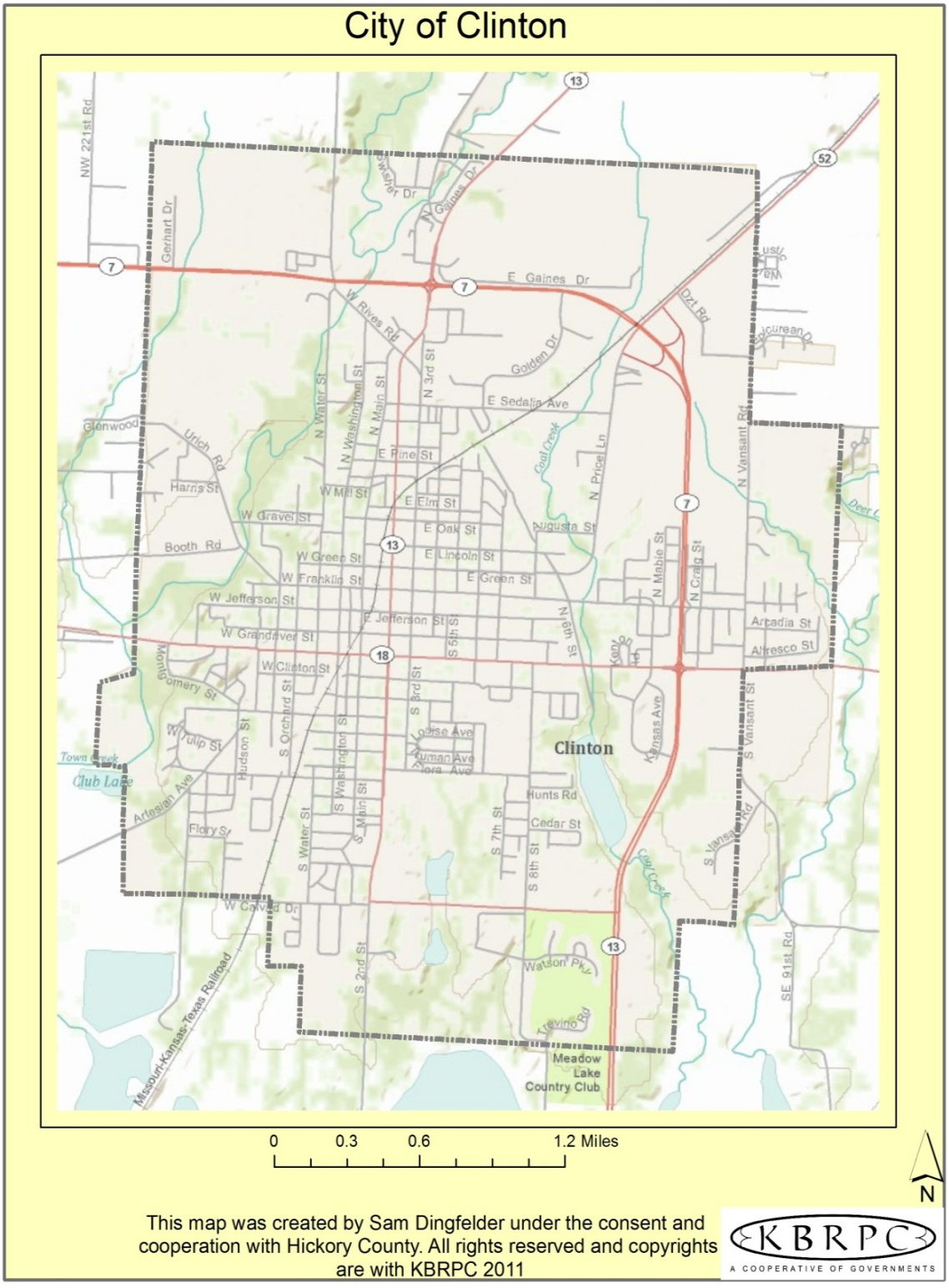
The Mayor and the Board of Aldermen are the policy making bodies in the city government. The city is divided into four wards and one Board of Aldermen member is elected from each ward for a two year term. The City of Clinton also has the following staff positions:

- City Administrator
- City Attorney
- City Clerk
- Municipal Judge
- Community Development Director
- Fire Chief
- Parks & Recreation Director
- Police Chief
- Street superintendent
- Sewer superintendent
- Wastewater Superintendent

Table 2.12.1-2 **Clinton Profile**

Classification City	3rd Class
Ambulance Service	Golden Valley Hospital
Building Regulations	Yes
Electric Service	KCP & L
Fire Service	City of Clinton
Floodplain regulations	Yes
Master plan	Yes
Median household income, 2008	$28,079
Median owner-occupied housing value	$69,200
Population	9,311
Sewer Service	$6.52 City Base – Volume rate = .281 cents per 100 gal.
Storm water Regulations	No
Subdivision regulations	Yes
Total housing units	4,329
Water Service	$7.41 City Base $5.86 / thousand gal.
Zoning Regulations	Yes

Figure 2.12.1-3 **Map of Clinton**



Deepwater

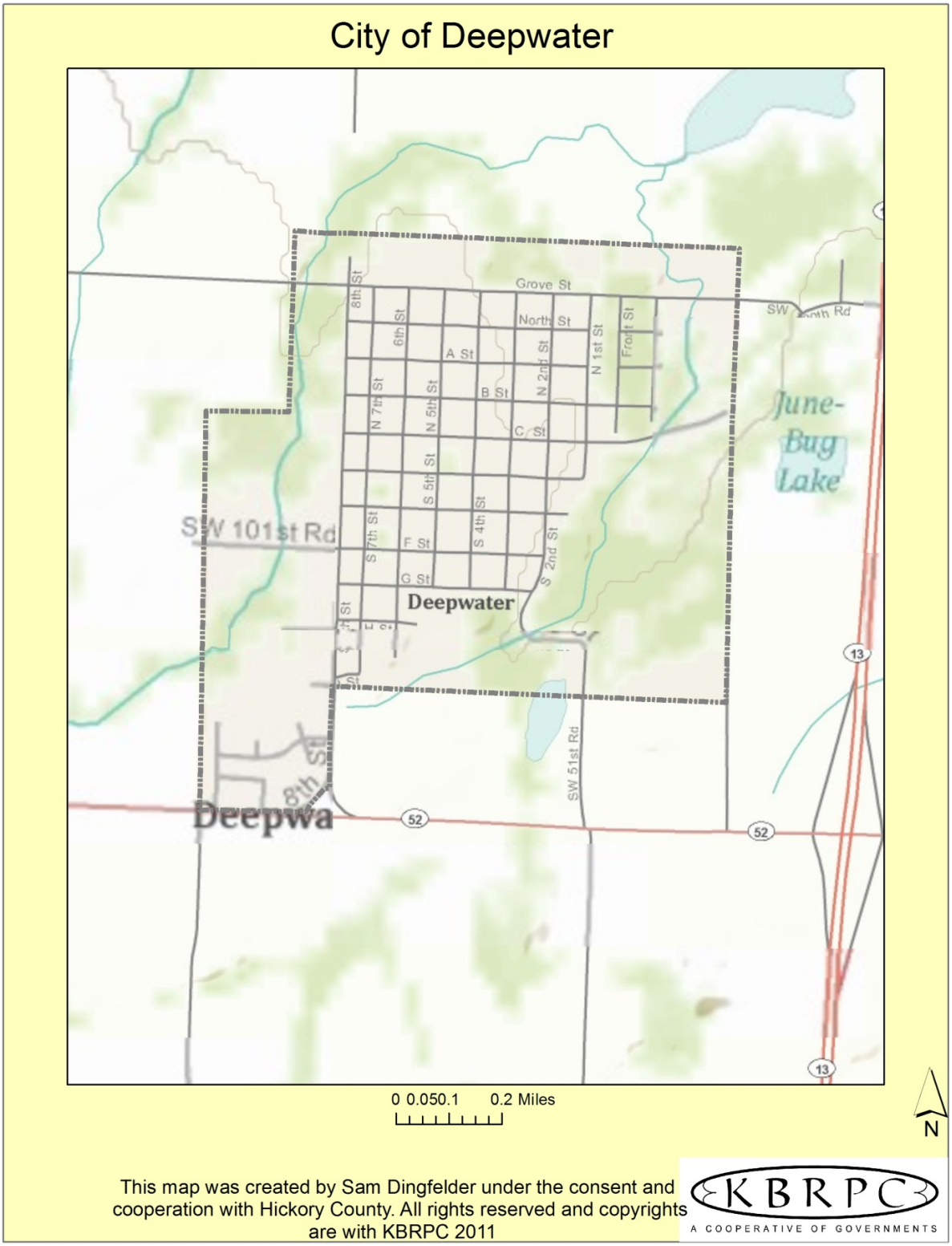
The Mayor and the Board of councilmen are the policy making bodies in the city government. The City of Deepwater also has the following staff positions:

- City Clerk
- City Collector
- Street/Water Superintendent

Table 2.12.1-3 **Deepwater Profile**

Classification City	4th Class
Ambulance Service	Golden Valley Hospital
Building Regulations	Yes
Electric Service	KCP & L
Fire Service	Deepwater Volunteer Fire Dept.
Floodplain regulations	Yes
Master plan	In Process
Median household income, 2009	$25,456
Median owner-occupied housing value	$47,023
Population	433
Sewer Service	$20.00 Per Month
Storm water Regulations	Yes
Subdivision regulations	Yes
Total housing units	192
Water Service	$8.50 first 1,000 gal. .006, after 1000 gal.
Zoning Regulations	Yes

Figure 2.12.1-4 **Map of Deepwater**



Montrose

Montrose is governed by a Mayor and a Board of 4 Aldermen. The term of office for each of these officials is currently two years. The city of Montrose also has the following staff positions:

- City Clerk
- Collector
- City Attorney
- City Emergency Management Director
- Sewer, Water and Street Superintendent
- Fire Chief

Table 2.12.1-4 **Montrose Profile**

City Classification	4th Class
Ambulance Service	Ellet Hospital Ambulance
Building Regulations	No
Electric Service	KCP & L
Fire Service	Montrose Volunteer Fire Dept.
Floodplain regulations	Yes
Master plan	No
Median household income	$21,500
Median owner-occupied housing value	Unknown
Population	384
Sewer Service	$10.20 City Base $1.50/thousand/gal.
Storm water Regulations	No
Subdivision regulations	No
Total housing units	208
Water Service	$14.95 1st 1,000gal
Zoning Regulations	Yes

Figure 2.12.1-5 **Map of Montrose**

Urich

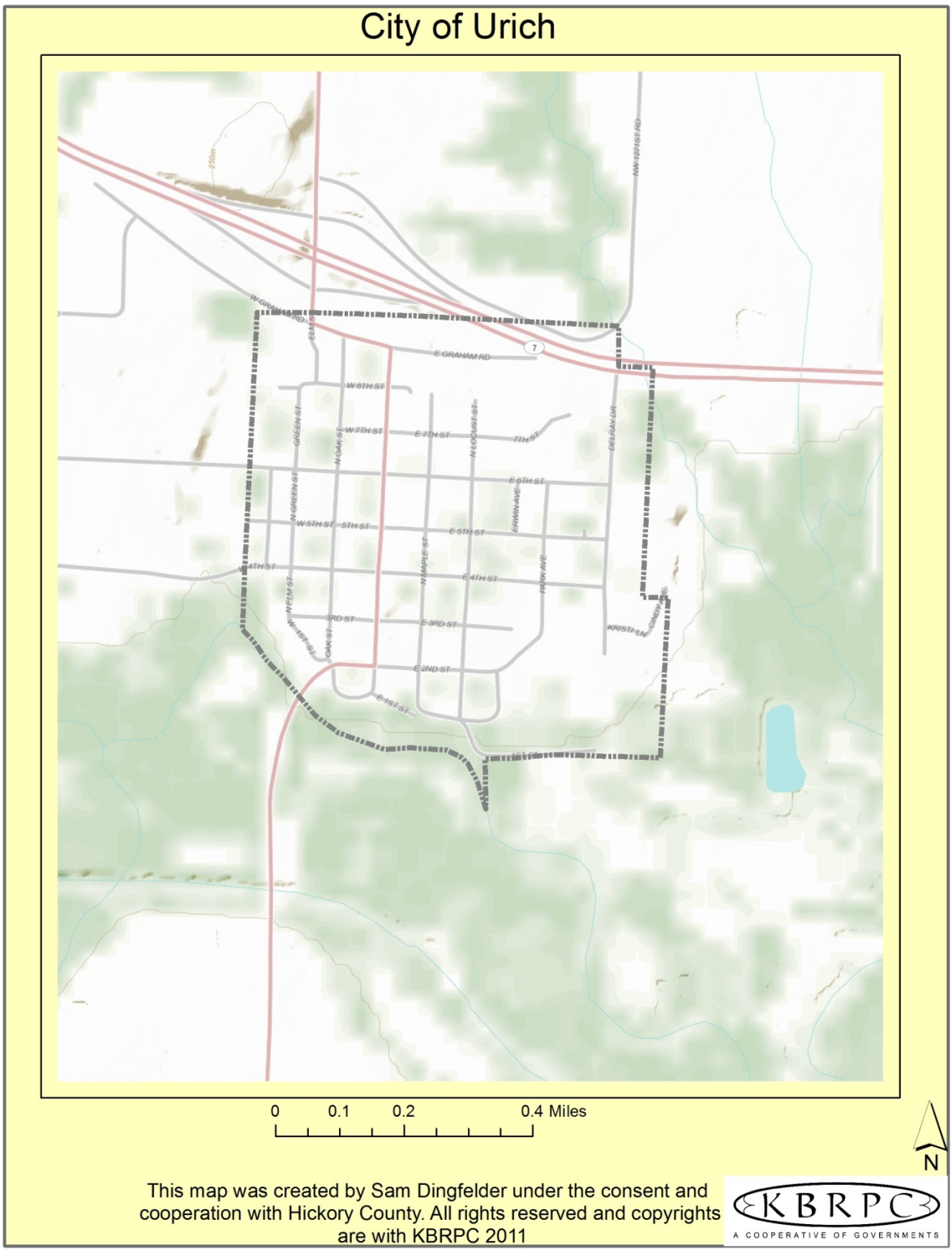
In addition to the Mayor and four city Aldermen, Urich also has the following staff positions:

- City Attorney
- City Clerk
- Sewer, water and Street Superintendent
- Fire Chief
- Municipal Judge

Table 2.12.1-5 **Urich Profile**

Classification City	4th Class
Ambulance Service	Golden Valley
Building Regulations	No
Electric Service	KCP & L
Fire Service	City of Urich
Floodplain regulations	Yes
Master plan	Yes
Median household income, 2008	38,704.00
Median owner-occupied housing value	66,473.00
Population (2009)	505
Sewer Service	City of Urich
Storm water Regulations	None
Subdivision regulations	Yes
Total housing units	236
Water Service	12.85 1st 1,000 gal.
Zoning Regulations	None

Figure 2.12.1-6 **Map of Urich**



Windsor

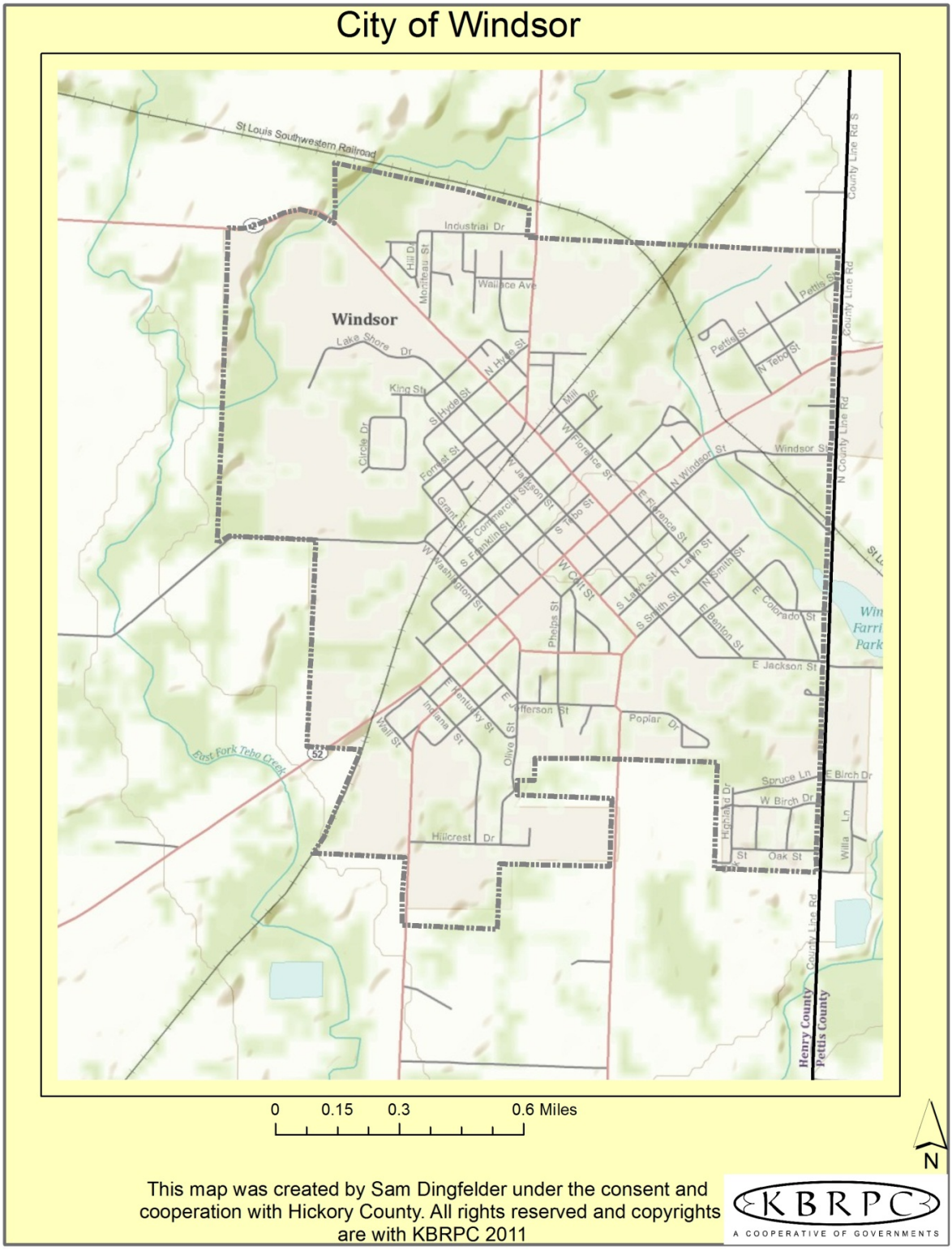
The City of Windsor has a Mayor and a City Councilman form of government. In addition to the Mayor there are six city councilman and the following additional staff positions:

- City Attorney
- City Clerk
- City Collector
- Fire Chief
- Public Works Director
- Emergency Management Director (EMD)
- Municipal Judge

Table 2.12.1-6 **Windsor Profile**

Classification City	4th Class
Ambulance Service	Windsor Ambulance District
Building Regulations	Yes Basic Building Codes
Electric Service	KCP & L
Fire Service	Windsor Rural Fire Dept.
Floodplain regulations	yes
Master plan	Yes
Median household income, 2008	$29,922
Median owner-occupied housing value	$53,300
Population	3,087
Sewer Service	$32.60 City Base (includes water, sewer &trash)
Storm water Regulations	yes
Subdivision regulations	Yes
Total housing units	1,418
Water Service	$32.60 City Base (includes water, sewer &trash)
Zoning Regulations	Yes

Figure 2.12.1-7 **Map of Windsor**



Districts

School Districts

Henry County has seven school districts that encompass 15 schools. Combined, the district schools hold more than 5,900 students and employ more than 547 certified staff. Each district has an elected Superintendent and School Board along with several administrative staff. The seven districts are:

- Calhoun R-VIII
- Clinton 124
- Davis R-XII
- Henry County R-I
- Leesville R-IX
- Montrose R-XIV
- Shawnee R-III

Note: Some students from the city of Urich attend the Sherwood Cass R-III School District, located in Cass County

Henry County Ambulance Districts

Henry County is serviced by two ambulance districts, each providing service to different areas of the county.

- Windsor Ambulance District
- Warsaw Lincoln Ambulance District
- *Golden Valley Memorial Hospital Ambulance (not a district)*

Henry County Water / Sewer Districts

There are three Water Districts within the County that are responsible for distributing water throughout the several communities located throughout the county. These districts are responsible for developing new water and sewer supply infrastructure and maintaining existing infrastructure.

Henry County PWSD # 3
Henry County PWSD # 4
Henry County Water Company

Road Districts

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

Henry County Area Fire Protection Districts:

- Cass County Fire District #5,
- Calhoun Rural Fire Association
- Clinton Rural Fire Protection District
- Tightwad Fire Protection District
- Warsaw Fire Protection District

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.

Fire Departments:

The above Fire Protection Districts include the following individual fire departments:

- Blairstown Fire Department
- Calhoun Fire Department
- Clinton Fire Department
- Deepwater Fire Department
- Montrose Fire Department
- Tightwad Fire Department
- Urich Fire Department
- Windsor 4 Rural Fire Department

2.12.2 Technical Resources

This section includes the technical resources of Henry 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 Henry County Sheriff and the Clinton Fire Department in conjunction with the Clinton Rural Fire Protection District both have mutual aid agreements in place with local police departments.

Emergency Management

The Henry County Emergency Program Manager has the responsibility for coordinating all the components of the emergency management system in the jurisdiction. These components consist of fire and police, emergency, medical service, public works, volunteers, and other groups contributing to the management of emergencies. The parts of the emergency management system are no different than the parts of government and the private sector that manage the day-to-day affairs of the community.

Emergency government is government in an emergency. Their job is to make certain that all components of the emergency management system:

- Know the threats to their jurisdictions
- Plan for emergencies
- Are able to operate effectively in an emergency
- Can conduct recovery operations after a disaster

The Manager is responsible for coordinating all the necessary activities to ensure effective operation of the emergency management system.

The Emergency Program Manager will work closely with other departments such as the fire department, police department, planning department, and department of public works. During an emergency, the Manager should coordinate the operations among these departments. The police, fire, and other emergency service agencies are independent. They have their own mandates; they have their own responsibilities to fulfill. In an emergency, however, all of these emergency responders must work together like a well-oiled machine. The public safety is poorly served by competitiveness and organizational jealously.

Coordination of police, fire, public works, emergency medical services, etc., throughout emergency management is a matter of personal style. Frequent contact, sharing advice, and combined training are all ways to make coordination easier. Most importantly, however, is to know the boundaries of coordination. For example, coordination means police and fire cooperate in setting up a security or crowd control line. The Emergency Program Manager should make certain that responsibility is assigned and action is taken without conflict or controversy. The Manager is definitely not to tell a police chief how or where to set up security.

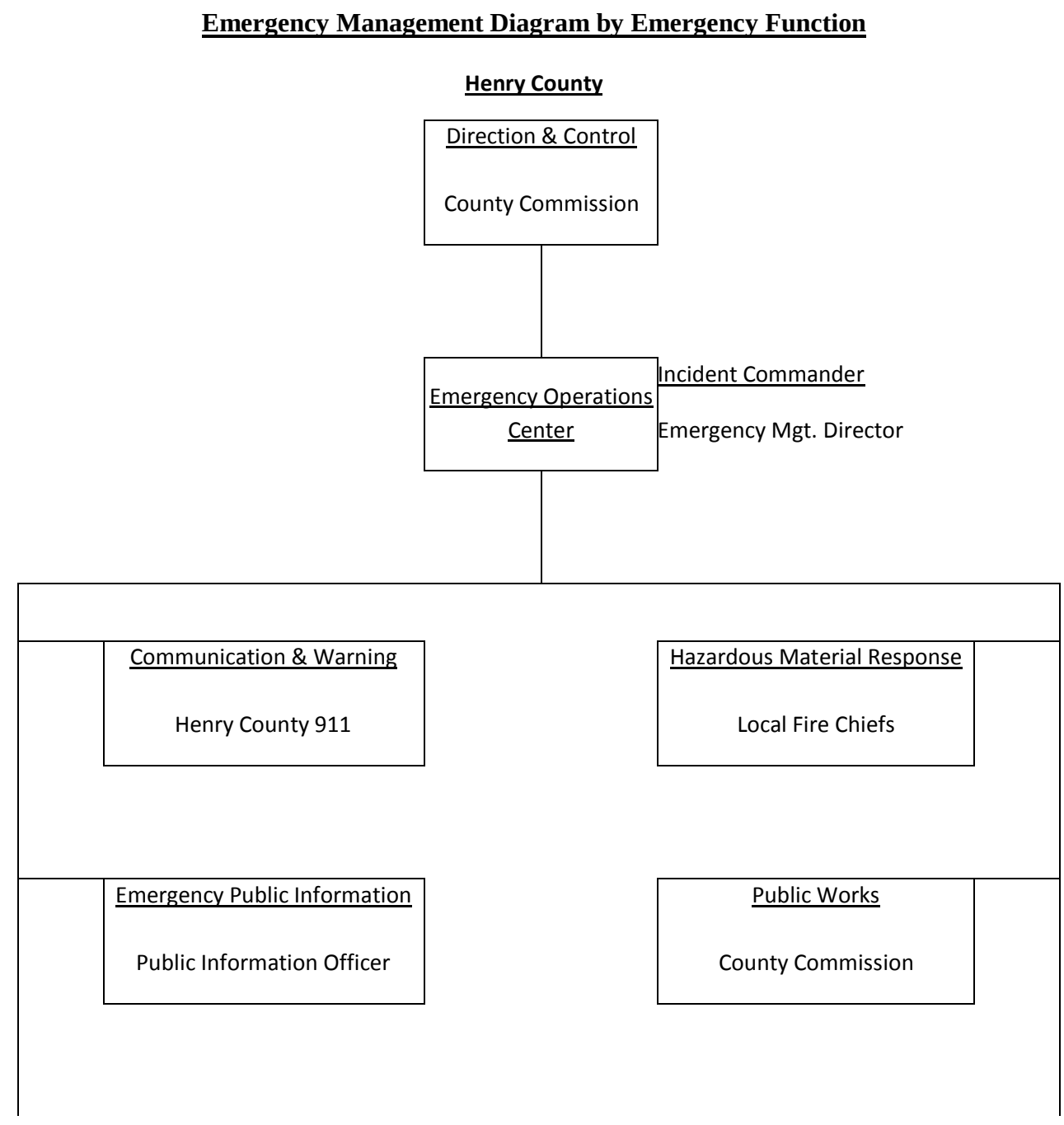
The Emergency Program Manager serves as coordinator when more than one emergency organization is involved. This always takes place in major disasters, but can occur in minor emergencies. For example, even in a fire, she/he may be called upon to coordinate the temporary housing of victims with the Red Cross or other social service agencies.

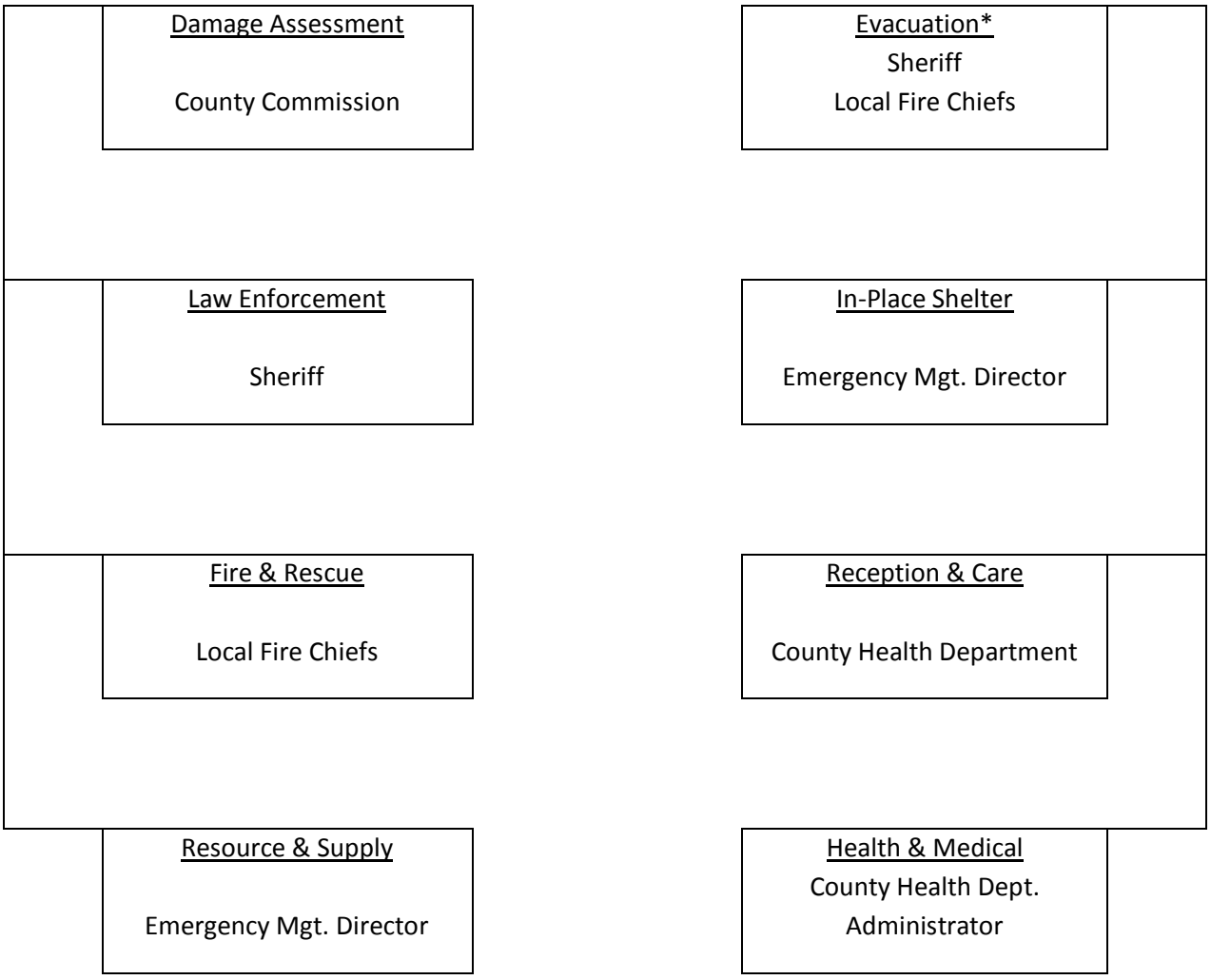
Equally important as coordinating agencies, is the role of the Emergency Program Manager in maintaining private sector interest in the emergency program. Emergency management partners in the private sector range from business and industry to civic organizations and individuals. The relationship with the local news media also cannot be overemphasized. A good working relationship with the press is a most important resource.

Finally, the Emergency Program Manager is unique because she/he has a role in hazard mitigation as well as emergency preparedness and response. While most mitigation efforts are the primary responsibility of other departments of local government, the Emergency Program Manager still has crucial roles in mitigation--that of motivator, coordinator, and monitor. She/he must be alert to risks and monitor opportunities to avoid hazardous conditions. No other agency or organization in government or the private sector has the responsibility to look at all hazards and all risks; no other agency or organization has the mandate to protect the public against any emergency condition.

Henry 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.

Figure 2.12.1-1 **Emergency Management Diagram taken from County Emergency Operations plan**





*joint responsibility

Source: Henry County Emergency Operations Plan

Emergency Operations Plan (EOP)

While this is not considered mitigation, an Emergency Operations Plan (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.

The purpose of the Henry EOP is "to save lives, minimize injuries, protect property, preserve functioning civil government, and maintain economic activities essential to Henry County." The chief elected official is ultimately responsible for emergency management activities within the boundaries of the jurisdiction.

The Presiding Commissioner of Henry County is responsible for those activities in the unincorporated areas of the county and in those incorporated communities that do not have a local emergency management organization (See Title XI, Division 10, and Chapter 11, of the Missouri Code of Regulations).

The chief elected official of each municipality (i.e., Mayor) has a similar responsibility within their corporate boundaries. These officials can delegate their authority but never their responsibility.

Henry County emergency management is set up along the following functional lines: direction and control; communications and warning; emergency public information; damage assessment; law enforcement; fire and rescue; civil disorder, hazardous material response, public works; evacuation; in-place shelter; reception and care; health and medical, terrorism response, and resource and supply. The plan also defines lines of succession for continuity of government during a disaster as well as preservation of records and the logistics of administrative functions such as procedures for obtaining temporary use of facilities. The EOP is reviewed annually and revised as needed.

Copies of the EOP can be found with the Office of Emergency Management, and at the Henry County Courthouse,

The **Henry County Central E-911 Dispatch Center** can quickly and efficiently notify specific regions in Henry 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. They have caller ID capabilities but do not possess any GPS capabilities.

Media

Local and regional media outlets provide regular weather information including forecasts for potentially destructive weather. Media outlets originating in or reaching Henry County are shown in Table 2.12.2-1.

Table 2.12.2-1 **Henry County Medial Outlets**

Media Outlet Name	Type	Base City
KDKD 95.3 FM	Radio Broadcast	Clinton
KLRQ 96.1 FM	Radio Broadcast	Clinton
K285EM 104.9 FM	Radio Broadcast	Clinton
KWKJ 98.5 FM	Radio Broadcast	Windsor
KPOQ 97.7 FM	Radio Broadcast	Sedalia
KXEA 104.9 FM	Radio Broadcast	Lowry City
KDKD 1510 AM	Radio Broadcast	Clinton
Clinton Daily Democrat	Newspaper	Clinton
Windsor Review	Newspaper	Windsor
New ERA	Newspaper	Windsor
KMOS-TV	Television	Sedalia

Law Enforcement Agencies

State, County and local law enforcement agencies are listed in Table below.

Table 2.12.2-2 **Law Enforcement Agencies**

Agency Name	Type	Phone Number
Henry County Sheriff	County	660-885-5587
Missouri Highway Patrol Office	State	660-885-6000
U.S. Marshal, Federal Court Building, Jefferson City	Federal	573-635-9708
Federal Bureau of Investigation, Jefferson City	Federal	573-636-8814
City of Clinton Police Department	City	660-885-5561
City of Urich Police Department	City	660-638-4813
City of Windsor Police Department	City	660-647-2211

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 Henry 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 (2010) 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 Henry County Plan.

Avalanches and volcanoes have not been included in this plan as they do not pose a threat due to Henry 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 formula.

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

In determining the potential frequency of occurrences, a simple formula was used. For historical events, the number of recorded events for the service area was divided by the number of years of record. This number was then multiplied by 100 to provide a percentage. This formula was used to determine future probability for each hazard.

For events that have not occurred, a probability of less than 1% was automatically assigned as the hazard cannot be excluded from the possibility of occurrence. Likewise, when discussing the probable risk of each hazard based upon historical occurrences, the following scale was utilized:

- Less than 1% chance of an event occurrence in any given year
- 1-10% chance of an event occurrence in any given year
- 10-80% chance of an event occurrence in any given year

- Near 100% chance of an event 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 many mitigation strategies already in place in the Planning Area.

Some are a result of actions taken since the development of the original Henry County Hazard Mitigation Plan in 2005.

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 Henry County and the following incorporated communities: Clinton, Urich, and Windsor
- Health care facilities in the county are accessible and provided with backup power.
- Cooperative agreements are in place between utility providers in the county.
- 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 some of school districts have two-way radios on board, but all of the buses have available communications by cell phone.
- The county is continuously maintaining tree limb lines.
- County or city-wide drills are published for the public.

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 Henry 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.

A summary of the federal and state classification systems, how the two systems relate to each other, and inspection requirements for regulated dams is shown in Table 3.2-1.

Table 3.2-1 **Dam Hazard Classification Table according to FEMA guidelines**

1. **Low Hazard Potential**
   Dams assigned the low hazard potential classification are those where failure or miss-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.
2. **Significant Hazard Potential**
   Dams assigned the significant hazard potential classification are those dams where failure or miss operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can 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.

3. **High Hazard Potential**
   Dams assigned the high hazard potential classification are those where failure or miss operation will probably cause loss of human life.

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

There are currently 62 dams in Henry County according to the Missouri Department of Natural Resources. None of these dams are regulated by the state. See Table 3.2.1-2.

Table 3.2.1-2 **Missouri Dam Report by County**

Missouri Department of Natural Resources

Missouri Dam Report by County

Regulated
Agriculture Exempt

HENRY

ID Number	Location	Year Complete	Height (ft)	Length (ft)	Drainage Area (acre)	Lake Area (acre)	Hazard Class	Permit Number
ACKLEY LAKE DAM MO20259	S33 T40N R25W	1970	25.00	Unknown	90.00	8.00	3	
B+L ELECTRIC LAKE DAM MO20644	S14 T41N R26W	1973	25.00	Unknown	100.00	5.00	3	
BARBER LAKE DAM MO20480	S33 T42N R24W	1970	25.00	Unknown	52.00	4.00	2	
BARBER LAKE DAM NO 2 MO50204	S32 T44N R24W	1975	27.00	440.00	500.00	28.00	3	
BARBER LAKE DAM-SEC 31 MO20484	S31 T44N R24W	1970	25.00	Unknown	150.00	5.00	3	
BEATY RANCH LAKE DAM MO20174	S20 T43N R26W	1937	20.00	Unknown	310.00	8.00	3	
BULLOCK LAKE DAM MO50205		1979	24.00	390.00	0.00	1.00		
BURNS LAKE DAM MO50203		1971	19.00	560.00	1.00	1.00		
CALLAWAY LAKE DAM MO20482	S08 T43N R24W	1800	25.00	Unknown	27.00	8.00	3	
CLINTON SOUTH QUAD NO.1 DAM MO20641	S35 T41N R26W	1800	25.00	Unknown	0.00	5.00	3	
DICKEY LAKE DAM MO20260	S14 T40N R26W	1880	25.00	Unknown	35.00	7.00	2	
DODY LAKE DAM MO20555	S34 T42N R25W	1977	25.00	Unknown	570.00	24.00	3	
DORRANCE DAM MO20640	S27 T41N R26W	1800	25.00	Unknown	0.00	12.00	3	
E. BURNS MO20063	S09 T41N R25W	1969	15.00	Unknown	646.00	16.00	3	
ENGLE LAKE DAM MO50206		1979	23.00	570.00	1.00	1.00		
GRAY LAKE DAM MO50207		1976	25.00	810.00	1.00	1.00		
GREEN LAKE DAM MO20653	S32 T44N R26W	1800	25.00	Unknown	34.00	5.00	3	
GROFF LAKE DAM MO20149	S13 T43N R26W	1940	25.00	Unknown	40.00	5.00	3	
HENDRICK LAKE DAM MO50208		1975	20.00	80.00	1.00	1.00		
HENRY LAKE DAM MO50209		1976	22.00	890.00	0.00	1.00		
HIGGS LAKE DAM MO50210		1979	21.00	800.00	0.00	1.00		
HINTON LAKE DAM NO 1 MO50211		1974	23.00	530.00	0.00	1.00		
HINTON LAKE DAM NO 2 MO50212	S11 T42N R25W	1977	15.00	890.00	140.00	9.00	3	
HUTCHERSON LAKE DAM MO20554	S15 T42N R25W	1977	23.00	Unknown	440.00	17.00	3	
KERNS LAKE DAM MO20459	S36 T43N R28W	1974	15.00	Unknown	142.00	10.00	3	

Department of Natural Resources

Missouri Dam Report by County

Regulated
Agriculture Exempt

HENRY

ID Number	Location	Year Complete	Height (ft)	Length (ft)	Drainage Area (acre)	Lake Area (acre)	Hazard Class	Permit Number
MILLAM LAKE DAM								
MO50202		1974	22.00	650.00	0.00	1.00		
MONTROSE LAKE DAM								
MO20151	S33 T41N R27W	1955	33.00	Unknown	91,000.00	1,700.00	3	
NETTELBLAD LAKE DAM								
MO20150	S01 T41N R28W	1930	25.00	Unknown	120.00	7.00	3	
NOLAND LAKE DAM								
MO20481	S06 T42N R24W	1975	25.00	Unknown	120.00	3.00	3	
NOLAND LAKE DAM								
MO50213		1974	25.00	250.00	0.00	1.00	3	
NORCROSS FARM LAKE DAM								
MO20651	S11 T43N R27W	1976	30.00	Unknown	220.00	18.00	3	
NORFLEET LAKE DAM								
MO20722	S35 T41N R24W	1976	25.00	Unknown	190.00	5.00	3	
O'DELL LAKE DAM								
MO20162	S01 T41N R25W	1960	20.00	Unknown	47.00	12.00	2	
PLUMLEE LAKE DAM								
MO20721	S05 T40N R24W	1800	25.00	Unknown	20.00	2.00	3	
RE MANSFIELD DAM								
MO20642	S35 T41N R26W	1800	25.00	Unknown	0.00	8.00	3	
SCHALLERT LAKE DAM								
MO20633	S30 T40N R26W	1800	25.00	Unknown	65.00	4.00	3	
SKELTON LAKE DAM								
MO20643	S11 T41N R26W	1800	25.00	Unknown	200.00	9.00	3	
STOTTS LAKE DAM								
MO20557	S17 T41N R25W	1971	25.00	Unknown	25.00	2.00	3	
TEBO DIVERSIONARY IMPOUNDMENT DAM								
MO20161	S15 T43N R25W	1960	20.00	Unknown	1,100.00	45.00	2	
TEBO FRESHWATER LAKE DAM								
MO20152	S26 T43N R25W	1957	26.00	Unknown	26,000.00	250.00	2	
WALL LAKE DAM								
MO20556	S35 T42N R25W	1972	20.00	Unknown	640.00	10.00	3	
WHITAKER DAM								
MO20148	S03 T40N R26W	1968	18.00	Unknown	200.00	30.00	3	
WHITE LAKE DAM								
MO20404	S04 T40N R25W	1964	25.00	Unknown	160.00	10.00	3	
WILLIAMS LAKE DAM								
MO20648	S32 T43N R26W	1977	21.00	Unknown	190.00	12.00	3	
WILLIAMS LAKE DAM								
MO20649	S03 T43N R26W	1977	28.00	Unknown	900.00	8.00	2	
WILLIAMS LAKE DAM 1								
MO50575		1967	44.00	500.00	1.00	1.00		
WILLIAMS LAKE DAM 2								
MO50214	S30 T43N R25W	1981	26.00	720.00	160.00	13.00		
WILLIAMS LAKE DAM-SEC 35								
MO20262	S35 T42N R24W	1964	25.00	Unknown	170.00	10.00	3	
WILLIAMS LAKE DAM-SEC 36								
MO20058	S36 T42N R24W	1967	30.00	Unknown	385.00	35.00	3	
WINDSOR LAKE DAM								
MO20553	S09 T43N R25W	1800	25.00	Unknown	29.00	4.00	3	
WOODWARD LAKE DAM								
MO50216		1968	27.00	310.00	0.00	1.00		

SUMMARY

Regulated Dams: 0	Total:		126,222.00	2,388.00
Total Dams: 62	Average:	24.04	2,408.12	45.88

3.2.1-2b.National Inventory of Dams Listing for Henry County

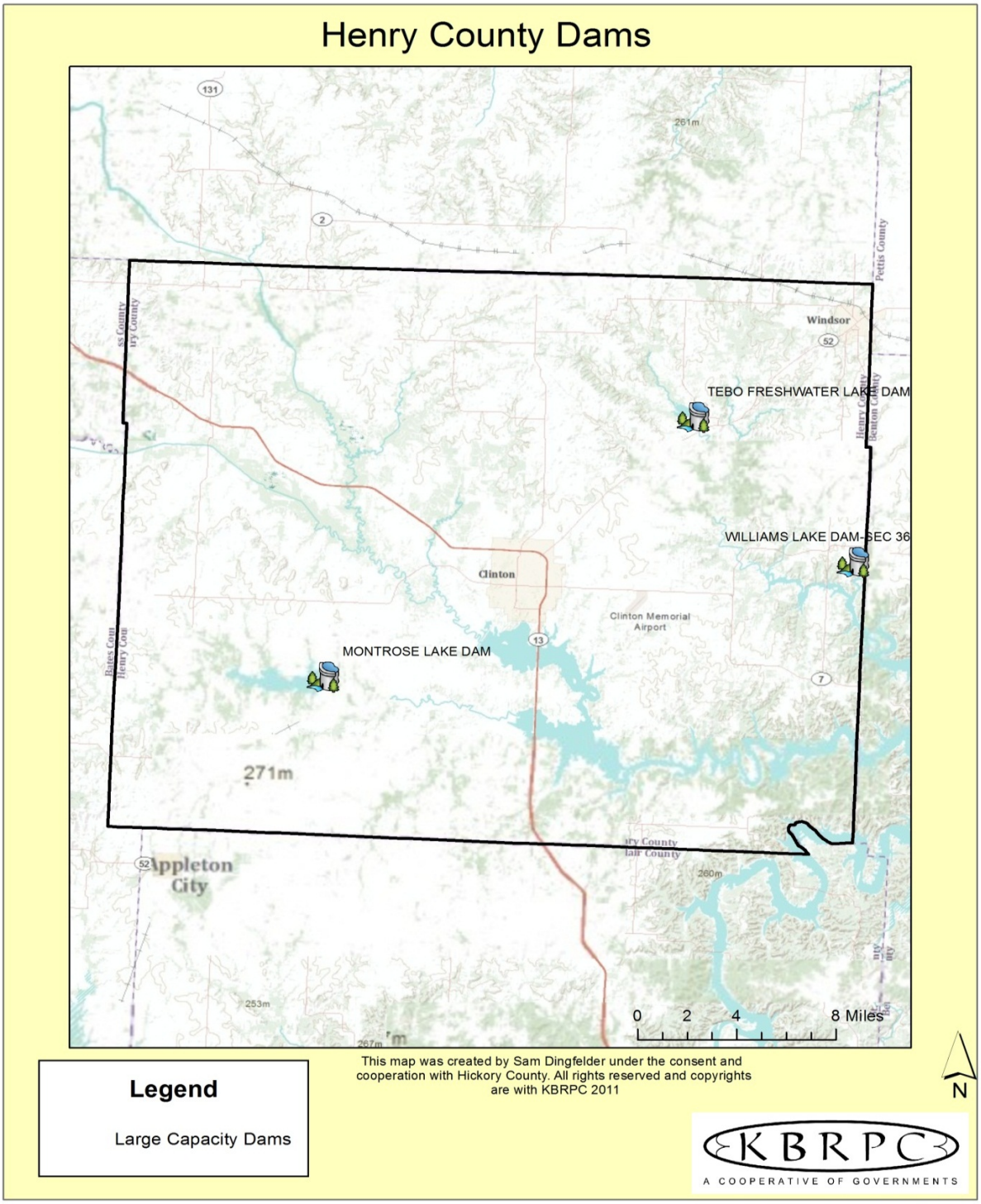
	Dam Type	NID Core Type	Foundation Type	Dam Height (ft.)	Dam Storage (acre-feet)	Detail
MO12339	Williams Lake Dam #2	Earth			26	100
MO20058	F.Williams Lake Dam No 2	Earth			29	134
MO20148	Whitaker Dam	Earth			18	150
MO20149	Groff Lake Dam	Earth			25	42
MO20150	Nettelblad Lake Dam	Earth			25	58
MO20151	Montrose Lake Dam	Earth			33	11000
MO20152	Tebo Freshwater Lake Dam	Earth			26	1500
MO20161	Tebo Diversionary Impoundment Dam	Earth			20	90
MO20162	O'Dell Lake Dam	Earth			20	40
MO20259	Ackley Lake Dam	Earth			25	65
MO20260	Dickey Lake Dam	Earth			25	49
MO20262	Williams Lake Dam-Sec 35	Earth			25	85
MO20403	Hinton Lake Dam	Earth			20	60
MO20404	White Lake Dam	Earth			25	65
MO20480	Barber Lake Dam	Earth			25	33
MO20481	Noland Lake Dam	Earth			25	25
MO20482	Callaway Lake Dam	Earth			25	67
MO20483	Barber Lake Dam-Sec 32	Earth			25	233
MO20484	Barber Lake Dam No 1(Sec 31)	Earth			21	57
MO20553	Windsor Lake	Earth			25	33

	Dam					
MO20554	Hutcherson Lake Dam	Earth			25	201
MO20555	Dody Lake Dam	Earth			25	269
MO20556	Wall Lake Dam	Earth			20	268
MO20557	Stotts Lake Dam	Earth			25	17
MO20633	Schallert Lake Dam	Earth			25	33
MO20640	Dorrance Dam	Earth			25	50
MO20641	Clinton South Quad No.1 Dam	Earth			25	50
MO20642	Re Mansfield Dam	Earth			25	50
MO20643	Skelton Lake Dam	Earth			25	69
MO20644	B+L Electric Lake Dam	Earth			25	37
MO20648	B. Williams Lake Dam No 1	Earth			22	172
MO20649	John Williams Lake Dam	Earth			27	286
MO20651	Norcross Farm Lake Dam	Earth			31	157
MO20653	Green Lake Dam	Earth			25	42
MO20721	Plumlee Lake Dam	Earth			25	17
MO20722	Norfleet Lake Dam	Earth			23	52
MO50201	Ackley Lake Dam	Earth			30	91
MO50202	Millam Lake Dam	Earth			23	54
MO50203	Burns Lake Dam	Earth			20	203
MO50204	Barber Lake Dam No 2	Earth			29	337
MO50205	Bullock Lake Dam	Earth			25	105
MO50206	Engle Lake Dam	Earth			24	122
MO50207	Gray Lake Dam	Earth			26	368

MO50208	Hendrick Lake Dam	Earth			21	109
MO50209	Henry Lake Dam	Earth			23	64
MO50210	Higgs Lake Dam	Earth			22	109
MO50211	Hinton Lake Dam No 1	Earth			24	73
MO50212	Hinton Lake Dam No 2	Earth			16	119
MO50213	Noland Lake Dam	Earth			26	64
MO50214	Williams Lake Dam No 2	Earth			27	100
MO50215	Windsor Lake Dam	Earth			19	60
MO50216	Woodward Lake Dam	Earth			28	71
MO50575	Williams Lake Dam No 1	Earth			45	989

The locations of the dams that would cause the most damage are shown in Figure 3.2.2-1

Figure 3.2.1-1 **County Dam Locations**



Existing Mitigation Strategies

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

Measure of Probability

In determining the potential frequency of occurrences, a simple formula was used. For historical events, the number of recorded events for the service area was divided by the number of years of record. This number was then multiplied by 100 to provide a percentage. This formula was used to determine future probability for each hazard.

For events that have not occurred, a probability of less than 1% was automatically assigned as the hazard cannot be excluded from the possibility of occurrence. Likewise, when discussing the probable risk of each hazard based upon historical occurrences, the following scale was utilized:

- Less than 1% chance of an event occurrence in any given year
- 1-10% chance of an event occurrence in any given year
- 10-80% chance of an event occurrence in any given year
- Near 100% chance of an event occurrence in any given year

Dam failure event probability:

0 events / 61 years = 0 x 100 = a less than 1% percent chance of a dam failure event in Henry County, in any given year.

Severity

Entire County: Low
Calhoun: Moderate
Clinton: Low
Deepwater: Moderate
Tightwad: Moderate

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 perception.

Table 3.2.2-1 **Drought Categories**

Drought Categories	
Agricultural drought	Defined by soil moisture deficiencies
Hydrological drought	Defined by declining surface and groundwater supplies
Meteorological drought	Defined by precipitation deficiencies
Hydrological drought and land use	Defined as meteorological drought in one 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

Table 3.2.2-2 **Palmer Drought Severity Index**

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

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 Figure 3.2.2-1).

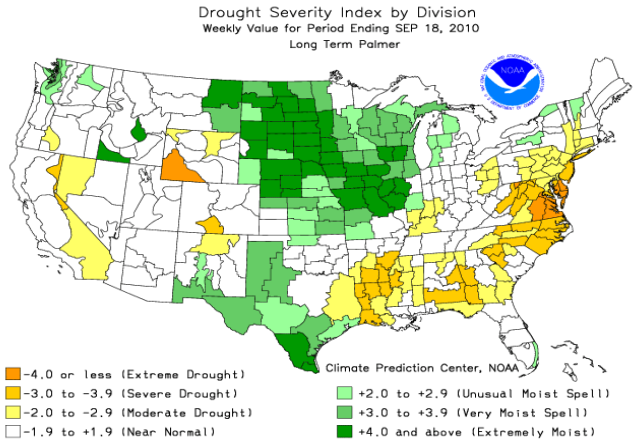
The most common type of drought in Mid-Missouri is the agricultural drought which happens on average every five years. Widespread crop damage, particularly to corn, is associated with agricultural drought in Missouri. The socioeconomic consequences of a drought can reach far beyond those immediately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

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 Map**



Palmer Drought Severity Index

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

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

Figure 3.2.2-2 **Drought Soils Map**

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 Henry 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 Henry 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). According to the Missouri Climate Center, Columbia recorded only 0.05 inches of rain in August 1986, making it the driest month on record.

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.

Although there have bee 170 recorded drought events that have occurred in the state of Missouri between 10/01/2006 and 12/3/2011, none of the events according to NOAA Storm Events Database, have been recorded in Henry County Missouri

source*http://www.ncdc.noaa.gov/stormevents/listevents.jsp?beginDate_mm=10&beginDate_dd=01&beginDate_yyyy=2006&endDate_mm=12&endDate_dd=31&endDate_yyyy=2011&county=ALL&eventType=Drought&statefips=29%2CMISSOURI*

Measure of Probability and Severity

Measure of Probability

In determining the potential frequency of occurrences, a simple formula was used. For historical events, the number of recorded events for the service area was divided by the number of years of record. This number was then multiplied by 100 to provide a percentage. This formula was used to determine future probability for each hazard.

For events that have not occurred, a probability of less than 1% was automatically assigned as the hazard cannot be excluded from the possibility of occurrence. Likewise, when discussing the probable risk of each hazard based upon historical occurrences, the following scale was utilized:

- Less than 1% chance of an event occurrence in any given year
- 1-10% chance of an event occurrence in any given year
- 10-80% chance of an event occurrence in any given year
- Near 100% chance of an event occurrence in any given year

Dam failure event probability:

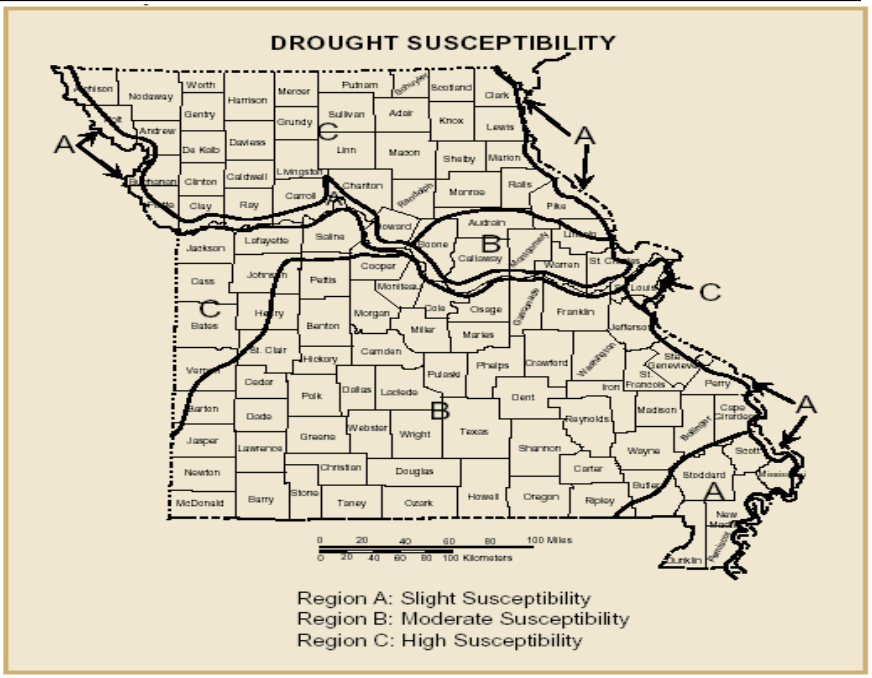
0 events / 5 years = 0 x 100 = a less than 1% percent chance of a drought event in Henry County, in any given year.

Severity

All of Henry County: Moderate

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 3.2.2-3.

Figure 3.2.2-3 **Missouri Drought Regions**



Henry County lies in both Regions B and C with West half of the county being in the region C"…High drought susceptibility, while the East half of the county lies in Region B, 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].

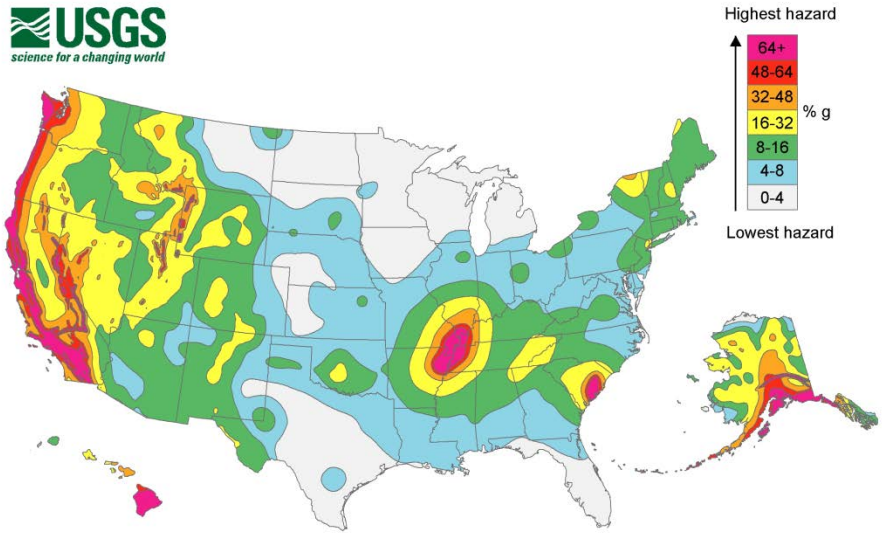
Description

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.

Earthquakes and dam failure/levee failure are secondary earthquake hazards that occur from ground shaking. Damage resulting from dam failure/levee failure is similar to that with flash flooding. Figure 3.2.3-1 shows the locations of likely earthquakes.

Figure 3.2.3-1 **Earthquake Hazard Locations**



Source: USGS

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 earthquakes.

- 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 jambs 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 Henry 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 3.2.3-2 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 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).

.

Figure 3.2.3-2 **Damage Example**

Source: National Geographic Earthquake photo gallery
(Note: The above photo is not from Missouri)

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 Henry 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 **Mercalli Scale Table**

II. Weak	Felt only by a few people at best, especially on the upper floors of buildings. Delicately suspended objects may swing.
III. Slight	Felt quite noticeably by people indoors, especially on the upper floors of buildings. Many do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration similar to the passing of a truck. Duration estimated.
IV. Moderate	Felt indoors by many people, outdoors by few people during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rock noticeably. Dishes and windows rattle alarmingly.
V. Rather Strong	Felt outside by most, may not be felt by some outside in non-favourable conditions. Dishes and windows may break and large bells will ring. Vibrations like large train passing close to house.
VI. Strong	Felt by all; many frightened and run outdoors, walk unsteadily. Windows, dishes, glassware broken; books fall off shelves; some heavy furniture moved or overturned; a few instances of fallen plaster. Damage slight.
VII. Very Strong	Difficult to stand; furniture broken; damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken. Noticed by people driving motor cars.
VIII. Destructive	Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture moved.
IX. Violent	General panic; damage considerable in specially designed structures, well designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X. Intense	Some well built wooden structures destroyed; most masonry and frame structures destroyed with foundation. Rails bent.
XI. Extreme	Few, if any masonry structures remain standing. Bridges destroyed. Rails bent greatly.
XII. Cataclysmic	Total damage - Everything is destroyed. Total destruction. Lines of sight and level distorted. Objects thrown into the air. The ground moves in waves or ripples. Large amounts of rock move position. Landscape altered, or leveled by several meters. In some cases, even the route of rivers is changed.

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

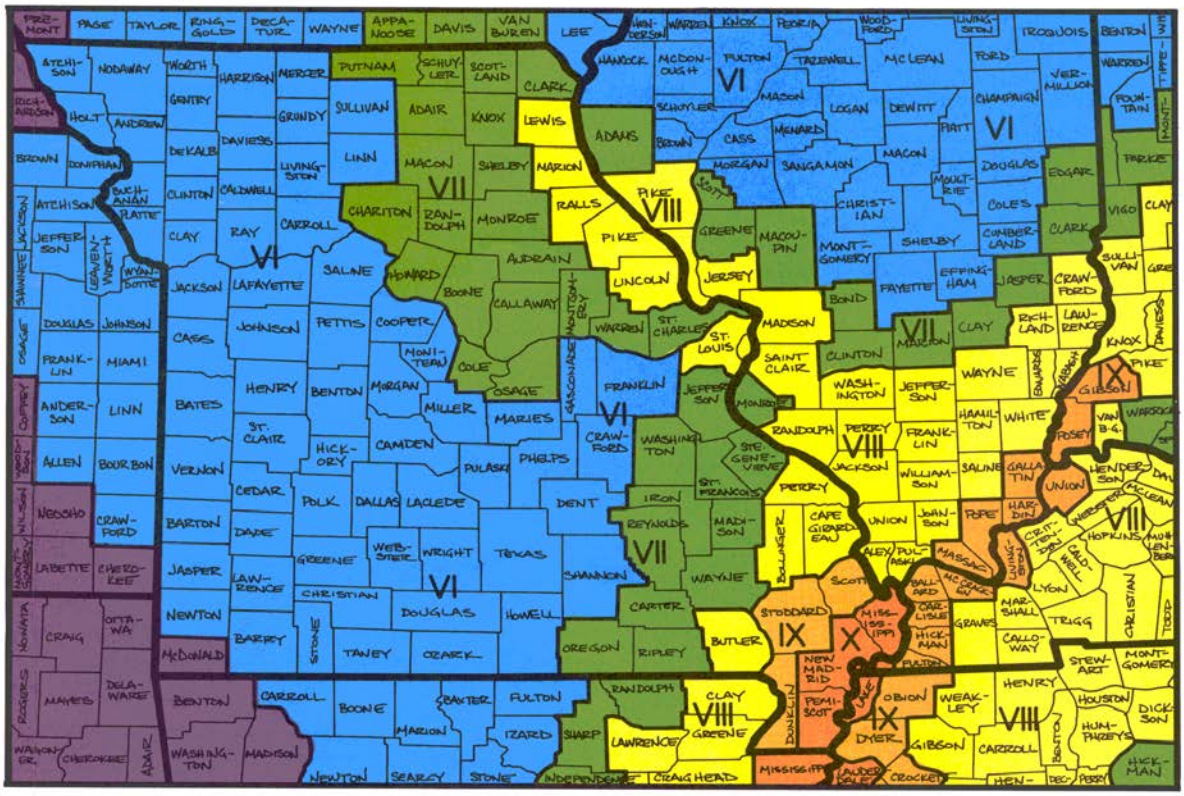
Another earthquake as powerful as the great quakes of 1811-12 may not occur for many years. Because of differences in the geology east and west of the Rocky Mountains, the effects of a magnitude 7 quake in the mid-continent United States could be far worse than those of the 1989 magnitude 7 Loma Prieta, 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.

Figure 3.2.3-3 show the predicted earthquake intensities that may be expected to occur during a major earthquake in the Henry County area.

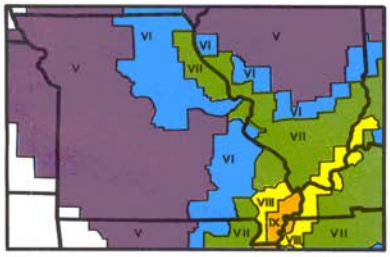
Table 3.2.3-3 **Projected Earthquake Intensities**

PROJECTED EARTHQUAKE INTENSITIES



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

6.7

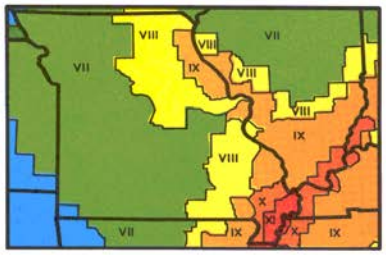


This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude – 6.7 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.

7.6

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

8.6

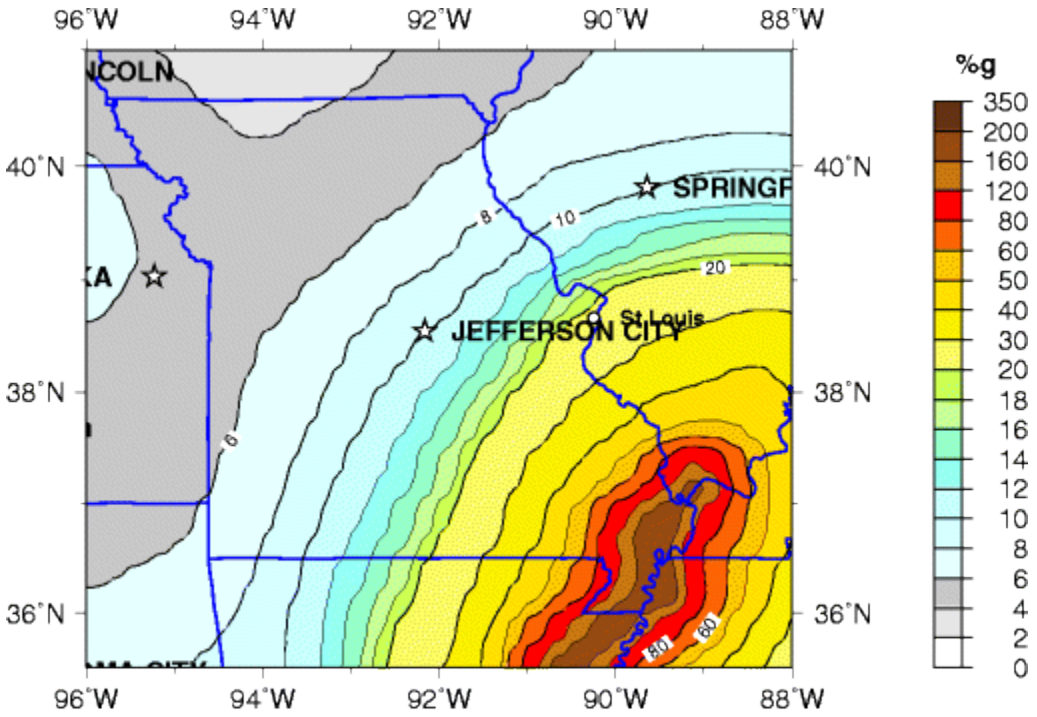


Source: Missouri SEMA: http://sema.dps.mo.gov/EQ%20Map.pdf

Locations/Areas Affected

Refer to Figure 3.2.3-4 below that depicts the Peak Acceleration (%g) with a 10% probability of exceedance within 50 years.

Figure 3.2.2-4 **Peak Acceleration Zones**



Source: USGS

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 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 some day 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 3.3.3-2 **Speed of Onset**

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.

Statement of Probable Future Severity

According to the SEMA map seen in Figure 3.2.3-3, Henry 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 Henry 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)

Table 3.2.3-3 Mercalli **Scale Level Possibilities**

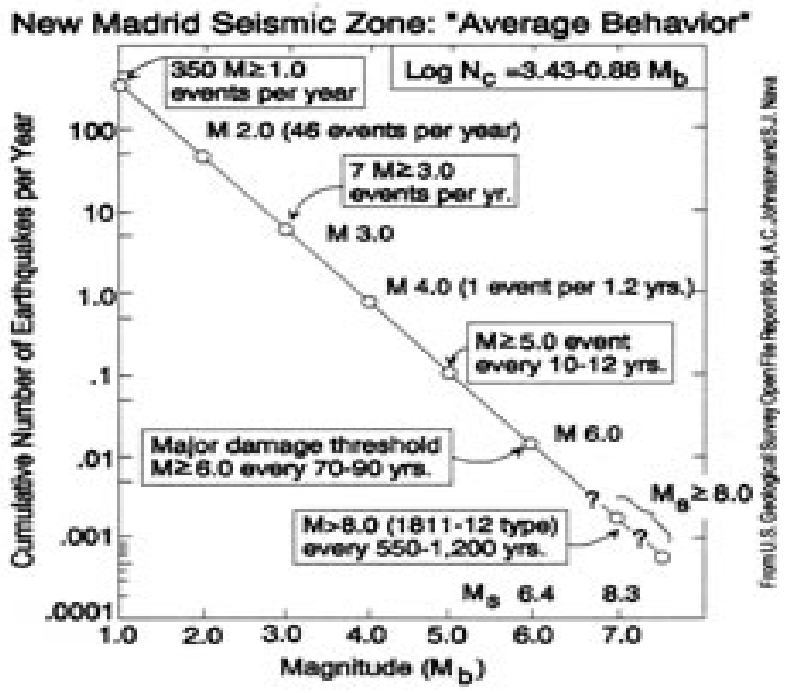
Modified Mercalli Levels I-V	Possible
Modified Mercalli Levels VI	Possible
Modified Mercalli Levels VII	Unlikely
Modified Mercalli Levels VII-XIII	Unlikely

Statement of Probable Risk/Likeliness of Future Occurrence

Due to the harder, colder, drier and less fractured nature of the rocks in the earth's crust in the central United States, earthquakes in this region shake and damage an area approximately 20 times larger than earthquakes in California and most other active seismic areas.

Even though large earthquakes occur much less frequently in the NMSZ than in California, the long term average quake threat, in terms of square miles affected per century, is about the same because of the approximately 20 times larger area affected in the central United States.

The frequency of large earthquakes in the New Madrid Seismic Zone (NMSZ) is still being debated. Several methods have been used to make estimates. Paleoseismology techniques are used to recognize evidence of large prehistoric earthquakes preserved in geologic materials (soil and rock). From the approximate locations, dates and magnitudes the long term average recurrence interval can be calculated. Currently, paleoseismologists infer two or more large earthquakes (magnitude 7 or larger) have occurred in the last 2,000 years or less giving recurrence interval estimates of 300 to 1,000 years for the large quakes. Probability models extrapolate the 200 years (approx.) of recorded history or 100 years (approx.) of instrumental recordings to estimate frequency. Probability estimates are given in the following table.



Source: http://www.dnr.mo.gov/geology/geosrv/geores/techbulletin1.htm

The NMSZ appears to be about 30 years overdue for a magnitude 6.3 quake because the last quake of this size occurred 100 hundred years ago at Charleston, Missouri; on Oct. 31, 1895 (it was a magnitude 6.7). A magnitude 6.3 quake near Lepanto, Arkansas, on Jan. 5, 1843, was the next prior earthquake of this magnitude. About 75 percent of the estimated recurrence time for a magnitude 7.6 earthquake has elapsed since the last quake of this size occurred in 1812.

The probability of a repeat of the 1881-12 (magnitude 7.5-8.0) earthquake is 7-10%

A magnitude 7.6 earthquake in the NMSZ will cause major damage near the fault system in the Missouri Bootheel, northeast Arkansas and western Kentucky and Tennessee.

Significant damage is expected to extend north of St. Louis up the Mississippi River valley, up the Ohio and Wabash River valleys to near Owensboro, Kentucky and Indianapolis, Indiana and down the Mississippi River valley to near Greenville, Mississippi. Significant damage is also expected in about 15 additional counties each in southern Illinois, western Kentucky and Tennessee, northeastern Arkansas and northwestern Mississippi and in about five counties in southeast Missouri outside the Bootheel.

Existing Mitigation Strategies

Multiple Jurisdictions

By law all schools in Henry 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.

Measure of Probability and Severity

Measure of Probability

In determining the potential frequency of occurrences, a simple formula was used. For historical events, the number of recorded events for the service area was divided by the number of years of record. This number was then multiplied by 100 to provide a percentage. This formula was used to determine future probability for each hazard. For events that have not occurred, a probability of less than 1% was automatically assigned as the hazard cannot be excluded from the possibility of occurrence. Likewise, when discussing the probable risk of each hazard based upon historical occurrences, the following scale was utilized:

- Less than 1% chance of an event occurrence in any given year
- 1-10% chance of an event occurrence in any given year
- 10-80% chance of an event occurrence in any given year
- Near 100% chance of an event occurrence in any given year

Earthquake event probability:

0 events / 61 years = 0 x 100 = 0 = a less than 1% percent chance of an earthquake event in Henry County, in any given year.

Severity

Table 3.2.3-4 **Community Severity**

Community	Possible Earthquake Severity
City of Blairstown	Level VI - Strong
Village of Brownington	Level VI – Strong
City of Calhoun	Level VI – Strong
City of Clinton	Level VI – Strong
City of Deepwater	Level VI – Strong
City of Montrose	Level VI – Strong
City of Urich	Level VI – Strong
City of Windsor	Level VI – Strong
All School Districts	Level VI – Strong
Al of Henry County	Level VI – Strong

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.

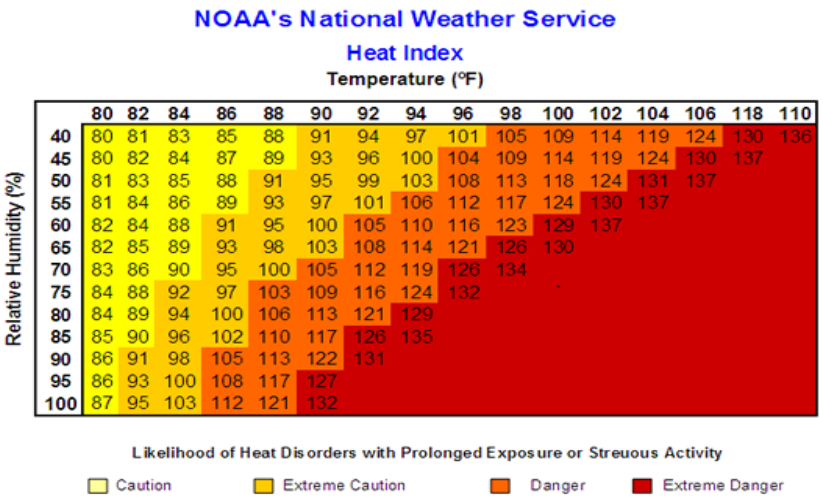
The National Oceanic and Atmospheric Administration defines life threatening conditions when heat overloads the human body's capacity to cool itself. In the disastrous heat wave of 1980, more than 1,200 people died nationwide. In a normal year, about 175 Americans succumb to the bodily stress of summer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



Source: http://www.nws.noaa.gov/om/heat/index.shtml

Geographic Location

The entire Planning Area is at risk from heat events.

Previous Occurrences

There were a total of 14 high temperature extremes occurring in Henry County from 1950 to 2011. The most intense heat wave causing death occurred in 1999, resulting in 46 deaths. (See Table 3.2.4-2)

Table 3.2.4-2 **Henry County Temperature Extremes Chart**

14 HIGH TEMPERATURE EXTREMES event(s) were reported in **Henry County, Missouri** between **04/30/1950** and **11/30/2011**.

*Click on **Location or County** to display Details.*

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

Missouri

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 MOZ001>005 - 005>008 - 011>017 - 020>025 - 028>033 - 037>040 - 043>046 - 053>054	07/18/1999	12:00 AM	Excessive Heat	N/A	22	0	0	0
3 MOZ020>021 - 028>030 - 037>038 - 043>045 - 053>054	08/22/2000	12:00 AM	Excessive Heat	N/A	1	0	0	0
4 MOZ001>008 - 011>017 - 020>025 - 028>033 - 037>040 - 043>046 - 053>054	09/01/2000	12:00 AM	Excessive Heat	N/A	3	0	0	0
5 MOZ001>008 - 011>017 - 020>025 - 028>033 - 037>040 - 043>046 - 053>054	07/06/2001	12:00 PM	Excessive Heat	N/A	2	0	0	0
6 MOZ001>008 - 011>017 - 020>025 - 028>033 - 037>040 - 043>046 - 053>054	07/17/2001	12:00 PM	Excessive Heat	N/A	2	0	0	0
7 MOZ001>008 - 011>017 - 020>025 - 028>033 - 037>040 - 043>046 - 053>054	08/01/2001	12:00 AM	Excessive Heat	N/A	4	0	0	0
8 MOZ001>008 - 011>017 - 020>025 - 028>033 - 037>040 - 043>046 - 053>054	08/09/2001	12:00 PM	Excessive Heat	N/A	1	0	0	0
9 MOZ020>022 - 028>032 - 037>040 - 043>046 - 054	07/04/2003	06:00 AM	Excessive Heat	N/A	1	0	0	0
10 MOZ001>002 - 004 - 011>013 - 020>022 - 028>029 - 033 - 037>038 - 043>045 - 053>054	07/14/2003	01:47 PM	Excessive Heat	N/A	2	0	0	0
11 MOZ001>008 - 011>017 - 020>025 - 028>033 - 037>040 - 043>046 - 053>054	07/21/2005	12:00 PM	Excessive Heat	N/A	0	0	0	0
12 MOZ001>008 - 011>017 - 020>025 - 028>033 - 037>040 - 043>046 - 053>054	07/16/2006	12:00 PM	Excessive Heat	N/A	4	0	0	0
13 MOZ001>008 - 011>017 - 020>025 - 028>033 - 037>040 - 043>046 - 053>054	07/29/2006	12:00 PM	Excessive Heat	N/A	0	0	0	0
14 MOZ001>008 - 011>017 - 020>025 - 028>033 - 037>040 - 043>046 - 053>054	08/01/2006	12:00 AM	Excessive Heat	N/A	2	0	0	0
				TOTALS:	46	55	0	50K

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

Measure of Probability

In determining the potential frequency of occurrences, a simple formula was used. For historical events, the number of recorded events for the service area was divided by the number of years of record. This number was then multiplied by 100 to provide a percentage. This formula was used to determine future probability for each hazard. For events that have not occurred, a probability of less than 1% was automatically assigned as the hazard cannot be excluded from the possibility of occurrence. Likewise, when discussing the probable risk of each hazard based upon historical occurrences, the following scale was utilized:

- Less than 1% chance of an event occurrence in any given year
- 1-10% chance of an event occurrence in any given year
- 10-80% chance of an event occurrence in any given year
- Near 100% chance of an event occurrence in any given year

High temperature event probability:

14 events / 61 years = .229 x 100 = a 22.9 % = a 10 to 80 percent chance of a high temperature event in Henry County, in any given year.

Severity

All of Henry County: Low

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 Henry County/City of Clinton 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.

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.

As indicated by Table 3.2.5-1, there were 71 flood events reported in Henry County from 2004 through 2010. There were no reported deaths but there was a total of $50,000 in property damage and a total of 501.300 Million dollars worth of damage to crops in Henry County.

Note: Although the weather event data located at http://www.ncdc.noaa.gov/stormevents/, previously listed events from 1950 and forward, it now only list information from 2006 and forward. There are no additional sources for this information.

Table 3.2.5-1 **Henry County Flood Events**

71 FLOOD event(s) were reported in **Henry County, Missouri** between **01/01/2004** and **03/31/2011**.

*Click on **Location or County** to display Details.*

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

Missouri								
Location or County	**Date**	**Time**	**Type**	**Mag**	**Dth**	**Inj**	**PrD**	**CrD**
1 MOZ044 - 046 - 054	01/18/2004	02:00 AM	Flood	N/A	0	0	0	0
2 MOZ054	03/04/2004	01:00 PM	Flood	N/A	0	0	0	0
3 MOZ054	03/28/2004	07:30 AM	Flood	N/A	0	0	0	0
4 Montrose	05/19/2004	02:09 AM	Flash Flood	N/A	0	0	0	0

5 MOZ020 - 028>029 - 032 - 037 - 039>040 - 044 - 046 - 054 - 054	05/19/2004	05:00 AM	Flood	N/A	0	0	0	0
6 MOZ054	06/10/2004	12:00 PM	Flood	N/A	0	0	0	0
7 MOZ054	06/18/2004	01:00 PM	Flood	N/A	0	0	0	0
8 MOZ054	07/24/2004	09:00 PM	Flood	N/A	0	0	0	0
9 MOZ054	09/18/2004	06:00 PM	Flood	N/A	0	0	0	0
10 MOZ054	11/11/2004	06:00 AM	Flood	N/A	0	0	0	0
11 MOZ054	11/24/2004	06:00 AM	Flood	N/A	0	0	0	0
12 MOZ054	11/24/2004	06:00 AM	Flood	N/A	0	0	0	0
13 MOZ054	11/26/2004	07:00 PM	Flood	N/A	0	0	0	0
14 MOZ054	01/04/2005	09:00 PM	Flood	N/A	0	0	0	0
15 MOZ054	01/04/2005	09:00 PM	Flood	N/A	0	0	0	0
16 Montrose	01/12/2005	07:20 PM	Flash Flood	N/A	0	0	0	0
17 MOZ054	02/13/2005	06:00 PM	Flood	N/A	0	0	0	0
18 MOZ054	06/04/2005	10:00 PM	Flood	N/A	0	0	0	0
19 MOZ054	06/04/2005	10:00 PM	Flood	N/A	0	0	0	0
20 MOZ054	06/09/2005	05:00 AM	Flood	N/A	0	0	0	0
21 MOZ054	06/13/2005	10:00 AM	Flood	N/A	0	0	0	0
22 MOZ054	08/26/2005	06:00 PM	Flood	N/A	0	0	0	0
23 Urich	04/29/2006	08:00 PM	Flood	N/A	0	0	0	0
24 Blairstown	04/30/2006	03:00 AM	Flood	N/A	0	0	0	0
25 Urich	04/14/2007	13:00 PM	Flood	N/A	0	0	0K	0K
26 Blairstown	04/15/2007	05:00 AM	Flood	N/A	0	0	0K	0K
27 Urich	04/26/2007	06:00 AM	Flood	N/A	0	0	0K	0K
28 Blairstown	04/26/2007	09:00 AM	Flood	N/A	0	0	0K	0K
29 Urich	05/02/2007	12:00 PM	Flood	N/A	0	0	0K	0K
30 Blairstown	05/03/2007	00:00 AM	Flood	N/A	0	0	0K	0K
31 Blairstown	05/06/2007	06:00 AM	Flood	N/A	0	0	0K	500K
32 Urich	05/06/2007	06:00 AM	Flood	N/A	0	0	0K	500K
33 Clinton	05/06/2007	16:57 PM	Flash Flood	N/A	0	0	0K	0K
34 Urich	06/01/2007	12:00 PM	Flood	N/A	0	0	0K	0K
35 Blairstown	06/01/2007	21:00 PM	Flood	N/A	0	0	0K	0K
36 Blairstown	06/28/2007	06:00 AM	Flood	N/A	0	0	0K	0K

37 Urich	06/28/2007	06:00 AM	Flood	N/A	0	0	0K	0K
38 Blairstown	06/29/2007	08:00 AM	Flash Flood	N/A	0	0	0K	0K
39 Clinton	06/30/2007	11:31 AM	Flash Flood	N/A	0	0	0K	0K
40 Tightwad	06/30/2007	11:31 AM	Flash Flood	N/A	0	0	0K	0K
41 Blairstown	07/01/2007	00:00 AM	Flood	N/A	0	0	5K	500.0M
42 Urich	07/01/2007	00:00 AM	Flood	N/A	0	0	45K	300K
43 Huntingdale	10/17/2007	18:00 PM	Flash Flood	N/A	0	0	0K	0K
44 Blairstown	02/05/2008	17:36 PM	Flood	N/A	0	0	0K	0K
45 Urich	02/06/2008	01:45 AM	Flood	N/A	0	0	0K	0K
46 Urich	02/18/2008	06:50 AM	Flood	N/A	0	0	0K	0K
47 Blairstown	03/03/2008	06:24 AM	Flood	N/A	0	0	0K	0K
48 Urich	03/03/2008	07:00 AM	Flood	N/A	0	0	0K	0K
49 Blairstown	03/17/2008	14:12 PM	Flood	N/A	0	0	0K	0K
50 Urich	03/17/2008	14:55 PM	Flood	N/A	0	0	0K	0K
51 Blairstown	04/08/2008	13:57 PM	Flood	N/A	0	0	0K	0K
52 Lucas	04/08/2008	16:47 PM	Flood	N/A	0	0	0K	0K
53 Urich	04/09/2008	19:35 PM	Flood	N/A	0	0	0K	0K
54 Blairstown	04/10/2008	07:32 AM	Flood	N/A	0	0	0K	0K
55 Lucas	04/18/2008	10:40 AM	Flood	N/A	0	0	0K	0K
56 Urich	04/22/2008	16:14 PM	Flood	N/A	0	0	0K	0K
57 Urich	04/24/2008	05:15 AM	Flood	N/A	0	0	0K	0K
58 Blairstown	04/24/2008	07:00 AM	Flood	N/A	0	0	0K	0K
59 Urich	05/02/2008	13:35 PM	Flood	N/A	0	0	0K	0K
60 Blairstown	05/02/2008	14:48 PM	Flood	N/A	0	0	0K	0K
61 Leesville	06/15/2008	14:00 PM	Flash Flood	N/A	0	0	0K	0K
62 Calhoun	09/12/2008	05:40 AM	Flash Flood	N/A	0	0	0K	0K
63 Clinton	09/12/2008	05:40 AM	Flash Flood	N/A	0	0	0K	0K
64 Montrose	09/12/2008	05:40 AM	Flash Flood	N/A	0	0	0K	0K

65 Quarles	09/12/2008	05:40 AM	Flash Flood	N/A	0	0	0K	0K
66 Blairstown	12/27/2008	11:46 AM	Flood	N/A	0	0	0K	0K
67 Urich	12/27/2008	16:00 PM	Flood	N/A	0	0	0K	0K
68 Urich	02/11/2009	17:00 PM	Flood	N/A	0	0	0K	0K
69 Clinton	06/15/2009	23:15 PM	Flash Flood	N/A	0	0	0K	0K
70 Windsor	06/15/2009	23:15 PM	Flash Flood	N/A	0	0	0K	0K
71 Clinton	06/16/2010	19:45 PM	Flash Flood	N/A	0	0	0K	0K
				TOTALS:	0	0	50K	501.300M

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

Measure of Probability

In determining the potential frequency of occurrences, a simple formula was used. For historical events, the number of recorded events for the service area was divided by the number of years of record. This number was then multiplied by 100 to provide a percentage.

This formula was used to determine future probability for each hazard. For events that have not occurred, a probability of less than 1% was automatically assigned as the hazard cannot be excluded from the possibility of occurrence. Likewise, when discussing the probable risk of each hazard based upon historical occurrences, the following scale was utilized:

- Less than 1% chance of an event occurrence in any given year
- 1-10% chance of an event occurrence in any given year
- 10-80% chance of an event occurrence in any given year
- Near 100% chance of an event occurrence in any given year

Flood event probability:

71 events / 61 years = 1.163 x 100 = a 100 % percent chance of a flood event in Henry County, during any given year.

Measure of Severity

All of Henry County: Moderate

Urich, Blairstown: Moderate

Geographic Location

The entire Planning Area is at risk from some type of flooding.

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 Henry County jurisdictions participate in the NFIP: Henry County, Calhoun, Clinton, Montrose, Urich and Windsor. (As of 01/31/2012) there are 15 NFIP policies in effect in Henry County, as indicated by Table 3.3.5-2.

Table 3.2.5-2 **NFIP Community Policies**

Participating Jurisdictions	Number of policies in effect
City of Calhoun	1
City of Clinton	6
City of Windsor	2
City of Montrose	1
City of Urich	1
Henry County	3
	Total: 15

http://bsa.nfipstat.com/reports/1011.htm#MOT

3.2.6 Land subsidence/Sinkhole

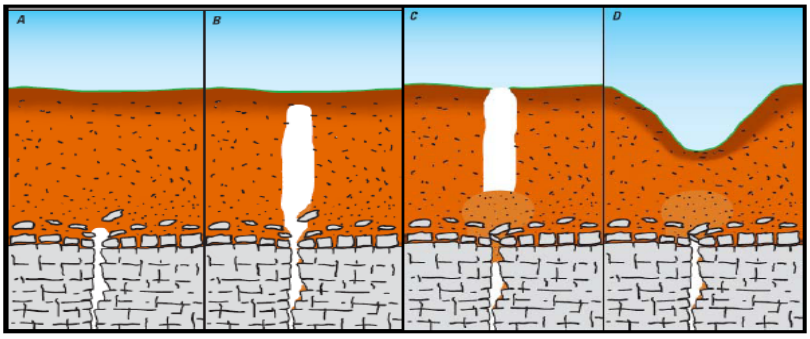
Description of Hazard

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 **Sinkholes**



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

Geographic Location

Sinkhole concerns are highlighted by the Missouri DNR mapping website in Figure 3.2.6-1. 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 Henry 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 Henry County is high.

Measure of Probability

In determining the potential frequency of occurrences, a simple formula was used. For historical events, the number of recorded events for the service area was divided by the number of years of record. This number was then multiplied by 100 to provide a percentage. This formula was used to determine future probability for each hazard.

For events that have not occurred, a probability of less than 1% was automatically assigned as the hazard cannot be excluded from the possibility of occurrence. Likewise, when discussing the probable risk of each hazard based upon historical occurrences, the following scale was utilized:

- Less than 1% chance of an event occurrence in any given year
- 1-10% chance of an event occurrence in any given year
- 10-80% chance of an event occurrence in any given year
- Near 100% chance of an event occurrence in any given year

Sinkhole event probability:

0 events / 61 years = 0 x 100 = less that a 1% percent chance of a sinkhole event in Henry County, in any given year.

Severity

All of Henry County: Low

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

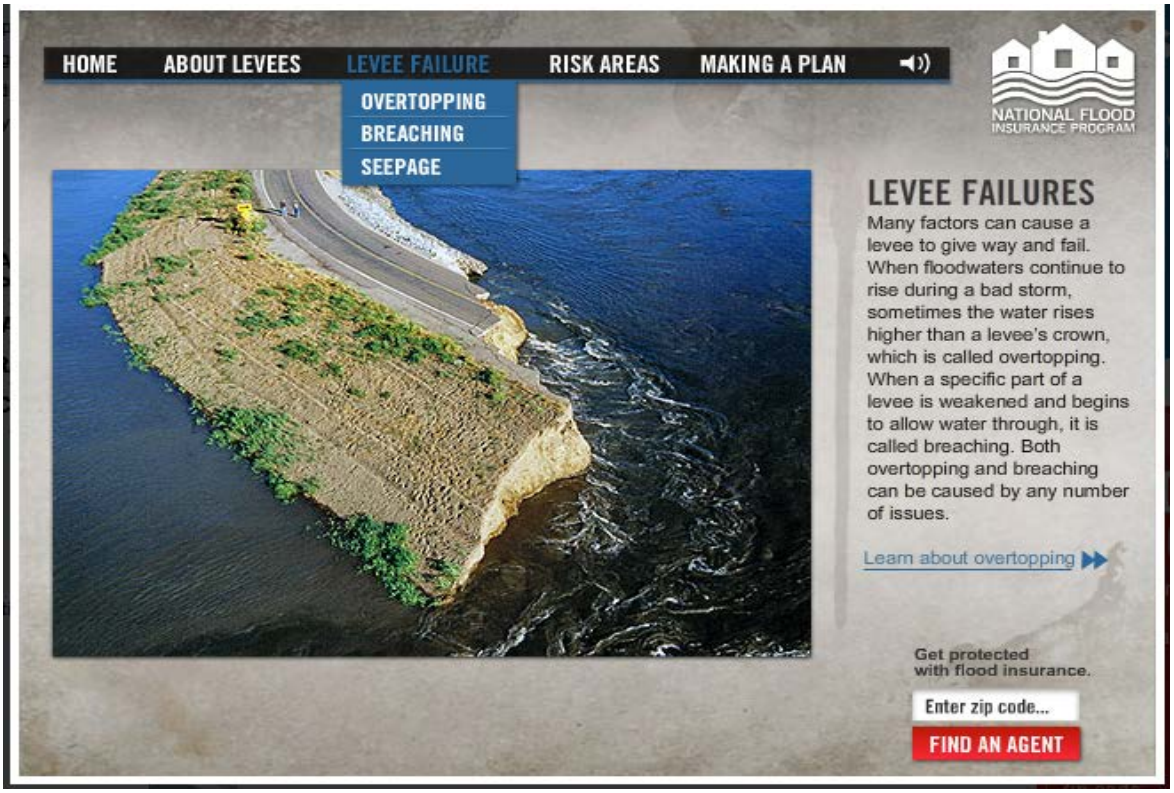
an earthen embankment designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding."

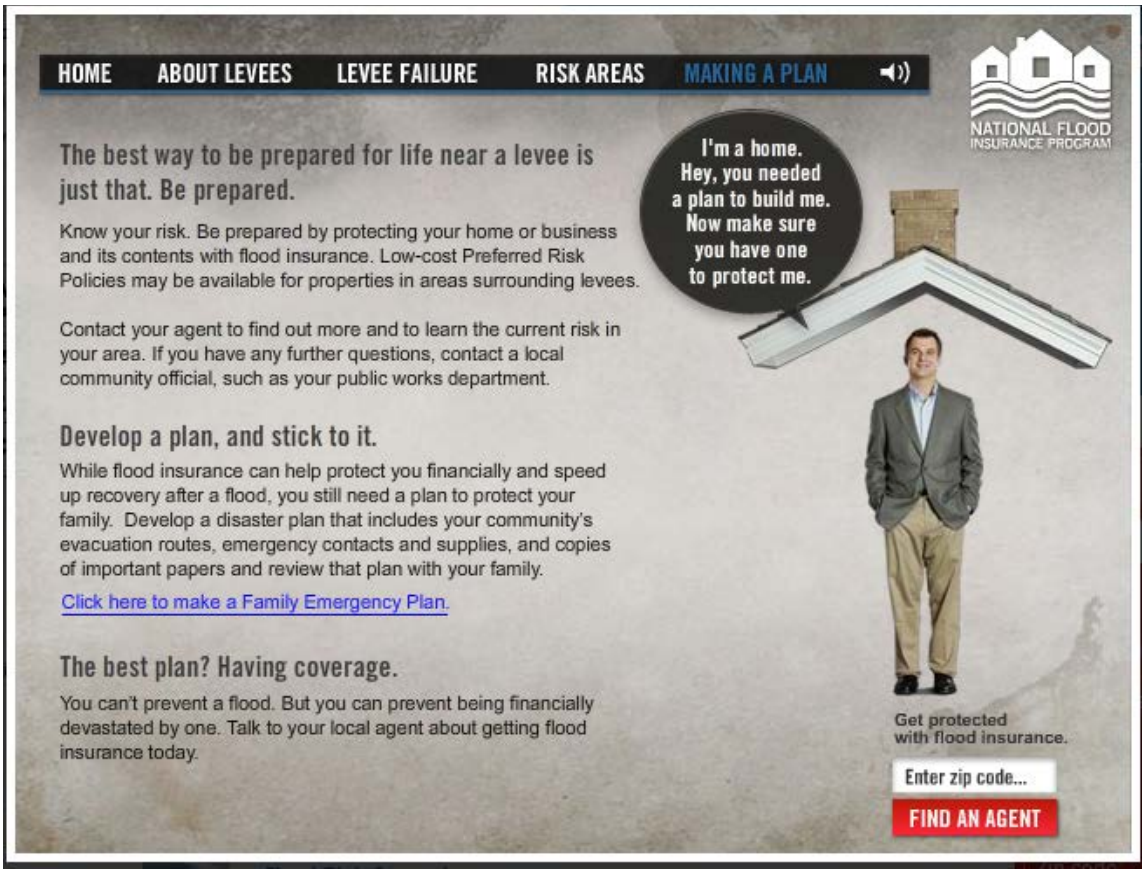
"Understanding the Risk in Levee-Impacted Areas"-FEMA excerpt

"People, who own property, live, or work in areas that are impacted by levee systems should be aware of the flood risk in these areas. No levee system provides full protection from all flooding events. Levee systems are designed to provide a specific level of flood protection.

Levee systems can be overtopped or even fail during flood events that are larger than the levee system was designed to contain. In addition, levee systems require regular maintenance to retain their level of flood protection. The fact is, levee systems can and do decay over time, and maintenance can become a serious challenge to levee owners. When levee systems fail or are overtopped, the damage is often catastrophic and more severe than if the levee system had not been built." For more information visit the FEMA website at www.fema.gov/plan.

Below is the levee failure simulation taken from the FloodSmart.gov website as part of the National Flood Insurance Program (NFIP).



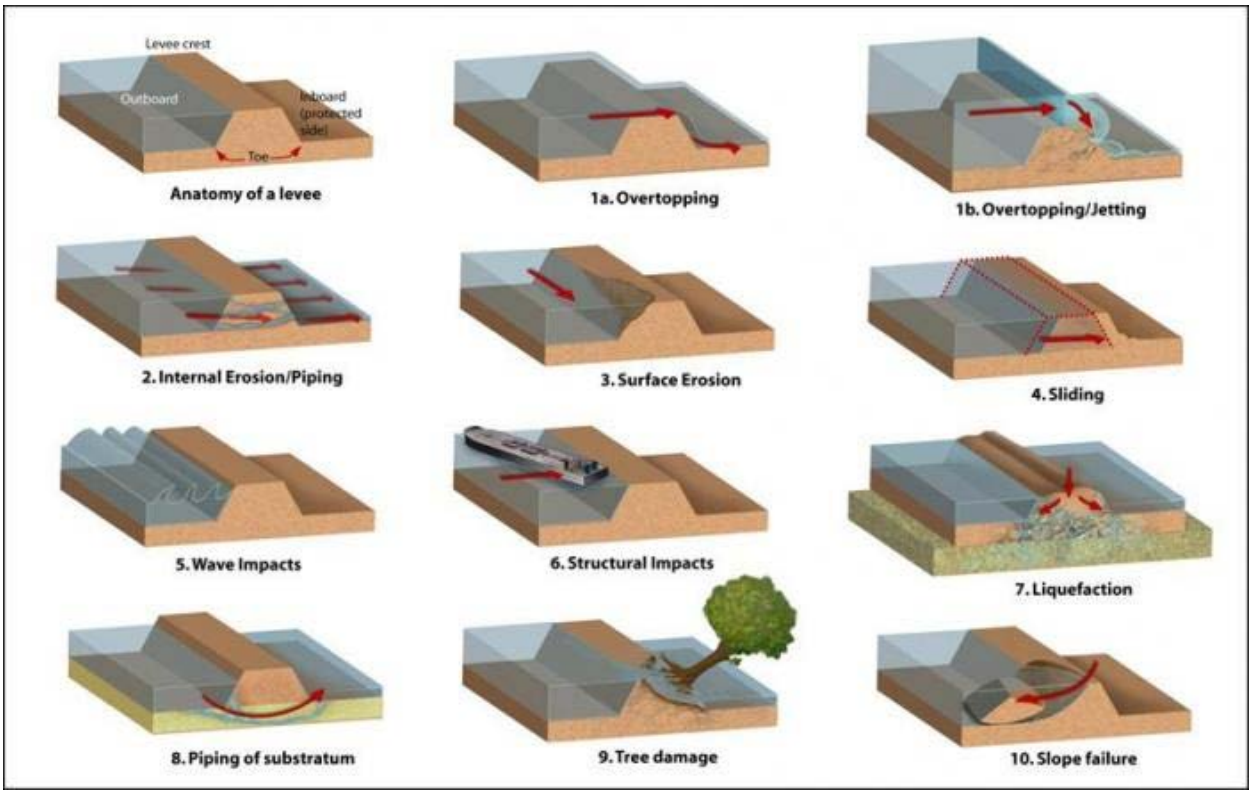


Levee failure, according to FEMA, can occur by the following means:

- **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.

See Figure 3.2.7-2

Figure 3.2.7-2 **Levee Failure Modes**



Source: mradwlive.wordpress.com

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.

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.

Previous Occurrences

There are no recorded incidents of levee failure in Henry County. According to the U.S. Army Corps of Engineers database, Henry County does not have any levees listed within the National Levee Database.

Measure of Probability

In determining the potential frequency of occurrences, a simple formula was used. For historical events, the number of recorded events for the service area was divided by the number of years of record. This number was then multiplied by 100 to provide a percentage. This formula was used to determine future probability for each hazard.

For events that have not occurred, a probability of less than 1% was automatically assigned as the hazard cannot be excluded from the possibility of occurrence. Likewise, when discussing the probable risk of each hazard based upon historical occurrences, the following scale was utilized:

- Less than 1% chance of an event occurrence in any given year
- 1-10% chance of an event occurrence in any given year
- 10-80% chance of an event occurrence in any given year
- Near 100% chance of an event occurrence in any given year

Levee failure event probability:

0 events / 61 years = 0 x 100 = 0 = less than 1 % percent probability of a sinkhole event in Henry County.

Existing Mitigation Strategies

There are no Levee mitigation strategies in Henry County.

3.2.8 Severe Winter Weather

Description of Hazard

Henry County seems to have some relatively random yet mild winter weather. Winter storms in Henry 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 Henry 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.

Besides snow and ice, extremely cold temperatures can produce problems.

The wind chill is determined by factoring cold temperatures and wind speed (see Table 3.2.8-1). For example, when the temperature is 20°F and the wind speed is 15 miles per hour, the resulting wind chill (what it really feels like) is 6°F.

This type of situation can be dangerous to people outdoors because their bodies can experience rapid heat loss, resulting in hypothermia (abnormally low body temperature)

Table 3.2.8-1 **NOAA Wind Chill Chart**

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New Wind Chill Chart

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

Frostbite occurs in 15 minutes or less

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

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

http://www.erh.noaa.gov/er/iln/tables.htm

Geographic Location

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

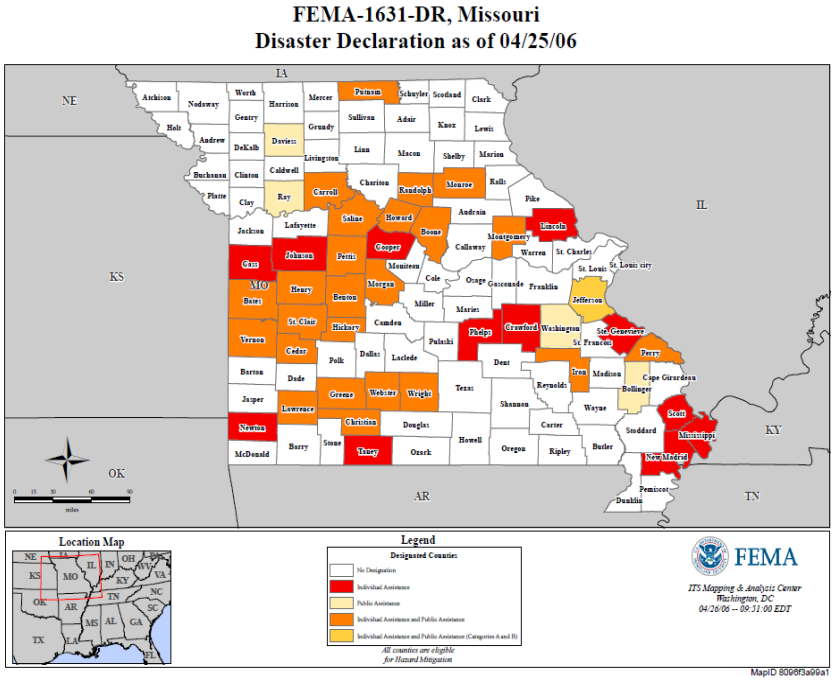
Previous Occurrences

January 31, 2002 (DR 1403): A massive severe winter storm system dumped snow and ice from Oklahoma to Kansas and into central and northern Missouri. In Missouri alone, more than 600,000 residents were without power, as ice-encased power lines snapped in fierce winds or were pulled down by falling trees and limbs.

Loss of electricity included more than 460,000 people in the Kansas City metro area alone (Jackson, Cass, Clay, and Platte counties). Additionally, residents in a line from Kansas City to the Iowa-Illinois border were without power as rural electric cooperative lines broke as well. Outages ranged from several days to nearly two weeks.

Damage to property, power restoration, and the cost of debris removal for local governments was so high that Missouri received a presidential disaster declaration (DR 1403) on February 6, 2002, which ultimately included 43 counties; 26 were designated for both Individual and Public Assistance, and 17 were eligible for Individual Assistance only The total eligible Public Assistance costs for this disaster ($61.9 million dollars as of August 2002) ranks the 2002 ice storm as Missouri‘s second most costly disaster to date.
Since 2008 there have been no FEMA Disaster Declarations caused by winter weather for Henry County, although neighboring counties have been included in FEMA winter weather Disaster Declarations, as demonstrated by Figure 3.3.8-1.

Figure 3.2.8-1 **Disaster Declaration Map**



Source: http://www.fema.gov/femaNews/disasterSearch.do

There were a total of 30snow and ice events reported in Henry County in the period of 1950 to 2011, with a total of 32.155M in property damage reported. See table 3.2.7-2.

Table 3.2.8-2 **Snow and Ice Events**

30 SNOW & ICE event(s) were reported in **Henry County, Missouri** between **04/30/1950** and **11/30/2011**.

*Click on **Location or County** to display Details.*

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

Missouri

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 MOZ031>033 - 038>040 - 043>046 - 053 - 054 - 067	01/18/1995	1800	Heavy Snow	N/A	0	0	200K	0
2 Northwest, Central An	11/11/1995	0100	Snow/ice	N/A	0	0	0	0
3 MOZ001>008 - 011>017 - 020>025 - 028>033 - 037>040 - 043>046 - 053 - 054	12/08/1995	0400	Snow	N/A	0	0	0	0
4 MOZ045>046 - 053>054	01/09/1997	12:00 AM	Heavy Snow	N/A	0	0	0	0
5 MOZ001>005 - 011>014 - 020>022 - 028>030 - 037>038 - 043>044 - 053>054	12/21/1997	05:00 AM	Ice Storm	N/A	0	0	0	0
6 MOZ045>046 - 054	03/11/2000	04:00 AM	Heavy Snow	N/A	0	0	0	0
7 MOZ030>031 - 037>039 - 043>045 - 053>054	11/08/2000	12:00 PM	Ice Storm	N/A	0	0	0	0
8 MOZ002>008 - 011>017 - 020>025 - 028>033 - 037>038 - 043>044 - 053>054	12/10/2000	11:00 PM	Winter Storm	N/A	0	0	0	0
9 MOZ028 - 033 - 037>040 - 043>046 - 053>054	12/13/2000	09:00 AM	Heavy Snow	N/A	0	0	0	0
10 MOZ001>008 - 011>017 - 020>025 - 028>033 - 037>040 - 043>046 - 053>054	01/28/2001	02:00 AM	Winter Storm	N/A	0	0	0	0
11 MOZ005>008 - 013>017 - 020>025 - 028>033 - 037>040 - 043>046 - 053>054	02/09/2001	02:00 AM	Winter Storm	N/A	0	0	0	0
12 MOZ001>002 - 006 - 011>013 - 015 - 020 - 054	02/27/2001	06:00 AM	Heavy Snow	N/A	0	0	0	0
13 MOZ025 - 028>033 - 037>040 - 043>046 - 053>054	01/30/2002	04:00 AM	Ice Storm	N/A	0	0	32.0M	0
14 MOZ007>008 - 016>017 - 021 - 046 - 054	03/01/2002	01:45 PM	Heavy Snow	N/A	0	0	0	0
15 MOZ053>054	01/02/2003	12:20 AM	Winter Storm	N/A	0	0	0	0
16 MOZ053>054	02/23/2003	07:30 PM	Winter Storm	N/A	0	0	0	0

17 MOZ039 - 045>046 - 053>054	12/10/2003	04:00 AM	Winter Storm	N/A	0	0	0	0
18 MOZ043 - 054	12/12/2003	10:00 AM	Winter Storm	N/A	0	0	0	0
19 MOZ053>054	01/25/2004	08:00 AM	Winter Storm	N/A	0	0	0	0
20 MOZ028>030 - 037>038 - 043>044 - 054	02/05/2004	01:00 PM	Winter Storm	N/A	0	0	0	0
21 MOZ030 - 038 - 044 - 054	11/30/2006	16:00 PM	Heavy Snow	N/A	0	0	5K	0K
22 MOZ044 - 054	01/12/2007	08:00 AM	Winter Storm	N/A	0	0	0K	0K
23 MOZ021 - 028 - 037 - 043>044 - 054	01/20/2007	15:00 PM	Heavy Snow	N/A	0	0	0K	0K
24 MOZ054	02/28/2009	05:00 AM	Heavy Snow	N/A	0	0	0K	0K
25 MOZ015 - 044 - 054	12/24/2009	03:00 PM	Winter Storm	N/A	0	0	0K	0K
26 MOZ001>003 - 006>008 - 013>015 - 021>022 - 024>025 - 028>029 - 031>033 - 037>038 - 043>045 - 054	01/06/2010	10:00 AM	Winter Storm	N/A	0	0	0K	0K
27 MOZ045 - 053 - 054	03/20/2010	04:00 AM	Winter Storm	N/A	0	0	0K	0K
28 MOZ002>004 - 022 - 038 - 044 - 054	01/10/2011	01:00 AM	Winter Weather	N/A	0	0	0K	0K
29 MOZ022 - 030 - 038 - 044 - 054	01/19/2011	02:00 PM	Winter Storm	N/A	0	0	0K	0K
30 MOZ037 - 043 - 054	03/13/2011	11:00 PM	Winter Weather	N/A	0	0	0K	0K
				TOTALS:	0	0	32.155M	0

Measure of Probability

In determining the potential frequency of occurrences, a simple formula was used. For historical events, the number of recorded events for the service area was divided by the number of years of record. This number was then multiplied by 100 to provide a percentage. This formula was used to determine future probability for each hazard.

For events that have not occurred, a probability of less than 1% was automatically assigned as the hazard cannot be excluded from the possibility of occurrence. Likewise, when discussing the probable risk of each hazard based upon historical occurrences, the following scale was utilized:

- Less than 1% chance of an event occurrence in any given year
- 1-10% chance of an event occurrence in any given year
- 10-80% chance of an event occurrence in any given year
- Near 100% chance of an event occurrence in any given year

Snow and Ice event probability:

30 events / 61 years = .491 x 100 = a 49 % percent chance of a snow or ice event in Henry County, = a 10 to 80% chance of an event, in any given year.

Severity

All of Henry County: Moderate

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 3.2.8-3.

Table 3.2.8-3 **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

Tornadoes are cyclical windstorms often associated with the Midwestern areas of the United States.
Weather conditions conducive to tornadoes often produce a wide range of other dangerous storm activities, including severe thunderstorms, downbursts, straight-line winds, lightning, hail, and heavy rains.

Essentially, tornadoes are a vortex storm with two components of winds.

The first is the rotational winds that can measure up to 500 miles per hour, and the second is an uplifting current of great strength. The dynamic strength of both these currents can cause vacuums that can overpressure structures from the inside.

Although tornadoes have been documented in all 50 states, most of them occur in the central United States. The unique geography of the central United States allows for the development of thunderstorms that spawn tornadoes. The jet stream, which is a high-velocity stream of air, determines which area of the central United States will be prone to tornado development. The jet stream normally separates the cold air of the north from the warm air of the south. During the winter, the jet stream flows west to east from Texas to the Carolina coast. As the sun ―moves north, so does the jet stream, which at summer solstice flows from Canada across Lake Superior to Maine. During its move northward in the spring and its recession south during the fall, the jet stream crosses Missouri, causing the large thunderstorms that breed tornadoes.

Tornadoes spawn from the largest thunderstorms. The associated cumulonimbus clouds can reach heights of up to 55,000 feet above ground level and are commonly formed when Gulf air is warmed by solar heating.

The moist, warm air is overridden by the dry cool air provided by the jet stream. This cold air presses down on the warm air, preventing it from rising, but only temporarily. Soon, the warm air forces its way through the cool air and the cool air moves downward past the rising warm air. This air movement, along with the deflection of the earth‘s surface, can cause the air masses to start rotating. This rotational movement around the location of the breakthrough forms a vortex, or funnel. If the newly created funnel stays in the sky, it is referred to as a funnel cloud. However, if it touches the ground, the funnel officially becomes a tornado.

A typical tornado can be described as a funnel-shaped cloud that is ―anchored‖ to a cloud, usually a cumulonimbus that is also in contact with the earth‘s surface. This contact on average lasts 30 minutes and covers an average distance of 15 miles. The width of the tornado (and its path of destruction) is usually about 300 yards. However, tornadoes can stay on the ground for upward of 300 miles and can be up to a mile wide. The National Weather Service, in reviewing tornadoes occurring in Missouri between 1950 and 1996, calculated the mean path length at 2.27 miles and the mean path area at 0.14 square mile.

The average forward speed of a tornado is 30 miles per hour but may vary from nearly stationary to 70 miles per hour. The average tornado moves from southwest to northeast, but tornadoes have been known to move in any direction. Tornadoes are most likely to occur in the afternoon and evening, but have been known to occur at all hours of the day and night.

Tornadoes are classified according to the EF- Scale (the original F – Scale was developed by Dr. Theodore Fujita, a renowned severe storm researcher). The Enhanced F- Scale (see Table 3.2.8-1) attempts to rank tornadoes according to wind speed based on the damage caused. This update to the original F scale was implemented in the U.S. on February 1, 2007.

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

The Enhanced F-scale still is a set of wind estimates (not measurements) based on damage. Its uses three-second gusts estimated at the point of damage based on a judgment of 8 levels of damage to the 28 indicators listed in Table 3.2.9-3. These estimates vary with height and exposure.

Important: The 3 second gust is not the same wind as in standard surface observations.

Standard measurements are taken by weather stations in open exposures, using a directly measured, and “one minute mile" speed.

Table 3.2.9-2 **Enhanced F Scale Damage Indicators**

NUMBER	DAMAGE INDICATOR	ABBREVIATION
1	Small barns, farm outbuildings	SBO
2	One- or two-family residences	FR12
3	Single-wide mobile home (MHSW)	MHSW
4	Double-wide mobile home	MHDW
5	Apt, condo, townhouse (3 stories or less)	ACT
6	Motel	M
7	Masonry apt. or motel	MAM
8	Small retail bldg. (fast food)	SRB
9	Small professional (doctor office, branch bank)	SPB
10	Strip mall	SM
11	Large shopping mall	LSM
12	Large, isolated ("big box") retail bldg.	LIRB
13	Automobile showroom	ASR
14	Automotive service building	ASB
15	School - 1-story elementary (interior or exterior halls)	ES
16	School - jr. or sr. high school	JHSH
17	Low-rise (1-4 story) bldg.	LRB
18	Mid-rise (5-20 story) bldg.	MRB
19	High-rise (over 20 stories)	HRB
20	Institutional Bldg. (hospital, govt., or university)	IB
21	Metal building system	MBS
22	Service station canopy	SSC
23	Warehouse (tilt-up walls or heavy timber)	WHB
24	Transmission line tower	TLT
25	Free-standing tower	FST
26	Free standing pole (light, flag, luminary)	FSP
27	Tree – hardwood	TH
28	Tree – softwood	TS

The year 2006 was a record year for tornadoes and severe weather outbreaks for Missouri. 102 tornadoes were recorded which surpassed the previous record year of 2003 when 84 tornadoes were recorded. Four sets of major storms went through the State: March 8–13 (DR 1631), March 30–April 2 (DR 1635), July 19–21 (EM 3267 and DR 1667), and September 22–23 tornado damages.

Between the two March/April storms, which both received declarations for severe storms, tornadoes, and flooding, 44 tornadoes touched down in Missouri.

Fourteen people were killed (making it the fifth year in which double-digit deaths from tornadoes occurred in Missouri since 1950), 147 were injured, 646 homes were destroyed, 3,678 homes were damaged, and 1,134 homes were affected. As of June 14, 2006, Missouri citizens had received more than $32 million in federal recovery assistance. As a result of the first round of storms, 41 counties received major disaster declarations. Also, there was an estimated $5.6 million in damages from these tornadoes reported by four Missouri Electrical Cooperatives. The second round of storms resulted in major disaster declarations for seven counties. In Pemiscot County, 100 percent of Braggadocio, 80 percent of Dearing, and over 60 percent of Caruthersville were destroyed. Major problems included drinking water, utilities, debris removal, and shelter and housing.

Henry County has endured 8 Major Disaster Declarations as demonstrated in table 3.2.9-3.

Table 3.2.9-3 **Henry County Disaster Decelerations**

Henry County Major Disaster Decelerations		
Deceleration Number	**Date**	**FEMA Disaster Type**
DR-1961	Declared March 23, 2011	Severe Winter Storm and Snowstorm
DR-1631	Declared March 16, 2006	Severe Storms, Tornadoes, and Flooding
DR-1524	Declared June 11, 2004	Severe Storms, Tornadoes, and Flooding
DR-1463	Declared May 6, 2003	Severe Storms, Tornadoes, and Flooding
DR-1403	Declared February 6, 2002	Ice Storm
DR-1054	Declared June 2, 1995	Severe Storm, Tornadoes, Hail, Flooding
DR-995	Declared July 9, 1993	Flooding, Severe Storm
DR-372	Declared April 19, 1973	Heavy Rains, Tornadoes, Flooding

http://www.fema.gov/news/eventcounties.fema?id=13812

Previous Occurrences

Tornado

The county has experienced 11 tornado events since 1950, as officially recorded by NOAA (see Table 3.2.9-4). There have been twenty injuries and $500,000 in property damages associated with these two tornado events.

Table 3.2.9-4 **Henry County Tornados**

11 TORNADO(s) were reported in **Henry County, Missouri** between **04/30/1950** and **11/30/2011**.

*Click on **Location or County** to display Details.*

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

Missouri

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 HENRY	03/31/1953	1630	Tornado	F1	0	0	3K	0
2 HENRY	12/04/1956	1920	Tornado	F2	0	2	25K	0
3 HENRY	03/31/1973	1125	Tornado	F0	0	0	0K	0
4 HENRY	04/19/1973	1930	Tornado	F4	0	5	25K	0
5 HENRY	05/28/1982	2030	Tornado	F1	0	0	250K	0
6 HENRY	12/01/1982	2000	Tornado	F1	0	0	0K	0
7 HENRY	11/15/1988	1655	Tornado	F1	0	0	25K	0
8 HENRY	06/08/1990	2035	Tornado	F1	0	0	0K	0
9 Urich	05/08/2003	08:21 PM	Tornado	F0	0	0	0	0
10 Calhoun	03/12/2006	03:50 PM	Tornado	F1	0	0	0	0
11 Urich	03/12/2006	08:07 PM	Tornado	F2	1	13	500K	0
				TOTALS:	1	20	828K	0

Measure of Probability

In determining the potential frequency of occurrences, a simple formula was used. For historical events, the number of recorded events for the service area was divided by the number of years of record. This number was then multiplied by 100 to provide a percentage. This formula was used to determine future probability for each hazard.

For events that have not occurred, a probability of less than 1% was automatically assigned as the hazard cannot be excluded from the possibility of occurrence.

Likewise, when discussing the probable risk of each hazard based upon historical occurrences, the following scale was utilized:

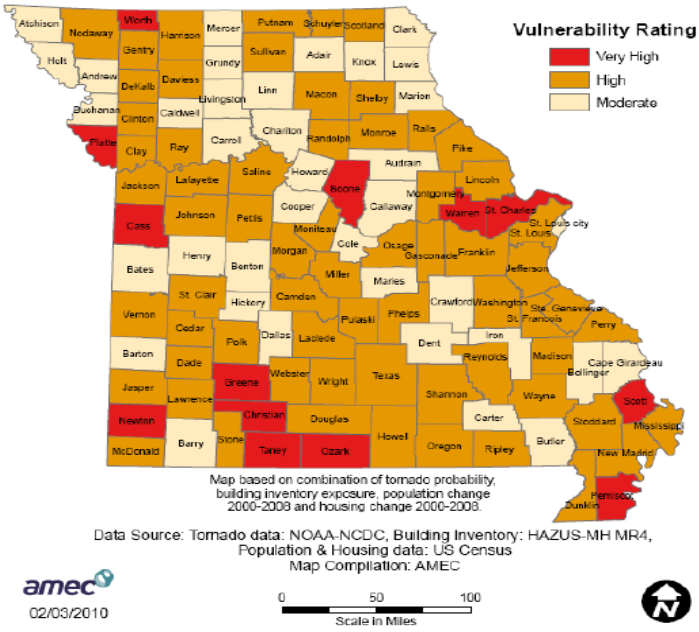
- Less than 1% chance of an event occurrence in any given year
- 1-10% chance of an event occurrence in any given year
- 10-80% chance of an event occurrence in any given year
- Near 100% chance of an event occurrence in any given year

Tornado event probability:

11 events / 61 years = .180 x 100 = a 10.03 % percent probability of a tornadic event in Henry County, = a 1-10% chance of a tornadic event, in any given year.

According to NOAA Henry County has an overall Moderate Tornado Vulnerability Rating as shown in Figure 3.2.9-1

Figure 3.2.9-1 **Tornado Vulnerability Rating**



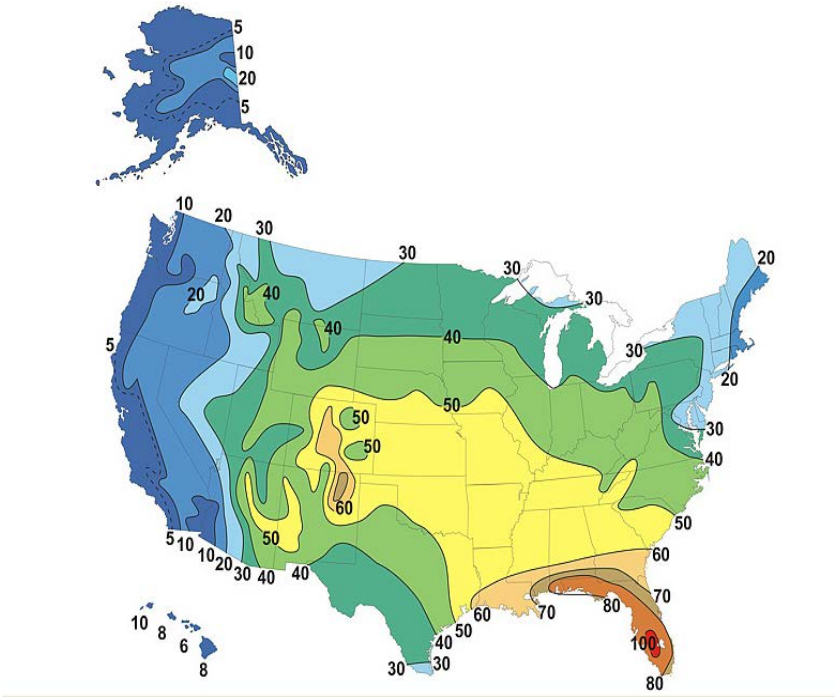
Severity

All of Henry County: Moderate

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 thunderstorm days per year in Missouri (see Figure 3.2.9-2). Many of these thunderstorms are severe.

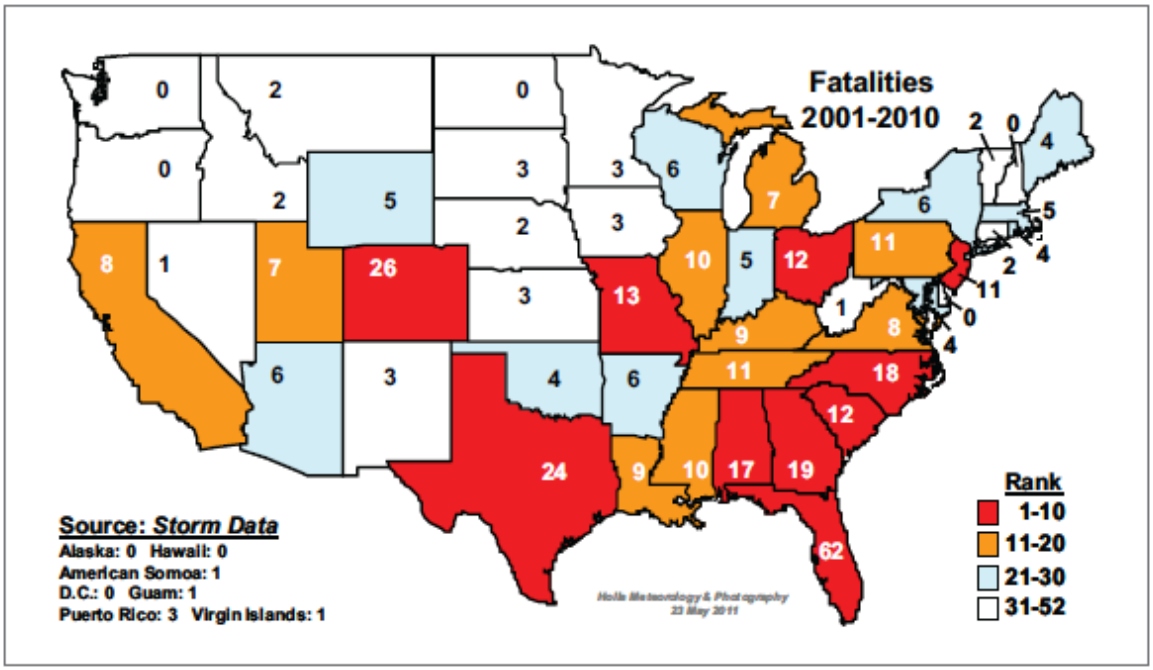
Figure 3.2.9-2 **Thunderstorm Occurrences**



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

Summer is the peak season for one of the nation's deadliest weather phenomena— lightning. But don't be fooled, lightning strikes year round. The goal of this Website is to safeguard U.S. residents from lightning. In the United States, an average of 55 people are reported killed each year by lightning. To date, there have been **26 deaths in 2011.** Hundreds of people are permanently injured each year. People struck by lightning suffer from a variety of long-term, debilitating symptoms, including memory loss, attention deficits, sleep disorders, chronic pain, numbness, dizziness, stiffness in joints, irritability, fatigue, weakness, muscle spasms, depression, and more. Lightning is a serious danger. See figure 3.2.8-2b

Figure 3.2.9-2b **NOAA statistics for the U.S. lightning Fatalities**



"Lightning is a rapid discharge of electrical energy in the atmosphere. The resulting clap of thunder is the result of a shock wave created by the rapid heating and cooling of the air in the lightning channel.

During a thunderstorm, winds within the thunderstorm cloud cause collision between the various precipitation particles within the storm cloud. These collisions cause very small ice crystals to lose electrons while larger particles of soft hail gain electrons. Upward winds within the cloud redistribute these particles and the charges they carry. The soft hail causes a negative charge build up near the middle and lower part of the storm cloud which, in turn, causes a positive charge to build up on the ground beneath the storm cloud. Eventually, when the charge difference between the negative charge in the cloud and the positive charge on the ground become large, the negative charge starts moving toward the ground. As it moves, it creates a conductive path toward the ground.

This path follows a zigzag shape as the negative charge jumps through segments in the air. When the negative charge from the cloud makes a connection with the positive charge on the ground, current surges through the jagged path, creating a visible flash of lightning. Thunder, high winds, darkening skies, rainfall and brilliant flashes of light are warning signs for lightning strikes."---NOAA's lightning safety resources

Figure 3.2.9-2c **NOAA's 2011 Lightning Fatalities in the U.S.**

2011 Lightning Fatality Demographics

State		Gender		Age		Day Of Week		By Month							
AZ	2	Mal	19 (73%)	0- 9	0 (0%)	Sun	3 (12%)		11	10	09	08	07	06	Norm*
AR	1	Fem	7 (27%)	10-19	3 (12%)	Mon	3 (12%)	Jan	0	0	0	1	0	1	0
CO	1			20-29	3 (12%)	Tue	3 (12%)	Feb	0	0	0	1	0	0	0
FL	1			30-39	1 (4%)	Wed	3 (12%)	Mar	0	0	1	0	1	0	1
GU	1			40-49	7 (27%)	Thu	4 (15%)	Apr	0	0	1	0	1	3	2
KS	1			50-59	9 (35%)	Fri	4 (15%)	May	1	4	2	2	5	5	6
LA	1			60-69	1 (4%)	Sat	6 (23%)	Jun	5	7	12	9	12	10	12
MI	2			70-79	2 (8%)			Jul	9	11	10	14	10	16	16
MO	3			80-89	0 (0%)			Aug	6	4	3	0	9	7	12
MS	1			Unknown	0 (0%)			Sep	4	2	4	1	5	4	5
MT	1							Oct	1*	1	1	0	2	2	1
NC	1							Nov		0	0	0	0	0	0
NJ	1							Dec		0	0	0	0	0	0
OH	1							Year	26*	29	34	28	45	48	55
PA	1														
SC	1														
SD	1														
UT	3														
WI	1														

Percentages may not add up to 100% due to rounding. * - Known Fatalities to date

Figure 3.2.9-2d Lightning Flashes by state from 1997-2010

Number of Cloud-To-Ground Flashes by State from 1997 to 2010

State	Flashes in 2010	Average Flashes 1997 to 2010
Alabama	779,399	819,634
Arizona	523,570	653,324
Arkansas	768,690	776,071
California	75,557	85,202
Colorado	436,430	520,833
Connecticut	16,926	20,216
Delaware	13,562	15,969
D.C.	789	791
Florida	1,098,979	1,438,322
Georgia	816,772	815,701
Idaho	67,234	84,145
Illinois	1,030,558	804,484
Indiana	539,765	504,053
Iowa	1,002,734	644,774
Kansas	1,052,961	944,191
Kentucky	524,256	537,537
Louisiana	693,515	921,775
Maine	26,234	47,260
Maryland	75,808	88,188
Massachusetts	21,566	25,346
Michigan	265,177	296,156
Minnesota	454,471	386,280
Mississippi	945,355	867,964
Missouri	1,218,638	1,032,593
Montana	399,084	358,471
Nebraska	736,208	549,112
Nevada	74,345	159,129
New Hampshire	9,992	23,194
New Jersey	37,831	45,611
New Mexico	808,537	898,167
New York	113,761	219,792
North Carolina	483,408	532,851
North Dakota	354,408	295,782
Ohio	425,639	442,822
Oklahoma	905,798	1,054,602
Oregon	41,040	54,938
Pennsylvania	239,808	307,045
Rhode Island	3,548	2,617
South Carolina	535,510	450,634
South Dakota	452,905	398,133
Tennessee	691,886	583,369
Texas	2,554,117	2,987,181
Utah	208,597	247,766
Vermont	13,966	26,733
Virginia	301,008	344,702
Washington	20,618	21,309
West Virginia	181,882	206,421
Wisconsin	382,025	302,683
Wyoming	233,864	304,973
TOTALS	**22,669,742**	**23,148,843**

These cloud-to-ground lightning flashes were measured by the National Lightning Detection Network® (NLDN®) over the land area inside state borders. The NLDN does not cover Alaska or Hawaii. The NLDN is owned and operated by Vaisala.

***High winds*:** According to NOAA, there have been 84 thunderstorm wind and other high wind events in Henry County.

These events were reported in Henry County since 1950 (see Table 3.2.9-5). These storms resulted in only 4 reported injuries and $1.186 million in property damage in Henry 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 3.2.9-5 **Thunderstorm Wind Events**

85 THUNDERSTORM WINDS event(s) were reported in **Henry County, Missouri** between **04/30/1950** and **11/30/2011**.

*Click on **Location or County** to display Details.*

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

Missouri

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 HENRY	06/13/1957	2300	Tstm Wind	0 kts.	0	0	0	0
2 HENRY	05/31/1958	2300	Tstm Wind	0 kts.	0	0	0	0
3 HENRY	11/17/1958	1200	Tstm Wind	0 kts.	0	0	0	0
4 HENRY	02/09/1959	2300	Tstm Wind	0 kts.	0	0	0	0
5 HENRY	06/11/1959	1700	Tstm Wind	65 kts.	0	0	0	0
6 HENRY	05/05/1961	1715	Tstm Wind	70 kts.	0	0	0	0
7 HENRY	07/04/1962	2040	Tstm Wind	74 kts.	0	0	0	0
8 HENRY	07/11/1962	1530	Tstm Wind	0 kts.	0	0	0	0
9 HENRY	07/09/1965	0150	Tstm Wind	52 kts.	0	0	0	0
10 HENRY	07/17/1968	1600	Tstm Wind	0 kts.	0	0	0	0
11 HENRY	06/28/1969	0745	Tstm Wind	0 kts.	0	0	0	0
12 HENRY	09/02/1970	1700	Tstm Wind	0 kts.	0	0	0	0
13 HENRY	06/04/1973	2000	Tstm Wind	0 kts.	0	0	0	0
14 HENRY	04/20/1974	1925	Tstm Wind	0 kts.	0	0	0	0
15 HENRY	04/18/1975	0300	Tstm Wind	0 kts.	0	0	0	0
16 HENRY	07/14/1978	1850	Tstm Wind	0 kts.	0	0	0	0
17 HENRY	07/11/1979	1525	Tstm Wind	0 kts.	0	0	0	0

18 HENRY	07/30/1979	1600	Tstm Wind	0 kts.	0	0	0	0
19 HENRY	08/20/1980	1900	Tstm Wind	0 kts.	0	0	0	0
20 HENRY	06/21/1981	0900	Tstm Wind	0 kts.	0	0	0	0
21 HENRY	07/24/1981	2310	Tstm Wind	61 kts.	0	0	0	0
22 HENRY	05/14/1982	2050	Tstm Wind	0 kts.	0	0	0	0
23 HENRY	05/16/1982	1515	Tstm Wind	52 kts.	0	0	0	0
24 HENRY	11/11/1982	1930	Tstm Wind	0 kts.	0	0	0	0
25 HENRY	12/01/1982	1958	Tstm Wind	0 kts.	0	0	0	0
26 HENRY	05/18/1987	2120	Tstm Wind	0 kts.	0	0	0	0
27 Montrose	04/15/1994	0105	Thunderstorm Winds	0 kts.	0	0	500K	0
28 Deepwater	04/15/1994	0121	Thunderstorm Winds	0 kts.	0	0	500K	0
29 Clinton	06/08/1994	0404	Thunderstorm Winds	0 kts.	0	0	1K	0
30 Urich	07/02/1994	0000	Thunderstorm Winds	0 kts.	0	0	0	0
31 Clinton	04/16/1995	1145	Thunderstorm Winds	0 kts.	0	0	50K	0
32 Clinton	06/08/1995	0245	Thunderstorm Winds	0 kts.	0	0	2K	0
33 Clinton	05/26/1996	10:45 PM	Tstm Wind	0 kts.	0	0	5K	0
34 Urich	08/14/1997	11:10 PM	Tstm Wind	0 kts.	0	0	5K	0
35 Calhoun	04/14/1998	09:55 PM	Tstm Wind	60 kts.	0	0	0	0
36 Clinton	06/18/1998	03:40 PM	Tstm Wind	60 kts.	0	0	20K	0
37 Windsor	04/05/1999	01:09 PM	Tstm Wind	0 kts.	0	0	10K	0
38 Windsor	04/08/1999	03:57 PM	Tstm Wind	61 kts.	0	0	0	0
39 Windsor	04/08/1999	04:10 PM	Tstm Wind	61 kts.	0	0	0	0
40 Clinton	05/17/1999	02:30 AM	Tstm Wind	55 kts.	0	0	0	0
41 Windsor	06/27/1999	09:45 PM	Tstm Wind	0 kts.	0	0	20K	0
42 Urich	07/26/2000	11:00 PM	Tstm Wind	52 kts.	0	0	0	0
43 Windsor	08/07/2000	05:20 PM	Tstm Wind	60 kts.	0	0	0	0
44 Tightwad	08/17/2000	03:25 PM	Tstm Wind	60 kts.	0	0	0	0
45 Brownington	08/17/2000	04:33 PM	Tstm Wind	57 kts.	0	0	0	0
46 Montrose	08/26/2000	05:50 PM	Tstm Wind	57 kts.	0	0	0	0
47 Clinton	09/11/2000	09:20 PM	Tstm Wind	57 kts.	0	0	0	0
48 Tightwad	04/14/2001	09:55 PM	Tstm Wind	60 kts.	0	0	0	0
49 Montrose	07/10/2001	03:22 AM	Tstm Wind	52 kts.	0	0	0	0
50 Clinton	09/07/2001	08:05 PM	Tstm Wind	57 kts.	0	0	0	0
51 Urich	07/22/2002	04:45 PM	Tstm Wind	52 kts.	0	0	0	0

52 Deepwater	12/18/2002	03:30 AM	Tstm Wind	52 kts.	0	0	0	0
53 Clinton	07/09/2003	09:29 PM	Tstm Wind	52 kts.	0	0	0	0
54 Calhoun	08/21/2003	10:00 PM	Tstm Wind	52 kts.	0	0	10K	0
55 Deepwater	08/21/2003	10:15 PM	Tstm Wind	61 kts.	0	3	5K	0
56 Clinton	06/12/2004	10:05 PM	Tstm Wind	61 kts.	0	0	0	0
57 Windsor	06/12/2004	10:10 PM	Tstm Wind	61 kts.	0	0	2K	0
58 Deepwater	07/05/2004	05:15 AM	Tstm Wind	65 kts.	0	0	8K	0
59 Brownington	07/05/2004	05:25 AM	Tstm Wind	65 kts.	0	1	25K	0
60 Clinton	06/07/2005	02:29 PM	Tstm Wind	52 kts.	0	0	0	0
61 Windsor	06/07/2005	02:56 PM	Tstm Wind	52 kts.	0	0	1K	0
62 Coal	07/23/2005	06:10 PM	Tstm Wind	52 kts.	0	0	0	0
63 Montrose	03/12/2006	10:45 PM	Tstm Wind	52 kts.	0	0	0	0
64 Clinton	08/07/2006	04:50 PM	Tstm Wind	52 kts.	0	0	1K	0
65 Clinton	08/16/2007	16:27 PM	Thunderstorm Wind	70 kts.	0	0	12K	0K
66 Germantown	09/30/2007	17:30 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
67 Clinton	09/30/2007	17:45 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
68 Clinton	06/06/2008	01:00 AM	Thunderstorm Wind	52 kts.	0	0	0K	0K
69 Clinton	06/08/2008	20:45 PM	Thunderstorm Wind	52 kts.	0	0	1K	0K
70 Clinton	06/15/2008	11:37 AM	Thunderstorm Wind	52 kts.	0	0	0K	0K
71 Clinton	06/15/2008	12:37 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
72 Urich	08/28/2008	19:00 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
73 Clinton	06/09/2009	01:35 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
74 Blairstown	06/09/2009	12:48 PM	Thunderstorm Wind	61 kts.	0	0	0K	0K
75 Clinton Mem Arpt	06/15/2009	10:25 PM	Thunderstorm Wind	61 kts.	0	0	2K	0K
76 La Due	06/15/2009	10:25 PM	Thunderstorm Wind	61 kts.	0	0	0K	0K
77 Clinton	06/15/2009	10:30 PM	Thunderstorm Wind	61 kts.	0	0	1K	0K
78 Clinton	07/12/2009	07:35 AM	Thunderstorm Wind	52 kts.	0	0	0K	0K
79 Clinton	08/04/2009	07:06 AM	Thunderstorm Wind	52 kts.	0	0	1K	0K
80 Clinton	07/11/2010	01:06 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
81 Windsor	07/11/2010	01:12 PM	Thunderstorm Wind	61 kts.	0	0	2K	0K
82 Urich	07/11/2010	12:38 PM	Thunderstorm Wind	56 kts.	0	0	0K	0K
83 Clinton	07/11/2010	12:54 PM	Thunderstorm Wind	61 kts.	0	0	3K	0K
84 Windsor	07/28/2011	05:40 PM	Thunderstorm Wind	52 kts.	0	0	2K	0K
85 Tightwad	08/07/2011	04:11 PM	Thunderstorm Wind	61 kts.	0	0	1K	0K

TOTALS:	0	4	1.189M	0

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

Measure of Probability

In determining the potential frequency of occurrences, a simple formula was used. For historical events, the number of recorded events for the service area was divided by the number of years of record. This number was then multiplied by 100 to provide a percentage. This formula was used to determine future probability for each hazard.

For events that have not occurred, a probability of less than 1% was automatically assigned as the hazard cannot be excluded from the possibility of occurrence. Likewise, when discussing the probable risk of each hazard based upon historical occurrences, the following scale was utilized:

- Less than 1% chance of an event occurrence in any given year
- 1-10% chance of an event occurrence in any given year
- 10-80% chance of an event occurrence in any given year
- Near 100% chance of an event occurrence in any given year

Thunderstorm wind event probability:

85 events / 61 years = 1.393 x 100 = 139 % = a near 100% percent probability of a thunder storm wind event in Henry County, in any given year.

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.

The National Weather Service uses hail as an indicator of a severe storm. If the hail measures 3/4" or larger, then the storm has enough energy to be very dangerous. In a storm, warm and cold air currents collide. Raindrops are created and fall until they hit a strong updraft, which tosses them up to freezing altitudes. These altitudes are sometimes very high. They fall and are tossed again, getting bigger each time, until they are heavy enough to resist the updraft.

Hail is a good indicator of storm strength, because the faster the updraft, the bigger the hailstone will be. Luckily, most stones are the size of peas. The table below lists a little information about hailstones and damage that the different sizes might cause.

Table 3.2.9-6 Sizes of Hailstones and Potential Damage Caused		
Size in Inches	**Common Description**	**Potential Damage**
1/4”	Pea sized hail	Could cause slight damage to trees and shrubs. People and animals in the open might be slightly injured.
1/2 “	Marble sized hail	This size of hail could cause slight damage to trees and shrubs. People and animals in the open might be slightly injured.
3/4"	Dime sized hail	This size of hail could cause moderate damage to trees and shrubs and injury to people and animals caught unprotected. It will also cause slight damage to automobiles and roofs.
1 1/2"	Golf ball sized hail	This size of hail could cause heavy damage to trees and shrubs and severe injury to unprotected people and animals. It will also cause moderate damage to automobiles and roofs. Golf ball sized hail could break glass and penetrate convertible tops.
3"	Baseball sized hail	This size of hail could cause severe damage to trees and shrubs and life threatening injuries to people and animals. This hail can cause extensive damage to automobiles and roofs.
4 “	Softball Sized Hail	This size of hail could cause devastating damage to trees and shrubs, severe injury and possible death to people and animals that are unprotected. It might also cause devastating damage to automobiles and buildings. This is large hail that falls rapidly. It can penetrate roofs and windows, which could cause damage to the interior of buildings and automobiles. Occupants face a risk of injury or death if good protection is not available.

Source: http://www.cityofmesquite.com/oem/hail.php

Thunderstorms that produce hail are dangerous because of the density of the hailstones and the speed at which they fall. Every year, hail causes over $1billion in damage to property and agricultural crops. Hail does most of its damage by falling from high in the sky, but there are other hazards that hail creates. Deep hail can easily worsen a flash flood situation. Since ice (hail) floats on water it tends to clog drainage paths, culverts and grates. In flat country, water, mud and hail combinations begin to cover the roadways fast. This picture represents another hazard created by hail

Appropriate Response Actions for Hail

- Try to take shelter from the hail under some type of heavy structure. Thin roofs such as might be found on outdoor awnings are better than nothing, but if the hail increases in size or severity it might penetrate the roof.

- Stay in your vehicle if you are on the road and never underneath an overpass. Stopping under an overpass causes problems for two reasons. First, your car blocks the road and leaves other motorists out in the storm. Second, your vehicle impedes the flow of traffic, which can cause accidents when other motorists are blinded by intense hail and rain.
- Insurance is carried on your vehicle to cover things like hail damage. Take the time to exit the freeway and find a place to shelter. If the storm intensifies, you may need stronger shelter than your vehicle can provide anyway.
- If you are in a building, use caution and stay away from the windows. Larger hailstones can break glass and cause injury.

NOAA lists 97 reported hailstorm events (with hail of at least 0.75 inch in diameter) in Henry County since 1950 (See Table 3.2.9-6).

While the NOAA data only indicates 1K of hail damage from these events in the county, the damage caused by hail is undoubtedly much higher.

Table 3.2.9-7 **Henry County Hail Events**

97 HAIL event(s) were reported in **Henry County, Missouri** between **04/30/1950** and **11/30/2011**.

*Click on **Location or County** to display Details.*

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

Missouri								
Location or County	**Date**	**Time**	**Type**	**Mag**	**Dth**	**Inj**	**PrD**	**CrD**
1 HENRY	05/07/1955	1100	Hail	1.00 in.	0	0	0	0
2 HENRY	05/27/1958	1500	Hail	1.75 in.	0	0	0	0
3 HENRY	06/28/1969	0745	Hail	1.75 in.	0	0	0	0
4 HENRY	05/21/1973	1040	Hail	1.75 in.	0	0	0	0
5 HENRY	05/21/1973	1500	Hail	1.00 in.	0	0	0	0
6 HENRY	05/26/1973	1825	Hail	2.75 in.	0	0	0	0
7 HENRY	03/26/1976	1445	Hail	1.00 in.	0	0	0	0
8 HENRY	05/11/1978	1905	Hail	1.50 in.	0	0	0	0
9 HENRY	04/02/1982	1440	Hail	0.75 in.	0	0	0	0
10 HENRY	05/21/1987	1745	Hail	0.75 in.	0	0	0	0
11 HENRY	04/03/1989	0915	Hail	1.50 in.	0	0	0	0
12 HENRY	05/24/1989	2329	Hail	0.75 in.	0	0	0	0
13 HENRY	05/13/1991	1235	Hail	1.00 in.	0	0	0	0

14 HENRY	05/13/1991	1335	Hail	1.00 in.	0	0	0	0
15 HENRY	05/13/1991	1345	Hail	1.25 in.	0	0	0	0
16 HENRY	05/13/1991	1422	Hail	1.00 in.	0	0	0	0
17 HENRY	05/13/1991	1445	Hail	1.25 in.	0	0	0	0
18 HENRY	07/02/1992	1710	Hail	0.75 in.	0	0	0	0
19 HENRY	07/03/1992	1715	Hail	1.75 in.	0	0	0	0
20 Windsor	03/30/1993	2215	Hail	1.75 in.	0	0	0	0
21 Urich	04/12/1993	1525	Hail	0.75 in.	0	0	0	0
22 Clinton	04/12/1993	1530	Hail	0.75 in.	0	0	0	0
23 Clinton	04/13/1993	1205	Hail	1.75 in.	0	0	0	0
24 Clinton	04/16/1995	1205	Hail	0.88 in.	0	0	0	0
25 Clinton	06/02/1996	03:38 PM	Hail	1.00 in.	0	0	0	0
26 Montrose	05/24/1998	09:13 PM	Hail	0.75 in.	0	0	0	0
27 Clinton	06/23/1998	01:00 AM	Hail	0.75 in.	0	0	0	0
28 Shawnee Mound	01/21/1999	10:45 AM	Hail	0.75 in.	0	0	0	0
29 Windsor	03/26/2000	06:10 PM	Hail	0.88 in.	0	0	0	0
30 Montrose	05/08/2000	05:35 PM	Hail	1.75 in.	0	0	0	0
31 Clinton	05/08/2000	06:00 PM	Hail	1.50 in.	0	0	0	0
32 Mt Zion	05/08/2000	06:17 PM	Hail	2.50 in.	0	0	0	0
33 Clinton	05/08/2000	08:25 PM	Hail	1.50 in.	0	0	0	0
34 Shawnee Mound	05/08/2000	08:29 PM	Hail	1.00 in.	0	0	0	0
35 Windsor	04/03/2001	09:40 AM	Hail	1.00 in.	0	0	0	0
36 Clinton	04/09/2001	08:50 PM	Hail	1.00 in.	0	0	1K	0
37 Clinton	10/04/2001	05:38 PM	Hail	0.88 in.	0	0	0	0
38 Montrose	05/08/2002	08:00 PM	Hail	0.75 in.	0	0	0	0
39 Calhoun	05/08/2002	08:49 PM	Hail	1.00 in.	0	0	0	0
40 Clinton	07/19/2002	04:25 PM	Hail	1.75 in.	0	0	0	0
41 Montrose	07/19/2002	04:32 PM	Hail	0.88 in.	0	0	0	0
42 Clinton	07/22/2002	03:20 PM	Hail	0.75 in.	0	0	0	0
43 Montrose	03/12/2003	09:51 PM	Hail	0.75 in.	0	0	0	0
44 Montrose	03/12/2003	09:58 PM	Hail	0.75 in.	0	0	0	0
45 Deepwater	04/24/2003	05:10 PM	Hail	0.75 in.	0	0	0	0
46 Tightwad	04/24/2003	05:40 PM	Hail	0.75 in.	0	0	0	0
47 Clinton	05/04/2003	09:30 PM	Hail	0.75 in.	0	0	0	0

48 Urich	05/06/2003	01:16 PM	Hail	0.75 in.	0	0	0	0
49 Windsor	05/06/2003	02:00 PM	Hail	0.88 in.	0	0	0	0
50 Tightwad	05/06/2003	02:35 PM	Hail	1.75 in.	0	0	0	0
51 Mt Zion	05/06/2003	03:15 PM	Hail	2.50 in.	0	0	0	0
52 Clinton	05/10/2003	02:47 AM	Hail	0.75 in.	0	0	0	0
53 Urich	07/11/2003	03:53 PM	Hail	1.00 in.	0	0	0	0
54 Urich	08/05/2003	06:45 PM	Hail	0.75 in.	0	0	0	0
55 Urich	09/26/2003	03:30 PM	Hail	1.00 in.	0	0	0	0
56 Clinton	09/26/2003	04:00 PM	Hail	0.75 in.	0	0	0	0
57 Clinton	05/13/2004	02:12 AM	Hail	0.75 in.	0	0	0	0
58 Calhoun	05/25/2004	10:50 AM	Hail	0.88 in.	0	0	0	0
59 Urich	08/23/2004	06:13 AM	Hail	0.75 in.	0	0	0	0
60 Calhoun	04/21/2005	04:10 PM	Hail	1.00 in.	0	0	0	0
61 Urich	04/21/2005	04:11 PM	Hail	0.88 in.	0	0	0	0
62 Clinton	06/07/2005	02:25 PM	Hail	0.88 in.	0	0	0	0
63 Clinton	03/12/2006	03:25 PM	Hail	0.88 in.	0	0	0	0
64 Clinton	03/12/2006	03:25 PM	Hail	1.75 in.	0	0	0	0
65 Calhoun	03/12/2006	03:46 PM	Hail	0.88 in.	0	0	0	0
66 Clinton	03/12/2006	11:05 PM	Hail	1.25 in.	0	0	0	0
67 Deepwater	03/12/2006	11:35 PM	Hail	0.75 in.	0	0	0	0
68 Urich	03/30/2006	07:51 PM	Hail	0.75 in.	0	0	0	0
69 Brownington	04/23/2006	09:35 PM	Hail	0.75 in.	0	0	0	0
70 Calhoun	04/23/2006	10:28 PM	Hail	0.75 in.	0	0	0	0
71 Blairstown	04/03/2007	09:24 AM	Hail	1.00 in.	0	0	0K	0K
72 Urich	04/03/2007	09:30 AM	Hail	1.00 in.	0	0	0K	0K
73 Blairstown	04/03/2007	09:40 AM	Hail	0.75 in.	0	0	0K	0K
74 Calhoun	04/03/2007	10:14 AM	Hail	0.88 in.	0	0	0K	0K
75 Windsor	04/03/2007	10:14 AM	Hail	0.75 in.	0	0	0K	0K
76 Coal	04/03/2007	10:15 AM	Hail	0.75 in.	0	0	0K	0K
77 Clinton	05/06/2007	16:10 PM	Hail	0.88 in.	0	0	0K	0K
78 Clinton	05/06/2007	16:11 PM	Hail	0.75 in.	0	0	0K	0K
79 Clinton	05/06/2007	16:15 PM	Hail	0.88 in.	0	0	0K	0K
80 Mt Zion	01/07/2008	14:32 PM	Hail	1.75 in.	0	0	0K	0K
81 Tightwad	01/07/2008	14:36 PM	Hail	0.75 in.	0	0	0K	0K

82 Windsor	01/08/2008	01:30 AM	Hail	1.75 in.	0	0	0K	0K
83 Clinton Mem Arpt	02/03/2008	10:41 AM	Hail	0.75 in.	0	0	0K	0K
84 Clinton	06/13/2008	00:20 AM	Hail	0.88 in.	0	0	0K	0K
85 Clinton	06/15/2008	12:41 PM	Hail	0.88 in.	0	0	0K	0K
86 La Due	10/31/2008	05:28 AM	Hail	0.75 in.	0	0	0K	0K
87 Urich	03/24/2009	07:20 AM	Hail	0.01 in.	0	0	0K	0K
88 Windsor	04/29/2009	03:45 PM	Hail	0.01 in.	0	0	0K	0K
89 Clinton	05/15/2009	12:12 PM	Hail	0.01 in.	0	0	0K	0K
90 Clinton	06/09/2009	10:55 AM	Hail	0.01 in.	0	0	0K	0K
91 Blairstown	04/06/2010	10:30 PM	Hail	0.01 in.	0	0	0K	0K
92 Urich	05/25/2010	02:44 PM	Hail	0.01 in.	0	0	0K	0K
93 Mt Zion	05/12/2011	04:54 PM	Hail	0.02 in.	0	0	0K	0K
94 Calhoun	06/18/2011	07:35 PM	Hail	0.01 in.	0	0	0K	0K
95 Windsor	06/18/2011	08:00 PM	Hail	0.02 in.	0	0	0K	0K
96 Windsor	06/18/2011	08:03 PM	Hail	0.02 in.	0	0	0K	0K
97 Tightwad	08/07/2011	04:14 PM	Hail	0.01 in.	0	0	0K	0K
				TOTALS:	0	0	1K	0

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

Measure of Probability

In determining the potential frequency of occurrences, a simple formula was used. For historical events, the number of recorded events for the service area was divided by the number of years of record. This number was then multiplied by 100 to provide a percentage. This formula was used to determine future probability for each hazard.

For events that have not occurred, a probability of less than 1% was automatically assigned as the hazard cannot be excluded from the possibility of occurrence. Likewise, when discussing the probable risk of each hazard based upon historical occurrences, the following scale was utilized:

- Less than 1% chance of an event occurrence in any given year
- 1-10% chance of an event occurrence in any given year
- 10-80% chance of an event occurrence in any given year
- Near 100% chance of an event occurrence in any given year

Hail event probability:

97 events / 61 years = 1.590 x 100 = a 159 % = a near 100 percent probability of a hail event in Henry County, = a near 100 % chance of a hail event, in any given year.

Severity:

All of Henry County

Table 3.2.9-8 **High Wind, Hail and Lightning Severity Ratings**

Event	**Severity Level**
High Winds	High
Hail	Moderate
Lightning	Low

Existing Mitigation Strategies

The Office of Emergency Management is proactive in educating the public about the dangers of tornadoes and thunderstorms.

Warning Systems
The following warning systems are used in the county:
Local television weather reports
Local radio weather reports
9-1-1 call center and Public Emergency Broadcast Center
Tornado Sirens

3.2.10 Wildfire

Description of Hazard

A combination of dry weather and wind make early spring the heart of wildfire season in Missouri. Across the Show-Me State, thousands of acres of forest and grassland will burn. Most of these fires will be caused by human negligence or malicious arson.

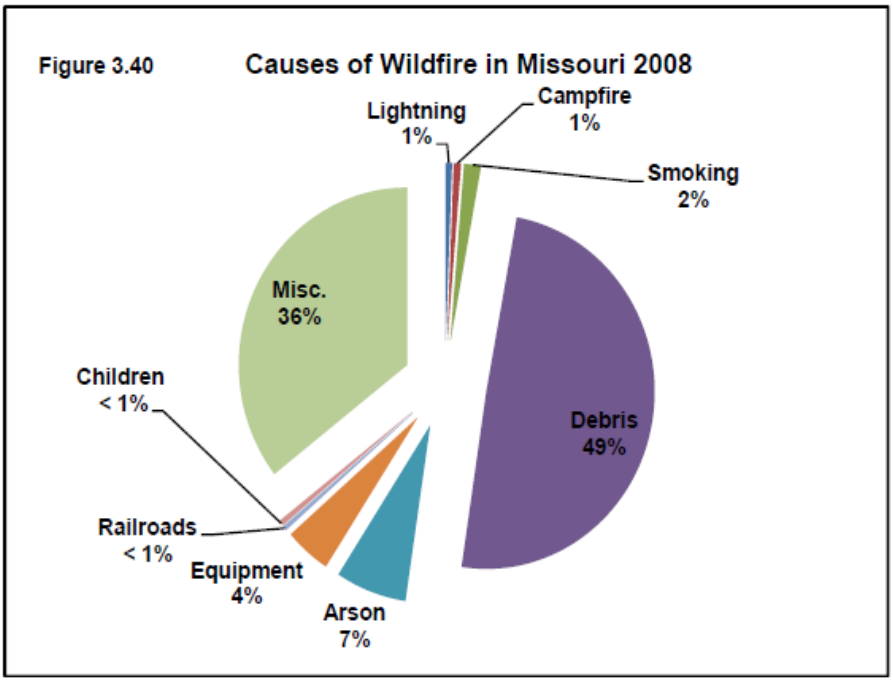
Numerous fires also occur in October and November due to the dryness associated with fall in Missouri. Many rural residents use this time of year to burn leaves and debris thus raising the possibility of a fire which burns out of control.

In Southwest Missouri, the threat of wildfire is even greater. Tons of fallen limbs scattered in the woods are a grim reminder of the disastrous 2007 ice storm.

As the fallen timber dries, it becomes fuel for future fires. Couple this with an increasing population and extensive home construction throughout the Ozarks, and you have the recipe for the next perfect storm: widespread, severe wildfires that could cause millions of dollars of property damage, injuries and even loss of life.

In days gone by, people often set fires to convert woodlands to pasture for cattle. Today, improper or unsafe debris burning is the leading cause of wildfire in Missouri. Most residents who burn debris never intend for their fire to get out of control, but in 2006, more than 1,500 escaped debris fires burned more than 17,000 acres of the state of Missouri.

Table 3.2.10-1 **Wildfire Causes**



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 more than 17,000 acres burned. NOAA only lists two wildfires from 1950-2010.

Geographic Location

The rural areas of Henry 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 Henry County in recent history, there have been no recorded events from 1950 to date, however, the Fire Districts in Henry County fight smaller wildfires/natural cover fires every year.

Measure of Probability and Severity

Measure of Probability

In determining the potential frequency of occurrences, a simple formula was used. For historical events, the number of recorded events for the service area was divided by the number of years of record. This number was then multiplied by 100 to provide a percentage. This formula was used to determine future probability for each hazard.

For events that have not occurred, a probability of less than 1% was automatically assigned as the hazard cannot be excluded from the possibility of occurrence. Likewise, when discussing the probable risk of each hazard based upon historical occurrences, the following scale was utilized:

- Less than 1% chance of an event occurrence in any given year
- 1-10% chance of an event occurrence in any given year
- 10-80% chance of an event occurrence in any given year
- Near 100% chance of an event occurrence in any given year

Wildfire event probability:

0 events / 61 years = 0 x 100 = 0 = a less than 1% chance of a wildfire event in Henry County, during any given year.

Severity: Moderate – Henry County
Moderate – All other participating jurisdictions

The Missouri State Hazard Mitigation Plan (2007) 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. WUI maps of the jurisdictions are available starting on page 153.

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

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 Henry 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 Henry County. This assessment can be used to identify potential areas where mitigation activities are needed. (See Table 3.3.1-1)

3.3.1 Henry County Inventory

Table 3.3.1-1 Henry County Assessed Values

Henry County 2010 Assessed Values	
Residential	$136,175,960
Commercial	$44,867,860
Agricultural	$16,281,940
Total Real Property	$197,325,760
Total Personal Property	$70,325,131
Total Utilities	$17,026,270

Table 3.3.1-2 **Henry County Owned Buildings**

County Owned Buildings		
Structure Name	**Value**	**Replacement Cost**
Court House	$3,518,000	$3,869,800
Former Jail	$57,400	$613,400
911 Call Center	$77,000	$84,700
Detention Center	$8,224,000	$9,046,400
Road and Bridge Building #1	$14,420	$15,862
Road and Bridge Building #2	$106,000	$116,600

Source: Henry County Clerks office

Agriculture

Table 3.3.1-2 show value estimates for agricultural land in Henry County and estimates of crop and livestock sales. Since almost half of the land area of Henry County is farmland (47%), the impact of agricultural losses due to a natural hazard could be a potential threat to the economic stability of the region.

Table 3.3.1-3 **Agriculture Census**

2007 Henry County Agricultural Census	
Number of Farms	1,125
Land in Farms	345,019 acres
Market Value of Products Sold	$59,913,000
Crops Sales	$26,019.000
Livestock Sales	33,894,000

Source: 2007 Census of Agriculture, County Profiles: http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/County_Profiles/Missouri/cp29083.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 3.3.1-4.

Table 3.3.1-4 **County Medical Facilities**

Facility	Location
Bothwell Health Center	Sedalia
Dr. Townsend Clinic	Clinton
Ellett Memorial Hospital	Appleton City
Golden Valley Medical	Clinton
Royal Oak Hospital	Windsor
St. Lukes Medical Clinic	Clinton
Golden Valley Clinic	Windsor

Table 3.3.1-5. **Critical Water, Wastewater Treatment and Storage Facilities**

Facility Name	City	Owner
Harry S. Truman PWSD 2	Clinton	Local Gov.
Henry County PWSD 1	Clinton	County
Henry County PWSD 2	Montrose	City
Henry County PWSD 3	Tightwad	PWSD 3
Henry County PWSD 4	Urich	PWSD 4

Table 3.3.1-6 shows the location of Henry County water towers and stand pipes.

Table 3.3.1-6 **Public Water Supply Tower Information**

Owner	Facility Name	# People Served	Number of Tanks/Stand Pipes
Montrose	Montrose	417	1
HC PWSD # 4	Clinton	44,000	1
Calhoun	Calhoun	491	1 S/P
Deepwater	Deepwater	433	1
Urich	Urich	501	1
Windsor	Windsor	1,500	1

Population

Table 3.3.1-7 shows an age profile of the Henry 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 3.3.1-7 **Henry County Population Profile**

ACS Demographic Estimates	Estimate	Percent	Margin of Error
Total population	22,294		*****
Male	10,910	48.9	+/-105
Female	11,384	51.1	+/-105
Median age (years)	43.0	(X)	+/-0.6
Under 5 years	1,318	5.9	+/-45
18 years and over	17,297	77.6	+/-69
65 years and over	4,289	19.2	+/-83
One race	21,889	98.2	+/-87
White	21,452	96.2	+/-73
Black or African American	267	1.2	+/-53
American Indian and Alaska Native	82	0.4	+/-55
Asian	43	0.2	+/-32
Native Hawaiian and Other Pacific Islander	0	0.0	+/-114
Some other race	45	0.2	+/-34
Two or more races	405	1.8	+/-87
Hispanic or Latino (of any race)	310	1.4	*****

Source: U S Census Bureau
http://factfinder.census.gov/servlet/ACSSAFFFacts?_event=Search&geo_id=&_geoContext=&_street=&_county=henry+county&_cityTown=henry+county&_state=04000US29&_zip=&_lang=en&_sse=on&pctxt=fph&pgsl=010

Table 3.3.1-8 **Historic Properties in Henry County**

National Registered Historic Property	Community
Anheuser Busch Brewing Association Building	Clinton
C. M. Clark House	Montrose
Clinton Square Historic District	Clinton
William F. Crome House	Clinton
Judge Jerubial Dorman House	Clinton
Gustave C. Haysler House	Clinton
St. Ludger Catholic Church	Montrose
C.C. Williams House	Clinton

Source: http://www.dnr.mo.gov/shpo/Henry.htm

Development Trends

Future development in Henry County can and will be impacted by several natural hazards. Development plans can use the Henry 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 or building designs. New developments from 2005 until the present are listed below.

City of Calhoun

In 2010 a $950,000 bond issue was passed to construct a new sewage treatment facility.

City of Clinton

The city accepted approximately 2000 lineal feet of sewage systems in a housing development, approximately $73,000 worth of upgrades to the city waste water plant. The city purchased a new sewer cleaner and installed a new AWOS system at the Clinton Airport.

City of Deepwater

The city is in the process of their sewer lines and wastewater treatment facility. Deepwater has also completed some infrastructure improvements including work on city streets.

City of Montrose

The city constructed a new water tower in 2009, built a new city maintenance building in 2010, and in 2011 upgraded their sewer lift station.

City of Urich

Since 2005 the city has installed an early warning siren system, added playground equipment to both City parks. The city has completed a "Vision Plan" for the next 40 years and established a committee to guide them.

Urich has upgraded the Fire Department equipment and building. The city currently has two ongoing projects, a sewer upgrade project as well as a sidewalk installation project.

City of Windsor

The city of Windsor is in the process of upgrading their current sewer treatment facility.

3.3.2 School Districts

Table 3.3.2-1 shows the Henry County school district populations.

Table 3.3.2-1 **Henry County School District Populations**

School District	School Name	Grades	Students	Certificated Staff
Calhoun R-VII	Calhoun Elementary	K-6	159	9
	Calhoun High	7-12	117	8
Deepwater	Lakeland High School	K-6	249	20
Shawnee R-III	Shawnee Elementary	K-8	54	7
Clinton	Clinton Middle	6-8	484	39
	Clinton Christian	Pre K	121	11
	Clinton High	9-12	691	46
	Clinton Technical	9-12	No data	14
	Henry Elementary	1-5	649	70
	Clinton Intermediate	3-5	400	31
Davis R-XII	Davis Elementary	K-8	48	5
Leesville R-IX	Leesville Elementary	K-8	96	11
Montrose R-XIV	Montrose Elementary	K-8	80	7
	Montrose High	9-12	42	7
	St. Mary Elementary	1-11	43	3
Henry County R-I	Windsor Elementary	K-6	398	34
	Windsor High	7-12	345	25

Source: http://www.publicschoolreview.com/school_ov/school_id/46114

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

Table 3.3.2-2 **School District Building Count**

Henry County School Districts Assessed Values			
School District	**Building Count**	**Building Replacement Cost**	**Assessed Valuation**
Davis R-12	2	$1,652,414	$1,652,414
Clinton	7	$50,533,806	$150,018,677
Henry County R-1	6	$19,102,312	$39,545,613
Shawnee R-III	1	$2,006,269	$8,291,362
Leesville R-IX	3	$1,856,539	$14,117,083
Montrose R-XIV	2	$9,340,964	$9,340,964
Calhoun	4	$484,600	$5,364,000

Table 3.3.2-3 show a representation of the Henry County school districts development trends.

Table 3.3.2-3 **School District Development Trends**

School District	Development
Calhoun R-VIII	Built a new school building in 2009 to replace building destroyed by fire.
Clinton	Constructed new 147,000 sqft. high school, occupied in 2009, remodeled and converted existing high school into middle school, remolded and converted existing middle school into intermediate school and plans to remodel elementary school front access for energy and safety purposes.
Davis R-XII	Replaced roof, installed carpet in all classrooms, replaced tile in cafeteria, halls and bathrooms.
Henry County R-I	Renovations to roofs, parking lots, electrical systems and kitchen equipment.
Shawnee R-III	Added new cafeteria.

3.3.3. Community Jurisdictions

Assessed values for property in Henry County were calculated using data from the Henry County Assessor's Office and collected through the county assessor and the City of Clinton. (See Table 3.3.3-1)

Table 3.3.3-1 **County and Community Assessed Values**

County and Community 2010 Assessed Value			
Name	**Type**	**Assessed Values**	
Henry County	**Residential**	$136,175,960	
	Commercial	$44,867,860	
	Agricultural	$16,281,940	
	Total Real Property		$197,325,760
	Total Personal Property		$70,325,131
	Total: Utilities		$17,026,270
		Total	**$284,677,161**
Name	**Type**	**Assessed Values**	
Blairstown	**Residential**	$272,660	
	Commercial	$40,500	
	Agricultural	$5,210	
	Total Real Property		$318,370
	Total Personal Property		$123,269
	Total: Utilities		$116,905
		Total	**$558,544**

Name	Type	Assessed Values	
Calhoun	**Residential**	$10,010,820	
	Commercial	$158,960	
	Agricultural	$20,650	
	Total Real Property		$1,181,430
	Total Personal Property		$456,259
	Total: Utilities		$114,246
		Total	**$1,751,935**
Name	**Type**	**Assessed Values**	
Clinton	**Residential**	$56,025,780	
	Commercial	$29,959,010	
	Agricultural	$101,100	
	Total Real Property		$86,085,890
	Total Personal Property		$24,829,707
	Total: Utilities		$2,057,094
		Total	**$112,972,691**
Name	**Type**	**Assessed Values**	
Deepwater	**Residential**	$1,352,640	
	Commercial	$231,540	
	Agricultural	$2,870	
	Total Real Property		$1,587,050
	Total Personal Property		$510,056
	Total: Utilities		$144,846
		Total	**$2,241,952**
Name	**Type**	**Assessed Values**	
Montrose	**Residential**	$1,499,070	
	Commercial	$530,730	
	Agricultural	$5,035	
	Total Real Property		$7,034,830
	Total Personal Property		$646,052
	Total: Utilities		$169,862
		Total	**$7,850,708**
Name	**Type**	**Assessed Values**	
Urich	**Residential**	$1,669,330	
	Commercial	$461,770	
	Agricultural	$970	
	Total Real Property		$2,132,070
	Total Personal Property		$708,450
	Total: Utilities		$138,256
		Total	**$2,978,776**
Name	**Type**	**Assessed Values**	
Windsor	**Residential**	$12,725,440	

Commercial	$3,049,760		
Agricultural	$31,700		
Total Real Property			$15,806,900
Total Personal Property			$4,106,566
Total: Utilities			$710,350
		Total	**$20,623,816**

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.

3.4.1 Dam Failure Vulnerability

Jurisdictions: unincorporated Henry County, Brownington, Clinton, Deepwater, and all public school districts.

Overview

Many incorporated and unincorporated areas of Henry County are vulnerable to the effects of dam failure. A dam failure in Henry 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. None of the 62 known dams in Henry County are classified by the State as "High Hazard", and none of the 62 dams are regulated by the state.

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.

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 Henry 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.

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.

Table 3.4.1-1 **Dam Failure Vulnerability Assessment**

	Henry County			
	0 = No Impact 1 = Rare 2 = Occasional 3 = Frequent	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**Total Risk Number**
Hazard	Likelihood of Event	Impact on Population	Impact on Property	Likelihood **X** Population + Property
Dam Failure	**0**	**1**	**1**	**2**

The vulnerability assessments in this section are based on the following scoring criteria. The higher the Total Risk Number the more vulnerability there is to the county or community.

1. Likelihood of Event:

a) **No Impact**: Less than a 1% chance of an event occurrence in any given year.
b) **Rare:** A 1-10% chance of an event occurrence in any given year.
c) **Occasional**: A 10 to 80% chance of an event occurrence in any given year.
d) **Frequent:** A near 100% chance of an event occurrence in any given year.

2. Impact on Population:

a) **No Impact** (0): No impact means that there is little or no likelihood of this hazard affecting the community or, if it occurs, there would be minimal affect on the community.
b) **Limited (1)**: Limited impact means that a disaster occurrence generally involves a serious threat to a moderate number of people in the community. There may be a few deaths and injuries and only minor population dislocations from such an occurrence.
c) Substantial (2): Substantial impact means that a disaster occurrence affects a significant number of people, and may involve some loss of life, injuries and possibly a sizable dislocation of population.
d) **Major (3)**: Major impact means a disaster occurrence affects a widespread are of the community or a concentrate area of the community or a concentrated area with severe effects, it may result in a large number of deaths and injuries and involve a massive evacuation and/or shelter operation.

3. Impact of Property:

a) **No Impact (0)**: No impact means there is little or no likelihood of this hazard affecting the community or, if it occurs, damage to public and private property would be minimal.
b) **Limited (1)**: Limited impact means that a disaster occurrence generally involves only light damage to public or private property.

c) **Substantial (2)**: Substantial impact means the a disaster occurrence results in moderate damage over a widespread or concentrated area. Damage to public and private property may exceed local resources to repair or replace.

d) Major (3): Major impact means that a disaster occurrence results in heavy damage to public and private property over a widespread area or a concentrate area with severe effects. The magnitude of the disaster may result in a Government Declaration of a Major Disaster or Emergency.

3.4.2 Drought Vulnerability

Jurisdictions: Unincorporated Henry County

Overview

All jurisdictions in the Planning Area are vulnerable to the effects of drought; the unincorporated agricultural areas of Henry 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. *We did not deem drought vulnerability a strong enough hazard to buildings to assess a building count for the county.*

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.

Table 3.4.2-1 **Drought Vulnerability Assessment**

	Henry County			
	0 = No Impact 1 = Rare 2 = Occasional 3 = Frequent	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**Total Risk Number**
Hazard	Likelihood of Event	Impact on Population	Impact on Property	Likelihood **X** Population + Property
Drought	0	**1**	**1**	**2**

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 Henry 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 Henry County, as measured on the MMI.

Statement of Next Disaster's Likely Adverse Impact on Community

The next disaster's likely adverse impact on Henry 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 VI Intensity effects in Henry County. Level V Intensity quake effects are considered "strong" and can result in significant damage to poorly built structures.

VI. Strong felt by all; many frightened and run outdoors, walk unsteadily. Windows, dishes, glassware broken; books fall off shelves; some heavy furniture moved or overturned; a few instances of fallen plaster. Damage slight.**)**

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.

Table 3.4.3-1 **Earthquake Vulnerability**

	Henry County			
	0 = No Impact 1 = Rare 2 = Occasional 3 = Frequent	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**Total Risk Number**
Hazard	Likelihood of Event	Impact on Population	Impact on Property	Likelihood **X** Population + Property
Earthquake	0	**0**	**0**	**0**

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 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 or prolonged heat, or cold exposures. *We did not deem drought vulnerability a strong enough hazard to buildings to assess a building count for the county.*

According to the US Census Bureau website the estimated Henry County 2008 elderly population stands at 19.5%. 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.

Table 3.4.4-1 **Extreme Heat Vulnerability**

Henry County				
	0 = No Impact 1 = Rare 2 = Occasional 3 = Frequent	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**Total Risk Number**
Hazard	Likelihood of Event	Impact on Population	Impact on Property	Likelihood **X** Population **+** Property
Extreme Heat	2	**1**	**0**	**2**

3.4.5 Flood Vulnerability

Jurisdictions: Unincorporated Henry County, excluding all school districts, Urich and Blairstown.

There are currently only FIRM's (flood insurance rate maps) issued by FEMA for the communities of Clinton, Montrose and Windsor in Henry county.

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.

Table 3.4.5-1 **Flood Vulnerability Assessment**

Henry County				
	0 = No Impact 1 = Rare 2 = Occasional 3 = Frequent	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**Total Risk Number**
Hazard	Likelihood of Event	Impact on Population	Impact on Property	Likelihood **X** Population + Property
Flood	3	**1**	**1**	**4**

Blairstown				
	0 = No Impact 1 = Rare 2 = Occasional 3 = Frequent	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**Total Risk Number**
Hazard	Likelihood of Event	Impact on Population	Impact on Property	Likelihood **X** Population + Property
Flood	3	**2**	**2**	**8**

Urich				
	0 = No Impact 1 = Rare 2 = Occasional 3 = Frequent	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**Total Risk Number**
Hazard	Likelihood of Event	Impact on Population	Impact on Property	Likelihood **X** Population + Property
Flood	3	**2**	**2**	**8**

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. Henry County currently does not have any Severe Repetitive Losses listed.

Henry County does not have any Severe Repetitive Losses listed.

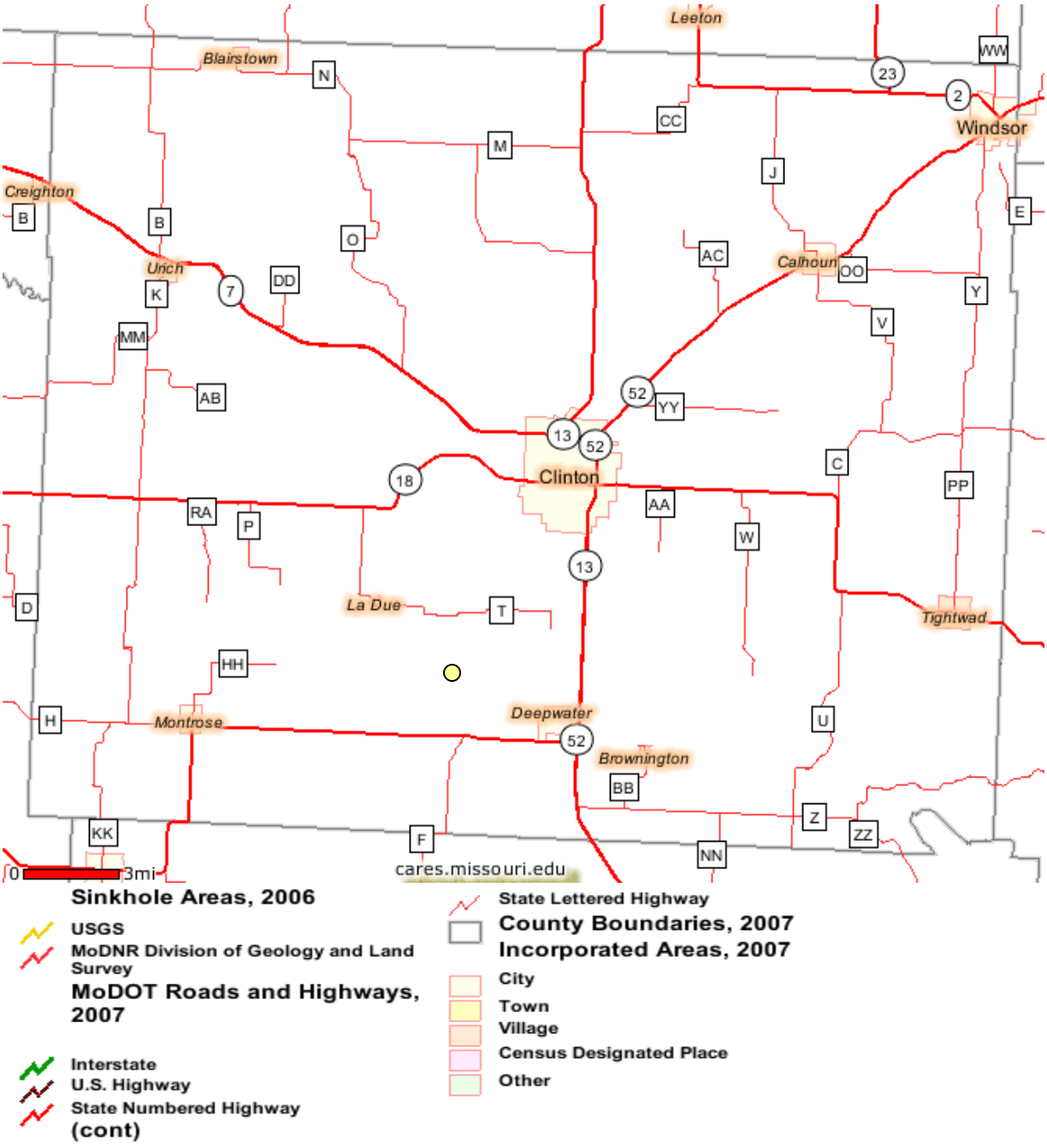
3.4.6 Land Subsidence/Sinkhole Vulnerability

Jurisdictions: Unincorporated Henry County

Missouri State Hazard Mitigation Plan (2007) 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."

Below is a map of the sinkhole area (yellow dots) located in Henry County. There is only one sinkhole within the county, but there are several sinkholes across county borders. (See Figure 3.4.6-1)

Figure 3.4.6-1 **Henry County Sinkhole Locations (CARES map room)**



Potential Impact on Existing Structure

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.

Potential Impact on Future Development

It is difficult to assess whether or not a sinkhole will have an effect on future development. 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.

Table 3.4.6-1 **Sinkhole Vulnerability**

	Henry County			
	0 = No Impact 1 = Rare 2 = Occasional 3 = Frequent	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**Total Risk Number**
Hazard	Likelihood of Event	Impact on Population	Impact on Property	Likelihood **X** Population + Property
Sinkhole	0	**0**	**0**	**0**

3.4.7 Levee Failure Vulnerability

Jurisdictions: Henry County

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 Henry 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.

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 Henry County are not regulated or inspected by any one agency it is difficult to predict what path future development will follow. Currently Henry County does not have any zoning and building regulations to prevent anyone from building within this floodplain area. There is no knowledge of any future development by any public school districts that would be vulnerable to this hazard.

Table 3.4.7-1 **Levee Failure Vulnerability**

	Henry County			
	0 = No Impact 1 = Rare 2 = Occasional 3 = Frequent	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**Total Risk Number**
Hazard	Likelihood of Event	Impact on Population	Impact on Property	Likelihood **X** Population **+** Property
Flood	0	**1**	**1**	**1**

3.4.8 Severe Winter Weather Vulnerability

Jurisdictions: All jurisdictions

Overview

Henry 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 Henry 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 2009 elderly population for Henry County stands at 4,186.

- **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.
  Should this occur 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 7 ice/snow storms since the previous plan was published in 2005.

Potential Impact on Future Development

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

Table 3.4.8-1 **Severe Winter Weather Vulnerability**

	Henry County			
	0 = No Impact 1 = Rare 2 = Occasional 3 = Frequent	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**Total Risk Number**
Hazard	Likelihood of Event	Impact on Population	Impact on Property	Likelihood **X** Population + Property
Severe Winter Weather	3	**2**	**1**	**7**

3.4.9 Tornado/Thunderstorm Vulnerability

Jurisdictions: All jurisdictions

Overview

All jurisdictions in Henry 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 Henry County have FEMA 361 standard storm shelters.

Other hazards associated with tornadoes include;

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

Henry County has been hit by 11 tornadoes since 1950 with one event on the date of 03/02/2006 causing the loss of one life. In 1982 a tornado touched down causing 2.5 million dollars in damages.

Overall, Henry County has had sustained 828 thousand dollars in property damager related 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.

Table 3.4.9-1 **Tornado Vulnerability**

	Henry County			
	0 = No Impact 1 = Rare 2 = Occasional 3 = Frequent	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**Total Risk Number**
Hazard	Likelihood of Event	Impact on Population	Impact on Property	Likelihood **X** Population + Property
Tornado	2	**2**	**2**	**6**

	Henry County			
	0 = No Impact 1 = Rare 2 = Occasional 3 = Frequent	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**Total Risk Number**
Hazard	Likelihood of Event	Impact on Population	Impact on Property	Likelihood **X** Population + Property
Severe Thunderstorm	3	**1**	**1**	**4**

3.4.10 Wildfire Vulnerability

Jurisdictions: All jurisdictions

Overview

Wildfires in Henry 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. According to the Missouri Department of Conservation there have been no wildfires reported in Henry County in the last year.

Potential Impact on Future Development

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

Table 3.4.10-**1** **Wildfire Vulnerability**

	Henry County			
	0 = No Impact 1 = Rare 2 = Occasional 3 = Frequent	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**0 = No Impact 1 = Limited 2 = Substantial 3 = Major**	**Total Risk Number**
Hazard	Likelihood of Event	Impact on Population	Impact on Property	Likelihood **X** Population + Property
Flood	0	**0**	**0**	**0**

Table 3.4.10-2 **Overall Vulnerability Ratings**

Overall Vulnerability Assessment Ratings (highest to lowest)		
Hazard	**Vulnerability Assessment Score**	**Reference Page**
Flood	7	Page 85
Severe Winter Weather	7	Page 97
Tornado	6	Page 104
Severe Thunderstorms	4	Page 111
Dam Failure	2	Page 58
Extreme Heat	2	Page 79
Drought	2	Page 63
Levee Failure	1	Page 92
Earthquake	0	Page 76
Sinkhole	0	Page 88
Wildfire	0	Page 120

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.

In determining the potential frequency of occurrences, a simple formula was used. For historical events, the number of recorded events for the service area was divided by the number of years of record. This number was then multiplied by 100 to provide a percentage. This formula was used to determine future probability for each hazard.

For events that have not occurred, a probability of less than 1% was automatically assigned as the hazard cannot be excluded from the possibility of occurrence. Likewise, when discussing the probable risk of each hazard based upon historical occurrences, the following scale was utilized:

- Less than 1% chance of an event occurrence in any given year
- 1-10% chance of an event occurrence in any given year
- 10-80% chance of an event occurrence in any given year
- Near 100% chance of an event 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 **Vulnerability Chart**

Participation Jurisdictions Vulnerability										
	Property Damage					**Injury and Death**				
N/A	Not Applicable					Not Applicable				
L	1-10%					Little or None				
M	10 – 80 %					Injuries Possible				
H	Near 100%					Major Injuries and Death Likely				
	Dam Failure	**Drought**	**Earthquake**	**Extreme Heat**	**Flood**	**Land subsidence /sinkhole**	**Levee Failure**	**Sever Winter Weather**	**Tornado and Thunderstorm**	**Wildfire**
Planning Area	M	M	L	M	M	L	L	M	H	M
Henry County	M	M	L	M	M	L	L	M	H	M
Blairstown	L	M	L	M	M	L	L	M	H	L
Brownington	L	M	L	M	M	L	L	M	H	L
Calhoun	L	L	L	M	L	L	L	M	H	L
Clinton	L	M	L	M	M	L	M	H	H	L
Deepwater	L	M	L	M	N/A	L	L	M	H	L

Montrose	L	M	L	M	N/A	L	L	M	H	L
Urich	L	L	L	M	N/A	L	L	M	H	L
Windsor	L	M	L	M	N/A	L	L	M	H	L
School Districts	L	L	L	M	N/A	L	L	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 Henry 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.

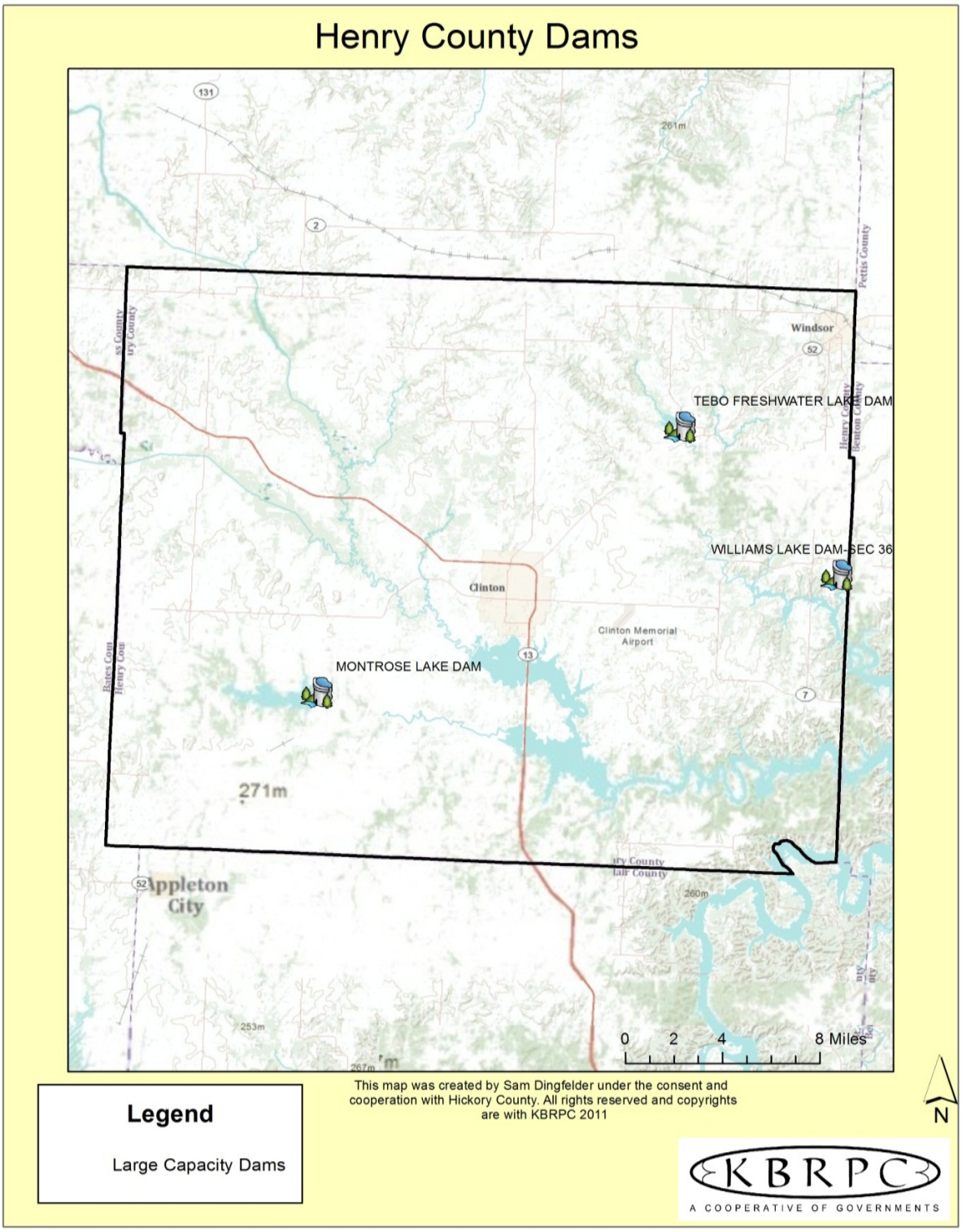
Note that ratings for dam failure are based on estimates of homes that lie within a half mile downstream of a high hazard dam. Due to the current lack of inundation studies, dam failure estimates are not exact and may change when proper inundation data is collected.

Dam Failure

Parcel data for Henry County indicate that there are no "High Hazard" dams located in the county, therefore the risk of a dam failure in the county causing major damage is minimal.

(Henry County significant dam location map is located on the next page)

Figure 3.5-1 Dam locations in Henry County



Drought

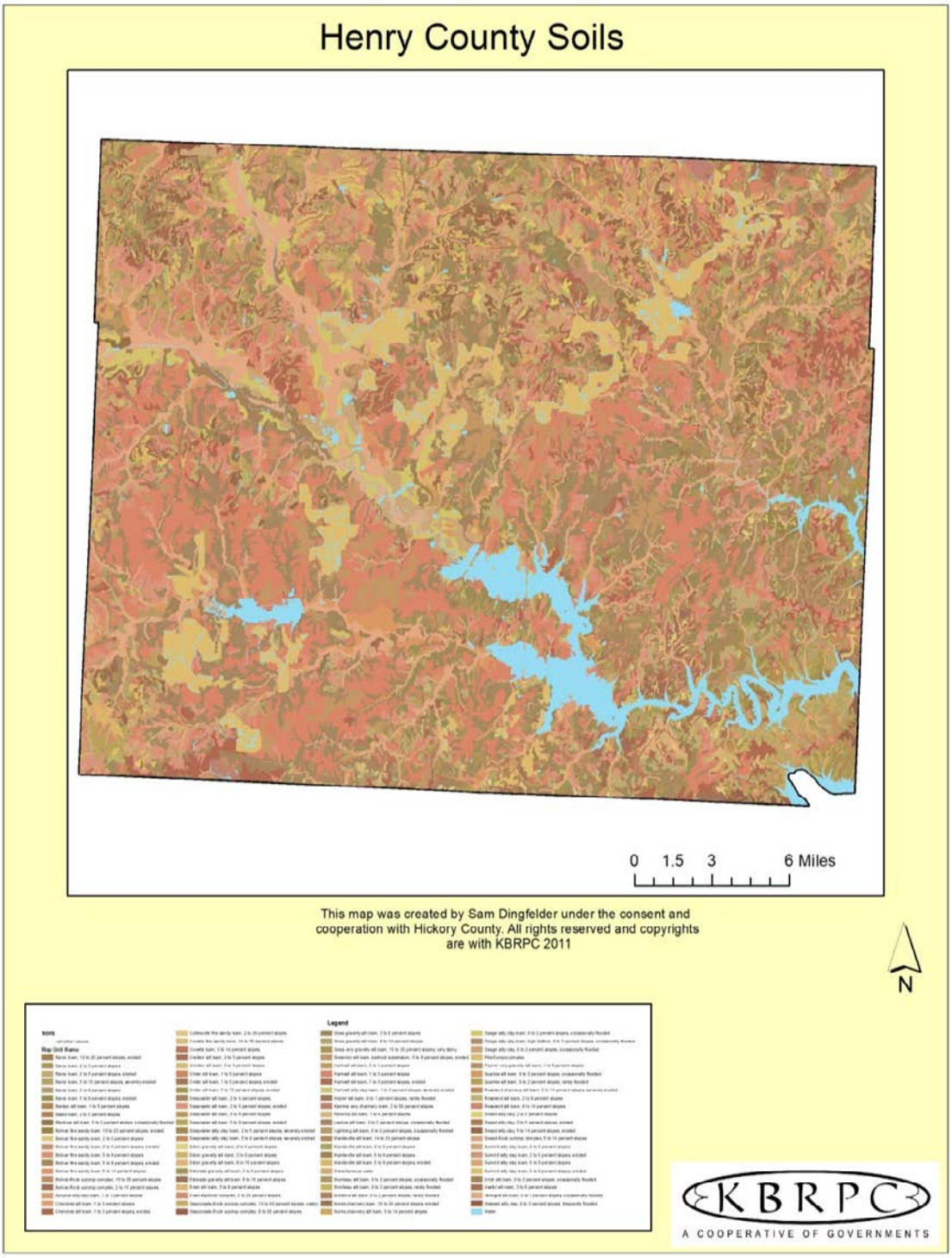
According to the 2007 US Census of Agriculture, Henry County has 345,019 acres of land use that is tied to farming activities. The Missouri State Drought Plan states that rural areas in the state are more vulnerable to the effects of drought. Incorporated jurisdictions are less vulnerable to the effects of drought due to suburban infrastructure.

Jurisdictions at greater risk:

Henry County

(Henry County Soils Map is located on next page)

Figure 3.5-2 **Henry County Soils**



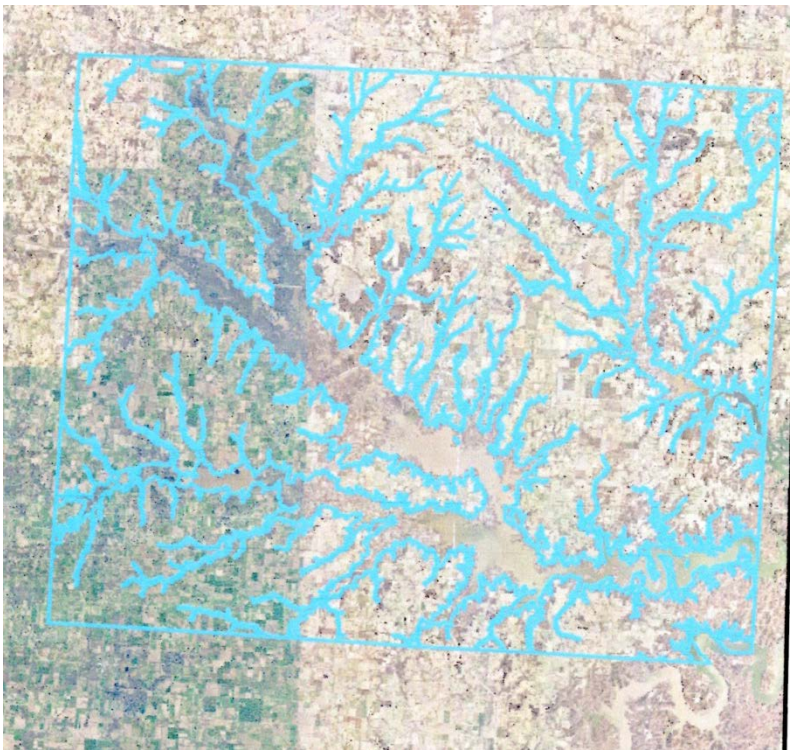
Flooding

There are no areas of Henry County that lie in the one hundred year or the five hundred year floodplains. An updated DFIRM for Henry County is available and included. All jurisdictions experience some type of complication associated with flash flooding due to storm water runoff or sheet flooding. These jurisdictions were given a rating a low vulnerability because probability and severity were also low for these areas.

Jurisdictions at greater risk:

As determined by previous flood events the communities of Blairstown and Uric have a higher flood risk potential.

Figure 3.5-3 **Henry County Floodplain map**



Source: Bob Easton, County Emergency Management Director

Wildfire

As stated in Section 3.2.10, Wildfire in Henry 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 Henry County those areas at greater risk.

According to statistics from the Missouri Department of Conservation (see Section 3.2.10, Figure 3.2.10-1), rural areas of Henry County and the rural/urban interfaces are most at risk from wildfires. From January, 2005 until the present, there have been no reported wildlife events according to current NOAA data.

Jurisdictions at greater risk:

All of Henry County

(Henry County wildfire risk maps are shown on the next eight pages.)

Figure 3.5-4 **Brownington Wildfire Map**

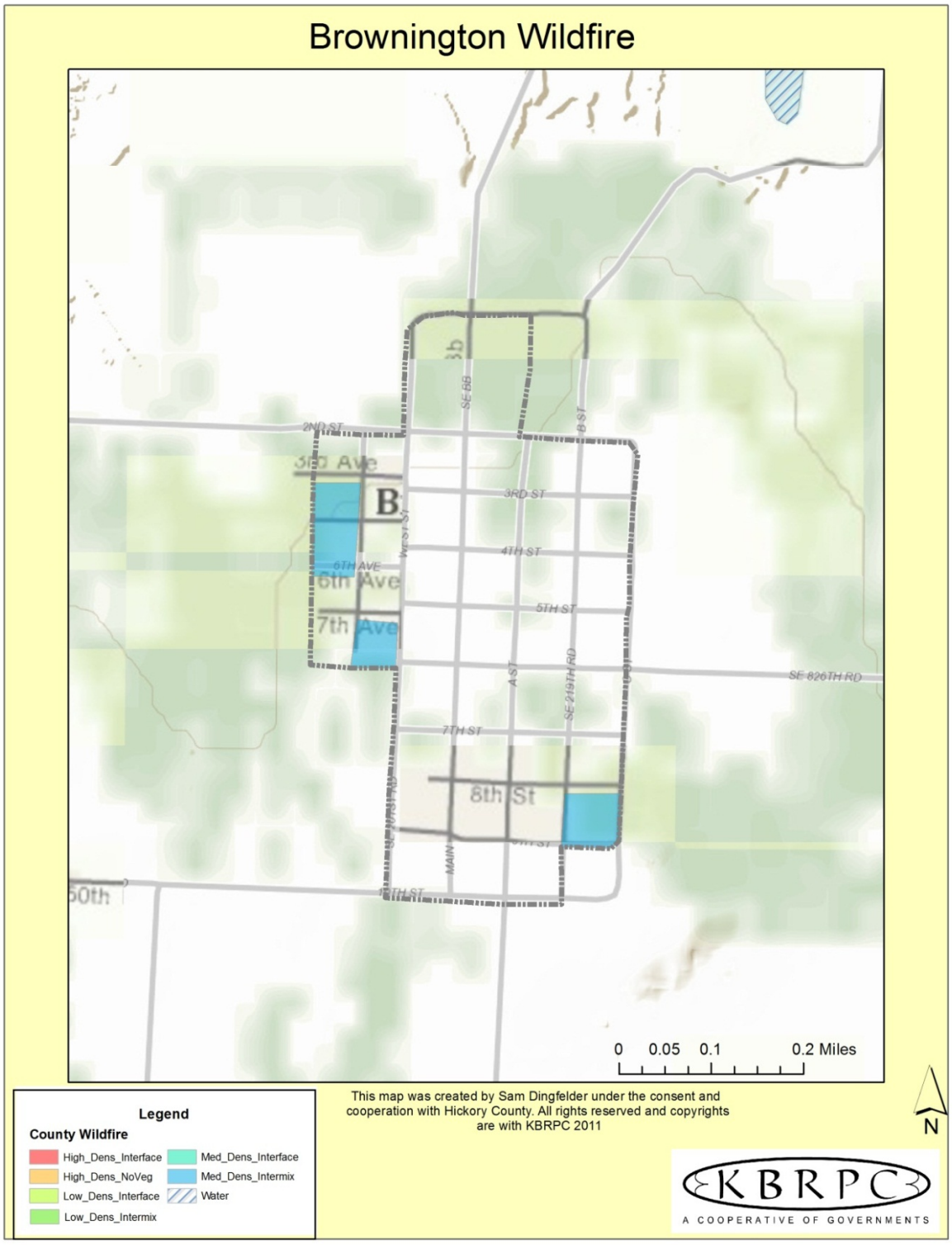


Figure 3.5-5 **Calhoun Wildfire Map**

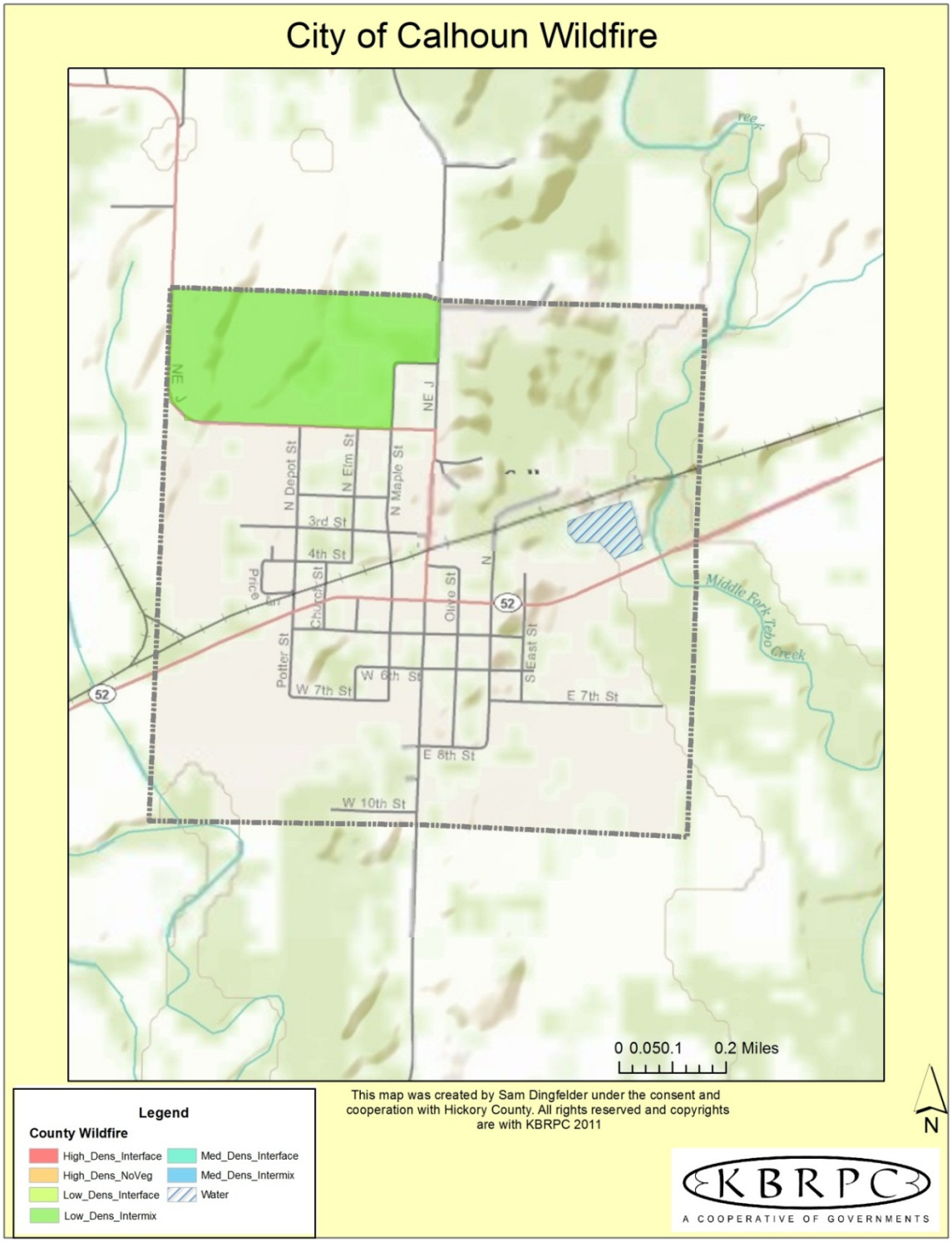


Figure 3.5-6 **Clinton Wildfire Map**

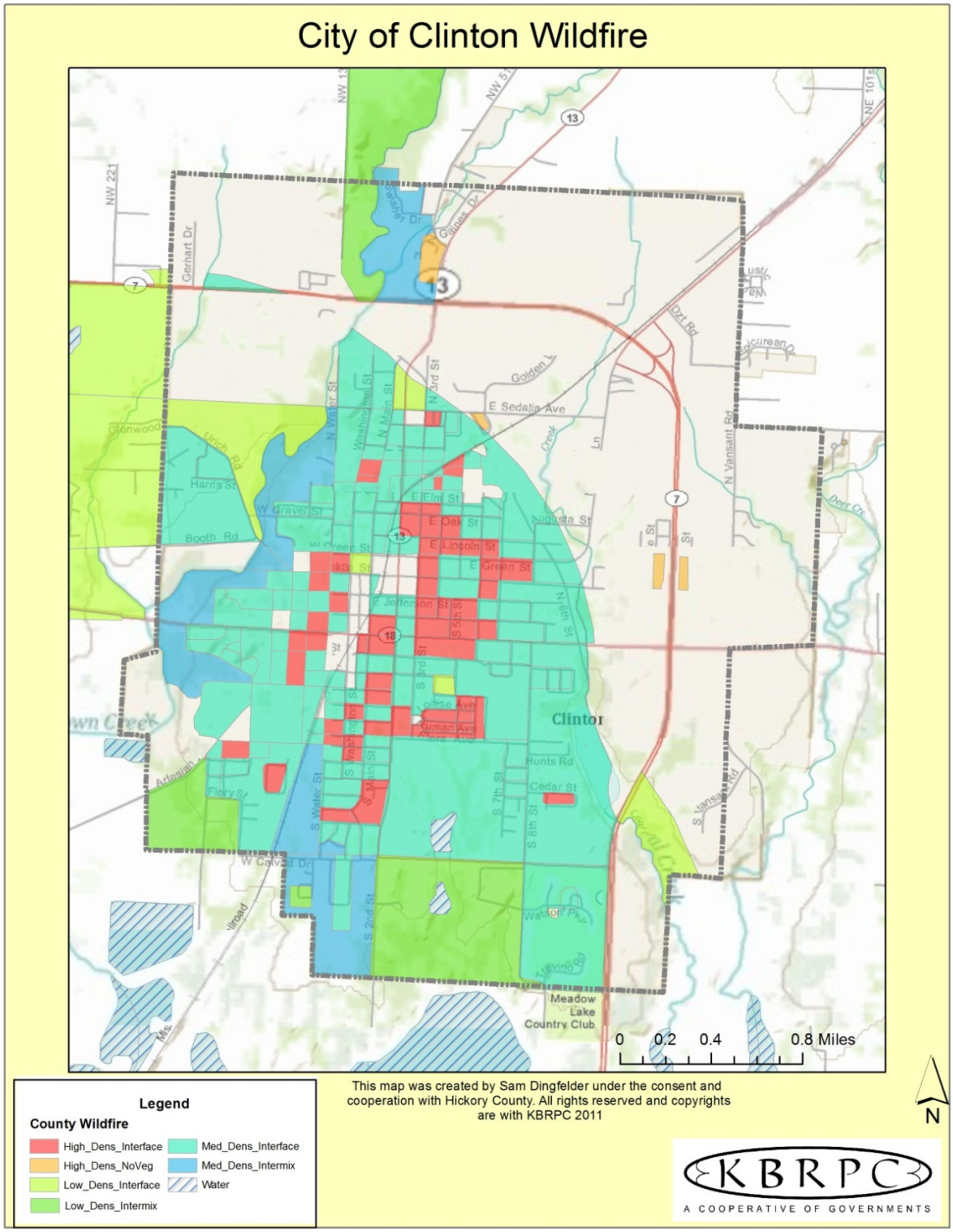


Figure 3.5-7 **Deepwater Wildfire Map**

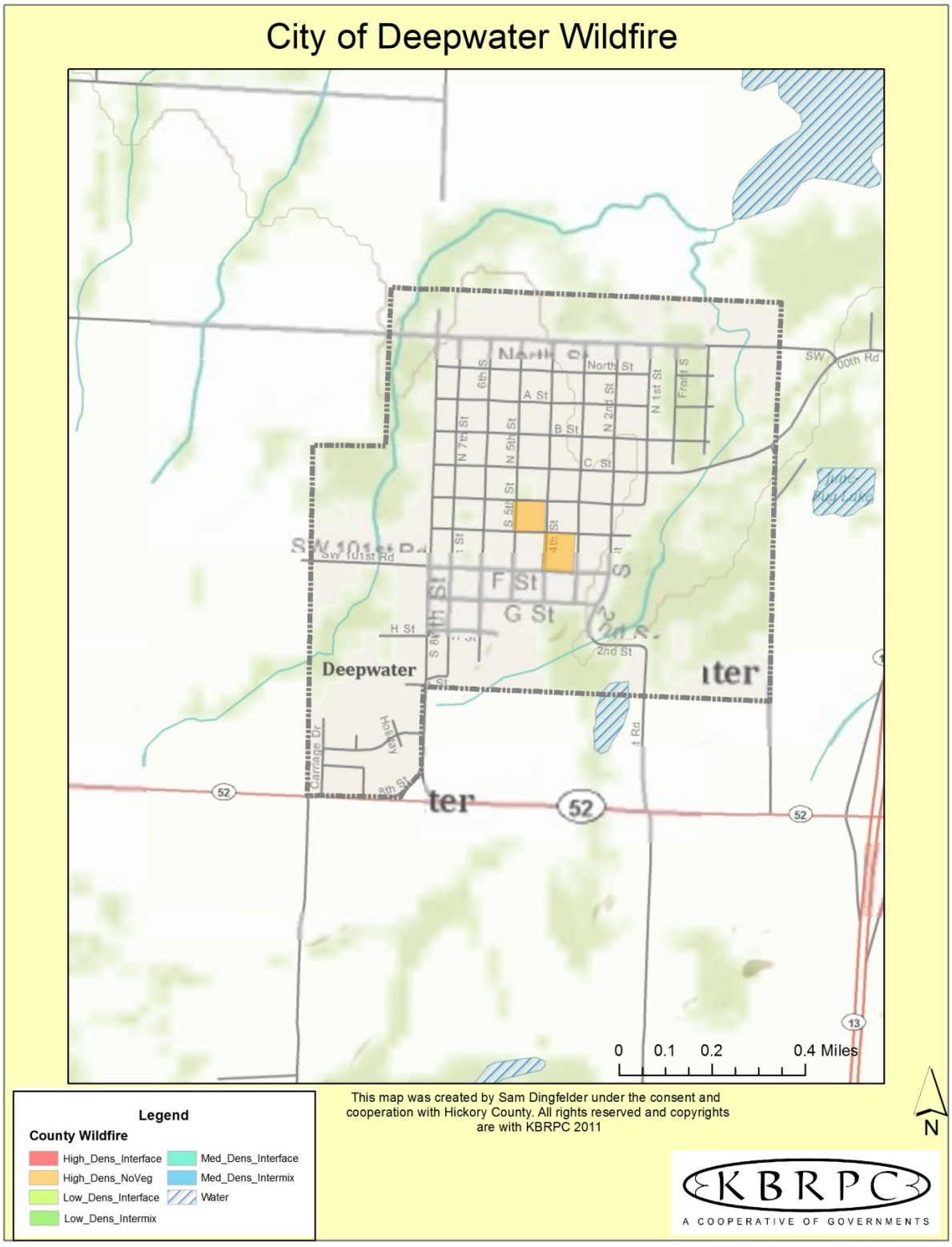


Figure 3.5-8 **Montrose Wildfire Map**

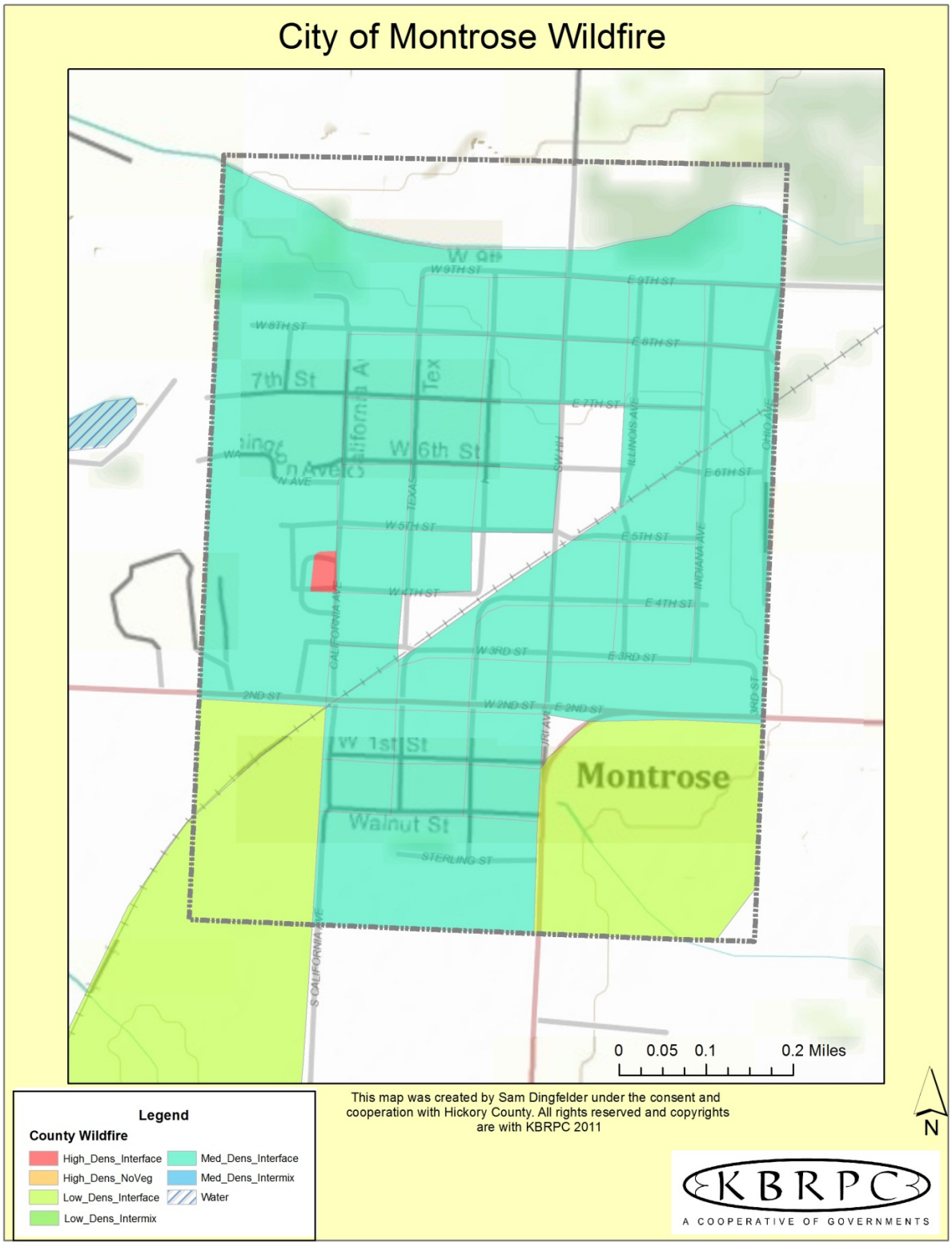


Figure 3.5-9 **Tightwad Wildfire Map**

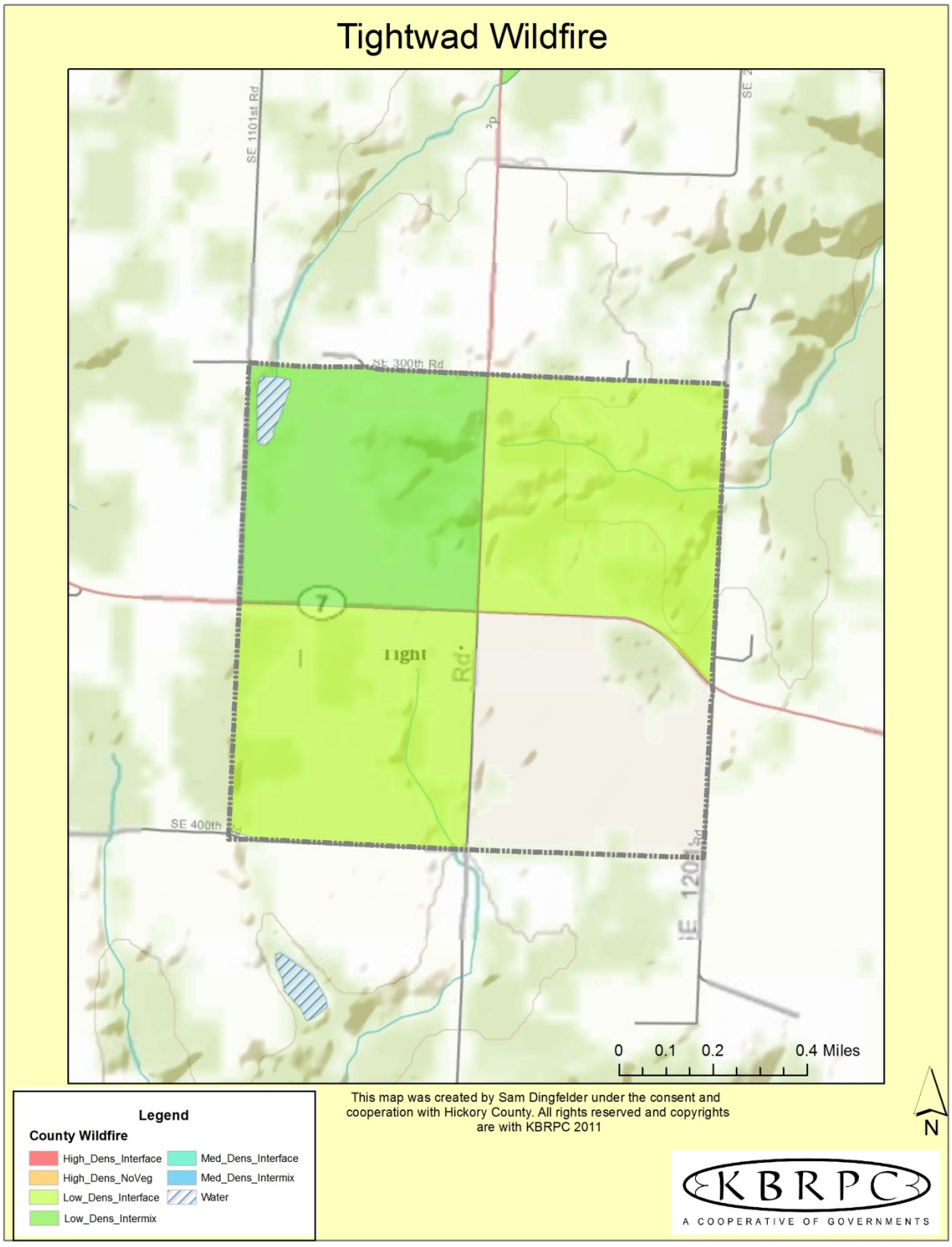


Figure 3.5-10 **Urich Wildfire Map**

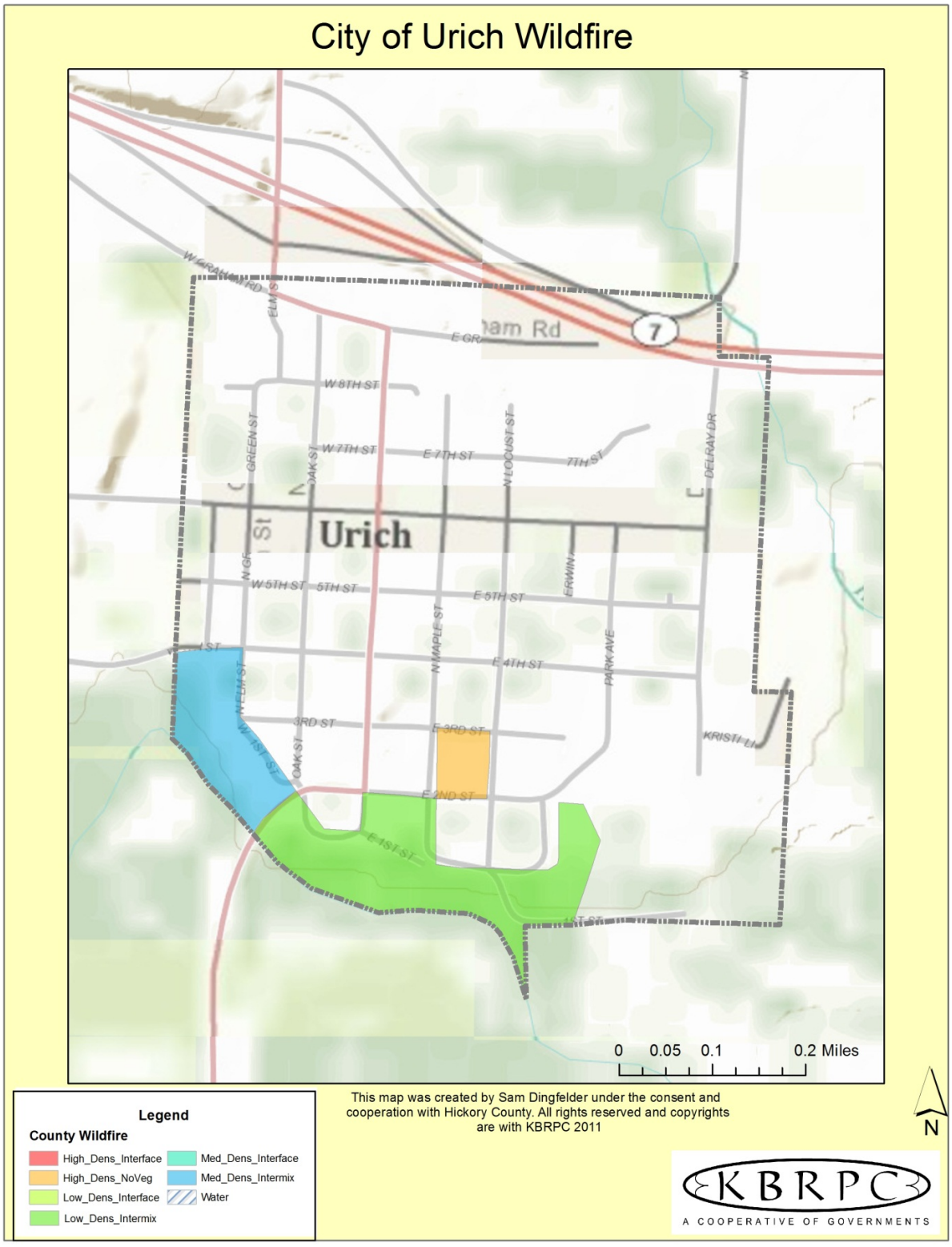
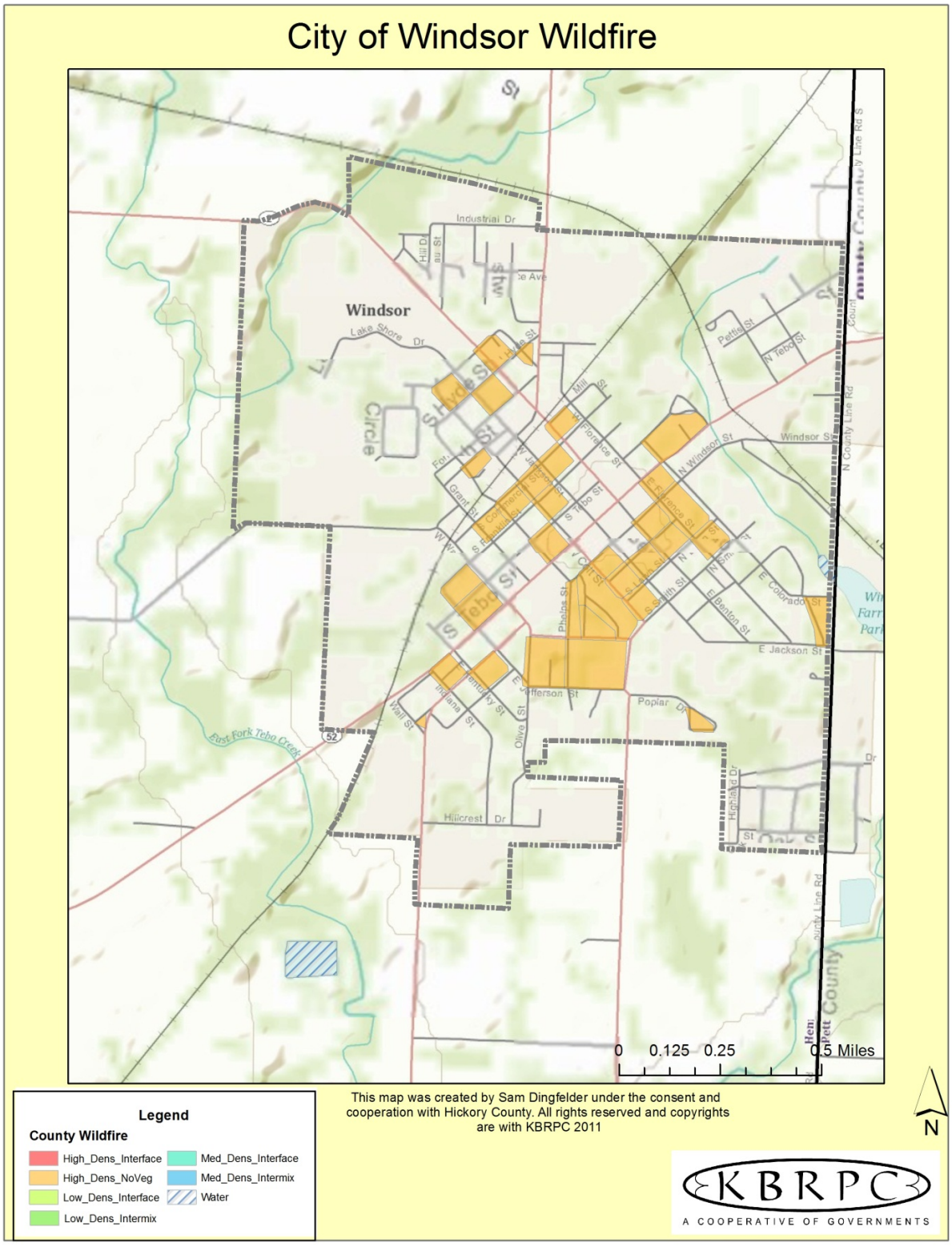


Figure 3.5-11 **Windsor Wildfire Map**



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 Henry 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 five county hazard mitigation goals for the Henry County Hazard Mitigation Plan (2010) 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 (2009-2010) 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.

4.3 Mitigation Goals, Objectives, and Actions

The development of the goals, objective and actions for the Henry County Natural Hazard Mitigation Plan began with a review of the previous set of goals, objectives for the original 2005 Henry County Plan. This effort was undertake at county wide meetings that were advertised to engage community representatives and the public.

A comprehensive list of the goals, objectives, and mitigation actions for the Henry County Hazard Mitigation Plan (2012) follow. The mitigation actions listed are for the entire Planning Area; participating jurisdictions will differ in the specific actions undertaken in their jurisdictions.

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).

All actions are identified as continuing, revised or new in the five year action matrix demonstrated in Table 4.5-2.

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 Assist communities with securing funding for early warning systems, improved communication systems, GIS/GPS, 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 Tree trimming programs and dead tree removal
1.3.2 Assist communities/county in securing 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. Encourage 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 Encourage minimum building standards for building codes in all cities

2.3.2 Encourage local and county governments to 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 should 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 Encourage county health department and local American Red Cross chapter to use publicity campaigns that make residents aware of proper measures to take during times of extreme heat or cold
3.3.2 Review and formalize 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 Encourage joint meetings of 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 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 Encourage meetings between city, county EMD's, SEMA, and elected officials to familiarize everyone with mitigation planning, implementation, and budgeting for mitigation projects

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. Encourage communities to budget for enhanced warning systems
5.1.2 Examine potential road and bridge upgrades that would reduce danger to residents during occurrences of natural disasters
5.1.3 All communities need to develop storm water management plans
5.1.4 Add sinkhole regulations to stream water ordinances if not already in place
5.1.5 Coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures
5.1.6 Encourage cities to 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 Encourage local government to purchase properties in the floodplain as funds become available and convert that land into public/recreational space
5.2.2 Encourage communities to zone all areas in floodplain as open space

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

The 5-year action matrix provides an analysis and prioritization of the county's natural hazard mitigation goals, objectives and actions by jurisdiction. The matrix also categorizes each action into on of the six categories of mitigation and illustrates the hazards addressed, the potential sources of funding the lead agency, and a brief evaluation of the results of the action as well as the STAPLEE criteria rating for each actin objective.

In addition, because certain hazards can impact incorporated areas and school districts more that the county as a whole, the matrix indicates which incorporated areas and school district could be specifically affected (or responsible for the action). The codes for jurisdiction or entity are shown below.

AC	All Cities
AG	All Governments
CG	County Governments
CA	Calhoun
CL	Clinton
DE	Deepwater
MT	Montrose
UR	Urich
WI	Windsor
CAS	Calhoun R-VIII School District
CLS	Clinton School District
DAV	Davis R-XII
HCS	Henry County R-XII
LS	Leesville R-IX
SS	Shawnee R-III
ASD	All School Districts

Table 4.3-1 Henry County Five-Year Action Matrix																		
								Natural Hazards										
Community	**Action**	**Type of Strategy**	**New, Revision, Ongoing**	**Priority Rank and Estimated Target Date**	**Probable Lead Organizer**	**Potential Funding Sources**	**Evaluation**	**Tornado / Severe Storm**	**Flood**	**Winter Weather**	**Drought**	**Heat wave**	**Earthquake**	**Dam Failure**	**Wildfire**	**Sinkhole**
Objective 1.1 Advise the public about health and safety precautions to guard against loss of life from natural hazards.																		
ACCALCLDEMTURWICS	1.1.1 Should develop education programs on personal emergency preparedness	Public information	Ongoing	High Continuing	City/ County EMD	N/A	Meeting attendance records	X	X	X	X	X	X	X	X	X
Objective 1.2: Use latest technology to provide adequate warning, communication, and mitigation of hazard events.																		
ACCALCLDEMTURWIHS	1.2.1 Should assist communities with securing funding for early warning systems, GIS/GPS and mitigation projects	Emergency services	Revision	High, Continuing	City/ County EMD	USDA Grants Private funding	Warning area coverage maps	X	X	X	X	X	X	X	X	X

Community	Action	Type of Strategy	New, Revision, Ongoing	Priority Rank and Estimated Target Date	Probable Lead Organizer	Potential Funding Sources	Evaluation	Tornado / Severe Storm	Flood	Winter Weather	Drought	Heat wave	Earthquake	Dam Failure	Wildfire	Sinkhole
ACCACLDEMTURWIHS	1.2.2 Communities should promote the purchase of weather radios by local resident to ensure advanced warning about threating weather or disasters	Public information.	Ongoing	Medium Continuing	Community information officer	N/A	N/A	X	X	X		X	X	X		
ACCACLDEMTURWI	1.2.3 Communities should partner with local radio stations to assure that appropriate warning is provided to county residents of impending disasters.	Emergency Services	Revision	High Continuing	City / County EMD	N/A	N/A	X	X	X	X	X	X	X	X	X

Community	Action	Type of Strategy	New, Revision, Ongoing	Priority Rank and Estimated Target Date	Probable Lead Organizer	Potential Funding Sources	Evaluation	Tornado / Severe Storm	Flood	Winter Weather	Drought	Heat wave	Earthquake	Dam Failure	Wildfire	Sinkhole
Objective 1.3: Reduce the danger to, enhance protection of, dangerous areas during hazard events																
CA CL DE MT UR WI	1.3.1: Should update tree trimming programs and dead tree removal.	Property protection.	Ongoing	Medium As needed	City / County public works	Internal or private funds	Annual program review.	X		X			X		X	
CA CL DE MT UR WI	1.3.2 Should assist communities/county in securing funding for road, bridge improvements.	Improved transportation abilities	Ongoing	Medium As needed	Presiding commissioner City government	DOT grants private funds	Improved road conditions	X	X	X			X	X		
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.																
AC CA CL DE MT UR WI	2.1.1 Should encourage a self-inspection program at critical facilities to assure that the building infrastructure is earthquake and tornado resistant.	Service protection	Revision	High 2015	Facility managers.	Internal or private funding	Annual review	X					X			

Community	Action	Type of Strategy	New, Revision, Ongoing	Priority Rank and Estimated Target Date	Probable Lead Organizer	Potential Funding Sources	Evaluation	Tornado / Severe Storm	Flood	Winter Weather	Drought	Heat wave	Earthquake	Dam Failure	Wildfire	Sinkhole
CA CL DE MT UR WI	2.1.2 Should encourage businesses to develop emergency plans.	Emergency Planning	Revision	High 2013	City / County Leaders	N/A	Emergency plan reviews.	X	X	X	X	X	X	X	X	
Objective 2.2: Discourage new development and encourage preventive measures for existing development in areas vulnerable to natural hazards, thereby reducing repetitive losses to the NFIP																
CA CL DE MT UR WI	2.2.1 Promote education on floodplain development and NFIP	Public education	Ongoing	High continuing	City / County EMS	N/A	Meeting attendance records		X					X		
Objective 2.3: Use regulations to ensure that development will not put people in harm's way or increase threats to existing properties.																
CL MT WI	2.3.1 Should encourage minimum building codes in all cities.	Property protection	Ongoing	High 2014	County Commissioners	Internal funds	Building codes in place	X	X	X		X	X			

CG CA CL DE MT UR WI	2.3.2 Will encourage local governments to develop and implement regulations for the securing of hazardous materials tanks and mobile homes to reduce hazards during flooding and high winds.	Public safety	New and ongoing	Low Continuing	County commission	Internal funds	Haz-Mat regulations in place	X	X				X			

Community	Action	Type of Strategy	New, Revision, Ongoing	Priority Rank and Estimated Target Date	Probable Lead Organizer	Potential Funding Sources	Evaluation	Tornado / Severe Storms	Flood	Winter Weather	Drought	Heat wave	Earthquake	Dam Failure	Wildfire	Sinkhole
Objective 3.1: Heighten public awareness about the full range of natural hazards by developing education and outreach programs.																
CA CL DE MT UR WI	3.1.1Should distribute SEMA brochures at public facilities and events.	Public education	Ongoing	High Continuing	County / City EMD	N/A	Community surveys	X	X	X		X	X	X	X	
CG CA CL DE MT UR WI	3.1.2 Should hold regular press releases from county and city EMD offices concerning hazards, where they strike, frequency and preparation.	Public information	Ongoing	High Continuing	County / City EMD	Internal	Press releases published	X	X	X	X	X	X	X	X	X
Objective 3.2: Provide information on assistance with mitigation activities																
AC CA CL DE MT UR WI	3.2.1 Should encourage local resident sot purchase NOAA all hazard radios through press releases and brochures.	Public information	Ongoing	High Continuing	County City leaders	Internal	Public information provided	X	X	X			X	X	X	

Community	Action	Type of Strategy	New, Revision, Ongoing	Priority Rank and Estimated Target Date	Probable Lead Organizer	Potential Funding Sources	Evaluation	Tornado / Severe Storm	Flood	Winter Weather	Drought	Heat wave	Earthquake	Dam Failure	Wildfire	Sinkhole
AG CG CA CL DE MT UR WI CS CAS CLS DAV HCS LS SS	3.2.2 Should ask SEMA mitigation specialist to present information to city councils county commission, Kaysinger Basin Regional Planning Commission, Henry County Emergency Planning Committee.	Public information	Ongoing	High Continuing	City / County EMD	N/A	Meeting attendance records.	X	X	X	X	X	X	X	X	X
Objective 3.3: Publicize and encourage adoption of mitigation measures.																

AG CG CA CL DE MT UR WI CS CAS CLS DAV HCS LS SS	3.3.1 Jurisdictions will perform continuous re-evaluation of HMP and other community planning.	County Services	New and ongoing	High Annually	All county, city and school administrators	N/A	Revised plans	X	X	X	X	X	X	X	X	X
CA CL DE MT UR WI	3.3.2 Should publicize adopted mitigation measures for public awareness.	Public information	Ongoing	High As new measures are developed	City / County EMD	N/A	Press release notices	X	X	X	X	X	X	X	X	X

Community	Action	Type of Strategy	New, Revision, Ongoing	Priority Rank and Estimated Target Date	Probable Lead Organizer	Potential Funding Sources	Evaluation	Tornado / Severe Storm	Flood	Winter Weather	Drought	Heat wave	Earthquake	Dam Failure	Wildfire	Sinkhole
Objective 3.4: Educate public on actions that are available																
AC CA CL DE MT UR WI	3. 4.1 Should encourage county health department and local American Red Cross to use publicity campaigns that make resident aware of proper measures to take during times of extreme heat or cold.	Public information	Ongoing	High Continuing	County information officer.	Internal	Press releases / radio spots provided to community			X		X				
AG AC ASD	3.4.2 Should publicize county and city-wide drills / exercises.	Public information	Ongoing	High As drills are scheduled	City / County EMD, information officer	Internal	Press releases / radio spots provided to community	X	X	X		X	X	X	X	

Community	Action	Type of Strategy	New, Revision, Ongoing	Priority Rank and Estimated Target Date	Probable Lead Organizer	Potential Funding Sources	Evaluation	Tornado / Severe Storm	Flood	Winter Weather	Drought	Heat wave	Earthquake	Dam Failure	Wildfire	Sinkhole
Objective 4.1: Build and support local partnerships to continuously become less vulnerable to hazards																
AG AC AS	4.1.1 Should encourage join meetings of organizations and agencies for emergency planning.	Increase Emergency Services education.	Ongoing	High As new plans are developed	City / County EMD	Internal funds / grant	Joint operations plans developed	X	X	X		X	X	X	X	
AG AC AS	4.1.2 Should conduct joint training and drills between agencies, public and private entities (including schools/businesses.	Planning	Ongoing	Low At least annually	City / County EMD											
AG AS	4.1.3 Should pool different agency resources to achieve widespread results.	Planning	Ongoing	Low Ongoing	City /County EMD	Grants / internal funds	Operations groups formed.	X	X	X	X	X	X	X	X	

Community	Action	Type of Strategy	New, Revision, Ongoing	Priority Rank and Estimated Target Date	Probable Lead Organizer	Potential Funding Sources	Evaluation	Tornado / Severe Storm	Flood	Winter Weather	Drought	Heat wave	Earthquake	Dam Failure	Wildfire	Sinkhole
Objective 4.2: Encourage participation of chief elected officials in planning.																
AC AG	4.2.1 Should encourage meetings between EMD, City/County, and SEMA to familiarize officials with mitigation planning and budgeting for mitigation projects.	Emergency planning	Ongoing	High Annually	City / County EMD	Internal	Minutes of meetings / updated plans	X	X	X	X	X	X	X	X	
Objective 5.1: incorporate hazard mitigation into the long-range planning and development activities of the county and each jurisdiction.																
AG CL MT	5.1.1 Should encourage communities to budget for enhanced warning systems maintenance and updating.	Emergency preparedness	Ongoing	Medium Continuing	County Commission	USDA grants /loans. Govt. grants	Increased warning capabilities.	X	X	X	X	X	X	X	X	
AG CL DE MT DE MT UR WI	5.1.2 Examine potential road and bridge upgrades that would reduce danger to residents during occurrence of natural disasters.	Planning	Ongoing	High Ongoing	City / County EMD City / County road departments.	Gov. program funds / private funding	Updated road systems		X	X		X	X			

Community	Action	Type of Strategy	New, Revision, Ongoing	Priority Rank and Estimated Target Date	Probable Lead Organizer	Potential Funding Sources	Evaluation	Tornado / Severe Storm	Flood	Winter Weather	Drought	Heat wave	Earthquake	Dam Failure	Wildfire	Sinkhole
AC AG	5.1.3 All communities should develop storm water management plans	Planning	Revision, ongoing	Medium Continuous	County commission, city governments	Grants internal funds	New plans completed	X	X							
AC AG	5.1.4 Jurisdictions should coordinate and integrate mitigation activities with city and county Emergency Operations Plans	Emergency planning	Revision, ongoing	High 2013	County commission, city governments	Internal funds	Mitigation actions written into EOP's.	X	X	X	X	X	X	X	X	X
AC AG	5.1.5 All cities should require contractor stormwater management plans in all new development – residential and commercial.	Planning	Revision, Ongoing.	High 2013	County Commission	Internal funds	Best practices incorporated	X	X					X		

Community	Action	Type of Strategy	New, Revision, Ongoing	Priority Rank and Estimated Target Date	Probable Lead Organizer	Potential Funding Sources	Evaluation	Tornado / Severe Storm	Flood	Winter Weather	Drought	Heat wave	Earthquake	Dam Failure	Wildfire	Sinkhole
Objective 5.2: Promote beneficial use of hazardous areas while expanding open space and recreational opportunities.																
AG CL	5.2.1 Local government should purchase properties in the floodplain as funds become available and convert that land into public space/recreation areas.	Property protection	Ongoing	Medium Ongoing	County / City government	Grants / private funding	Repetitive flood losses decreased		X							
AG AC	5.2.2 Communities should zone all areas in floodplain as open space.	Loss prevention	Ongoing	Medium Ongoing	County / City government	Grants / private funding	Repetitive flood losses decreased		X							
Objective 6.1: Research the use of outside sources of funding																
AG AC	6.1.1 Communities should work with SEMA to learn about new funding opportunities.	Planning	Ongoing	High Ongoing	City / County EMD	N/A	New opportunities discovered	X	X	X	X	X	X	X	X	X

Community	Action	Type of Strategy	New, Revision, Ongoing	Priority Rank and Estimated Target Date	Probable Lead Organizer	Potential Funding Sources	Evaluation	Tornado / Severe Storm	Flood	Winter Weather	Drought	Heat wave	Earthquake	Dam Failure	Wildfire	Sinkhole
AC AG	6.1.2 Should structure grant proposals for road/bridge upgrades so that hazard mitigation concerns can be also met.	Planning	Ongoing	High As needed	City and County govt.	Internal	Grant proposals written	X	X	X	X	X	X	X	X	X
AC AG CA CL DE MT UR	6.1.3 Communities should work with state/local/federal agencies to include mitigation in all economic and community development projects.	Planning	Revision	High 2013	City and county planners.	Internal funds	Policy drafted and approved.	X	X	X	X	X	X	X	X	X

Community	Action	Type of Strategy	New, Revision, Ongoing	Priority Rank and Estimated Target Date	Probable Lead Organizer	Potential Funding Sources	Evaluation	Tornado / Severe Storm	Flood	Winter Weather	Drought	Heat wave	Earthquake	Dam Failure	Wildfire	Sinkhole
Objective 6.2: Encourage property owners to invest in hazard mitigation projects on their own property.																
AG AC	6.2.1 Should encourage communities to implement cost sharing programs with private property owners for hazard mitigation projects that benefit the community as a whole.	Planning	Ongoing	Low Continuing	County Commission /EMD	Grants / Govt. Loans / internal funds	Policies implemented	X	X	X	X	X	X	X	X	
	6.2.2 Cities and county should implement public awareness programs about the benefits of hazard mitigation projects, both public and private.	Planning	Ongoing	High 2013	County Commission /EMD	Grants / Govt. Loans / internal funds	Public awareness campaign implemented	X	X	X	X	X	X	X	X	

Community	Action	Type of Strategy	New, Revision, Ongoing	Priority Rank and Estimated Target Date	Probable Lead Organizer	Potential Funding Sources	Evaluation	Tornado / Severe Storm	Flood	Winter Weather	Drought	Heat wave	Earthquake	Dam Failure	Wildfire	Sinkhole
Objective 6.3: In the event of a disaster declaration, be prepared to apply for hazard mitigation for prioritized projects.																
	6.3.1 All jurisdictions should prioritize mitigation projects, based on cost effectiveness starting with greatest threat of life, health, and property.	Planning	Ongoing	High Continuing	City and County EMD	N/A	Project priority document created and implemented into planning	X	X	X	X	X	X	X	X	

4.4 Prioritization, Implementation, and Administration

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.

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

STAPLEE Review and Prioritization of Mitigation Actions and Objectives

In drafting this prioritization, Kaysinger Basin Regional Planning Commission and community planning partners worked cooperatively to determine which STAPLEE criteria each action did or was likely to be achieved. The criteria that were considered "met" are identified with a "+", and the criteria that were not considered met are identified with a "0". The methodology also allows for "-"designation when impacts are expected to be negative. The participants in this process have defined High, Medium and Low priorities to be assigned as follows:

- **High:** Meets five of the seven STAPLEE criteria.
- **Medium:** Meets four of the seven STAPLEE criteria.
- **Low:** Meets three of the seven STAPLEE criteria.

Table 4.4-1 Definition of the STAPLEE Criteria		
Abbreviation	Criteria	Definition of the Criteria
S	Social	Mitigation action are acceptable to the community if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the community's social and cultural values.
T	Technical	Mitigation actions are technically most effective if they provide long-term reduction of loses and have minimal secondary adverse impacts.
A	Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
P	Political	Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support of the action.
L	Legal	It is crucial that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
E	Economical	Budget constraints can significantly deter the implementation of mitigation actions. Hence, it is important to evaluate whether an action is cost-effective and possible to fund.
E	Environmental	Sustainable mitigation actions that do not have an adverse effect on the environment, that comply with Federal, State, and local environmental regulations, are consistent with the community's environmental goals, have mitigation benefits while being environmentally sound.

Table 4.4-2 Prioritization of Action Objectives using STAPLEE and simple scores.									
Objective	**Social**	**Technical**	**Administrative**	**Political**	**Legal**	**Economic**	**Environmental**	**Total**	Priority
1.1.1 Should develop education programs on personal emergency preparedness	+	**0**	+	+	+	+	+	**6**	High
1.2.1 Should assist communities with securing funding for early warning systems, GIS/GPS and mitigation projects	+	+	**0**	+	+	-	+	**5**	High
1.2.2 Communities should promote the purchase of weather radios by local resident to ensure advanced warning about threating weather or disasters	+	+	+	–	–	–	+	**4**	Medium
1.2.3 Communities should partner with local radio stations to assure that appropriate warning is provided to county residents of impending disasters.	+	+	+	+	+	+	+	**7**	High

1.3.1: Should update tree trimming programs and dead tree removal.	+	-	-	-	+	+	+	**4**	Medium
1.3.2 Should assist communities/county in securing funding for road, bridge improvements.	+	+	–	+	+	–	–	**4**	Medium
2.1.1 Should encourage a self-inspection program at critical facilities to assure that the building infrastructure is earthquake and tornado resistant.	+	+	+	-	+	+	+	**6**	High
2.1.2 Should encourage businesses to develop emergency plans.	+	+	+	+	+	+	+	**7**	High
2.2.1 Promote education on floodplain development and NFIP	+	+	+	+	+	+	+	**7**	High
2.3.1 Should encourage minimum building codes in all cities.	+	+	+	–	+	+	+	**6**	High
2.3.2 Will encourage local governments to develop and implement regulations for the securing of hazardous materials tanks and mobile homes to reduce hazards during flooding and high winds.	+	+	–	–	–	–	+	**3**	Low
3.1.1Should distribute SEMA brochures at public facilities and events.	+	+	+	+	+	+	+	**7**	High
3.1.2 Should hold regular press releases from county and city EMD offices concerning hazards, where they strike, frequency and preparation.	+	+	+	+	+	+	+	**7**	High
3.2.1 Should encourage local residents to purchase NOAA all hazard radios through press releases and brochures.	+	+	+	+	+	+	+	**7**	High
3.2.2 Should ask SEMA mitigation specialist to present information to city councils county commission, Kaysinger Basin Regional Planning Commission, Henry County Emergency Planning Committee.	+	+	+	+	+	+	+	**7**	High
3.3.1 Jurisdictions will perform continuous re-evaluation of HMP and other community planning.	+	+	+	+	+	+	+	**7**	High
3.3.2 Should publicize adopted mitigation measures for public awareness.	+	+	+	+	+	+	+	**7**	High
3. 4.1 Should encourage county health department and local American Red Cross to use publicity campaigns that make residents aware of proper measures to take during times of extreme heat or cold.	+	+	+	+	+	+	+	**7**	High
3.4.2 Should publicize county and city-wide drills / exercises	+	+	+	+	+	+	+	**7**	High
4.1.1 Should encourage join meetings of organizations and agencies for emergency planning.	+	+	+	-	+	+	+	**6**	High
4.1.2 Should conduct joint training and drills between agencies, public and private entities (including schools/businesses	–	–	+	–	+	–	+	**3**	Low
4.1.3 Should pool different agency resources to achieve widespread results	+	+	–	–	+	–	+	**3**	Low

4.2.1 Should encourage meetings between EMD, City/County, and SEMA to familiarize officials with mitigation planning and budgeting for mitigation projects.	+	+	+	+	+	+	+	**7**	High
5.1.1 Should encourage communities to budget for enhanced warning systems maintenance and updating.	+	+	–	–	+	–	+	**4**	Medium
5.1.2 Examine potential road and bridge upgrades that would reduce danger to residents during occurrence of natural disasters	+	+	+	+	+	–	+	**6**	High
5.1.3 All communities should develop storm water management plans	+	+	–	–	+	–	+	**4**	Medium
5.1.4 Jurisdictions should coordinate and integrate mitigation activities with city and county Emergency Operations Plans	+	+	+	+	+	+	+	**7**	High
5.1.5 All cities should require contractor stormwater management plans in all new development – residential and commercial.	+	+	+	+	+	+	+	**7**	High
5.2.1 Local government should purchase properties in the floodplain as funds become available and convert that land into public space/recreation areas.	+	+	–	–	+	–	+	**4**	Medium
5.2.2 Communities should zone al areas in floodplain as open space.	–	+	–	+	+	–	+	**4**	Medium
6.1.1 Communities should work with SEMA to learn about new funding opportunities.	+	+	+	+	+	+	+	**7**	High
6.1.2 Should structure grant proposals for road/bridge upgrades so that hazard mitigation concerns can be also met.	+	+	+	+	+	+	+	**7**	High
6.1.3 Communities should work with state/local/federal agencies to include mitigation in all economic and community development projects.	+	+	–	+	+	–	+	**5**	High
6.2.1 Should encourage communities to implement cost sharing programs with private property owners for hazard mitigation projects that benefit the community as a whole.	+	–	–	–	+	–	+	**3**	Low
6.2.2 Cities and county should implement public awareness programs about the benefits of hazard mitigation projects, both public and private.	+	+	+	+	+	+	+	**7**	High
6.3.1 All jurisdictions should prioritize mitigation projects, based on cost effectiveness starting with greatest threat of life, health, and property.	+	+	+	+	+	+	+	**7**	High

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)
- Repetitive Flood Claims (RFC)
- Severe Repetitive Loss (SRL)

Mitigation activities which are eligible for funding vary between the programs. All potential projects must match the stated goals and objectives of the Henry County Hazard Mitigation Plan and the State of Missouri Hazard Mitigation Plan. (See Table 4.5-1)

Table 4.5-1 **Funding Activities**

Eligible Activities

Eligible Activities	HMGP	PDM	FMA	RFC	SRL
1. Mitigation Projects	✓	✓	✓	✓	✓
Property Acquisition and Structure Demolition or Relocation	✓	✓	✓	✓	✓
Structure Elevation	✓	✓	✓	✓	✓
Mitigation Reconstruction					✓
Dry Floodproofing of Historic Residential Structures	✓	✓	✓	✓	✓
Dry Floodproofing of Non-residential Structures	✓	✓	✓	✓	
Minor Localized Flood Reduction Projects	✓	✓	✓	✓	✓
Structural Retrofitting of Existing Buildings	✓	✓			
Non-structural Retrofitting of Existing Buildings and Facilities	✓	✓			
Safe Room Construction	✓	✓			
Infrastructure Retrofit	✓	✓			
Soil Stabilization	✓	✓			
Wildfire Mitigation	✓	✓			
Post-disaster Code Enforcement	✓				
5% Initiative Projects	✓				
2. Hazard Mitigation Planning	✓	✓	✓		
3. Management Costs	✓	✓	✓	✓	✓

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. (See table 5.4-2)

Table 4.5-2 **Cost Share Requirements**

Cost Share Requirements

Programs	Mitigation Activity Grant (Percent of Federal/Non-Federal Share)
HMGP	75/25
PDM	75/25
PDM—subgrantee is small impoverished community	90/10
PDM—Tribal grantee is small impoverished community	90/10
FMA	75/25
FMA—severe repetitive loss property with Repetitive Loss Strategy	90/10
RFC	100/0
SRL	75/25
SRL—with Repetitive Loss Strategy	90/10

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/hmgp/

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/

Repetitive Flood Claims Grant Program (RFC)

The Repetitive Flood Claims (RFC) grant program was authorized in 1968 to assist States and communities in reducing flood damages to insured properties that have had one or more claims to the NFIP.

In order to apply for funding through this 100% Federal share program, a community must show that it can't meet FMA requirements due to lack of cost share match or capacity to manage the activities. This doesn't necessarily mean it needs to be a low-income community.

A St. Louis area community was awarded a RFC grant on the basis that it couldn't meet FMA requirements because it was in the middle of the budget cycle.

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

Severe Repetitive Loss Grant Program (SRL)

The Severe Repetitive Loss (SRL) grant program was authorized in 2004 to provide funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss (SRL) properties insured under the NFIP.

A 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. There are very specific requirements for this grant program; requirements need to be studied carefully before making application. For buyouts under SRL, a property must be on FEMA's validated SRL list to be eligible. Property owner consultations are required before submitting an application.

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

Henry County has developed a method to ensure that regular review of the Henry County Natural Hazard Mitigation plan occurs. The county's hazard Mitigation Plan Committee consists of the County Commissioners, municipal officials, members of the Henry County Emergency Management Committee, and a team member from Kaysinger Basin Regional Planning Commission.

The county EMD will be responsible for contacting all Hazard Mitigation Planning Committee members and organizing annual meetings. The County Commission, the EMD and the participating municipalities will be responsible for monitoring and evaluating the progress of the mitigation strategies in the plan. They 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.

They will also 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, including which implementation process worked well, and difficulties encountered, how coordination efforts were proceeding, and which strategies should be revised.

Following the annual review, the County EMD will then have three months to update and make changes to the plan as determined necessary before submitting it to the Committee members and the State Hazard Mitigation

Officer. If no changes are necessary, the State Hazard Mitigation Officer will be given a justification for this determination.

This Hazard Mitigation Planning Committee shall consist of, at a minimum the following members:
One member of the Henry County Commission.
One member of the Henry County Local Emergency Planning Commission
The Henry County Emergency Management Director
Two representatives from local industry
Other county residents that may wish to attend.
This Mitigation Plan Review meeting shall occur on or before April 1 of each year, beginning in 2013.

The general public will be encouraged to attend Hazard Mitigation Planning Committee meetings through posted notices, reminders or announcements. Kaysinger Basin Regional Planning Commission will continue to host any announcements as well as a copy of the latest plan on the Kaysinger Basin Regional Planning Commission website at http://www.kaysinger.com/.

The following data gaps in the current plan should be examined during the 2015 update process:

Dam Failure

Information from the mapping any possible high hazards dams in the county should be 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,

Flood

To the best of my ability, flooding, dam failure, and levee failure are represented in Appendix B. With more experience and time, detailed HAZUS mapping should be incorporated into the 2015 update. Levee Failure

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 2015 update: http://www.iwr.usace.army.mil/iltf/index.cfm

5.2 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 Henry County Hazard Mitigation Plan will be partly integrated into the Henry 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 in Henry County.

Specific information on integration of the plan into other planning mechanisms in the participating jurisdictions is shown in Table 5.3-1.

Table 5.2-1 **Organization HMP Implementation Process**

Jurisdiction	Plan of Implementation of HMP into Other Plans
Calhoun	Will incorporate the County Hazard Mitigation Plan into the City Master plan as well as into the City Emergency Operations Plan (EOP).
Clinton	The city of Clinton has the County HMP incorporated into all City emergency plans.
Deepwater	City resolution incorporating the County HMP into the city master plan
Montrose	City resolution to incorporate the County HMP into the new city Emergency Operations Plan (currently under development)
Urich	Will incorporate the County Hazard Mitigation Plan into the City Emergency Operations Plan (EOP).

Windsor	Will incorporate the County Hazard Mitigation Plan into the City Master plan as well as into the City Emergency Operations Plan (EOP).

5.3 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 Henry 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 Henry 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

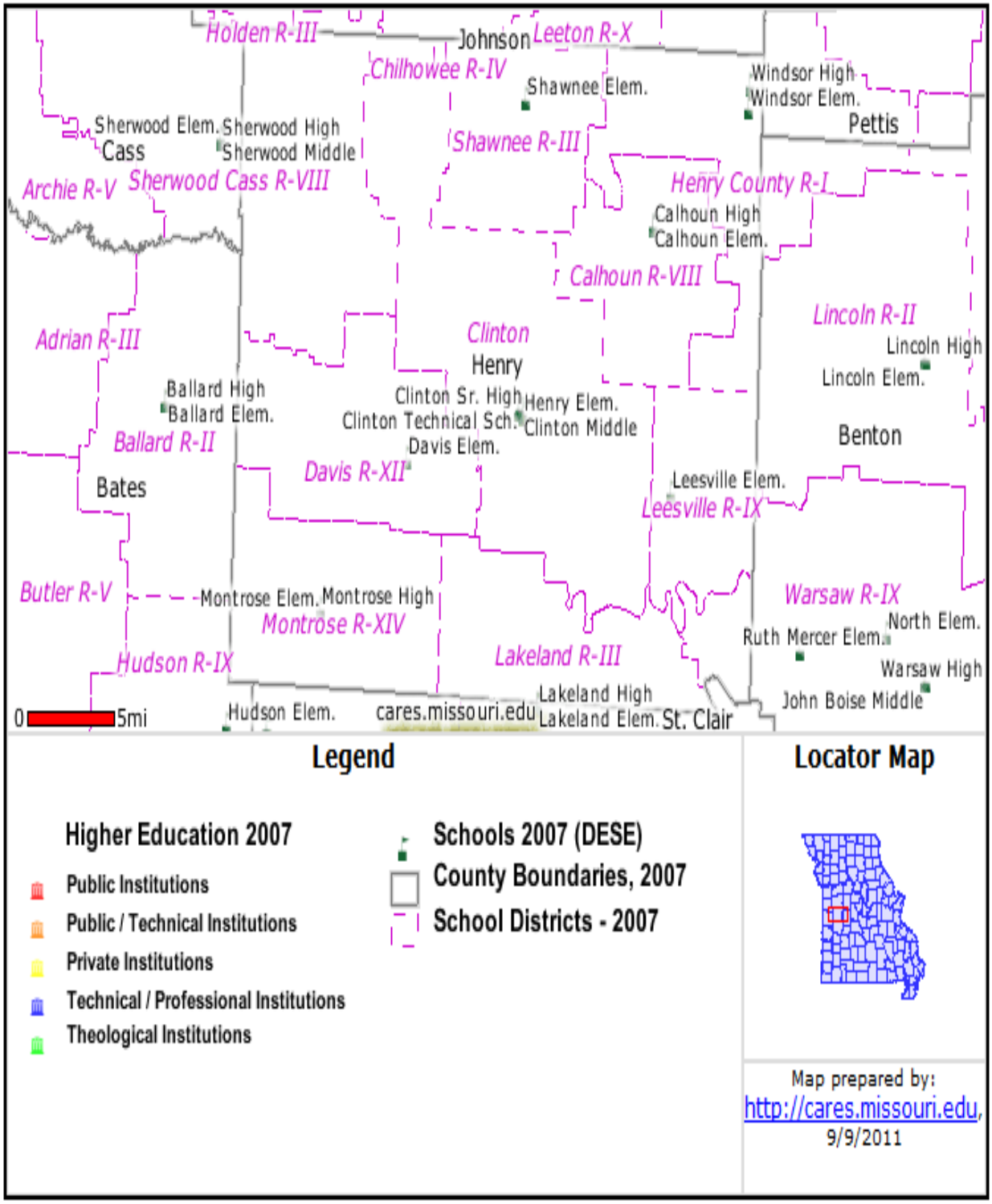
Public notice of the upcoming yearly review and maintenance of the plan will be given via postings on the Kaysinger Basin RPC website and through the KBRPC newsletter. Notice of any public meetings concerning the maintenance of the plan will be given in accordance with Missouri's "Sunshine Law" (Revised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

Section 6 Maps

Education Facilities
Fire Departments
Population Density
Land Use/Cover
Healthcare Facilities
Transportation
Floodplain Maps
Dams

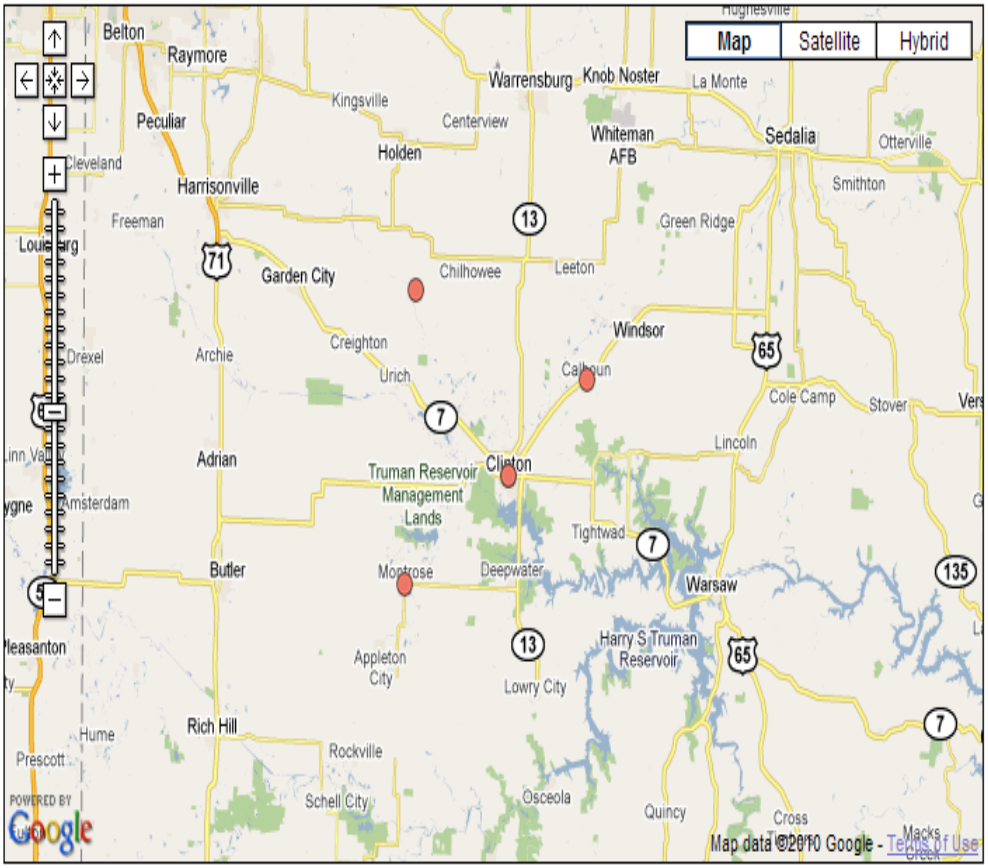
* Some of Section 6 maps were created with CARES Interactive Maps.

Education Facilities

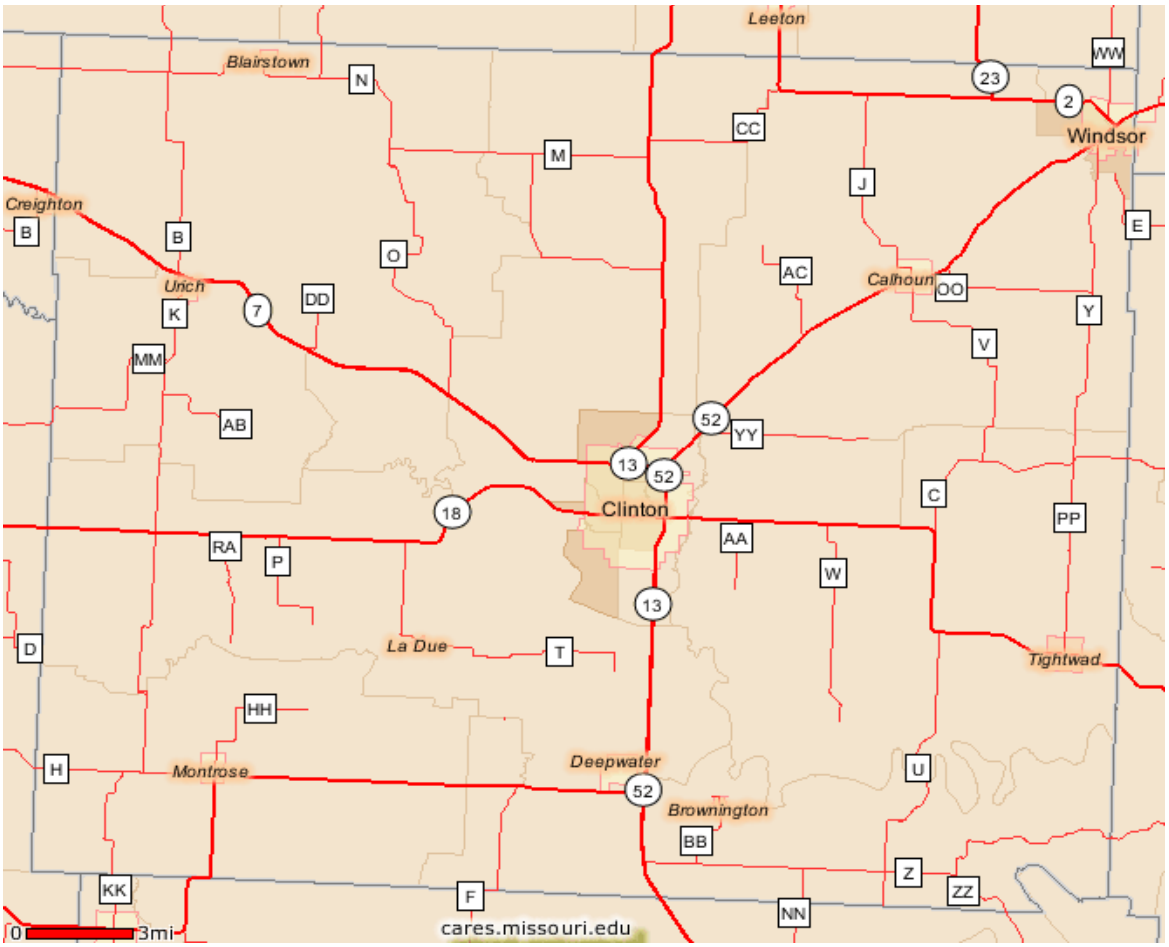


Fire Departments

Fire Departments in Henry County Missouri (6 Fire Stations)



Population Density



MoDOT Roads and Highways, 2007

- Interstate
- U.S. Highway
- State Numbered Highway
- State Lettered Highway

County Boundaries, 2007

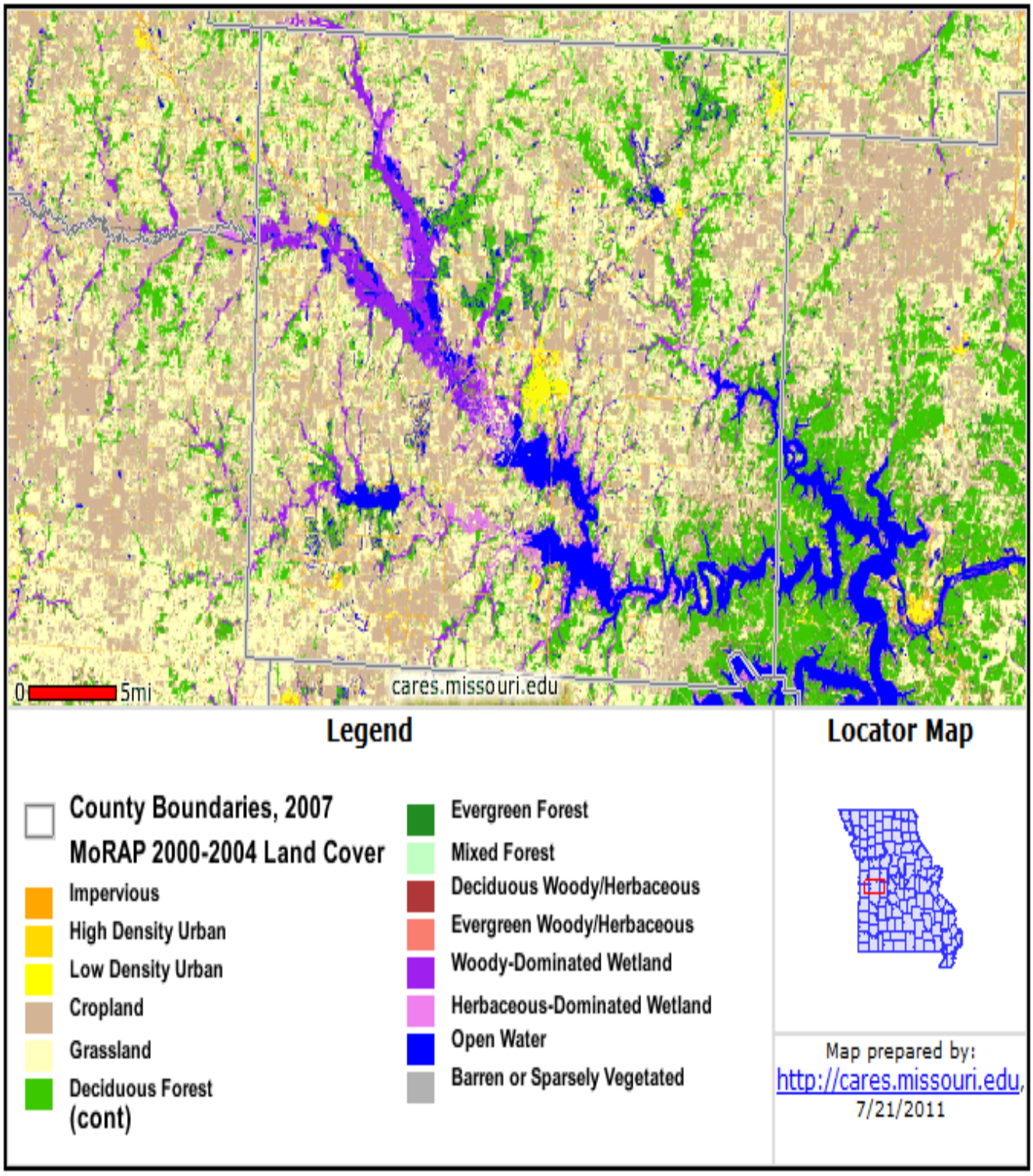
Incorporated Areas, 2007

- City
- Town
- Village
- Census Designated Place
- Other

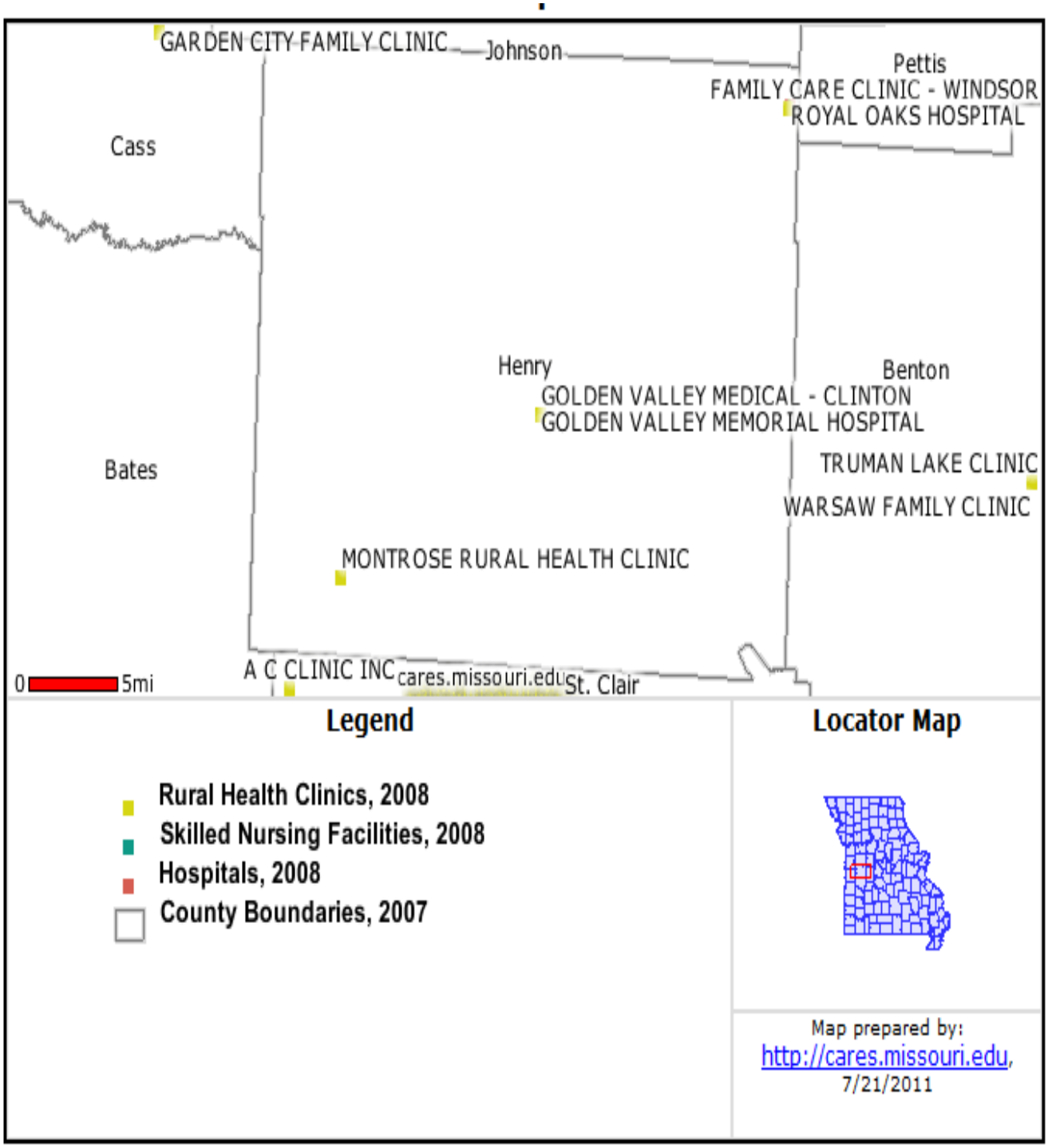
Persons per Sq. Mile by Block Group, 2000

- 6,178.1 or more
- 2,547.29 - 6,178.09
- 326.9 - 2,547.28
- Less than 326.9
- No population

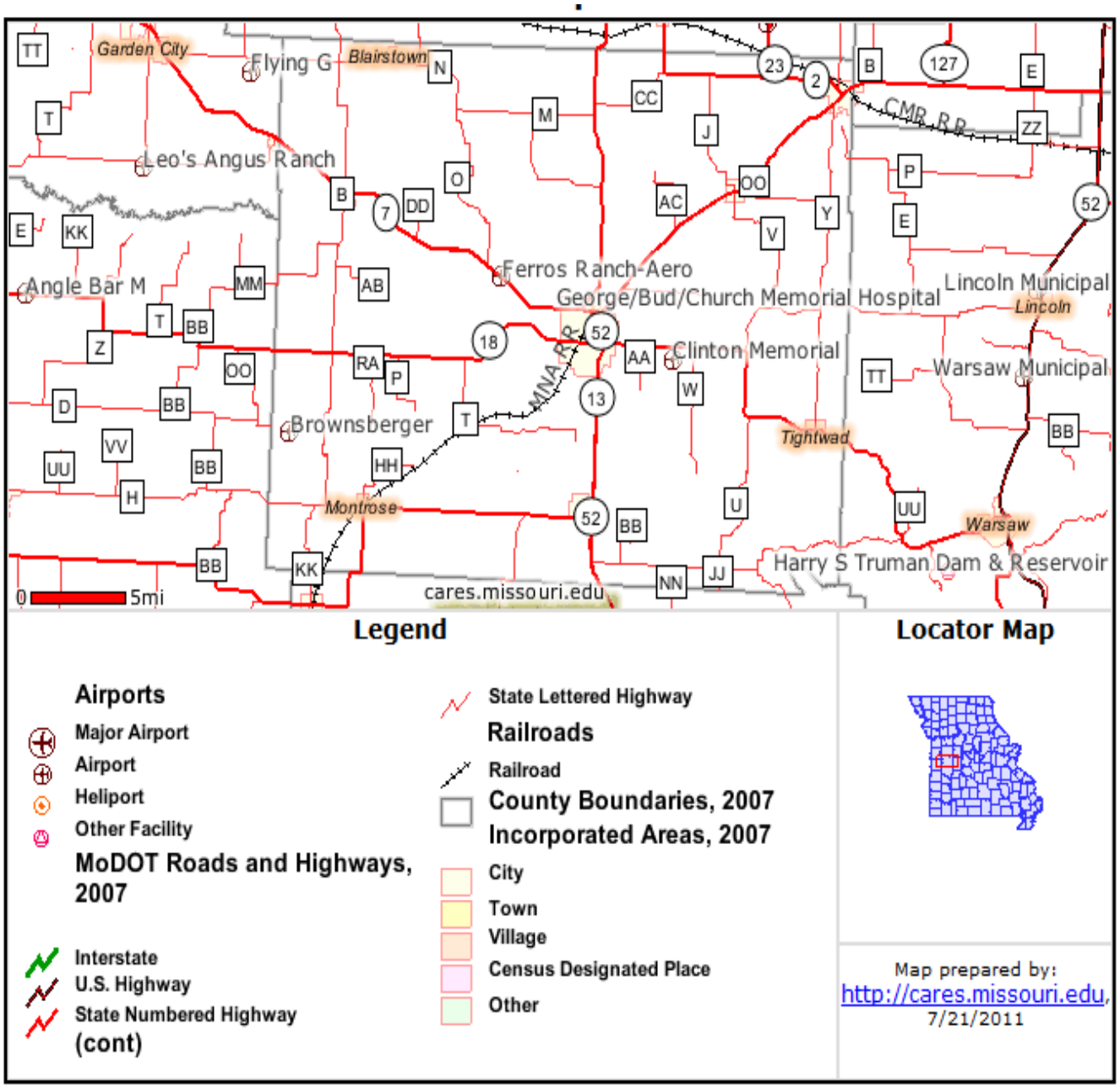
Land Use/Cover



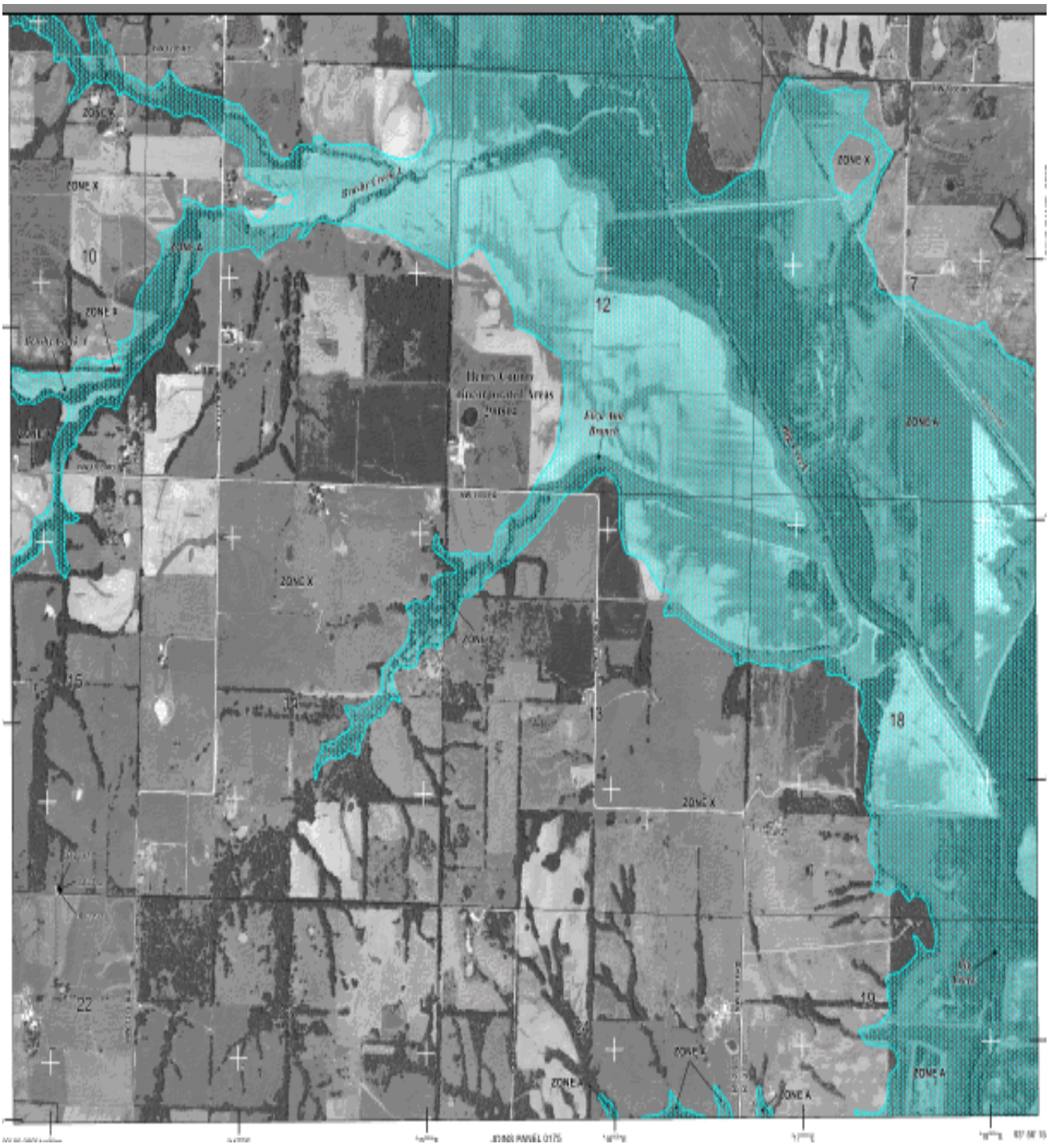
Healthcare Facilities



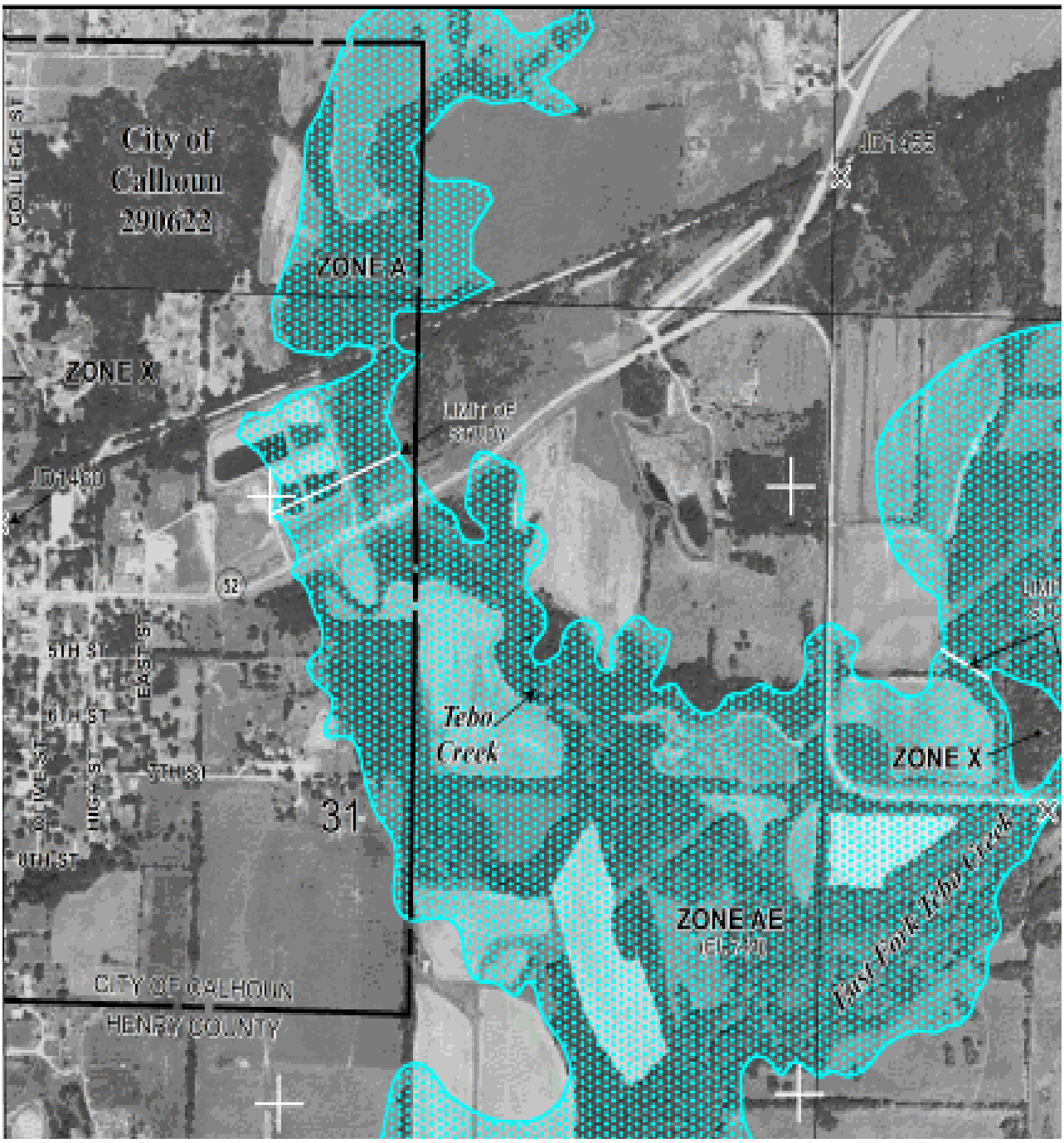
Transportation



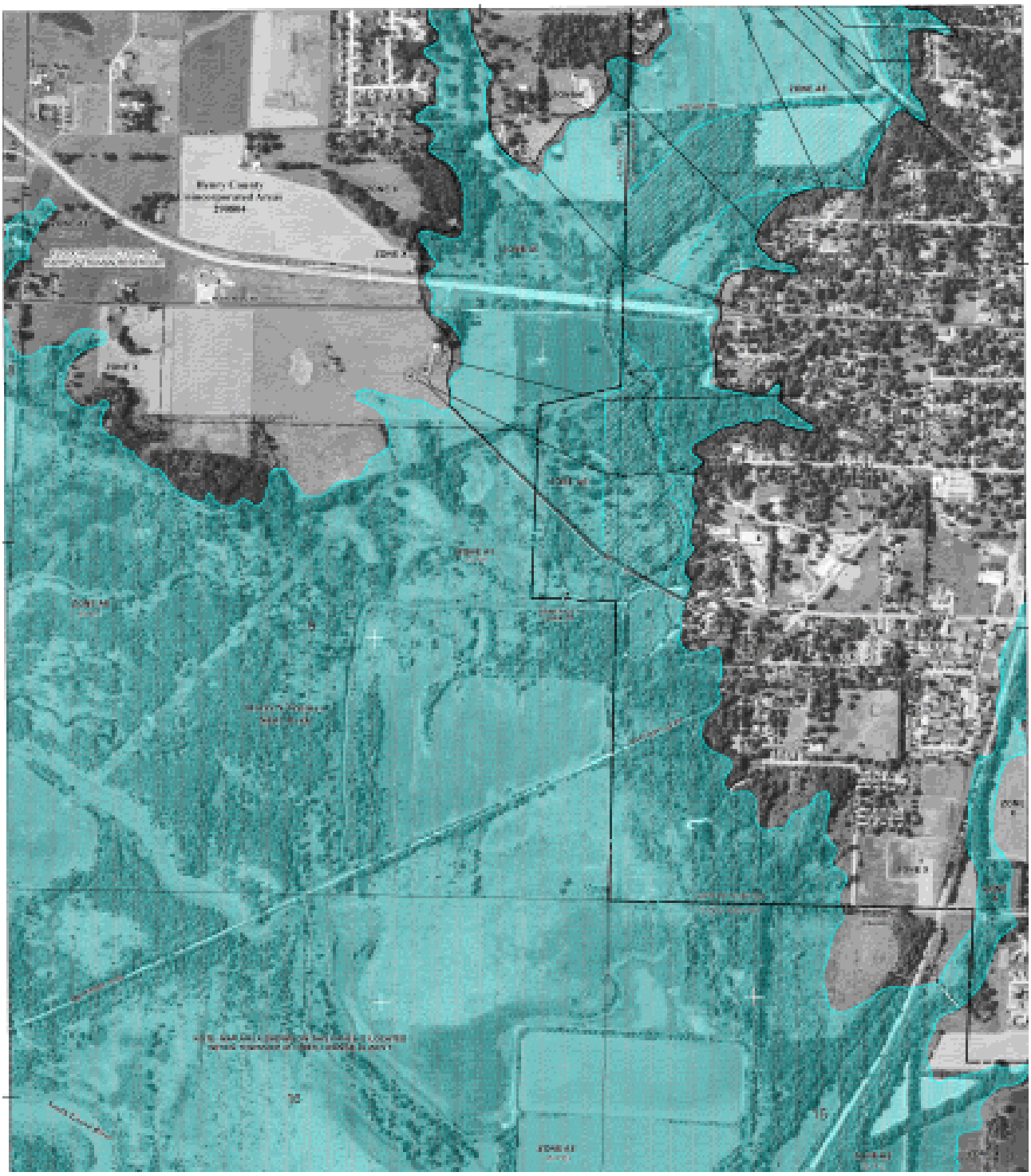
FIRM **County Floodplain**



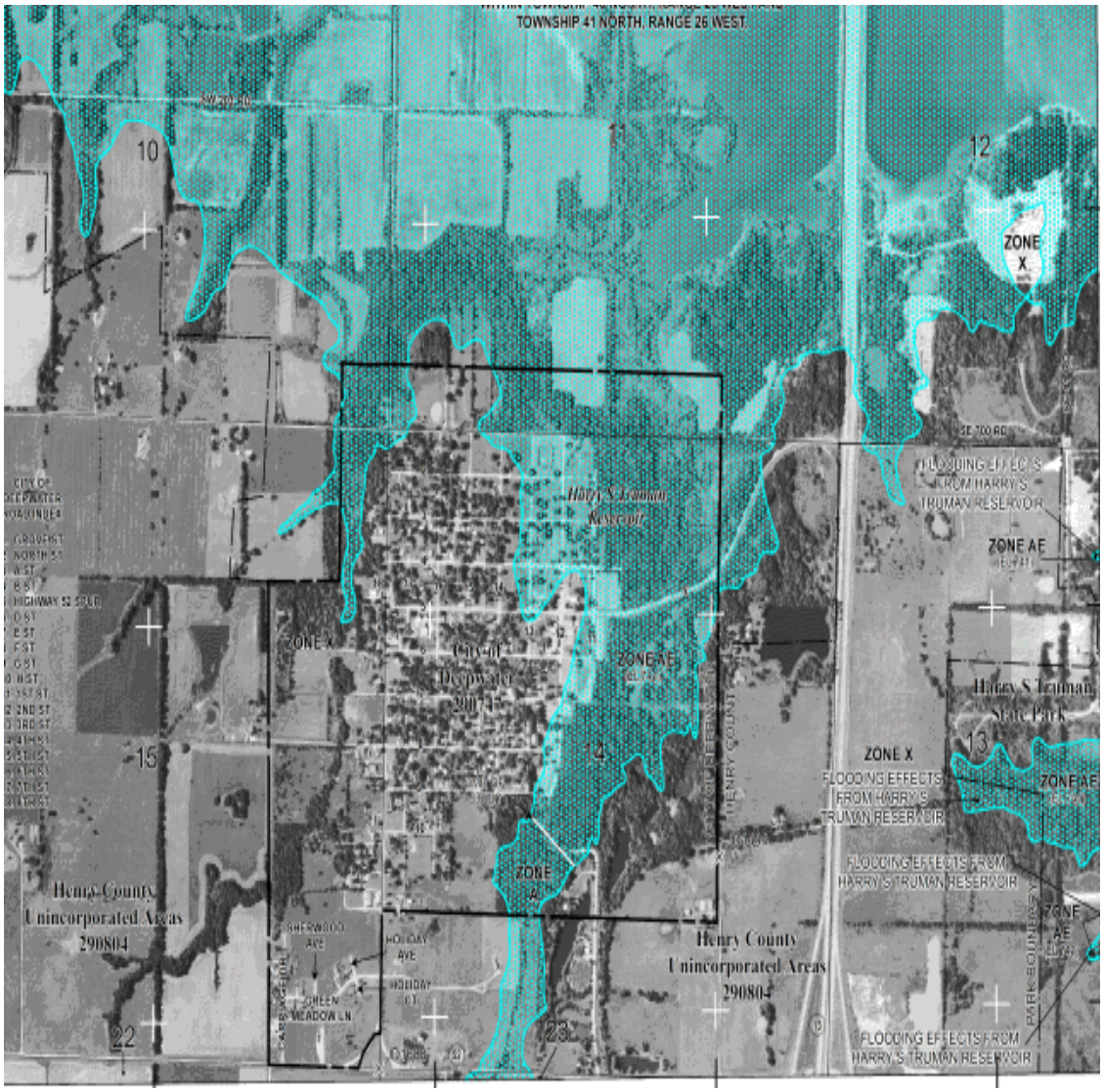
FIRM Calhoun Floodplain



FIRM Clinton Floodplain

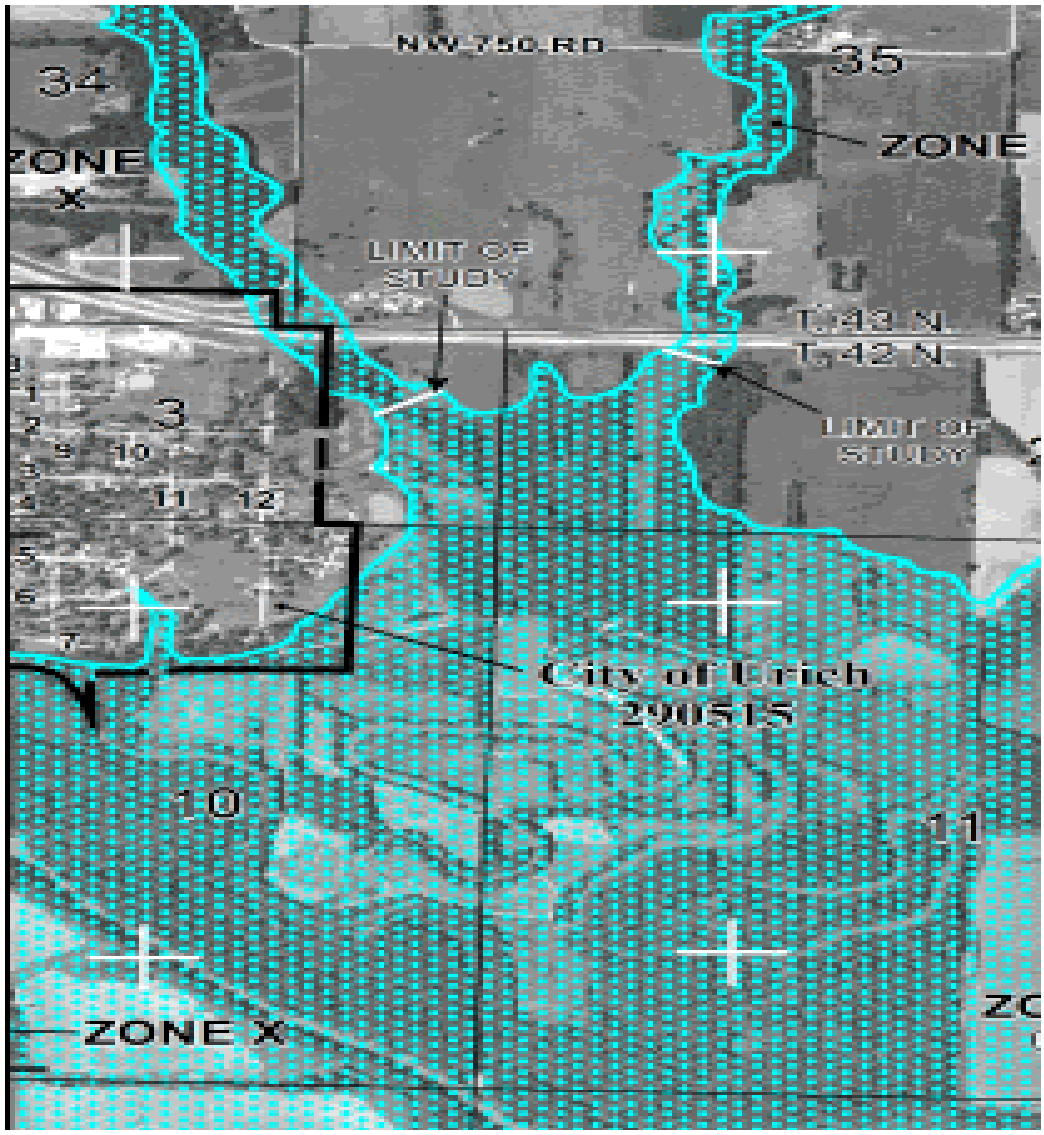


FIRM Deepwater Floodplain

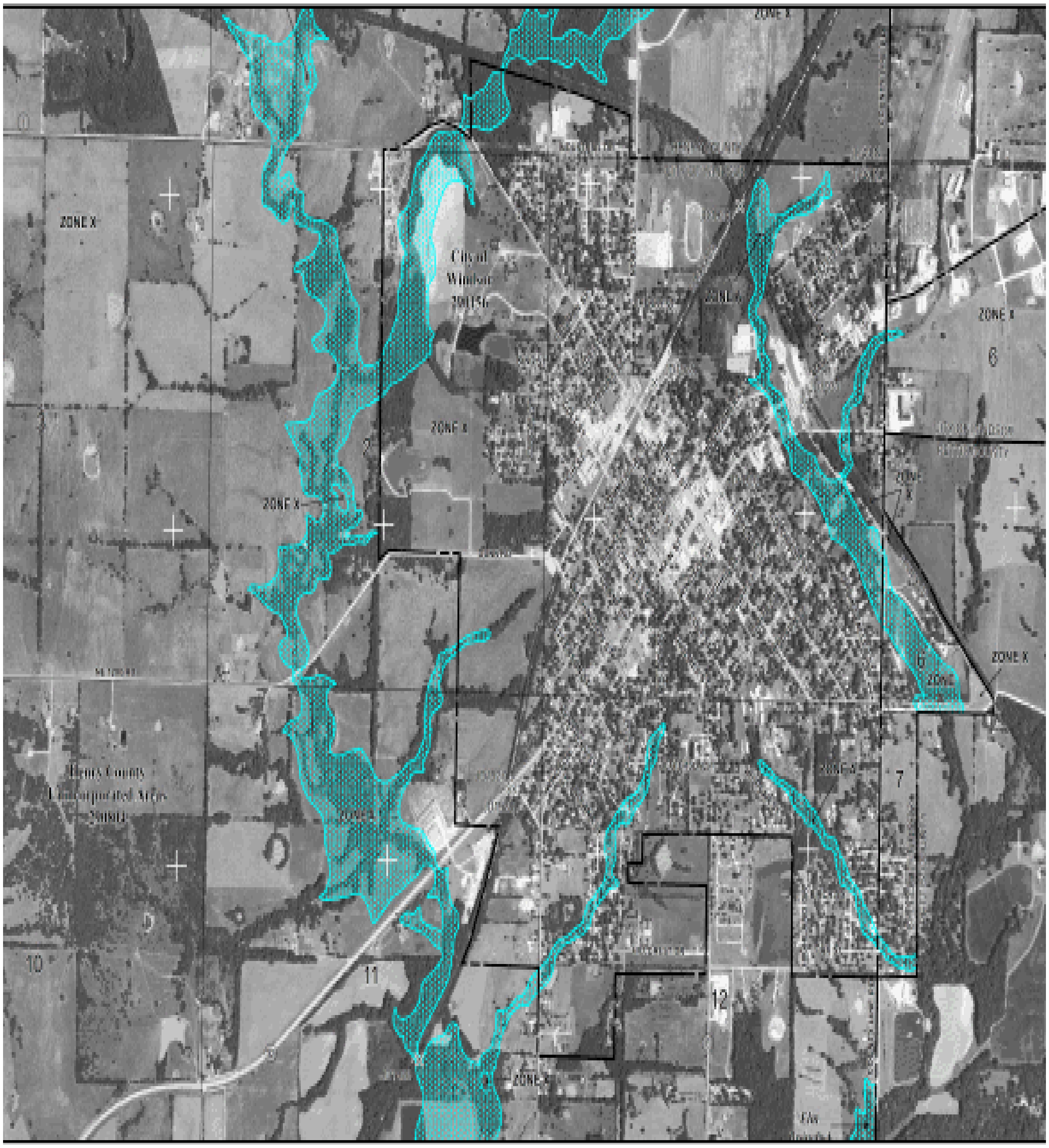


FIRM Montrose Floodplain

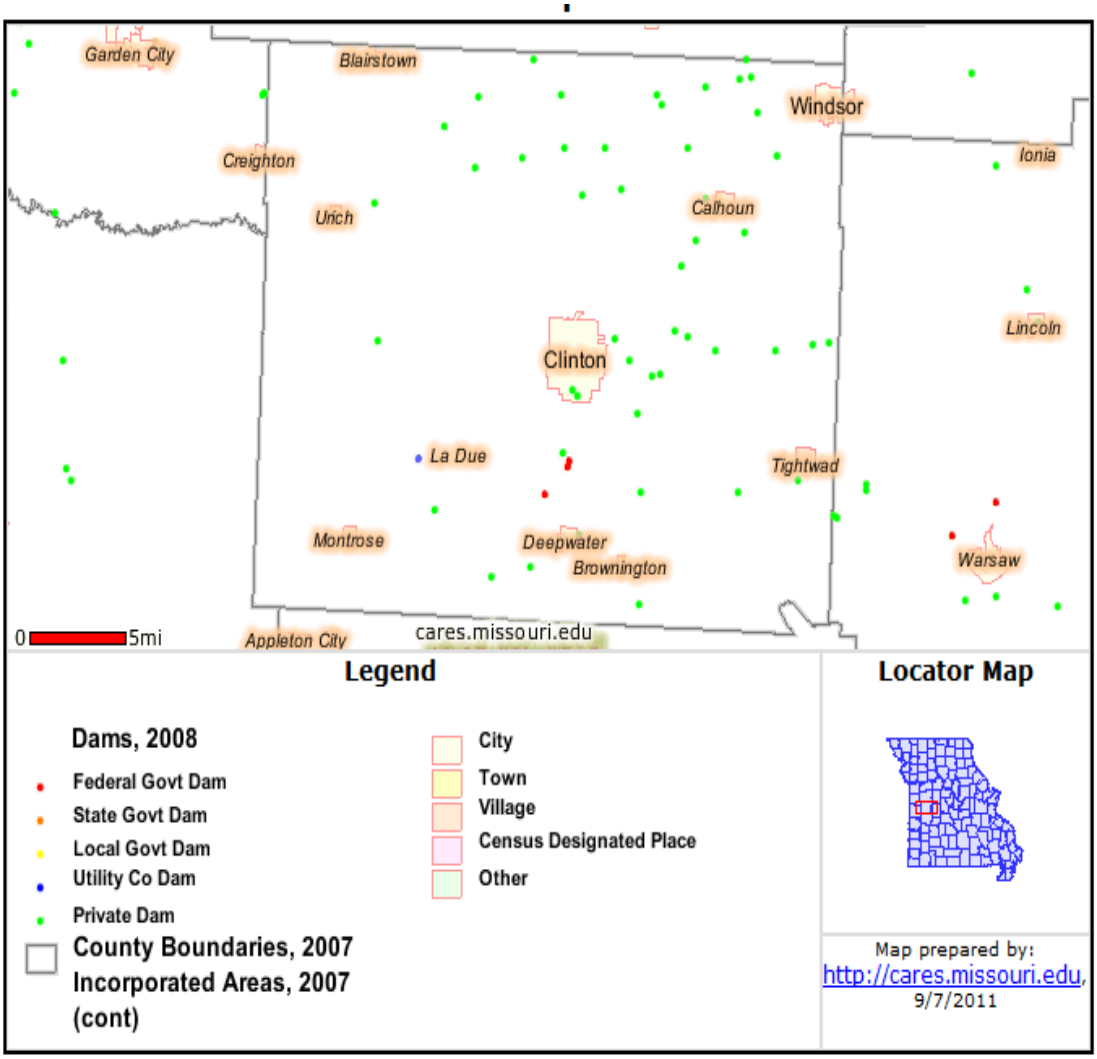
FIRM Urich Floodplain



FIRM Windsor Floodplain


ZONE X
City of
Windsor
6
7
10
11
12

Dams


Garden City
Blairstown
Windsor
Ionia
Creighton
Urich
Calhoun
Lincoln
Clinton
La Due
Tightwad
Montrose
Deepwater
Brownington
Warsaw
Appleton City
0
5mi
cares.missouri.edu
Legend
Dams, 2008
Federal Govt Dam
State Govt Dam
Local Govt Dam
Utility Co Dam
Private Dam
County Boundaries, 2007
Incorporated Areas, 2007
(cont)
City
Town
Village
Census Designated Place
Other
Locator Map
Map prepared by:
http://cares.missouri.edu,
9/7/2011

APPENDICES

Appendix A

Adoption Resolutions

The following resolution was adopted by Henry County on _____, 2011.

RESOLUTION NUMBER _____ *(Example)*

A RESOLUTION OF INTENT TO PARTICIPATE IN NATURAL HAZARD MITIGATION AND TO WORK TOWARD BECOMING A SAFER COMMUNITY.

WHEREAS, the County of Henry recognizes that no community is immune from natural hazards whether it be tornado/severe thunderstorm, flood, severe winter weather, drought, heat wave, earthquake, dam failure or wildfire and recognizes the importance enhancing its ability to withstand natural hazards as well as the importance of reducing the human suffering, property damage, interruption of public services and economic losses caused by those hazards; and

WHEREAS, the County of Henry may have previously pursued measures such as building codes, fire codes, floodplain management regulations, zoning ordinances, and stormwater management regulations to minimize the impact of natural hazards; and

WHEREAS, the Federal Emergency Management Agency and the State Emergency Management Agency have developed a natural hazard mitigation program that assists communities in their efforts to become Disaster-Resistant Communities which are sustainable communities after a natural disaster that focus, not just on disaster relief, but also on recovery and reconstruction that brings the community to at least pre-disaster conditions in an accelerated, orderly and preplanned manner; and

WHEREAS, by participating in the Natural Hazards Mitigation program, the County of Henry will be eligible to apply for post-disaster mitigation funds; and

WHEREAS, the County of Henry desires to commit to working with government partners and community partners to implement the Natural Hazards Mitigation Plan; and

WHEREAS, the County of Henry will implement pertinent precepts of the mitigation plan by incorporation into other community plans and mechanisms where appropriate; and

WHEREAS, the County of Henry will participate in evaluation and review of the Plan after a disaster as well as complete a mandated five-year update submitted to the State Emergency Management Agency and the Federal Emergency Management Agency for review and approval; and

NOW, THEREFORE BE IT RESOLVED BY THE COUNTY COMMISSION OF THE COUNTY OF HENRY AS FOLLOWS:

The County of Henry hereby approves the Henry County Multi-Jurisdictional Natural Hazard Mitigation Plan attached hereto for the purpose of building a safer community by reducing natural hazard vulnerability.

Henry County Presiding Commissioner Date

Henry County Commissioner Date

The following resolution was adopted by the City of Blairstown, Henry County, Missouri on _____.

RESOLUTION NO. _____

WHEREAS, the Henry County Hazard Mitigation Plan is a multi-jurisdictional hazard mitigation plan prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, the City of Blairstown participated in the preparation of the Henry County Hazard Mitigation Plan; and

WHEREAS, the citizens of the Blairstown have been afforded an opportunity to comment and provide input on the Plan and the mitigation actions therein; and

WHEREAS, the city of Blairstown has reviewed the Plan and affirms that the Plan will be updated no less than every five years

NOW THEREFORE, BE IT RESOLVED by the Board of Aldermen that the City of Blairstown adopts the Vernon County Hazard Mitigation Plan as this jurisdiction's Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this ____ day of _____, 2011 at the meeting of the Board of Aldermen.

Mayor	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**

The following resolution was adopted by the Village of Brownington, Henry County, Missouri on _____.

RESOLUTION NO. _____

WHEREAS, the Henry County Hazard Mitigation Plan is a multi-jurisdictional hazard mitigation plan prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, the Village of Brownington participated in the preparation of the Henry County Hazard
Mitigation Plan; and

WHEREAS, the citizens of the Brownington have been afforded an opportunity to comment and provide input on the Plan and the mitigation actions therein; and

WHEREAS, the city of Brownington has reviewed the Plan and affirms that the Plan will be updated no less than every five years

NOW THEREFORE, BE IT RESOLVED by the Board of Aldermen that the City of Brownington
adopts the Vernon County Hazard Mitigation Plan as this jurisdiction's Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this ____ day of _____, 2011 at the meeting of the Board of Aldermen.

Mayor	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**

The following resolution was adopted by the City of Calhoun, Henry County, Missouri on _____.

RESOLUTION NO. _____

WHEREAS, the Henry County Hazard Mitigation Plan is a multi-jurisdictional hazard mitigation plan prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, the City of Calhoun participated in the preparation of the Henry County Hazard Mitigation Plan; and

WHEREAS, the citizens of the Calhoun have been afforded an opportunity to comment and provide input on the Plan and the mitigation actions therein; and

WHEREAS, the city of Calhoun has reviewed the Plan and affirms that the Plan will be updated no less than every five years

NOW THEREFORE, BE IT RESOLVED by the Board of Aldermen that the City of Calhoun adopts the Vernon County Hazard Mitigation Plan as this jurisdiction's Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this ____ day of _____, 2011 at the meeting of the Board of Aldermen.

Mayor	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**

The following resolution was adopted by the City of Clinton, Henry County, Missouri on _____.

RESOLUTION NO. _____

WHEREAS, the Henry County Hazard Mitigation Plan is a multi-jurisdictional hazard mitigation plan prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, the City of Clinton participated in the preparation of the Henry County Hazard Mitigation Plan; and

WHEREAS, the citizens of the Clinton have been afforded an opportunity to comment and provide input on the Plan and the mitigation actions therein; and

WHEREAS, the city of Clinton has reviewed the Plan and affirms that the Plan will be updated no less than every five years

NOW THEREFORE, BE IT RESOLVED by the Board of Aldermen that the City of Clinton adopts the Vernon County Hazard Mitigation Plan as this jurisdiction's Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this ____ day of _____, 2011 at the meeting of the Board of Aldermen.

Mayor	**Date**
Councilman	**Date**
Councilman	**Date**
Councilman	**Date**
Councilman	**Date**
Councilman	**Date**

RESOLUTION NO. _____
The following resolution was adopted by the City of Montrose, Henry County, Missouri on _____.

RESOLUTION NO. _____

WHEREAS, the Henry County Hazard Mitigation Plan is a multi-jurisdictional hazard mitigation plan prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, the City of Montrose participated in the preparation of the Henry County Hazard Mitigation Plan; and

WHEREAS, the citizens of the Montrose have been afforded an opportunity to comment and provide input on the Plan and the mitigation actions therein; and

WHEREAS, the city of Montrose has reviewed the Plan and affirms that the Plan will be updated no less than every five years

NOW THEREFORE, BE IT RESOLVED by the Board of Aldermen that the City of Montrose adopts the Vernon County Hazard Mitigation Plan as this jurisdiction's Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this ____ day of _____, 2011 at the meeting of the Board of Aldermen.

Mayor	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**

The following resolution was adopted by the City of Urich, Henry County, Missouri on

_____.

RESOLUTION NO. _____

WHEREAS, the Henry County Hazard Mitigation Plan is a multi-jurisdictional hazard mitigation plan prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, the City of Urich participated in the preparation of the Henry County Hazard Mitigation Plan; and

WHEREAS, the citizens of the Urich have been afforded an opportunity to comment and provide input on the Plan and the mitigation actions therein; and

WHEREAS, the city of Urich has reviewed the Plan and affirms that the Plan will be updated no less than every five years

NOW THEREFORE, BE IT RESOLVED by the Board of Aldermen that the City of Urich adopts the Vernon County Hazard Mitigation Plan as this jurisdiction's Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this ____ day of _____, 2011 at the meeting of the Board of Aldermen.

Mayor	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**

The following resolution was adopted by the City of Windsor, Henry County, Missouri on _____.

RESOLUTION NO. _____

WHEREAS, the Henry County Hazard Mitigation Plan is a multi-jurisdictional hazard mitigation plan prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, the City of Windsor participated in the preparation of the Henry County Hazard Mitigation Plan; and

WHEREAS, the citizens of the Windsor have been afforded an opportunity to comment and provide input on the Plan and the mitigation actions therein; and

WHEREAS, the city of Urich has reviewed the Plan and affirms that the Plan will be updated no less than every five years

NOW THEREFORE, BE IT RESOLVED by the Board of Aldermen that the City of Windsor adopts the Vernon County Hazard Mitigation Plan as this jurisdiction's Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this ____ day of _____, 2011 at the meeting of the Board of Aldermen.

Mayor	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**
Alderman	**Date**

The following resolution was adopted by the Clinton 124 School District, Henry County, Missouri on _____.

WHEREAS, Clinton 124 School District participated in the preparation of the Henry County Hazard Mitigation Plan; and

WHEREAS, the citizens and school officials of the City of Clinton have been afforded an opportunity to comment and provide input on the Plan and the mitigation actions therein; and

WHEREAS, the City of Clinton and Clinton 124 District has reviewed the Plan and affirms that the Plan will be updated no less than every five years

NOW THEREFORE, BE IT RESOLVED by the School Board that the Clinton 124 District adopts the Henry County Hazard Mitigation Plan as this jurisdiction's Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this ____ day of _____, 2011 at the meeting of the School Board.

Craig Eaton **Superintendent** **Date**

Dave Garnett **President** **Date**

The following resolution was adopted by the Calhoun R-VIII School District, Henry County, Missouri on _____.

RESOLUTION NO. _____

WHEREAS, the Henry County Hazard Mitigation Plan is a multi-jurisdictional hazard mitigation plan prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, Calhoun R-VIII School District participated in the preparation of the Henry County Hazard Mitigation Plan; and

WHEREAS, the citizens and school officials of Calhoun R-VIII have been afforded an opportunity to comment and provide input on the Plan and the mitigation actions therein; and

WHEREAS, the County and Calhoun R-VIII District has reviewed the Plan and affirms that the Plan will be updated no less than every five years

NOW THEREFORE, BE IT RESOLVED by the School Board that the Calhoun R-VIII District adopts the Henry County Hazard Mitigation Plan as this jurisdiction's Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this ____ day of _____, 2011 at the meeting of the School Board.

Daniel Roberts **Superintendent** **Date**

Bret Ridgway **President** **Date**

The following resolution was adopted by the Davis R-XII School District, Henry County, Missouri on _____.

RESOLUTION NO. _____

WHEREAS, the Henry County Hazard Mitigation Plan is a multi-jurisdictional hazard mitigation plan prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, Davis R-XII School District participated in the preparation of the Henry County Hazard Mitigation Plan; and

WHEREAS, the citizens and school officials of the City of Clinton have been afforded an opportunity to comment and provide input on the Plan and the mitigation actions therein; and

WHEREAS, the City of Clinton and Davis R-XII District has reviewed the Plan and affirms that the Plan will be updated no less than every five years

NOW THEREFORE, BE IT RESOLVED by the School Board that the Davis R-XII District adopts the Henry County Hazard Mitigation Plan as this jurisdiction's Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this ____ day of _____, 2011 at the meeting of the School Board.

Deborah Day **Principal** **Date**

Michael Hendrich **President** **Date**

The following resolution was adopted by the Henry County R-I, Henry County, Missouri on _____.

RESOLUTION NO. _____

WHEREAS, the Henry County Hazard Mitigation Plan is a multi-jurisdictional hazard mitigation plan prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, Henry County R-I participated in the preparation of the Henry County Hazard Mitigation Plan; and

WHEREAS, the citizens and school officials of the City of Windsor have been afforded an opportunity to comment and provide input on the Plan and the mitigation actions therein; and

WHEREAS, the City of Windsor and Henry County R-I has reviewed the Plan and affirms that the Plan will be updated no less than every five years

NOW THEREFORE, BE IT RESOLVED by the School Board that the Henry County R-I School District adopts the Henry County Hazard Mitigation Plan as this jurisdiction's Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this ____ day of _____, 2011 at the meeting of the School Board.

Gordon Myers **Superintendent** **Date**

Cathy Roberts **President** **Date**

The following resolution was adopted by the Shawnee R-III School District, Henry County, Missouri on

_____.

RESOLUTION NO. _____

WHEREAS, the Henry County Hazard Mitigation Plan is a multi-jurisdictional hazard mitigation plan prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, Shawnee R-III participated in the preparation of the Henry County Hazard Mitigation Plan; and

WHEREAS, the citizens and school officials of the County have been afforded an opportunity to comment and provide input on the Plan and the mitigation actions therein; and

WHEREAS, the County and Shawnee R-III has reviewed the Plan and affirms that the Plan will be updated no less than every five years

NOW THEREFORE, BE IT RESOLVED by the School Board that the Shawnee R-III School District adopts the Henry County Hazard Mitigation Plan as this jurisdiction's Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this ____ day of _____, 2011 at the meeting of the School Board.

Nancy Akert **Principal** **Date**

John Dameron **President** **Date**

Appendix B

Sign-In Sheets from Meetings

Brownington Sign in Sheet

Kaysinger Basin Regional Planning Commission

Hazard Mitigation Plan

Location: Brownington

Time: 7:00 p.m. - 8:00

Name	Title
Joyce Griffith	clerk
Steve Schaaf	mayor - temp
B. Dane Bonnett	~~alderman~~ trustee
Brian Lee Bradley	~~alderman~~ trustee
Brent Crowder	trustee
Mike Tyler	citizen
Richard Harsard	citizen
Sheila West	citizen
Julie Evans	citizen
Jerry Goss	citizen
Pat Gregory	citizen
Charlotte Gregory	citizen

Calhoun Sign in Sheet

7:00 – 8:15

KBRPC

Project:	Calhoun Town Hall Meeting	Meeting Date	9/13/10
Facilitator:	Sam Dingfelder	Place:	City Hall

Name	Job Title	Organization Representing	Email
Keith Patten		Northside alderman	
Ina Reddins		city clerk	
[illegible]		Mayor - tem	
Kennith R. Willings		Southside alderman	willing@embarqmail.com
Clint C. Sheets		Fire Chief	
ROBERT HILLS		HENRY CO. SHERIFF'S OFFICE	
Ragena Mize		Calhoun R-VII Superintendent	
Vicki Levy		Resident	SAUCEYMAKER@live.com
CARL Levy		Resident	

Clinton Sign in Sheet

7:30-9

CITY OF CLINTON
OPEN PUBLIC MEETING SIGN IN SHEET

TYPE OF MEETING: Open City Council
DATE: 8-3-10

(All persons attending must list their name and address.)

NAME:	ADDRESS:
Edward L. McLaughlin	Clinton, MO
Samantha Dingfelder	Clinton, MO
Rolf Leed	Clinton MO
Mary Lou Swan	104 N Main Clinton
Gerald D. Byser	609 East Oak

Individuals desiring to speak at the meeting are asked to fill out a speaker card and submit it to the Clerk prior to the call to order. Speakers are respectfully asked to limit their comments to three (3) minutes or less. Speakers will be called on to speak during the appropriate portion of the meeting. Please address your comments to the Mayor/Chairman.

* Council Members on back *

Henry County Sign in Sheet

3-4:15

KBRPC	
Project: Henry County HMP- Meeting	**Meeting Date:** 12 August 2010
Facilitator: Sam Dingfelder- Regional Planner	**Place/Room:** Clinton City Hall

Name	Organization Representing	Email
Sandra Underwood	City of Windsor	windsor@iland.net ✓
Joel Semler	City of Deepwater	Deepwatermayor.com ✓
Gary Mount	City of Clinton	gmount@cityofclintonmo.com ✓
Bob Easton	Henry Co EM A	bdeaston@embarqmail.com
Leo Huff	Clinton Fire Dept	Chief.200@Embarqmail.com

Henry County Sign in Sheet

Henry Co.

Kaysinger Basin Regional Planning Commission

Hazard Mitigation Plan Meeting - Date: 7/13/11

ocation: KBRPC Office **Time:** 3:00 - 4:30

Name:	Title:
Jeanne Beas	Citizen - Windsor
Patricia Puttonen	Alderwoman - Windsor
DARLA Conner	City Clerk - Ulrich
Tina Redding	City Clerk - Calhoun
Deborah Day	Supt. - Davis R-12 School

Deepwater Sign in Sheet

7pm. - 8p.m.

KBRPC

Project:	Deepwater City Hall Meeting	Meeting Date	9/8/10
Facilitator:	Sam Dingfelder	Place:	City Hall

Name	Job Title	Organization Representing	Email (optional)
Ann Fellhoelter	City Clerk	DW	deepwaterclerk@gmail.com
Jon Smith	Chief of Police		deepwaterpd@gmail.com
Sean Ratsik		N. Side Alderman	
Charles Kelley		S. City Councilman	
Joel Semler	Mayor		deepwatermayor@gmail.com
Taylor Bush		citizen Planning Commissioner	
Dolores Hicks		citizen	
Tom Bledsoe		citizen	
Dori Semler		mayor's wife	
Darrell Wolfe		citizen City maintenance	
Billy & Gene Noble		citizen	
John R. McClendon		citizen	
Lavinna C. Young		citizen-	

Urich Sign in Sheet

Urich 7-9

Regular Meeting - Sign In 8/10/10

Visitors

Sam Dingfelder - Kaysinger Basin RPC - Clinton, MO

Frank Charles, Mayor
Ronnie Wehmeyer
Barbara Puckett
Olive Wells
Cindy Neff
Darla Conner, City Clerk
Travis Evans, Sewer/Water Supt
Mike Erwin, Fire Chief
[illegible] Deputy Sheriff

Windsor Sign in Sheet

7:30 - 10:00 p.m.

KBRPC

roject: Henry Co. HMP | **Meeting Date:** 9/14/10

Facilitator: Sam Dingfelder- Regional Planner | **Place/Room:** Windsor City Hall

Name	Title/Organization Representing	Email
Sandra Underwood	City Clerk	Windsor@iland.net
Mike Parris	Alderman	meparris@embarqmail.com
Patricia Rochelle	alderman	alderman3@iland.net
Steve Clubine	Alderman	steveclubine@embarqmail.com
[illegible]	Mayor	
MARTI HOWARD	ALDERMAN	5HOWARDS@EMBARQMAIL.COM
John Morley	Alderman	
Scott Lawson	Alderman	
William Fannon	Clinton Healthcare ~~Editor~~	
Danny Hampton	Windsor Review	news@OUPINC.com
Lois Quigley	Windsor - Retired	lois-quigley2000@yahoo.com
Danielle Haynes	Administrative Assistant	Sgilly255@yahoo.com
[illegible]	Air National Guard/FULLTIME	Prairiedog26@yahoo.com
[illegible]	[illegible]	
ROB HILLS	HENRY CO. SHERIFF'S OFFICE	

Kaysinger Basin Regional Planning Commission	
Henry County Natural Hazard Mitigation Plan	
Location: Kaysinger Basin Headquarters (Clinton)	Date/Time: September 8, 2011 3:00 p.m. -- 4:30

Name	Title
GARY Mount	Comm. Devel. Dir. City of Clinton.
ROBERT L FISTER	DIRECTOR EMA Henry Co
Andy Ford	Middle School Principal Emergency Coordinator
Deborah Day	Davis R-XII Principal
Frank Charles	Mayor City of Urich

Appendix C

Press Releases/ Meeting Announcements

Public Service Announcement for Community Events Calendar, September 9, 2010

On Monday the 13th at Calhoun and Tuesday the 14th at Windsor, Kaysinger Basin Regional Planning Commission will be discussing the public's role in updating the county's Natural Hazard Mitigation Plan at the town hall meetings. A Natural Hazard Mitigation Plan identifies the hazards within each county, the concerns of the citizens in case of a natural disaster, and how to mitigate for such events. This plan is updated every 5 years and is required by Federal Emergency Management Agency (FEMA). Having this plan allows each county and participating cities to apply for federal grants. If you have any questions please contact Sam Dingfelder at Kaysinger Basin Regional Planning Commission at 660-885-3393 or sam@kaysinger.com.

'Natural Hazard Mitigation' Town Hall meetings.....

On Monday, September 13, at Calhoun and Tuesday, September 14, at Windsor, Kaysinger Basin Regional Planning commission will be discussing the public's role in updating the county's Natural Hazard Mitigation Plan at town hall meetings.

Both meetings will be held at the city halls. The Calhoun meeting starts at 7 p.m. on Monday and Windsor's meeting will be at 7:30 p.m. on Tuesday.

A Natural Hazard Mitigation Plan identifies the hazards within each county, the concerns of the citizens in case of a natural disaster and how to mitigate for such events.

This plan is updated every five years and is required by Federal Emergency Management Agency (FEMA).

Having this plan allows each county and participating cities to apply for federal grants.

If you have any questions, please contact Sam Dingfelder at Kaysinger Basin Regional Planning Commission at 660-885-3393 or sam@kaysinger.com.

AN ECONOMIC DEVELOPMENT DISTRICT
KAYSINGER BASIN REGIONAL PLANNING COMMISSION
BATES BENTON CEDAR HENRY HICKORY ST. CLAIR VERNON

KBRPC
A COOPERATIVE OF GOVERNMENTS

Public Service Announcement

Contact: Samantha Dingfelder
Phone: (660) 885-3393

FOR IMMEDIATE RELEASE
July 5, 2011

COMMENT SOUGHT ON HAZARD MITIGATION PLAN

Henry County, MO – The public is encouraged to review and comment on the new Henry County Natural Hazard Mitigation Plan before it is finalized. This plan was created to reduce losses to communities from damage caused by natural hazard events.

Taxpayers pay billions of dollars each year for disaster recovery. Some events are predictable, and often, damages can be reduced or eliminated. The federal Disaster Mitigation act of 2000 requires communities to develop an approved local hazard mitigation plan to remain eligible for certain federal funding.

Kaysinger Basin Regional Planning Commission, along with local agencies and local school districts have worked together to develop this plan. The planning committee addressed natural and man-made hazards – ranging from flooding to tornados, severe winter weather, flood/levee damage and earthquakes – and considered the impacts of these events on local communities. Please feel free to view the plan on Kaysinger Basin's website at www.kaysinger.com under the "Hazard Mitigation" tab after July 22nd.

The time, location and date of this public meeting is as follows:

Date: Wednesday July 13th
Time: 3:00 pm
Place: Kaysinger Basin Office
908 N. Second St.
Clinton, MO 64735

-End-

908 North Second Street – Clinton, Missouri 64735 - (660) 885-3393 phone - (660) 885-4166 fax

Clinton Daily Democrat

Thursday, July 7, 2011 Page 15

Hazard Mitigation Plan to be explained

The public is encouraged to review and comment on the new Henry County Natural Hazard Mitigation Plan before it is finalized. This plan was created to reduce losses to communities from damage caused by natural hazard events.

Taxpayers pay billions of dollars each year for disaster recovery. Some events are predictable, and often, damages can be reduced or eliminated. The federal Disaster Mitigation act of 2000 requires communities to develop an approved local hazard mitigation plan to remain eligible for certain federal funding.

Kaysinger Basin Regional Planning Commission, along with local agencies and local school districts have worked together to develop this plan. The planning committee addressed natural and man-made hazards-ranging from flooding to tornadoes, severe winter weather, flood/levee damage and earthquakes-and considered the impacts of these events on local communities. Please feel free to view the plan on Kaysinger Basin's website at www.kaysinger.com under the "Hazard Mitigation" tab after July 22.

The time, location and date of this public meeting is as follows: Wednesday, July 31, 3 p.m. at the Kaysinger Basin Office, 908 N. Second Street, Clinton.

AN ECONOMIC DEVELOPMENT DISTRICT

KAYSINGER BASIN REGIONAL PLANNING COMMISSION

BATES BENTON CEDAR HENRY HICKORY ST. CLAIR VERNON

KBRPC

A COOPERATIVE OF GOVERNMENTS

Clinton School District
Superintendent
1106 S. 2nd St.
Clinton, MO 64735

Re: Henry County Natural Hazard Mitigation Plan

To whom it may concern;

Kaysinger Basin is currently in the process of updating the Henry County Natural Hazard Mitigation Plan. This plan is updated every 5 years and is critiqued by the State Emergency Management Agency (SEMA) and is ultimately approved by FEMA. This document allows 'participating jurisdictions' to apply for FEMA grants and will help with natural disaster reimbursement funds like those received in the Joplin tornado disaster. Each county has a hazard mitigation plan in which federal, state, and local emergency officials use in the event of a natural disaster.

Kaysinger Basin is hosting a meeting on July 13 at the Kaysinger Basin Regional Planning Commission office at 3:00. This meeting will discuss the update process, specific sections for each city, school, county, and copies of the new plan to be implemented after FEMA approval. You may remember providing our staff with some information via worksheets. Your participation and eligibility for this plan hinges on your attendance to this meeting. If someone from your jurisdiction is unable to attend, please notify us immediately and we will make an effort to meet with you at some other time.

This process will also help Henry County offset some of the cost associated with this project. The meeting time will be counted as an in-kind donation of funds. If you have any questions please feel free to contact us;

Sam Dingfelder
Phone: 660-885-3393
Fax: 660-885-4166
Email:

Tom L. Hutchings
Phone: 660-885-3393
Fax: 660-885-4166
Email:

908 North Second Street – Clinton, Missouri 64735 - (660) 885-3393 phone - (660) 885-4166 fax

Wed. Aug. 10, 2011

daily 1:45 6:45 9:15 (reg adm + $2 3D fee)

COWBOYS & ALIENS PG13dlp
daily 1:50 4:15 6:50 9:15

SMURFS 2D PGdlp(reg adm)
daily 4:10 6:55

SMURFS 3D PG realD 3D
daily 1:55 9:10 (reg adm + $2 3D fee)

CHANGE UP Rdts
daily 1:50 4:10 6:50 9:10

RISE OF THE APES PG13dts
daily 1:55 4:10 6:55 9:10

Starts Fri *30 MIN OR LESS Rdts
daily 2:00 4:00 7:00 9:00

Starts Fri *FINAL DESTINATION 5 3D R (reg adm + $2 3D fee)
daily 2:05 4:05 7:05 9:05

(*no passes) Please no children under 5 in PG13 or R after 6pm

Regional Weather.....

(continued from page one)

highs in the upper 70's, northeast winds 10-15 mph with gusts to around 25 mph, chance of rain 80 percent. Wednesday night, mostly cloudy, chance of showers and thunderstorms in the evening, lows in the lower 60's, east winds five to 10 mph, chance of rain 50 percent. Thursday, partly sunny, highs in the mid-80's, east winds five to 10 mph. Thursday night, mostly cloudy, chance of showers and thunderstorms after midnight, lows in the upper 60's, chance of rain 40 percent.

NARFE to meet.....

(continued from page one)

letting you know what is happening and an Internet site to assist you with retirement and current and many other issues.

If you cannot attend meetings and wish to join or get further information on this and other issues, go to www.narfe.org on the Internet or contact Jim Hegendeffer at 660-351-2790.

Comments sought....

Kaysinger Basin Regional Planning Commission is now accepting comments and suggestions on the Henry County Natural Hazard Mitigation Plan.

The plan is posted on the website at www.kaysinger.com under the "Hazard Mitigation" tab.

Please submit comments via e-mail or other writing, but not by phone. Everything must be well documented.

You may send e-mail at sam@kaysinger.com or tom@kaysinger.com.

EXPRESS YOUR OPINION
The Clinton Daily Democrat
P.O.Box 586
Clinton, MO 64735

This. Sept. 1, 2011

'Listening Post' in Clinton this Friday.....

Congresswoman Vicky Hartzler announces a 4th Congressional District Listening Post has been scheduled for Sept. 2 in Clinton at the Henry County Courthouse, 100 West Franklin, 10 a.m.-12 noon.

Each Listening Post held throughout the 4th District is hosted by a member of Congresswoman Hartzler's staff and is intended to provide citizens the opportunity to discuss matters of importance to them.

Hartzler staff member Shaelyn McClanahan will meet with constituents and report back to the Congresswoman.

For more information, contact Congresswoman Hartzler's Harrisonville office at (816) 884-3411.

Hazard Mitigation...

Kaysinger Basin Regional Planning Commission is hosting a final meeting for the Henry County Natural Hazard Mitigation Plan before submitting the completed copy to SEMA. The meeting will be held Thursday, Sept. 8, 3 p.m., at the Kaysinger Basin Office, 908 North Second Street, Clinton.

This plan, once approved by SEMA and FEMA, will provide federal disaster mitigation fund opportunities and become a proper document to be used in the event of a natural disaster, along with an emergency operations plan.

This plan was created to reduce losses to participating jurisdictions from damage caused by natural hazards events.

Taxpayers pay billions of dollars each year for disaster recovery. Some events are predictable and often damages can be reduced or eliminated.

The state of Missouri is taking preventative measures to ensure electric cooperatives are eligible for receiving Federal Emergency Management Agency (FEMA) and SEMA grant funding through this natural hazard mitigation plan.

aghast as we are that stalker been targeted. Often, being pr or incidents which have occu volves an "unpalatable" situati have its virtues. As Edmund B for evil to triumph is for good folded 5 x 7 handbills proclain of hate. It is from the National Nazi Swastika appears on a sm American Flag. Headquartered nutty groups who pretty much Which means they probably ha you and I. There are Veterans of tected us from evil fighting Naz and stood against the many freec country. The same holds true for Japan and their own version of handbill in this newspaper woul sands of households in our area. years have seen messages of hate messages are constitutionally pr privileges....the parameters of whi shame these National Socialist Mc ing in our area.

In the 1920s, we had a number Ku Klux Klan in Henry County. On Senator from Oklahoma had some rally, it is said, took place in Bethe Socialist Movement, this reprehens and didn't like most people nor ma the 1920s, the Henry County KKK faith who had a grocery store on the would be trouble unless the grocer men in Clinton, including some fro force. Most were Veterans of World W number were members of area bank institutions. They had a rotating wa and nothing materialized. It was lar masterful thing on the side. They pa to the grocer or his firm, certain loa leadership of the Henry County KKI things down considerably and in a fe was virtually extinct. Hint. Trade has tor in the history of the human race.

***

These were passed on to me.

HANDY DUAL O

Jack made his way through veterin taxidermist.

Upon graduation, he decided he cou better serve the needs of his patients ar his practice and, therefore, his income.

He opened his own offices with a sh Jones, Veterinary Medicine and Taxider dog back!"

***

THE CAR P

For the second time in a row, I was fo with whom I car-pooled to our children and explained that my husband had th able to take my turn.

A few minutes before she was due to p showed up. Since it was too late for me after all, I asked my husband to hide the inside. I also explained to my son that he about his father's whereabouts.

Unfortunately, my husband forgot and chatting with a friend when my carpool pa returned from practice. I asked him if she

"Yes," he replied, "she asked me which the house was my father. But don't worry

***

Have a great day. Thank you for you support. Your friend, D

Classifieds Get Res