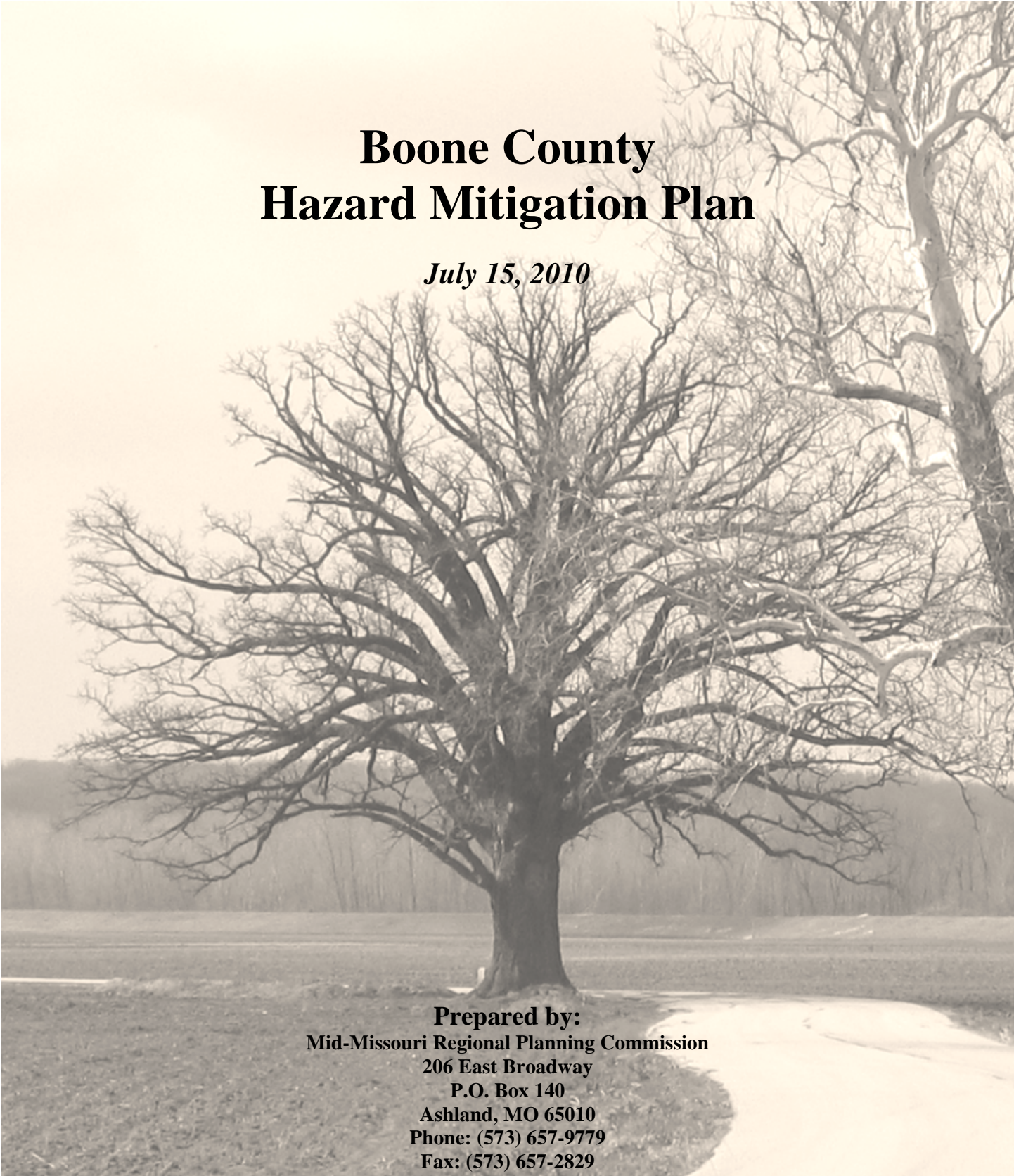


Boone County Hazard Mitigation Plan

July 15, 2010



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Cover Photo: The 90 foot Missouri Champion Bur Oak near McBaine has survived fire, several lightning strikes, and untold numbers of floods and droughts in its 350 plus years of life in the Missouri River floodplain. With its superior genetic makeup, it stands as a fitting symbol for effective hazard mitigation in Boone County. *(Photo courtesy of Tim Williams, Boonville, MO.)*

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Executive Summary

The Boone County Hazard Mitigation Plan is a multi-jurisdictional plan prepared and written with the active participation of nineteen jurisdictions in Boone County (the county itself, nine communities, six school districts, two colleges, and one university). Fifteen of these jurisdictions completed the requirements to be considered participating jurisdictions in the plan.

The plan profiles ten natural hazards (dam failure, drought, earthquake, extreme heat, flood, levee failure, land subsidence/sinkhole, severe winter weather, tornado/thunderstorm, and wildfire) which threaten lives and property in some, or all, of the participating jurisdictions. Each hazard has been evaluated with regard to its previous occurrence, probability and severity of future occurrence, existing mitigation strategies in place to deal with it, and its potential impact on each jurisdiction.

An overall mitigation strategy has been developed through thoughtful consideration of the threats involved and the time, resources, and willpower to mitigate their effects. The goals of this mitigation strategy are:

Goal 1: Mitigation Planning - Mitigate effects of future natural hazards throughout the County through public and private action.

Goal 2: Mitigation Policy - Develop policies that limit the impact of natural hazards on lives and property.

Goal 3: Mitigation Programs - Implement cost effective and feasible mitigation programs to protect lives and property of Boone County jurisdictions.

Goal 4: Public Awareness - Increase public awareness of natural hazards in order to make the public a greater partner in hazard mitigation planning.

Goal 5: Future Development - Promote hazard-proof development in the jurisdictions of Boone County.

Specific mitigation actions have been developed and prioritized by each participating jurisdiction to further the goals of the overall mitigation strategy.

The Boone County Hazard Mitigation Plan will be adopted by resolution of each of the participating jurisdictions. Participation in, and formal adoption of, this plan qualifies a jurisdiction to apply for Federal Emergency Management Agency (FEMA) pre-disaster mitigation grants and the mitigation portion of post-disaster mitigation grants.

The plan will be updated in five years, as required by FEMA. It will be evaluated and maintained on a yearly basis prior to this update.

Prerequisites

Multi-Jurisdictional Plan Adoption

<i>Requirement §201.6(c)(5):</i>	<i>For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.</i>
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Adoption resolutions for the participating jurisdictions are included in Appendix A.

Section 1: Introduction and Planning Process

1.1 Purpose

The Boone County Hazard Mitigation Plan is designed as a resource for county and municipal governments, residents, developers, organizations, and others interested in controlling the potentially disastrous effects of natural hazards in Boone County. Each year natural hazards take a great toll in the United States. Boone County is not immune; it is subject to numerous natural hazards which can threaten life and property. A well-conceived mitigation strategy, developed through an inclusive and thoughtful planning process, is an important step in protecting citizens and reducing loss.

The Federal Emergency Management Agency (FEMA) defines mitigation as “sustained action taken to reduce or eliminate long-term risk to people and their property from hazards and their effects.” A 2006 study by the Institute for Building Science found that \$4 was saved in post-disaster response and recovery for every \$1 spent on pre-disaster mitigation.

The Boone County Hazard Mitigation Plan was developed by the communities and citizens of Boone County, their elected officials and public servants. The process was carried out by identifying the natural hazards that impact Boone County and its residents, assessing the probability of occurrence and severity posed by each hazard, identifying the most vulnerable areas, and evaluating all possible mitigation actions which might be effective. Potential mitigation actions were assessed and prioritized based on the perceived need, probable outcome, potential for being executed, and benefit related to cost.

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

Multiple jurisdictions within Boone County participated in the development of this plan. Having a current and approved hazard mitigation plan makes each of the participating jurisdictions eligible to apply for FEMA pre-disaster mitigation grants and the mitigation portion of post-disaster mitigation grants.

1.2 Background

Responding to and mitigating for natural disasters has been a subject of increasing focus for the federal government in the past decades.

The process for declaring Presidential Disasters was established with the passage of the Disaster Relief Act of 1974. In 1988, the Robert T. Stafford Disaster Relief and Emergency Assistance Act created the organizational framework through which funds and assistance would be provided after a Presidential Disaster Declaration; FEMA was designated to coordinate the relief efforts.

In 1993, FEMA created the Mitigation Directorate to oversee hazard mitigation. This established mitigation as the cornerstone of emergency management.

The Disaster Mitigation Act of 2000 further defined activities related to disaster relief and mitigation; one of its provisions encourages development of hazard mitigation measures, including land use and construction regulations.

1.3 History of the Boone County Hazard Mitigation Plan

In November 2003, 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. Boone County, a member of the Mid-Missouri Regional Planning Commission (Mid-MO RPC), contracted with the Mid-MO RPC to facilitate the development of a hazard mitigation plan for the county.

A Project Steering Committee was formed to oversee the planning and writing of the original Boone County Hazard Mitigation Plan in 2004. The plan was approved by FEMA and adopted by the participating jurisdictions in the spring of 2005.

Maintenance of Hazard Mitigation Plan 2005- 2009

The Boone County Hazard Mitigation Plan 2005 was written to be a working document to guide participating jurisdictions in the county in the work of mitigating potential hazards. To this effect, the plan has been publicly available on the website of the Mid-MO RPC (www.mmrpc.org) since it was approved and adopted in 2005.

During the ensuing years, the Mid-MO RPC has kept the jurisdictions informed of mitigation grant opportunities through letters, the RPC’s monthly newsletter (*The Current*), and announcements at meetings of the RPC.

Fourteen of the mitigation actions decided upon in the original plan have been implemented or completed at this time. A table of these completed mitigation actions is included in Section 4 of this plan (see Figure 4.1).

The maintenance plan in the original document called for an annual review of the plan by the Boone County Hazard Mitigation Steering Committee, facilitated by the Mid-MO 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.

1.4 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 Boone County Hazard Mitigation Plan is a multi-jurisdictional plan. Planners from the Mid-MO RPC (Plan Author) developed the following criteria 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 by the Technical Steering Committee 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

The participating jurisdictions in the original plan (2005) and those participating to any degree in the updated plan (2010) are shown in Figure 1.1. 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.

The chart in Figure 1.1 also tracks the completion of the criteria for inclusion as a participating jurisdiction in the plan. The column on the far right of the chart (“2010 Participating Jurisdictions”) indicates those jurisdictions which have completed the above requirements and are requesting approval of the plan prior to formal adoption. It should be noted that both Stephens College and Columbia College are private entities; Stephens College participated to the same degree in the planning process as other participating jurisdictions.

The primary representatives for each jurisdiction participating to any degree in the update process are shown in Figure 1.2. 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.

The following jurisdictions have participated in the planning process and been in further communication with the Plan Author but have not completed all of the preliminary requirements for consideration as participating jurisdictions: City of Harrisburg, Hallsville R-IV School District, Harrisburg R-VIII School District, and Columbia College. A representative from the Village of Pierpont attended an initial meeting where the plan was presented and a draft reviewed, but there has been no further participation since that point. Information regarding these jurisdictions is included in the plan even though they have not fulfilled the requirements for consideration as participating jurisdictions at this point.

The Village of McBaine was contacted regarding participation in the plan but no response was received. Information about McBaine is included in the plan, although it does not appear that McBaine will be a participating jurisdiction.

Figure 1.1 Multi-jurisdictional Plan Participants							
Jurisdiction	2005 Participating Jurisdiction	2010 Planning Participation	2010 Participating Jurisdiction Criteria				2010 Participating Jurisdiction
			Survey Completed	Review of Draft	Mitigation Actions	Formal Adoption	
Boone County	x	x	x	x	x		x
City of Ashland	x	x	x	x	x		x
City of Centralia	x	x	x	x	x		x
City of Columbia	x	x	x	x	x		x
City of Hallsville	x	x	x	x	x		x
Village of Hartsburg	x	x	x	x	x		x
City of Huntsdale	x	x	x	x	x		x
City of Rocheport	x	x	x	x	x		x
City of Sturgeon	x	x	x	x	x		x
Centralia R-VI School District		x	x	x	x		x
Columbia Public Schools		x	x	x	x		x
Southern Boone School District		x	x	x	x		x
Sturgeon R-V School District		x	x	x	x		x
Stephens College		x	x	x	x		x
University of Missouri		x	x	x	x		x
Village of Pierpont		x		x			
City of Harrisburg	x	x		x			
Hallsville R-IV School District		x		x			
Harrisburg R-VIII School District		x		x			
Columbia College		x		x			

Figure 1.2

Jurisdictional Planning Representatives

Jurisdiction	Planning Representative	Position	2010 PARTICIPATING JURISDICTION
Boone County	Karen M. Miller	County Commissioner, District 1	x
City of Ashland	Chris Heard	City Administrator	x
City of Centralia	Lynn P. Behrns	City Administrator	x
City of Columbia	Steve Hunt	Manager of Environmental Services, Dept. of Public Works	x
City of Hallsville	Bob Hipple	City Administrator	x
Village of Hartsburg	Nancy Grant	Mayor	x
City of Huntsdale	Debby Lancaster	Mayor	x
City of Rocheport	John Zondca	Mayor	x
City of Sturgeon	Gene Kelly	Mayor	x
Centralia R-VI School District	Darin Ford	Superintendent	x
Columbia Public Schools	Preston Bass	Coordinator of Safety and Security	x
Southern Boone School District	Rick Briedwell	Building, Grounds & Transportation Director	x
Sturgeon R-V School District	Shawn Schultz	Superintendent	x
Stephens College	Tony Coleman	Director of Campus Security	x
University of Missouri	Peter Ashbrook	Director of Environmental Health and Safety	x
Village of Pierpont	Justin John	Chairman	
City of Harrisburg	Kathy Wilhite	City Clerk	
Hallsville R-IV School District	Don Lewis	District Safety Coordinator	
Harrisburg R-VIII School District	Tony Perkins	School Resource Officer	
Columbia College	Bob Klausmeyer	Director of Campus Safety	

1.5 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 Boone County Hazard Mitigation Plan was directed by planners from Mid-MO RPC (Plan Author) 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 Mid-MO RPC staff in expectation of an MOA from SEMA for the update (April-Aug. 2009)
2. Preliminary discussions with the Boone County Commission and SEMA regarding the update of the Boone County Hazard Mitigation Plan (July 2009)
3. MOA for Update of Boone County Hazard Mitigation Plan received from SEMA (Aug. 2009)
4. Formation of a Technical Steering Committee to prepare preliminary draft of the update and provide input throughout the update process (Aug. 2009)
5. Meetings with Technical Steering Committee to prepare update including pre-analysis of mitigation actions and their prioritization for the participating jurisdictions (Sept.-Nov. 2009)
6. Draft of update due at SEMA for review (Oct. 30, 2009)
7. Survey to officials of participating jurisdictions on capabilities, vulnerable assets, and future development (Dec. 2009)
8. Presentation of update draft to officials of participating jurisdictions, neighboring jurisdictions, the public, interested agencies, businesses, and non-profits (Dec. 15, 2009)
9. Feedback from participating jurisdictions on mitigation actions and their prioritization decisions for their jurisdictions (Dec. 2009-Jan. 2010)
10. Incorporation of survey information and mitigation actions feedback from participating jurisdictions into update draft (Dec. 2009-Jan. 2010)
11. Continuing work by Technical Steering Committee on reviewing the update progress (Dec. 2009-Jan. 2010)
12. Presentation of final draft for public comment before submission for SEMA/FEMA final approval (Jan. 19, 2010)
13. Final plan due at SEMA for submission to FEMA (Jan. 30, 2010)
14. 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 Mid-MO RPC, which works with communities throughout Boone County, initiated the formation of the committee and participated in the committee meetings.

The Director of the Office of Emergency Management (OEM) and Public Safety Joint Communications (PSJC) was invited to be on the committee. OEM/PSJC directs emergency management for all of Boone County, including both the unincorporated areas and the incorporated communities (Ashland, Centralia, Columbia, Hallsville, Harrisburg, Hartsburg, Huntsdale, McBaine, Pierpont, Rocheport, and Sturgeon).

The City Administrator of the City of Ashland was invited to be on the committee to represent the interests of the smaller communities in the county.

The Building, Grounds & Transportation Director for the Southern Boone School District was invited to participate on the committee to represent the interests of the school districts in the smaller communities and rural areas.

Inquiry letters were sent to the Boone County Commissioners and the Director of the Planning and Development Department in the City of Columbia (the largest city in the county) asking for designation of other appropriate individuals for the committee. Outreach was also made to the Columbia Public Schools and to the University of Missouri for designation of appropriate individuals.

The Technical Steering Committee consisted of the following individuals:

Rachel Bacon, Planner, Columbia Planning and Development Department
Preston Bass, Coordinator of Safety and Security, Columbia Public Schools
Rick Briedwell, Building, Grounds & Transportation Director, Southern Boone School District
Derin Campbell, Acting Director, Boone County Public Works
Susan Galeota, Administrative Assistant, Mid-MO Regional Planning Commission
Chris Heard, City Administrator, City of Ashland
Steve Hunt, Manager of Environmental Services, Columbia Department of Public Works
Karen M. Miller, Commissioner, Boone County Commission
Ryland Rodes, Planner, Boone County Planning & Building Department
Zim Schwartze, Director, Office of Emergency Management and Public Safety Joint Communications for Columbia and Boone County
Katrina Thomas, Regional Planner/GIS Specialist, Mid-MO Regional Planning Commission
Jason Warzinik, GIS Manager, Boone County GIS Department

Technical Steering Committee Meetings

Regular meetings of the Technical Steering Committee were held from September through November 2009. A brief summary of each meeting is shown in Figure 1.3. Sign-in sheets for each meeting are included in Appendix B.

Figure 1.3		
Technical Steering Committee Meetings		
Meeting	Agenda	Meeting Date
Technical Steering Committee #1	General introduction to Boone County Hazard Mitigation Plan; overview of sections of plan and hazards profiled; review of goals, objectives and actions in current plan.	Sept. 16, 2009
Technical Steering Committee #2	Discussion of and consensus on updating all sections of plan; review of hazard profiles and actions for severe winter weather, tornado and thunderstorm, extreme heat, wildfire, and flood.	Oct. 9, 2009
Technical Steering Committee #3	Discussion of and consensus on removing extraneous information which does not bear directly on hazard mitigation; review of hazard profiles and actions for flood, dam failure, levee failure, drought, earthquake, and land subsidence/sinkhole; formation of a storm water subcommittee.	Oct. 16, 2009
Storm Water Subcommittee	Discussion of and consensus on storm water mitigation actions to be included in updated plan.	Oct. 20, 2009
Technical Steering Committee #4	Prioritization of mitigation actions with consideration given to benefit/cost, feasibility, timeframe, appropriate jurisdiction, and lead organizer.	Nov. 6, 2009
Technical Steering Committee #5	Completion of prioritization from Mtg. #4; overall review of mitigation goals, objectives, and actions; discussion and consensus on Plan Maintenance.	Nov. 30, 2009

Summary of Update of the Plan

The Technical Steering Committee decided that each section of the plan needed to be updated. The original plan was written early in FEMA's decision making cycle regarding requirements for Hazard Mitigation Plans. It 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.

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

Figure 1.4 General Review and Update of Plan by Section		
Description	Revised	Pages (Original Plan)
<p>Section 1: Introduction Moved some material from Section 1 to more appropriate sections in the plan. Added some material and reorganized according to the following subsections: Purpose, Background, History of the Boone County Hazard Mitigation Plan, Participating Jurisdictions, and The Update Process. Material on Plan Monitoring was moved to a new Section in updated plan (Section 5: Plan Maintenance Process).</p>	Yes	9-17
<p>Section 2: Community Profile Removed and updated community profiles. 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.</p>	Yes	18-43
<p>Section 3: Risk Assessment Reviewed all charts and graphs and updated with current information, as necessary; 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 Hazard Mitigation Plan 2007. Reorganized hazard profiles and made specific changes to each hazard profile to make the plan a more relevant and useful document. Removed all vulnerability assessment charts to update data and reformat per FEMA guidelines.</p>	Yes	44-131
<p>Section 4: Capability/Vulnerability Assessment Section removed entirely: Capability Assessment moved to Section 2; Vulnerability Assessment was already in Section 3 of original plan, despite the name of Section 4.</p>	Yes	132-151
<p>Section 5: Mitigation Goals and Strategies Updated the Mitigation Goals, Objectives, and Actions to reflect decisions made by the Technical Steering Committee and 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.</p>	Yes	152-166
<p>Section 6: Plan Maps Removed all maps; numerous new maps created.</p>	Yes	167-175
<p>Appendices Replaced appendices with appropriate ones for update.</p>	Yes	176-205

Given the above structural changes, the current plan's organization is:

- Section 1: Introduction and Planning Process
- Section 2: Planning Area Profile and Capabilities
- Section 3: Risk Assessment
- Section 4: Mitigation Strategy
- Section 5: Plan Maintenance Process
- Section 6: Maps
- Appendices

Requirement §201.6(b):	<i>In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;</i>
Requirement §201.6(b):	<i>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;</i>

Educators Meeting

A meeting for representatives of the six school districts, Columbia College, Stephens College, and the University of Missouri was held on Dec. 11, 2009 at the Roger B. Wilson Boone County Government Center. An overview of the plan was presented; the educational representatives then discussed and came to consensus on mitigation actions for the educational institutions. A sign-in sheet for this meeting is included in Appendix B.

Public Meetings for Comment and Input

Two meetings were held for public comment and input on the update of this plan. The first meeting was held during the drafting stage and the second prior to the plan being submitted for approval by FEMA. Public notice was given for the meetings in accordance with Missouri’s “Sunshine Law” (Revised Statutes of Missouri 610.010, 610.020, 610.023, and 610.024.) The meetings were also announced through various media outlets.

First Meeting for Public Comment and Input

A first meeting for public comment and input on the plan update was held on Dec. 15, 2009 in the County Commission Chambers, Roger B. Wilson Boone County Government Center, Columbia. An overview of the plan was presented with an opportunity for feedback, comments, and questions. It was emphasized at the meeting that the current draft of the update is always available online at: www.mmrpc.org (Library Section). A sign-in sheet for this meeting is included in Appendix B.

Media notice for the Dec. 15, 2009 meeting for public comment was given through the following venues:

- Mid-MO Regional Planning Commission e-newsletter (December 2009) – An article on the public meeting was included in the e-newsletter sent to a contact list of approximately 250 on

Dec. 7, 2009 (see Appendix C). The contact list is comprised of county/community officials, emergency management personnel, economic development directors, and other interested parties throughout the 6 county region of the Mid-MO RPC.

- KOPN Community Radio (89.5 FM): A Public Service Announcement was submitted on Dec. 7, 2009 to be read as often as possible until the time of the meeting (see Appendix C). KOPN broadcasts from Columbia with a listening area which covers Boone County and parts of neighboring counties; the broadcast also streams live on the internet.
- Roger B. Wilson Boone County Government Center bulletin boards: A Public Notice of the meeting was posted beginning on Dec. 8, 2009 (see Appendix C).
- KBIA Events Calendar Online: KBIA is the local National Public Radio affiliate. An announcement was posted on their website at: <http://www.kbia.org/events/events-calendar.php> beginning on Dec. 8, 2009.
- Columbia Daily Tribune newspaper online edition: A meeting announcement was in the calendar of upcoming events beginning on Dec. 12, 2009.
- Columbia Daily Tribune newspaper print edition: A meeting announcement was in the calendar of upcoming events on Dec. 14, 2009.

Second Meeting/Open House for Public Comment and Input

A second meeting/open house for public comment and input on the draft of the plan was held on January 19, 3:00-6:30 PM at the Mid-Missouri Regional Planning Commission, 206 E. Broadway, Ashland. Prior to this meeting, the draft of the plan was made available to the public in the reference sections of the Columbia Public Library and the Southern Boone County Public Library in Ashland. A sign-in sheet for this meeting is included in Appendix B.

Media notice for the January 19, 2009 meeting/open house was given through the following venues:

- Mid-MO Regional Planning Commission January 2009 e-newsletter (see Appendix C).
- Mid-MO Regional Planning Commission website: A notice of the meeting was posted on the home page (see Appendix C).
- KOPN Community Radio (89.5 FM): A Public Service Announcement was submitted on Jan. 11, 2009 to be read as often as possible until the time of the meeting (see Appendix C).
- KBIA Events Calendar Online: An announcement was submitted on Jan. 11, 2009 for posting on the KBIA website: <http://www.kbia.org/events/events-calendar.php>.
- Columbia Daily Tribune online: A meeting announcement was submitted on Jan. 11, 2009.

- Columbia Tribune newspaper print edition: A press release/meeting announcement was sent on Jan. 11, 2009 (see Appendix C).
- Columbia Missourian print and online editions: A meeting announcement/press release was sent on Jan. 11, 2009 (see Appendix C).

Requirement
§201.6(b):

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

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

- Missouri State Hazard Mitigation Plan (2007), State Emergency Management Agency (SEMA)
- Boone County Emergency Operations Plan
- SEMA Situation Reports (<http://sema.dps.mo.gov/SitReps/Situation%20Reports.htm>)
- Comprehensive Economic Development Strategy for the Mid-MO Region (2009)
- Long Range Transportation Plan (LRTP), Missouri Department of Transportation
- Regional Transportation Plan (2009), Mid-MO Regional Planning Commission
- Atlas of Missouri Ecoregions, Missouri Department of Conservation
- Missouri Drought Plan (2002), Missouri Department of Natural Resources
- Hinkson Creek Watershed Management Plan
- Bonne Femme Watershed Plan (February, 2007)
- Boone County Storm Water Ordinance (draft)

Section 2: Planning Area Profile and Capabilities

2.1 History

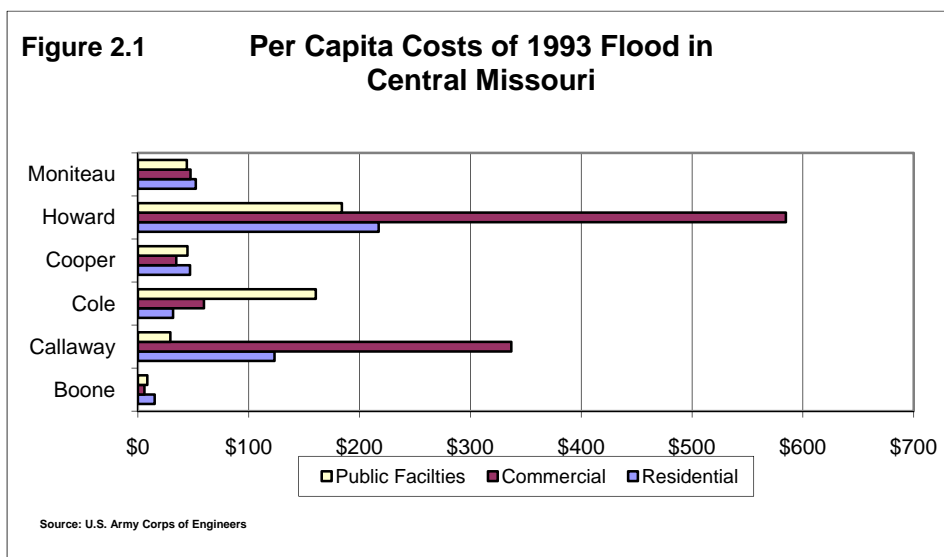
Boone County, presently the most populous county in central Missouri, was established in 1821. The county was named for Daniel Boone, one of the most popular icons of early American settlement.

Boone County did not rise to a level of prominence in the state until the University of Missouri, the first public university west of the Mississippi, was established in Columbia in 1839. Nine hundred Boone County citizens won the bid for the university by pledging \$117,921 in cash and land. The location of the university in Columbia has meant increased development for Boone County ever since. The university continues to attract students from all over the state, country, and world to study and work in the region.

2.2 Natural Hazard History

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

The historic Missouri River Floods of 1993 and 1995 caused extensive damage in several areas of the county. Boone County fared better than other counties in the mid-Missouri region in terms of direct loss (see Figure 2.1). However, Boone County is an economic and social center in the region; when surrounding counties and cities are impacted by a natural hazard, Boone County feels an associated impact.



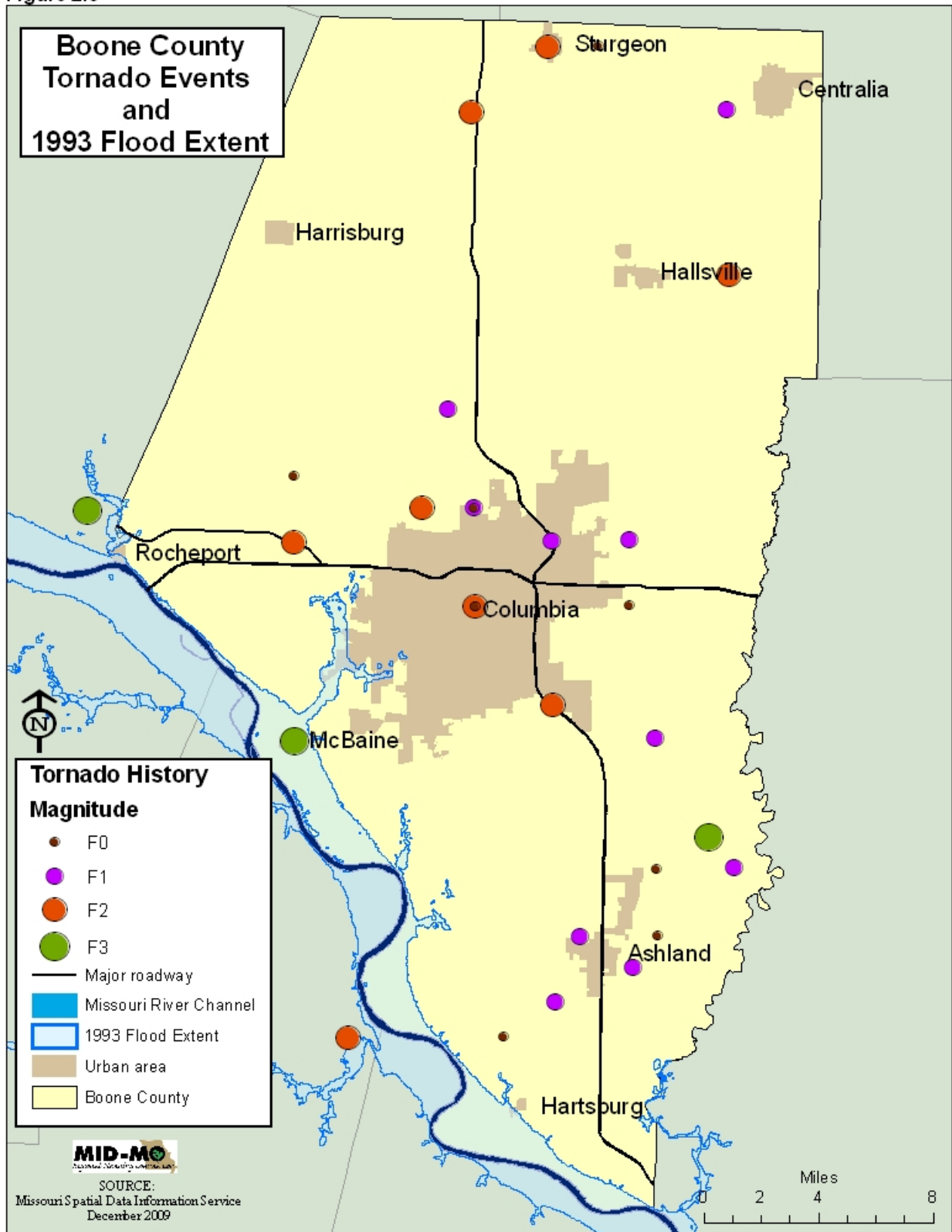
In 1998 a tornado destroyed part of the Southridge subdivision in Columbia (see Figure 2.2). There was no loss of life but property destruction was significant resulting in an approximate six million dollar loss, according to statistics from the Missouri Climate Center.

Figure 2.2 Southridge Subdivision



The extent of the 1993 flood in Boone County and locations of historic tornado events can be seen in Figure 2.3.

Figure 2.3



2.3 Geography and Ecology

Boone County is located in central Missouri with an area covering 685 square miles. It is located midway between Kansas City to the west and St. Louis to the east.

The county is bordered on the north by Randolph and Audrain counties, on the southwest by the Missouri River, on the west by Cooper, Howard, and Moniteau counties, and on the south and east by Cole and Callaway counties, respectively. The City of Columbia is the county seat and most populous community.

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

Prairie (Claypan Till Plains)

The distinguishing feature of this subsection is the presence of well-developed claypan soils on a flat glacial till plain. Postglacial stream erosion has made little progress in this subsection, and most of the surface is flat or gently rolling with local relief less than 100 feet. Bedrock exposures are rare. Most of the subsection was formerly prairie, with narrow belts of timber along stream courses. Most of the subsection is now farmland, of which a very large percentage is in cropland.

River Hills (Outer Ozark Border Subsection – Woodland Hills, Karst Hills)

The Outer Ozark Border Subsection consists of a belt of deeply dissected hills and bluff lands bordering the Missouri and Mississippi Rivers and several relatively smooth **karst** plains. Relief in the river hills is mostly 200–350 feet. Slopes are steep and bedrock exposures are common. Loess, occasionally very thick, mantles the uplands of the entire subsection. Geologic strata are variable but consist mainly of Mississippian limestone high in the landscape and a variety of Ordovician dolomite formations in the valleys. The ecoregion was historically timbered in oak savanna and woodland, oak and mixed-hardwood forests, and occasional prairie and glade openings. Today, land use is extremely varied, including row crops, improved pasture, and densely wooded valleys. Urbanization pressures are great in the multicounty St. Louis metropolitan area and at Columbia and Cape Girardeau.

Karst, as defined by the United States Geological Survey (USGS), “is a terrain with distinctive landforms and hydrology created from the dissolution of soluble rocks, principally limestone and dolomite. Karst terrain is characterized by springs, caves, sinkholes, and a unique hydrogeology that results in aquifers that are highly productive but extremely vulnerable to contamination.” This land type will be touched on again in the land subsidence and sinkhole hazard profile in Section 2.

Alluvial Plain (Missouri River Alluvial Plain Subsection)

The subsection consists of the Missouri River channel and its adjoining alluvial plain across the northern Ozarks. Formerly the channel contained numerous islands and bars, but in the last half century it has been narrowed, its islands virtually eliminated, and its banks stabilized. Soils are deep and loamy. Pre-settlement vegetation was mostly bottomland forest dominated by riverfront species including willow, cottonwood, sycamore, elm, silver maple, and hackberry. True mixed hardwood forests with oak, sugar maple, walnut, and bitternut hickory were limited to high terraces. The alluvial plain is subject to flooding, although many bottoms have some degree of levee protection. Today land use is chiefly row crops.

Public Land

Boone County has several state owned land areas and one National Forest (see Figure 2.4). 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.

Figure 2.4 Public Land		
Name	Responsible Agency	Acres
Rock Bridge Memorial State Park	Missouri Department of Natural Resources	2272
Mark Twain National Forest (Cedar Creek)	United States Forest Service	~19000
Three Creeks Conservation Area	Missouri Department of Conservation	1506
Eagle Bluffs Conservation Area	Missouri Department of Conservation	3706
Hinkson Woods Conservation Area	Missouri Department of Conservation	80
Green Conservation Area	Missouri Department of Conservation	328
Rocky Forks Lake Conservation Area	Missouri Department of Conservation	2234
Finger Lakes State Park	Missouri Department of Natural Resources	1128
Hartsburg Access	Missouri Department of Conservation	35
Hart Creek	Missouri Department of Conservation	658
Schnabel Woods	Missouri Department of Conservation	79
HJ Waters and CB Moss Wildlife Area	Missouri Department of Conservation	102
Lick Creek Conservation Area	Missouri Department of Conservation	300
Source: Missouri Spatial Data Information Server (MSDIS)		

Incorporated Communities

Boone County consists of the following eleven incorporated communities:

Ashland	Hallsville	Huntsdale	Rocheport
Centralia	Harrisburg	McBaine	Sturgeon
Columbia	Hartsburg	Pierpont	

The Missouri River

The Missouri River's relationship to Boone County deserves special attention because the river is the defining physical feature in Mid-Missouri and it surrounds the southwestern border of the county.

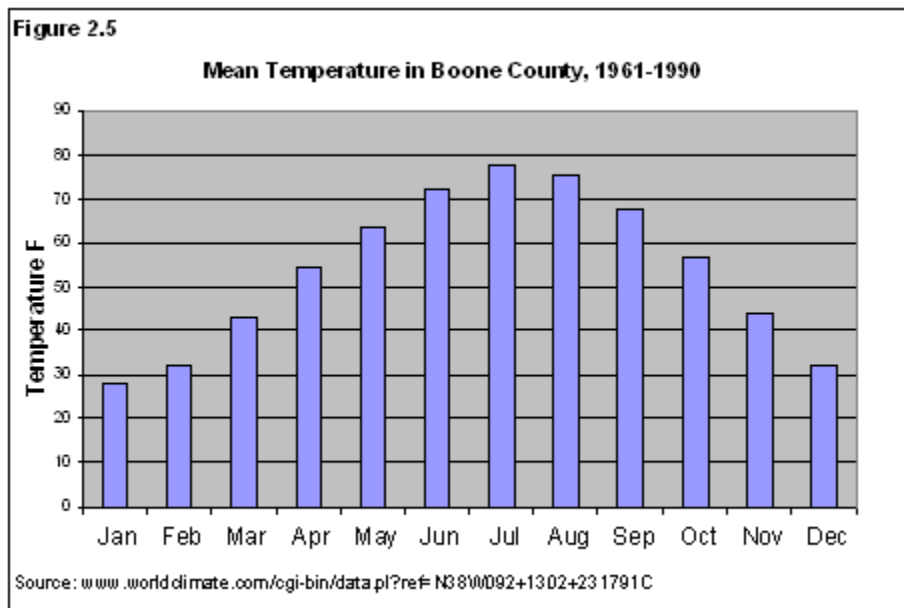
The Missouri River drains approximately one sixth of the United States and is the longest river in the country. Flood control structures, power plants, and other engineering projects have profoundly changed the course of the river.

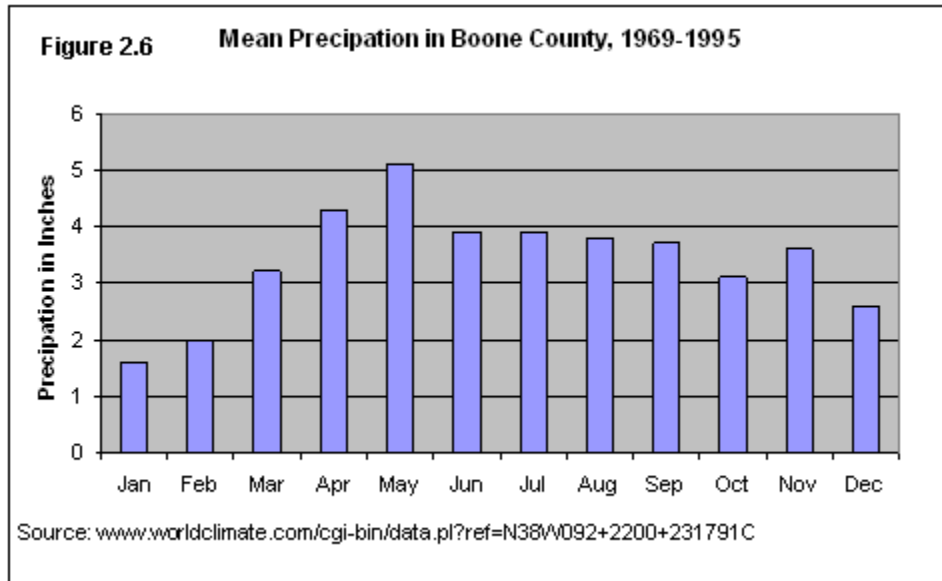
The Missouri River has also been designated as the most endangered river in the country according to American Rivers, an environmental watchdog group; this is largely due to the regulation of flow by upriver dams in other states. Riparian restoration work and development upstream can and will impact Boone County.

2.4 Climate

Mean annual precipitation for Boone County is 40–42 inches. The wettest months are May–June and September; 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 17–18°. Mean July maximum daily temperature is 90°.

Boone 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 Boone County does have extreme variations in weather at times, there is a seasonal pattern. Figures 2.5 and 2.6 demonstrate temperature and precipitation trends.





2.5 Form of Government

Boone County is considered a Class 1 county, with an assessed value of \$2,304,493,856. According to the US Census Bureau, the estimated population in 2008 was 154,365. The county government consists of the County Commission which oversees the following offices: Assessor, Auditor, Collector, Clerk, Public Administrator, Public Attorney, Recorder, Sheriff, and Treasurer. The Boone County Commission has authority to administer county structures, infrastructures, and finances as well as a master plan, zoning codes, subdivision regulations, floodplain regulations and storm water regulations. The three-member County Commission generally is the final authority on county issues; the remaining bodies provide the information used by the County Commissioners to create policy.

2.6 Community Partnerships

Boone County has working relationships with its towns and cities as well as neighboring counties. This is particularly evident in regard to the mutual aid agreements that exist between fire and police jurisdictions. A significant partnership exists between Boone County and the City of Columbia with regard to storm water regulations. This partnership helps both jurisdictions create policy helpful in mitigating storm water issues.

Boone County jurisdictions have partnered successfully with the Mid-Missouri Regional Planning Commission (Mid-MO RPC) and five surrounding counties on numerous grant applications. Local elected and appointed leaders provide the core board positions and committees established by the Regional Planning Commission.

2.7 Demographic Information

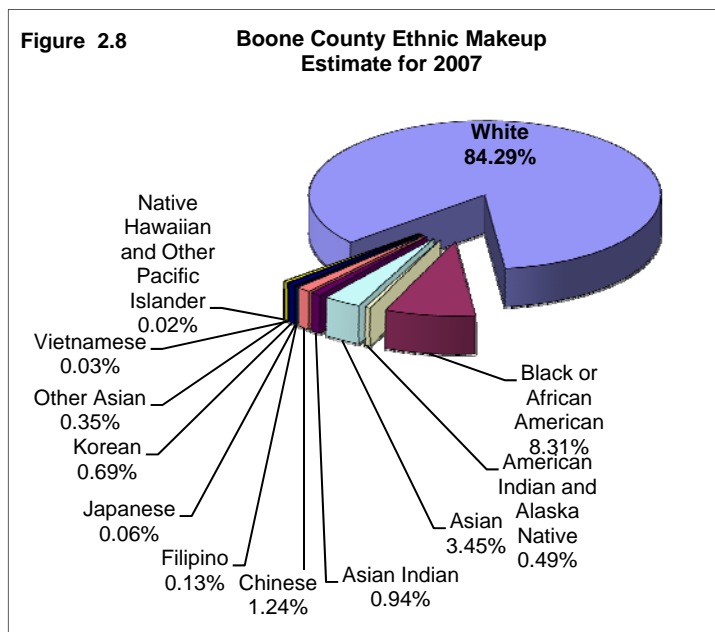
Boone County saw a rapid rise in population since the 2000 census with a growth rate of 13%. In 1992 Columbia was designated as the second best place to live in the country by Money magazine and in 2006 ranked 76 in the top 100 cities in the US. A low cost of living, the presence of cultural amenities, and high-quality schools each contributed to these trends.

Figure 2.7 portrays some key demographic information about Boone County and how it compares to the rest of Missouri. Boone County, with its Metropolitan Statistical Area (MSA) designation (see Section 2.9) and its relatively dense population, is an urban area. Boone County, and in particular Columbia, is a regional hub of economic, educational, and social activity.

Figure 2.7 Selected Demographic Statistics, 2008 projections		
	Boone County	Missouri
Total population	154,365	5,911,605
Persons per square mile	197.7	81.2
Median income	\$43,171	\$50,007
Persons below poverty level	16.9%	13.3%
High school graduates	89.2%	81.3%
Percentage of Bachelors degree or higher	41.7%	21.6%
Mean travel time to work (min.)	17.8	23.8

U.S. Census Bureau Revised July 1, 2008 <http://quickfacts.census.gov/qfd/states/29000.html>

The ethnic makeup of the population of Boone County is shown in Figure 2.8.



2.8 Income

Boone County mimics Missouri closely in terms of the number of households that earn specific percentages of income (see Figure 2.9). This is a somewhat surprising set of statistics given the high level of educational attainment in Boone County and the usual correlation of high educational attainment with high income.

The population in the lower income brackets is particularly vulnerable to natural hazards. Reliable transportation to get out of the path of a tornado, lack of adequate insurance, and poor housing conditions can all contribute to making the impacts of a natural hazard worse for people living in poverty. Hazard mitigation planning must take into account the needs of this, and other, vulnerable populations.

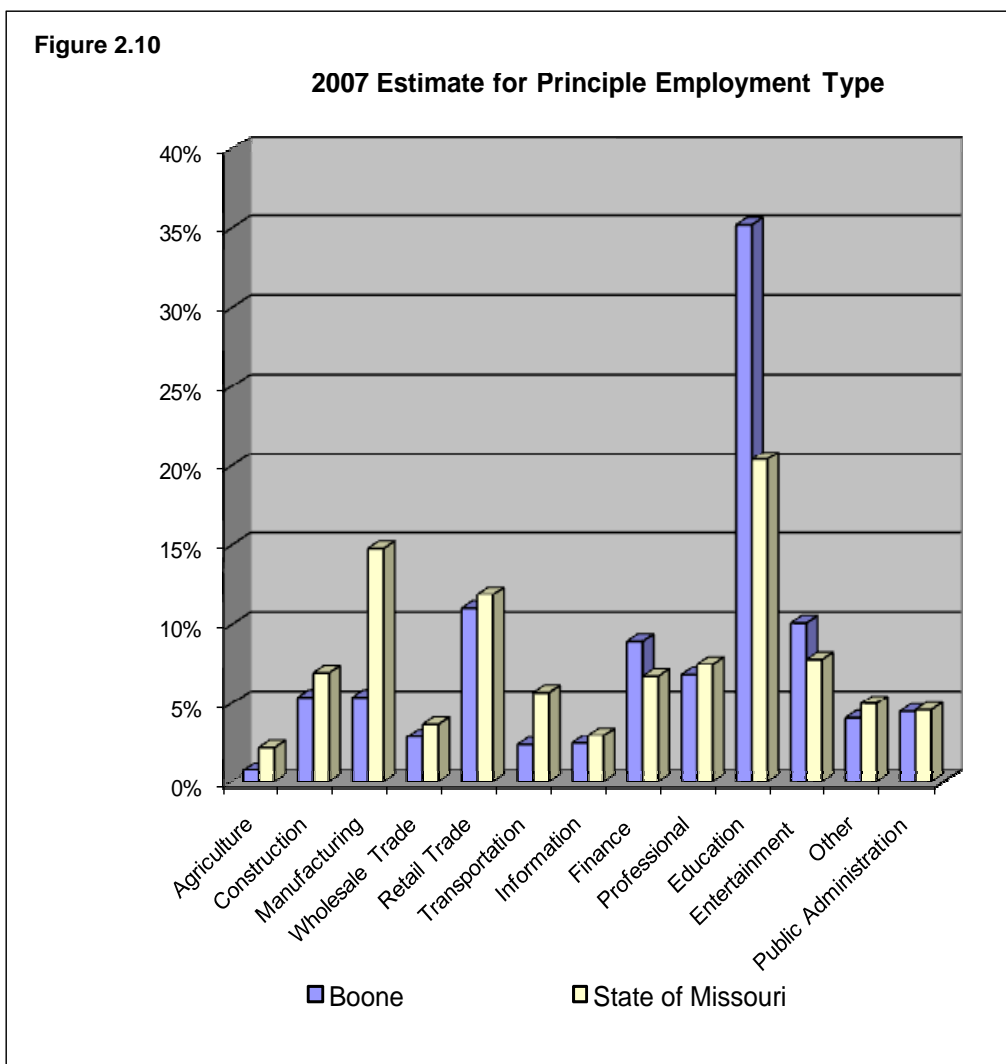
Figure 2.9 2007 Household Income				
Income Ranges	Boone	Boone %	Missouri	Missouri %
Median household income in dollars	\$43,171	N/A	\$44,545	N/A
Total number households in 2007	62,559	N/A	2,300,211	N/A
# of households (HHs) with income < \$10,000	6,126	9.8%	191,532	8.3%
# of HHs with income of \$10,000 to \$14,999	3,834	6.1%	148,860	6.5%
#of HHs with income of \$15,000 to \$24,999	8,143	13.0%	286,176	12.4%
# of HHs with income of \$25,000 to \$34,999	7,418	11.9%	283,299	12.3%
# of HHs with income of \$35,000 to \$49,999	9,493	15.2%	362,950	15.8%
# of HHs with income of \$50,000 to \$74,999	11,293	18.1%	448,534	19.5%
# of HHs with income of \$75,000 to \$99,999	6,695	10.7%	258,889	11.3%
#of HHs with income of \$100,000 to \$149,999	6,555	10.5%	208,997	9.1%
#of HHs with income of \$150,000 to \$199,999	1,599	2.6%	59,783	2.6%
# of HHs with income of \$200,000 or more	1,403	2.2%	51,191	2.2%
Source: U.S. Census Bureau				

2.9 Economy, Industry and Employment

Boone County is within a designated Metropolitan Statistical Area (MSA), according to the U.S. Census Bureau. Metropolitan statistical areas (metro and micro areas) are geographic entities defined by the U.S. Office of Management and Budget (OMB) for use by Federal statistical agencies in collecting, tabulating, and publishing Federal statistics. A metro area consists of a core urban area of 50,000 or more population, the county or counties containing the core urban area, and adjacent counties which have a high degree of social and economic integration with the urban core (as measured by commuting to work).

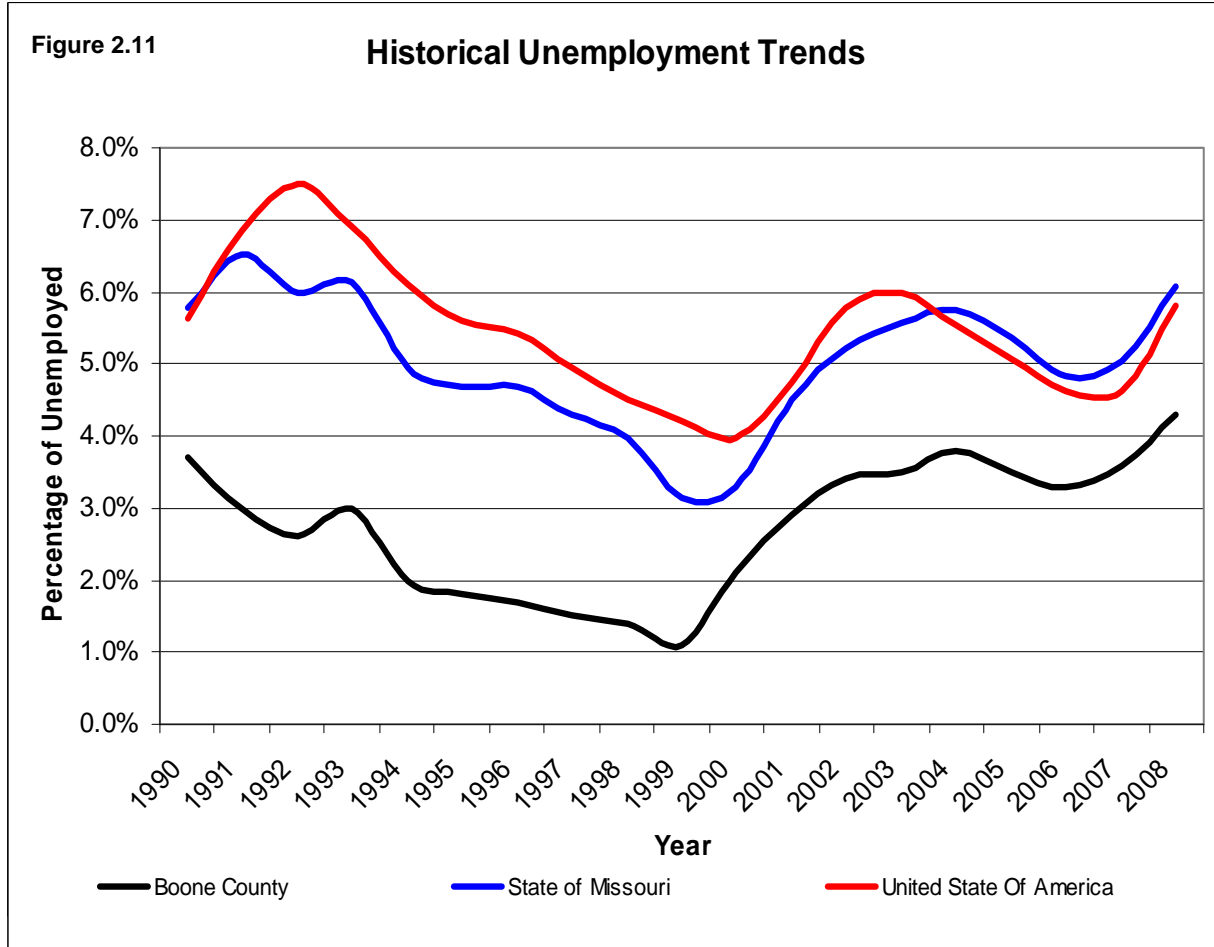
Columbia is the urban core for this metro area. Neighboring Howard County was added to the Columbia MSA in 2000 and expanded the MSA population by approximately 10,000 people. The MSA designation is indicative of growth in the Columbia area. Columbia has tried to harness some of this growth through annexation efforts in recent years. Municipal annexation has been a divisive issue throughout the county with the public voting down annexation proposals on occasion.

Boone County has jobs in sectors that are often more lucrative than those found in the surrounding counties. There are a high percentage of government, university, and medical jobs available. Figure 2.10 depicts the principle types of employment found in Boone County.



Source: U.S. Census Bureau

The location of the University of Missouri - Columbia, state and federal offices, and various other industries give Boone County one of the lowest unemployment rates in both Missouri and the US (see Figure 2.11).



Source: U.S. Bureau of Labor Statistics

Agriculture

Almost 259,000 acres, 58% of the county, is involved in agriculture. Soybeans, corn, and hay makeup the top three crops in Boone County. Other crops consist of wheat, sorghum, grapes, apples, various types of nuts, and garden vegetables. Cattle used for beef and milk production are also a major part of Boone County agricultural production. Market value for crops and livestock in 2007 topped \$45,000,000.

2.10 Transportation and Commuting Patterns

Roadways

Boone County serves as a crossroads for two of the state's major highway systems. Running east-west across the county is Interstate 70. This system connects the metropolitan areas of Kansas City and St. Louis. Intersecting Interstate 70 in Columbia is U.S. Highway 63, which runs north-south through the county. This highway serves as a major route for transporting goods, providing access to work for many residents, and bringing many visitors to the University of Missouri in Columbia as well as the state government facilities in neighboring Jefferson City (Cole County). The highway also provides access to the Columbia Regional Airport.

Railroads

According to the Missouri Department of Transportation's Long-Range Transportation Plan (LRTP), 33 percent of all product movement in Missouri is conducted by rail. The city of Columbia, located in Boone County, operates the Columbia Terminal Railroad (COLT). The MoDOT Multimodal Division administers the state's railroad program. The railroad section of the Multimodal Division works with Amtrak and also works to improve public and railroad employee safety, and is also responsible for public highway-railroad crossings, and inspection of railroad infrastructure as it relates to track, grade crossing signals, and operating practices of each railroad.

Air

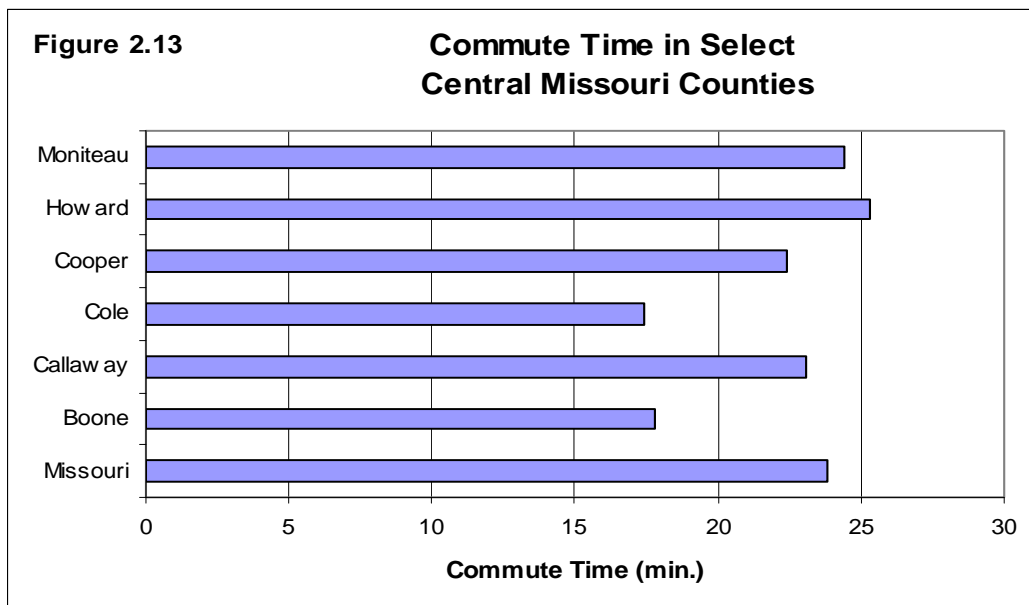
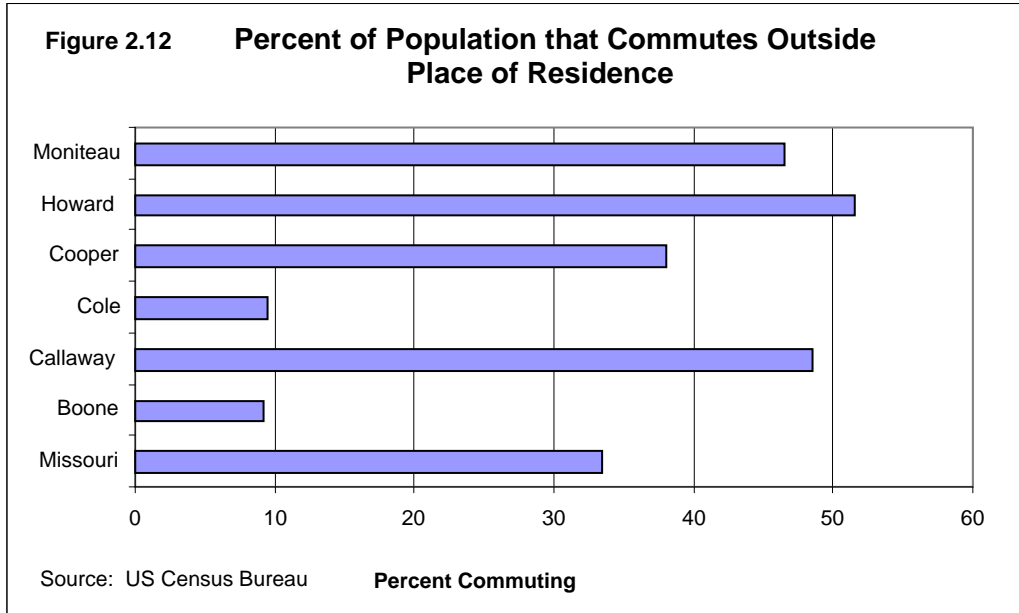
Boone County has one airport, the Columbia Regional Airport, which is located east of Highway 63 between Ashland and Columbia.

The Columbia Regional Airport is owned and operated by the City of Columbia. An airport advisory board composed of thirteen members (seven appointed by the Columbia City Council) exists to make a continuous study of airport needs and of aviation in the area. The advisory board makes recommendations to the Council for the development and use of the airport. The governing bodies of Boone County, Jefferson City, Fulton and Ashland may also appoint one member to the Board. Airport operations are administered by the Airport Manager.

Regionally, there are airports located in Boonville (Cooper County), Fulton (Callaway County), and Jefferson City. Jefferson City Memorial Airport is located in Callaway County, across the Missouri River from the main part of Jefferson City (Cole County).

Commuting Patterns

Boone County is a center for jobs in the central Missouri region. The vast majority of Boone County residents work within the county. Both the percentage of residents commuting outside their place of residence and average commute time are substantially lower than in the neighboring counties, with the exception of Cole County where the state capitol is located (see Figures 2.12 and 2.13). The average commute time for Boone County residents is 17.8 minutes (see Figure 2.13). This compares to a state average of 23.8 minutes.



Boone County has a significantly higher daytime than evening population, especially in the City of Columbia. The major factor accounting for this is the large daily influx of over 11,500 workers to the county. This population of workers can be more easily quantified than the number of people who come to Columbia to shop and conduct other types of business. Emergency management and mitigation planning must take this mobile and shifting population into account when considering the effects of any natural hazard.

2.11 Education

Pre K-12

As of 2008, there are approximately 24,287 students and 2,292 teachers in six public school districts and thirteen private schools in Boone County (see Figure 2.14).

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

Figure 2.14			
Boone County Public School Districts			
School District	Number of Schools	# Students	# Teachers
Centralia R-VI	4	1,314	117
Columbia Public Schools	30	17,186	1625
Hallsville R-IV	4	1,333	137
Harrisburg R-VIII	3	580	55
Southern Boone	4	1,415	136
Sturgeon R-V	3	442	58
TOTAL	48	22,270	2,128
Boone County Private Schools			
Community	Private School	# Students	# Teachers
Columbia	Apple School	69	1
Columbia	Christian Chapel Academy	186	20
Columbia	Christian Fellowship School	277	26
Columbia	Columbia Catholic School	648	31
Columbia	Children's House Montessori of Columbia	72	1
Columbia	Columbia Independent School	216	29
Columbia	Columbia Montessori School	83	20
Columbia	Columbia SDA Junior Academy	54	4
Columbia	Good Shepherd Lutheran School	85	6
Columbia	Islamic School of Columbia	45	7
Columbia	Morningside Community School	7	1
Columbia	Stephens College Children's School	86	4
Harrisburg	Harrisburg Preschool & Day Care Center	42	2
TOTAL		1870	152
TOTAL PUBLIC AND PRIVATE SCHOOLS		24,140	2,280
Source: http://dese.mo.gov/directory/discnty.htm#boone			
Source: http://www.privateschoolreview.com/county_private_schools/stateid/MO/county/29019			

Higher Education

Boone County has three major institutions of higher learning: Columbia College, Stephens College, and the University of Missouri (see Figure 2.15). These schools are potential resources for hazard mitigation planning in Boone County. The large and well constructed buildings can act as shelters and large gathering spaces in the event of an emergency. Also, as the Hazard Mitigation Plan is implemented, there is the potential to engage student help with local mitigation projects either as a part of course work or as internships.

Figure 2.15 Boone County Higher Education		
Institution	Location	Local Enrollment
Columbia College	Columbia	4,200*
Stephens College	Columbia	1,147**
University of Missouri	Columbia	30,200**

Sources: *<http://www.ccis.edu/day/prospective/factsheet.asp>; **IPEDS College data 2008-2009

2.12 Major Employers

Figure 2.16 depicts major employers (non- retail) and number of employees in Boone County.

Figure 2.16 Top 30 Boone County Employers 2008			
Company Name	# FT Benefitted Employees*	Company Name	# FT Benefitted Employees*
University of Missouri	8491	Boone County Government	364
University Hospital & Clinics	4014	Columbia College	339
Columbia Public Schools	2006	Watlow, Inc	320
Boone Hospital Center	1527	Columbia Insurance Group	313
MBS Textbook Exchange	1314	ABC Laboratories, Inc.	308
City of Columbia	1275	Boyce and Bynum	308
U.S. Dept. of Veterans Affairs***	1206	MidwayUSA	307
State Farm Insurance Companies	1145	Boone County National Bank	268
Shelter Insurance Companies	1061	Tribune Publishing Company	256
State of Missouri (excludes MU)****	806	U.S. Dept of Agriculture**	254
Hubbell Power Systems, Inc.	800	3M	250
Kraft Foods Columbia	592	Frito-Lay/Quaker Oats	250
Emery Sapp & Sons, Inc.	431	Dana Corporation	246
US Postal Service	410	MFA, Inc.	240
Square D	370	Mid-Mo Mental Health Center	230

*Does not include retail, ** Includes MU, Extension and System employees

Sources: www.columbiaredi.com, *** Federal Office of Personnel Management, **** Missouri Office of Personnel

2.13 Capabilities Assessment

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

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

2.13.1 Staff/Organizational Capabilities and Community Profiles

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

NOTE:

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

Boone County

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

Boone County also has the following staff positions:

- Assessor
- Auditor
- Collector
- Clerk
- Public Administrator
- Public Attorney
- Recorder
- Sheriff
- Treasurer

Ashland

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

- City Administrator
- City Clerk
- Public Works Director
- Police Chief

Figure 2.17 Ashland Profile	
Classification City	4 th class
Population	3,002
Median household income, 2008	\$38,921
Median owner-occupied housing value	\$145,000
Total housing units	1470
Water service	City of Ashland
Electric service	AmerenUE and Boone Electric Coop
Ambulance service	University Hospital and Boone Hospital Center
Sewer service	City of Ashland
Fire service	Southern Boone County Fire Protection District
Master plan	Yes
Building regulations	Yes
Stormwater regulations	Yes
Zoning regulations	Yes
Subdivision regulations	Yes
Floodplain regulations	Yes

City website: www.ashlandmo.us

Centralia

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

- City Administrator
- City Clerk
- Fire
- Police
- Foreman of Streets and Sanitation
- Foreman of Water and Sewer
- Line Foreman

Figure 2.18 Centralia Profile	
Classification City	4th class
Population	~4100
Median household income, 2008	\$34,475
Median owner-occupied housing value	\$65,000
Total housing units	\$1,764
Water service	City of Centralia
Electric service	City of Centralia
Ambulance service	Boone Hospital Center
Sewer service	City of Centralia
Fire service	City of Centralia
Master plan	Yes
Building regulations	Yes
Stormwater regulations	No
Zoning regulations	Yes
Subdivision regulations	Yes
Floodplain regulations	Yes

City website: www.centraliamo.org

Columbia

The City of Columbia has a council/manager form of government. The mayor and 6 council members are elected by the citizens of Columbia and serve as non-paid members for 3 years with staggered terms of service. The City Manager reports to the Mayor and Council and is considered the chief administrator. Department heads for all municipal functions report to the City Manager. Columbia also has the following offices and staff positions:

- City Manager
- City Clerk
- Office of Emergency Management
- Fire
- Planning & Development
- Police
- Public Communications
- Public Safety Joint Communications (PSJC)
- Public Works

Figure 2.19 Columbia Profile	
Classification City	Home rule
Population	100,733
Median household income, 2008	\$41,184
Median owner-occupied housing value	\$162,300
Total housing units	44,229
Median gross rent	\$681
Water service	City of Columbia
Electric service	City of Columbia
Ambulance service	Boone Hospital Center and University Hospital
Sewer service	City of Columbia and Boone County Sewer District
Fire service	City of Columbia and Boone County Fire Protection District
Master plan	Yes
Building regulations	Yes
Stormwater regulations	Yes
Zoning regulations	Yes
Subdivision regulations	Yes
Floodplain regulations	Yes
Source: City of Columbia	

City website: www.gocolumbiamo.com

Hallsville

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

- City Administrator
- Chief of Police
- City Clerk
- Planning & Zoning Commission

Figure 2.20 Hallsville Profile	
Classification City	4th class
Population	~1400
Median household income, 2008	\$35,536.00
Median owner-occupied housing value	\$70,400.00
Total housing units	450
Water service	PWD #4 and City of Hallsville
Electric service	Ameren UE and Boone Electric Cooperative
Ambulance service	Boone Hospital Center
Sewer service	City of Hallsville
Fire service	Boone County Fire Protection District
Master plan	Yes
Building regulations	Yes
Stormwater regulations	No
Zoning regulations	Yes
Subdivision regulations	Yes
Floodplain regulations	Yes

City Website: <http://hallsville.missouri.org>

Hartsburg

The Mayor and the City Council are the policy making bodies in the city government.

Figure 2.22 Hartsburg Profile	
Classification City	Village
Population	108
Median household income, 2008	\$32,500
Median owner-occupied housing value	\$82,000
Total housing units	52
Water service	Boone County Water District #1
Electric service	Ameren UE
Ambulance service	University Hospital
Sewer service	City
Fire service	Southern Boone County Fire Protection District
Master plan	No
Building regulations	Yes
Stormwater regulations	No
Zoning regulations	Yes
Subdivision regulations	No
Floodplain regulations	Yes

Huntsdale

The Mayor and the City Council are the policy making bodies in the city government. Huntsdale also has the following staff position:

- City Clerk

Figure 2.23 Huntsdale Profile	
Classification City	Town
Population	26
Median household income, 2008	NA
Median owner-occupied housing value	NA
Total housing units	17
Water service	Boone County Water District #1
Electric service	Boone County Electric Coop.
Ambulance service	University of Missouri Hospital
Sewer service	NA
Fire service	Boone County Fire Protection
Master plan	No
Building regulations	Yes
Stormwater regulations	No
Zoning regulations	No
Subdivision regulations	No
Floodplain regulations	Yes

City website: www.huntsdalemo.com

Rocheport

The Mayor and the City Council are the policy making bodies in the city government. Rocheport also has the following staff position:

- City Clerk

Figure 2.26 Rocheport Profile	
Classification City	4 th Class
Population	208
Median household income, 2008	\$32,188
Median owner-occupied housing value	\$63,600
Total housing units	126
Water service	Boone County Water District #1
Electric service	Boone Electric Cooperative
Ambulance service	University Hospital
Sewer service	City of Rocheport
Fire service	Boone County Fire Protection District
Master plan	No
Building regulations	Yes
Stormwater regulations	No
Zoning regulations	No
Subdivision regulations	No
Floodplain regulations	Yes

Sturgeon

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

- City Clerk
- Police Chief

Figure 2.27 Sturgeon Profile	
Classification City	4 th Class
Population 2000	944
Median household income, 2000	\$33,173
Median owner-occupied housing value	\$59,700
Total housing units	382
Water service	City of Sturgeon
Electric service	Boone Electric Coop. and Ameren UE
Ambulance service	Boone Hospital Center
Sewer service	City of Sturgeon
Fire service	Boone County Fire Protection District
Master plan	No
Building regulations	Yes
Stormwater regulations	No
Zoning regulations	No
Subdivision regulations	No
Floodplain regulations	Yes

City website: www.sturgeon-mo.org

Districts

School Districts

Boone County has six school districts that encompass 48 schools. Combined, the district schools hold more than 22,000 students and employ more than 2,100 teachers. Each district has an elected Superintendent and School Board along with several administrative staff. The six districts are:

- Centralia R-VI
- Columbia 93
- Hallsville R-IV
- Harrisburg R-VIII
- Southern Boone County R-I
- Sturgeon R-V

Boone County Water Districts

Four Water Districts are responsible for distributing water throughout the County except in places served by a municipality. They are responsible for developing new water supply infrastructure and maintaining existing infrastructure.

Each water district is composed of an elected board. Water Districts are primarily related to mitigation activities focused on drought, wildfire, and flood. Connecting water supplies so that rural areas of Boone County have multiple water supplies is an important mitigation technique. Protecting water supply infrastructure from floodwaters is an important task also under the purview of the Districts.

Boone County Regional Sewer District

The Sewer District consists of a four-member board and a County Commissioner who are responsible for wastewater quality within Boone County, except for those facilities operated by a municipality or private entity.

The Boone County Regional Sewer District is directly connected to mitigation by being responsible for the health and safety of Boone County citizens as it pertains to sewer lines, lagoons and other similar infrastructure. Part of that responsibility includes protecting infrastructure from natural hazards and, for example, lagoons from overflowing in a flood event.

Centralia Special Road District

- Organized through Chapter 233 of the Missouri Statutes
- Composed of three commissioners elected to serve three-year terms
- Responsible for maintaining the roads and bridges of the Centralia Township and an additional 15 square miles in the area

The three commissioners of the District can identify projects that may be particularly helpful to protecting the road infrastructure of northeastern Boone County.

Fire Protection Districts

Several fire departments/districts serve Boone County including the Boone County Fire Protection District, the Centralia Fire Department, the Columbia Fire Department, the Columbia Regional Airport Public Safety Department, and the Southern Boone County Fire Protection District. While the municipal fire departments are run through the oversight of the city, the two county fire districts are administered by an elected Board of Directors and the appointed Fire Chief. The capabilities of these districts will be expanded under Technical Capability (Section 2.13.2).

2.13.2 Technical Capabilities

This section includes the technical capabilities of Boone County, Fire Protection, Law Enforcement agencies, and Organizations and Volunteers Active in Disasters (OVAD).

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 Boone County Sheriff and the Boone County Fire Protection District both have mutual aid agreements in place with local police departments.

Boone County

Boone County has full time planners, engineers, emergency response staff, building inspectors, and others who can help identify and guide hazard mitigation strategies. The staff is backed by a computer system and information technology department that allows for quick and easy exchange of information, advanced GIS capabilities, and other associated tasks. High speed internet connections, email, online databases, and user friendly websites provide a wide range of information both for citizens and county employees. There is also an extensive inventory of trucks, earthmovers, and other vehicles. Solid coordination exists between agencies and local jurisdictions.

Office of Emergency Management

- Boone County and the City of Columbia share oversight of the Office of Emergency Management
- Eight people on staff responsible for emergency contingency planning, public education, and emergency response coordination in both Boone County and the City of Columbia
- Staff write and update the Emergency Operations Plan, conduct ongoing public education related to emergency information, and identify and fix gaps in emergency response, preparedness, and mitigation
- Staff has had extensive training from SEMA, FEMA, and other bodies in emergency response, preparedness, recovery, mitigation, and overall emergency management

The Office of Emergency Management is a critical part of hazard mitigation planning because their mission so closely coincides with that of hazard mitigation planning. They accomplish this task through public education, use of an advanced GIS, strong coordination efforts, and other tools.

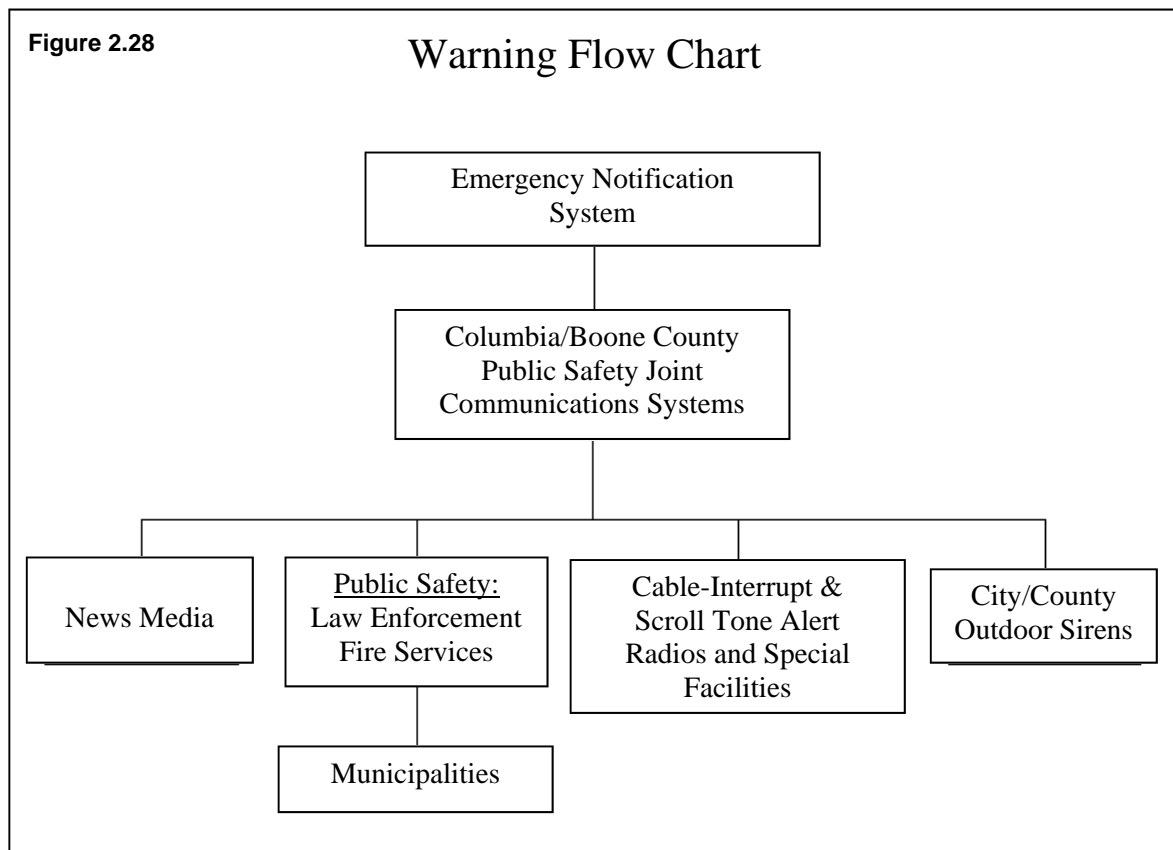
Emergency Operations Plan (EOP)

Boone County has a well-designed and comprehensive Emergency Operations Plan (EOP). The EOP consists of specific directions for local government to undertake in the event of an emergency. While this is not considered mitigation, an EOP is an essential tool in helping reduce the threat of a natural hazard (or any other hazard). Furthermore, the EOP directs local authorities in cleaning up after a natural hazard. When this happens, these local authorities can use that as an opportunity to learn from the event and see what did and did not work in regard to

mitigation strategy. Those lessons can then be employed in the Hazard Mitigation Plan and the EOP.

Copies of the EOP can be found online at <http://www.gocolumbiamo.com/EM/eop.php> or by contacting the Office of Emergency Management at 17 North 7th Street, Columbia, Missouri 65201, 573-874-7400.

The **Columbia/Boone County Public Safety Joint Communications/E-911 Dispatch Center** can quickly and efficiently notify specific regions in Boone County in the event of a probable natural hazard (see Figure 2.28). The Center also has systems in place to check that each warning siren and system works each time they are employed. If a problem is found it is immediately repaired. Information on this Center and general communication and warning systems throughout Boone County can be found online in Emergency Operations Plan at: <http://www.gocolumbiamo.com/EM/eop.php>



Source: City of Columbia Emergency Operations Plan (EOP)

Detailed, reliable, and timely information distributed to the public may be the single best mitigation activity there is to protect life and property from many natural hazards.

Local and regional media outlets provide regular weather information including forecasts for potentially destructive weather. Broadcast media stations originating in or reaching Boone County are shown in Figure 2.29.

Figure 2.29			
Boone County Broadcast Media			
TV Station	Base City	FM Radio Stations	Base City
KOMU Channel 8	Columbia	KOPN 89.5 FM	Columbia
KMIZ Channel 17	Columbia	KBIA 91.3 FM	Columbia
KMOS Channel 6	Sedalia	KCMQ 96.7 FM	Columbia
KRCG Channel 13	Jefferson City	KPLA 101.5 FM	Columbia
KNLJ Channel 25	Jefferson City	KBXR 102.3 FM	Columbia
		K280EJ 103.9 FM	Columbia
		KOQL 106.1 FM	Ashland
		KJLU 88.9 FM	Jefferson City
AM Radio Stations	Base City		
KFRU 1400 AM; 1 kW	Columbia	KMCV 89.9 FM	High Point
KBNN 750 AM; 5 kW	Lebanon	KNLG 90.3 FM	New Bloomfield
WHB 810 AM; 50 kW	Kansas City, KS	KMFC 92.1 FM	Centralia
KFAL 900 AM; 1 kW	Fulton	KLOZ 92.7 FM	Eldon
KWOS 950 AM; 5 kW	Jefferson City	KWJK 93.1 FM	Boonville
KXEN 1010 AM; 50 kW	Festus-St. Louis	KSSZ 93.9 FM	Fayette
WHO 1040 AM; 50 kW	Des Moines, IA	KATI 94.3 FM	California
KRMS 1150 AM; 10 kW	Osage Beach	KWWR 95.7 FM	Mexico
KMOX 1120 AM; 50 kW	St. Louis	KCLR 99.3 FM	Boonville
KLIK 1240 AM; 5 kW	Jefferson City	KBBM 100.1 FM	Jefferson City
KKHK 1250 AM; 25 kW	Kansas City, KS	KJMO 104.1 FM	Jefferson City
WSDZ 1260 AM; 20 kW	Belleville, IL	KKCA 100.5 FM	Fulton
KRLL 1420 AM; 1 kW	California	KWJK 103.5 FM	Boonville
KWRT 1370 AM; 1 kW	Boonville	KTXY 106.9 FM	Jefferson City

Fire Protection Districts

Several fire departments/districts serve Boone County including the Boone County Fire Protection District, the Centralia Fire Department, the Columbia Fire Department, the Columbia Regional Airport Public Safety Department, and the Southern Boone County Fire Protection District. These departments operate a total of twenty-three (23) stations at locations throughout the county, its municipalities, and the Columbia Regional Airport.

The **Boone County Fire Protection District**, the 3rd largest fire department in Missouri, is governed by a five-member board of directors elected by the public and serves the county from fourteen (14) fire stations. Full service (fire, rescue, EMS, and haz-mat) is provided for six communities and 532 square miles of unincorporated areas in the county. Boone County Fire District provides service to certain portions of the City of Columbia (recently annexed areas), per preexisting territorial agreements. The District provides fire, rescue and medical services and has:

- Eight chief officers, three battalion chiefs and 36 station captains and lieutenants administer the district's operation
- Over 110 firefighting pieces of fire and rescue apparatus and some 225 firefighters/emergency medical personnel and paramedics
- A Hazardous Materials Division
- A State Homeland Security Regional Response Team and a Federal Emergency Management Agency Urban Search and Rescue Team
- A Type II wildfire team.
- A dive rescue unit

The Centralia Fire Department provides service within the corporate limits of Centralia and has limited response capability to hazardous material incidents and EMS calls.

Columbia Fire Department

- A full career fire department operating out of eight (8) stations with approximately 126 firefighters and approximately 20 pieces of apparatus
- A hazardous materials team with response equipment tailored to the scene of an emergency incident

The Columbia Regional Airport Public Safety Department responds to incidents on airport property with assistance provided, as needed, by the Columbia Fire Department, the Southern Boone County Fire Department, and the Boone County Fire Protection District.

The Southern Boone County Fire Protection District is governed by a three-member elected body and serves the southern one-third of the county. It has a limited hazardous materials response capability. The district protects an area of 100 square miles and a population of approximately 10,000 from 4 stations located in southern Boone County.

Law Enforcement Agencies

Boone County Sheriff’s Office.....	(573) 875-1111
Columbia Police Department.....	(573) 874-7652
University of Missouri Campus Police Dept.....	(573) 882-7201
Columbia College Campus Security.....	(573) 875-7315
Stephens College Campus Security.....	(573) 876-7299 or (573) 442-2211
Ashland Police Department.....	(573) 657-9062
Centralia Police Department.....	(573) 682-2132
Hallsville Police Department.....	(573) 696-3838
Sturgeon Police Department.....	(573) 687-3321

State Agencies (Missouri)

Missouri State Highway Patrol, Troop F, Jefferson City	(573) 751-1000
Missouri State Highway Patrol, General Headquarters, Jefferson City.....	(573) 751-3313
Missouri State Water Patrol, Headquarters, Jefferson City.....	(573) 751-3333
Missouri Department of Conservation.....	(573) 751-4115
Department of Natural Resources, Park Rangers.....	(573) 751-1000
State Fire Marshal’s Office (arson, bombing), Jefferson City.....	(573) 751-2930

Federal Agencies

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

Organizations and Volunteers Active in Disasters (OVAD)

OVAD provides for the effective use of volunteers in enhancing the ability to mitigate, prepare, respond, and recover from disasters throughout Boone County. OVAD activity is coordinated through the Boone County office of the State of Missouri Division of Family Services, in conjunction with the overall plan from the Office of Emergency Management.

Organizations in Boone County such as the American Red Cross, Columbia Office of Volunteer Services, Salvation Army, Columbia/Boone County Health Department, church agencies, and other non-profits are active in supporting the work of OVAD.

2.13.3 Legal Authority

Boone County has at its disposal a variety of powers given to it by the State of Missouri relevant to mitigation activities. A brief review of these powers is listed below.

Police Powers

The police are responsible for protecting the overall public; local governments can add requirements pertinent to hazard mitigation.

Land Use and Building Codes

The State of Missouri has given local governments the right to create and enforce planning and zoning regulations around construction and development including areas within designated floodplains and subdivisions.

In Boone County, zoning ordinances define how and where residential and commercial developments can be built. They prescribe the following:

- Where communication facilities can be built
- Where developments can be built
- What the density of a development should be

Subdivision regulations provide specific guidelines that new developments must meet in order to be in compliance with safety and management decisions.

County regulations on building and zoning can be obtained online at www.showmeboone.com/PB or by contacting the Planning and Building Department located at 801 East Walnut, Room 210, Columbia, MO 65201-7730, (573) 886-4330.

Ashland, Centralia, and Columbia all have building and zoning information available on the following websites:

www.ashlandmo.us/
www.gocolumbiamo.org
www.centraliamo.org/

Information on which incorporated communities have zoning and/or building codes is included in the community profiles in Section 2.13.

Acquisition

Local governments may find the most effective method for completely “hazard-proofing” a particular piece of property or area is to acquire the property (either in fee or a lesser interest, such as an easement); this removes the property from the private market and eliminates or reduces the possibility of inappropriate development. Missouri legislation empowers cities,

towns, and counties to acquire property for public purpose by gift, grant, devise, bequest, exchange, purchase, lease or eminent domain.

Taxation

The power to levy taxes and special assessments is an important tool delegated to local governments by Missouri law. The power of taxation extends beyond the collection of revenue, and impacts the pattern of development in the community.

Local units of government also have the authority to levy special assessments on property owners for all or part of the costs of acquiring, constructing, reconstructing, or improving protective structures within a designated area. This can serve to increase the cost of building in such areas, thereby discouraging development. Special assessments seem to offer little in terms of control over land use in developing areas. They can, however, be used to finance the provision of necessary services within municipal or county boundaries. In addition, they are useful in distributing to the new property owners the costs of the infrastructure required by new development. The major constraint in using special assessments is political.

Spending

Local governments have the power to make expenditures in the public interest. A community can control its growth to some extent by tentatively committing itself to a timetable for the provision of capital to extend services, especially when the provision of on-site sewage disposal and water supply to the surrounding area is unusually expensive. A local community can also regulate the extension of and access to services. This tactic can help guide development away from hazard prone areas.

2.13.4 Political Willpower

Boone County citizens have seen the effects of natural hazards in the floods of 1993 and 1995 and the Southridge tornado of 1998. People are well aware of the impacts these events had on lives and property in the county. Due to this awareness, it is expected that the current and future political climates are favorable for supporting and advancing mitigation strategies in Boone County.

Section 3: Risk Assessment

3.1 Identifying Hazards

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

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

- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Flood (includes riverine 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 (2007) indicates that expansive soils, landslides, and rockfalls 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 Boone County Plan.

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

3.2 Profiling Hazards

Requirement
§201.6(c)(2)(i):

[The risk assessment shall include a] description of the...location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

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

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

Measures of Probability and Severity

The assessments of probability and severity included in each profile were based on the following definitions from the Missouri State Hazard Mitigation Plan (2007) :

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

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

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

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

When the measure of probability and/or severity for a specific hazard differs among participating jurisdictions within the Planning Area, this will be delineated in the hazard profile.

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 Boone 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:

- Building codes are in place in Boone County and the following incorporated communities: Ashland, Centralia, Columbia, Hallsville, Harrisburg, Hartsburg, Pierpont, Rocheport, and Sturgeon.
- Resources for the public on retrofitting and protecting buildings are available through the Office of Emergency Management.
- Critical infrastructure in the county is 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.
- Evacuation routes are in place in all school districts in the county.
- Buses in all school districts have two-way radios on board.
- A public education hazard awareness program is in place through the OEM.
- Hazard information is provided to customers of local hotels through an agreement between the OEM and the Missouri Hotel & Lodging Association.

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 Boone 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 Figure 3.1.

Fig. 3.1 Dam Hazard Classification Systems

Federal Classification	Federal Criterion	State Classification	Downstream Environment	Inspection Requirement (Regulated Dams)
High hazard	Probable loss of human life	Class 1	10 or more permanent dwellings; or any public building	Every 2 years
		Class 2	1-9 permanent dwellings; or 1 or more campgrounds with permanent water, sewer and electrical services; or one or more industrial buildings	Every 3 years
Significant hazard	No probable loss of human life but potential economic loss, environmental damage, disruption of lifeline facilities or other impact of concern	Class 3	Everything else	Every 5 years
Low hazard	No probable loss of human life; low economic and/or environmental loss; loss principally limited to owner's property			

Sources: Federal Guidelines for Dam Safety, Hazard Potential Classification System for Dams, April 2004, <http://www.fema.gov/library/viewRecord.do?id=1830>; <http://www.sos.mo.gov/adrules/csr/current/10csr/10c22-2.pdf>; Glenn Lloyd, Civil Engineer/Dam Safety Inspector, MO DNR, Water Resources Center, Dam Safety Program

There are currently 126 dams in Boone County according to the Department of Natural Resources database. Of these, only seventeen are regulated by the state (see Figure 3.2).

Figure 3.2 Hazard Categories of Boone County Dams

Hazard Category	Regulated Dams	Unregulated Dams	All County Dams	Percentage of Total Dams
High	12	31	46	37%
Significant	1	6	7	6%
Low	3	70	73	58%
Total	16	107	126	100%

Specific information for each of the 17 regulated dams and 110 unregulated dams can be found in Appendix D. It must be remembered that, according to information from Missouri DNR, much of this data, perhaps most of it, for the unregulated dams has not been updated since the dam survey was first conducted in the late 1970s and early 1980s. The heights of the unregulated dams may be, in some cases, the only currently reliable information.

Geographic Location

The locations of the dams in Boone County are shown in Figures 3.3-3.6.

Figure 3.3

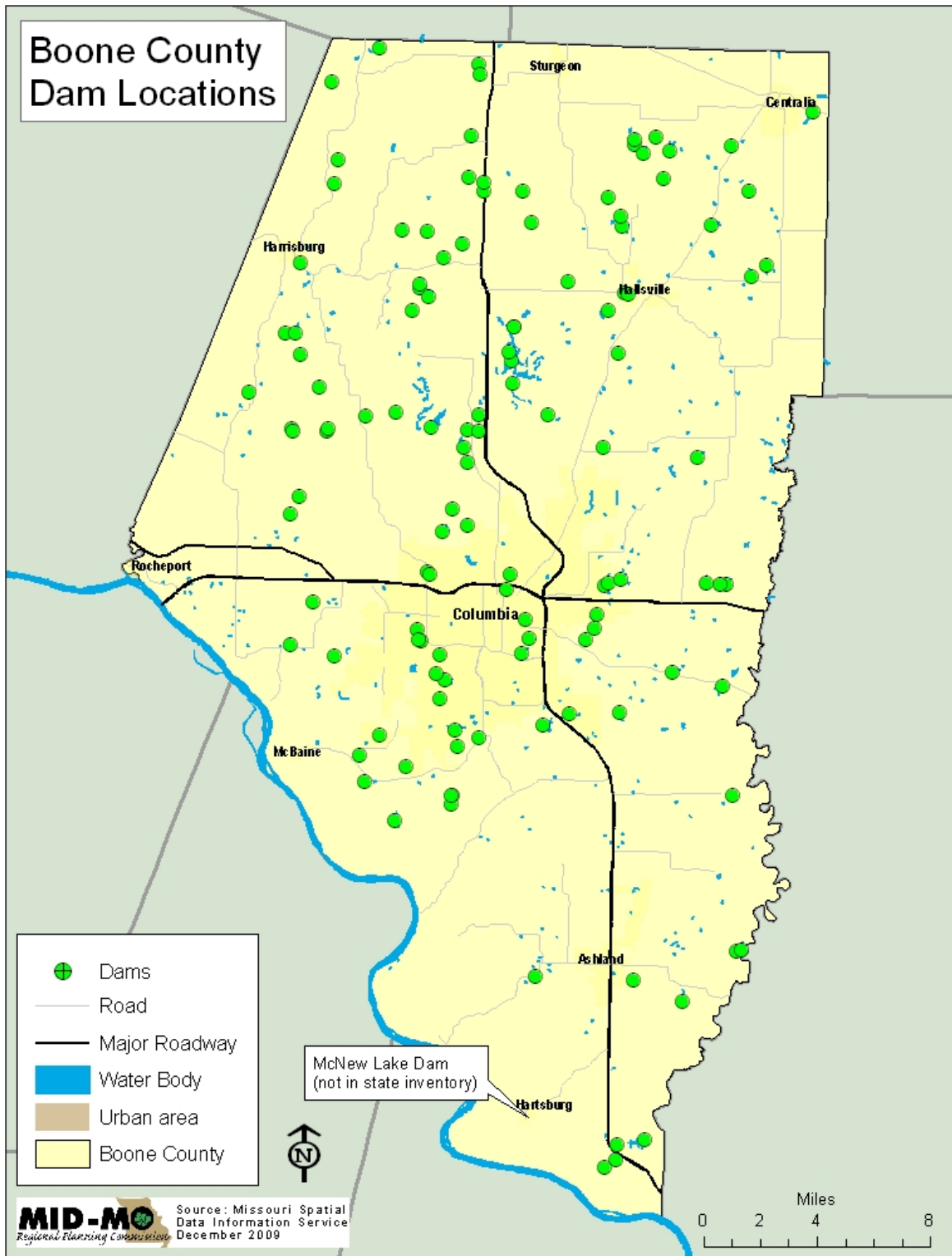


Figure 3.4

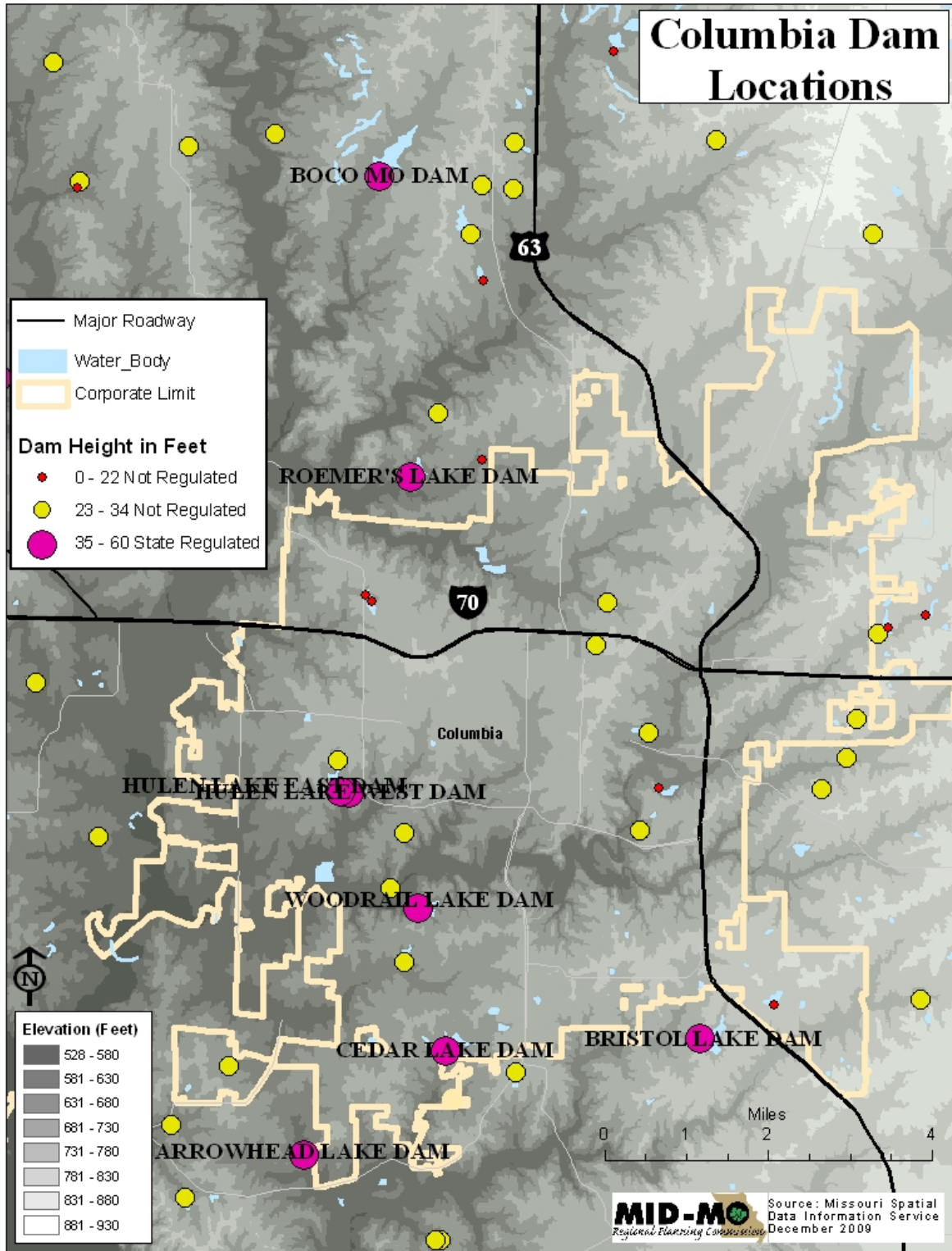


Figure 3.5

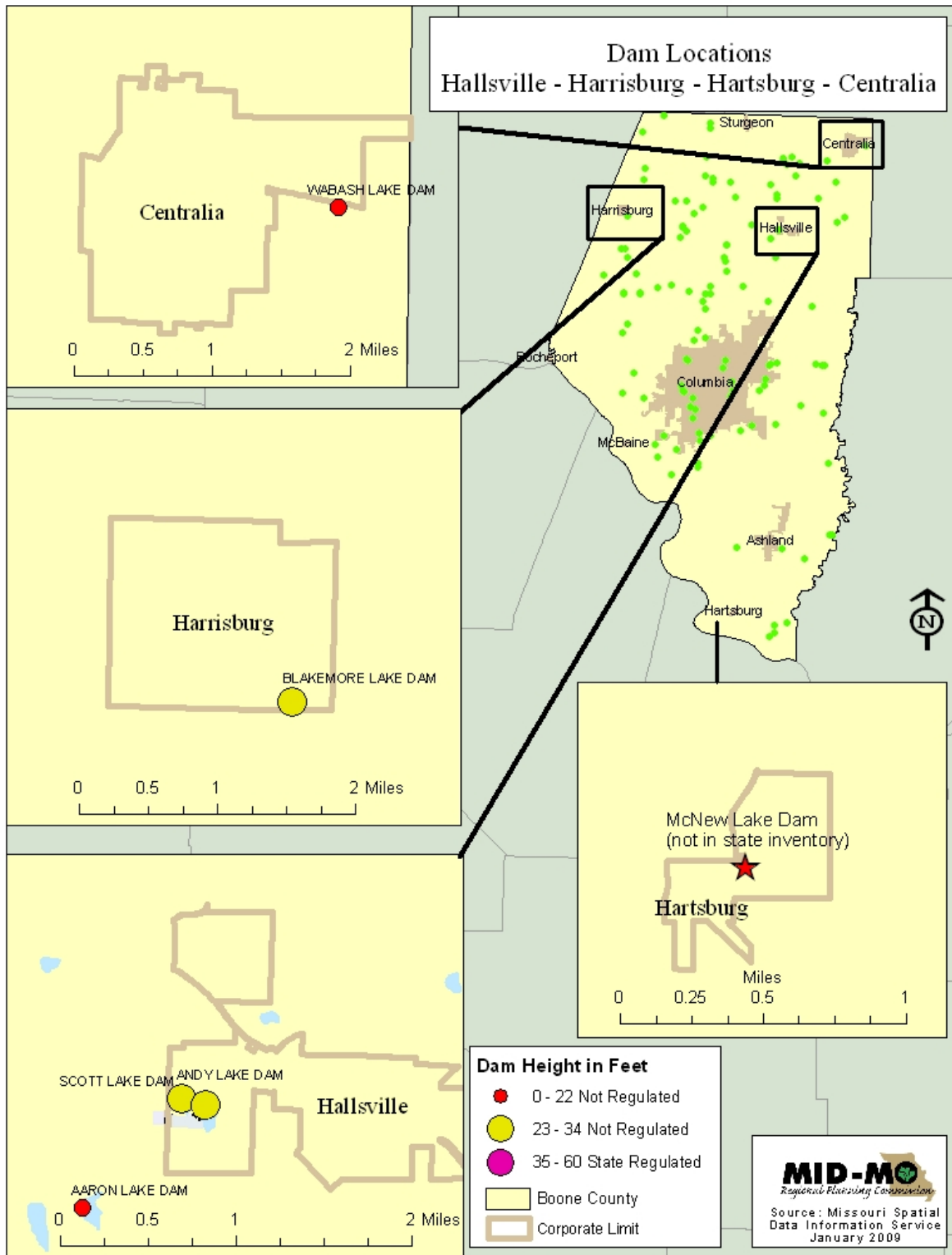
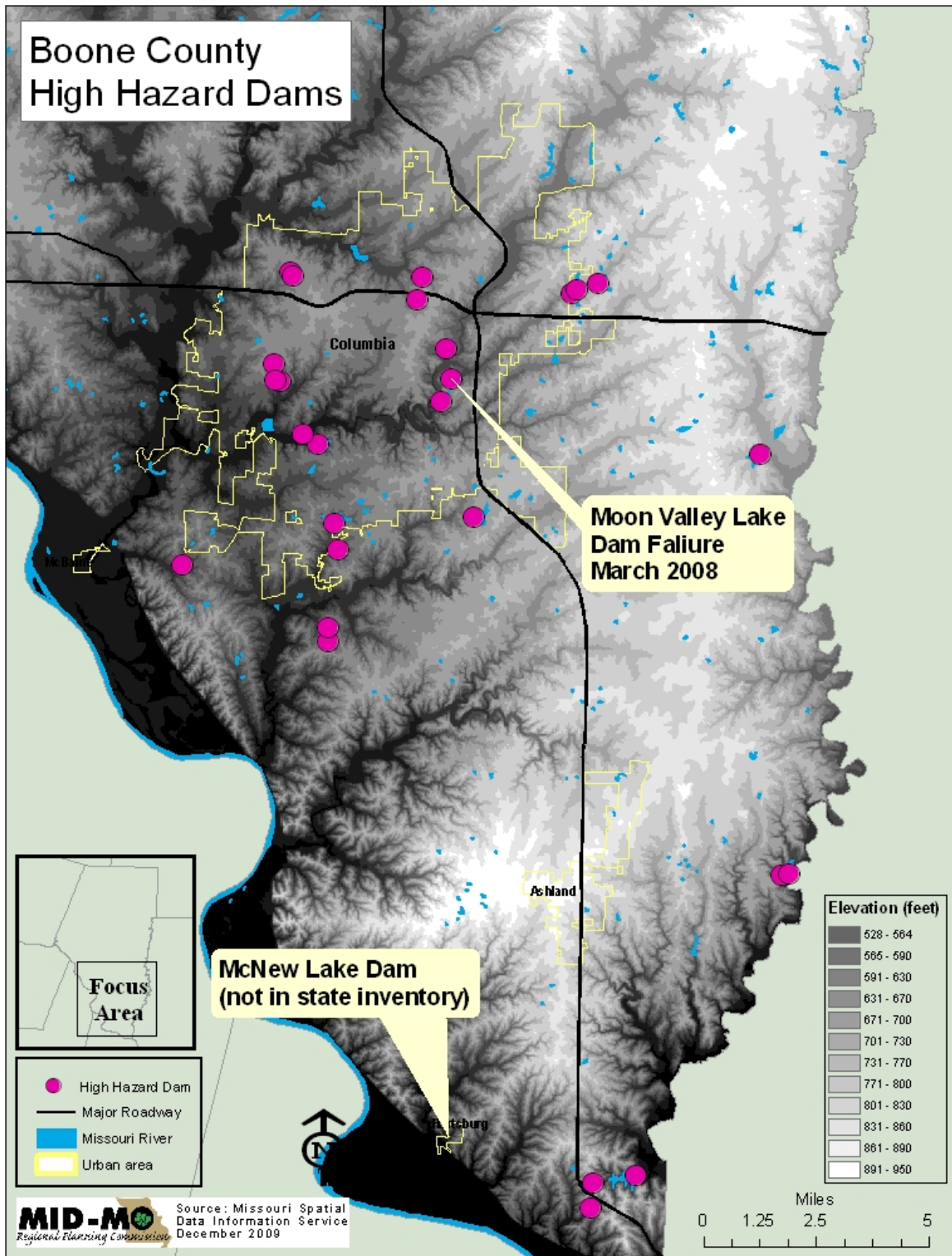


Figure 3.6

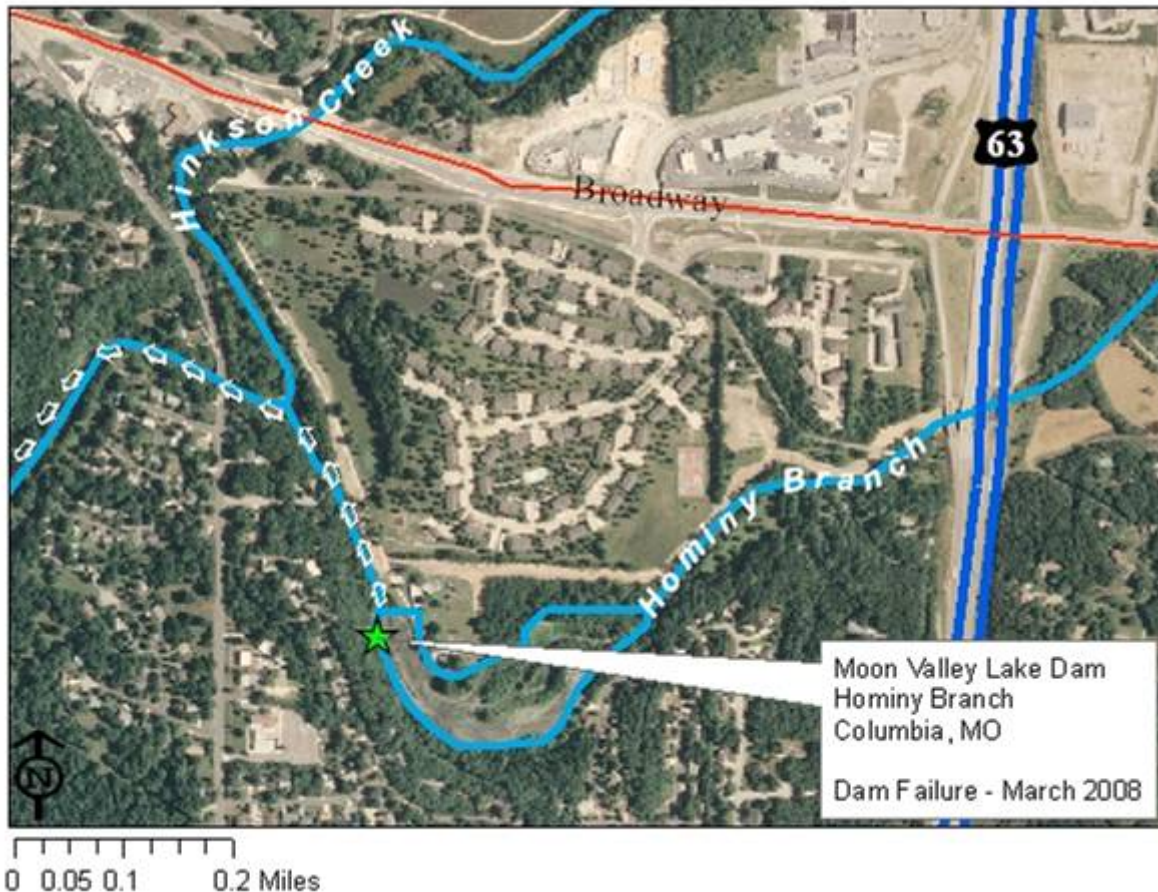


Previous Occurrences

Boone County experienced its first known dam failure in March 2008 when Moon Valley Lake Dam in Columbia failed (see Figures 3.6 and 3.7). This 18 foot high dam had been built in 1964; it drained 2,100 acres and had a 13 acre reservoir according to the DNR database.

Moon Valley Lake Dam was classified as high hazard according to the federal classification system; however, there was no loss of life with the dam failure. This may be partially attributable to the fact that Moon Valley Lake was silted in and the main release from the dam failure was silt. Silt from the lake went down the Hominy Branch into the Hinkson Creek (see Figure 3.7). The added silt has caused greater flooding problems on the Hinkson Creek since the time of the dam failure. The City of Columbia estimated the cost of removing the sediment and stabilizing about 2,000 feet of the stream bank to be in the vicinity of \$400,000.

Figure 3.7



In late October 2009, there was a near failure of Renn's Lake Dam in neighboring Cole County. The dam's structure had been weakened by tree roots and heavy rainfall caused a 15-foot section of the earthen dam to erode. Emergency crews and volunteers were able to relieve the pressure

on the dam and avert complete failure by pumping thousands of gallons of water out of the lake. The failure or near failure of two dams in central Missouri within two years has highlighted this potential hazard in the region.

Boone and Cole Counties are not the only counties in Missouri to experience dam failures. According to the Missouri State Hazard Mitigation Plan (2007), Missouri has the largest number of manmade dams in any state. The Stanford University's National Performance of Dams Program documented 16 dam failures in Missouri between 1975 and 2001.

More recently, there was a huge dam failure which destroyed Johnson Shut-Ins State Park in Reynolds County. On December 14, 2005, the AmerenUE's Taum Sauk reservoir dam at their hydroelectric complex failed; 1.5 billion gallons of water were released into the park in 10 minutes. There was no loss of life, even though the superintendent's family was swept out of their home. However, if this failure had occurred during the summer when the popular park has many visitors, it could have resulted in a catastrophic loss of life.

All of these dam failures indicated that this is a serious problem which needs attention. Many of Missouri's smaller dams are becoming a greater hazard as they continue to age and deteriorate. While hundreds of them need to be rehabilitated, lack of available funding and often questions of ownership loom as obstacles difficult to overcome.

Measure of Probability and Severity

Probability: Low – Boone County, Centralia, Columbia, Hallsville, Hartsburg
Not applicable – all other participating jurisdictions

Severity: Moderate – Boone County, Columbia, Hartsburg
Low – Centralia, Hallsville
Not applicable - all other participating jurisdictions

54 dams in Boone County are considered to pose high or significant hazard should there be a dam break. Of these dams, 40 of them are not regulated by the state and thus not subject to inspection requirements. The Missouri State Hazard Mitigation Plan (2007) quotes Jim Alexander, chief engineer for the DNR's Dam Safety Program, who says that many of the unregulated dams have gone without inspections for years. "There are accidents out there waiting to happen," he notes.

Existing Mitigation Strategies

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

3.2.2 Drought

Description of Hazard

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

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

The period of lack of precipitation needed to produce a supply drought will vary between regions and the particular manifestations of a drought are influenced by many factors. As an aid to analysis and discussion, the research literature has defined different categories of drought (see Figure 3.8).

Figure 3.8	
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	

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 Figure 3.9), 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.)

Figure 3.9	
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

Missouri is divided into six regions of similar climactic conditions for PDSI reporting; Boone County is located in the Northeast Region.

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 Boone 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 Boone 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, 1901 was the driest year on record in Columbia with an annual precipitation of only 21.35 inches.

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. In July 2003, Boone County was in a Phase 1 Drought Advisory; by January 2004 this advisory was no longer in effect in the county.

The droughts of 2005 and 2006 again caused great hardship for many crop and livestock producers in the state. Boone County was one of 30 Missouri counties in Phase 3 Conservation in July 2005. 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. By September of 2006, however, the county was in a Phase 2 Drought Alert; this was changed to Phase 3 Conservation by November 2006. In October, Boone County was one of 85 Missouri counties designated by the USDA as primary natural disaster areas due to losses from the drought conditions of 2006. Conditions began to improve with a large snowstorm in late November/early December.

Boone County was in Phase 1 Drought Advisory in both February and October of 2007.

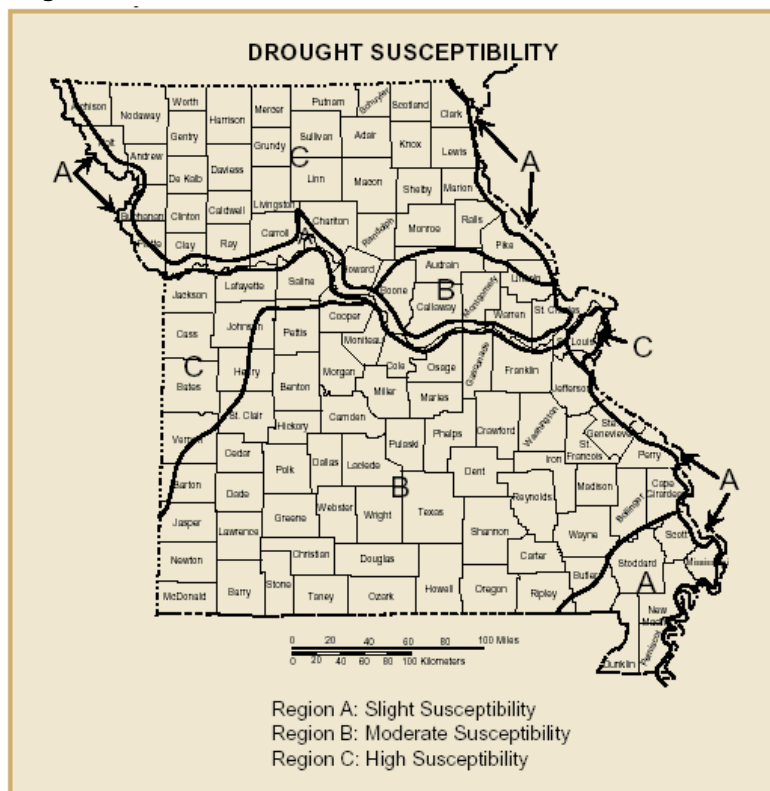
Measure of Probability and Severity

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

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

The Missouri Department of Natural Resources has defined different regions of drought susceptibility in the Missouri Drought Plan (2002). A map of the different regions is shown in Figure 3.10.

Figure 3.10



Most of Boone County lies in Region B which is defined as “...moderate drought susceptibility. Groundwater resources are adequate to meet domestic and municipal water needs, but due to required well depths, irrigation wells are very expensive. The topography generally is unsuitable for row-crop irrigation.”

The very northwest section of the county lies in Region C which is defined as “...severe drought vulnerability. Surface water resources usually become inadequate during extended drought. Groundwater resources are normally poor, and typically supply enough water only for domestic needs. Irrigation is generally not feasible. When irrigation is practical, groundwater withdrawal

may affect other uses. Surface water sources are used to supplement irrigation supplied by groundwater sources.”

The southern strip of the county, bordering the Missouri River, lies in Region A which is defined as having “...minor surface and groundwater supply drought susceptibility. It is a region underlain by saturated sands and gravels (alluvial deposits). Surface and groundwater resources are generally adequate for domestic, municipal, and agricultural needs.”

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

Hazard Description

The United States Geological Society (USGS) describes an earthquake as “a sudden movement of the earth's crust caused by the release of stress accumulated along geologic faults or by volcanic activity.” Earthquakes can be one of the most destructive forces of nature causing death, destruction of property, and billions of dollars of damage.

The New Madrid Seismic Zone (NMSZ), which runs through southeastern Missouri, is the most active seismic zone east of the Rocky Mountains. Any hazard mitigation planning in Missouri must, of necessity, take possible earthquakes into account.

Missouri and much of the Midwest can feel earthquakes from very far away because the geology of the area is more amenable to ground shaking than the California geology. New Madrid earthquakes can cover up to twenty times the area of typical California earthquakes because of this differing geology.

Measuring Earthquake Magnitude and Intensity

In any discussion of earthquakes, it is important to distinguish between two measurements: **magnitude** and **intensity**.

The **magnitude** of an earthquake is a measurement of the actual energy released by the quake at its epicenter. In the U.S., it is commonly measured by the Richter Scale denoted with an Arabic numeral (e.g. 6.0).

The **intensity** of an earthquake refers to the potentially damaging effects of a quake at any particular site. Intensity is measured by the Modified Mercalli Intensity Scale (MMI) and expressed by a Roman numeral (e.g. VI).

A single earthquake will thus have one magnitude but different intensities depending on a location's distance from the epicenter of the quake, intervening soil type, and other factors.

Geographic Location

The entire Planning Area is at risk for the effects of an earthquake along the New Madrid Seismic Zone. Areas close to the Missouri River may be particularly vulnerable. The soil, or alluvium, along river channels is especially vulnerable to liquefaction from earthquake waves; river alluvium also tends to amplify the waves.

Previous Occurrences

Historical quakes along the New Madrid Seismic Zone in southeastern Missouri have been some of the largest in U.S. history since European settlement. The Great New Madrid Earthquake of 1811-1812 was a series of over 2000 quakes which caused destruction over a very large area.

According to information from Missouri SEMA’s Earthquake Program, some of the quakes measured at least 7.6 in magnitude and five of them measured 8.0 or more.

The 1811-1812 quakes changed the course of the Mississippi River. Some of the shocks were felt as far away as Washington D.C. and Boston.

The first federal disaster relief act was a result of the Great New Madrid Earthquake of 1811-1812. President James Madison signed an act into law which issued “New Madrid Certificates” for government lands in other territories to residents of New Madrid County who wanted to leave the area.

Measure of Probability and Severity

Probability: High – Planning Area

Severity: High – Planning Area

How likely are earthquakes along the New Madrid Seismic Zone? In 2002, the U.S. Geological Survey (USGS) released the following expectations for earthquakes in the zone in following 50 years:

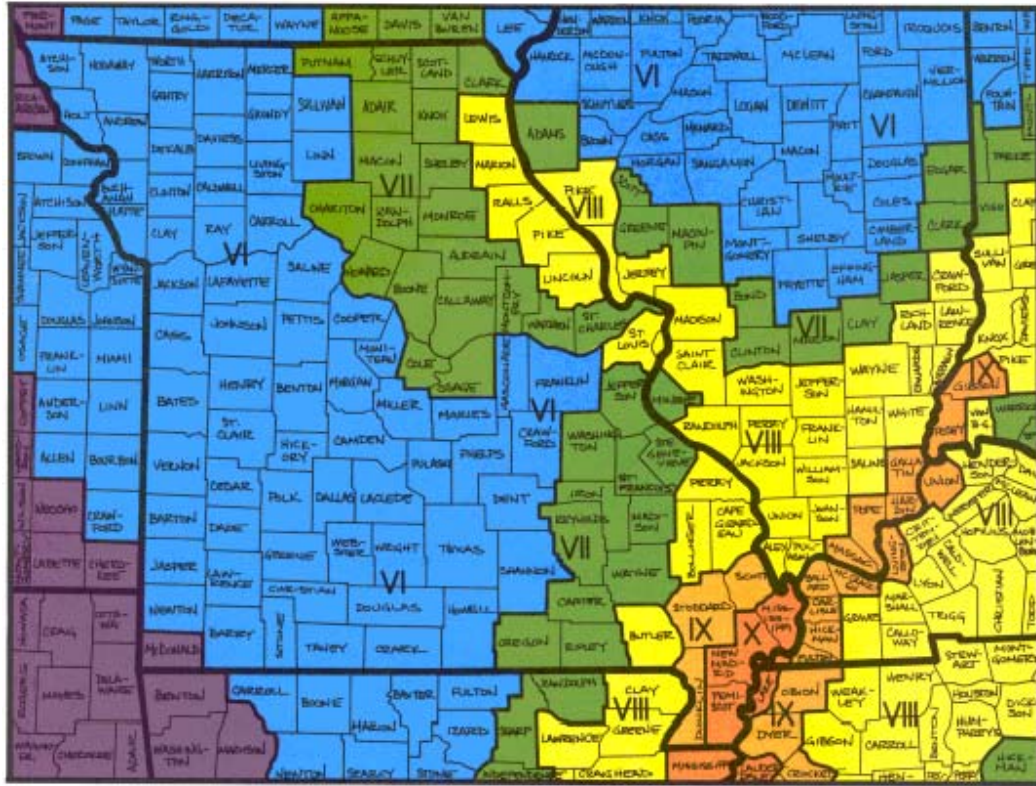
- 25-40% percent chance of a magnitude 6.0 and greater earthquake.
- 7 -10% chance of a magnitude 7.5 - 8.0 quake (magnitudes similar to those in 1811-1812)

According to the USGS, Boone County is one of the 47 counties in Missouri that would be severely impacted by a 7.6 magnitude earthquake with an epicenter on or near the New Madrid Seismic Zone.

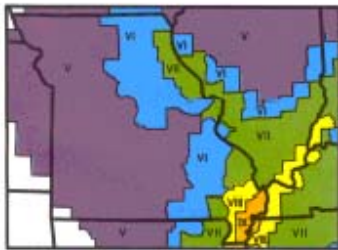
The State Emergency Management Agency (SEMA) has made projections of the highest earthquake intensities which would be experienced throughout the state of Missouri should various magnitude quakes occur along the New Madrid Seismic Zone (see Figure 3.12), as measured by the Modified Mercalli Intensity Scale (see Figure 3.13). The pertinent information for Boone County is summarized in Figure 3.11.

Figure 3.11			
Projected Earthquake Hazard for Boone County			
Magnitude at NMSZ	Probability of Occurrence (2002 -2052)	Intensity in Boone County (MMI)	Expected Damage
6.7	25-40%	VI	Slight
7.6	7-10%	VII	Significant damage to poorly built structures

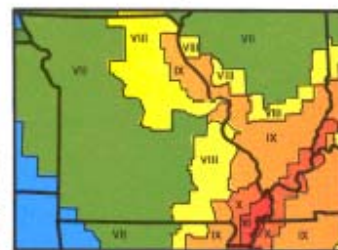
Figure 3.12 Highest Projected Modified Mercalli Intensities by County



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.



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.



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.

Figure 3.13

Modified Mercalli Intensity Scale	
I. Instrumental	Not felt by many people unless in favorable conditions.
II. Feeble	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-favorable 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. Ruinous	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. Disastrous	Some well built wooden structures destroyed; most masonry and frame structures destroyed with foundation. Rails bent.
XI. Very Disastrous	Few, if any masonry structures remain standing. Bridges destroyed. Rails bent greatly.
XII. Catastrophic	Total damage - Almost everything is destroyed. Lines of sight and level distorted. Objects thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move position.
Source: http://en.wikipedia.org/wiki/Mercalli_intensity_scale	

Existing Mitigation Strategies

Multiple Jurisdictions

By law all schools in Boone 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. A press release to educate the public about earthquake preparedness and the availability of educational materials was issued in July 2009. OEM focuses on earthquake preparedness in February each year during “Earthquake Awareness Month”.

County

The Boone County Building Code covers building earthquake resistant structures.

3.2.4 Extreme Heat

Description of Hazard

Extreme heat is the number one weather-related killer in the United States, according to National Oceanic and Atmospheric Administration (NOAA). In contrast to the visible, destructive, and violent nature of floods, hurricanes, and tornadoes, extreme heat is a silent killer. Heat kills by overloading the human body’s capacity to cool itself. According to information from NOAA, more than 1500 people die on average from excessive heat each year in the United States.

Air temperature is not the only factor to consider when assessing the likely effects of extreme heat. 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 NWS takes into account both air temperature and relative humidity (See Figure 3.14). The Heat Index, also known as the apparent temperature, is a measure of how hot it really feels.

Figure 3.14 Heat Index

		RELATIVE HUMIDITY												
		40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
A I R T E M P E R A T U R E F°	110°	136												
	108°	130	137											
	106°	124	130	137										
	104°	119	124	131	137									
	102°	114	119	124	130	137								
	100°	109	114	118	124	129	136							
	98°	105	109	113	117	123	128	134						
	96°	101	104	108	112	116	121	126	132					
	94°	97	100	102	106	110	114	119	124	129	135			
	92°	94	96	99	101	105	108	112	116	121	126	131		
	90°	91	93	95	97	100	103	106	109	113	117	122	127	132
	88°	88	89	91	93	95	98	100	103	106	110	113	117	121
	86°	85	87	88	89	91	93	95	97	100	102	105	108	112
	84°	83	84	85	86	88	89	90	92	94	96	98	100	103
	82°	81	82	83	84	84	85	86	88	89	90	91	93	95
80°	80	80	81	81	82	82	83	84	84	85	86	86	87	

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

Residents of both urban and rural areas are vulnerable to excessive heat. There are many factors such as age, general level of health, outdoor activity level, and availability of air conditioning that will affect the actual risk level.

Geographic Location

The entire Planning Area is at risk from extreme heat events.

Previous Occurrences

Boone County has had many periods of extreme heat in the last two decades (see Figure 3.15). The data indicates that extreme heat usually occurs in July and August in Boone County.

When examining the data in Figure 3.15, it is important to take into consideration that the deaths, injuries, and economic losses represent all counties in Missouri affected by the period of extreme heat.

One of the deaths recorded in the data did occur in Boone County. In August 2002, a 59 year old man died from heat exhaustion after collapsing in his yard while doing yard work.

Figure 3.15
Periods of Extreme Heat in Boone County, 1994-2008

Date	Heat Index	Deaths	Injuries	Property Damage	Crop Damage	Length (days)
06/12/94	100 +	4	55	0	50K	12
07/17/95	120	20	225	75K	0.4M	6
07/28/95	110 +	0	120	15K	25K	4
08/01/95	110-120	9	230	0	400K	most of August
07/18/98	110	0	137	0	0	5
08/23/98	105	0	10	0	0	3
07/18/99	105-115	42	397	0	0	14
08/28/00	105-110	1	125	0	0	4
09/01/00	105-110	1	38	0	0	3
07/07/01	105-110	5	61	0	0	4
07/17/01	110-115	0	19	0	0	1
07/21/01	105-115	3	71	0	0	4
07/29/01	105-115	0	4	0	0	3
08/01/01	105	0	34	0	0	2
08/07/01	102-110	1	10	0	0	3
08/21/01	105-110	0	14	0	0	2
07/08/02	105-110	1	26	0	0	2
07/20/02	105-115	0	47	0	0	3
07/26/02	105-115	0	185	0	0	6
08/01/02	100 +	1	59	0	0	6
07/03/03	105	3	93	0	0	7
08/15/03	105 +	2	54	0	0	7
08/24/03	105-110	0	0	0	0	5
07/20/04	105-110	0	25	0	0	3
07/20/05	105-120	4	65	0	0	7
07/17/06	105-110	0	12	0	0	4
07/29/06	105-110	0	0	0	0	3
08/01/06	105?	0	59	0	0	2
08/05/07	105-110	0	0	0	0	12
TOTALS		97	2175	90K	875K	

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

Measures of Probability and Severity

Probability: Moderate – Planning Area

Severity: Moderate – Planning Area

Existing Mitigation Activities

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

The Boone County/City of Columbia 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.

The National Weather Service (NWS) has devised a method to warn of advancing heat waves up to seven days in advance. The new Mean Heat Index is a measure of how hot the temperatures actually feel to a person over the course of a full 24 hours. It differs from the traditional Heat Index in that it is an average of the Heat Index from the hottest and coldest times of each day.

The National Weather Service initiates alert procedures when the Heat Index is expected to exceed 105°- 110°F for at least two consecutive days. (The exact Heat Index temperature used depends on specifics of the local climate.) The following are released to the media and over NOAA All-Hazard Weather Radio:

- Heat Index values are included in zone and city forecasts.
- Special Weather Statements and/or Public Information Statements are issued which present a detailed discussion of the Heat Index Values, who is most at risk, and safety rules for reducing risk.
- In severe heat waves, State and local health officials are assisted in preparing Civil Emergency Messages which include Special Weather Statements and more detailed medical information, advice, and names and telephone numbers of health officials.

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

Boone County and its jurisdictions are at great risk for flooding because the southern border of the County is situated on the bank of the Missouri River, the longest river in the United States. The Missouri River drains approximately one-sixth of the area of the continental United States, according to the USGS. It drains over half the state of Missouri as it flows eastward to join the Mississippi River at St. Louis. Since Boone County is located less than 200 miles upstream from the mouth of this 2,540 mile river, it is obvious that flooding is a major concern for the county. There are also numerous creeks throughout the county with year-round water flows draining into the Missouri River.

Flooding is defined as partial or complete inundation of usually dry areas. Riverine flooding refers to when a river or creek overflows its normal boundaries. A rapid accumulation or runoff of surface waters may impact smaller rivers and creeks and cause flash flooding. Flash flooding can also occur as a result of dams being breached or overtopped. Flash floods can develop in just a matter of hours and are responsible for more flood related deaths than any other type of flooding.

The areas adjacent to rivers and stream banks that serve to carry excess floodwater during rapid runoff 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.

In some cases, however, flooding may not be directly attributable to a river, stream or lake overflowing its banks. It may simply be the combination of excessive rainfall and/or snowmelt, saturated ground, and inadequate drainage. With no place else to go, water will find the lowest elevations, areas that are often not in a floodplain. This type of flooding, often referred to as sheet flooding, is becoming increasingly prevalent as development outstrips the ability of the drainage infrastructure to properly carry and disburse the water flow.

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.

Most flooding in Boone County occurs in late spring and summer but floods can occur in any season (see Figure 3.16).

Figure 3.16 Boone County Flood Events by Month, 1993-2009	
January	2
February	0
March	2
April	4
May	14
June	9
July	5
August	6
September	4
October	2
November	0
December	0

Geographic Location

The entire Planning Area is at risk from some type of flooding. Hartsburg, Huntsdale, McBaine, Rocheport, and the unincorporated areas near the Missouri River are at higher risk of riverine flooding than the rest of the county. The Flood Insurance Rate Map (FIRM) for Boone County shows the flood zones for these jurisdictions at greater risk. The FIRMS for the participating jurisdictions at greater risk are included (see figures 3.17-3.19).

Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk. Each zone reflects the severity or type of flooding in the area.

The current FIRM available for Boone County shows an effective date of 1983. The FIRM for Boone County is currently in the process of being updated. New construction, increases in storm water, and changes in land use have impacted flood zone boundaries; these effects on flood zones will need to be reflected in the updated FIRM.

Hartsburg, MO
 FIRM Data June 15, 1983

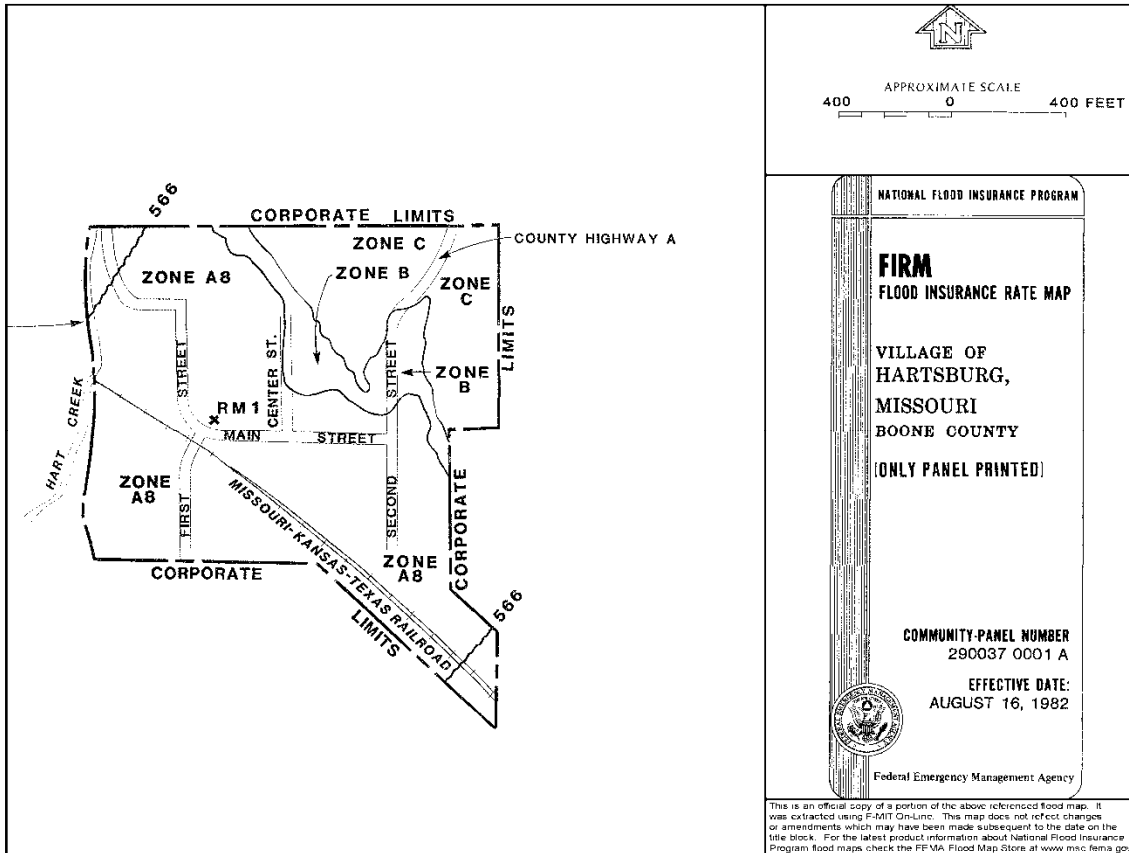


Figure 3.17 Section of Boone County FIRM including Village of Hartsburg

Huntsdale, MO
 FIRM Data June 15, 1983

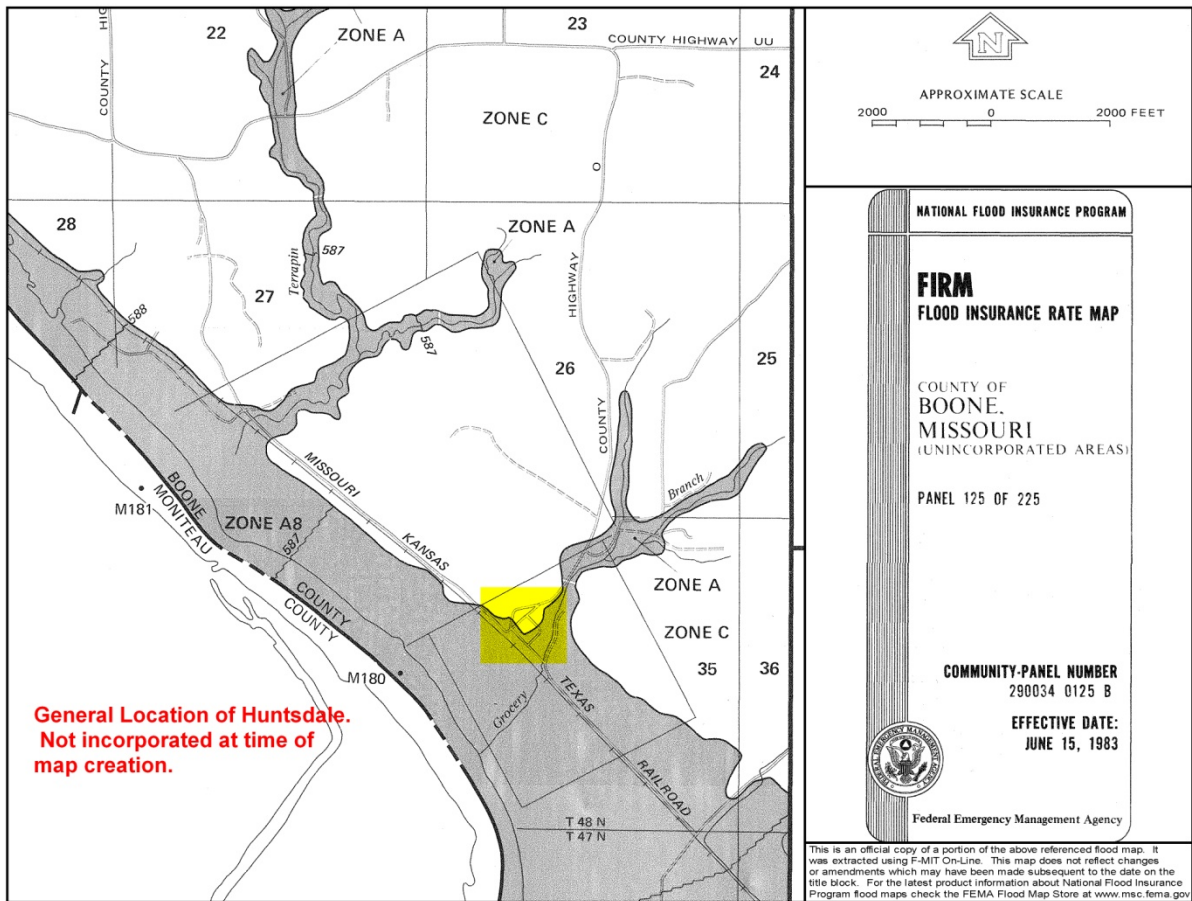


Figure 3.18 Section of Boone County FIRM including Huntsdale

Rocheport, MO
 FIRM Data June 15, 1983

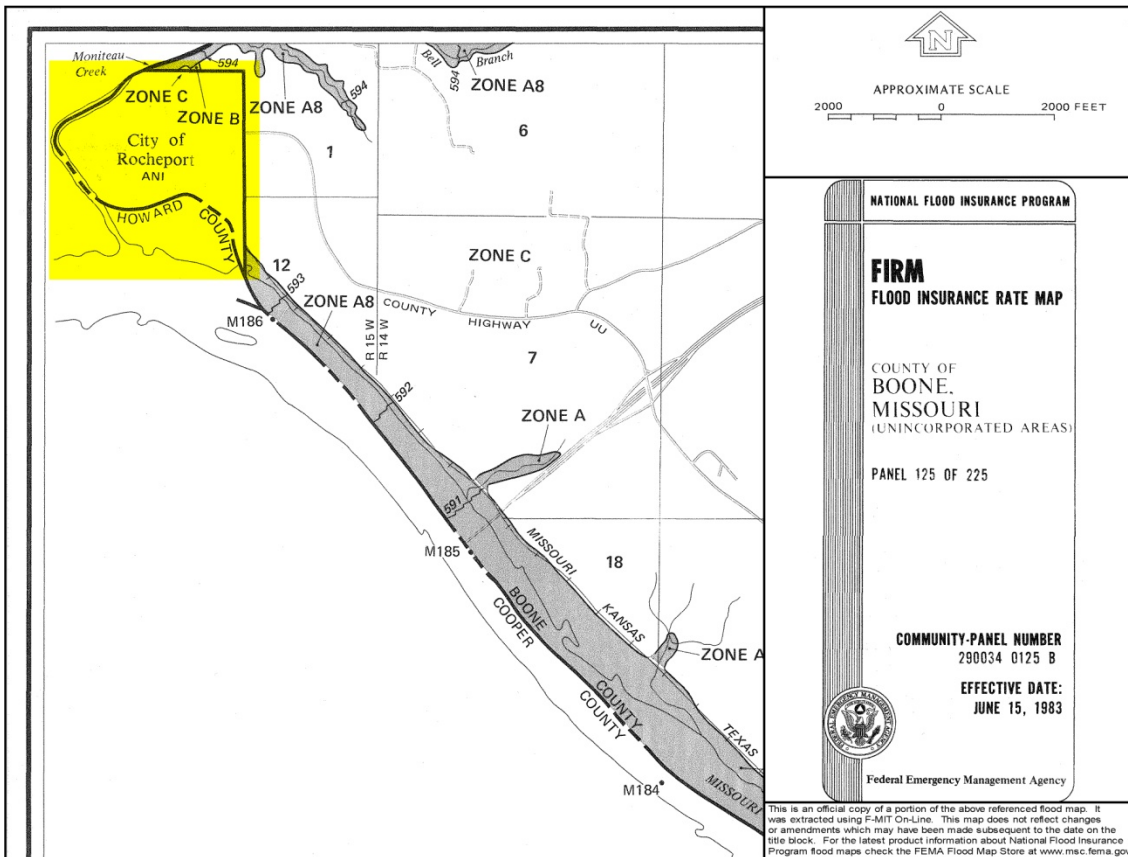


Figure 3.19 Section of Boone County FIRM including City of Rocheport

Flash flooding and subsequent road closures are a concern for all jurisdictions in the Planning Area. Flash flooding occurs throughout the Planning Area and as a result road closures due to high water are common throughout the county. A map showing road closure locations is included (see Figures 3.20-3.21a, b).

Figure 3.20

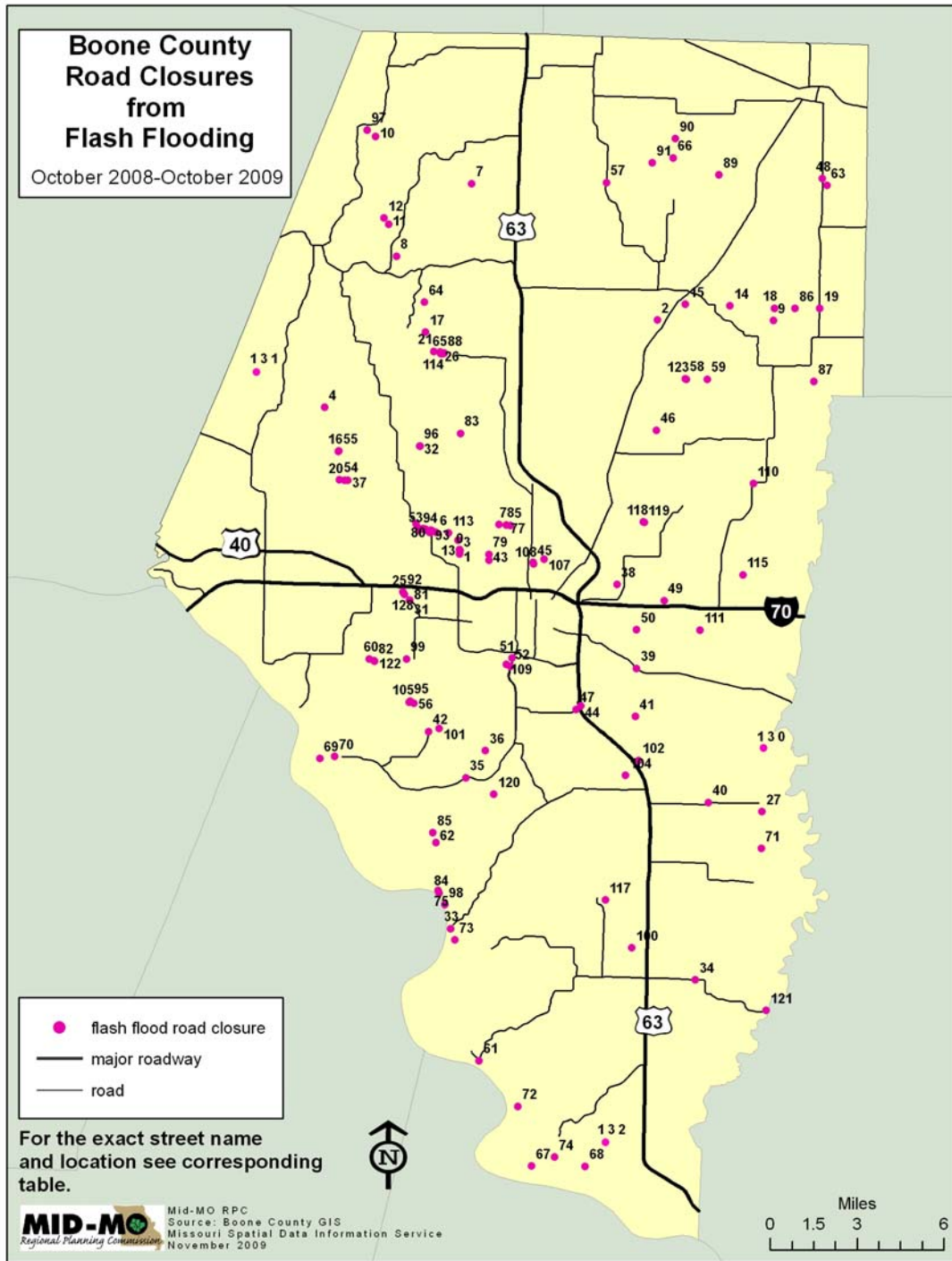


Figure 3.21a

Road Closures Due to Flash Flooding Events*
(see corresponding map)

#	Road Name	#	Road Name
0	Black Foot Rd	35	Route K @ Southwest Way (Gateway S. Subdivision)
1	Blackfoot Rd @ City/County Line	36	Old Plank Rd just south of Forum
2	Frink Rd at Kemper Rd	37	6800 BLK Hatton Chappel
3	2850 Block of Blackfoot Rd	38	Orchard Lane @ McKee
4	Wilhite Rd East of Evert School Rd	39	Broadway @ Old Hawthorne
5	Brown School Rd E East of Providence Rd	40	Rangeline RD @ Highway AB
6	Wilcox at Twin Bridges	41	Rolling Hills @ Sugar Grove
7	Williams Rd near the low water crossing	42	RT KK @ Apple Wood Creek Rd
8	Lockwood Lane East of Hgwy NN	43	3200 BLK Creasy Springs
9	Davenport Rd 1 mi North of Doris Blvd	44	4100 BLK Lenoir RD
10	Perche Church Rd 1/4 mile south of RT F	45	Northland @ Blue Ridge
11	Stidham Rd, closed from the bridge to Hwy NN	46	Orear Rd @ Hill View
12	Richardson Dr @ Stidham Rd	47	Nifong @ Ponderosa
13	Blackfoot Rd at the Columbia City Limits	48	19000 BLK Rt Z
14	Owen School Rd @ Level Rd	49	6700 Block St Charles
15	Rt B @ Kemper Rd	50	5500 Block Richland Rd
16	Bell Rd @ Locust Grove Church Rd	51	Research Park @ outer rd (Providence)
17	Red Rock Rd, Lewis Lane and Silver Fork Creek	52	Providence @ Mic Deaver
18	Owen School @ Davenport Rd	53	Rt E @ Twin bridges
19	Owen School Rd @ Rt Z	54	Locust Grove @ Hatton Chappel
20	Hatton Chapel Rd, east of Locust Grove Church Rd	55	Locust Grove @ Bell
21	Stone Dr @ Silver Fork Hill Creek	56	3800 Block Scott Blvd
22	Driskel at RT E	57	Route V @ Thomas Hill
23	Wilcox at RT E	58	Mount Zion @ Hecht
24	Route E at the Twin Bridges	59	Mount Zion @ Hague
25	Strawn at Hominy Creek	60	Gillespie Bridge near Coats Lane
26	Stone Dr at the low water crossing	61	River Rd at Wilton
27	IT Testing	62	Woodie Proctor Rd at Smith Hatchery RD
28	Driskel Rd closed at Route E	63	Grassland School Rd near Rt Z
29	Route E @ Twin Bridges	64	Willis West of Rt YY
30	Wilcox Rd @ Route E	65	Stone Dr/Dripping Springs Rd
31	Strawn Rd near I70 Dr. Southwest	66	20000 Block Farwest School Rd N
32	Akeman Bridge Rd @ low water crossing	67	Hartsburg Bottom Rd at Hart Creek
33	Easley River Rd near Coopers Landing	68	Hartsburg Bottom Rd, Claysville to Soft Pit Hill
34	Route Y, west of Rangeline Rd	69	Burr Oak Rd @ McBaine

Figure 3.21b

Road Closures Due to Flash Flooding Events*
(see corresponding map)

#	Road Name	#	Road Name
70	Route K @ McBaine	102	Bass Lane near Rolling Hill RD
71	Boone county IT testing	103	Black Foot at the City Limits
72	River Rd, between Hartsburg and Wilton	104	Boone Femme Church Rd at Low Water Crossing
73	Rippeto Rd, Harold Cunningham to Easley River Rd	105	Brushwood Lake West of Scott
74	Bush Landing Rd, Hartsburg to Grimes Rd	106	2800 Block Stone Dr W
75	Smith Hatchery Rd at Coopers Landing	107	Blue Ridge Rd and Parker
76	Wilcox Rd near Route E	108	Northland @ Blueridge
77	Brown School east of Clearview	109	Research Park Behind Stoney Creek Inn
78	Brown School west of Clearview	110	Rt Z @ Maupin Rd
79	Creasy Springs at Bear Creek Trail	111	Richland Rd @ Trade Winds PKWY
80	Route E @ Wilcox	112	Blackfoot @ Oneal Rd
81	500 BLK STRAWN	113	Oneal @ Blackfoot
82	Gillespie Bridge Rd @ Coats Lane	114	Stone Dr West of Dripping Springs RD
83	4500 Block Akeman Bridge Rd	115	9200 Block of St Charles Rd E
84	Easley River Rd	116	Route E @ Twin Bridges
85	Smith Hatchery RD	117	Minor Hill Rd just East of RT DD
86	Owens School Rd	118	Hinkson Creek Rd @ Wyatt Lane
87	Marshall Lane just east of Nienaber Lane	119	Hinkson Creek Rd near Wyatt Lane
88	Stone Dr closed at low water crossing	120	Hill Creek Rd at Little Bonne Femme Creek
89	Adams Rd near Lost Woods Ln	121	RT Y @ Boone/Callaway Co Line
90	Farwest School Rd from Lost Woods to Hwy CC	122	Gillespie Bridge Rd near Coats Lane
91	Barnes Rd North of Dunbar Rd	123	Mt Zion Church Rd at Hague Rd
92	Strawn near I70 Dr SW	124	Wilcox Rd East of RT E
93	Wilcox Rd, between Rt E and Oneal Rd	125	Blackfoot Rd at city limits
94	Driskel Rd, between Rt E and Moreau Rd	126	Driskel Rd @ Route E
95	Brushwood Lake Rd, between Scott Blvd and bridge	127	Wilcox Rd @ Route E
96	3900 Block Akeman Bridge Rd	128	Strawn Rd, south of I-70 Dr. Southwest
97	Porter Rd South of RT F	129	Rte E at Twin Bridges
98	Easley River Rd near Rippeto Rd	130	E Vemer's Ford Rd
99	Gillespie Bridge near Scott BLVD	131	Herman Nichols Rd south of Richland School
100	Crump Lane S. South of Martin Lane	132	S Slate Creek Rd
101	Highway KK near Old Mill Creek		

* Road closures occurred between 10/2008 and 10/2009

Source: Boone County GIS Department

Previous Occurrences

The floods of 1993 and 1995 were the worst repetitive flood events in Missouri history, according to the Missouri State Hazard Mitigation Plan (2007). There were five presidential disaster declarations for flooding during this period; Boone County was included in Disaster Declaration #995 (July 9, 1993) and Disaster Declaration #1054 (June 2, 1995).

All levees in Boone County failed during the Flood of 1993, according to the U.S. Army Corps of Engineers. More information about this is included under Levee Failure (Section 3.2.7).

The towns of Hartsburg, Huntsdale, McBaine, Rocheport and the unincorporated areas near the Missouri River experienced elevated loss statistics during the Missouri River floods of 1993 and 1995 as compared with damages in the remainder of the county. The extent of the 1993 flood in Hartsburg and Rocheport are shown in Figures 3.22 and 3.23.

Figure 3.22

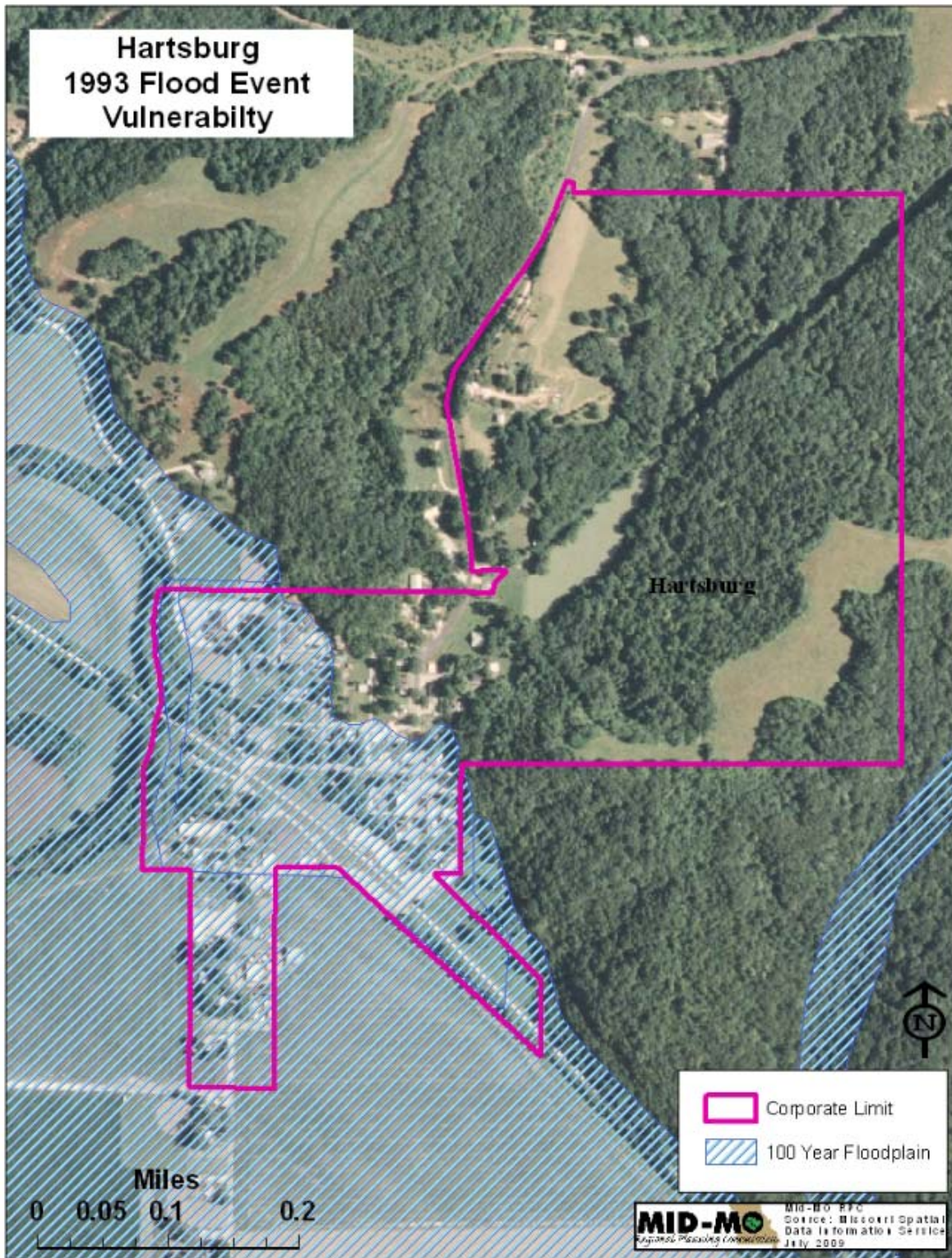
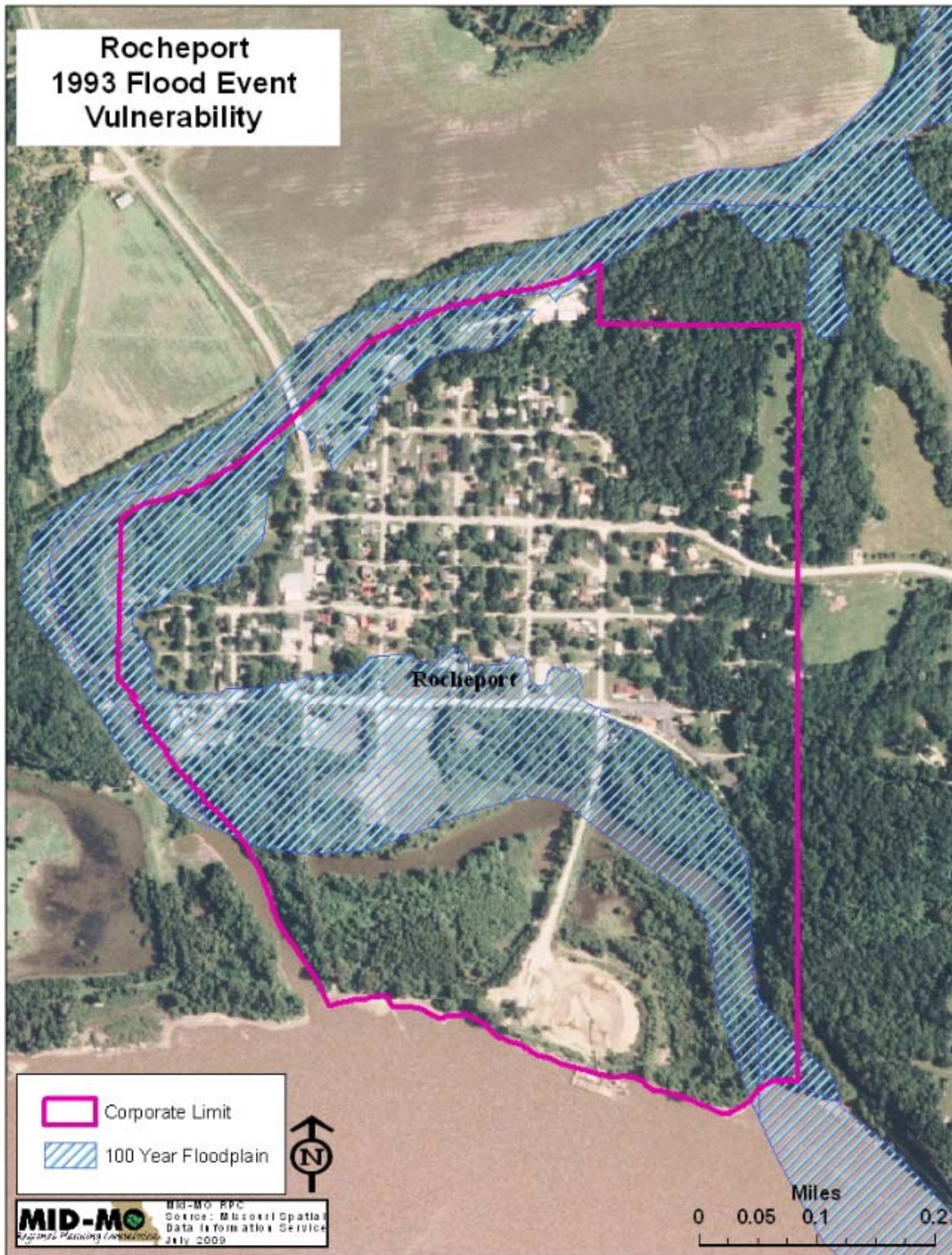


Figure 3.23



In addition to the river floods of 1993 and 1995, data from NOAA indicates 49 other flooding events in Boone County since the fall of 1993. One of these was a Missouri River flood in April of 1994 which caused \$5 million in property damage and \$5 million in crop damage across 79 Missouri counties and the City of St. Louis. The other 47 flooding events recorded by NOAA are shown in Figure 3.24a-c.

Figure 3.24a						
Boone County Historic Flood Data						
Location	Date	Type	Deaths	Injuries	Property Damage	Crop Damage
Columbia	09/19/93	Urban Flood	0	0	0	0
Columbia/ County	09/22/93	Flash Flood	0	0	50K	0
Countywide	4/11/94 - 4/19/94	River Flood	0	0	NA	NA
Columbia and Hallsville area	4/11/94 - 4/12/94	Flash Flood	0	0	0	0
Centralia	05/07/95	Rural Flood	0	0	0	0
Countywide	05/17/95	Flash Flood	0	0	5.5K	0
Southern Boone	5/1/96 - 5/31/96	River Flood	0	0	0	0
Eastern Boone	06/22/97	Flash Flood	0	0	0	0
Central Boone	09/08/97	Urban/Small Stream Fld	0	0	0	0
Northern Boone	06/29/98	Flash Flood	0	0	0	0
Central Boone	07/04/98	Flash Flood	0	0	0	0
Columbia	08/27/98	Urban/Small Stream Fld	0	0	0	0
Countywide	10/05/98	Flash Flood	0	0	0	0
Southern Boone	10/06/98	River Flood	0	0	0	0
Northern Boone	06/12/99	Flash Flood	0	0	0	0
Southern Boone	05/27/00	Flash Flood	0	0	0	0
Central and Northern Boone	08/07/00	Flash Flood	0	0	0	0
Countywide	1/28/01 - 1/29/01	Urban/Small Stream Fld	0	0	0	0
Columbia	05/17/01	Flash Flood	0	0	0	0
Southern Boone	6/4/01 - 6/13/01	River Flood	0	0	0	0
Countywide	06/06/01	Urban/Small Stream Fld	0	0	0	0
SW Columbia and North of McBaine	07/19/01	Flash Flood	0	0	0	0

Figure 3.24b						
Boone County Historic Flood Data						
Location	Date	Type	Deaths	Injuries	Property Damage	Crop Damage
Countywide	05/07/02	Flash Flood	0	0	0	0
Southern Boone	5/8/02 - 5/20/02	River Flood	0	0	0	0
Countywide	05/09/02	Flash Flood	0	0	0	0
Northern Boone	5/12/02 - 5/13/02	Flash Flood	0	0	0	0
Southern Boone	08/18/02	Flash Flood	0	1	0	0
Columbia	08/20/02	Flash Flood	0	0	0	0
Northern Boone	06/12/03	Flash Flood	0	0	0	0
Northern Boone	6/25/03 - 6/26/03	Flash Flood	0	0	0	0
Countywide	03/26/04	Flash Flood	0	0	500K	0
Countywide	08/26/04	Flash Flood	0	0	0	0
Countywide	1/12/05 - 1/13/05	Flash Flood	0	0	0	0
Columbia	05/11/05	Flash Flood	0	0	0	0
Columbia	08/26/05	Flash Flood	0	0	0	0
Columbia	09/19/05	Flash Flood	0	0	0	0
Central Boone	06/11/06	Flash Flood	0	0	0	0
Centralia	05/06/07	Flash Flood	0	0	0	0
Columbia	05/06/07	Flash Flood	0	0	45K	0
Southern Boone	05/08/07	River Flood	0	0	10K	25K
Northern Boone	04/10/08	Flash Flood	0	0	1K	0
Central to Northern Boone	06/13/08	Flash Flood	0	0	1K	0

Figure 3.24c

Boone County Historic Flood Data

Location	Date	Type	Deaths	Injuries	Property Damage	Crop Damage
Central to Southern Boone	07/22/08	Flash Flood	0	0	0	0
Northern Boone	07/25/08	Flash Flood	0	0	0	0
Hallsville area	7/27/08 - 7/28/08	Flash Flood	0	0	0	0
Countywide	03/24/09	Flash Flood	0	0	0	0
Northern Boone	04/29/09	Flash Flood	0	0	0	0
Northern Boone	05/15/09	Flash Flood	0	0	0	0
Southern Boone	07/04/09	Flash Flood	0	0	0	0
TOTALS:			0	1	5.613M	5.025M
Source: http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms						

FEMA Repetitive Losses in Boone County

Repetitive losses from flooding have taken their toll in Boone County. According to information provided by the State Emergency Management Agency, there have been almost \$2.5 million dollars in National Flood Insurance Program(NFIP) repetitive loss payments in the county between 1981 and August 31, 2009. This figure represents 51 individual loss payments on 14 properties.

A number of flood prone properties in Boone County were acquired with Hazard Mitigation Grant Program (HMGP) funds through the Missouri Flood Buyout Program after the 1993 flood. The locations of these properties are shown in Appendix E. There is further information on Repetitive Loss Properties under Flood Vulnerability (Section 3.4.5).

Measure of Probability and Severity

Probability: High – Hartsburg, Huntsdale, Rocheport
Moderate – Boone County, Columbia
Low - all other participating jurisdictions

Severity: High – Hartsburg, Huntsdale, Rocheport
Moderate – Boone County, Columbia
Low - all other participating jurisdictions

Existing Mitigation Activities

National Flood Insurance Program (NFIP)

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 Boone County jurisdictions participate in the NFIP: Boone County, Ashland, Centralia, Columbia, Hallsville, Hartsburg, Rocheport, and Sturgeon. Detailed information on NFIP participation is shown in Figure 3.25; a summary of the NFIP insurance policies in the county is shown in Figure 3.26.

Figure 3.25		
Boone County NFIP Participating Communities		
Local governments	Date of Entry	Effective Map
Boone County	06/15/83	06/15/83
Ashland	08/24/84	NSFHA*
Centralia	04/15/77	04/15/77
Columbia	08/28/71	08/16/95
Hallsville	01/01/06	NSFHA*
Hartsburg	08/16/82	08/16/82
Rocheport	08/02/82	08/02/82
Sturgeon	05/01/87	05/01/87
* No Special Flood Hazard Area		
Source: http://www.fema.gov/fema/csb.shtm		

Figure 3.26			
NFIP Policies in Boone County as of 07/31/2009			
Community	Policies In-Force	Insurance In-Force Whole	Written Premium In-Force
Boone County	63	\$10,121,600	29,808
Ashland	0	0	0
Centralia	0	0	0
Columbia	76	\$18,405,800	52,474
Hallsville	1	\$28,000	119
Hartsburg	25	\$2,861,000	15,435
Rocheport	3	\$237,200	1,326
Sturgeon	1	\$46,900	370
Source: http://bsa.nfipstat.com/reports/1011.htm#MOT			

County

A Stream Buffer Ordinance, Order 205-2009, was passed by the Boone County Commission in April 2009 with an implementation date of June 1, 2009, and a review after one year of implementation. One of the ordinances many focuses is reduction of flash flooding. The ordinance governs the unincorporated areas of the county.

A Joint Storm Water Task Force, formed by the Boone County Commission and the City of Columbia, met from 2002 to 2008 and drafted a Storm Water Ordinance for the County. The ordinance is currently under review and pending adoption.

Columbia

The City of Columbia has a Stormwater Master Plan. It has a Stormwater Management Program located within the Department of Public Works.

Columbia’s “Stormwater Management & Water Quality Manual” was updated in February 2009. The manual includes the following specifications for road classifications and their respective levels of safety against flooding (see Figure 3.27).

Figure 3.27 Design Capacity for Streets		
Street Classification	Minimum Design Storm Capacity	Design Storm Return Interval
Arterial	1%	100 year
Collector and Local Non-Residential	4%	25 year
Residential	10%	10 year

Source: Stormwater Management & Water Quality Manual, Columbia, MO, 2009

Other

The National Weather Service issues flooding hazard alerts according to three response levels (See Figure 3.28). These alerts are broadcast through local media.

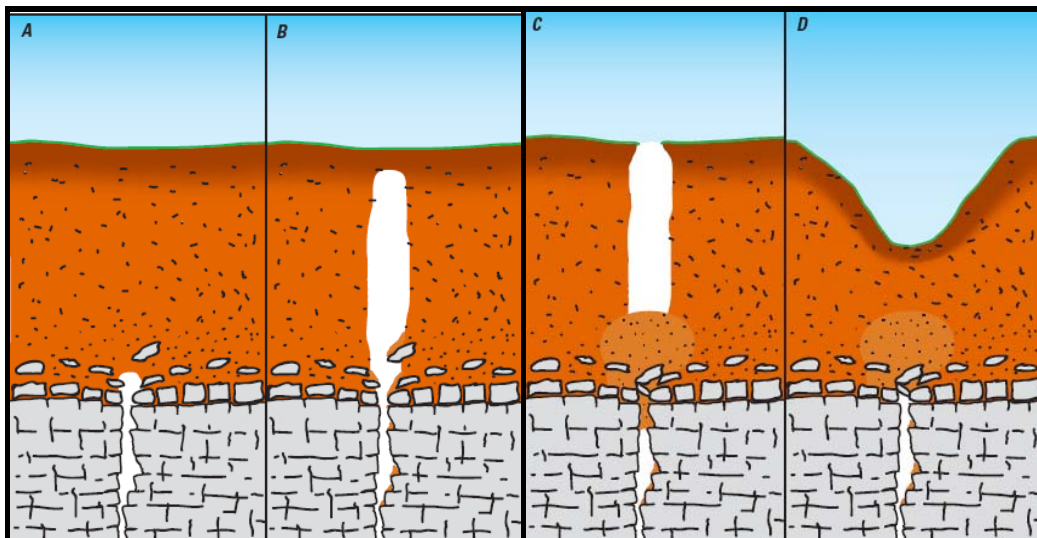
Figure 3.28 Flood Response Levels	
Response level	Description
Flood Watch	Flash flooding or flooding is possible within a designated area
Flood Warning	Flash flooding or flooding has been reported or is imminent
Flood Advisory	Flooding of small streams, streets, and low lying areas, such as railroad underpasses and some urban drains is occurring

3.2.6 Land Subsidence/ Sinkhole

Description of Hazard

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.” Figure 3.29 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 3.29



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

The Southern portion of the City of Columbia and the Southwestern portion of the county are most vulnerable to the effects of land subsidence and subsequent sinkhole development. The Karst regions of the southwestern portion of the county make the area a prime location for this hazard.

There are 418 known sinkholes in the Planning Area (See Figure 3.30). Two hundred and ninety of these are located between Interstate 70 and the City of Ashland in the southwestern corner of

the Boone County. Eight sinkholes are located within the city limits of Columbia. It is important to note that future sinkhole developments have the potential to occur near these areas and also in other areas that have no developed sinkholes. Gradual or sudden land subsidence is a key sign of sinkhole formation.

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 areas in Boone 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 Boone County is high.

Measure of Probability and Severity

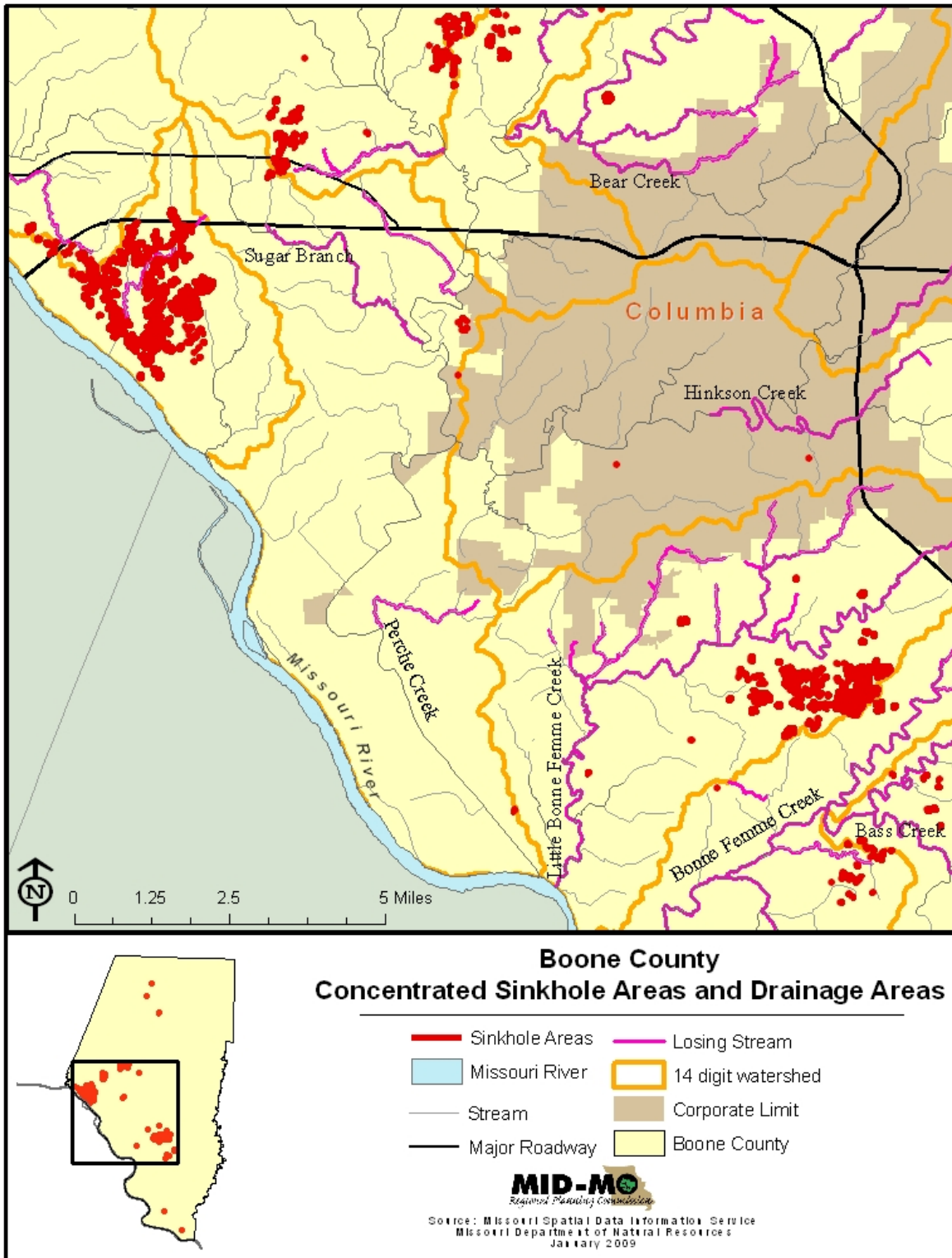
Probability: High – Boone County, Columbia
Not applicable - All other participating jurisdictions

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

Existing Mitigation Strategies

Boone County is in the process of adopting a new Stormwater Ordinance. The draft ordinance contains provisions that limit the impact of construction on sensitive areas such as sinkholes. View the Boone County Stormwater Ordinance draft at:
<http://www.showmeboone.com/PW/Default.htm>

Figure 3.30



3.2.7 Levee Failure

Description

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

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

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

There is no single agency with responsibility for levee oversight. The US Army Corps of Engineers has specific and limited responsibilities for approximately 2,000 levees nationwide. There are two levee districts in Boone County: the McBaine Levee District and the Hartsburg Levee District. These levee districts are organized by the Boone County Circuit Court. There are other privately owned and maintained levees in Boone County which do not belong to these levee districts.

For both levee districts and privately owned levees, the responsibilities of the local owners or sponsors are broad. These may include levee safety, land use planning and development, building codes and operations, maintenance, repair, rehabilitation, and replacement of the levee. The certification of levees for FEMA’s National Flood Insurance Program is also the responsibility of the local levee owners or sponsors.

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.

Federally authorized and some non-federal levees may be eligible for Corps of Engineers rehabilitation assistance funding. Only the two levee districts in Boone County, the McBaine Levee District and the Hartsburg Levee District, are currently eligible for Corps of Engineers levee rehabilitation assistance should they receive damage during a flood event. It is important to note that the current levees in Boone County are agricultural levees and as such are built to withstand only 50 year floods.

Figure 3.31 lists the levees in the levee districts in Boone County. Some levees are shared by property owners in neighboring counties.

Figure 3.31 Boone County Levees		
Levee Name	Sponsor	Acres
Hartsburg LD SEC 1	Hartsburg Levee District	2105
Hartsburg LD SEC 2	Hartsburg Levee District	1331
Hartsburg LD SEC 3	Hartsburg Levee District	26
McBaine	McBaine Levee District	318
Source: USGS, Columbia Environmental Research Center, 2001.		

Geographic Location

Major levees in the Planning Area are located along the southwestern border of Boone County separating the Missouri River from agricultural land. Structures in Boone County that would be vulnerable to the effects of levee failure would include those areas lying in or near the Missouri River floodplain and its tributaries. Levees protect agricultural land near McBaine, Hartsburg, and Huntsdale.

According to the Missouri State Hazard Mitigation Plan, there is limited data on levees and their locations and conditions, but this should improve due to recently initiated nationwide levee certification efforts. The only available information on levee locations is the 1983 FIRM (see Figure 3.32). It must be noted that these locations have probably shifted due to the 1993 flood and the failure of all levees in Boone County.

Previous Occurrences

During the 1993 Flood, according to the US Army Corps of Engineers, all levees in Boone County failed and resulted in the inundation of land and structures being protected by those levees. The water treatment plant for the City of Columbia was located in the path of the flood water but, due to intensive efforts by several parties, there were no effects on the structure.

According to the Boone County Health Department, no Boone County public water or city water supplies in the county suffered contamination. Some private wells were sampled and found to contain higher bacteria levels after the flood. These wells were treated with chlorine and the issue was resolved.

Measures of Probability and Severity

Probability: Moderate – Boone County, Hartsburg, Huntsdale
Not applicable – All other participating jurisdictions

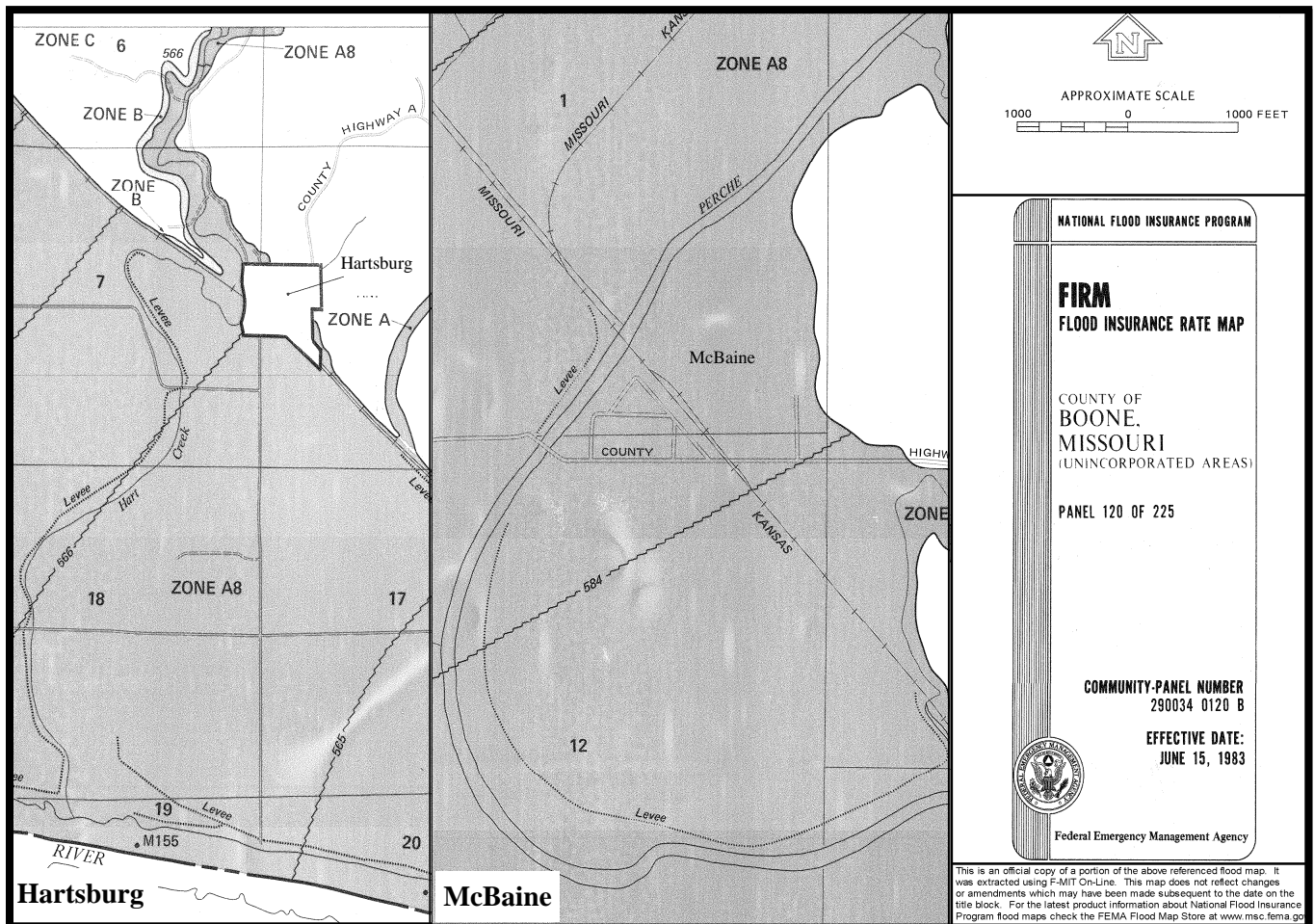
Severity: Moderate – Boone County, Hartsburg, Huntsdale
Not applicable – All other participating jurisdictions

Existing Mitigation Strategies

While the US Army Corps of Engineers oversees the inspection of the Hartsburg and McBaine Levee Districts, it is up to the owner or sponsor of private levees to inspect and maintain their levees. Because so many levees are privately owned tracking of levee conditions is a point of concern.

“Operations and Maintenance is important to levee safety, but it is not the only factor that affects risk and reliability of a levee, and should not be represented as such. It is important to note, there is still a large universe of private and other non Corps levees that have not been inventoried or inspected/assessed. We don’t know the size of this universe, where the levees are located, their condition, or the consequences of failure, loss of life being of paramount concern.” – US Army Corps of Engineers

Figure 3.32 1983 Levee locations around Hartsburg and McBaine (then unincorporated)



3.2.8 Severe Winter Weather

Description of Hazard

Boone County experiences at least one winter storm almost every year; certain years are particularly notable for their storm frequency and/or intensity. Winter storms in central Missouri contain ice, snow, severe cold, sleet, and wind; each of these has the potential to disrupt life in the region by making normal activity difficult and/or dangerous.

Winter storms pose a threat to central Missouri by creating disruptions in electricity, telephone, and other critical infrastructures. Employees may be unable to get to work due to icy conditions, unplowed roadways, disruptions in transportation services, or facility damage. A shortage of supplies may ensue with a longer stretch of severe winter weather.

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

Geographic Location

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

Previous Occurrences

Boone County experienced 42 officially recorded winter storms in the period Jan. 1, 1993 – Oct. 31, 2009, according to data from NOAA and FEMA. Figure 3.33a-b summarizes available data for these storms including additional information from SEMA Situation Reports.

Winter storms typically move through a large area. The number of counties affected by a storm is indicated in Figure 3.35 for those storms where deaths, injuries, and/or costs are reported. The deaths, injuries, and estimated costs reflect all counties in Missouri affected by the storm. For example, the total cost for the heavy snowstorm of January 18, 1995 was estimated at \$2.4 million for the 22 Missouri counties affected; the snowplowing and cleanup costs for this storm were estimated to be nearly \$400,000 in Boone County. (This storm set a new 24-hour snowfall record of 19.7" in Columbia.) The winter storm on Dec. 1, 2006 which resulted in eleven fatalities statewide was responsible for one traffic-related death in Boone County.

More cost information is available for storms for which Presidential Disaster Declarations were made. After a Presidential Disaster Declaration, Public Assistance (PA) and/or Individual Assistance (IA) is made available through FEMA. The PA can be further specified as a specific category; the categories relevant to this data are Category A for debris removal and Category B for emergency protective measures.

Since 2006, there have been three Presidential Disaster Declarations for severe winter weather which included Boone County (#1673, #1676, and #1736). In all of these disasters, Public Assistance (PA) was made available to Boone County through FEMA.

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

The severe winter weather in the first two weeks of December 2007 resulted in both a Presidential Emergency Declaration (#3281) for the ice storm beginning on Dec. 8, 2007 and a Presidential Disaster Declaration (#1736) for the entire 10-day period of severe winter weather. Boone County received a total of \$308,823 in PA funds from the Disaster Declaration. SEMA activated the State Emergency Operations Center and the Governor of Missouri declared a State Emergency which made state resources available to assist local governments.

These storms caused widespread power outages in Southern Boone County, according to SEMA Situation Reports. About 200 power outages were addressed in the Ashland area; Hartsburg was without power. Shelter was made available in both Ashland and Hartsburg. A man was killed by a falling tree in Southern Boone County while cutting another tree down with a chainsaw.

Figure 3.33a

Severe Winter Storms in Boone County, Missouri 1993-2009

Date	Storm Type	Deaths	Injuries	Estimated Cost (Million \$)	Presidential Disaster or Emergency Declaration #	# of Counties	Assistance in Boone County (IA or PA)
02/22/94	Glaze/ice Storm	0	15	0		9 plus City of St. Louis	
04/05/94	Winter Storm	0	0	0.5		31 plus City of St. Louis	
01/06/95	Ice Storm	0	0	0			
01/18/95	Heavy Snow	0	0	2.4		22	
12/08/95	Snow	0	0	0			
12/18/95	Winter Storm	0	0	0			
01/02/96	Winter Storm	0	0	0			
01/03/96	Winter Storm	0	0	0			
11/25/96	Ice Storm	0	0	0			
01/08/97	Winter Storm	0	0	0			
01/15/97	Winter Storm	0	0	0			
01/27/97	Winter Storm	0	0	0			
04/10/97	Winter Storm	0	0	0			
12/08/97	Winter Storm	0	0	0			
01/12/98	Winter Storm	0	0	0			
03/08/98	Winter Storm	0	0	0			

Figure 3.33b

Severe Winter Storms in Boone County, Missouri 1993-2009

Date	Storm Type	Deaths	Injuries	Estimated Cost (Million \$)	Presidential Disaster Declaration #	# of Counties	Assistance in Boone County (IA or PA)
12/21/98	Winter Storm	0	0	0			
01/01/99	Winter Storm	0	0	0			
01/27/00	Winter Storm	0	0	0			
03/11/00	Winter Storm	0	0	0			
12/13/00	Heavy Snow	0	0	0			
01/29/02	Ice Storm	0	0	82.5	1403	43	IA
03/02/02	Winter Storm	0	0	0			
03/25/02	Winter Storm	0	0	0			
12/04/02	Winter Storm	0	0	0			
12/24/02	Winter Storm	0	0	0			
01/01/03	Winter Storm	0	0	0			
02/23/03	Winter Storm	0	0	0			
12/09/03	Winter Storm	0	0	0			
12/13/03	Winter Storm	0	0	0			
01/25/04	Winter Storm	0	0	0			
11/24/04	Winter Storm	0	0	0			
12/08/05	Winter Storm	0	0	0			
11/29/06	Winter Storm	0	0	0			
12/01/06	Winter Storm	11	0	23	1673	13 plus City of St. Louis	PA
01/12/07	Ice Storm	15	0	65	1676	38 plus City of St. Louis	PA
12/01/07	Winter Weather	0	0	0			
12/6/07-12/15/07	Winter Weather	4	0	34.8	1736	42	PA
12/08/07	Ice Storm	0	0	NA	3281	entire state	PA (A,B)
02/11/08	Winter Weather	0	0	0			
02/23/08	Winter Weather	0	0	0			
01/26/09	Winter Storm	NA	NA	NA	3303	entire state	PA (B)
TOTAL		30	15	208.2			

Sources: <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent-storms>; <http://www.fema.gov/news/disasters.fema>; <http://sema.dps.mo.gov/SitReps/Situation%20Reports.htm>

Measure of Probability and Severity

Probability: High – Planning Area

Severity: Moderate – Planning Area

Existing Mitigation Activities

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

Utility Companies

The Boone County Electric Cooperative, City of Centralia, and City of Columbia Water and Light Department have policies regarding tree trimming and brush removal around power lines. Consistent maintenance of trees and brush around utility lines limits the possibility of power outages during a severe winter storm. Maintenance also makes financial sense because repairing fallen utility lines and poles is costly and dangerous.

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 Figure 3.34.

Figure 3.34 National Weather Service Winter Warnings	
Winter Weather Advisory	Winter weather conditions are expected to cause significant inconveniences and may be hazardous. If 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 are about to begin in your area.
Blizzard Warning	Snow and strong winds will combine to produce a blinding snow (near zero visibility), deep drifts, and life-threatening wind chill. Seek refuge immediately.
Frost/Freeze Warning	Below freezing temperatures are expected and may cause significant damage to plants, crops, or fruit trees. In areas unaccustomed to freezing temperatures, people who have homes without heat need to take added precautions.

3.2.9 Tornado and Thunderstorm

Description of Hazard

A tornado is a violently rotating column of air which is generated by a powerful thunderstorm. The potential destruction posed by a tornado touching ground is well known.

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

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

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

Technological advances such as Doppler radar, computer modeling, and Emergency Warning Systems, have increased the amount of time the general public has to respond to a tornado. Despite these advances, tornadoes can still strike an area with little warning. Often people have no more than a few minutes to get to safety. Being able to quickly get to a safe place is absolutely imperative in order to prevent loss of life.

The destructive effects of a tornado depend on the strength of the winds, proximity to people and structures, the strength of structures, and/or how well a person is sheltered. Tornadoes are classified by the Fujita scale, which ranks tornadoes according to wind speed and destruction (see Figure 3.35).

Figure 3.35

The Fujita Scale			
F-Scale Number	Intensity Phrase	Wind Speed	Type of Damage Done
F0	Gale tornado	40-72 mph	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.
F1	Moderate tornado	73-112 mph	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant tornado	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	Severe tornado	158-206 mph	Roof and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted
F4	Devastating tornado	207-260 mph	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	Incredible tornado	261-318 mph	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel reinforced concrete structures badly damaged.
F6	Inconceivable tornado	319-379 mph	These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 wind that would surround the F6 winds. Missiles, such as cars and refrigerators would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies

Source: <http://www.tornadoproject.com/fscale/fscale.htm#top>

Thunderstorms, in and of themselves, can do great damage even when a tornado is not involved. Heavy rain, lightning, hail, and straight-line winds which often accompany thunderstorms each present their own particular concerns.

Geographic Location

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

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

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

Previous Occurrences

Tornado

Boone County ranks fourth in the number of tornadoes in a Missouri county between 1950 and 2005, according to the Missouri State Hazard Mitigation Plan (2007). The county has experienced thirty-two tornado events since 1950, as officially recorded by NOAA (see Figure 3.36). There have been 26 injuries and \$34.811 million in property damages associated with these thirty-two tornadoes. Eight F2 (“significant tornado”) and three F3 (“severe tornado”) tornadoes are included in these statistics.

Figure 3.36

Tornado Events in Boone County 1/01/1950 - 05/31/2009.

Location	Date	Time	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Boone County	04/30/54	15:15	F2	0	0	25K	0
Boone County	04/30/54	16:15	F2	0	0	25K	0
Boone County	04/30/54	17:15	F2	0	0	25K	0
Boone County	12/04/56	22:30	F2	0	0	250K	0
Boone County	09/28/59	16:00	F1	0	0	3K	0
Boone County	10/04/59	19:40	F0	0	0	3K	0
Boone County	10/04/59	19:40	F0	0	0	3K	0
Boone County	01/25/65	21:50	F0	0	0	0K	0
Boone County	12/08/66	2:30	F1	0	0	25K	0
Boone County	09/07/72	15:15	F1	0	0	25K	0
Boone County	03/13/73	21:46	F1	0	0	25K	0
Boone County	05/26/73	18:50	F2	0	1	250K	0
Boone County	12/04/73	6:30	F0	0	0	25K	0
Boone County	05/12/80	17:43	F2	0	0	25K	0
Boone County	04/16/82	17:05	F0	0	0	0K	0
Boone County	05/29/82	3:00	F1	0	0	3K	0
Boone County	04/03/84	15:15	F1	0	0	0K	0
Boone County	04/29/84	16:45	F1	0	0	25K	0
Boone County	10/16/84	4:30	F1	0	0	25K	0
Boone County	06/17/85	0:04	F1	0	0	2.5M	0
Boone County	06/02/87	13:56	F0	0	1	0K	0
Boone County	11/27/90	11:12	F3	0	0	250K	0
Boone County	11/27/90	11:20	F3	0	3	25.0M	0
Boone County	07/02/92	17:33	F1	0	0	250K	0
Boone County	07/02/92	17:43	F0	0	0	0K	0
Columbia	07/08/95	16:15	F0	0	0	0	0
Columbia	11/10/98	1:58	F3	0	16	6.0M	0
Midway	04/08/99	16:55	F2	0	5	0	0
Hinton	04/08/99	17:05	F2	0	0	0	0
Ashland	02/25/00	15:35	F0	0	0	0	0
Centralia	03/26/00	18:15	F1	0	0	50K	0
Midway	05/17/01	15:30	F0	0	0	0	0
TOTALS:				0	26	34.811M	0

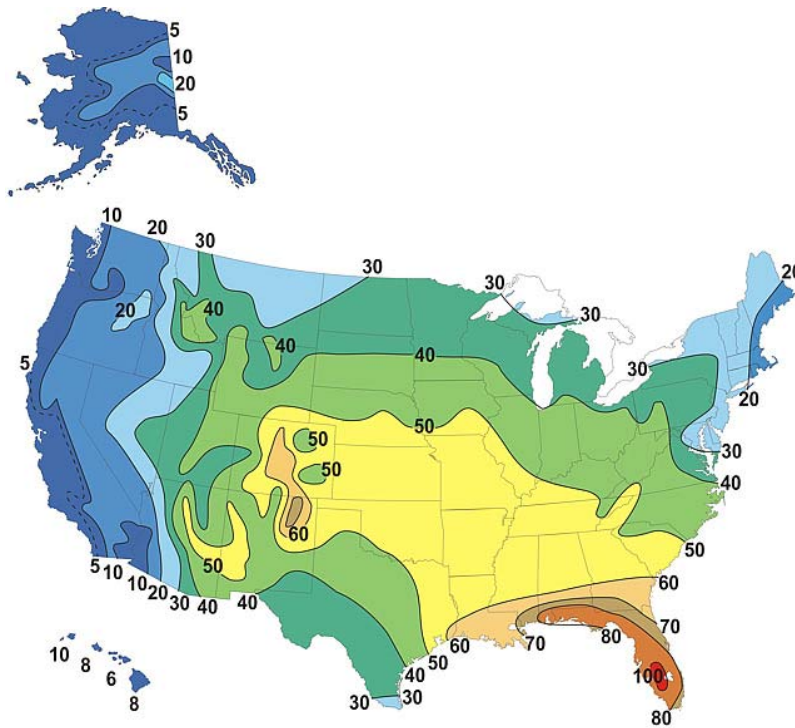
Source: <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>

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.

Boone County is located in a part of the country with a relatively high number of thunderstorms. National Weather Service data indicates that there are on average 50-60 thunderstorm days per year in Missouri (see Figure 3.37). Many of these thunderstorms are severe.

Figure 3.37 Average Number of Thunderstorm Days Annually in U.S.



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

High winds: According to NOAA, there have been 238 thunderstorm wind and other high wind events reported in Boone County since 1950 (see Figure 3.38a-g). These storms resulted in at least 33 injuries and \$142,000 in property damage in Boone County. Property damage in the county during that period may have been higher; a thunderstorm on April 18, 1995 was responsible for \$700,000 property damage in 23 Missouri counties, including Boone, and the City of St. Louis. Some of that recorded damage may have occurred in Boone 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.

Figure 3.38a

Windstorm Events in Boone County 1/01/1950 - 12/31/2009.

Location	Date	Time	Type	Magnitude (mph)	Deaths	Injuries	Property Damage	Crop Damage
Boone Co.	8/29/1955	16:00	Tstm Wind	na	0	0	0	0
Boone Co.	6/24/1956	18:30	Tstm Wind	na	0	0	0	0
Boone Co.	7/3/1956	17:00	Tstm Wind	61	0	0	0	0
Boone Co.	6/11/1957	20:57	Tstm Wind	na	0	0	0	0
Boone Co.	6/11/1957	23:30	Tstm Wind	na	0	0	0	0
Boone Co.	5/31/1958	21:55	Tstm Wind	76	0	0	0	0
Boone Co.	7/30/1958	23:00	Tstm Wind	79	0	0	0	0
Boone Co.	7/30/1958	23:00	Tstm Wind	79	0	0	0	0
Boone Co.	9/27/1959	22:30	Tstm Wind	na	0	0	0	0
Boone Co.	10/4/1959	19:40	Tstm Wind	na	0	0	0	0
Boone Co.	10/4/1959	19:45	Tstm Wind	na	0	0	0	0
Boone Co.	10/4/1959	20:10	Tstm Wind	na	0	0	0	0
Boone Co.	4/21/1961	3:50	Tstm Wind	na	0	0	0	0
Boone Co.	4/22/1961	4:00	Tstm Wind	66	0	0	0	0
Boone Co.	5/5/1961	18:40	Tstm Wind	58	0	0	0	0
Boone Co.	6/6/1961	14:50	Tstm Wind	58	0	0	0	0
Boone Co.	5/24/1962	23:00	Tstm Wind	na	0	0	0	0
Boone Co.	4/19/1963	2:00	Tstm Wind	81	0	0	0	0
Boone Co.	6/28/1963	22:40	Tstm Wind	58	0	0	0	0
Boone Co.	4/6/1964	19:55	Tstm Wind	na	0	0	0	0
Boone Co.	3/3/1966	7:30	Tstm Wind	na	0	0	0	0
Boone Co.	3/17/1966	21:45	Tstm Wind	na	0	0	0	0
Boone Co.	7/29/1966	15:15	Tstm Wind	58	0	0	0	0
Boone Co.	12/8/1966	2:29	Tstm Wind	60	0	0	0	0
Boone Co.	1/24/1967	15:00	Tstm Wind	58	0	0	0	0
Boone Co.	4/16/1967	23:30	Tstm Wind	60	0	0	0	0
Boone Co.	8/3/1967	16:00	Tstm Wind	67	0	0	0	0
Boone Co.	7/17/1968	18:30	Tstm Wind	na	0	0	0	0
Boone Co.	7/26/1969	23:00	Tstm Wind	67	0	0	0	0
Boone Co.	4/29/1970	20:00	Tstm Wind	na	0	0	0	0
Boone Co.	5/10/1970	17:38	Tstm Wind	70	0	0	0	0
Boone Co.	5/10/1970	18:00	Tstm Wind	na	0	0	0	0
Boone Co.	6/12/1970	18:20	Tstm Wind	na	0	0	0	0
Boone Co.	12/15/1971	3:00	Tstm Wind	59	0	0	0	0
Boone Co.	5/7/1973	14:55	Tstm Wind	70	0	0	0	0
Boone Co.	7/20/1973	16:30	Tstm Wind	na	0	0	0	0
Boone Co.	5/20/1975	14:30	Tstm Wind	68	0	0	0	0
Boone Co.	3/4/1976	16:15	Tstm Wind	na	0	0	0	0
Boone Co.	8/10/1976	19:55	Tstm Wind	60	0	0	0	0
Boone Co.	5/30/1977	16:00	Tstm Wind	60	0	0	0	0

Figure 3.38b

Windstorm Events in Boone County 1/01/1950 - 12/31/2009.

Location	Date	Time	Type	Magnitude (mph)	Deaths	Injuries	Property Damage	Crop Damage
Boone Co.	7/9/1978	0:31	Tstm Wind	59	0	0	0	0
Boone Co.	7/30/1979	17:00	Tstm Wind	0	0	0	0	0
Boone Co.	10/30/1979	23:20	Tstm Wind	na	0	0	0	0
Boone Co.	5/31/1980	19:05	Tstm Wind	na	0	0	0	0
Boone Co.	5/31/1980	19:23	Tstm Wind	na	0	0	0	0
Boone Co.	6/4/1980	7:30	Tstm Wind	na	0	0	0	0
Boone Co.	8/4/1980	14:00	Tstm Wind	na	0	0	0	0
Boone Co.	8/5/1980	21:47	Tstm Wind	na	0	0	0	0
Boone Co.	9/16/1980	18:00	Tstm Wind	na	0	0	0	0
Boone Co.	4/3/1981	19:08	Tstm Wind	na	0	0	0	0
Boone Co.	4/3/1981	19:34	Tstm Wind	na	0	0	0	0
Boone Co.	4/13/1981	21:00	Tstm Wind	na	0	0	0	0
Boone Co.	4/13/1981	21:32	Tstm Wind	na	0	0	0	0
Boone Co.	5/23/1981	20:51	Tstm Wind	na	0	0	0	0
Boone Co.	7/9/1981	19:10	Tstm Wind	na	0	0	0	0
Boone Co.	7/20/1981	13:00	Tstm Wind	na	0	0	0	0
Boone Co.	7/20/1981	13:03	Tstm Wind	59	0	0	0	0
Boone Co.	7/23/1981	2:50	Tstm Wind	60	0	0	0	0
Boone Co.	7/23/1981	3:38	Tstm Wind	67	0	0	0	0
Boone Co.	7/23/1981	3:56	Tstm Wind	70	0	0	0	0
Boone Co.	7/23/1981	7:00	Tstm Wind	na	0	0	0	0
Boone Co.	7/23/1981	17:10	Tstm Wind	67	0	0	0	0
Boone Co.	7/25/1981	0:43	Tstm Wind	82	0	0	0	0
Boone Co.	7/25/1981	1:30	Tstm Wind	69	0	0	0	0
Boone Co.	3/12/1982	19:10	Tstm Wind	na	0	0	0	0
Boone Co.	3/15/1982	22:30	Tstm Wind	na	0	0	0	0
Boone Co.	3/30/1982	8:07	Tstm Wind	58	0	0	0	0
Boone Co.	4/2/1982	16:48	Tstm Wind	60	0	0	0	0
Boone Co.	4/2/1982	16:54	Tstm Wind	59	0	0	0	0
Boone Co.	5/14/1982	20:15	Tstm Wind	60	0	0	0	0
Boone Co.	5/20/1982	22:20	Tstm Wind	58	0	0	0	0
Boone Co.	5/21/1982	22:20	Tstm Wind	60	0	0	0	0
Boone Co.	5/30/1982	12:23	Tstm Wind	64	0	0	0	0
Boone Co.	6/7/1982	6:55	Tstm Wind	60	0	0	0	0
Boone Co.	6/7/1982	7:27	Tstm Wind	58	0	0	0	0
Boone Co.	6/8/1982	6:10	Tstm Wind	na	0	0	0	0
Boone Co.	6/8/1982	6:20	Tstm Wind	na	0	0	0	0
Boone Co.	6/8/1982	6:30	Tstm Wind	70	0	0	0	0
Boone Co.	6/8/1982	19:22	Tstm Wind	58	0	0	0	0
Boone Co.	6/8/1982	22:50	Tstm Wind	82	0	0	0	0

Figure 3.38c

Windstorm Events in Boone County 1/01/1950 - 12/31/2009.

Location	Date	Time	Type	Magnitude (mph)	Deaths	Injuries	Property Damage	Crop Damage
Boone Co.	6/8/1982	23:05	Tstm Wind	82	0	0	0	0
Boone Co.	8/26/1982	14:58	Tstm Wind	58	0	0	0	0
Boone Co.	9/2/1982	0:49	Tstm Wind	58	0	0	0	0
Boone Co.	9/13/1982	17:30	Tstm Wind	60	0	0	0	0
Boone Co.	4/27/1983	15:38	Tstm Wind	62	0	0	0	0
Boone Co.	3/15/1984	16:41	Tstm Wind	64	0	0	0	0
Boone Co.	4/29/1984	16:15	Tstm Wind	61	0	0	0	0
Boone Co.	5/13/1984	5:20	Tstm Wind	na	0	0	0	0
Boone Co.	7/3/1984	20:20	Tstm Wind	60	0	0	0	0
Boone Co.	10/16/1984	4:20	Tstm Wind	na	0	0	0	0
Boone Co.	10/16/1984	4:45	Tstm Wind	na	0	0	0	0
Boone Co.	6/17/1985	0:03	Tstm Wind	na	0	0	0	0
Boone Co.	7/14/1986	14:45	Tstm Wind	58	0	0	0	0
Boone Co.	7/14/1986	14:50	Tstm Wind	na	0	0	0	0
Boone Co.	7/14/1986	15:02	Tstm Wind	64	0	0	0	0
Boone Co.	7/14/1986	15:19	Tstm Wind	64	0	0	0	0
Boone Co.	7/14/1986	15:35	Tstm Wind	na	0	0	0	0
Boone Co.	9/23/1986	18:30	Tstm Wind	na	0	0	0	0
Boone Co.	5/31/1987	14:54	Tstm Wind	na	0	0	0	0
Boone Co.	6/2/1987	14:20	Tstm Wind	na	0	0	0	0
Boone Co.	7/5/1987	10:51	Tstm Wind	na	0	0	0	0
Boone Co.	8/8/1987	17:52	Tstm Wind	62	0	0	0	0
Boone Co.	8/16/1987	17:30	Tstm Wind	79	0	0	0	0
Boone Co.	8/16/1987	18:15	Tstm Wind	na	0	0	0	0
Boone Co.	3/24/1988	18:35	Tstm Wind	na	0	0	0	0
Boone Co.	5/8/1988	14:38	Tstm Wind	60	0	0	0	0
Boone Co.	11/15/1988	18:20	Tstm Wind	61	0	0	0	0
Boone Co.	11/15/1988	18:53	Tstm Wind	na	0	0	0	0
Boone Co.	5/25/1989	7:45	Tstm Wind	na	0	0	0	0
Boone Co.	5/25/1989	9:35	Tstm Wind	na	0	0	0	0
Boone Co.	3/14/1990	19:52	Tstm Wind	na	0	0	0	0
Boone Co.	5/15/1990	12:39	Tstm Wind	na	0	0	0	0
Boone Co.	6/8/1990	19:31	Tstm Wind	64	0	0	0	0
Boone Co.	6/11/1990	23:38	Tstm Wind	58	0	0	0	0
Boone Co.	7/11/1990	23:38	Tstm Wind	58	0	0	0	0
Boone Co.	3/12/1991	13:00	Tstm Wind	58	0	0	0	0
Boone Co.	10/2/1991	20:35	Tstm Wind	na	0	0	0	0
Boone Co.	4/15/1992	14:25	Tstm Wind	na	0	0	0	0
Boone Co.	6/17/1992	13:30	Tstm Wind	na	0	0	0	0
Boone Co.	7/2/1992	17:35	Tstm Wind	81	0	10	0	0

Figure 3.38d

Windstorm Events in Boone County 1/01/1950 - 12/31/2009.

Location	Date	Time	Type	Magnitude (mph)	Deaths	Injuries	Property Damage	Crop Damage
Boone Co.	7/2/1992	18:03	Tstm Wind	na	0	0	0	0
Boone Co.	7/11/1992	16:40	Tstm Wind	na	0	0	0	0
Ashland	4/26/1994	19:30	Tstm Wind	na	0	0	5K	0
Columbia	6/25/1994	20:55	Tstm Wind	na	0	0	5K	0
Columbia	6/25/1994	21:05	Tstm Wind	na	0	0	0	0
Columbia	6/25/1994	21:05	Tstm Wind	58	0	0	0	0
Columbia	6/25/1994	21:15	Tstm Wind	78	0	0	5K	0
Columbia	6/25/1994	21:25	Tstm Wind	na	0	0	0	0
Columbia	4/10/1995	16:33	Tstm Wind	60	0	0	0	0
23 counties plus City of St. Louis	4/18/1995	8:30	High Winds	30-58	0	0	700K	0
Rocheport	5/16/1995	18:20	Tstm Wind	na	0	0	12K	0
Columbia	5/16/1995	18:30	Tstm Wind	na	0	0	1K	0
Ashland	6/7/1995	10:38	Tstm Wind	60	0	0	0	0
Boone Co.	6/7/1995	10:45	Tstm Wind	na	0	0	5K	0
Columbia	6/8/1995	4:20	Tstm Wind	60	0	0	2K	0
Harrisburg	7/8/1995	16:05	Tstm Wind	70	0	0	0	0
Columbia/Harrisburg	7/8/1995	16:10	Tstm Wind	70	0	0	0	0
Columbia	7/8/1995	16:20	Tstm Wind	na	0	0	1K	0
Ashland	7/8/1995	16:30	Tstm Wind	na	0	0	2K	0
Columbia	5/27/1996	0:00	Tstm Wind	62	0	0	0	0
Columbia	5/27/1996	0:15	Tstm Wind	67	0	0	50K	0
Centralia	7/27/1997	15:45	Tstm Wind	58	0	0	0	0
Columbia	3/27/1998	15:55	Tstm Wind	59	0	0	0	0
Columbia	3/27/1998	16:00	Tstm Wind	59	0	0	2K	0
Centralia	3/27/1998	16:20	Tstm Wind	58	0	0	0	0
Hallsville	3/31/1998	13:30	Tstm Wind	58	0	0	0	0
Columbia	5/1/1998	19:43	Tstm Wind	58	0	0	0	0
Ashland	6/13/1998	22:30	Tstm Wind	60	0	0	0	0
Columbia	6/22/1998	3:00	Tstm Wind	63	0	0	0	0
Centralia	6/29/1998	21:30	Tstm Wind	61	0	0	0	0
Columbia	11/10/1998	2:00	Tstm Wind	81	0	0	0	0
Columbia	7/28/1999	10:30	Tstm Wind	69	0	1	0	0
Centralia	3/26/2000	16:20	Tstm Wind	63	0	0	0	0
Centralia	3/26/2000	18:25	Tstm Wind	70	0	0	0	0
Hallsville	3/26/2000	18:25	Tstm Wind	70	0	0	0	0
Columbia	5/24/2000	3:55	Tstm Wind	60	0	0	0	0
Columbia	6/25/2000	21:30	Tstm Wind	64	0	0	0	0

Figure 3.38e

Windstorm Events in Boone County 1/01/1950 - 12/31/2009.

Location	Date	Time	Type	Magnitude (mph)	Deaths	Injuries	Property Damage	Crop Damage
Columbia	7/2/2000	16:20	Tstm Wind	63	0	0	0	0
Sturgeon	8/7/2000	18:25	Tstm Wind	59	0	0	0	0
Centralia	8/7/2000	18:30	Tstm Wind	58	0	0	0	0
Huntsdale	8/7/2000	18:50	Tstm Wind	59	0	0	0	0
Columbia Regional Airport	8/7/2000	21:37	Tstm Wind	58	0	0	0	0
Columbia Regional Airport	8/7/2000	21:39	Tstm Wind	69	0	0	0	0
Ashland	8/17/2000	17:56	Tstm Wind	69	0	0	0	0
Sturgeon	8/23/2000	21:05	Tstm Wind	59	0	0	0	0
Centralia	8/23/2000	21:10	Tstm Wind	59	0	0	0	0
Centralia	8/23/2000	21:15	Tstm Wind	59	0	0	0	0
Hallsville	9/11/2000	20:03	Tstm Wind	64	0	0	0	0
Columbia	9/11/2000	20:13	Tstm Wind	60	0	0	0	0
28 counties plus City of St. Louis	2/25/2001	0:00	High Wind	46	0	0	0	0
28 counties plus City of St. Louis	3/13/2001	9:00	High Wind	52	0	0	0	0
Ashland	4/10/2001	18:05	Tstm Wind	63	0	0	0	0
Ashland	4/10/2001	18:09	Tstm Wind	70	0	0	0	0
Columbia	5/17/2001	16:04	Tstm Wind	61	0	0	0	0
Harrisburg	6/1/2001	18:58	Tstm Wind	58	0	0	0	0
Columbia	7/3/2001	21:40	Tstm Wind	58	0	0	0	0
Columbia	7/19/2001	15:10	Tstm Wind	63	0	0	0	0
28 counties plus City of St. Louis	3/9/2002	6:00	High Wind	49	0	0	0	0
Columbia Regional Airport	4/27/2002	21:24	Tstm Wind	70	0	0	0	0
Columbia	5/8/2002	20:10	Tstm Wind	70	0	1	0	0
Columbia	7/6/2002	17:00	Tstm Wind	63	0	0	0	0
Columbia	7/6/2002	17:05	Tstm Wind	63	0	0	50K	0
Columbia	7/22/2002	16:25	Tstm Wind	63	0	0	0	0
Sturgeon	8/19/2002	4:45	Tstm Wind	69	0	0	0	0

Figure 3.38f

Windstorm Events in Boone County 1/01/1950 - 12/31/2009.

Location	Date	Time	Type	Magnitude (mph)	Deaths	Injuries	Property Damage	Crop Damage
Harrisburg	5/8/2003	11:20	Tstm Wind	75	0	0	0	0
Harrisburg	5/8/2003	11:40	Tstm Wind	75	0	0	0	0
Hallsville	5/8/2003	11:56	Tstm Wind	86	0	0	0	0
Shaw	5/8/2003	11:56	Tstm Wind	66	0	0	0	0
Centralia	5/8/2003	12:00	Tstm Wind	86	0	1	0	0
Columbia	5/10/2003	19:50	Tstm Wind	64	0	0	0	0
Columbia Regional Airport	8/21/2003	19:51	Tstm Wind	81	0	0	0	0
Ashland	9/21/2003	16:05	Tstm Wind	58	0	0	0	0
Centralia	5/24/2004	22:10	Tstm Wind	60	0	0	0	0
Centralia	5/24/2004	22:30	Tstm Wind	63	0	0	0	0
Sturgeon	5/27/2004	16:45	Tstm Wind	63	0	0	0	0
Columbia	5/31/2004	18:39	Tstm Wind	63	0	0	0	0
Hallsville	6/12/2004	23:39	Tstm Wind	60	0	0	0	0
Rocheport	7/5/2004	6:48	Tstm Wind	63	0	0	0	0
Centralia	8/25/2004	23:50	Tstm Wind	60	0	0	0	0
Columbia	4/21/2005	21:15	Tstm Wind	58	0	0	0	0
Midway	5/11/2005	14:30	Tstm Wind	81	0	0	0	0
Columbia	8/13/2005	15:20	Tstm Wind	66	0	0	0	0
Sturgeon	8/13/2005	15:40	Tstm Wind	63	0	0	0	0
Centralia	8/13/2005	15:45	Tstm Wind	63	0	0	0	0
Columbia	9/19/2005	17:15	Tstm Wind	63	0	0	0	0
Columbia	9/19/2005	19:30	Tstm Wind	66	0	0	0	0
Ashland	9/26/2005	5:40	Tstm Wind	66	0	0	0	0
Columbia	3/12/2006	17:10	Tstm Wind	60	0	0	0	0
Columbia	5/24/2006	16:06	Tstm Wind	66	0	0	0	0
Columbia Regional Airport	6/10/2006	18:13	Tstm Wind	74	0	0	0	0
Ashland	6/10/2006	18:15	Tstm Wind	69	0	0	0	0
Rocheport	7/13/2006	20:20	Tstm Wind	69	0	0	0	0
Hallsville	7/21/2006	7:30	Tstm Wind	63	0	0	0	0
Columbia	7/21/2006	7:40	Tstm Wind	60	0	0	0	0
Easley	8/2/2006	17:30	Tstm Wind	58	0	0	0	0
Centralia	8/18/2006	18:00	Tstm Wind	59	0	0	0	0
McBaine	8/18/2006	18:20	Tstm Wind	60	0	0	0	0
Columbia	8/18/2006	18:25	Tstm Wind	60	0	0	0	0

Figure 3.38g

Windstorm Events in Boone County 1/01/1950 - 12/31/2009.

Location	Date	Time	Type	Magnitude (mph)	Deaths	Injuries	Property Damage	Crop Damage
Columbia Regional Airport	4/24/2007	19:53	Tstm Wind	61	0	0	0	0
Rocheport	5/6/2007	14:25	Tstm Wind	60	0	0	0	0
Midway	5/6/2007	14:35	Tstm Wind	63	0	0	0	0
Columbia	5/6/2007	15:08	Tstm Wind	58	0	0	0	0
Sturgeon	8/12/2007	21:45	Tstm Wind	60	0	0	0	0
Centralia	8/12/2007	21:50	Tstm Wind	60	0	0	0	0
Columbia	8/12/2007	21:55	Tstm Wind	61	0	0	0	0
Columbia Regional Airport	8/12/2007	22:09	Tstm Wind	60	0	0	0	0
Centralia	4/10/2008	15:55	Tstm Wind	60	0	0	0	0
6 counties	5/11/2008	0:00	Strong Wind	55	0	0	0	0
Columbia	6/24/2008	18:42	Tstm Wind	60	0	0	0	0
Hallsville	7/2/2008	21:15	Tstm Wind	64	0	0	3K	0
Hallsville	7/27/2008	21:50	Tstm Wind	64	0	0	0	0
Columbia Regional Airport	8/28/2008	18:30	Tstm Wind	55	0	20	0	0
Columbia	5/7/2009	21:50	Tstm Wind	68	0	0	0	0
Columbia Regional Airport	5/7/2009	22:02	Tstm Wind	63	0	0	0	0
Columbia	5/15/2009	16:40	Tstm Wind	60	0	0	0	0
Easley	6/16/2009	0:12	Tstm Wind	60	0	0	0	0
Midway	6/23/2009	20:30	Tstm Wind	60	0	0	0	0
Hallsville	6/27/2009	20:59	Tstm Wind	60	0	0	0	0
Total					0	33	842K	2K
Boone County Total					0	33	142K	0

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

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

NOAA lists 289 reported hailstorm events (with hail of at least 0.75 inch in diameter) in Boone County since 1950 (see Figure 3.39a-h). On one occasion, 4 inch diameter hail was reported; there have been numerous reports of hail greater than 2.5 inches in diameter.

While the NOAA data only indicates \$20,000 of hail damage from these events in the county, the damage caused by hail is undoubtedly much higher. The NOAA data before 1993 is very general; the location is listed generally as Boone County and no damages are reported in that time period.

In addition, the last quantified property damage in the data is from June 1995; there has definitely been significant hail damage since that time. The Boone County Public Works Annual Report 2007 lists the following expenses for hail damage repairs in 2006:

- Jail Roof (\$790,841.00)
- Columbia Health Facility Roof and Walkway Cover (\$41,950.00)
- Fairgrounds Roofs (\$199,225.00)
- Reality House Roof & Misc. (\$18,050.00)
- Public Works Misc. (\$8,800.00)

This totals to over \$1million and represents the damage incurred by county buildings in a one year period. A large number of vehicles and private homes were also damaged during this period.

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

Figure 3.39a

Hailstorm Events in Boone County 1/01/1950 - 12/31/2009.

Location	Date	Time	Diameter	Deaths	Injuries	Property Damage	Crop Damage
Boone County	4/23/1958	20:35	1.00 in.	0	0	0	0
Boone County	4/27/1959	18:05	1.75 in.	0	0	0	0
Boone County	3/29/1960	15:30	0.75 in.	0	0	0	0
Boone County	6/6/1961	14:50	1.75 in.	0	0	0	0
Boone County	5/30/1962	16:45	1.75 in.	0	0	0	0
Boone County	5/30/1962	16:45	1.75 in.	0	0	0	0
Boone County	5/4/1963	6:25	0.75 in.	0	0	0	0
Boone County	4/11/1965	2:15	1.75 in.	0	0	0	0
Boone County	5/17/1966	17:00	1.75 in.	0	0	0	0
Boone County	5/23/1966	15:15	1.50 in.	0	0	0	0
Boone County	8/3/1967	16:00	1.00 in.	0	0	0	0
Boone County	5/8/1968	17:55	1.50 in.	0	0	0	0
Boone County	5/8/1968	18:15	1.00 in.	0	0	0	0
Boone County	5/8/1968	19:00	1.75 in.	0	0	0	0
Boone County	6/22/1969	8:45	1.75 in.	0	0	0	0
Boone County	5/10/1970	17:20	0.75 in.	0	0	0	0
Boone County	5/10/1970	17:37	1.00 in.	0	0	0	0
Boone County	5/10/1973	5:00	1.75 in.	0	0	0	0
Boone County	5/26/1973	19:04	0.75 in.	0	0	0	0
Boone County	6/18/1973	20:45	0.75 in.	0	0	0	0
Boone County	4/13/1974	19:55	1.75 in.	0	0	0	0
Boone County	5/29/1974	8:00	0.75 in.	0	0	0	0
Boone County	5/29/1974	16:00	1.00 in.	0	0	0	0
Boone County	5/29/1974	16:20	1.75 in.	0	0	0	0
Boone County	5/29/1974	17:45	1.75 in.	0	0	0	0
Boone County	6/14/1974	21:10	1.75 in.	0	0	0	0
Boone County	9/18/1975	18:30	1.75 in.	0	0	0	0
Boone County	3/26/1976	17:20	0.75 in.	0	0	0	0
Boone County	5/15/1976	15:15	1.00 in.	0	0	0	0
Boone County	6/1/1977	15:30	1.75 in.	0	0	0	0
Boone County	3/7/1980	9:30	0.75 in.	0	0	0	0
Boone County	4/8/1981	18:30	0.75 in.	0	0	0	0
Boone County	4/12/1981	8:25	1.75 in.	0	0	0	0
Boone County	4/17/1981	19:55	1.50 in.	0	0	0	0
Boone County	4/17/1981	20:00	2.75 in.	0	0	0	0
Boone County	4/16/1982	16:41	1.75 in.	0	0	0	0
Boone County	4/16/1982	16:50	1.75 in.	0	0	0	0
Boone County	5/11/1982	15:52	1.75 in.	0	0	0	0
Boone County	5/18/1982	17:10	0.75 in.	0	0	0	0
Boone County	5/20/1982	16:25	1.75 in.	0	0	0	0
Boone County	5/20/1982	21:40	1.75 in.	0	0	0	0

Figure 3.39b

Hailstorm Events in Boone County 1/01/1950 - 12/31/2009.

Location	Date	Time	Diameter	Deaths	Injuries	Property Damage	Crop Damage
Boone County	5/21/1982	16:32	1.75 in.	0	0	0	0
Boone County	5/21/1982	21:40	1.75 in.	0	0	0	0
Boone County	5/28/1982	18:55	1.75 in.	0	0	0	0
Boone County	9/1/1982	22:55	0.75 in.	0	0	0	0
Boone County	11/1/1982	17:10	1.00 in.	0	0	0	0
Boone County	11/1/1982	17:10	1.75 in.	0	0	0	0
Boone County	11/1/1982	17:10	2.75 in.	0	0	0	0
Boone County	11/1/1982	17:25	2.75 in.	0	0	0	0
Boone County	11/1/1982	17:35	1.00 in.	0	0	0	0
Boone County	5/1/1983	6:10	1.75 in.	0	0	0	0
Boone County	3/15/1984	16:15	1.00 in.	0	0	0	0
Boone County	3/15/1984	16:22	0.75 in.	0	0	0	0
Boone County	4/3/1984	15:20	0.75 in.	0	0	0	0
Boone County	4/29/1984	7:55	1.00 in.	0	0	0	0
Boone County	4/29/1984	8:55	1.00 in.	0	0	0	0
Boone County	5/4/1984	17:22	0.75 in.	0	0	0	0
Boone County	5/4/1984	17:58	0.75 in.	0	0	0	0
Boone County	5/13/1984	5:15	0.75 in.	0	0	0	0
Boone County	5/25/1984	16:05	1.75 in.	0	0	0	0
Boone County	6/8/1984	16:39	0.75 in.	0	0	0	0
Boone County	7/3/1984	19:55	1.00 in.	0	0	0	0
Boone County	7/3/1984	20:24	0.75 in.	0	0	0	0
Boone County	9/10/1984	18:10	1.75 in.	0	0	0	0
Boone County	9/13/1984	18:38	0.75 in.	0	0	0	0
Boone County	10/16/1984	4:30	1.75 in.	0	0	0	0
Boone County	6/2/1985	13:46	0.75 in.	0	0	0	0
Boone County	9/22/1985	14:40	0.75 in.	0	0	0	0
Boone County	5/8/1986	12:05	1.00 in.	0	0	0	0
Boone County	9/23/1986	17:42	0.75 in.	0	0	0	0
Boone County	5/21/1987	18:10	0.75 in.	0	0	0	0
Boone County	3/24/1988	18:10	0.75 in.	0	0	0	0
Boone County	3/24/1988	18:13	0.75 in.	0	0	0	0
Boone County	4/5/1988	16:15	1.00 in.	0	0	0	0
Boone County	4/5/1988	17:20	2.00 in.	0	0	0	0
Boone County	11/4/1988	6:30	1.00 in.	0	0	0	0
Boone County	5/28/1989	13:15	0.75 in.	0	0	0	0
Boone County	6/6/1990	6:45	1.75 in.	0	0	0	0
Boone County	6/7/1990	17:40	1.25 in.	0	0	0	0
Boone County	6/7/1990	18:01	1.75 in.	0	0	0	0
Boone County	6/7/1990	18:20	1.75 in.	0	0	0	0
Boone County	3/12/1991	15:15	1.00 in.	0	0	0	0

Figure 3.39c

Hailstorm Events in Boone County 1/01/1950 - 12/31/2009.

Location	Date	Time	Diameter	Deaths	Injuries	Property Damage	Crop Damage
Boone County	3/22/1991	17:45	0.75 in.	0	0	0	0
Boone County	3/22/1991	18:10	1.00 in.	0	0	0	0
Boone County	3/22/1991	18:25	1.00 in.	0	0	0	0
Boone County	7/2/1991	6:20	0.75 in.	0	0	0	0
Boone County	3/6/1992	12:15	1.75 in.	0	0	0	0
Boone County	3/6/1992	12:30	1.50 in.	0	0	0	0
Boone County	3/9/1992	17:00	0.75 in.	0	0	0	0
Boone County	4/15/1992	11:55	1.00 in.	0	0	0	0
Boone County	4/15/1992	14:10	1.50 in.	0	0	0	0
Boone County	7/2/1992	14:55	1.75 in.	0	0	0	0
Boone County	9/7/1992	20:04	0.75 in.	0	0	0	0
Harrisburg	3/30/1993	18:05	1.00 in.	0	0	5K	0
Harrisburg	4/13/1993	14:44	0.75 in.	0	0	0	0
Sturgeon	4/13/1993	15:03	0.75 in.	0	0	0	0
Hartsburg	4/19/1993	2:00	0.75 in.	0	0	0	0
Columbia	4/27/1994	14:52	1.25 in.	0	0	5K	0
Columbia	6/25/1994	20:10	1.75 in.	0	0	5K	0
Columbia	6/25/1994	20:50	1.25 in.	0	0	0	0
Wilton	4/16/1995	12:30	0.75 in.	0	0	0	0
Columbia	4/16/1995	20:46	0.75 in.	0	0	0	0
Columbia	4/16/1995	20:52	1.75 in.	0	0	2K	0
Columbia	4/16/1995	21:00	1.00 in.	0	0	0	0
Hallsville	5/16/1995	22:35	0.75 in.	0	0	0	0
Sturgeon	5/18/1995	7:23	1.75 in.	0	0	0	0
Sturgeon	6/7/1995	10:20	1.75 in.	0	0	0	0
Sturgeon	6/7/1995	10:27	2.00 in.	0	0	3K	0
Hallsville	6/7/1995	10:38	1.75 in.	0	0	0	0
Columbia	7/8/1995	16:10	0.75 in.	0	0	0	0
Ellington	7/8/1995	1945	0.75 in.	0	0	0	0
Columbia Regional Airport	4/21/1996	16:15	1.00 in.	0	0	0	0
Hallsville	5/14/1996	13:45	0.88 in.	0	0	0	0
Centralia	5/25/1996	15:38	1.00 in.	0	0	0	0
Harrisburg	6/2/1996	19:10	0.75 in.	0	0	0	0
Hinton	6/2/1996	19:22	0.75 in.	0	0	0	0
Columbia	4/18/1997	20:00	1.74 in.	0	0	0	0
Centralia	4/15/1998	16:40	0.75 in.	0	0	0	0
Columbia	5/23/1998	16:36	1.75 in.	0	0	0	0
Centralia	5/23/1998	16:55	0.75 in.	0	0	0	0
Sturgeon	1/21/1999	13:00	1.75 in.	0	0	0	0
Midway	1/21/1999	18:40	0.75 in.	0	0	0	0

Figure 3.39d

Hailstorm Events in Boone County 1/01/1950 - 12/31/2009.

Location	Date	Time	Diameter	Deaths	Injuries	Property Damage	Crop Damage
Columbia	1/21/1999	18:55	0.75 in.	0	0	0	0
Columbia	1/21/1999	11:43	0.88 in.	0	0	0	0
Hallsville	1/21/1999	11:55	1.00 in.	0	0	0	0
Hallsville	1/21/1999	12:55	1.00 in.	0	0	0	0
Sturgeon	1/21/1999	12:57	1.75 in.	0	0	0	0
Hallsville	2/29/2000	18:35	1.00 in.	0	0	0	0
Columbia	2/29/2000	18:45	0.75 in.	0	0	0	0
Columbia Regional Airport	3/26/2000	14:10	0.75 in.	0	0	0	0
Columbia	3/26/2000	17:50	1.00 in.	0	0	0	0
Columbia	3/26/2000	17:55	0.75 in.	0	0	0	0
Columbia	3/26/2000	18:03	0.88 in.	0	0	0	0
Harrisburg	5/8/2000	18:27	0.88 in.	0	0	0	0
Columbia	5/8/2000	18:57	0.88 in.	0	0	0	0
Sturgeon	5/22/2000	16:55	1.00 in.	0	0	0	0
Hallsville	6/4/2000	17:10	1.00 in.	0	0	0	0
Ashland	8/17/2000	17:42	1.50 in.	0	0	0	0
Ashland	8/17/2000	17:47	0.75 in.	0	0	0	0
Ashland	8/17/2000	17:56	0.88 in.	0	0	0	0
Midway	4/10/2001	1:05	0.75 in.	0	0	0	0
Sturgeon	4/10/2001	2:07	0.75 in.	0	0	0	0
Harrisburg	4/10/2001	17:45	1.00 in.	0	0	0	0
Columbia	4/10/2001	17:55	1.75 in.	0	0	0	0
Columbia	4/10/2001	18:01	1.75 in.	0	0	0	0
Ashland	4/10/2001	18:05	2.75 in.	0	0	0	0
Ashland	4/10/2001	18:09	0.75 in.	0	0	0	0
Columbia	5/17/2001	15:45	0.88 in.	0	0	0	0
Columbia	5/17/2001	16:04	0.88 in.	0	0	0	0
Columbia	6/4/2001	9:50	0.88 in.	0	0	0	0
Columbia	5/6/2002	22:17	0.75 in.	0	0	0	0
Columbia	5/6/2002	22:43	0.75 in.	0	0	0	0
Columbia	5/6/2002	22:47	0.75 in.	0	0	0	0
Columbia	5/6/2002	23:05	0.75 in.	0	0	0	0
McBaine	5/12/2002	12:20	0.88 in.	0	0	0	0
McBaine	5/12/2002	12:26	0.88 in.	0	0	0	0
Columbia	5/12/2002	12:34	0.75 in.	0	0	0	0
Deer Park	5/12/2002	12:35	0.75 in.	0	0	0	0
Hallsville	6/4/2002	15:25	0.75 in.	0	0	0	0
Ashland	12/18/2002	13:17	1.00 in.	0	0	0	0

Figure 3.39e

Hailstorm Events in Boone County 1/01/1950 - 12/31/2009.

Location	Date	Time	Diameter	Deaths	Injuries	Property Damage	Crop Damage
Columbia Regional Airport	12/18/2002	13:24	0.88 in.	0	0	0	0
Columbia	12/18/2002	1:45	1.75 in.	0	0	0	0
Columbia	12/18/2002	1:47	1.00 in.	0	0	0	0
Harrisburg	5/8/2003	11:20	0.75 in.	0	0	0	0
Harrisburg	5/8/2003	11:25	1.00 in.	0	0	0	0
Columbia	5/8/2003	11:30	0.75 in.	0	0	0	0
Hallsville	5/8/2003	11:45	0.75 in.	0	0	0	0
Centralia	5/8/2003	12:06	0.75 in.	0	0	0	0
Columbia	5/10/2003	2:35	0.75 in.	0	0	0	0
Hallsville	5/10/2003	17:30	1.00 in.	0	0	0	0
Columbia	5/14/2003	19:38	0.75 in.	0	0	0	0
Columbia	5/14/2003	19:50	0.75 in.	0	0	0	0
Columbia	8/19/2003	17:40	1.75 in.	0	0	0	0
Sturgeon	8/21/2003	19:05	1.00 in.	0	0	0	0
Ashland	9/21/2003	16:05	0.75 in.	0	0	0	0
Columbia	9/26/2003	15:45	0.75 in.	0	0	0	0
Ashland	4/21/2005	15:30	0.88 in.	0	0	0	0
Ashland	4/21/2005	15:35	1.75 in.	0	0	0	0
Columbia	4/21/2005	19:00	0.75 in.	0	0	0	0
Ashland	4/21/2005	20:00	0.75 in.	0	0	0	0
Harrisburg	5/11/2005	13:10	0.88 in.	0	0	0	0
Harrisburg	5/11/2005	13:20	4.00 in.	0	0	0	0
Ashland	5/11/2005	13:30	0.88 in.	0	0	0	0
Harrisburg	5/11/2005	13:40	1.75 in.	0	0	0	0
Columbia	5/11/2005	13:45	2.00 in.	0	0	0	0
Columbia	5/11/2005	13:46	1.75 in.	0	0	0	0
Columbia	5/11/2005	13:49	0.88 in.	0	0	0	0
Columbia	5/11/2005	13:57	0.88 in.	0	0	0	0
Columbia	5/11/2005	13:59	0.75 in.	0	0	0	0
Midway	5/11/2005	14:24	0.88 in.	0	0	0	0
Midway	5/11/2005	14:28	0.88 in.	0	0	0	0
Hallsville	5/11/2005	14:44	2.75 in.	0	0	0	0
Columbia	5/11/2005	15:20	0.75 in.	0	0	0	0
Columbia	5/11/2005	15:25	0.75 in.	0	0	0	0
Columbia	5/11/2005	16:05	1.00 in.	0	0	0	0
Centralia	6/8/2005	13:50	0.75 in.	0	0	0	0
Centralia	6/8/2005	14:05	0.88 in.	0	0	0	0
Columbia	6/8/2005	14:25	0.75 in.	0	0	0	0
Columbia	6/8/2005	14:25	1.00 in.	0	0	0	0
Columbia	6/8/2005	14:40	1.25 in.	0	0	0	0

Figure 3.39f

Hailstorm Events in Boone County 1/01/1950 - 12/31/2009.

Location	Date	Time	Diameter	Deaths	Injuries	Property Damage	Crop Damage
Columbia	9/19/2005	16:50	0.88 in.	0	0	0	0
Columbia	9/19/2005	16:55	1.00 in.	0	0	0	0
Columbia	9/19/2005	16:59	0.75 in.	0	0	0	0
Columbia	9/19/2005	17:11	1.00 in.	0	0	0	0
Columbia	9/19/2005	18:52	1.00 in.	0	0	0	0
Rocheport	11/5/2005	17:15	1.00 in.	0	0	0	0
Harrisburg	11/5/2005	17:25	1.00 in.	0	0	0	0
Sturgeon	11/5/2005	17:50	1.75 in.	0	0	0	0
Columbia	11/5/2005	18:05	0.88 in.	0	0	0	0
Columbia	11/5/2005	19:15	0.88 in.	0	0	0	0
Columbia	11/5/2005	19:20	0.75 in.	0	0	0	0
Columbia	11/5/2005	19:20	1.75 in.	0	0	0	0
Columbia	3/11/2006	15:18	1.00 in.	0	0	0	0
Columbia	3/11/2006	15:20	2.00 in.	0	0	0	0
Hallsville	3/11/2006	15:20	1.00 in.	0	0	0	0
Columbia	3/11/2006	15:21	1.25 in.	0	0	0	0
Hallsville	3/11/2006	15:28	0.75 in.	0	0	0	0
Hallsville	3/11/2006	15:30	1.75 in.	0	0	0	0
Columbia	3/11/2006	15:31	1.75 in.	0	0	0	0
Columbia	3/11/2006	15:40	1.75 in.	0	0	0	0
Easley	3/11/2006	16:05	1.75 in.	0	0	0	0
Columbia	3/11/2006	16:06	1.00 in.	0	0	0	0
Columbia	3/11/2006	16:12	1.75 in.	0	0	0	0
Columbia	3/11/2006	16:25	1.75 in.	0	0	0	0
Columbia	3/11/2006	16:41	0.75 in.	0	0	0	0
Harrisburg	3/12/2006	16:47	0.88 in.	0	0	0	0
Rocheport	3/12/2006	16:55	1.00 in.	0	0	0	0
Midway	3/12/2006	17:00	1.75 in.	0	0	0	0
Columbia	3/12/2006	17:05	1.00 in.	0	0	0	0
Columbia	3/12/2006	17:10	1.75 in.	0	0	0	0
Columbia	3/12/2006	17:15	1.50 in.	0	0	0	0
Columbia	3/12/2006	17:15	1.75 in.	0	0	0	0
Columbia	3/12/2006	17:15	3.00 in.	0	0	0	0
Columbia	3/12/2006	17:20	1.50 in.	0	0	0	0
Columbia	3/12/2006	17:30	2.50 in.	0	0	0	0
Columbia	3/13/2006	0:20	0.75 in.	0	0	0	0
Harrisburg	3/30/2006	21:40	0.88 in.	0	0	0	0
Harrisburg	3/30/2006	21:40	1.00 in.	0	0	0	0
Harrisburg	3/30/2006	21:43	0.88 in.	0	0	0	0
Sturgeon	3/30/2006	21:45	0.75 in.	0	0	0	0
Ashland	3/30/2006	22:35	0.75 in.	0	0	0	0
Columbia	4/2/2006	14:50	0.75 in.	0	0	0	0

Figure 3.39g

Hailstorm Events in Boone County 1/01/1950 - 12/31/2009.

Location	Date	Time	Diameter	Deaths	Injuries	Property Damage	Crop Damage
Wilton	4/19/2006	19:47	0.75 in.	0	0	0	0
Ashland	4/19/2006	19:55	1.50 in.	0	0	0	0
Ashland	4/19/2006	19:56	1.00 in.	0	0	0	0
Ashland	4/19/2006	19:56	1.75 in.	0	0	0	0
Ashland	4/19/2006	20:00	1.75 in.	0	0	0	0
Columbia	5/24/2006	15:40	0.75 in.	0	0	0	0
Columbia	5/24/2006	15:50	1.75 in.	0	0	0	0
Columbia	5/24/2006	16:06	0.75 in.	0	0	0	0
Hallsville	6/10/2006	16:02	0.88 in.	0	0	0	0
Columbia	6/10/2006	16:50	0.88 in.	0	0	0	0
Columbia	6/10/2006	17:05	1.00 in.	0	0	0	0
Columbia	6/10/2006	17:45	0.75 in.	0	0	0	0
Columbia	6/10/2006	18:01	1.00 in.	0	0	0	0
Columbia	6/10/2006	21:35	0.75 in.	0	0	0	0
Columbia	6/10/2006	21:50	0.75 in.	0	0	0	0
Columbia	6/10/2006	21:50	1.75 in.	0	0	0	0
Columbia	7/21/2006	7:35	0.88 in.	0	0	0	0
Columbia	7/21/2006	7:40	1.00 in.	0	0	0	0
Hallsville	7/21/2006	7:45	0.75 in.	0	0	0	0
Columbia	4/3/2007	7:30	0.75 in.	0	0	0	0
Columbia	4/3/2007	7:35	0.75 in.	0	0	0	0
Columbia	4/3/2007	7:35	1.00 in.	0	0	0	0
Columbia	4/3/2007	7:45	0.75 in.	0	0	0	0
Ashland	5/6/2007	16:00	1.00 in.	0	0	0	0
Columbia	4/3/2008	11:28	1.00 in.	0	0	0	0
Columbia	4/3/2008	11:32	0.75 in.	0	0	0	0
Columbia	4/3/2008	11:35	1.25 in.	0	0	0	0
Sturgeon	5/25/2008	15:16	1.00 in.	0	0	0	0
Ashland	5/25/2008	19:10	1.00 in.	0	0	0	0
Sturgeon	5/30/2008	17:05	0.88 in.	0	0	0	0
Columbia	5/31/2008	16:15	0.88 in.	0	0	0	0
Harrisburg	6/24/2008	18:16	1.00 in.	0	0	0	0
Columbia	6/24/2008	18:22	0.88 in.	0	0	0	0
Easley	6/27/2008	22:55	0.88 in.	0	0	0	0
Ashland	7/22/2008	8:20	0.75 in.	0	0	0	0
Columbia	12/27/2008	9:26	0.88 in.	0	0	0	0
Columbia	5/7/2009	21:40	0.75 in.	0	0	0	0
Columbia	5/7/2009	21:50	1.00 in.	0	0	0	0
Columbia	5/7/2009	22:00	1.00 in.	0	0	0	0
Midway	5/15/2009	16:37	1.75 in.	0	0	0	0
Columbia	5/15/2009	16:50	0.88 in.	0	0	0	0

Figure 3.39h

Hailstorm Events in Boone County 1/01/1950 - 12/31/2009.

Location	Date	Time	Diameter	Deaths	Injuries	Property Damage	Crop Damage
Ashland	6/8/2009	4:15	0.75 in.	0	0	0	0
Hinton	6/17/2009	17:45	1.00 in.	0	0	0	0
Columbia	6/17/2009	17:55	1.75 in.	0	0	0	0
Prathersville	6/17/2009	18:05	1.00 in.	0	0	0	0
Stephens	6/17/2009	18:15	1.00 in.	0	0	0	0
Hallsville	6/27/2009	20:59	1.00 in.	0	0	0	0
TOTALS:				0	0	20K	0

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

Measure of Probability and Severity

Probability: High – Planning Area

Severity: High – Planning Area

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

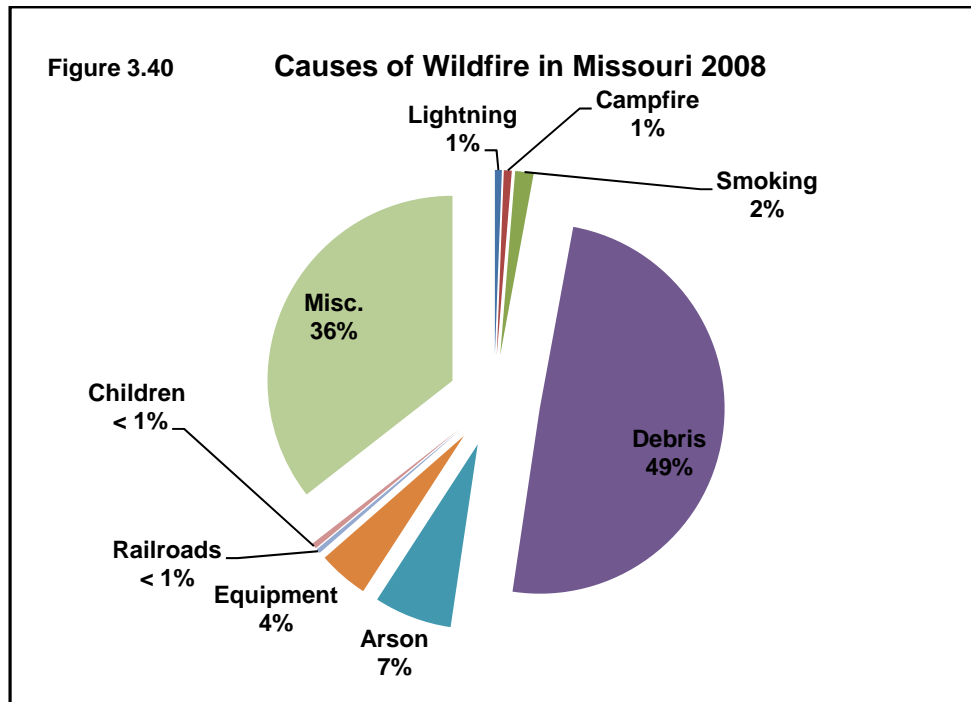
Description of Hazard

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

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

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

The major causes of wildfires in Missouri are various human activities, according to statistics from the Missouri Department of Conservation (see Figure 3.40).



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

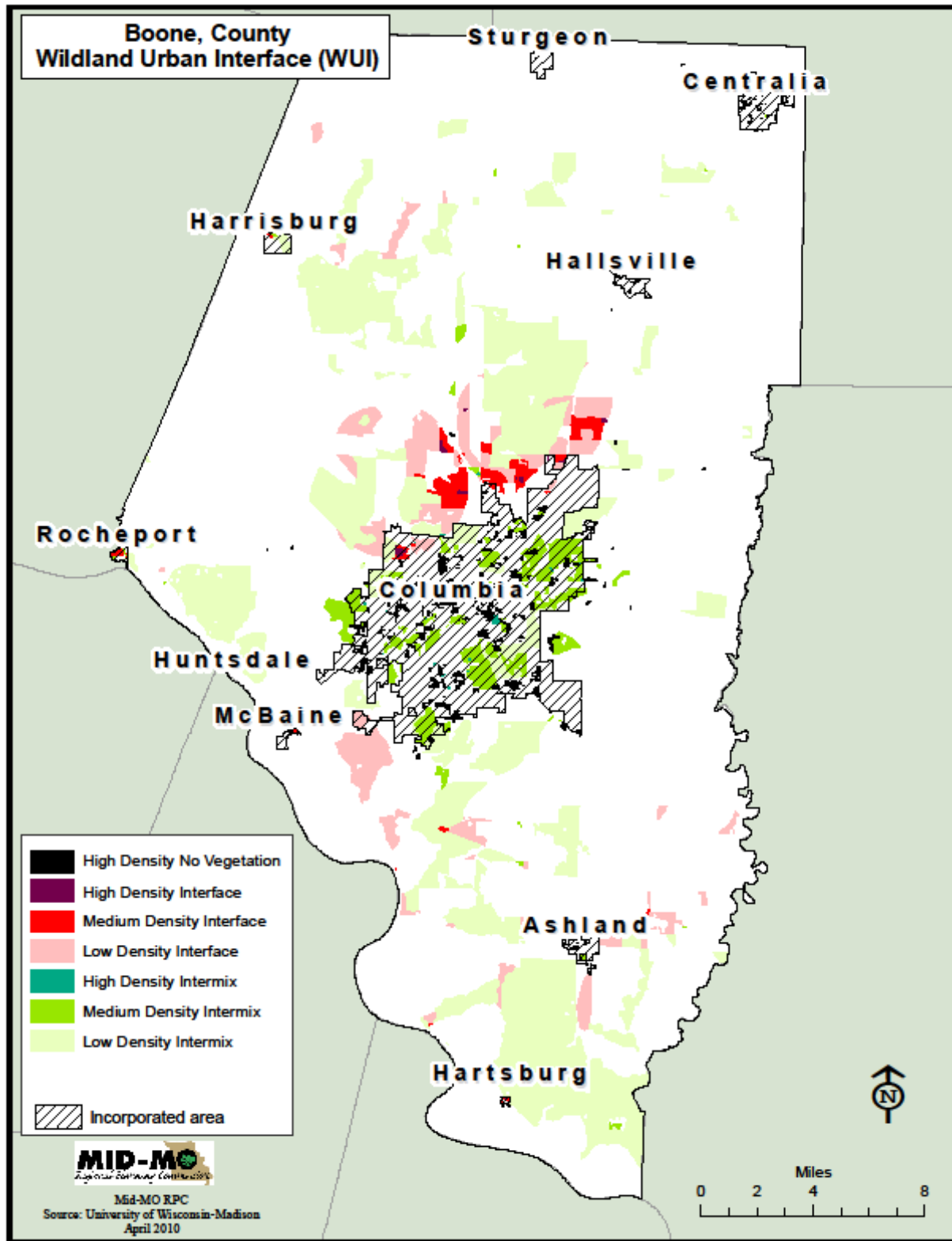
Structures are scattered throughout a wildland area. There is no clear line of demarcation; wildland fuels are continuous outside of and within the developed area. The development density in the intermix ranges from structures very close together to one structure per 40 acres.

- 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.

Both Interface and Intermix communities exist in Boone County. Areas of Hartsburg and Rocheport fall within these categories and are mapped in section 3.5. Figure 3.41 shows the WUI for Boone County.

Figure 3.41



Geographic Location

The rural areas of Boone 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 Boone County in recent history. However, the Fire Districts in Boone County fight smaller wildfires/natural cover fires every year.

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

Measure of Probability and Severity

Probability: Moderate – Boone County, Hartsburg, Rocheport
Low – All other participating jurisdictions

Severity: Moderate – Boone County, Hartsburg, Rocheport
Low – 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.

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

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

This section will provide an inventory assessment of vulnerable structures, equipment, and populations within Boone 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 Boone County. This assessment can be used to identify potential areas where mitigation activities are needed.

3.3.1 Boone County Inventory

Assessed and Appraised Values

Figure 3.42 Boone County			
2009 Assessed Values		2000 Building Counts	
Residential	\$1,333,816,090	Residential	52,872
Commercial	\$24,681,678	Commercial	529
Agricultural	\$534,384,258	Other	663
Total: Real Property	\$1,892,882,026	Total	54,064
Total: Personal Property	\$378,020,300	County Owned Property	
Total: Railroads and Utilities	\$33,591,530	Number of Buildings	\$ Value
		42	\$94,673,108
Total Value	\$2,304,493,856		
Source: Boone County Assessor's Office		Source: US Census Bureau	

Figure 3.43 shows Boone County owned property and replacement costs as stated in the January 2010 insurance statement.

Figure 3.43 Boone County Owned Buildings and Replacement Costs			
County/City Health Dept.	\$6,295,695	Boone County Fair Grounds	
Alternative Sentencing Center	\$787,920	Fairground Lights and Poles	\$52,500
IV-D (Child Support Enforcement)	\$1,333,500	Coliseum	\$2,520,000
PED-NET	\$1,284,150	Concessions	\$46,200
Johnston Building	\$719,250	Concessions	\$46,200
Sheriff Substation North	\$42,000	Concessions	\$46,200
Sheriff Substation South	NA	Concessions	\$46,200
Public Works Department	\$1,277,010	Concessions	\$46,200
Snow and Ice Storage	\$1,298,850	Horse Barn	\$202,650
Asphalt Storage	\$305,760	Horse Barn	\$202,650
Sign Shop	\$20,000	Horse Barn	\$202,650
Centralia Health Clinic	\$834,960	Horse Barn	\$202,650
Courthouse	\$42,000,000	Livestock Barn	\$81,900
Garage	\$99,960	Livestock Barn	\$81,900
Government Center	\$9,429,210	Livestock Barn	\$81,900
Jail	\$17,640,000	Restrooms	\$57,960
Johnson Building	\$1,223,355	Restrooms	\$57,960
Juvenile Justice Center	\$2,958,215	Restrooms	\$133,400
Reality House	\$1,855,875	Shelter	\$6,825
Courthouse Square Lights	\$790,037	Shelter	\$13,650
		Show Place	\$226,800
		Shower House	\$60,483
		Shower House	\$60,483

Source: Boone County Insurance Statement effective date January 2010

Agriculture

Figures 3.44a-b show value estimates for agricultural land in Boone County and estimates of crop and livestock production. Since over half of the land area of Boone County is farmland, the impact of agricultural losses due to a natural hazard could be a potential threat to the economic stability of the region.

Figure 3.44	
2007 Boone County Agricultural Overview	
Number of Farms	1,322
Land In Farms	258,734 acres (58.5% of Boone County)
Market Value of Products Sold	\$45,523,000
Crop Sales	\$29,169,000
Livestock Sales	\$16,354,000
2007 Census of Agriculture, County Profiles; http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/County_Profiles/	

Figure 3.44b								
Crop	Planted		Harvested		Yield		Production	
	2008	2009	2008	2009	2008	2009	2008	2009
	acres		acres		bushels		bushels	
Corn	20,800	22,300	19,600	21,700	130	141	2,556,000	3,059,000
Soybeans	40,600	44,200	38,900	44,000	32.5	43.5	1,268,000	1,914,000
Wheat	12,400	7,800	12,200	7,300	46.5	44	569,600	321,200
Grain Sorghum	2,300	1,700	1,700	1,600	93	69	157,500	110,000
Hay	acres		acres		tons/acre		tons	
	NA	NA	44,000	NA	1.95	NA	86,000	NA
Beef Cows, Milk Cows and All Cattle and Calves	Beef Cows		Milk Cows		All Cattle and Calves		Value of All Cattle	
	head		head		head		1,000 Dollars	
	16,500	14,700	200	200	31,000	29,100	26,660	22,698
Source: National Agriculture Statistics Service (USDA), http://www.nass.usda.gov/Statistics_by_State/Missouri/Publications/County_Estimates/index.asp								

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.

Figure 3.45 Critical Medical Facilities	
Trauma Centers	City
University of Missouri Hospital and Clinics	Columbia
Federally Qualified Health Centers	
Family Health Center	Columbia
J.W. "Blind" Boone Community Center	Columbia
Heart of Missouri Mental Health Center	Columbia
Rusk Rehabilitation Center, LLC	Columbia
Columbia Regional Hospital	Columbia
University of MO Hospital & Clinics	Columbia
Boone Hospital Center	Columbia
Rural Clinics	
Centralia Family Health Clinic	Centralia
Nursing Home Facilities	
Ashland Healthcare	Ashland
Bluegrass Terrace	Ashland
Bluffs, The	Columbia
Bristol Manor of Centralia	Centralia
Ashland Villa	Ashland
Bluff Creek Terrace	Columbia
Candlelight Lodge Retirement Center	Columbia
Columbia Healthcare Center	Columbia
Columbia Manor Care Center	Columbia
Harambee House	Columbia
Heritage Hall Nursing Center	Centralia
Hillcrest Residential Care	Columbia
Parkside Manor	Columbia
Stuart House, The	Centralia
Sturgeon Rest Home	Sturgeon
Tiger Place	Columbia
Lenoir Gardens	Columbia
Lenoir Health Care Center	Columbia
Lenoir Manor	Columbia
South Hampton Place	Columbia
Source: Missouri Department of Health and Senior Services Information Technology Services Division	

Critical Water and Wastewater Treatment and Storage Facilities

Figure 3.46 Municipal Wastewater Treatment Facilities			
Facility Name	City	Owner Name	Owner City
BCRSD HARTSBURG, VILLAGE	Hartsburg	CITY OF HARTSBURG	Hartsburg
BCSD, EAGLE KNOLL SUBD	Hartsburg	BOONE CO REG SEWER DIST	Columbia
ASHLAND LAGOONS	Ashland	ASHLAND, CITY OF	Ashland
COLUMBIA REGIONAL AIRPORT	Columbia	COLUMBIA PUB WORKS DEPT	Columbia
BCSD, BROOKFIELD ESTATES	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD UNIVERSITY ESTATES	Columbia	BOONE CO REG SEWER DIST	Columbia
COLUMBIA REGIONAL WASTEWA	Columbia	CITY OF COLUMBIA	Columbia
BCSD, SOUTH ROUTE K WWTF	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, ARROWHEAD LAKE ESTS	Columbia	BOONE CO REG SEWER DIST	Columbia
MCBANE WETLAND/EAGLE BLUFFS	Columbia	U.S. ARMY CORP OF ENGINEE	Kansas City
BCSD, SPRINGPARK SUBD	Columbia	BOONE CO REG SEWER DIST	Columbia
BOONE CO ROAD/BRIDGE SHOP	Columbia	BOONE CO PUB WORKS DEPT	Columbia
BCSD, PRAIRIE MEADOWS WWT	Columbia	BOONE CO REG SEWER DIST	Columbia
COLUMBIA REGIONAL WASTEWA	Columbia	CITY OF COLUMBIA	Columbia
BCSD, EL CHAPARRAL SUBD	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, CONCORDE EST SUBD	Columbia	BOONE CO REG SEWER DIST	Columbia
BCRSD - OTSCON	Columbia	BOONE CO REG SEWER DIST	Columbia
BSCD SUNRISE ESTATES, SE	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD SUGAR TREE HILLS SU	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, HIGHFIELD ACRES	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, SUNRISE ESTATES NE	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, SUNRISE ESTATES NW	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD MEADOW VILLAGE	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, SHAW WWTF	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, WESTWOOD MEADOWS	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, LEE HEIGHTS	Columbia	BOONE CO REG SEWER DIST	Columbia
ROLLINGWOOD SUBD PLT2	Columbia	BOONE CO REG SEWER DIST	Columbia
BCRSD, MIDWAY CROSSINGS	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD TRAILS WEST SUBD	Columbia	BOONE CO REG SEWER DIST	Columbia
ROCHEPORT WWTF	Rocheport	CITY OF ROCHEPORT	Rocheport
BCSD ROLLINGWOOD PLAT #1	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, OBERLIN VALLEY	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, EL REY HEIGHTS	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, RAYFIELD SUBDIVISIO	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, CLEARVIEW ACRES SUB	Columbia	BOONE CO REG SEWER DIST	Columbia
COLUMBIA LANDFILL AND YAR	Columbia	CITY OF COLUMBIA	Columbia
BCSD, PHENORA SOUTH SUBD	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD/WAGON TRAIL HTS WWTF	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, POWELL COMM. LAGOON	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, FALL CREEK SUBD	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, SUN VALLEY ESTATES	Columbia	BOONE CO REG SEWER DIST	Columbia
BON GOR LAKE ESTATES	Columbia	BOONE CO REG SEWER DIST	Columbia

Facility Name	City	Owner Name	Owner City
BCSD, SHARIDAN HILLS SUBD	Columbia	BOONE CO REG SEWER DIST	Columbia
COUNTY DOWNES WWTF	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD LAKE CAPRI SUBDIVIS	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, HILLVIEW ACRES SUBD	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, TWIN LAKES SUBD	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD RICHARDSON ACRES	Columbia	BOONE CO REG SEWER DIST	Columbia
BCSD, CEDAR GATE SUBD	Hallsville	BOONE CO REG SEWER DIST	Columbia
BCRSO QUARTER MILE HILLS	Hallsville	BOONE CO REG SEWER DIST	Columbia
BCSD, SUNNYSLOPE WWTF	Hallsville	BOONE CO REG SEWER DIST	Columbia
HALLSVILLE LAND APP SYS	Hallsville	HALLSVILLE	Hallsville
HARRISBURG WWTF	Harrisburg	CITY OF HARRISBURG	Harrisburg
CENTRALIA WW DISPOSAL FAC	Centralia	CENTRALIA, CITY OF	Centralia
STURGEON WWTF	Sturgeon	STURGEON, CITY OF	Sturgeon

Source: Missouri Spatial Data Information Server

Figure 3.47 Public Water Supply Towers			
Water Supply Owner	# of Tanks	Water Supply Owner	# of Tanks
Boone Co. Cons. PWSD #1	11	Ashland	2
Boone Co. PWSD #4	4	Bon-Gor Lake Estates Subd.	1
Boone Co. PWSD #9	5	Centralia	2
Boone Co. PWSD #10	2	Columbia	9
		Hallsville	1

Source: Missouri Spatial Data Information Server

Figure 3.48 Public Water Treatment Plant		
Owner	Facility Name	People Served
Columbia	McBaine Water Treatment Plant	>98,000

Source: Missouri Spatial Data Information Server

Critical Boone County Public Works Equipment

Figure 3.49		
Columbia/Boone County Public Works Equipment Inventory		
Columbia Municipal Public Works		
5 Graders	3 skid loaders	1 Boom Truck
5 Loaders	1 Track Hoe	8 Rear-loader Trash Vehicles
20 Dump Trucks	35 Pickups	100+ Open Top Roll-Off Containers
6 Backhoes	3 Forklifts	5 Roll-Off Trucks
Boone County Road & Bridge Department		
9 Graders	1 Track hoe	1 port-a-john
2 Loader	2 Uni-Loaders	1 400 gallon water trailer
1 Bulldozer	1 5kw generator	2 Broom (Self-propelled)
3 Backhoe – rubber tired	1 6" Water pump	8 Motor Graders
15 Gravel Trucks	1 Boom truck	2 Service Trucks
10 Pickup Trucks	2 Brush chipper	2 Low Boy Trailers
4 SUV	18 chainsaws	3 Road Tractors
1 Suburban	5 demolition saws	2 Track-hoes
3 Service trucks	2 stale bed trucks	3 Uni-loaders
1 Low Boy Trailer	3 Flatbed trailers	2 Stake Bed Trucks
2 Road Tractors	1 flat utility trailer	2 Flat Utility Trailers
1 5000 gallon Water Trailer	2 2" portable water pumps	
Source: Columbia / Boone County EOP I-12 April 2008 - Appendix 3 to Annex I		

Population

Figure 3.50 shows an age profile of the Boone 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.

Figure 3.50		Boone County 2008 Population by Age
Persons under 5 years old		10,342
Persons under 18 years old		34,269
Persons between 18 and 65 years old		95,234
Persons 65 years old and over		14,510
Total		154,365
Source: US Census Bureau		

Historic Properties

Figure 3.51 Boone County National Register of Historic Places			
National Register-listed Property	Community	National Register-listed Property	Community
Ballenger Building	Columbia	Kress Building	Columbia
Bond's Chapel Methodist Episcopal Church	Hartsburg	Maplewood	Columbia
(Blind Boone) John W. Boone House	Columbia	McCain Furniture Store	Columbia
Central Dairy Building	Columbia	Miller Building, Matthews Hardware, Metropolitan Building	Columbia
Albert Bishop Chance House and Gardens	Centralia	Missouri State Teachers Association	Columbia
Chatol	Centralia	Missouri Theater	Columbia
Coca-Cola Bottling Company Building	Columbia	Missouri United Methodist Church	Columbia
Columbia Cemetery	Columbia	Missouri, Kansas, and Texas Railroad Depot	Columbia
Columbia National Guard Armory	Columbia	Moses U. Payne House	Rocheport
Sanford F. Conley House	Columbia	North Ninth Street Historic District	Columbia
Frederick Douglass School	Columbia	Pierce Pennant Motor Hotel	Columbia
Downtown Columbia Historic District	Columbia	Rocheport Historic District	Rocheport
East Campus Neighborhood Historic District	Columbia	Sanborn Field and Soil Erosion Plots	Columbia
Samuel H. Elkins and Isabel Smith House	Columbia	Second Baptist Church	Columbia
First Christian Church	Columbia	Second Christian Church	Columbia
Francis Quadrangle Historic District	Columbia	Senior Hall	Columbia
Gordon Tract Archeological Site	Columbia	St. Paul A.M.E. Church	Columbia
David Gordon House and Collins Log Cabin	Columbia	Stephens College, South Campus	Columbia
Greenwood	Columbia	John N. and Elizabeth Taylor House	Columbia
David Guitar House	Columbia	Tiger Hotel	Columbia
Samuel E. Hackman Building	Hartsburg	Virginia Building	Columbia
Hamilton--Brown Shoe Factory	Columbia	Wabash Railroad Station and Freight House	Columbia
William B. Hunt House	Columbia	Wright Brothers Mule Barn	Columbia

Source: <http://www.nr.nps.gov/nrlloc1.htm>

Development Trends

Future development in Boone County can and will be impacted by several natural hazards. Development plans can use the Boone 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.

Northeastern Columbia has development trends that will result in higher populations and higher population concentrations through residential, commercial, and industrial growth.

Boone County, the City Ashland, and the City of Columbia currently have information on community development and planning available on their websites. Development trend information in other jurisdictions throughout the county can be attained through other means such as attendance of city council meetings.

3.3.2 School Districts and Higher Education

Population

Figure 3.52

Boone County School District Populations				
School District	School Name	Grades	Certificated Staff	Students
Centralia R-VI	Centralia High (1050)	9-12	38	395
	Chester Boren Middle (3000)	6-8	37	436
	Chance Elem. (4020)	PK-2	42	488
	Centralia Intermediate (4050)	3-5	N/A	N/A
Columbia 93	Juvenile Justice Ctr. (1015)	1-12	3	28
	Frederick Douglass High (1020)	PK-12	28	230
	Columbia-Hickman High (1050)	10-12	167	2143
	Rock Bridge Sr. High (1075)	PK-12	135	1745
	Columbia Area Career Ctr. (1100)	10-12	44	N/A
	Jefferson Jr. High (2050)	08-09	78	845
	Oakland Jr. High (2060)	08-09	71	753
	West Jr. High (2075)	08-09	92	965
	Ann Hawkins Gentry Middle (3000)	06-07	78	710
	Smithton Middle (3040)	06-07	96	866
	John B. Lange Middle (3060)	06-07	85	809
	Thomas Benton Elem. (4020)	PK-05	37	262
	Blue Ridge Elem. (4040)	PK-05	53	511
	Cedar Ridge Elem. (4050)	PK-05	25	164
	Derby Ridge Elem. (4055)	PK-05	65	725
	Fairview Elem. (4060)	PK-05	46	558
	Eugene Field Elem. (4080)	PK-05	37	289
	Ulysses S. Grant Elem. (5000)	PK-05	34	326
	Mary Paxton Keeley Elem. (5010)	PK-05	57	690
	Robert E. Lee Elem. (5020)	PK-05	35	334
	Midway Heights Elem. (5025)	PK-05	28	267
	Mill Creek Elem. (5030)	PK-05	58	762
	New Haven Elem. (5035)	PK-05	31	32
	Parkade Elem. (5040)	PK-05	47	473
	John Ridgeway Elem. (5060)	K-05	29	228
	Rock Bridge Elem. (5080)	PK-05	46	493
	Russell Blvd. Elem. (6000)	PK-05	48	525
	Shepard Blvd. Elem. (6010)	PK-05	44	545
	West Blvd. Elem. (6020)	PK-05	30	287

	Two Mile Prairie Elem. (6040)	K-05	29	309
	Center for Gifted Education (6080)	1-5	13	24
Hallsville R-IV	Hallsville High (1050)	9-12	40	393
	Hallsville Middle (3000)	6-8	37	315
	Hallsville Intermediate (4020)	2-5	38	388
	Hallsville Primary (4040)	PK-01	22	237
Harrisburg R-VIII	Harrisburg High (1050)	9-12	26	293
	Harrisburg Middle (3000)	7-8	N/A	N/A
	Harrisburg Elem. (4020)	K-06	29	296
Southern Boone Co. R-I	Southern Boone High (1050)	9-12	44	449
	Southern Boone Middle (3000)	6-8	37	432
	Southern Boone Primary (4010)	PK-02	31	315
	Southern Boone Elem. (4020)	33-05	24	219
Sturgeon R-V	Sturgeon High (1050)	9-12	18	133
	Sturgeon Middle (3000)	5-8	19	149
	Sturgeon Elem. (4020)	K-4	21	172
Missouri Department of Elementary and Secondary Education - Revised: February 10 2009				

Building Counts and Replacement Costs

Figure 3.53a			
Boone County School Districts Assessed Values			
School District	Buildings	Replacement Cost (building and contents)	Assessed Valuation
Centralia R-VI	17	\$30,676,373	\$82,852,396
Columbia 93	50	\$370,450,665	\$1,975,541,024
Hallsville R-IV	4	NA	\$65,968,214
Harrisburg R-VIII School District	3	NA	\$32,363,877
Southern Boone Co. R-I School District	8	\$34,020,431	\$98,490,285
Sturgeon R-V School District	5	\$13,615,586	\$29,412,217
MO Department of Elementary and Secondary Education - Revised: February 10 2009 and Boone County School Districts			

Figure 3.53b		
Higher Education Facilities		
School District	Buildings	Replacement Cost (building and contents)
University of Missouri (main campus only)	324	\$3.1 Billion
Columbia College	20	NA
Stephens College	16	NA
Source: Hazard Mitigation Survey to Universities 2009		

Development Trends

The following chart shows available development information for the educational institutions which are participating jurisdictions in the Boone County Hazard Mitigation Plan.

Centralia R-VI	NA
Columbia 93	NA
Southern Boone Co. R-I	NA
Sturgeon R-V	Passed bond issue proposal to brick in current single pane picture windows in the middle school. Renovation proposal includes installation of a new retro-fit metal roof, window replacement, installation of thru-wall heating/AC units, and asbestos testing and removal. Project expected to start in summer 2010.
University of Missouri-Columbia	MU prepares a Campus Master Plan that is widely circulated within the campus community and publicly in the March/April time frame each year. Information about most the recent MU Campus Master Plan can be found at: http://www.cf.missouri.edu/masterplan/
Stephens College	NA

It should be noted that the University of Missouri-Columbia, Stephen's College, and all other public school districts in Boone County do not have structures that are identified as being directly vulnerable to any location specific hazards. For this planning process, location specific hazards include: Dam Failure, Flood, Land Subsidence/ Sinkhole, and Levee Failure. While structures in these jurisdictions are not directly affected by these hazards, indirect effects from flash flooding that may affect access to structures and pose a low threat to populations can occur.

3.3.3 Community Jurisdictions

Assessed values for property in Boone County were calculated using data from the Boone County Assessor’s Office and collected through surveys from each community. The “Total Incorporated Building Count” represents all buildings within the community’s corporate limits.

Figure 3.54		Assessed Values and Building Counts		
Community	2009 Assessed Values		City Owned Property	
Ashland	Residential	\$28,808,585	Buildings	10 \$2,748,656
	Commercial	\$259,248	Contents	NA
	Agricultural	\$6,585,621	Equipment	NA
	Total: Real Property	\$35,653,454	Vehicles	15 \$350,306
	Total: Personal Property	\$6,385,656	Total	25
	Total: Railroads and Utilities	\$942,794	Total Incorporated Building Count	
	Total Value	\$42,981,904	1480	
Centralia	Residential	\$22,376,234	Buildings	4 \$11,008,000
	Commercial	\$38,864	Contents	(blanket ins. limit)
	Agricultural	\$11,176,129	Equipment	
	Total: Real Property	\$33,594,227	Vehicles	37 \$1,433,353
	Total: Personal Property	\$8,709,704	Total	41
	Total: Railroads and Utilities	\$554,886	Total Incorporated Building Count	
	Total Value	\$42,855,817	1768	
Columbia	Residential	\$908,393,643	Buildings	100 \$162,659,885
	Commercial	\$7,186,199	Contents	
	Agricultural	\$466,345,395	Equipment	
	Total: Real Property	\$1,381,925,237	Vehicles	555 \$6,531,741
	Total: Personal Property	\$252,878,909	Total	655 \$169,191,626
	Total: Railroads and Utilities	\$5,451,561	Total Incorporated Building Count	
	Total Value	\$1,640,255,707	44,329	
Hallsville	Residential	\$9,375,079	Buildings	4 \$497,047
	Commercial	\$46,891	Contents	NA
	Agricultural	\$2,383,677	Equipment	\$364,643
	Total: Real Property	\$11,805,647	Vehicles	7 NA
	Total: Personal Property	\$2,661,245	(Above are Insured Values)	
	Total: Railroads and Utilities	\$491,887	Total	11 \$861,690
	Total Value	\$14,958,779	Total Incorporated Building Count	
			604	

Community	2009 Assessed Values	City Owned Property
Hartsburg	Residential \$421,717	Buildings 2 \$45,000
	Commercial \$3,433	Contents NA
	Agricultural \$276,213	Equipment NA
	Total: Real Property \$701,363	Vehicles 2 \$39,000
	Total: Personal Property \$147,868	Total 4
Total: Railroads and Utilities \$82,635	Total Incorporated Building Count	
	Total Value \$931,866	54
Huntsdale	Residential \$105,383	None
	Commercial	
	Agricultural	
	Total: Real Property \$105,383	
	Total: Personal Property \$34,965	
Total: Railroads and Utilities \$0	Total Incorporated Building Count	
	Total Value \$140,348	17
Rocheport	Residential \$1,577,802	Buildings 2 \$191,480
	Commercial \$2,301	Contents NA
	Agricultural \$613,302	Equipment NA
	Total: Real Property \$2,193,405	Vehicles 0
	Total: Personal Property \$331,272	Total 2
Total: Railroads and Utilities \$35,429	Total Incorporated Building Count	
	Total Value \$2,560,106	128
Sturgeon	Residential \$3,714,358	Buildings 9 \$845,681
	Commercial \$10,080	Contents \$191,076
	Agricultural \$769,454	Equipment \$130,000
	Total: Real Property \$4,493,892	Vehicles 5 \$56,000
	Total: Personal Property \$1,204,416	Total 14 \$1,222,757
Total: Railroads and Utilities \$728,787	Total Incorporated Building Count	
	Total Value \$6,427,095	425
Source: Boone County Assessor's Office		Source: US Census Bureau 2000 Data

3.4 Vulnerability Summary and Impact

Requirement §201.6(c)(2)(ii):	<i>[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.</i>
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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 Boone County, Centralia, Columbia, Hartsburg, Hallsville (excluding University of Missouri, Stephen’s College, and all public school districts)

Overview

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

The Dam Inventory for the state of Missouri was compiled in the late 1970’s to early 1980’s. The state has classified 46 of Boone County’s dams as “High Hazard”. Of the 46 High Hazard dams in Boone County, 31 are unregulated. Only half of those 31 unregulated dams have ever been documented as having been inspected; one was inspected in 1997 and all others were inspected between 1979 and 1986. This presents two main problems. First, it has been more than 20 years since most of the unregulated High Hazard dams have been inspected, not counting the ones that were never inspected. Second, because these are *unregulated* dams, the state has no jurisdiction over maintenance. These two issues lead to the overall problem of dam location and development downstream.

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.

While evaluating the state dam inventory list and comparing it to 2009 aerial images of the Planning Area a few locations were found to be inconsistent with the Missouri Department of Natural Resources database.

The following dams are listed as High Hazard according to the state database, but according to 2009 aerial imagery they no longer exist or hold water:

Brandel Lake Dam (State regulated)
Highlands Lake Dam (unregulated)
Highlands South Lake Dam (unregulated)
Moon Valley Lake Dam (unregulated)

In addition to the data changes above, Stephens Lake Dam in Columbia is listed as an unregulated High Hazard dam, but was completely drained and rebuilt in 2004; this has not been updated in the state database.

McNew Lake Dam, located within the town of Hartsburg, does not appear in the state inventory of dams. Because of its close proximity and position uphill from several residences in the community, this dam should be viewed as “High Hazard”. This dam has been included in all maps.

Potential Impact on Existing Structures

Centralia, Columbia, Hartsburg, and Hallsville all have dams inside, or within a mile upstream of, their corporate boundaries. The University of Missouri-Columbia, Stephen’s College, and 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.

Figures 3.55 through 3.65 depict the downstream areas, and parcels that are within a half mile of the dam. All figures were created using the same scale. Because inundation information is not available at this time it is not possible to know exactly the severity or distance of a dam failure.

Potential Impact on Future Development

Dam Failure has the potential to impact future development in the county and its jurisdictions. Because many dams in Boone County are privately owned and not regulated by the state the potential for development below aging or unsafe dams is an issue that needs to be addressed. If development occurs without knowledge of problem dam that may lie upstream, that development is put in jeopardy. Currently, there is no knowledge of any future development by the University of Missouri, Stephen's College, or any public school districts that would be vulnerable to this hazard.

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. It is expected that the mapping of the regulated high hazard dams in Boone County will be carried out in 2010-2011, according to inspectors from Dam Safety Program. After an inundation study on a dam is finished, it will be the responsibility of the dam owner to work with the County Emergency Management Director in developing an Emergency Action Plan for the dam.

Figure 3.55

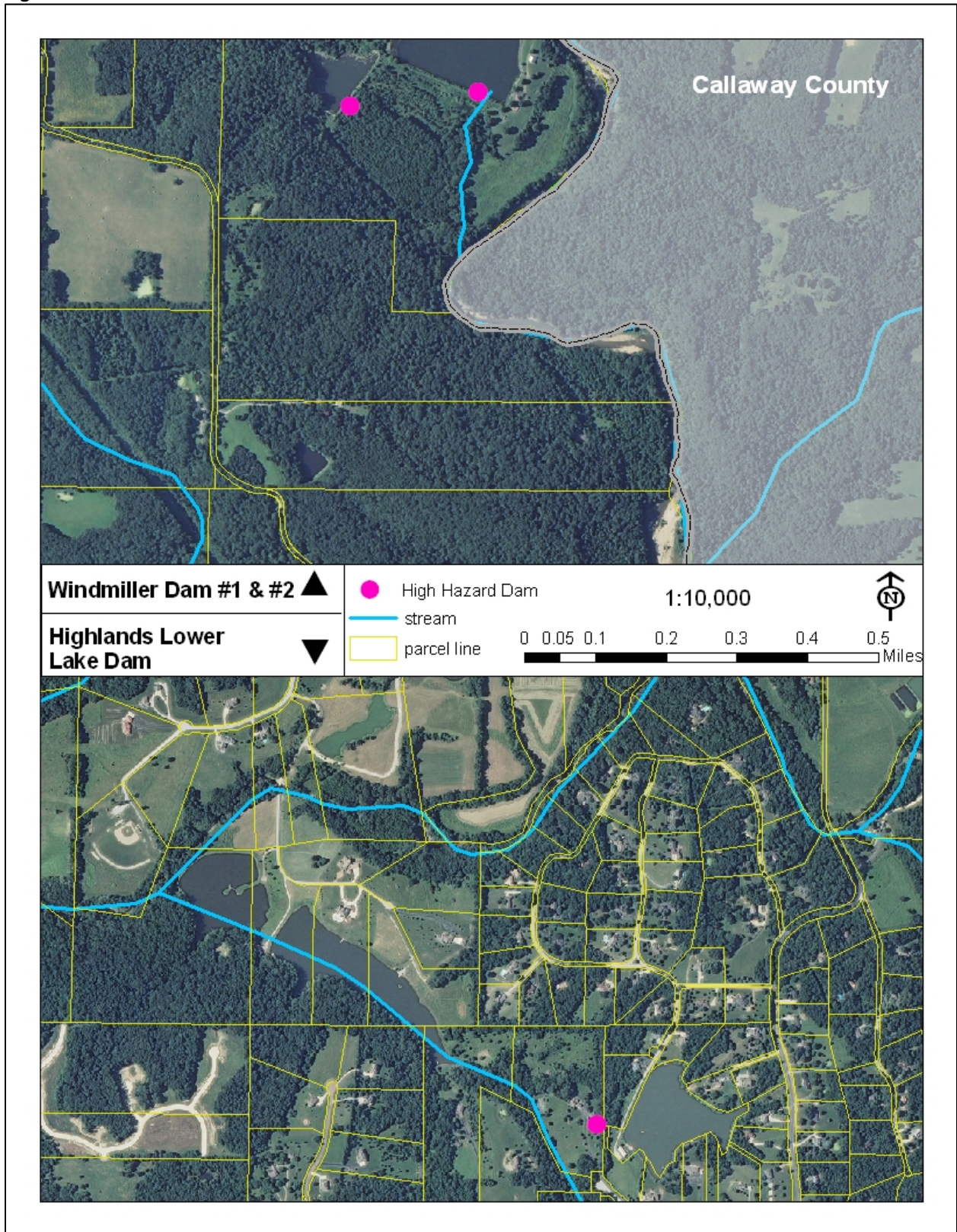


Figure 3.56

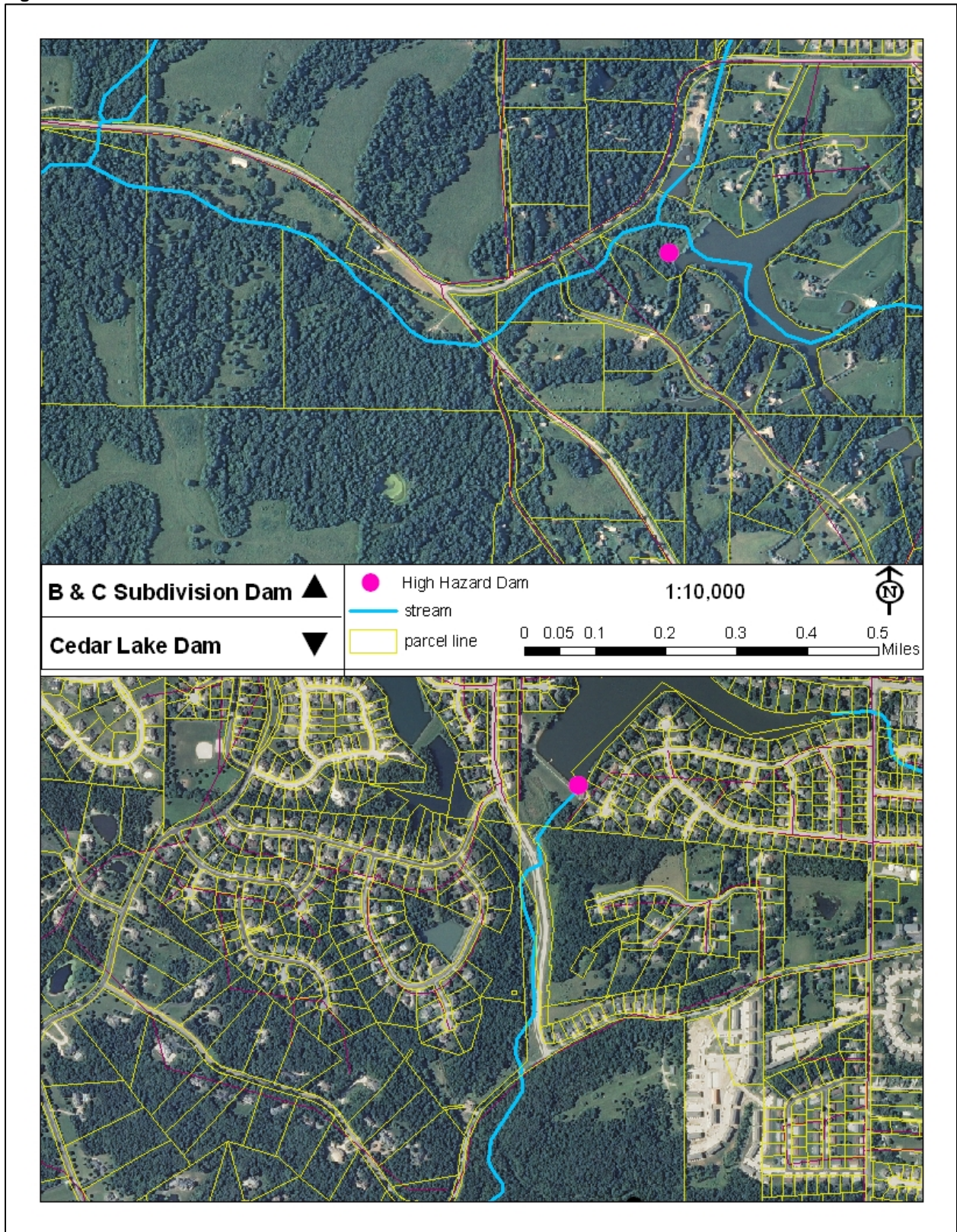


Figure 3.57

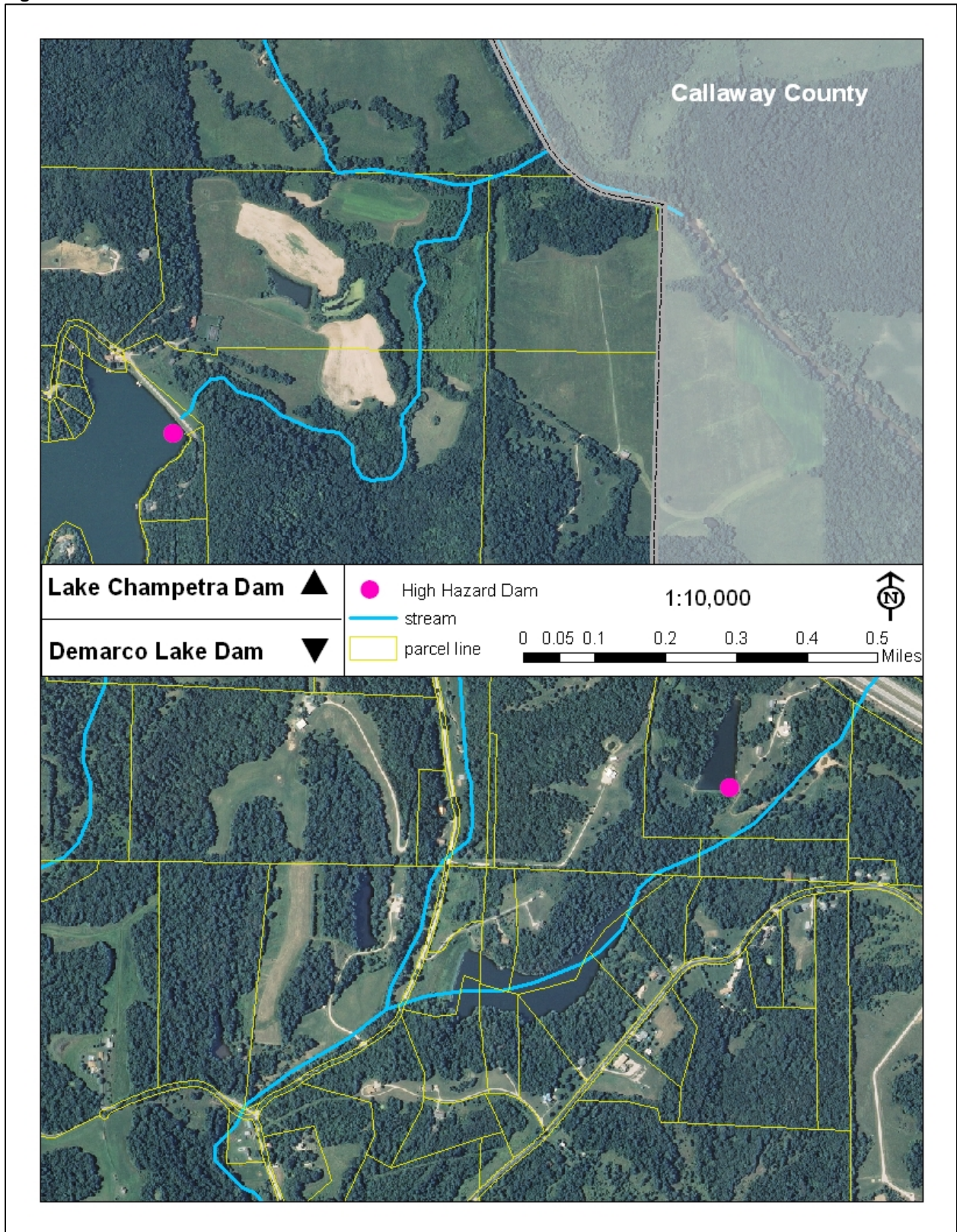


Figure: 3.58

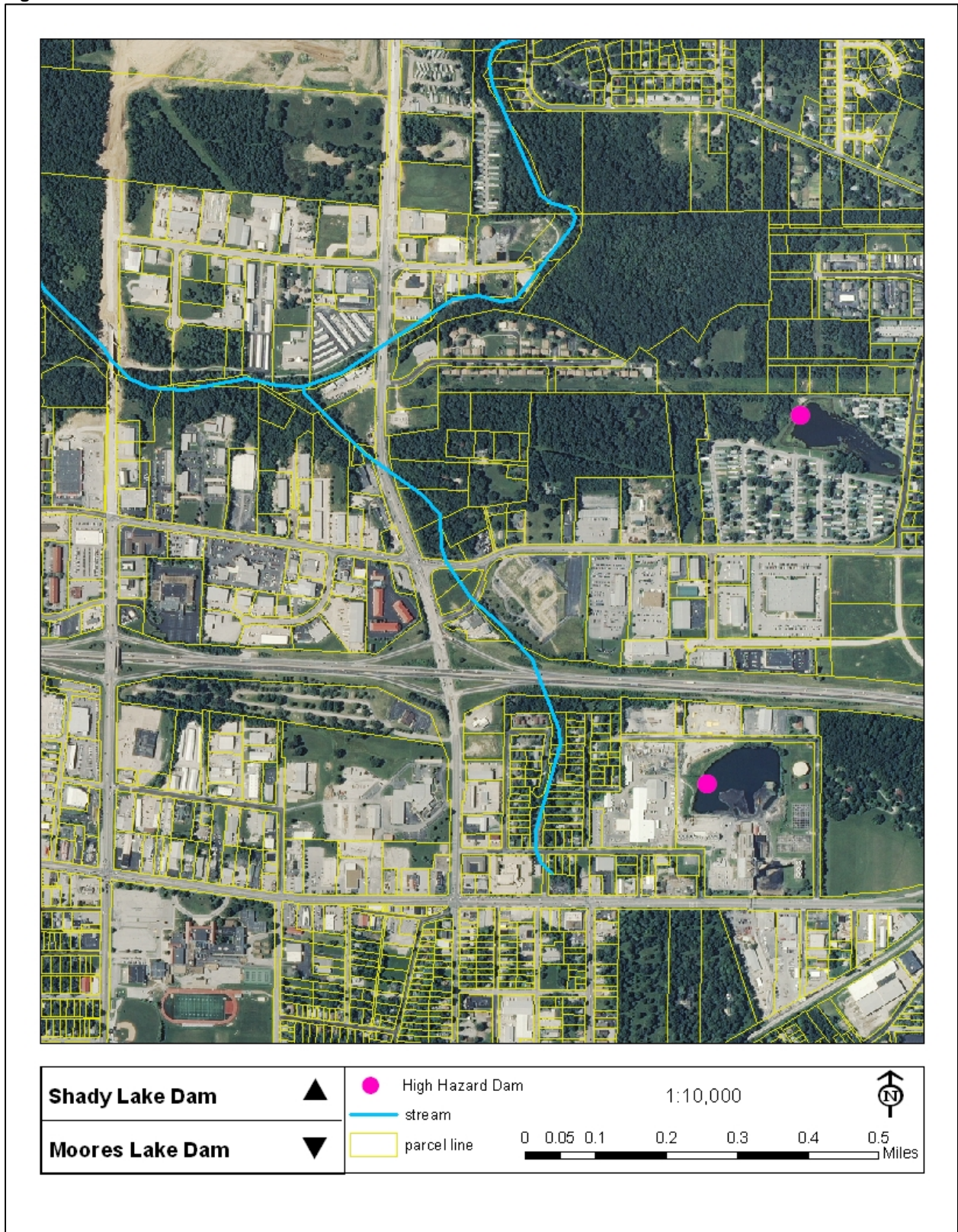


Figure: 3.59

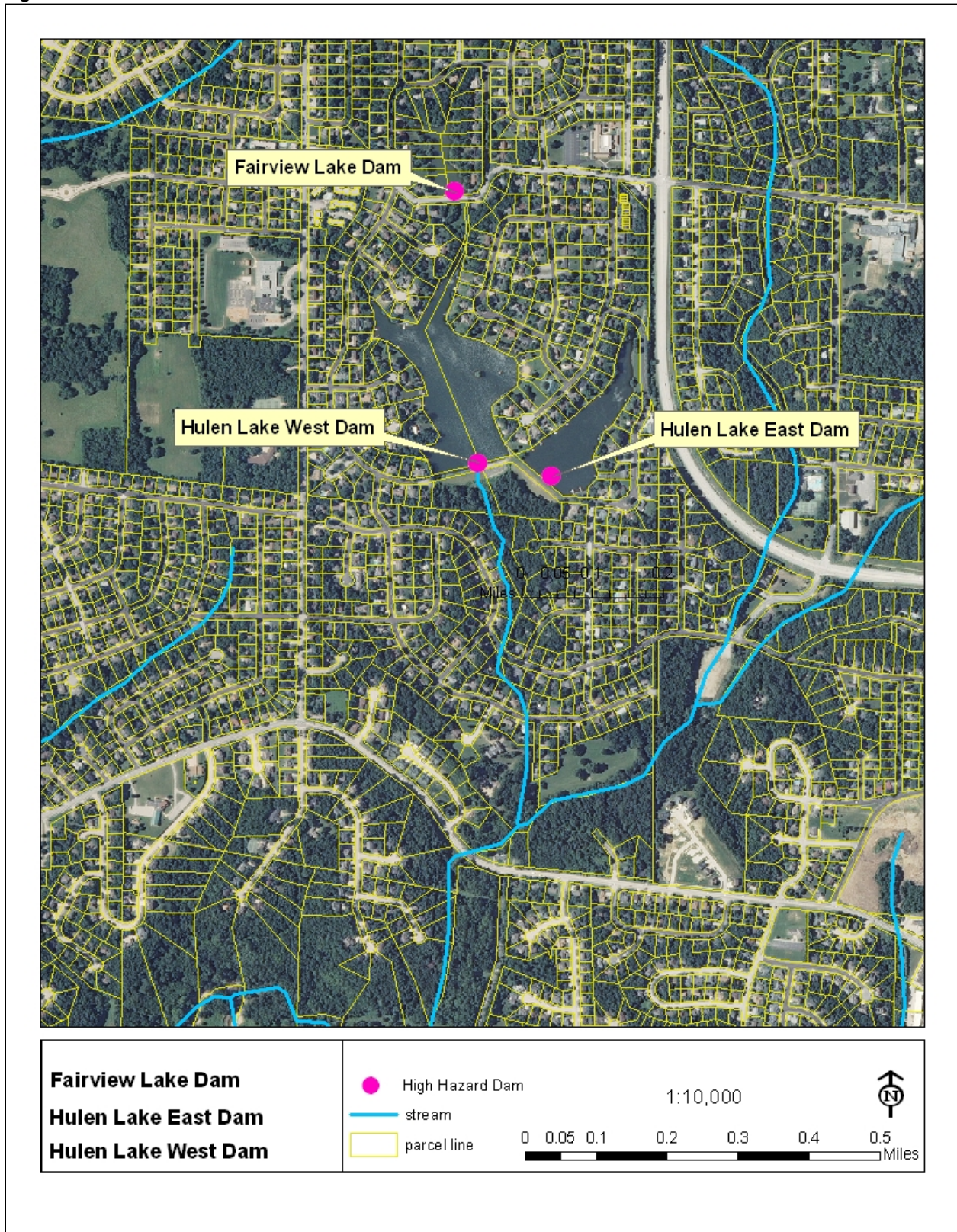


Figure: 3.60

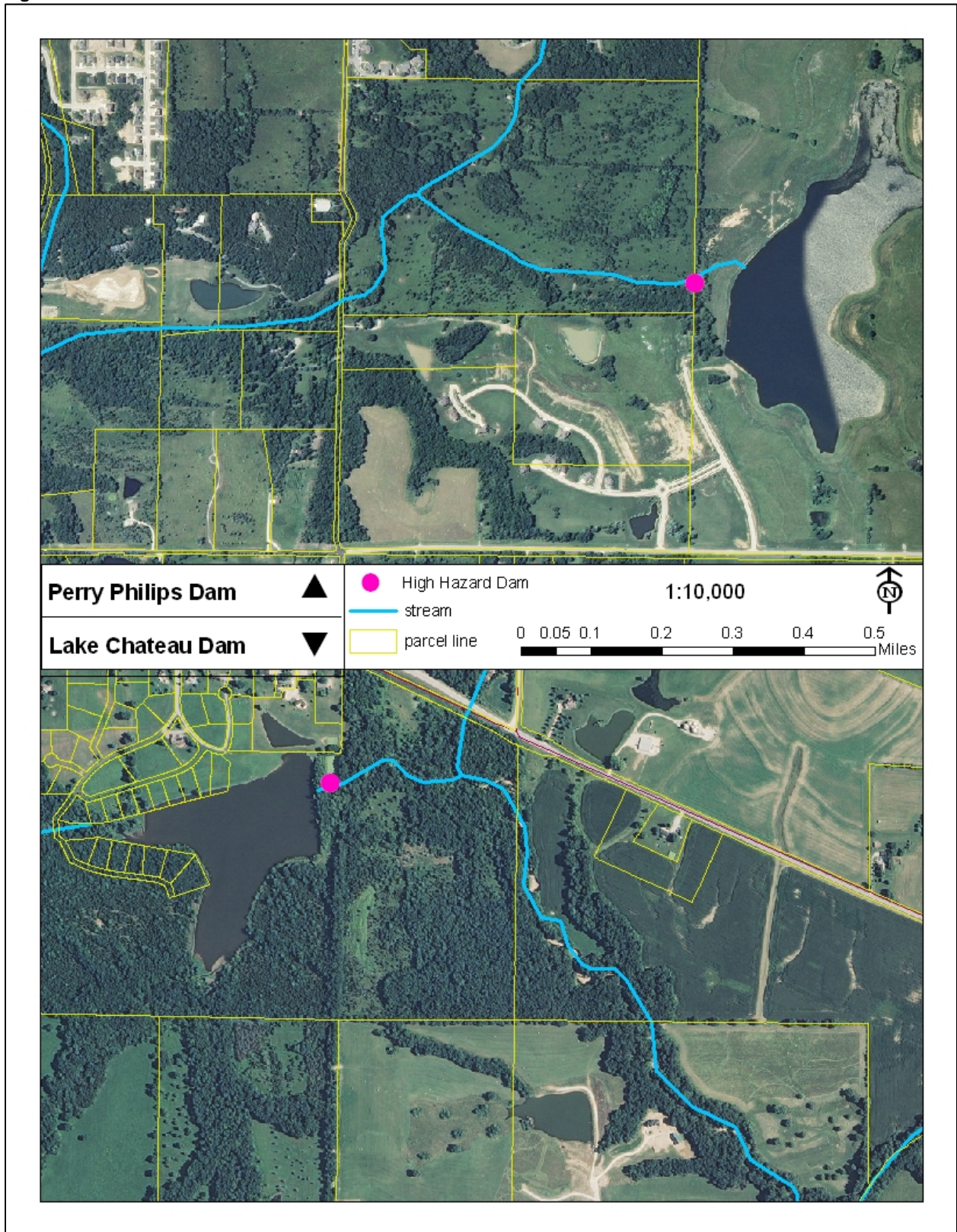


Figure: 3.61

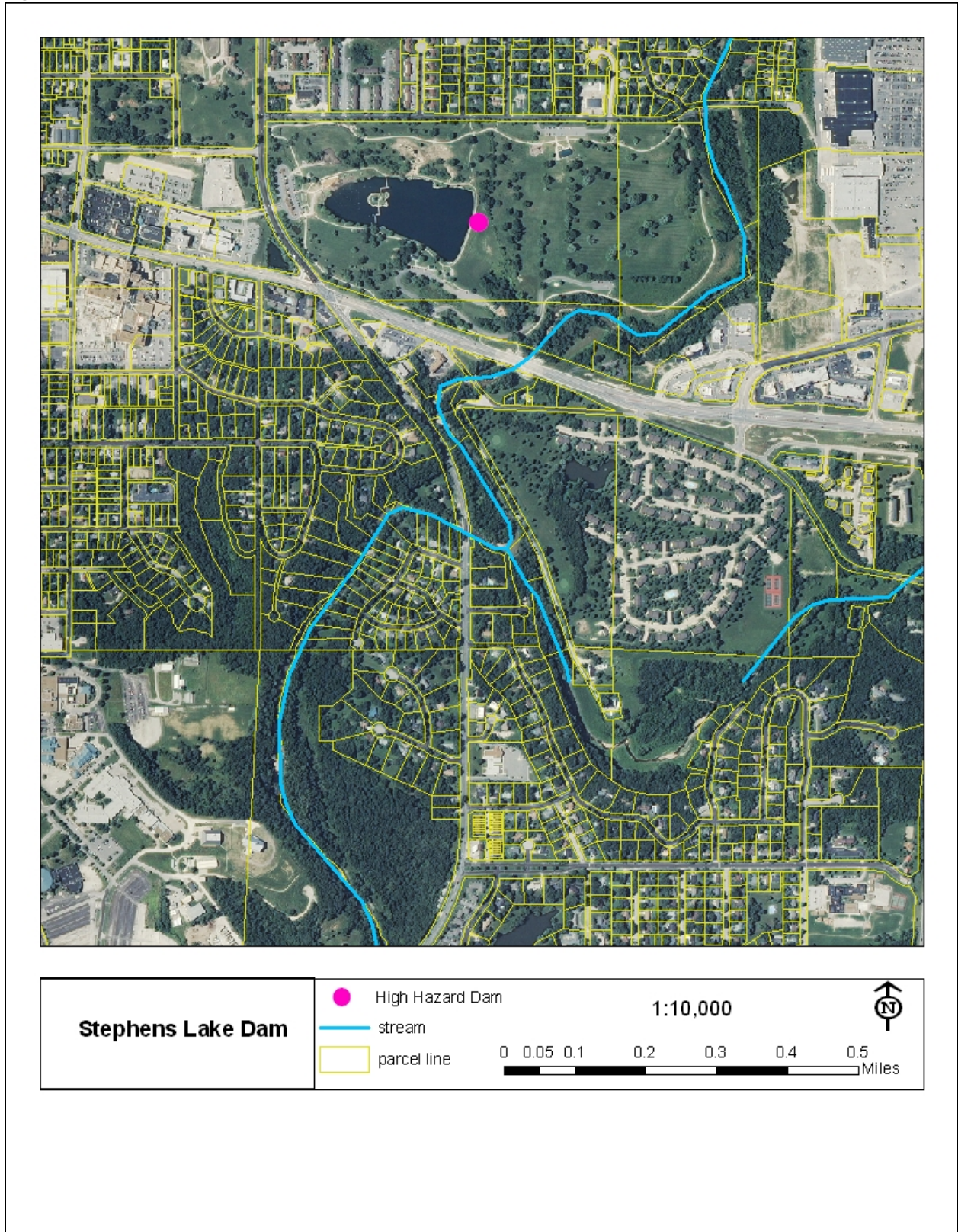


Figure: 3.62

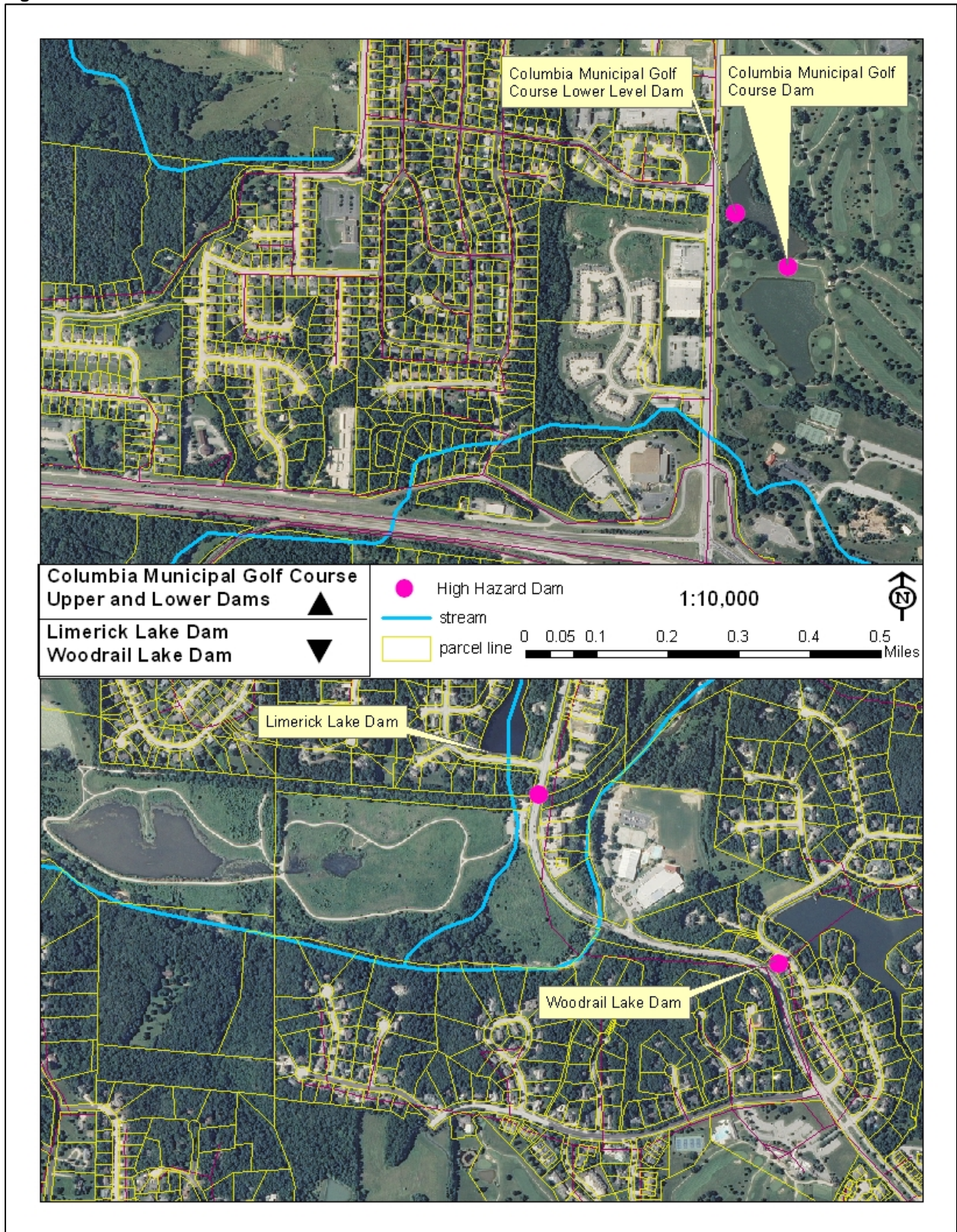


Figure 3.63

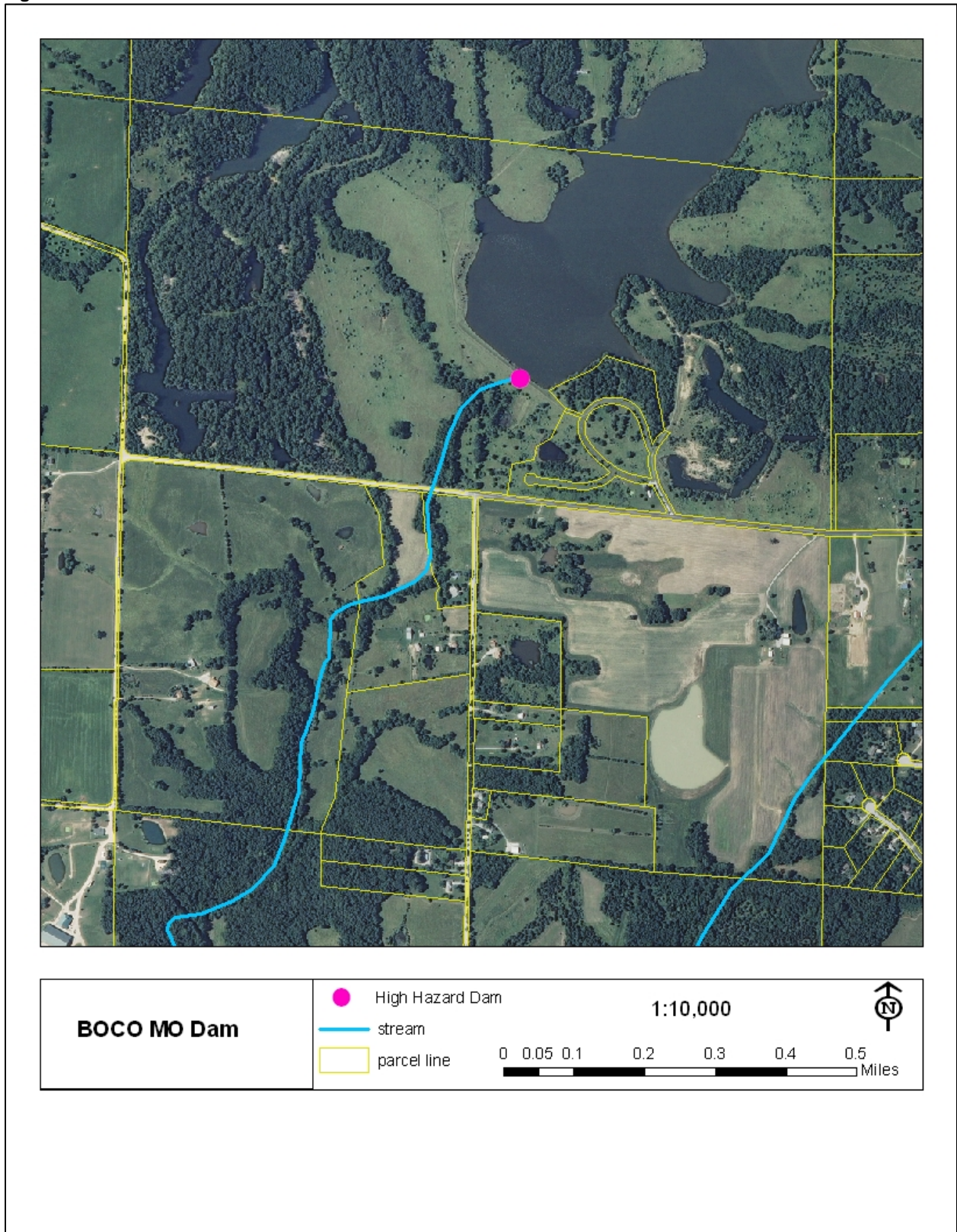


Figure 3.64

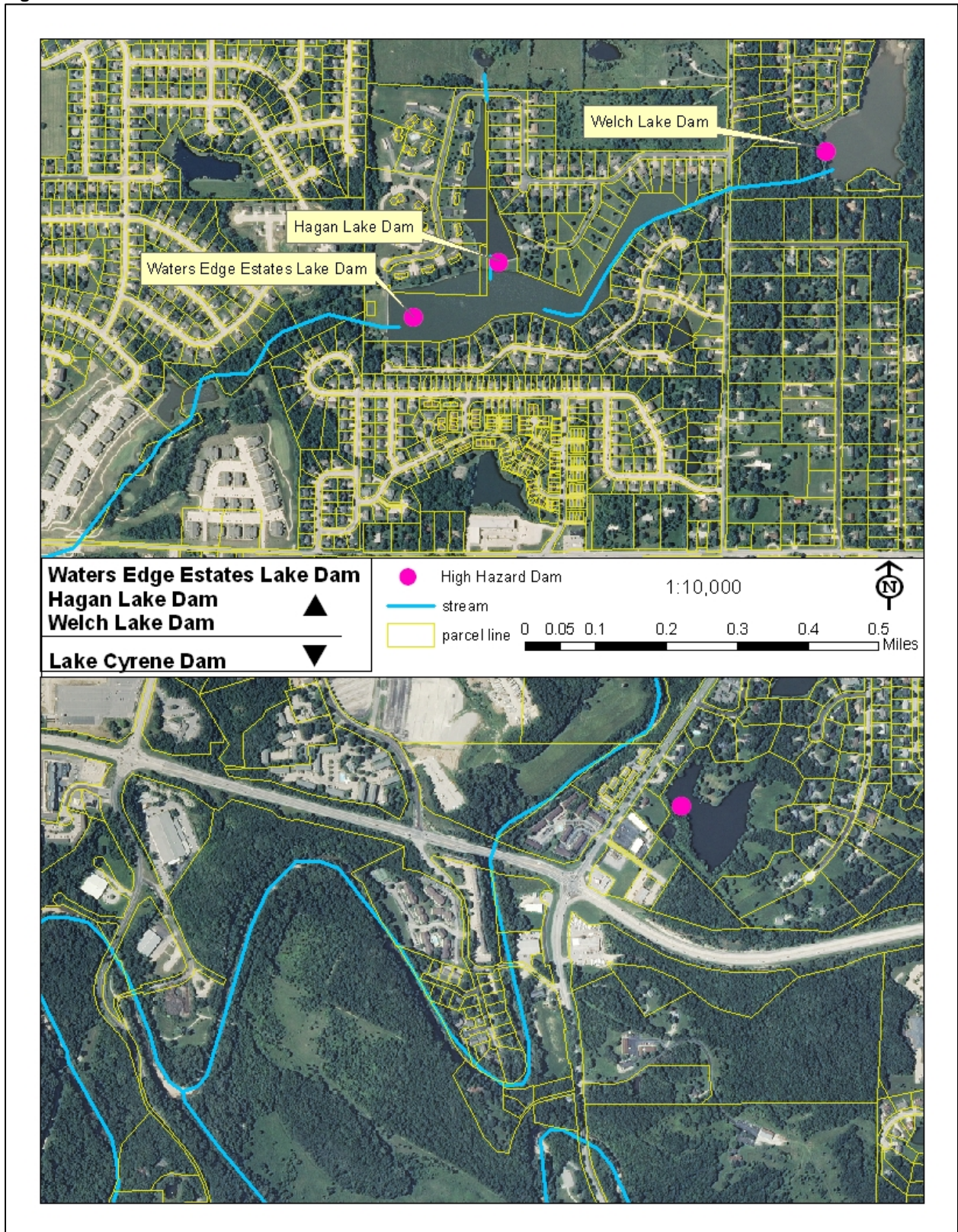
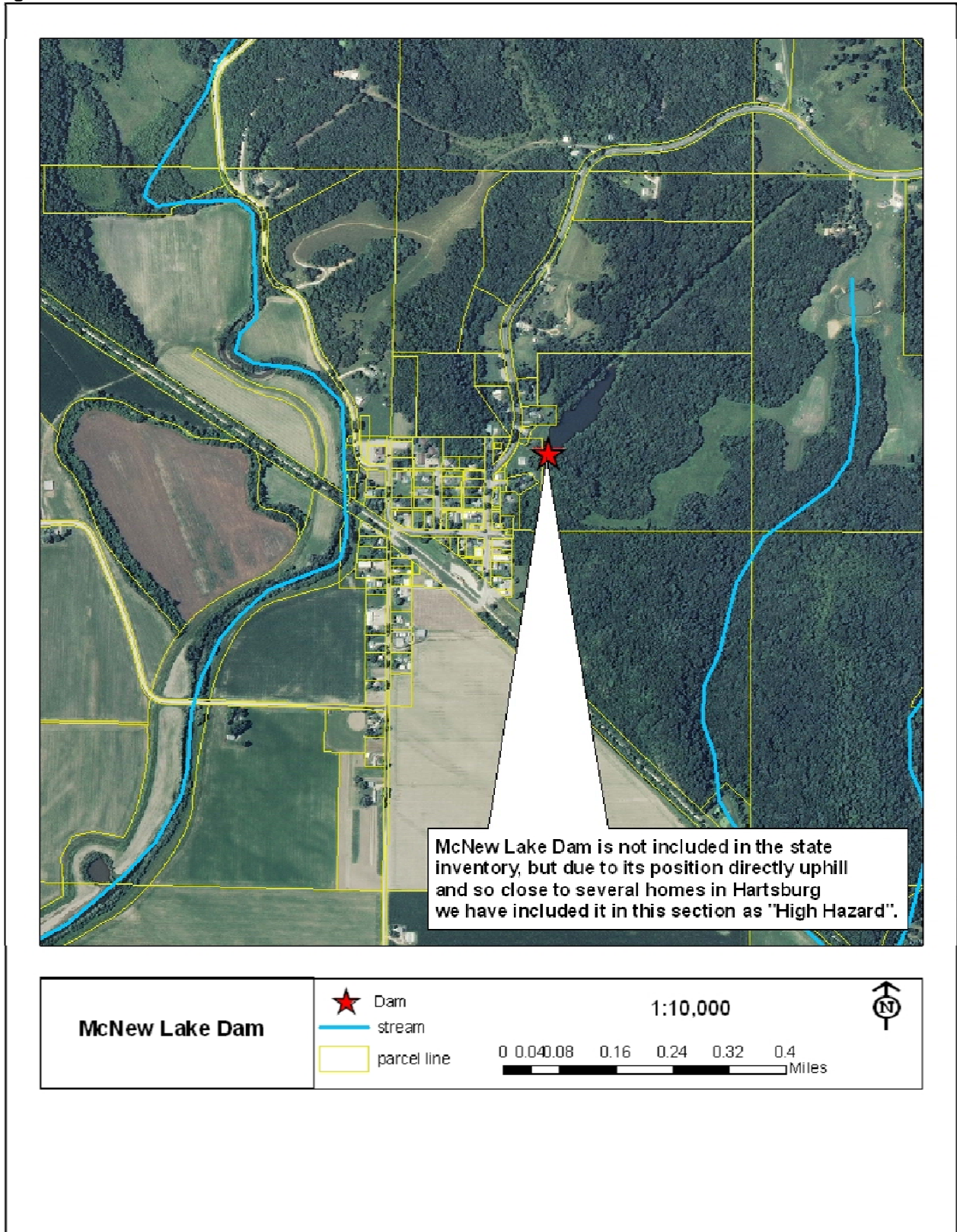


Figure 3.65



3.4.2 Drought Vulnerability

Jurisdictions: unincorporated Boone County

Overview

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

Potential Impact on Existing Structures

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

Potential Impact on Future Development

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

3.4.3 Earthquake Vulnerability

Jurisdictions: All Jurisdictions

Overview

An earthquake of sufficient magnitude in the New Madrid Seismic Zone has the potential to affect all jurisdictions in Boone 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 VI Intensity effects in Boone County, as measured on the MMI

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 VII Intensity effects in Boone County. Level VII Intensity quake effects are considered “very 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.
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.

Figure 3.66 shows an estimate for vulnerable structures in the event of an Earthquake.

Figure 3.66

Impact Assessment --- Earthquake					
High Vulnerability = 10 - 100% of buildings impacted					
Maximum Calculated Impact (100%)					
Jurisdiction	Building Type				
	Residential	Commercial	Industrial	Agricultural	Religious
Boone County	48503	2852	750	292	256
Ashland	1057	76	20	6	8
Centralia	1764	87	24	9	14
Columbia	29020	1949	408	93	165
Hallsville	464	23	8	2	4
Hartsburg	86	4	1	0	3
Huntsdale	17	0	0	0	0
Rocheport	176	12	4	0	1
Sturgeon	565	21	5	0	5
Source: HAZUS - MH					

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.

3.4.4 Extreme Heat Vulnerability

Jurisdictions: All Jurisdictions

Overview

All jurisdictions are vulnerable to the effects of extreme heat. While heat-related illness and death can occur due to exposure to intense heat in just one afternoon, heat stress on the body has a cumulative effect. The persistence of a heat wave increases the danger. Loss of life is the most significant consequence of extreme heat. The elderly and those active or employed in outdoor settings are most vulnerable. According to the World Health Organization, “elderly” is defined as those over the age of 65. Elderly are the most susceptible to complications from excessive and/or prolonged cold or heat. According to the US Census Bureau website the estimated Boone County 2008 elderly population stands at 14,344. 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.

Figure 3.67 shows an estimate for vulnerable structures in the event of Extreme heat. It should be noted that people are more vulnerable to the effects Extreme Heat than structures.

Figure 3.67

Impact Assessment --- Extreme Heat					
Medium Vulnerability = 5 - 10% of buildings impacted					
Maximum Calculated Impact (10%)					
Jurisdiction	Building Type				
	Residential	Commercial	Industrial	Agricultural	Religious
Boone County	4850	285	75	29	26
Ashland	106	8	2	1	1
Centralia	176	9	2	1	1
Columbia	2902	195	41	9	17
Hallsville	46	2	1	0	0
Hartsburg	9	0	0	0	0
Huntsdale	2	0	0	0	0
Rocheport	18	1	0	0	0
Sturgeon	56	2	1	0	1

Source: HAZUS - MH

Potential Impact on Future Development

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

3.4.5 Flood Vulnerability

Jurisdictions: unincorporated Boone County, Hartsburg, Huntsdale, Rocheport (excluding University of Missouri-Columbia, Stephen’s College, and all public school districts)

Overview

Large-scale floods such as the 1993 flood are devastating events for entire regions of the country. Not only was Mid-Missouri impacted but, the entire Midwest suffered large losses in life, property, and crop damage which carried over to the rest of the United States. Transit routes were disrupted, people lost jobs, and crops never made it to market. Small-scale floods or flash flooding can impact a neighborhood or a city but are limited in their spatial extent.

Potential Impact on Existing Structures

Boone County residents, structures, and infrastructure lying in or near the Missouri River Floodplain are all vulnerable to the effects of a major flood. The University of Missouri, Stephen’s College, and all public school district structures in Boone County are not vulnerable to the effects of this hazard. While riverine flooding does not pose a direct threat to educational and other jurisdictions there is a low, indirect threat to access of structures and to populations during times of flash flooding. Other structures not within designated floodplains are also vulnerable to the effects of flash flooding brought on by storm water or sheet flooding. Figure 3.68 estimates the number of buildings (by occupancy) that are likely to be impacted by a 100-yr flood event. Boone County has an estimated 599 residential structures located in the 100-yr flood inundation area (457 would sustain no damages, 103 would sustain 1-10% damage, 26 would sustain 11-20% damage, etc.) This information was derived from inventory data associated with FEMA’s loss estimation software HAZUS-MH as provided by the State Emergency Management Agency (SEMA).

Figure 3.68

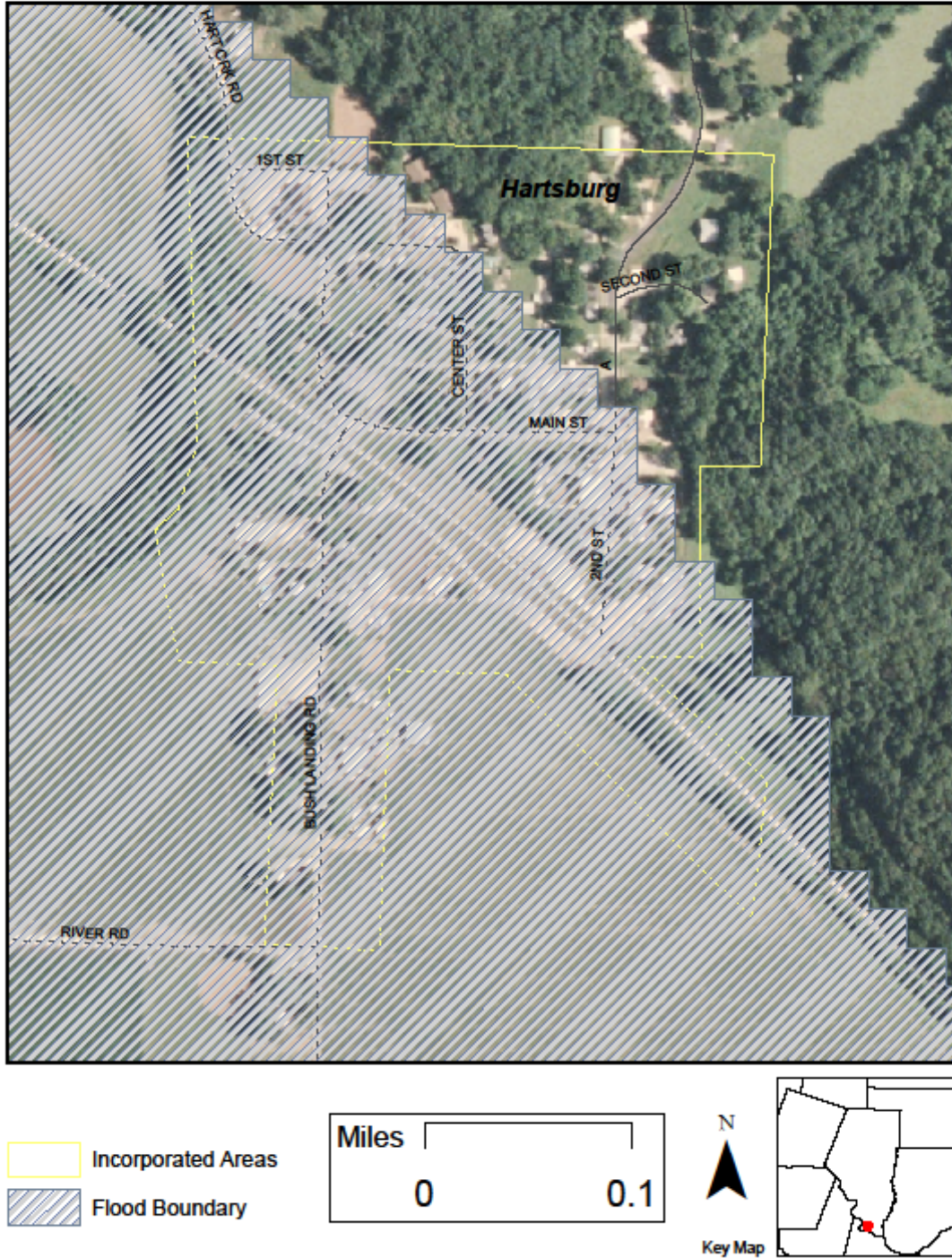
100 year flood event - Boone County								
Building Damage Count by General Occupancy and Range of Damage (%)								
	None	1-10%	11-20%	21-30%	31-40%	41-50%	Substantial	Total
Agriculture	0	0	0	0	0	0	0	0
Commercial	2	6	8	0	0	24	0	40
Education	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Industrial	0	1	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0
Residential	457	103	26	11	0	1	1	599

Based on 2006 data provided by Hazus MH

Maps on the following two pages were provided by the State Emergency Management Agency using HAZUS-MH data (see Figures 3.69-3.70). They depict the 100 Year Flood Boundary in two communities near the Missouri River. A HAZUS-MH map is not available for Huntsdale, but it is a vulnerable jurisdiction.

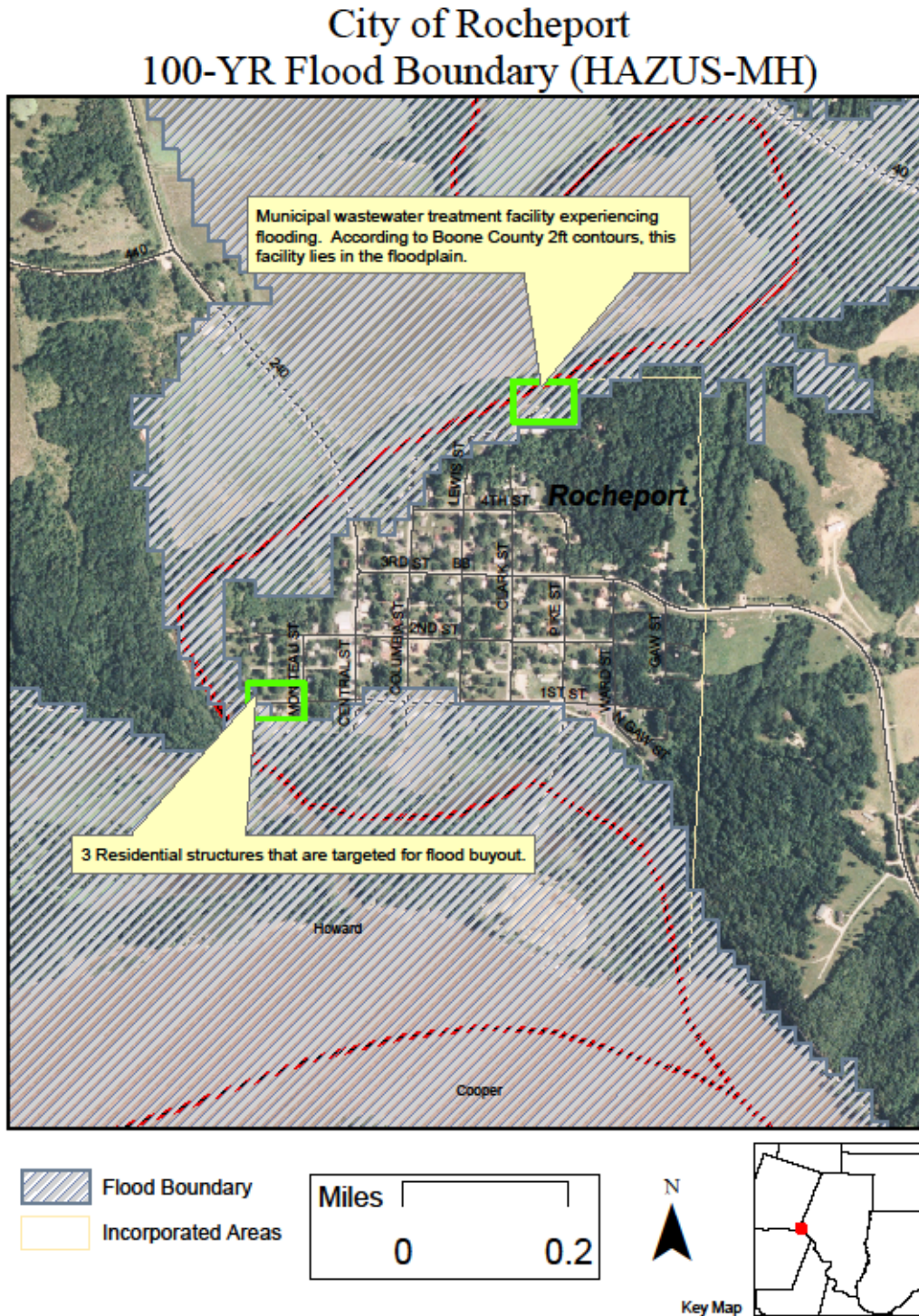
Figure 3.69

Village of Hartsburg 100- YR Flood Boundary (HAZUS-MH)



In the City of Rocheport, the municipal wastewater treatment facility deals with flooding on a regular basis; a mitigation action is included in the plan to address this issue. In addition, there are three houses in the floodplain which the City of Rocheport has targeted for buyout.

Figure 3.70



Potential Impact on Future Development

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

National Flood Insurance Program Repetitive Loss Properties

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

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

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

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

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

Information on the repetitive loss properties in the Planning Area is shown in Figure 3.71.

Figure 3.71 NFIP Repetitive Loss Properties						
Community Name	Total Cost	Average Cost Per Loss	# of Losses	# of Properties	Mitigated	As of Date
Boone County	\$234,414	\$13,789	17	4	no	08/31/2009
Columbia	\$2,142,239	\$82,394	26	6	no	08/31/2009
Hartsburg	\$121,572	\$15,197	8	4	no	08/31/2009

Source: State Emergency Management Agency

3.4.6 Land Subsidence /Sinkhole Vulnerability

Jurisdictions: unincorporated Boone County, Columbia (SW)

Overview

The Southern portion of the City of Columbia and structures and people in the Southwestern portion of the county are most vulnerable to the effects of land subsidence and subsequent sinkhole development. The Karst regions of the southwestern portion of the county make the area a prime location for this hazard.

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.”

Potential Impact on Existing Structures

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

Potential Impact on Future Development

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

3.4.7 Levee Failure Vulnerability

Jurisdictions: Hartsburg, Huntsdale, McBaine (excluding University of Missouri-Columbia, Stephen’s College, and all public school districts), unincorporated Boone County along the Missouri River

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 Boone County that would be vulnerable to the effects of levee failure would include those areas lying in or near the Missouri River floodplain and its tributaries. Since the 1993 Flood many structures have been relocated, bought out, abandoned, or remodeled which has reduced the amount of vulnerable structures and people in areas where levees could potentially fail. The University of Missouri, Stephen’s College, and all public school district structures in Boone County are not vulnerable to the effects of 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 Boone County are not regulated or inspected by any one agency it is difficult to predict what path future development will follow. It is important to note that levees in Boone County are located in designated floodplains. This means that all new construction in these areas fall under Boone County’s construction and zoning regulations and must adhere to that coding. Currently, there is no knowledge of any future development by the University of Missouri, Stephen’s College, or any public school districts that would be vulnerable to this hazard.

3.4.8 Severe Winter Weather Vulnerability

Jurisdictions: All Jurisdictions

Overview

Boone County rarely 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 Boone 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. According to the World Health Organization, “elderly” is defined as those over the age of 65. Elderly are the most susceptible to complications from excessive and/or prolonged cold or heat. According to the US Census Bureau website the estimated 2008 elderly population for Boone County stands at 14,344.
- **Roads and Bridges-** Roads and bridges serve as vital arteries for all residents. Winter storms often limit the effectiveness of the arteries 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. When this happens power outages occur that 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.

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.

Figure 3.72 shows an estimate for vulnerable structures in the event of Severe Winter Weather.

Figure 3.72

Impact Assessment --- Severe Winter Weather					
Medium Vulnerability = 5 - 10% of buildings impacted					
Maximum Calculated Impact (10%)					
Jurisdiction	Building Type				
	Residential	Commercial	Industrial	Agricultural	Religious
Boone County	4850	285	75	29	26
Ashland	106	8	2	1	1
Centralia	176	9	2	1	1
Columbia	2902	195	41	9	17
Hallsville	46	2	1	0	0
Hartsburg	9	0	0	0	0
Huntsdale	2	0	0	0	0
Rocheport	18	1	0	0	0
Sturgeon	56	2	1	0	1

Source: HAZUS - MH

Potential Impact on Future Development

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

3.4.9 Tornado/Thunderstorm Vulnerability

Jurisdictions: All Jurisdictions

Overview

All jurisdictions in Boone 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 cause an average of 70 fatalities and 1,500 injuries in the U.S. each year. 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.

Other hazards associated with Tornadoes and Thunderstorms:

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

Boone County has been hit by 32 tornadoes since 1950 with none causing significant loss of life or excessive financial loss when compared to other major tornado disasters experienced by other parts of the country. 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 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.

Figure 3.73 shows an estimate for vulnerable structures in the event of a Tornado or Thunderstorm.

Figure 3.73

Impact Assessment --- Tornado and Thunderstorm					
High Vulnerability = 10 - 100% of buildings impacted					
Maximum Calculated Impact (100%)					
Jurisdiction	Building Type				
	Residential	Commercial	Industrial	Agricultural	Religious
Boone County	48503	2852	750	292	256
Ashland	1057	76	20	6	8
Centralia	1764	87	24	9	14
Columbia	29020	1949	408	93	165
Hallsville	464	23	8	2	4
Hartsburg	86	4	1	0	3
Huntsdale	17	0	0	0	0
Rocheport	176	12	4	0	1
Sturgeon	565	21	5	0	5
Source: HAZUS - MH					

Potential Impact on Future Development

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

3.4.10 Wildfire Vulnerability

Jurisdictions: All Jurisdictions

Overview

Wildfires in Boone 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.

Potential Impact on Future Development

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

3.5 Jurisdictional Vulnerability Variations

Requirement §201.6(c)(2)(iii):	<i>For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.</i>
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Vulnerability is defined by FEMA as the extent to which people will experience harm and property will be damaged from a hazard.

Figure 3.74 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 Figure 3.74.

Below the measures of Probability and Severity have been restated.

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

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

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

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

A vulnerability rating highlighted in yellow indicates where the vulnerability in a jurisdiction varies from the overall vulnerability of the Planning Area.

Figure 3.74

Participating Jurisdictions' Vulnerability

		Property Damage					Injury or Death			
NA	not applicable					not applicable				
L	0-5%					little or none				
M	5-10%					injuries possible				
H	10-100%					major injuries and death likely				
	Dam Failure	Drought	Earthquake	Extreme Heat	Flood	Land Subsidence/ Sinkhole	Levee Failure	Severe Winter Weather	Tornado and Thunderstorm	Wildfire
Planning Area	M	M	H	M	M	M	M	M	H	M
Boone County	M	M	H	M	M	M	M	M	H	M
Ashland	na	L	H	M	L	na	na	M	H	L
Centralia	L	L	H	M	L	na	na	M	H	L
Columbia	M	L	H	M	M	M	na	M	H	L
Hallsville	L	L	H	M	L	na	na	M	H	L
Hartsburg	M	L	H	M	H	na	M	M	H	M
Huntsdale	na	L	H	M	H	na	M	M	H	L
Rocheport	na	L	H	M	H	na	na	M	H	M
Sturgeon	na	L	H	M	L	na	na	M	H	L
Centralia R-VI School District	na	L	H	M	L	na	na	M	H	L
Columbia Public Schools	na	L	H	M	L	na	na	M	H	L
Southern Boone School District	na	L	H	M	L	na	na	M	H	L
Sturgeon R-V School District	na	L	H	M	L	na	na	M	H	L
Stephens College	na	L	H	M	L	na	na	M	H	L
University of Missouri	na	L	H	M	L	na	na	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 Boone 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

As stated in Section 3.4.1, inundation studies for dam failures in Boone County will be carried out in the near future, probably in 2010-2011. Without these inundation studies an accurate evaluation of risk is not available. Parcel data for areas downstream of high hazard dams is shown in Section 3.4.1. Columbia and Hartsburg received “Medium” vulnerability ratings due to the number of High Hazard dams as compared to possible affected area. Again, inundation information is not available to accurately quantify vulnerability.

Jurisdictions at greater risk:

Columbia, Hartsburg

Figure 3.75 Estimated Exposed Structures

Impact Assessment --- Dam Failure					
Low Vulnerability = 0 - 5% of buildings impacted					
Maximum Calculated Impact (5%)					
Jurisdiction	Building Type				
	Residential	Commercial	Industrial	Agricultural	Religious
Columbia	1451	97	20	5	9
Hartsburg	4	0	0	0	0
Low Vulnerability = 0 - 5% of buildings impacted					
Maximum Calculated Impact (5%)					
Centralia	1138	5	1	0	0
Hallsville	23	1	0	0	0
Source: HAZUS - MH					

Drought

According to the 2007 US Census of Agriculture, 58.5% of Boone County land use is tied to farming activities. The Missouri State Drought Plan states that rural areas in the state are more vulnerable to the effects of drought. In 2007 the market value of Boone County farm products was estimated at \$45.5 million. Incorporated jurisdictions are less vulnerable to the effects of drought due to urban infrastructure.

Jurisdictions at greater risk:

Unincorporated Boone County

Figure 3.76 Estimated Exposed Structures

Impact Assessment --- Drought					
Medium Vulnerability = 5 - 10% of buildings impacted					
Maximum Calculated Impact (10%)					
Jurisdiction	Building Type				
	Residential	Commercial	Industrial	Agricultural	Religious
Boone County	4850	285	75	29	26
Low Vulnerability = 0 - 5% of buildings impacted					
Maximum Calculated Impact (5%)					
Ashland	53	4	1	0	0
Centralia	1138	5	1	0	0
Columbia	1451	97	20	5	9
Hallsville	23	1	0	0	0
Hartsburg	4	0	0	0	0
Huntsdale	1	0	0	0	0
Rocheport	9	0	0	0	0
Sturgeon	28	1	0	0	0
Source: HAZUS - MH					

Flooding

According to 2006 HAZUS data provided by SEMA, Boone County has one industrial structure, 599 residential structures, and 40 commercial structures that lie in the 100 year flood inundation area. A total of 26 structures out of 640 would incur more than 30% damage. Portions of Hartsburg, Huntsdale, McBaine, and Rocheport all lay within the 100 year flood plain. Although McBaine is not a participating jurisdiction, data for the community is combined with data for other jurisdictions. Specific value assessment data for these communities is addressed in Section 3.4.5. An updated DFIRM for Boone County is in the process of being updated. The most current floodplain available data for these areas is from 1983.

In addition to those communities that are at high risk for riverine flooding, all other jurisdictions experience some type of complication associated with flash flooding due to storm water runoff or sheet flooding. These other jurisdictions were given a rating a low vulnerability because probability and severity were also low for these areas.

Jurisdictions at greater risk:

Hartsburg, Huntsdale, Rocheport, unincorporated Boone County near Missouri River

Figure 3.77 Estimated Exposed Structures

Impact Assessment --- Flood					
High Vulnerability = 10 - 100% of buildings impacted					
Maximum Calculated Impact (100%)					
Jurisdiction	Building Type				
	Residential	Commercial	Industrial	Agricultural	Religious
Hartsburg	86	4	1	0	3
Huntsdale	17	0	0	0	0
Rocheport	176	12	4	0	1
Medium Vulnerability = 5 - 10% of buildings impacted					
Maximum Calculated Impact (10%)					
Boone County	4850	285	75	29	26
Columbia	2902	195	41	9	17
Low Vulnerability = 0 - 5% of buildings impacted					
Maximum Calculated Impact (5%)					
Ashland	53	4	1	0	0
Centralia	1138	5	1	0	0
Hallsville	23	1	0	0	0
Sturgeon	28	1	0	0	0
Source: HAZUS - MH					

Levee Failure

The communities of Hartsburg, Huntsdale, and McBaine all lie behind levees that are part of the Army Corps of Engineers Rehabilitation Program. The Hartsburg Levee District and the McBaine Levee District are separate taxing entities organized by the circuit court. Most areas behind these levees are in designated floodplains and new construction must meet Boone County floodplain regulations. While there are two main levee districts that are addressed in this assessment, several privately owned levees also exist in the county. Privately owned levees are maintained by their owners. Official data on the locations of private levees is not available. Figure 3.79 depicts general levee locations around the jurisdictions of Hartsburg, Huntsdale, and the community of McBaine.

Figures 3.80 and 3.81 show the locations of levees in respect to the community boundaries. It should be noted that a section of the Katy Trail that runs through Hartsburg was elevated to 32 feet following the 1993 flood. This improved section is owned by the Missouri Department of Natural Resources and provides extra levee protection for the town of Hartsburg.

Jurisdictions at greater risk:

Hartsburg, Huntsdale, unincorporated Boone County along the Missouri River

Figure 3.78 Estimated Exposed Structures

Impact Assessment --- Levee Failure					
Medium Vulnerability = 5 - 10% of buildings impacted					
Maximum Calculated Impact (10%)					
Jurisdiction	Building Type				
	Residential	Commercial	Industrial	Agricultural	Religious
Boone County	4850	285	75	29	26
Hartsburg	9	0	0	0	0
Huntsdale	2	0	0	0	0
Source: HAZUS - MH					

Figure 3.79

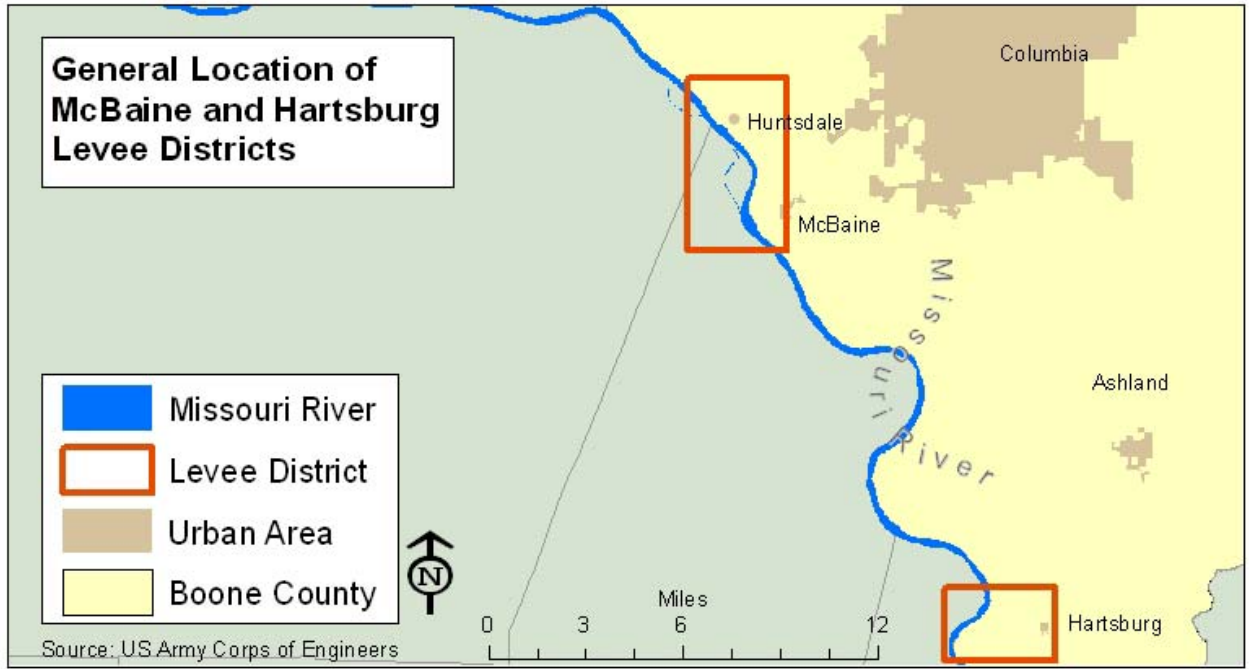


Figure 3.80

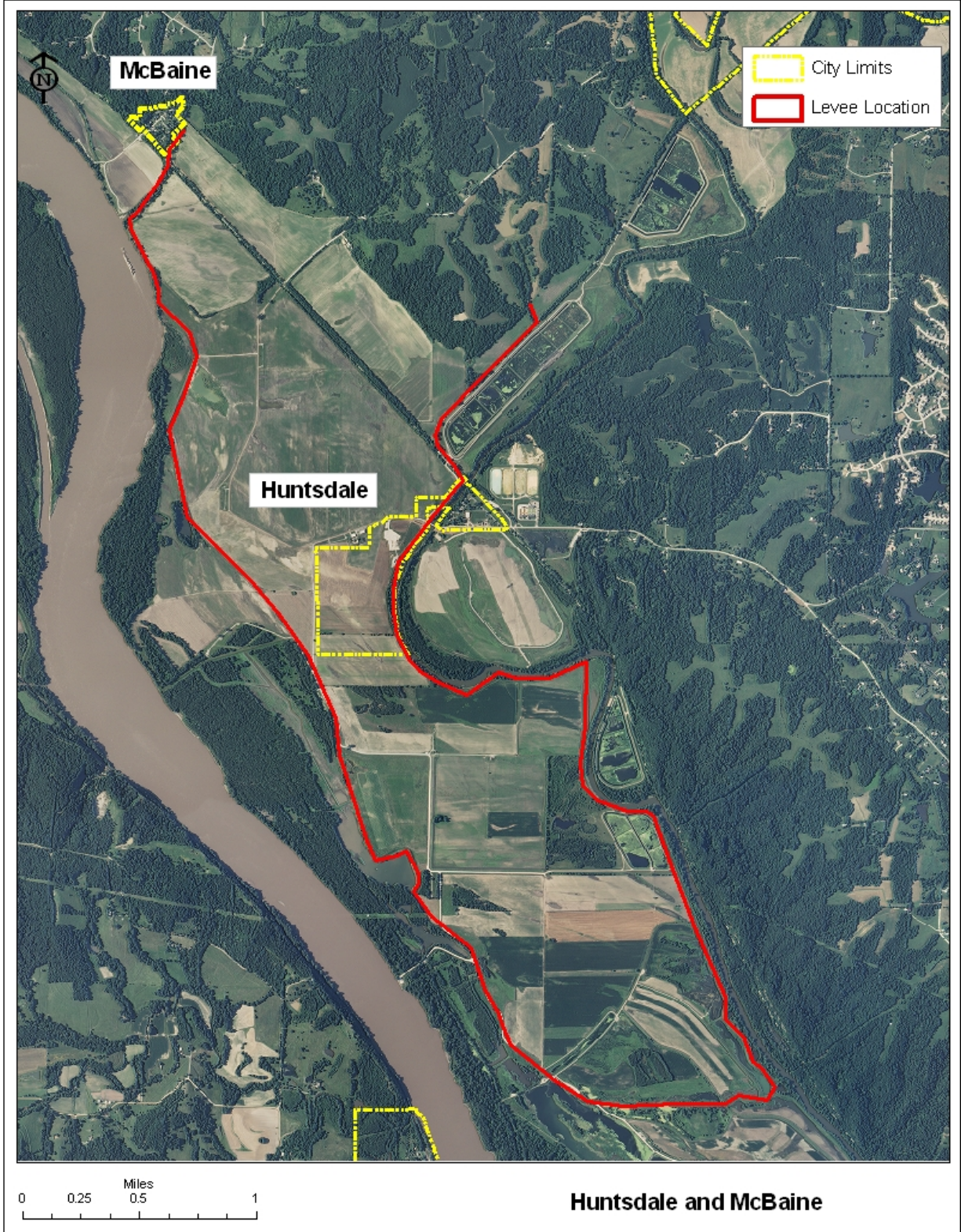
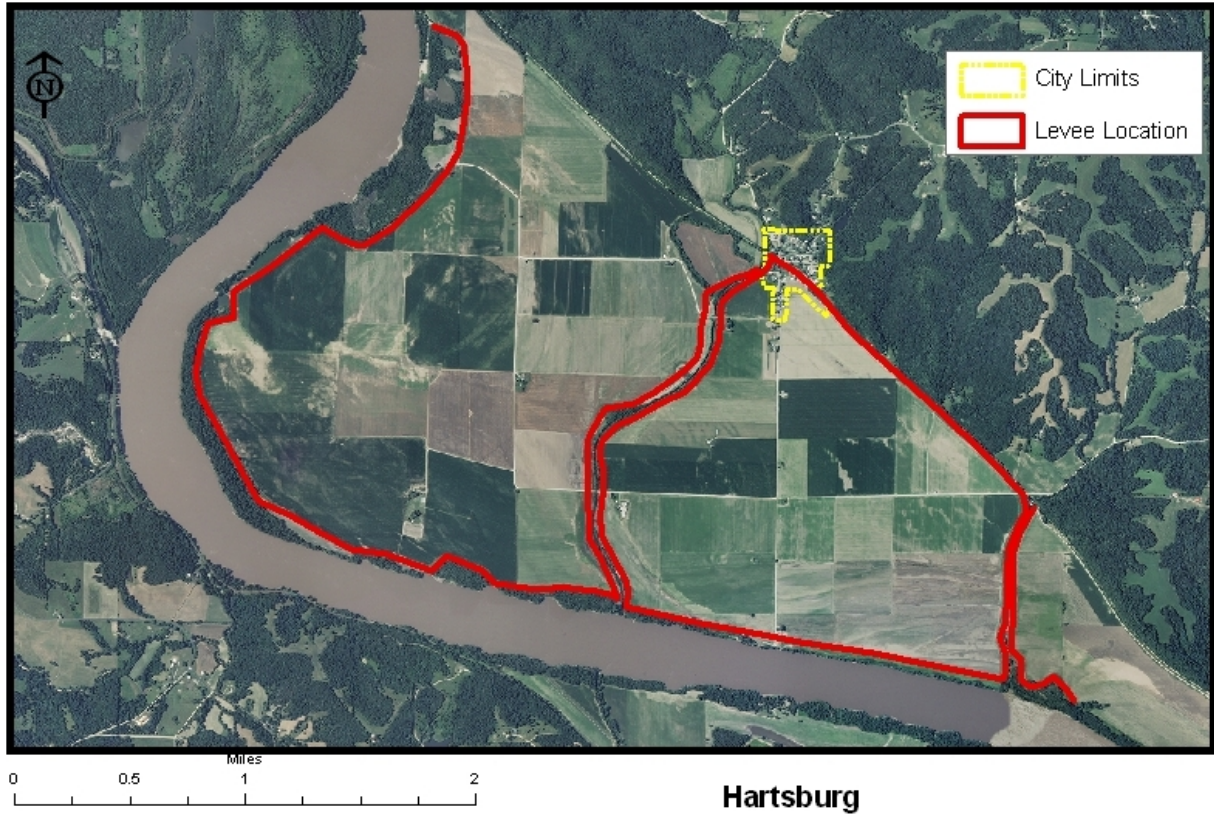


Figure 3.81



Huntsdale and McBaine levee location information for Figure 3.80 was provided by McBaine Levee District President, John Sam Williamson and Joe Gibbs PE. Hartsburg levee location information for Figure 3.81 was provided by Floodplain Administrator Mike Rodemeyer.

The following data in Figures 3.82-3.85 is taken from information provided by Engineer Cliff Sanders of the US Army Corps of Engineers in Glasgow, MO. The data includes protected area information from a “Supplemental Levee Inspection Information” form. Data on these forms was collected when levees were last inspected in February 2005.

Figure 3.82

Hartsburg Levee District - Section 1
Levee Embankment Data
<p>LEVEE DESIGNED GAGE FUNCTION READING/STATION: 32.0' Jefferson City Gage</p> <p>LEVEL OF PROTECTION PROVIDED: Exceeds a 10-year flood event</p> <p>AVERAGE HEIGHT OF LEVEE: 6' to 14'</p> <p>AVERAGE CROWN WIDTH: 10' to 22'</p> <p>AVERAGE SIDE SLOPE: Landside slope ranges from 1 on 3 to 1 on 4. ; Riverside slope ranges from 1 on 3 to 1 on 4.</p> <p>ANNUAL MAINTENANCE COSTS: \$1,500.00</p>
Protected Features
<p>TOTAL ACRES PROTECTED: 1,800</p> <p>TOTAL AGRICULTURAL PRODUCTION ACRES PROTECTED: 1,800</p> <p>TOWNS: 0</p> <p>BUSINESSES: 1</p> <p>RESIDENCES: 3</p> <p>ROADS: Approximately 6.00 miles of gravel surfaced County roads and approximately 6.00 miles of unimproved farm to market roads.</p> <p>UTILITIES: Approximately 8.00 miles of utility lines.</p> <p>BARNs: 9</p> <p>MACHINE SHEDS: 3</p> <p>OUTBUILDINGS: 0</p> <p>IRRIGATION SYSTEMS: 10</p> <p>GRAIN BINS: 10</p> <p>OTHER FACILITIES: Approximately 2.00 miles of Katy Trail State Park.</p>

Figure 3.83

Hartsburg Levee District - Section 3
Levee Embankment Data
<p>LEVEE DESIGNED GAGE FUNCTION READING/STATION: 32.0' Jefferson City Gage</p> <p>LEVEL OF PROTECTION PROVIDED: Exceeds a 10-year flood event</p> <p>AVERAGE HEIGHT OF LEVEE: 3' to 12' above landside natural ground surface</p> <p>AVERAGE CROWN WIDTH: 5' to 12'</p> <p>AVERAGE SIDE SLOPE: L/S: Ranges from 1 on 3 to 1 on 4 ; Riverside slope 1 on 3</p> <p>ANNUAL MAINTENANCE COSTS: \$1,500.00</p>
Protected Features
<p>TOTAL ACRES PROTECTED: 1,000</p> <p>TOTAL AGRICULTURAL PRODUCTION ACRES PROTECTED: 950</p> <p>TOWNS: Sections of the City of Hartsburg, Missouri</p> <p>BUSINESSES: 12</p> <p>RESIDENCES: 35</p> <p>ROADS: Approximately 4.00 miles of gravel surfaced County Roads, approximately 2.00 miles of asphalt surfaced Township Roads and approximately 4.00 miles of non-surfaced farm roads.</p> <p>UTILITIES: Approximately 10.00 miles of utility lines.</p> <p>BARNs: 2</p> <p>MACHINE SHEDS: 10</p> <p>OUTBUILDINGS: 12</p> <p>IRRIGATION SYSTEMS: 2</p> <p>GRAIN BINS: 7</p> <p>OTHER FACILITIES: Lions park and ball field, 2 City parks, approximately 2.00 miles of Katy Trail State Park along with Department of Natural Resources parking lot with restrooms, U.S. Post Office, 2 churches, 12 senior housing units (HUD), American Legion Post, town sewer system and public water supply district.</p>

Figure 3.84

Hartsburg Levee District - Section 3
Levee Embankment Data
LEVEE DESIGNED GAGE FUNCTION READING/STATION: 32.0' Jefferson City Gage
LEVEL OF PROTECTION PROVIDED: Exceeds a 10-year flood event
AVERAGE HEIGHT OF LEVEE: 4' to 14'
AVERAGE CROWN WIDTH: 8' to 16'
AVERAGE SIDE SLOPE: Landside slope ranges from 1 on 3 to 1 on 4 ; Riverside slope ranges from 1 on 3 to 1 on 4
ANNUAL MAINTENANCE COSTS: \$1,500.00
Protected Features
TOTAL ACRES PROTECTED: 700
TOTAL AGRICULTURAL PRODUCTION ACRES PROTECTED: 700
TOWNS: 0
BUSINESSES: 0
RESIDENCES: 0
ROADS: Approximately 3.00 miles of gravel surfaced County Roads and approximately 2.00 miles of unimproved farm to market roads.
UTILITIES: 0
BARNs: 0
MACHINE SHEDS: 1
OUTBUILDINGS: 0
IRRIGATION SYSTEMS: 3
GRAIN BINS: 0
OTHER FACILITIES: Approximately 2.50 miles of Katy Trail State Park.

Figure 3.85

McBaine Levee District
Levee Embankment Data
LEVEE DESIGNED GAGE FUNCTION READING/STATION: 33.7' Boonville Gage
LEVEL OF PROTECTION PROVIDED: Exceeds a 10-year flood event
ANNUAL MAINTENANCE COSTS: \$8,300.00
Protected Features
TOTAL ACRES PROTECTED: 2,614
TOTAL AGRICULTURAL PRODUCTION ACRES PROTECTED: 2,351
TOWNS: 1
BUSINESSES: 4
RESIDENCES: 1
ROADS: Approximately 3.00 miles of County asphalt surfaced roads; approximately 3.00 miles of County gravel surfaced roads; approximately 2 miles of service roads within Eagle Bluffs Conservation Area; 3.00 miles of unimproved farm to market roads.
UTILITIES: City of Columbia facilities include; potable water and wastewater lines; Municipal potable water wells; Private and domestic water wells; City and State wastewater management units; pipelines and pump stations; public electric, phone, fiber optic, natural gas and refined petroleum fuel lines.
BARNS: 0
MACHINE SHEDS: 4
OUTBUILDINGS: 0
IRRIGATION SYSTEMS: 3
GRAIN BINS: 0

Wildfire

As stated in Section 3.2.10, Wildfire in Boone 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 Boone County those areas are at greater risk and vary in vulnerability from the incorporated areas.

According to statistics from the Missouri Department of Conservation (see Section 3.2.10, Figure 3.41), rural areas of Boone County and the rural/urban interfaces are most at risk from wildfires.

The jurisdictions of Rocheport and Hartsburg are placed in a higher risk category due to the WUI (Wildland Urban Interface) in those communities. Data provided by the University of Wisconsin-Madison outlines areas where high fuel loads and structures overlap creating a higher risk scenario. It should be noted that the community of Rocheport is more heavily wooded than Hartsburg and that data is taken down to census level. Figure 3.87 shows the mapped interface for Rocheport and Hartsburg. More information on the WUI can be found in Section 3.2.10.

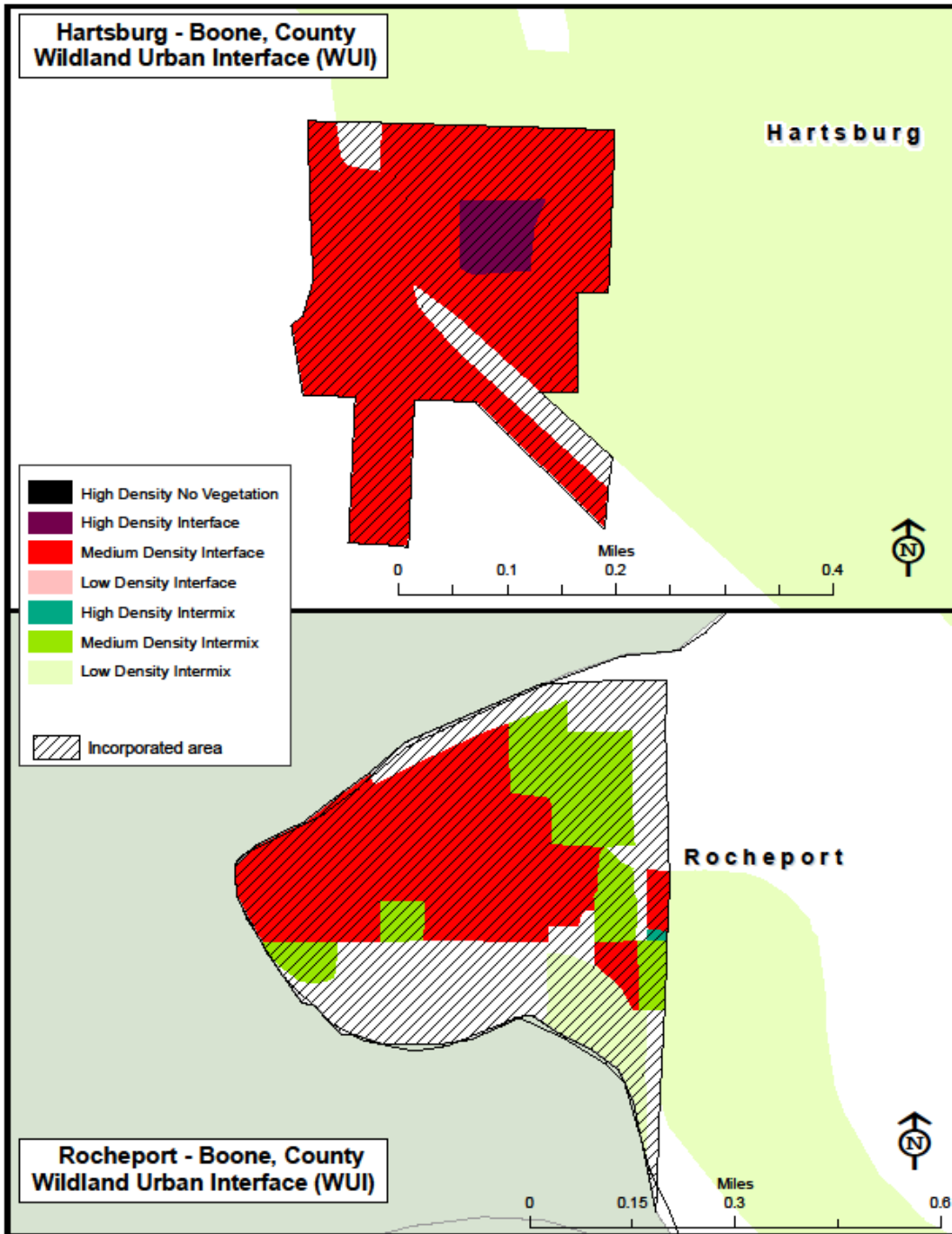
Jurisdictions at greater risk:

Hartsburg, Rocheport, Unincorporated Boone County

Figure 3.86 Estimated Exposed Structures

Impact Assessment --- Wildfire					
Medium Vulnerability = 5 - 10% of buildings impacted					
Maximum Calculated Impact (10%)					
Jurisdiction	Building Type				
	Residential	Commercial	Industrial	Agricultural	Religious
Boone County	4850	285	75	29	26
Hartsburg	9	0	0	0	0
Rocheport	18	1	0	0	0
Low Vulnerability = 0 - 5% of buildings impacted					
Maximum Calculated Impact (5%)					
Ashland	53	4	1	0	0
Centralia	1138	5	1	0	0
Columbia	1451	97	20	5	9
Hallsville	23	1	0	0	0
Huntsdale	1	0	0	0	0
Sturgeon	28	1	0	0	0
Source: HAZUS - MH					

Figure 3.87



Section 4: Mitigation Strategy

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 Boone 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 Boone County Hazard Mitigation Plan (2010) are:

- Goal 1: Mitigation Planning - Mitigate effects of future natural hazards throughout the County through public and private action.
- Goal 2: Mitigation Policy - Develop policies that limit the impact of natural hazards on lives and property.
- Goal 3: Mitigation Programs - Implement cost effective and feasible mitigation programs to protect lives and property of Boone County jurisdictions.
- Goal 4: Public Awareness - Increase public awareness of natural hazards in order to make the public a greater partner in hazard mitigation planning.
- Goal 5: Future Development - Promote hazard-proof development in the jurisdictions of Boone County.

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 floodproofing 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 was evaluated.

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

The existing actions were divided into the three categories of completed, deleted, or deferred; the fourth category of new mitigation actions was added.

Descriptions of the four categories are as follows:

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

The actions in each of these categories, along with explanatory information, can be seen in Figures 4.1 – 4.4. The charts for completed and deleted actions use the goal language of the original plan; the deferred and new action charts use the updated language for the goals.

Not all of the new actions originated with the Hazard Mitigation Technical Steering Committee. There was a separate Educators Meeting (see Section 1.5) where three of the four actions pertaining to the school districts and colleges/university were written (#3.2.2, #3.2.3, #3.2.4). In addition, some of the communities which are participating jurisdictions added new actions specific to their communities.

Figure 4.1a			
Mitigation Actions Completed from Boone County Hazard Mitigation Plan 2005			
Goals, Objectives, and Actions	Priority Rank/ Target Date	Evaluation	Outcome
Goal #1: Mitigate effects of future natural hazards in the county.			
Objective 1.1 Incorporate mitigation planning and procedures into the community.			
Develop Storm Water Task Force.	Medium 2007	Task Force formed	Joint Storm Water Task Force for Boone County was formed, finished its work, and made recommendations. As of Oct. 2009, the recommendations are pending adoption.
Objective 1.2 Encourage private involvement in mitigation activities.			
Encourage local hotels to provide customers with hazard information.	High 2006	Materials Available	This has been set up in Oct. 2009 through an arrangement between the OEM and the Missouri Hotel & Lodging Association.
Encourage cooperative agreements with utility providers to activate energy between utility districts.	High Continual	Agreements adopted	Cooperative agreements are in place.
Develop agreements with local shelters.	High Continuing	Agreements in Place	Agreements are in place.
Goal #2: Develop policies that will limit impacts of natural hazards in Boone County.			
Objective 2.1 Pass appropriate ordinances for mitigation efforts.			
Pass ordinance not to allow development in the mapped floodway.	High 2006	Ordinance passed	County flood plain ordinance has been adopted.
Objective 2.2 Adopt new codes and standards.			
Adopt and enforce latest model building codes and national engineering standards.	High Continuing	Codes in place	Codes are in place in Boone County and Columbia. A new mitigation action will be written concerning reviewing codes every two years.

Figure 4.1b			
Mitigation Actions Completed from Boone County Hazard Mitigation Plan 2005			
Goals, Objectives, and Actions	Priority Rank/ Target Date	Evaluation	Outcome
Goal #3 Protect the County’s most valuable assets and vulnerable populations through cost effective and feasible mitigation projects whenever financially possible.			
Objective 3.1 Protect buildings and valuable assets.			
Evaluate access problems to critical infrastructure.	Medium 2007	Evaluation complete	Completed; no access problems.
Provide back-up power to all critical infrastructure.	Medium 2007	Power available	Backup power is available.
Objective 3.2 Protect vulnerable populations.			
Ensure Evacuation routes are adequate with special consideration for schools and nursing homes.	High Continuing	Evacuation Routes in place	Evacuation routes are in place for all schools in the county. A new mitigation action has been written concerning nursing homes.
Ensure school buses have two-way radios on board.	High Continuing	Radios in place	Radios are in place in all schools in county.
Goal #4: Increase the public awareness of natural hazards in the County in order to make the public a partner in hazard mitigation.			
Objective 4.1 Have educational materials for public on all hazards.			
Develop public education hazard awareness program.	High 2006	Program in place	Program developed.
Establish education materials for public regarding earthquakes in Missouri.	Public Awareness	Materials Published	Materials on hand reference earthquake preparedness; press release educating public and making materials available (July 2009); annual focus on this each February during "Earthquake Awareness Month; new action created re: maintenance and distribution of these materials
Goal #5: Ensure that future development in the County is as “hazard proof” as possible by contributing to the sustainability of the community.			
Objective 5.1 Promote hazard proof development.			
Encourage developers to build earthquake resistant structures.	Medium 2007	New codes passed	County building codes now cover this.
Maintain resources for public on retrofitting and protection techniques.	Medium 2007	Resources Available	Resources are now available.

Figure 4.2a	
Mitigation Actions Deleted for 2010 Update of Boone County Hazard Mitigation Plan 2005	
Goals, Objectives, and Actions	Reason for Deletion
Goal #1: Mitigate effects of future natural hazards in the county.	
Objective 1.1 Incorporate mitigation planning and procedures into the community.	
Complete Community Rating System Application.	This will not be considered as an action until Boone County has a current and accurate FIRM.
Encourage participation in Community Rating System of NFIP. Have all of Boone County participate.	This will not be considered as an action until Boone County has a current and accurate FIRM.
Create Capital Improvement Plan.	This is not a priority for the Boone County Commission.
Set up centralized permitting process.	This was considered a very low priority.
Objective 1.2 Encourage private involvement in mitigation activities.	
Encourage property owners to purchase earthquake insurance.	It is not the role of the County to encourage such purchase. This is being changed to an educational action and is part of a new action under Objective 4.1.
Encourage purchase of drought insurance in agricultural community.	This is not the role of the County; National Resource Conservation Service (NRCS) does this.
Develop evacuation procedures for dam.	General evacuation procedures are covered in OEM's Emergency Operation Plan.
Re-roof homes with fire resistant shingles.	Building codes address this already.
Goal #2: Develop policies that will limit impacts of natural hazards in Boone County.	
Objective 2.2 Adopt new codes and standards.	
Encourage State to adopt policies for infrastructure within the county.	This was deemed a low priority objective which would not be worth focusing energy on.
Develop land use regulation downstream from dam.	There are no dams in Hartsburg and Rocheport.
Develop building codes that discourage heavy snow loads on rooftops.	Building codes address this already.

Figure 4.2b	
Mitigation Actions Deleted for 2010 Update of Boone County Hazard Mitigation Plan 2005	
Goals, Objectives, and Actions	Reason for Deletion
Goal #3 Protect the County’s most valuable assets and vulnerable populations through cost effective and feasible mitigation projects whenever financially possible.	
Objective 3.1 Protect buildings and valuable assets.	
Encourage use of fire resistant utility poles.	This was deemed a low priority; difficult to influence these decisions.
Build Fire roads into dense forest areas.	Dense forest areas in Boone County are all under state or federal jurisdiction.
Remove vegetation and combustible material from critical infrastructure.	Utility companies are doing this and they will be writing their own hazard mitigation plans.
Develop cost estimates of protecting a facility vs. buyout.	Not a priority.
Retrofit public buildings to make them more wind resistant.	Unrealistic.
Ensure architectural features are constructed to minimize windborne debris.	Unrealistic.
Objective 3.2 Protect vulnerable populations.	
Require camping facilities to have safe rooms on premises.	There are very limited camping facilities in Boone County.
Goal #4: Increase the public awareness of natural hazards in the County in order to make the public a partner in hazard mitigation.	
Objective 4.1 Have educational materials for public on all hazards.	
Provide educational materials for outdoor workers and school athletic organizations on the dangers of excessive heat exposure.	Health Dept. (County?) already does these alerts: Missouri High School Athletic Association (MHSAA) provides coaches with pamphlets concerning this.
Encourage safe driving through public education campaigns, websites, community events.	This was designated to be an OEM action but it is not part of the function of the OEM.
Provide public education materials concerning the dangers of icy roads.	This is already being done through numerous radio spots & media contacts carried out for National Preparedness Month.
Provide education materials for homeowners near large fuel sources.	The MO MDC already has such materials available on their website.
Goal #5: Ensure that future development in the County is as “hazard proof” as possible by contributing to the sustainability of the community.	
Objective 5.1 Promote hazard proof development.	
Acquire destroyed or damaged properties and relocate people voluntarily.	There is no interest in pursuing this action.
Require new residential construction to meet latest wind resistant standards.	It was decided to delete this and add a more broadly focused new action re: encouraging codes in every incorporated community.
Encourage retrofitting old homes to adopt similar standards of new homes.	This was deemed unrealistic.

Figure 4.3a Mitigation Actions Deferred to 2010 Update of Boone County Hazard Mitigation Plan	
Goals, Objectives, and Actions	Reason Action has Not Been Completed and is being Deferred to Updated Plan
Goal 1. Mitigation Planning: Mitigate effects of future natural hazards throughout the County through public and private action.	
Objective 1.1 Incorporate mitigation planning and procedures into the community.	
Create, Revise, and Update Flood Insurance Rate Maps (FIRM).	New FIRM map was put out in Sept. 2009 and is still under review; wording of action changed to "Adopt Flood Insurance Rate Map (FIRM) when updated" for update.
Encourage development of Storm Water Master Plan.	The County Storm Water Ordinance has been written and is pending approval. Changed to High Priority because of the level of hazard which storm water flooding presents in Boone County.
Update staff knowledge of earthquake safety.	A 2 hr. classroom presentation has been given to the OEM staff; however, there has been a large staff turnover so this will be done again in 2010 and will be ongoing; action edited to "Public Safety Joint Communications staff".
Encourage cooperative agreements between water districts.	Wording changed to "Encourage cooperative agreements between municipalities and water supply districts to ensure adequate supply for fire flow" for the update.
Identify multiple sources of water in areas currently receiving water from minimal supplies.	Wording changed to "Encourage the local water district to have adequate fire flow" for the update.
Objective 1.2 Encourage private involvement in mitigation activities.	
Encourage Utility Companies to maintain right of ways.	Wording changed to "Encourage electric utilities to maintain right of ways" for the update.
Have alternate power sources for emergency vehicles.	Backup portable & fixed generators are available for emergency vehicles but this is a continuing objective; language changed to "Have alternate power sources readily available for the electric needs of emergency vehicles and the buildings where they are located"; action moved to Objective 1.1.

Figure 4.3b Mitigation Actions Deferred to 2010 Update of Boone County Hazard Mitigation Plan	
Goals, Objectives, and Actions	Reason Action has Not Been Completed and is being Deferred to Updated Plan
Goal 2. Mitigation Policy: Develop policies that limit the impact of natural hazards on lives and property.	
Objective 2.1 Pass appropriate ordinances for mitigation efforts.	
Review and update flood damage prevention ordinance.	This is an ongoing priority; for update, wording changed to “• Review and update flood damage prevention/floodplain management ordinances, in compliance with NFIP requirements, when current and correct D-FIRMs are available.”
Objective 2.2 Adopt new codes and standards.	
Develop regulations for roads from dams.	Wording changed to "roads on dams" for update.
Goal 3. Mitigation Programs: Implement cost effective and feasible mitigation programs to protect lives and property of Boone County jurisdictions.	
Objective 3.1 Protect buildings and valuable assets.	
Brace high value equipment.	Have had higher priorities. Changed to "Secure high value equipment located outside county and municipal buildings (e.g. HVAC, generators, communication equipment) for update.
Objective 3.2 Protect vulnerable populations.	
Encourage shelters to have alternative heating sources.	Red Cross and Health Dept. provide generator backup at this time; continuing objective
Goal 5. Future Development: Promote hazard-proof development in the jurisdictions of Boone County.	
Adopt procedures for review of subdivision plans to minimize flood problems.	These have been adopted by the County, Ashland, and Columbia.
Acquire properties susceptible to flood damage.	No grants obtained; added phrase "when buyout grants are available" for update.
Target Repetitive Loss Properties for flood buyout.	No grants obtained.

Figure 4.4a

New Mitigation Actions for 2010 Boone County Hazard Mitigation Plan

Goals, Objectives, and Actions

Goal 1. Mitigation Planning: Mitigate effects of future natural hazards throughout the County through public and private action.

Objective 1.1 Incorporate mitigation planning and procedures into the community.

Continue to supply updated GIS base map information to support changing/updating the D-FIRM maps using local, accurate data.

Become a participant in the NFIP.

The Public Works Department will adhere to a routine maintenance schedule for brush cutting and tree trimming to keep branches from overhanging roads.

Continue monthly testing of outdoor warning sirens in compliance with procedures set by the Office of Emergency Management.

Replace 2, 3, and 4 inch water lines with 6 inch lines to ensure adequate supply for fire flow.

Objective 1.2 Encourage private involvement in mitigation activities.

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

Encourage underground utilities in improvements and new development.

Goal 2. Mitigation Policy: Develop policies that limit the impact of natural hazards on lives and property.

Objective 2.1 Pass appropriate ordinances for mitigation efforts.

Develop policy and enforcement regulations concerning burning permits/Encourage development of burn permit procedure.

Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.

Develop building codes or ordinances to ensure post-development flow mimics pre-development flow in regard to storm water.

Limit construction and development in known subsidence/sinkhole areas.

Add sinkhole regulations to stream buffer/storm water ordinance.

Objective 2.2 Adopt new codes and standards.

Encourage adoption of building codes in every incorporated community.

Review building codes every two years for possible update.

Adopt regulation stating that any newly built dam must have a maintenance plan approved before construction.

Adopt the prevailing County storm water regulations once they are formalized by the County.

Figure 4.4b

New Mitigation Actions for 2010 Boone County Hazard Mitigation Plan

Goal 3. Mitigation Programs: Implement cost effective and feasible mitigation programs to protect lives and property of Boone County jurisdictions.

Objective 3.1 Protect buildings and valuable assets.

Evaluate and implement effective strategies to mitigate flooding at the wastewater treatment plant in Rocheport.

Mitigate the effects of flooding on public infrastructure.

Objective 3.2 Protect vulnerable populations.

Ensure evacuation plans are adequate for nursing homes and special needs populations.

Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.

Evaluate and maintain emergency preparedness plans.

Conduct emergency preparedness exercises periodically throughout the year.

Build tornado safe rooms.

Goal 4. Public Awareness: Increase public awareness of natural hazards in order to make the public a greater partner in hazard mitigation planning.

Continue to educate the public on natural hazards.

Maintain and distribute materials for public regarding earthquakes in Missouri and the benefits and availability of earthquake insurance.

Continue to help the public realize the liability and responsibility for maintaining dams on private property.

4.3 Mitigation Goals, Objectives, and Actions

A comprehensive list of the goals, objectives, and mitigation actions for the Boone County Hazard Mitigation Plan (2010) follows. The mitigation actions listed are for the entire Planning Area; participating jurisdictions will differ in the specific actions undertaken in their jurisdictions. The mitigation actions for each participating jurisdiction are included under Prioritization, Implementation, and Administration (Section 4.4).

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

For some of the actions (#1.1.10, 1.2.1, 1.2.3, 2.1.6, 3.2.5), one or more participating jurisdictions slightly altered the language of the action written by the Technical Steering Committee to make it more specifically relevant. In those cases, the alternate wording is shown in parentheses below.

Goal 1: Mitigation Planning - Mitigate effects of future natural hazards throughout the County through public and private action.

Objective 1.1 Incorporate mitigation planning and procedures into the community.

- 1.1.1 Continue to supply updated GIS base map information to support changing/updating the D-FIRM maps using local, accurate data. (Both)
- 1.1.2 Adopt Flood Insurance Rate Maps (FIRMs) when updated. (Both)
- 1.1.3 Become a participant in the NFIP. (Both)
- 1.1.4 Encourage development of Storm Water Master Plan. (Both)
- 1.1.5 Update Public Safety Joint Communications staff knowledge of earthquake safety. (Both)
- 1.1.6 Have alternate power sources readily available for the electric needs of emergency vehicles and the buildings where they are located. (Both)
- 1.1.7 Continue with monthly testing of warning systems in compliance with procedures set out by the Office of Emergency Management.
- 1.1.8 The Public Works Department will adhere to a routine maintenance schedule for brush cutting and tree trimming to keep branches from overhanging roads. (Both)
- 1.1.9 Encourage the local water district to have adequate fire flow. (Both)
- 1.1.10 Encourage cooperative agreements between municipalities and water supply districts to ensure adequate supply for fire flow. (Maintain cooperative agreements between municipality and adjacent water supply districts to ensure adequate supply for fire flow.) (Both)

Objective 1.2 Encourage private involvement in mitigation activities.

- 1.2.1 Encourage electric utilities to maintain right of ways. (Maintain electric utility right of ways.) (Encourage city electric utility to maintain right of ways.) (Both)
- 1.2.2 Encourage underground utilities in improvements and new development. (New)

- 1.2.3 Review and formalize relationships with cooling and warming centers in each community. (Review and formalize plans for cooling and warming centers in each community.)

Goal 2: Mitigation Policy - Develop policies that limit the impact of natural hazards on lives and property.

Objective 2.1 Pass appropriate ordinances for mitigation efforts.

- 2.1.1 Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements. (Both)
- 2.1.2 Review and update flood damage prevention/floodplain management ordinances, in compliance with NFIP requirements, when current and correct D-FIRMs are available. (Both)
- 2.1.3 Develop building codes or ordinances to ensure post-development flow mimics pre-development flow in regard to storm water. (Both)
- 2.1.4 Limit construction and development in known subsidence/sinkhole areas. (New)
- 2.1.5 Add sinkhole regulations to stream buffer/storm water ordinance. (New)
- 2.1.6 Develop policy and enforcement regulations concerning burning permits. (Encourage development of burn permit procedure.) (Both)

Objective 2.2 Adopt new codes and standards.

- 2.2.1 Review building codes every three years for possible update. (Both)
- 2.2.2 Encourage adoption of building codes in every incorporated community. (Both)
- 2.2.3 Develop regulations for roads on dams. (Both)
- 2.2.4 Adopt regulation stating that any newly built dam must have a maintenance plan approved before construction. (New)
- 2.2.5 Adopt the prevailing County regulations concerning storm water once they are formalized by the County. (Both)

Goal 3: Mitigation Programs - Implement cost effective and feasible mitigation programs to protect lives and property of Boone County jurisdictions.

Objective 3.1 Protect buildings and valuable assets.

- 3.1.1 Secure high value equipment located outside county and municipal buildings (e.g. HVAC, generators, communication equipment).
- 3.1.2 Replace 2, 3, and 4 inch water lines with 6 inch lines to ensure adequate supply for fire flow. (Both)
- 3.1.3 Evaluate and implement effective strategies to mitigate flooding at the wastewater treatment plant in Rocheport. (Existing)
- 3.1.4 Mitigate the effects of flooding on public infrastructure. (Both)

Objective 3.2 Protect vulnerable populations.

- 3.2.1 Ensure evacuation plans are adequate for nursing homes and special needs populations.
- 3.2.2 Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.
- 3.2.3 Evaluate and maintain emergency preparedness plans.
- 3.2.4 Conduct emergency preparedness exercises periodically throughout the year.
- 3.2.5 Build tornado safe rooms. (Develop church basement as tornado safe room.)
- 3.2.6 Encourage shelters to have alternative heating sources.

Goal 4: Public Awareness - Increase public awareness of natural hazards in order to make the public a greater partner in hazard mitigation planning.

- 4.0.1 Continue to educate the public on natural hazards.
- 4.0.2 Maintain and distribute materials for public regarding earthquakes in Missouri and the benefits and availability of earthquake insurance.
- 4.0.3 Continue to help the public realize the liability and responsibility for maintaining dams on private property. (Both)

Goal 5: Future Development - Promote hazard-proof development in the jurisdictions of Boone County.

- 5.0.1 Adopt procedures for review of subdivision plans to minimize flood problems. (Both)
- 5.0.2 Target Repetitive Loss Properties for flood buyout. (Existing)
- 5.0.3 Acquire properties susceptible to flood damage when buyout grants are available. (Existing)

Overview of Mitigation Actions by Hazards Addressed and Participating Jurisdictions

An overview of the mitigation actions, the hazards addressed, and the participating jurisdictions to which they apply is shown in Figures 4.5a-f. The following abbreviations have been used for hazards:

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

Figure 4.5a

Overview of Mitigation Actions by Hazard and Jurisdiction

Action #	Mitigation Action	Hazards Addressed	County	Ashland	Centralia	Columbia	Hallsville	Hartsburg	Huntsdale	Rocheport	Sturgeon	Schools				
												Centralia-VI	Columbia P.S.	Southern Boone	Sturgeon R-V	Stephens College
Goal 1: Mitigation Planning - Mitigate effects of future natural hazards throughout the county through public and private action.																
Objective 1.1 Incorporate mitigation planning and procedures into the community.																
1.1.1	Continue to supply updated GIS base map information to support changing/updating the D-FIRM maps using local, accurate data.	FL	X			X										
1.1.2	Adopt Flood Insurance Rate Maps (FIRM) when updated.	FL	X	X	X	X	X	X		X	X					
1.1.3	Become a participant in the NFIP.	FL							X							
1.1.4	Encourage development of Storm Water Master Plan.	FL	X													
1.1.5	Update Public Safety Joint Communications staff knowledge of earthquake safety.	EQ	X	X	X	X	X	X	X	X	X					
1.1.6	Have alternate power sources for emergency vehicles.	EQ, WW, T, WF	X	X	X	X	X	X		X	X					
1.1.7	Continue monthly testing of outdoor warning sirens in compliance with procedures set by the Office of Emergency Management.	T, WW	X	X	X	X	X	X		X	X					
1.1.8	Develop routine maintenance schedule for brush cutting and tree trimming to keep branches from overhanging roads.	WW, T, WF	X													
1.1.9	Encourage the local water district to have adequate fire flow.	WF									X					
1.1.10	Encourage cooperative agreements between municipalities and water supply districts to ensure adequate supply for fire flow.	WF		X		X	X	X		X						

Figure 4.5b

Overview of Mitigation Actions by Hazard and Jurisdiction

Action #	Mitigation Action	Hazards Addressed	County	Ashland	Centralia	Columbia	Hallsville	Hartsburg	Huntsdale	Rocheport	Sturgeon	Schools				
												Centralia-VI	Columbia P.S.	Southern Boone	Sturgeon R-V	Stephens College
Objective 1.2 Encourage private involvement in mitigation activities.																
1.2.1	Encourage electric utilities to maintain right of ways.	WW, T, WF	X	X	X	X	X	X	X	X	X					
1.2.2	Encourage underground utilities in improvements and new development.	WW, T, WF	X	X	X	X	X	X			X					
1.2.3	Review and formalize relationships with cooling centers in each community.	H		X	X	X	X	X	X	X	X					

Figure 4.5c

Overview of Mitigation Actions by Hazard and Jurisdiction

Action #	Mitigation Action	Hazard Addressed	County	Ashland	Centralia	Columbia	Hallsville	Hartsburg	Huntsdale	Rocheport	Sturgeon	Schools				
												Centralia-VI	Columbia P.S.	Southern Boone	Sturgeon R-V	Stephens College
Goal 2: Mitigation Policy - Develop policies that limit the impact of natural hazards on lives and property.																
Objective 2.1 Pass appropriate ordinances for mitigation efforts.																
2.1.1	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.	FL, LF	X	X	X	X	X	X		X	X					
2.1.2	Review and update flood damage prevention/floodplain management ordinances, in compliance with NFIP requirements, when current and correct D-FIRMs are available.	FL	X	X	X	X	X	X		X	X					
2.1.3	Develop building codes or ordinances to ensure post-development flow mimics pre-development flow in regard to storm water.	FL	X	X	X	X	X	X			X					
2.1.4	Limit construction and development in known subsidence/sinkhole areas.	SK	X													
2.1.5	Add sinkhole regulations to stream buffer/storm water ordinance.	SK				X										
2.1.6	Develop policy and enforcement regulations concerning burning permits.	WF	X		X		X	X	X		X					

Figure 4.5d

Overview of Mitigation Actions by Hazard and Jurisdiction

Action #	Mitigation Action	Hazards Addressed											Schools				
			County	Ashland	Centralia	Columbia	Hallsville	Hartsburg	Huntsdale	Rocheport	Sturgeon	Centralia-VI	Columbia P.S.	Southern Boone	Sturgeon R-V	Stephens College	University of MO
Objective 2.2 Adopt new codes and standards.																	
2.2.1	Review building codes every two years for possible update.	EQ, WW, T, WF	X			X											
2.2.2	Encourage adoption of building codes in every incorporated community.	EQ, WW, T, WF							X								
2.2.3	Develop regulations for roads on dams.	DF		X		X		X									
2.2.4	Adopt regulation stating that any newly built dam must have a maintenance plan approved before construction.	DF	X														
2.2.5	Adopt the prevailing County regulations concerning storm water once they are formalized by the County.	FL						X									

Figure 4.5e

Overview of Mitigation Actions by Hazard and Jurisdiction

Action #	Mitigation Action	Hazards Addressed	County	Ashland	Centralia	Columbia	Hallsville	Hartsburg	Huntsdale	Rocheport	Sturgeon	Schools					
												Centralia-VI	Columbia P.S.	Southern Boone	Sturgeon R-V	Stephens College	University of MO
Goal 3: Mitigation Programs - Implement cost effective and feasible mitigation programs to protect lives and property of Boone County jurisdictions.																	
Objective 3.1 Protect buildings and valuable assets.																	
3.1.1	Secure high value equipment located outside county and municipal buildings (e.g. HVAC, generators, communication equipment).	EQ, T	X			X											
3.1.2	Replace 2, 3, and 4 inch water lines with 6 inch lines to ensure adequate supply for fire flow.	WF									X						
3.1.3	Evaluate and implement effective strategies to mitigate flooding at the wastewater treatment plant in Rocheport.	FL								X							
3.1.4	Mitigate the effects of flooding on public infrastructure.	FL	X			X											
Objective 3.2 Protect vulnerable populations.																	
3.2.1	Ensure evacuation plans are adequate for nursing homes and special needs populations.	EQ, WW, T	X	X	X	X	X	X		X	X						
3.2.2	Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.	EQ										X	X	X	X	X	X
3.2.3	Evaluate and maintain emergency preparedness plans.	EQ, T										X	X	X	X	X	X
3.2.4	Conduct emergency preparedness exercises periodically throughout the year.	EQ, T										X	X	X	X	X	X
3.2.5	Build tornado safe rooms.	T		X			X	X			X	X	X				X
3.2.6	Encourage shelters to have alternative heating sources.	EQ, T, WW	X	X	X	X	X	X		X	X						

Figure 4.5f

Overview of Mitigation Actions by Hazard and Jurisdiction

Action #	Mitigation Action	Hazards Addressed											Schools				
			County	Ashland	Centralia	Columbia	Hallsville	Hartsburg	Huntsdale	Rocheport	Sturgeon	Centralia-VI	Columbia P.S.	Southern Boone	Sturgeon R-V	Stephens College	University of MO
Goal 4: Public Awareness - Increase public awareness of natural hazards in order to make the public a greater partner in hazard mitigation planning.																	
4.0.1	Continue to educate the public on natural hazards.	DF, DR, EQ, H, FL, SK, WW, T, WF	X	X	X	X	X	X	X	X	X						
4.0.2	Maintain and distribute materials for public regarding earthquakes in Missouri and the benefits and availability of earthquake insurance.	EQ	X	X	X	X	X	X	X	X	X						
4.0.3	Continue to help the public realize the liability and responsibility for maintaining dams on private property.	DF	X	X	X	X	X	X	X		X						
Goal 5: Future Development - Promote hazard-proof development in the jurisdiction of Boone County.																	
5.0.1	Adopt procedures for review of subdivision plans to minimize flood problems.	FL	X	X	X	X	X	X			X						
5.0.2	Target Repetitive Loss Properties for flood buyout.	FL				X		X									
5.0.3	Acquire properties susceptible to flood damage when buyout grants are available.	FL				X		X		X							

**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.

Boone County is in the process of having its FIRM, last issued in 1983, updated and digitized.

The jurisdictions of Boone County and the City of Columbia both have extensive GIS, engineering, and planning capabilities. Current information such as 2' contours and current engineered modeling was provided to SEMA/FEMA for incorporation into the new Boone County D-FIRM map approximately four years before its release in September of 2009. The new and updated information submitted by Boone County and the City of Columbia was not included in the new map. Work is currently being pursued to ensure that the current and accurate data, which has been made available, is incorporated into the map (see communication in Appendix G.)

The importance of current and accurate FIRM maps in a locale highly susceptible to flooding events, such as Boone County, cannot be stated strongly enough. Boone County has seen extensive growth and development since the 1983 FIRM was published; this development has caused significant changes in the topography of the county.

Accurate flood maps are the basis of the NFIP. Appropriate and effective mitigation begins with accurate information. With this in mind, the following mitigation action was written for the jurisdictions of Boone County and the City of Columbia:

- Continue to supply updated GIS base map information to support changing/updating the D-FIRM maps using local, accurate data.

The following mitigation actions pertain to jurisdictions in these plans which are already participating in the NFIP:

- Adopt Flood Insurance Rate Maps (FIRMs) when updated.
- Review and update flood damage prevention ordinance, in compliance with NFIP requirements, when current and correct D-FIRMs are available.

The following mitigation action pertains to those jurisdictions that are not currently participants in NFIP but are eligible and interested in becoming NFIP participants:

- Become a participant in the NFIP.

4.4 Prioritization, Implementation, and Administration

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

Prioritization by Technical Steering Committee

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

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

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

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

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

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

Prioritization by Participating Jurisdictions

The prioritization of the suggested mitigation actions by the Hazard Mitigation Technical Steering Committee was a preliminary overall prioritization for the entire Planning Area. It was undertaken as a first step in assisting the participating jurisdictions in their individual prioritization processes.

Educational Institutions

In the case of the educational institutions, the representatives from the school districts and colleges/university developed mitigation actions specific to their institutions at a separate Educators Meeting on Dec. 11, 2009 (see Section 1.5). This was accomplished through a general discussion of the unique circumstances in the educational institutions and the specific state statutes regarding Earthquake Safety in the schools.

The following three mitigation actions were written for the educational institutions through discussion and consensus:

- 3.2.2 Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.
- 3.2.3 Evaluate and maintain emergency preparedness plans.
- 3.2.4 Conduct emergency preparedness exercises periodically throughout the year.

These three mitigation actions are already in process in the schools, colleges, and university. Regarding cost/benefit assessment, it was established that these actions have already been included in the operating budgets of all the educational institutions because they are so important for safety (benefit); therefore, there would be no additional cost to the educational institutions for these actions. There was a consensus that a high priority is appropriate for each of these three ongoing mitigation actions.

It was also recognized at the Educators Meeting that building a tornado safe room would possibly be appropriate for some of the educational districts/institutions (Action #3.2.5). This decision was deferred to the individual educational jurisdictions and is discussed under the specific jurisdictions interested in the action (see Sections 4.4.10, 4.4.11, and 4.4.15.)

(It should be noted, once again, that Stephens College is a private institution but participated to the same degree in the planning process as all other participating jurisdictions.)

All Other Participating Jurisdictions

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

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

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

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

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

The prioritization, implementation, and administration decisions concerning mitigation actions for all participating jurisdiction are outlined in the following sections (Sections 4.4.1 – 4.4.19).

4.4.1 Boone County

Figure 4.6 a
Mitigation Action Process for Boone County
Contact: Karen M. Miller Position: County Commission, District 1
<p>Who was involved in reviewing the mitigation actions?</p> <p>The Planning Department (Stan Shawver, Ryland Rodes) as well as the Public Works Department (Derin Campbell) responsible for many of the ordinances reviewed the document and made suggested changes to the Commission for our review. All three Commissioners (Commissioner Skip Elkin, Commissioner Karen M. Miller, Commissioner Ken Pearson) reviewed the document for concurrence.</p>
<p>What process did you use to prioritize the actions for your community?</p> <p>The preliminary prioritization provided by the Hazard Mitigation Technical Steering Committee was reviewed by all affected according to the guidance provided in the “Information and Guidelines for Assessing Mitigation Actions for Your Jurisdiction” sheet provided by the Hazard Mitigation Technical Steering Committee. A key to assessing the priority of an action had to do with whether the task required an additional funding source or was already in the budget.</p> <p>There was a consensus among the reviewers that this preliminary prioritization was appropriate for the County and would be approved as the final prioritization for Boone County. It should be noted that Boone County was represented by four members on the Technical Steering Committee (Commissioner Karen M. Miller, Zim Schwartz – Emergency Management Director, Derin Campbell – Acting Director of Public Works, and Ryland Rodes – Planner) who were closely involved in the preliminary prioritization process.</p> <p>The reviewers changed the language of one action for Boone County:</p> <ul style="list-style-type: none"> • 2.1.6 “Develop policy and enforcement regulations concerning burning permits” changed to “Encourage development of burn permit procedure.” The priority level for this action remained at Medium.
<p>How was benefit vs. cost taken into account during prioritization?</p> <p>It had a lot to do with if it was affordable in these economic times. If there was a significant benefit to preventing a disaster and it was within our capacity to budget for it, it was included in the budget for FY10.</p>

Figure 4.6 b											
Mitigation Actions for Boone County											
Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.1	Continue to supply updated GIS base map information to support changing/updating the D-FIRM maps using local, accurate data.	FL	High	The County will be meeting with FEMA staff to work on the next step of their digitization project.	County Commission	City of Columbia, GIS Departments	Internal Funds	Minimal	Property Protection	Ongoing	GIS information supplied
1.1.2	Adopt Flood Insurance Rate Maps (FIRM) when updated.	FL	High	This will happen as a matter of course once the update is completed to the County's satisfaction.	County Commission		No Funds Necessary	Minimal	Property Protection	2012	Updated FIRMs adopted
1.1.4	Encourage development of Storm Water Master Plan.	FL	High	This will take place as a matter of course once the ordinance is adopted and a utility is being evaluated.	County Commission		No Funds Necessary	Minimal	Property Protection	2010	Plan adopted
1.1.5	Update Public Safety Joint Communications staff knowledge of earthquake safety.	EQ	High	A training will be held in 2010 and then on an ongoing basis.	Office of Emergency Management	Local Government	Internal Funds	Minimal	Enhanced safety/less injury and loss of life	2010 then Ongoing	Training attended

Figure 4.6 c

Mitigation Actions for Boone County

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.6	Have alternate power sources readily available for the electric needs of emergency vehicles and the buildings where they are located.	EQ, WW, T, WF	High	OEM will make recommendations to local public safety entities.	Office of Emergency Management	Local Government	Internal Funds / Program Funds	Minimal	Emergency Preparedness	Ongoing	Alternative power sources available
1.1.7	Continue with monthly testing of warning systems in compliance with procedures set out by the Office of Emergency Management.	T	High	The warning systems are automatically tested through contract with a company; a check system is in place to ensure that the sirens went off.	Office of Emergency Management		Internal Funds	Moderate	Sirens are in working operation when needed	Ongoing	Regular testing

Figure 4.6 d

Mitigation Actions for Boone County

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.8	The Public Works Department will adhere to a routine maintenance schedule for brush cutting and tree trimming to keep branches from overhanging roads.	WW, T, WF	High	This is an ongoing activity within the Public Works Department.	Public Works Department		Internal Funds	Minimal	Avoidance of excessive labor and expenses associated with tree and brush removal from roads after severe weather; avoidance of road closures due to severe weather.	Ongoing	Brush and trees are trimmed.
1.2.1	Encourage electric utilities to maintain right of ways.	WW, T, WF	High	This is an ongoing activity within the Public Works Department.	Public Works Department		No Funds Necessary	Minimal	Utilities remain operational during and after severe weather.	Ongoing	Right of ways are maintained
1.2.2	Encourage underground utilities in improvements and new development.	WW, T, WF	High	The County and developers work together to encourage underground utilities for new development.	Planning and Building Department		No Funds Necessary		Utilities remain operational during and after severe weather.	Ongoing	Utilities are underground in new developments

Figure 4.6 e

Mitigation Actions for Boone County

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
2.1.1	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.	FL, LF	High	This is an ongoing activity within the Planning and Building Department.	Planning and Building Department		Internal Funds	Minimal	Property Protection	Ongoing	Ordinances are enforced
2.1.2	Review and update flood damage prevention/floodplain management ordinances, in compliance with NFIP requirements, when current and correct D-FIRMs are available.	FL	High	The County is working with FEMA to develop the most up to date mapping possible using the most current tools.	County Commission	Congressional Delegation	Internal Funds	Minimal	Property and Life Protection	Ongoing	Ordinances are reviewed and updated (if update is needed)
2.1.3	Develop building codes or ordinances to ensure post-development flow mimics pre-development flow in regard to storm water.	FL	High	The new stormwater ordinance, once adopted in first quarter 2010, will require a plan to accomplish this practice.	County Commission		Internal Funds	Minimal	Property Protection	2010	Adoption of Stormwater Ordinance

Figure 4.6 f											
Mitigation Actions for Boone County											
Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
2.1.4	Limit construction and development in known subsidence/sinkhole areas.	SK	High	County regulations require the identification of sinkholes on any preliminary development.	County Commission		No funds necessary	Minimal	Property Protection	Ongoing	Construction in sink hole areas requires engineered plans
2.1.6	Encourage development of burn permit procedure.	WF	Medium	Office of Emergency Management will initiate discussions on this with Fire Districts.	Office of Emergency Management	Fire Districts	Internal Funds	Minimal	Life and Property Protection	2017	Policy is in place and enforced
2.2.1	Review building codes every three years for possible update.	EQ, WW, T, WF	High	The County is currently in the process of reviewing the most recent code.	County Planning & Building Inspections	County Commission	Internal Funds	Minimal	Life and Property Protection	Ongoing	Codes are reviewed and updated (if update is appropriate)
2.2.4	Adopt regulation stating that any newly built dam must have a maintenance plan approved before construction.	DF	High	The County Commission does not currently have the authority to require this. The Commission is working with the legislature to get authority or have a requirement at the state level for maintenance plans.	County Commission	DNR and State Legislature	No funds necessary	Minimal	Life and Property Protection	Ongoing	Regulation is adopted

Figure 4.6 g

Mitigation Actions for Boone County

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.1.1	Secure high value equipment located outside county and municipal buildings (e.g. HVAC, generators, communication equipment).	EQ, T	High	Office of Emergency Management will make recommendations on this.	Office of Emergency Management	Local Government	Internal Funds	Minimal	Property Protection	Ongoing	Equipment is secured
3.1.4	Mitigate the effects of flooding on public infrastructure.	FL	High	Departments of Public Works and Planning will make recommendations on this.	Depts. of Public Works and Planning	County Commission	Internal Funds and Grants	Moderate to High	Property Protection	Ongoing	Public infrastructure is protected
3.2.1	Ensure evacuation plans are adequate for nursing homes and special needs populations.	EQ, WW, T	High	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Evacuation plans are in place
3.2.6	Encourage shelters to have alternative heating sources.	EQ, T, WW	Low	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Alternative heating is available

Figure 4.6 h

Mitigation Actions for Boone County

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
4.0.1	Continue to educate the public on natural hazards.	DF, DR, EQ, H, FL, SK, WW, T, WF	High	This is an ongoing activity of the Office of Emergency Management and is carried out through press releases and available literature.	Office of Emergency Management	Local Media	Program Funds	Minimal	Life and Property Protection	Ongoing	Natural hazard education for public occurs.
4.0.2	Maintain and distribute materials for public regarding earthquakes in Missouri and the benefits and availability of earthquake insurance.	EQ	Medium	This will be part of the general public education on natural hazards.	Office of Emergency Management		Program Funds	Minimal	Life and Property Protection	Ongoing	Materials are available and distributed.
4.0.3	Continue to help the public realize the liability and responsibility for maintaining dams on private property.	DF	Low	This will be part of the general public education on natural hazards.	Office of Emergency Management		Program Funds	Minimal	Life and Property Protection	Ongoing	Public education takes place.

Figure 4.6 i

Mitigation Actions for Boone County

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
5.0.1	Adopt procedures for review of subdivision plans to minimize flood problems.	FL	High	The new storm water ordinance, once adopted first quarter 2010, will require this review.	County Commission		No Funds Necessary	Minimal	Property Protection	Ongoing	Procedures are adopted.

4.4.2 Ashland

Figure 4.7 a	
Mitigation Action Process for Ashland	
Contact:	Chris Heard
Position:	City Administrator
Who was involved in reviewing the mitigation actions?	
The City Administrator, Mayor, and Chief of Police	
What process did you use to prioritize the actions for your community?	
Group discussion and committee meetings	
<p>The “Information and Guidelines for Assessing Mitigation Actions for Your Jurisdiction” sheet provided by the Hazard Mitigation Technical Steering Committee was reviewed by the City Administrator, Mayor, and Chief of Police. The reviewers then looked at each proposed mitigation action and its preliminary prioritization, using the Prioritization Guidelines Scale and Projected Cost Scale provided, to assess if this prioritization was appropriate for Ashland or needed to be changed. The decisions of the reviewers were arrived at by consensus.</p> <p>The prioritizations of the following actions were changed:</p> <ul style="list-style-type: none">• 1.1.10 Encourage cooperative agreements between municipalities and water supply districts to ensure adequate supply for fire flow. Changed from Medium to Low Priority because agreements have been put into place over the past 5 years in order to have more effective government service.• 1.2.1 Encourage electric utilities to maintain right of ways. Changed from High to Medium Priority because this is currently taking place and will be ongoing.• 3.2.5 Build tornado safe room. Prioritization of Medium assigned because there is a need for a tornado safe room but significant local funds would be required for this project. <p>The preliminary priority ratings of all other mitigation actions were deemed appropriate for Ashland and approved as the final priority ratings by consensus.</p>	
How was benefit vs. cost taken into account during prioritization?	
Most items had minimal cost. The items that the city will work on are more policy than projects. Items that had cost, the cost was from the private sector.	

Figure 4.7 b

Mitigation Actions for City of Ashland

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.2	Adopt Flood Insurance Rate Maps (FIRM) when updated.	FL	High	Review when available	Board of Aldermen		No Funds Necessary	None	Lower insurance rates	2012	Updated FIRMs adopted
1.1.5	Update Public Safety Joint Communications staff knowledge of earthquake safety.	EQ	High	A training will be held in 2010 and then on an ongoing basis.	Office of Emergency Management		Internal Funds	Minimal	Enhanced safety/less injury and loss of life	2010 then Ongoing	Training attended
1.1.6	Have alternate power sources readily available for the electric needs of emergency vehicles and the buildings where they are located.	EQ, WW, T, WF	High	OEM will make recommendations to local public safety entities.	Office of Emergency Management	Board of Aldermen	Internal Funds / Program Funds	Minimal	Emergency Preparedness	Ongoing	Alternative power sources available

Figure 4.7 c

Mitigation Actions for Ashland

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.7	Continue monthly testing of outdoor warning sirens in compliance with procedures set by the Office of Emergency Management.	T, WW	High	The warning systems are automatically tested through a contracted company; a check system is in place to ensure the sirens are functioning properly.	Office of Emergency Management		Internal Funds	Moderate	Sirens are in proper working order and sound when needed.	Ongoing	Regular testing
1.1.10	Encourage cooperative agreements between municipalities and water supply districts to ensure adequate supply for fire flow.	WF	Low	Work with Water District One	Board of Aldermen	Water District One	No funds necessary	Minimal	Adequate supply for fire flow	Ongoing	Agreements in Place
1.2.1	Encourage electric utilities to maintain right of ways.	WW, T, WF	Medium	Work with Boone Electric and UE	City Administrator	Electric Companies	No Funds Necessary	Minimal	No disruption in service during and after storms	Ongoing	Right of ways are maintained

Figure 4.7 d

Mitigation Actions for Ashland

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.2.2	Encourage underground utilities in improvements and new development.	WW, T, WF	High	Encourage through development approval	Utilities	Local Government	No Funds Necessary	Minimal	No disruption in service during and after storms	Ongoing	Utilities are underground in new developments
1.2.3	Review and formalize relationships with cooling and warming centers in each community.	H	Medium	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Agreements in Place
2.1.1	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.	FL	High	This is an ongoing activity	Code Official		Internal Funds	Minimal	Protection of life and property	Ongoing	Ordinances are enforced

Figure 4.7 e

Mitigation Actions for Ashland

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
2.1.2	Review and update flood damage prevention/floodplain management ordinances, in compliance with NFIP requirements, when current and correct D-FIRMs are available.	FL	High	This is an ongoing activity	Code Official		Internal Funds	Minimal	Protection of life and property	Ongoing	Ordinances are reviewed and updated (if update is needed)
2.1.3	Develop building codes or ordinances to ensure post-development flow mimics pre-development flow in regard to storm water.	FL	High	Controlled by plan submittals	Code Official	Developers	Internal Funds	Minimal	Protection of life and property	2010	Building codes are in place
3.2.1	Ensure evacuation plans are adequate for nursing homes and special needs populations.	EQ, WW, T	High	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Evacuation plans are in place

Figure 4.7 f

Mitigation Actions for Ashland

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.5	Build tornado safe room.	T	Medium	Work with other organizations to create a site for the community	Board of Aldermen	School/Community Groups	FEMA Pre-disaster Mitigation Grant Program, Local Match	\$1.5 million	Protection of life	Ongoing	Safe room is built.
3.2.6	Encourage shelters to have alternative heating sources.	EQ, T, WW	Low	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Alternative heating is available
4.0.1	Continue to educate the public on natural hazards.	DF, DR, EQ, H, FL, SK, WW, T, WF	High	This is an ongoing activity of the Office of Emergency Management and is carried out through press releases and available literature.	Office of Emergency Management	Local Media	Program Funds	Minimal	Life and Property Protection	Ongoing	Natural hazard education for public occurs.

Figure 4.7 g

Mitigation Actions for Ashland

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
4.0.2	Maintain and distribute materials for public regarding earthquakes in Missouri and the benefits and availability of earthquake insurance.	EQ	Medium	This will be part of the general public education on natural hazards.	Office of Emergency Management		Program Funds	Minimal	Life and Property Protection	Ongoing	Materials are available and distributed.
4.0.3	Continue to help the public realize the liability and responsibility for maintaining dams on private property.	DF	Low	This will be part of the general public education on natural hazards.	Office of Emergency Management		Program Funds	Minimal	Life and Property Protection	Ongoing	Public education takes place.
5.0.1	Adopt procedures for review of subdivision plans to minimize flood problems.	FL	High	Create new municipal code for development regulations.	Code Official	Developers	No Funds Necessary	Minimal	Life and Property Protection	Ongoing	Procedures are adopted.

4.4.3 Centralia

Figure 4.8 a		Mitigation Action Process for Centralia	
Contact:	Lynn P. Behrns	Position:	City Administrator
Who was involved in reviewing the mitigation actions?			
City Administrator, Staff and Department Heads			
What process did you use to prioritize the actions for your community?			
<p>The “Information and Guidelines for Assessing Mitigation Actions for Your Jurisdiction” sheet provided by the Hazard Mitigation Technical Steering Committee was reviewed by the City Administrator, Staff and Department Heads. These reviewers then looked at each proposed mitigation action and its preliminary prioritization, using the Prioritization Guidelines Scale and Projected Cost Scale provided, to assess if this prioritization was appropriate for Centralia or needed to be changed. There were informal discussions on the matter, taking into account existing emergency plans, facility studies, and the draft update of the master plan for Centralia. The final decisions of the reviewers were arrived at by consensus.</p> <p>The language for the following action was changed slightly for Centralia but the Priority Rating remained at High:</p> <ul style="list-style-type: none"> • 1.2.1 “Encourage electric utilities to maintain right of ways” changed to “Encourage city electric utility to maintain right of ways.” <p>Changes in prioritization were made for the following actions:</p> <ul style="list-style-type: none"> • 1.2.2 Encourage underground utilities in improvements and new development. Changed from High Priority to Medium/High Priority because the subdivision codes already require this for new development and retrofitting to underground utilities is a Medium/High Priority. • 2.1.6 Develop policy and enforcement regulations concerning burning permits. Changed from Medium Priority to Low Priority because regulations are already in place concerning when and how burning can take place; there is not community support at this time to go any further with burning policy. <p>All other priority ratings suggested by the Hazard Mitigation Technical Steering Committee were deemed appropriate for Centralia and approved as the final priority ratings by consensus.</p>			
How was benefit vs. cost taken into account during prioritization?			
Most suggestions involved little new expenditure, only time of employees.			

Figure 4.8 b

Mitigation Actions for Centralia

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.2	Adopt Flood Insurance Rate Maps (FIRM) when updated.	FL	High	Will be adopted by Centralia after the County adopts a satisfactory updated FIRM.	County Commission	Local Government	No Funds Necessary	Minimal	Citizens will be able to purchase flood insurance at lower rates.	2012	Updated FIRMs adopted
1.1.5	Update Public Safety Joint Communications staff knowledge of earthquake safety.	EQ	High	A training will be held in 2010 and then on an ongoing basis.	Office of Emergency Management	Local Government	Internal Funds	Minimal	Enhanced safety/less injury and loss of life	2010 then Ongoing	Training attended
1.1.6	Have alternate power sources readily available for the electric needs of emergency vehicles and the buildings where they are located.	EQ, WW, T, WF	High	OEM will make recommendations to local public safety entities.	Office of Emergency Management	Local Government	Internal Funds / Program Funds	Minimal	Emergency Preparedness	Ongoing	Alternative power sources available
1.1.7	Continue monthly testing of outdoor warning sirens in compliance with procedures set by the Office of Emergency Management.	T, WW	High	The warning systems are automatically tested through a contracted company; a check system is in place to ensure the sirens are functioning properly.	Office of Emergency Management		Internal Funds	Moderate	Sirens are in proper working order and sound when needed.	Ongoing	Regular testing

Figure 4.8 c

Mitigation Actions for Centralia

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.2.1	Encourage city electric utility to maintain right of ways.	WW, T, WF	High	This is an ongoing activity.	Electric Department		No Funds Necessary	Minimal	Utilities are operational during and after storm events.	Ongoing	Right of ways are maintained
1.2.2	Encourage underground utilities in improvements and new development.	WW, T, WF	Medium to High	This is being done and will continue.	City Administrator		Electric Fund	Minimal	Utilities are operational during and after storm events.	Ongoing	Utilities are underground in new developments
1.2.3	Review and formalize relationships with cooling and warming centers in each community.	H	Medium	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life.	Ongoing	Agreements in Place
2.1.1	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.	FL	High	This is an ongoing process when issuing building permits and reviewing subdivision plans.	City Administrator		Internal Funds	Minimal	Protection of life and property	Ongoing	Ordinances are enforced

Figure 4.8 d

Mitigation Actions for Centralia

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
2.1.2	Review and update flood damage prevention/floodplain management ordinances, in compliance with NFIP requirements, when current and correct D-FIRMs are available.	FL	High	Appropriate changes in ordinances will be made when notified that changes in federal regulations have been made.	City Administrator		Internal Funds	Minimal	Protection of life and property	Ongoing	Ordinances are reviewed and updated (if update is needed)
2.1.3	Develop building codes or ordinances to ensure post-development flow mimics pre-development flow in regard to storm water.	FL	High	This is part of the subdivision code.	City Administrator		Internal Funds	Minimal	Protection of life and property	Ongoing	Building codes are in place
2.1.6	Develop policy and enforcement regulations concerning burning permits.	WF	Low	Regulations are in place concerning when and how burning can take place.	City Administrator	Volunteer Fire Department	Internal Funds	Minimal	Protection of life and property	Ongoing	Policy is in place and enforced
3.2.1	Ensure evacuation plans are adequate for nursing homes and special needs populations.	EQ, WW, T	High	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Evacuation plans are in place

Figure 4.8 e

Mitigation Actions for Centralia

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.6	Encourage shelters to have alternative heating sources.	EQ, T, WW	Low	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Alternative heating is available
4.0.1	Continue to educate the public on natural hazards.	DF, DR, EQ, H, FL, SK, WW, T, WF	High	This is an ongoing activity of the Office of Emergency Management and is carried out through press releases and available literature.	Office of Emergency Management	Local Media	Program Funds	Minimal	Life and Property Protection	Ongoing	Natural hazard education for public occurs.
4.0.2	Maintain and distribute materials for public regarding earthquakes in Missouri and the benefits and availability of earthquake insurance.	EQ	Medium	This will be part of the general public education on natural hazards.	Office of Emergency Management		Program Funds	Minimal	Life and Property Protection	Ongoing	Materials are available and distributed.
4.0.3	Continue to help the public realize the liability and responsibility for maintaining dams on private property.	DF	Low	This will be part of the general public education on natural hazards.	Office of Emergency Management		Program Funds	Minimal	Life and Property Protection	Ongoing	Public education takes place.

Figure 4.8 f

Mitigation Actions for Centralia

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
5.0.1	Adopt procedures for review of subdivision plans to minimize flood problems.	FL	High	These are in place	City Administrator		No Funds Necessary	Minimal	Property Protection	Ongoing	Procedures are adopted.

4.4.4 Columbia

Figure 4.9 a	
Mitigation Action Process for Columbia	
Contact:	Steve Hunt
Position:	Manager of Environmental Services, Dept. of Public Works
Who was involved in reviewing the mitigation actions?	
Steve Hunt, Dave Nichols - both Public Works Mike Schmitz and Dave Storvick - Water and Light Zim Schwartz, Emergency Management Director	
What process did you use to prioritize the actions for your community?	
<p>The City employees listed above reviewed the “Information and Guidelines for Assessing Mitigation Actions for Your Jurisdiction” sheet provided by the Hazard Mitigation Technical Steering Committee. The reviewers then looked at each proposed mitigation action and its preliminary prioritization, using the Prioritization Guidelines Scale and Projected Cost Scale provided, to assess if this prioritization was appropriate for Columbia or needed to be changed. Assessment of the appropriateness of the preliminary prioritization for Columbia was based on the severity of the hazard, likelihood of occurrence, risk to the population and cost to mitigate.</p> <p>It was decided that the preliminary prioritization of the actions by the Hazard Mitigation Technical Steering Committee was appropriate for Columbia and would be approved as the final prioritization. This decision was arrived at by consensus.</p> <p>The language of the following actions was changed slightly for Columbia but their priority ratings remained the same:</p> <ul style="list-style-type: none"> • 1.1.10 “Encourage cooperative agreements between municipalities and water supply districts to ensure adequate supply for fire flow” changed to “Maintain cooperative agreements between municipality and adjacent water supply districts to ensure adequate supply for fire flow.” • 1.2.1 “Encourage electric utilities to maintain right of ways” changed to “Maintain electric utility right of ways.” 	
How was benefit vs. cost taken into account during prioritization?	
As described above, the benefit vs. cost was used to help prioritize mitigation actions. Many of the actions have minimal cost; those with moderate cost are already included in budgets; the one action with significant cost (5.0.3 – “buyouts”) would involve securing grant funds but was deemed a high priority because of its overall benefit.	

Figure 4.9 b

Mitigation Actions for Columbia

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.1	Continue to supply updated GIS base map information to support changing/updating the D-FIRM maps using local, accurate data.	FL	High	Public Works staff will provide flood plain modeling info and Letter of Map Review (LOMR) applications to SEMA as they come available.	Public Works Department	County Commission GIS Departments	Internal Funds	Minimal	More accurate flood plain maps; citizens will benefit from more accurate determination of how their property is affected.	Ongoing	GIS information supplied
1.1.2	Adopt Flood Insurance Rate Maps (FIRM) when updated.	FL	High	Public Works will prepare documents to seek City Council adoption of new maps.	Public Works Department	City Council	No Funds Necessary	Minimal	Keep Columbia in compliance; citizens can acquire flood insurance at lowest possible rate.	2012	Updated FIRMs adopted
1.1.5	Update Public Safety Joint Communications staff knowledge of earthquake safety.	EQ	High	A training will be held in 2010 and then on an ongoing basis.	Office of Emergency Management	Local Government	Internal Funds	Minimal	Enhanced safety/less injury and loss of life	2010 then Ongoing	Training attended

Figure 4.9 c

Mitigation Actions for Columbia

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.6	Have alternate power sources readily available for the electric needs of emergency vehicles and the buildings where they are located.	EQ, WW, T, WF	High	OEM will make recommendations to local public safety entities.	Office of Emergency Management	Local Government	Internal Funds / Program Funds	Minimal	Emergency Preparedness	Ongoing	Alternative power sources available
1.1.7	Continue monthly testing of outdoor warning sirens in compliance with procedures set by the Office of Emergency Management.	T, WW	High	The warning systems are automatically tested through a contracted company; a check system is in place to ensure the sirens are functioning properly.	Office of Emergency Management		Internal Funds	Moderate	Sirens are in proper working order and sound when needed.	Ongoing	Regular testing
1.1.10	Maintain cooperative agreements between municipality and adjacent water supply districts to ensure adequate supply for fire flow.	WF	Medium	Maintain agreements for water sharing and interconnects with adjacent water districts to share water between boundaries in the event of outages or low flow/pressure situations.	Columbia Water and Light		No funds necessary	Minimal	Protection of life and property	Ongoing	Agreements in Place

Figure 4.9 d

Mitigation Actions for Columbia

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.2.1	Maintain electric utility right of ways.	WW, T, WF	High	Columbia Water and Light currently has an active vegetation management program that includes maintenance of its right of ways.	Columbia Water and Light		Internal Funds	Moderate	Protection of life and property	Ongoing	Right of ways are maintained
1.2.2	Encourage underground utilities in improvements and new development.	WW, T, WF	High	Columbia Water and Light's current policy is for all new extensions to its electric distribution system to be made underground, unless special circumstances are present and are approved by the Director. Columbia Water and Light currently has yearly budget allowances for undergrounding existing overhead distribution facilities.	Columbia Water and Light		Internal Funds	Moderate	Protection of life and property	Ongoing	Utilities are underground in new developments

Figure 4.9 e

Mitigation Actions for Columbia

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.2.3	Review and formalize relationships with cooling and warming centers in each community.	H	Medium	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Agreements in Place
2.1.1	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.	FL	High	Public Works staff reviews all development plans to ensure ordinances are followed.	Public Works Department		Internal Funds	Minimal	Protection of life and property	Ongoing	Ordinances are enforced
2.1.2	Review and update flood damage prevention/floodplain management ordinances, in compliance with NFIP requirements, when current and correct D-FIRMs are available.	FL	High	Public Works staff will prepare updated ordinances for City Council consideration as needed.	Public Works Department		Internal Funds	Minimal	Protection of life and property	Ongoing	Ordinances are reviewed and updated (if update is needed)

Figure 4.9 f

Mitigation Actions for Columbia

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
2.1.3	Maintain building codes or ordinances to ensure post-development flow mimics pre-development flow in regard to storm water.	FL	High	Staff will review ordinances and department requirements annually.	Public Works Department		Internal Funds	Minimal	Protection of Columbia's streams and water quality	2010	Building codes or ordinances are in place
2.1.5	Add sinkhole regulations to stream buffer/storm water ordinance.	SK	Medium	Staff will draft sinkhole regulations for City Council consideration.	Public Works Department		Internal Funds	Minimal	Protection of life and property	2015	Regulations are added
2.2.1	Review building codes every two years for possible update.	EQ, WW, T, WF	High	Staff will review codes along with Building Code Commission and adopt current regulations as directed.	Public Works Department		Internal Funds	Minimal	Protection of life and property	Ongoing	Codes are reviewed and updated (if update is appropriate)

Figure 4.9 g

Mitigation Actions for Columbia

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
2.2.3	Develop regulations for roads on dams.	DF	High	Staff will develop ordinance for City Council consideration that addresses the placement of public roadways on non-regulated dams.	Public Works Department		Internal Funds	Minimal	Protection of life and property	2015	Regulations are adopted
3.1.1	Secure high value equipment located outside county and municipal buildings (e.g. HVAC, generators, communication equipment).	EQ, T	High	Office of Emergency Management will make recommendations on this.	Office of Emergency Management	Dept. of Public Works, Police Dept, Fire Dept.	Internal Funds	Minimal	Protection of property	Ongoing	Equipment is secured
3.1.4	Mitigate the effects of flooding on public infrastructure.	FL	High	Departments of Public Works and Planning will make recommendations on this.	Depts. of Public Works and Planning	City Council	Internal Funds and Grants	Moderate to High	Property Protection	Ongoing	Public infrastructure is protected
3.2.1	Ensure evacuation plans are adequate for nursing homes and special needs populations.	EQ, WW, T	High	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Evacuation plans are in place
3.2.6	Encourage shelters to have alternative heating sources.	EQ, T, WW	Low	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Alternative heating is available

Figure 4.9 h

Mitigation Actions for Columbia

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
4.0.1	Continue to educate the public on natural hazards.	DF, DR, EQ, H, FL, SK, WW, T, WF	High	This is an ongoing activity of the Office of Emergency Management and is carried out through press releases and available literature.	Office of Emergency Management	Local Media	Program Funds	Minimal	Protection of life and property	Ongoing	Natural hazard education for public occurs.
4.0.2	Maintain and distribute materials for public regarding earthquakes in Missouri and the benefits and availability of earthquake insurance.	EQ	Medium	This will be part of the general public education on natural hazards.	Office of Emergency Management		Program Funds	Minimal	Protection of life and property	Ongoing	Materials are available and distributed.
4.0.3	Continue to help the public realize the liability and responsibility for maintaining dams on private property.	DF	Low	This will be part of the general public education on natural hazards.	Office of Emergency Management		Program Funds	Minimal	Protection of life and property	Ongoing	Public education takes place.

Figure 4.9 i

Mitigation Actions for Columbia

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
5.0.1	Adopt procedures for review of subdivision plans to minimize flood problems.	FL	High	Staff reviews all subdivision plans to ensure structures are not built in floodway and are 2 feet above the 100 yr. flood elevation when placed in flood fringe.	Public Works Department		No Funds Necessary	Minimal	Protection of life and property	Ongoing	Procedures are adopted.
5.0.2	Target Repetitive Loss Properties for flood buyout.	FL	High	Columbia Storm Water Utility will evaluate properties that are repeatedly flooded and make decision whether to buy out or improve drainage systems.	Public Works Department		Program Funds	Minimal	Protect life and minimize insurance claims	Ongoing	Properties are targeted.
5.0.3	Acquire properties susceptible to flood damage when buyout grants are available.	FL	High	Columbia Storm Water Utility will continue to purchase properties that are flood prone when funding is available.	Public Works Department		FEMA Grant Funds/Storm Water Utility	Significant	Protect life and minimize insurance claims	Ongoing	Properties are acquired.

4.4.5 Hallsville

Figure 4.10 a	
Mitigation Action Process for Hallsville	
Contact:	Bob Hipple
Position:	City Administrator
Who was involved in reviewing the mitigation actions? City Administrator, City Clerk, Police Chief, Public Work Director	
What process did you use to prioritize the actions for your community? The City Administrator, City Clerk, Police Chief, and Public Work Director reviewed the “Information and Guidelines for Assessing Mitigation Actions for Your Jurisdiction” sheet provided by the Hazard Mitigation Technical Steering Committee. The reviewers then looked at each proposed mitigation action and its preliminary prioritization, using the Prioritization Guidelines Scale and Projected Cost Scale provided, to assess if this prioritization was appropriate for Hallsville or needed to be changed. It was decided that the preliminary prioritization determined by the Hazard Mitigation Technical Steering Committee was appropriate for Hallsville and would be approved as the final prioritization. This decision was arrived at by consensus.	
How was benefit vs. cost taken into account during prioritization? Benefit vs. cost was part of the discussion; almost all of the mitigation actions had very little or no cost to the local government. The one mitigation action which would have a significant local cost would be the tornado safe room. It was decided that this was a high priority because the benefit of having a tornado safe room would be very high.	

Figure 4.10 b

Mitigation Actions for Hallsville

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.2	Adopt Flood Insurance Rate Maps (FIRM) when updated.	FL	High	Will adopt map when appropriate.	Local Government		No Funds Necessary	Minimal	Life and Property Protection	2012	Updated FIRMs adopted
1.1.5	Update Public Safety Joint Communications staff knowledge of earthquake safety.	EQ	High	A training will be held in 2010 and then on an ongoing basis.	Office of Emergency Management	Local Government	Internal Funds	Minimal	Enhanced safety/less injury and loss of life	2010 then Ongoing	Training attended
1.1.6	Have alternate power sources readily available for the electric needs of emergency vehicles and the buildings where they are located.	EQ, WW, T, WF	High	OEM will make recommendations to local public safety entities.	Office of Emergency Management	Local Government	Internal Funds / Program Funds	Moderate	Emergency Preparedness	Ongoing	Alternative power sources available

Figure 4.10 c

Mitigation Actions for Hallsville

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.7	Continue monthly testing of outdoor warning sirens in compliance with procedures set by the Office of Emergency Management.	T, WW	High	Public Safety Joint Communications has the warning systems automatically tested through a contracted company; a check system is in place to ensure the sirens are functioning properly.	Office of Emergency Management	Local Government	Internal Funds	Moderate	Sirens are in proper working order and sound when needed.	Ongoing	Regular testing
1.1.10	Encourage cooperative agreements between municipalities and water supply districts to ensure adequate supply for fire flow.	WF	Medium	These are in place by contract and interconnections.	Local Government	Water District #4	No funds necessary	Minimal	Reduced loss of life and property	Ongoing	Agreements in Place
1.2.1	Encourage electric utilities to maintain right of ways.	WW, T, WF	High	Utilities are already implementing this.	Local Government	Utilities	No Funds Necessary	Minimal public cost	Fewer outages due to ice	Ongoing	Right of ways are maintained
1.2.2	Encourage underground utilities in improvements and new development.	WW, T, WF	High	Revise subdivision regulations	Local Government		No Funds Necessary	Low	Fewer outages	Ongoing	Utilities are underground in new developments

Figure 4.10 d

Mitigation Actions for Hallsville

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.2.3	Review and formalize relationships with cooling and warming centers in each community.	H	Medium	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life.	Ongoing	Agreements in Place
2.1.1	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.	FL	High	In place	Board of Aldermen	Local Government	Internal Funds	Minimal	Prevention of property and life loss	Ongoing	Ordinances are enforced
2.1.2	Review and update flood damage prevention/floodplain management ordinances, in compliance with NFIP requirements, when current and correct D-FIRMs are available.	FL	High	Will be done as appropriate	Board of Aldermen	Local Government	Internal Funds	Minimal	Prevention of property and life loss	Ongoing	Ordinances are reviewed and updated (if update is needed)

Figure 4.10 e

Mitigation Actions for Hallsville

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
2.1.6	Develop policy and enforcement regulations concerning burning permits.	WF	Medium	Enforce State regulations and local code ban on solid waste and trash burning	Local Government		Internal Funds	Minimal	Prevention of property and life loss	Ongoing	Policy is in place and enforced
3.2.1	Ensure evacuation plans are adequate for nursing homes and special needs populations.	EQ, WW, T	High	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Evacuation plans are in place
3.2.5	Build tornado safe room.	T	High	Incorporate in Capital Improvement Plan	Board of Aldermen	Local Government	FEMA Pre-disaster Mitigation Grant Program, Local Match	High	Protection of life and vital records; maintain services	2015	Safe room is built.
3.2.6	Encourage shelters to have alternative heating sources.	EQ, T, WW	Low	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Alternative heating is available

Figure 4.10 f

Mitigation Actions for Hallsville

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
4.0.1	Continue to educate the public on natural hazards.	DF, DR, EQ, H, FL, SK, WW, T, WF	High	This is an ongoing activity of the Office of Emergency Management and is carried out through press releases and available literature.	Office of Emergency Management	Local Media	Program Funds	Minimal	Life and Property Protection	Ongoing	Natural hazard education for public occurs.
4.0.2	Maintain and distribute materials for public regarding earthquakes in Missouri and the benefits and availability of earthquake insurance.	EQ	Medium	This will be part of the general public education on natural hazards.	Office of Emergency Management	State and Local Government	Program Funds	Minimal	Life and Property Protection	Ongoing	Materials are available and distributed.
4.0.3	Continue to help the public realize the liability and responsibility for maintaining dams on private property.	DF	Low	This will be part of the general public education on natural hazards.	Office of Emergency Management	Local Government	Program Funds	Minimal	Life and Property Protection	Ongoing	Public education takes place.
5.0.1	Adopt procedures for review of subdivision plans to minimize flood problems.	FL	High	Ongoing	Local Government		No Funds Necessary	Minimal	Life and Property Protection	Ongoing	Procedures are adopted.

4.4.6 Hartsburg

Figure 4.11 a	
Mitigation Action Process for Hartsburg	
Contact:	Nancy Grant
Position:	Mayor
Who was involved in reviewing the mitigation actions?	
The five City Council Members: Nancy Grant, Mayor; Doug Lammers, Vice-Mayor; Jeanette Crawford, Treasurer; Mike Rodemeyer, Acting Secretary and Disaster Coordinator; Wayne McMillen, Trustee	
What process did you use to prioritize the actions for your community?	
The five members of the City Council reviewed the “Information and Guidelines for Assessing Mitigation Actions for Your Jurisdiction” sheet provided by the Hazard Mitigation Technical Steering Committee. The reviewers then looked at each proposed mitigation action and its preliminary prioritization, using the Prioritization Guidelines Scale and Projected Cost Scale provided, to assess if this prioritization was appropriate for Hartsburg or needed to be changed. Each mitigation action was discussed with an emphasis on its feasibility, importance to the welfare of the community, and the cost involved. The decisions of the reviewers were arrived at by discussion leading to consensus.	
The priority levels of the following actions were changed:	
<ul style="list-style-type: none"> • 5.0.2 Target Repetitive Loss Properties for flood buyout. Changed from High Priority to Medium Priority because of resistance of the owner to sell for buyout. • 5.0.3 Acquire properties susceptible to flood damage when buyout grants are available. Changed from High Priority to Medium Priority because of resistance of the owner to sell for buyout. 	
In addition, the City Council members changed the wording of the following actions:	
<ul style="list-style-type: none"> • 1.2.3 “Review and formalize relationships with cooling and warming centers in each community” changed to “Review and formalize plans for cooling and warming centers in each community.” The Priority Rating remained at Medium. • 3.2.5 “Build tornado safe room” to “Develop Church basement as tornado safe room” and assigned it a Medium Priority. 	
The following new mitigation action was added:	
<ul style="list-style-type: none"> • 2.2.5 Adopt the prevailing County storm water regulations once they are formalized by the County. This action was assigned a Medium Priority. 	
The priority ratings of the remaining mitigation actions were evaluated as appropriate for Hartsburg and approved as the final priority ratings by consensus.	
How was benefit vs. cost taken into account during prioritization?	
There was a discussion of the weight of each mitigation action in relation to its cost to the community (both in monetary and time/effort/management terms) and its importance to the welfare of community.	

Figure 4.11 b

Mitigation Actions for Hartsburg

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.2	Adopt Flood Insurance Rate Maps (FIRM) when updated.	FL	High	We are participating in revision meetings.	City Council		No Funds Necessary	Minimal	Basic to any flood actions	2012	Updated FIRMs adopted
1.1.4	Adopt prevailing county regulations concerning storm water once they are formalized.	FL	Medium	City Council will meet, review, and adopt.	City Council		Internal	Minimal	Protection of life and property	2011	Storm water regulations are adopted
1.1.5	Update Public Safety Joint Communications staff knowledge of earthquake safety.	EQ	High	A training will be held in 2010 and then on an ongoing basis.	Office of Emergency Management	Local Government	Internal Funds	Minimal	Enhanced safety/less injury and loss of life	2010 then Ongoing	Training attended
1.1.6	Have alternate power sources readily available for the electric needs of emergency vehicles and the buildings where they are located.	EQ, WW, T, WF	High	OEM will make recommendations to local public safety entities.	Office of Emergency Management	City Council	Internal Funds / Program Funds	Moderate	Emergency Preparedness	Ongoing	Alternative power sources available (i.e. generator)

Figure 4.11 c

Mitigation Actions for Hartsburg

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.7	Continue monthly testing of outdoor warning sirens in compliance with procedures set by the Office of Emergency Management.	T, WW	High	The warning systems are automatically tested through a contracted company; a check system is in place to ensure the sirens are functioning properly.	Office of Emergency Management		Internal Funds	Moderate	Sirens are in proper working order and sound when needed.	Ongoing	Regular testing
1.2.3	Review and formalize plans for cooling and warming centers in each community.	H	Medium	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life.	Ongoing	Agreements in Place
2.1.1	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.	FL, LF	High	Attend SEMA meetings re: this topic. Be available to town residents when building or remodeling; issue building permits accordingly.	City Council		Internal Funds	Minimal	Protection of Property	Ongoing	Ordinances are enforced

Figure 4.11 d

Mitigation Actions for Hartsburg

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
2.1.2	Review and update flood damage prevention/floodplain management ordinances, in compliance with NFIP requirements, when current and correct D-FIRMs are available.	FL	High	Attend SEMA meetings re: this topic. Be available to town residents when building or remodeling; issue building permits accordingly.	City Council		Internal Funds	Minimal	Protection of Property	Ongoing	Ordinances are reviewed and updated (if update is needed)
2.1.6	Develop policy and enforcement regulations concerning burning permits.	WF	Medium	County meetings, town council meetings with Fire Department	City Council		Internal Funds	Minimal	Protection of life and property	2017	Policy in place and enforced
2.2.5	Adopt the prevailing County storm water regulations once they are formalized by the County.	FL	Medium	City Council will meet, review, and adopt.	City Council		Internal Funds	Minimal	Protection of life and property	2011	Storm water regulations are adopted
3.2.1	Ensure evacuation plans are adequate for special needs populations.	EQ, WW, T	High	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Evacuation plans are in place

Figure 4.11 e

Mitigation Actions for Hartsburg

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.5	Develop church basement as tornado safe room.	T	Medium	Discuss with Church Council; gain their approval; inform citizenry.	City Council	Peace United Church of Christ	Internal Funds	Minimal	Protection of life	2011	Safe area is developed
3.2.6	Encourage shelters to have alternative heating sources.	EQ, T, WW	Low	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Alternative heating is available
4.0.1	Continue to educate the public on natural hazards.	DF, DR, EQ, H, FL, SK, WW, T, WF	High	This is an ongoing activity of the Office of Emergency Management and is carried out through press releases and available literature.	Office of Emergency Management	Local Media	Program Funds	Minimal	Life and Property Protection	Ongoing	Natural hazard education for public occurs.
4.0.2	Maintain and distribute materials for public regarding earthquakes in Missouri and the benefits and availability of earthquake insurance.	EQ	Medium	This will be part of the general public education on natural hazards.	Office of Emergency Management		Program Funds	Minimal	Life and Property Protection	Ongoing	Materials are available and distributed.

Figure 4.11 f

Mitigation Actions for Hartsburg

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
4.0.3	Continue to help the public realize the liability and responsibility for maintaining dams on private property.	DF	Low	This will be part of the general public education on natural hazards.	Office of Emergency Management		Program Funds	Minimal	Life and Property Protection	Ongoing	Public education takes place.
5.0.2	Target Repetitive Loss Properties for flood buyout.	FL	Medium	Review info from SEMA/FEMA	City Council	SEMA/FEMA	Program Funds	Minimal	Reduce Property Buyout expenditures	Ongoing	Properties are targeted.
5.0.3	Acquire properties susceptible to flood damage when buyout grants are available.	FL	Medium	Discuss with targeted homeowners to learn of their willingness to participate in Buyout.	City Council	SEMA/FEMA	FEMA Grant Funds	Minimal	Reduce subsequent flood damage expenditures	Ongoing	Properties are acquired.

4.4.7 Huntsdale

Figure 4.12 a	
Mitigation Action Process for Huntsdale	
Contact:	Debby Lancaster
Position:	Mayor
Who was involved in reviewing the mitigation actions?	
All the members of the community	
What process did you use to prioritize the actions for your community?	
<p>A community meeting was held to review the “Information and Guidelines for Assessing Mitigation Actions for Your Jurisdiction” sheet provided by the Hazard Mitigation Technical Steering Committee. The community members looked at each mitigation action suggested for Huntsdale by the Technical Steering Committee. Some of the suggested actions (1.1.6, 1.1.7, 1.1.10, 1.2.2, 2.2.3, 3.2.1, 3.2.5, 3.2.6, and 5.0.1) did not receive adequate community support so they were removed from the list of mitigation actions. The community members reviewed the preliminary priority ratings of the remaining actions, using the Prioritization Guidelines Scale and Projected Cost Scale provided, to assess if the priority ratings were appropriate for Huntsdale or needed to be changed.</p> <p>It was decided that the preliminary priority ratings for the mitigation actions were appropriate for Huntsdale and would be approved as the final priority ratings. This decision was discussed in “Public Comments” and was a consensus of the citizens in attendance.</p>	
How was benefit vs. cost taken into account during prioritization?	
There is no cost to the community for any of the mitigation actions chosen.	

Figure 4.12 b

Mitigation Actions for Huntsdale

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.3	Become a participant in the NFIP.	FL	High	Working on application with FEMA	City Council		None	None	Mitigate loss from flood damage	Ongoing	Participation in NFIP
1.1.5	Update Public Safety Joint Communications staff knowledge of earthquake safety.	EQ	High	A training will be held in 2010 and then on an ongoing basis.	Office of Emergency Management	Local Government	Internal Funds	Minimal	Enhanced safety/less injury and loss of life	2010 then Ongoing	Training attended
1.2.1	Encourage electric utilities to maintain right of ways.	WW, T, WF	High	Continue communication with utilities	City Council		No Funds Necessary	None	Utilities are functional during and after storm events	Ongoing	Right of ways are maintained
1.2.3	Review and formalize relationships with cooling and warming centers in each community.	H	Medium	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life.	Ongoing	Agreements in Place
2.1.6	Develop policy and enforcement regulations concerning burning permits.	WF	Medium	Huntsdale uses DNR's regulations on burning.	City Council		Internal Funds	None	Reduce fire hazard	Ongoing	Policy is in place and enforced

Figure 4.12 c

Mitigation Actions for Huntsdale

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
2.2.2	Encourage adoption of building codes in every incorporated community.	EQ, WW, T, WF	High	Use of International Building Codes	City Council		No funds necessary	None	Life and Property Protection	Ongoing	Codes are adopted
4.0.1	Continue to educate the public on natural hazards.	DF, DR, EQ, H, FL, SK, WW, T, WF	High	This is an ongoing activity of the Office of Emergency Management and is carried out through press releases and available literature.	Office of Emergency Management	Local Media	Program Funds	Minimal	Life and Property Protection	Ongoing	Natural hazard education for public occurs.
4.0.2	Maintain and distribute materials for public regarding earthquakes in Missouri and the benefits and availability of earthquake insurance.	EQ	Medium	This will be part of the general public education on natural hazards.	Office of Emergency Management		Program Funds	Minimal	Life and Property Protection	Ongoing	Materials are available and distributed.

Figure 4.12 d

Mitigation Actions for Huntsdale

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
4.0.3	Continue to help the public realize the liability and responsibility for maintaining dams on private property.	DF	Low	This will be part of the general public education on natural hazards.	Office of Emergency Management		Program Funds	Minimal	Life and Property Protection	Ongoing	Public education takes place.

4.4.8 Rocheport

Figure 4.13 a	
Mitigation Action Process for Rocheport	
Contact:	John Zondca
Position:	Mayor
Who was involved in reviewing the mitigation actions? The Mayor, City Aldermen, and City Clerk	
What process did you use to prioritize the actions for your community? <p>The “Information and Guidelines for Assessing Mitigation Actions for Your Jurisdiction” sheet provided by the Hazard Mitigation Technical Steering Committee was reviewed at a City Council meeting. The reviewers then looked at each proposed mitigation action and its preliminary prioritization, using the Prioritization Guidelines Scale and Projected Cost Scale provided, to assess if this prioritization was appropriate for Rocheport or needed to be changed. The individual mitigation actions were discussed until a consensus was reached on each one.</p> <p>It was decided that the preliminary priority ratings were appropriate for Rocheport and would be approved as the final priority ratings.</p> <p>In addition, the following mitigation action was added for Rocheport:</p> <p>3.1.3 Evaluate and implement effective strategies to mitigate flooding at the wastewater treatment plant in Rocheport. This action was assigned a High Priority level.</p>	
How was benefit vs. cost taken into account during prioritization? The mitigation actions being undertaken have little or no cost for the city except for 3.1.3 (mitigate flooding at wastewater treatment plant). It was decided that this action was important enough that it be given a High Priority even though it would result in significant local cost. Grant funding to assist with this project will be sought.	

Figure 4.13 b

Mitigation Actions for Rocheport

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.2	Adopt Flood Insurance Rate Maps (FIRM) when updated.	FL	High	FIRM will be adopted after it is adopted by County	City Aldermen		No Funds Necessary	Minimal	Citizens able to purchase NFIP flood insurance	2012	Updated FIRMs adopted
1.1.5	Update Public Safety Joint Communications staff knowledge of earthquake safety.	EQ	High	A training will be held in 2010 and then on an ongoing basis.	Office of Emergency Management		Internal Funds	Minimal	Enhanced safety/less injury and loss of life	2010 then Ongoing	Training attended
1.1.6	Have alternate power sources readily available for the electric needs of emergency vehicles and the buildings where they are located.	EQ, WW, T, WF	High	OEM will make recommendations to local public safety entities.	Office of Emergency Management		Internal Funds / Program Funds	Minimal	Emergency Preparedness	Ongoing	Alternative power sources available
1.1.7	Continue monthly testing of outdoor warning sirens in compliance with procedures set by the Office of Emergency Management.	T, WW	High	The warning systems are automatically tested through a contracted company; a check system is in place to ensure the sirens are functioning properly.	Office of Emergency Management		Internal Funds	Moderate	Sirens are in proper working order and sound when needed.	Ongoing	Regular testing

Figure 4.13 c

Mitigation Actions for Rocheport

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.10	Encourage cooperative agreements between municipalities and water supply districts to ensure adequate supply for fire flow.	WF	Medium	Agreements are currently in place with Boone County Water District #1	City Aldermen	Boone County Water District #1	No funds necessary	Minimal	Protection of life and property	Ongoing	Agreements in Place
1.2.1	Encourage electric utilities to maintain right of ways.	WW, T, WF	High	City will continue dialogue and monitoring maintenance of right of ways	Mayor	Boone Electric Cooperative	No Funds Necessary	Minimal	Utilities are operational during and after storm events	Ongoing	Right of ways are maintained
1.2.3	Review and formalize relationships with cooling and warming centers in each community.	H	Medium	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Agreements in Place
2.1.1	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.	FL	High	Enforcement is an ongoing process	Mayor and City Aldermen	Planning and Zoning Commission	Internal Funds	Minimal	Protection of life and property	Ongoing	Ordinances are enforced

Figure 4.13 d

Mitigation Actions for Rocheport

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
2.1.2	Review and update flood damage prevention/floodplain management ordinances, in compliance with NFIP requirements, when current and correct D-FIRMs are available.	FL	High	Ordinances will be reviewed and updated, as required	Mayor and City Aldermen	Planning and Zoning Commission	Internal Funds	Minimal	Protection of life and property	Ongoing	Ordinances are reviewed and updated (if update is needed)
3.1.3	Evaluate and implement effective strategies to mitigate flooding at the wastewater treatment plant in Rocheport.	FL	High	Various solutions to the flooding will be researched and the most effective/cost effective one will be implemented when funding is available.	Mayor and City Aldermen		FEMA Mitigation Grants/Local match	Significant	Protection of property	2015	Flooding at Wastewater Treatment Plant has been effectively mitigated.
3.2.1	Ensure evacuation plans are adequate for nursing homes and special needs populations.	EQ, WW, T	High	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Evacuation plans are in place

Figure 4.13 e

Mitigation Actions for Rocheport

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.6	Encourage shelters to have alternative heating sources.	EQ, T, WW	Low	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Alternative heating is available
4.0.1	Continue to educate the public on natural hazards.	DF, DR, EQ, H, FL, SK, WW, T, WF	High	This is an ongoing activity of the Office of Emergency Management and is carried out through press releases and available literature.	Office of Emergency Management	Local Media	Program Funds	Minimal	Life and Property Protection	Ongoing	Natural hazard education for public occurs.
4.0.2	Maintain and distribute materials for public regarding earthquakes in Missouri and the benefits and availability of earthquake insurance.	EQ	Medium	This will be part of the general public education on natural hazards.	Office of Emergency Management		Program Funds	Minimal	Life and Property Protection	Ongoing	Materials are available and distributed.

Figure 4.13 f

Mitigation Actions for Rocheport

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
5.0.3	Acquire properties susceptible to flood damage when buyout grants are available.	FL	High	This will be done if, and when, grant money becomes available.	City Aldermen	Planning and Zoning Commission	FEMA Grant Funds	Minimal	Protection of life and property	Ongoing	Properties are acquired.

4.4.9 Sturgeon

Figure 4.14 a	
Mitigation Action Process for Sturgeon	
Contact:	Gene Kelly
Position:	Mayor
Who was involved in reviewing the mitigation actions? Mayor Gene Kelly and the City Council	
What process did you use to prioritize the actions for your community? The “Information and Guidelines for Assessing Mitigation Actions for Your Jurisdiction” sheet provided by the Hazard Mitigation Technical Steering Committee was reviewed by Mayor Gene Kelly. The Mayor then looked at each proposed mitigation action and its preliminary prioritization, using the Prioritization Guidelines Scale and Projected Cost Scale provided, to assess if this prioritization was appropriate for Sturgeon or needed to be changed. Mayor Kelly discussed the major issues with the City Council at a Council Meeting. There was a consensus that the preliminary priority ratings were appropriate for Sturgeon and would be approved as the final priority ratings.	
How was benefit vs. cost taken into account during prioritization? Safety and the best interests of the community were placed as the first consideration and then the city budget was taken into account. The only two actions which would result in significant local cost are 3.1.2 (replace water lines for adequate fire flow) and 3.2.5 (build tornado safe room). Both of these actions were given high priority because they have to do with community safety. Discussions are underway re: possible grant funds to help with these projects.	

Figure 4.14 b

Mitigation Actions for Sturgeon

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.2	Adopt Flood Insurance Rate Maps (FIRM) when updated.	FL	High	City plans to adopt when maps are available.	Board of Aldermen		No Funds Necessary	None	Better defines flood areas	2012	Updated FIRMs adopted
1.1.5	Update Public Safety Joint Communications staff knowledge of earthquake safety.	EQ	High	A training will be held in 2010 and then on an ongoing basis.	Office of Emergency Management	Local Government	Internal Funds	Minimal	Enhanced safety/less injury and loss of life	2010 then Ongoing	Training attended
1.1.6	Have alternate power sources readily available for the electric needs of emergency vehicles and the buildings where they are located.	EQ, WW, T, WF	High	OEM will make recommendations to local public safety entities.	Office of Emergency Management	Local Government	Internal Funds / Program Funds	Minimal	Emergency Preparedness	Ongoing	Alternative power sources available
1.1.7	Continue monthly testing of outdoor warning sirens in compliance with procedures set by the Office of Emergency Management.	T, WW	High	The warning systems are automatically tested through a contracted company; a check system is in place to ensure the sirens are functioning properly.	Office of Emergency Management		Internal Funds	Moderate	Sirens are in proper working order and sound when needed.	Ongoing	Regular testing

Figure 4.14 c

Mitigation Actions for Sturgeon

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
1.1.9	Encourage the local water district to have adequate fire flow.	WF	Medium	Will discuss with WD #10.	Mayor	Board of Aldermen	No funds necessary	None	Better fire protection	Ongoing	Water district has adequate fire flow
1.2.1	Encourage electric utilities to maintain right of ways.	WW, T, WF	High	Haven't received any complaints.	Mayor/Board of Aldermen	AmerenUE	No Funds Necessary	Minimal	Safer and more attractive	Ongoing	Right of ways are maintained
1.2.2	Encourage underground utilities in improvements and new development.	WW, T, WF	High	Ameren UE will be encouraged to go underground when possible.	Mayor/Board of Aldermen	AmerenUE	No Funds Necessary	Minimal	Safer and more attractive	Ongoing	Utilities are underground in new developments
1.2.3	Review and formalize relationships with cooling and warming centers in each community.	H	Medium	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life.	Ongoing	Agreements in Place
2.1.1	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.	FL	High	Will continue the floodplain program the city has in place.	Mayor/Board of Aldermen		Internal Funds	Minimal	Prevent building in areas that flood.	Ongoing	Ordinances are enforced

Figure 4.14 d

Mitigation Actions for Sturgeon

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
2.1.2	Review and update flood damage prevention/floodplain management ordinances, in compliance with NFIP requirements, when current and correct D-FIRMs are available.	FL	High	Recent check by a floodplain representative said our program looked adequate.	Mayor/Board of Aldermen		Internal Funds	Minimal	Prevent building in areas that flood.	Ongoing	Ordinances are reviewed and updated (if update is needed)
2.1.6	Develop policy and enforcement regulations concerning burning permits.	WF	Medium	A new ordinance is being considered at our Jan. 2010 meeting.	Mayor/Board of Aldermen		Internal Funds	Minimal	Safer and prevents bad odors.	2010	Policy is in place and enforced
3.1.2	Replace 2, 3, and 4 inch water lines with 6 inch lines to ensure adequate supply for fire flow.	WF	Medium	Plan to have additional meetings with WD #10 to insure we have adequate water. Working with Mid-MO RPC on water grants.	Mayor/Board of Aldermen	WD #10	Federal grants/local match	High	Better fire protection	2015	Water lines replaced

Figure 4.14 e

Mitigation Actions for Sturgeon

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.1	Ensure evacuation plans are adequate for nursing homes and special needs populations.	EQ, WW, T	High	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Evacuation plans are in place
3.2.5	Build tornado safe room.	T	High	Being discussed with Mid-MO RPC.	Public Safety Committee	Mayor/Board of Aldermen	FEMA Pre-disaster Mitigation Grant Program, Local Match	High	Protection of life.	2015	Safe room is built.
3.2.6	Encourage shelters to have alternative heating sources.	EQ, T, WW	Low	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.	Office of Emergency Management	Red Cross	Internal Funds	Minimal	Protection of life	Ongoing	Natural hazard education for public occurs.
4.0.1	Continue to educate the public on natural hazards.	DF, DR, EQ, H, FL, SK, WW, T, WF	High	This is an ongoing activity of the Office of Emergency Management and is carried out through press releases and available literature.	Office of Emergency Management	Local Media	Program Funds	Minimal	Life and Property Protection	Ongoing	Natural hazard education for public occurs.

Figure 4.14 f

Mitigation Actions for Sturgeon

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
4.0.2	Maintain and distribute materials for public regarding earthquakes in Missouri and the benefits and availability of earthquake insurance.	EQ	Medium	This will be part of the general public education on natural hazards.	Office of Emergency Management		Program Funds	Minimal	Life and Property Protection	Ongoing	Materials are available and distributed.
4.0.3	Continue to help the public realize the liability and responsibility for maintaining dams on private property.	DF	Low	This will be part of the general public education on natural hazards.	Office of Emergency Management		Program Funds	Minimal	Life and Property Protection	Ongoing	Public education takes place.
5.0.1	Adopt procedures for review of subdivision plans to minimize flood problems.	FL	Medium	No new subdivision in floodplain at time.	Mayor/Board of Aldermen		No Funds Necessary	Minimal	Life and Property Protection	Ongoing	Procedures are adopted.

4.4.10 Centralia R-VI School District

<p>Figure 4.15 a</p> <p align="center">Mitigation Action Process for Centralia R-VI School District</p>	
Contact:	Darin Ford
Position:	Superintendent
<p>Who was involved in reviewing the mitigation actions? Superintendent Darin Ford; Tom Fair, School Resource Officer; Safety Committee</p>	
<p>What process did you use to prioritize the actions for your community?</p> <ul style="list-style-type: none"> • 3.2.2, 3.2.3, and 3.2.4 – These actions were prioritized for all the participating educational institutions at the Educators Meeting on Dec. 11, 2009. The prioritization was accomplished by discussion leading to consensus (see Section 4.4 Educational Institutions). • 3.2.5 – The District’s School Resource Officer heads up a safety committee that identifies critical issues. We have repeatedly looked at and revisited our tornado procedures within the district and still have numerous concerns surrounding the safety of our students and staff. One issue in Centralia is that our landscape is so flat and the water table so high that basements are rare in our community. We have discussed concern with the City manager as well and the possibility of a community solution. There was a consensus among those involved on the need and importance of additional resources for tornado safety (such as a tornado safe room) but also recognition of the significant cost of such a project and need for outside funds; for these reasons, a priority of medium was assigned to the building of a tornado safe room. 	
<p>How was benefit vs. cost taken into account during prioritization?</p> <ul style="list-style-type: none"> • 3.2.2, 3.2.3, and 3.2.4 – Established at the Educators Meeting that these actions are already being covered in the operating budgets of all educational institutions because their benefit is so great. • 3.2.5 – Obviously, the benefits are great for our students and our community. However, it is cost prohibitive when you consider all of the other expenses that go into educating children. Sometimes large safety projects like this one are hard to justify without assistance. 	

Figure 4.15 b

Mitigation Actions for Centralia R-VI School District

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.2	Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.	EQ	High	Continue to instruct and train the students and staff of Centralia R-6	Safety Coordinator		NA	None	Avoidance of potential student and staff injury or death	Ongoing	Actions outlined in RSMO are carried out
3.2.3	Evaluate and maintain emergency preparedness plans.	EQ, T	High	Centralia R-6 safety committee will continue to evaluate plans and drills	Safety Coordinator	Administration	NA	None	Avoidance of injury or death due to confusion or not knowing how to react	Ongoing	Plans are evaluated and maintained
3.2.4	Conduct emergency preparedness exercises periodically throughout the year.	EQ, T	High	Centralia R-6 safety committee will continue to conduct drills and include local emergency agencies	Safety Committee	Local emergency agencies	NA	None	Avoidance of injury and confusion of staff and students	Ongoing	Plans and drills are conducted

Figure 4.15 c

Mitigation Actions for Centralia R-VI School District

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.5	Build tornado safe rooms.	T	Medium	Increase the safeness of our tornado refuge areas	Safety Committee	Administration	Grants	Significant	Increase the safety of each building	Unknown	Building project completed

4.4.11 Columbia Public Schools

Figure 4.16 a	
Mitigation Action Process for Columbia Public Schools	
Contact:	Preston Bass
Position:	Coordinator of Safety and Security
Who was involved in reviewing the mitigation actions? Nick Boren, Deputy Superintendent and Preston Bass, Coordinator of Safety and Security	
What process did you use to prioritize the actions for your community? <ul style="list-style-type: none">• 3.2.2, 3.2.3, and 3.2.4 – These actions were prioritized for all the participating educational institutions at the Educators Meeting on Dec. 11, 2009. The prioritization was accomplished by discussion leading to consensus (see Section 4.4 Educational Institutions).• 3.2.5 – The reviewers discussed this action and came to a consensus that the Priority should be Medium based on the perceived need and the cost involved.	
How was benefit vs. cost taken into account during prioritization? <ul style="list-style-type: none">• 3.2.2, 3.2.3, and 3.2.4 – Established at the Educators Meeting that these actions are already being covered in the operating budgets of all educational institutions because their benefit is so great.• 3.2.5 – Discussed that building a tornado safe room would be advantageous but there would be a significant local match, even if grant funds were obtained.	

Figure 4.16 b

Mitigation Actions for Columbia Public Schools

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.2	Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.	EQ	High	Columbia Public Schools will carry out the requirements of the Revised Statutes.	Columbia Public School Administration, Building Principals/Directors/Coordinators/Staff		NA	0	Prevent/reduce injury or possible death to students and staff	Ongoing	Actions as outlined in Revised Statutes are carried out
3.2.3	Evaluate and maintain emergency preparedness plans.	EQ, T	High	Columbia Public School administration will meet on a regular basis to evaluate our crisis plans.	Columbia Public School Administration		NA	0	To be proactive in trying to prevent or reduce the potential of injuries to students and staff	Ongoing	Emergency preparedness plans are evaluated and maintained

Figure 4.16 c

Mitigation Actions for Columbia Public Schools

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.4	Conduct emergency preparedness exercises periodically throughout the year.	EQ, T	High	Columbia Public Schools will continue to conduct emergency preparedness drills periodically per state mandates and recommendations.	Columbia Public School Administration, Building Principals/Directors/Coordinators/Staff		NA	0	To maintain a climate of awareness and to avoid confusion among staff and students that will prevent personal injury	Ongoing	Emergency preparedness exercises are conducted
3.2.5	Build tornado safe rooms.	T	Medium	Build tornado safe rooms as funding becomes available.	Columbia Public School Administration		FEMA Mitigation Grants/Local Matching Funds	High	Reduce injury to students and staff.	2018	Tornado safe rooms are built.

4.4.12 Southern Boone School District

Figure 4.17 a Mitigation Action Process for Southern Boone School District	
Contact:	Rick Briedwell
Position:	Building, Grounds & Transportation Director
Who was involved in reviewing the mitigation actions?	Rick Briedwell, Building, Grounds & Transportation Director
What process did you use to prioritize the actions for your community?	These actions were prioritized for all the participating educational institutions at the Educators Meeting on Dec. 11, 2009. The prioritization was accomplished by discussion leading to consensus (see Section 4.4 Educational Institutions).
How was benefit vs. cost taken into account during prioritization?	It was established at the Educators Meeting that these actions are already being covered in the operating budgets of all educational institutions because their benefit is so great.

Figure 4.17 b

Mitigation Actions for Southern Boone School District

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.2	Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.	EQ	High	Continue to instruct and train students and staff on earthquake emergency preparedness including sending out information concerning earthquake procedures.	Southern Boone Administration	N/A	N/A	0	Avoidance of potential student/staff injury or possible death	Ongoing	Actions outlined in Revised Statutes are carried out
3.2.3	Evaluate and maintain emergency preparedness plans.	EQ, T	High	Southern Boone Administration will continue to meet regularly to evaluate the crisis plan and flipchart.	Southern Boone Administration	N/A	N/A	0	Avoidance of potential student/staff injury or possible death due to confusion or uncertainty of how to react	Ongoing	Emergency Preparedness plans are evaluated and maintained

Figure 4.17 c

Mitigation Actions for Southern Boone School District

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.4	Conduct emergency preparedness exercises periodically throughout the year.	EQ, T	High	Southern Boone School District will conduct emergency preparedness drills periodically per state mandates and recommendation.	Southern Boone Principals/Staff	N/A	N/A	0	Avoidance of confusion among staff and students that may lead to personal injury	Ongoing	Emergency Preparedness drills are conducted

4.4.13 Sturgeon R-V School District

Figure 4.18 a	
Mitigation Action Process for Sturgeon R-V School District	
Contact:	Shawn Schulz
Position:	Superintendent
Who was involved in reviewing the mitigation actions?	Shawn Schulz, Superintendent
What process did you use to prioritize the actions for your community?	These actions were prioritized for all the participating educational institutions at the Educators Meeting on Dec. 11, 2009. The prioritization was accomplished by discussion leading to consensus (see Section 4.4 Educational Institutions).
How was benefit vs. cost taken into account during prioritization?	It was established at the Educators Meeting that these actions are already being covered in the operating budgets of all educational institutions because their benefit is so great.

Figure 4.18 b

Mitigation Actions for Sturgeon R-V School District											
Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.2	Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.	EQ	High	Continue to instruct and train students and staff on earthquake emergency preparedness including sending out information concerning earthquake procedures.	Sturgeon R-V School Administration		N/A	0	Avoidance of potential student/staff injury or possible death	Ongoing	Actions outlined in Revised Statutes are carried out.
3.2.3	Evaluate and maintain emergency preparedness plans.	EQ, T	High	Sturgeon R-V Crisis Committee will continue to meet regularly to evaluate the crisis plan and flipchart. Regularly scheduled drills and other needed drills will be discussed during the meetings also.	Crisis Committee Chairperson	Administration	N/A	0	Avoidance of potential student/staff injury or possible death due to confusion or uncertainty of how to react	Ongoing	Emergency preparedness plans are evaluated and maintained.

Figure 4.18 c

Mitigation Actions for Sturgeon R-V School District											
Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.4	Conduct emergency preparedness exercises periodically throughout the year.	EQ, T	High	Sturgeon R-V School District will conduct emergency preparedness drills periodically per state mandates and recommendation.	Sturgeon R-V School Principals/Staff		N/A	0	Avoidance of confusion among staff and students that may lead to personal injury	Ongoing	Emergency preparedness plans are conducted.

4.4.14 Stephens College

Figure 4.19 a	
Mitigation Action Process for Stephens College	
Contact:	Tony Coleman
Position:	Director of Campus Security
Who was involved in reviewing the mitigation actions?	Stephens College President Dianne Lynch and Tony Coleman, Director of Campus Security
What process did you use to prioritize the actions for your community?	These actions were prioritized for all the participating educational institutions at the Educators Meeting on Dec. 11, 2009. The prioritization was accomplished by discussion leading to consensus (see Section 4.4 Educational Institutions).
How was benefit vs. cost taken into account during prioritization?	It was established at the Educators Meeting that these actions are already being covered in the operating budgets of all educational institutions because their benefit is so great.

Figure 4.19 b

Mitigation Actions for Stephens College

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.2	Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.	EQ	High	Stephens College will instruct and train staff and faculty on earthquake emergency preparedness. In addition, information will be posted concerning campus earthquake procedures.	Campus Security and the Emergency Management Team		NA	0	Avoidance of potential injury or death to students and staff	Ongoing	Actions outlined in Revised Statutes are carried out.
3.2.3	Evaluate and maintain emergency preparedness plans.	EQ, T	High	Stephens College will continue to conduct regular meetings of the Emergency Management Team to evaluate our Emergency Operations Plan.	Stephens College Emergency Management Team, College President		NA	0	By review and implementation of the Emergency Operations Plan we hope to reduce potential injury or death to students and staff.	Ongoing	Emergency preparedness plans are evaluated and maintained.

Figure 4.19 c

Mitigation Actions for Stephens College

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.4	Conduct emergency preparedness exercises periodically throughout the year.	EQ, T	High	Stephens College will continue to conduct emergency preparedness drills and exercises per state and federal mandates and recommendations.	Stephens College Emergency Management Team		NA	0	Avoidance of potential injury or death to students and staff	Ongoing	Emergency preparedness exercises are conducted.

4.4.15 University of Missouri

Figure 4.20 a		Mitigation Action Process for University of Missouri	
Contact:	Peter Ashbrook	Position:	Director of Environmental Health and Safety
Who was involved in reviewing the mitigation actions? Peter Ashbrook, Director of Environmental Health and Safety			
What process did you use to prioritize the actions for your community? <ul style="list-style-type: none"> • 3.2.2, 3.2.3, and 3.2.4 – These actions were prioritized for all the participating educational institutions at the Educators Meeting on Dec. 11, 2009. The prioritization was accomplished by discussion leading to consensus (see Section 4.4 Educational Institutions). • 3.2.5 – This action was prioritized based on an informal assessment of the hazards the campus has experienced over the last 5 years, along with feedback from emergency exercises. 			
How was benefit vs. cost taken into account during prioritization? <ul style="list-style-type: none"> • 3.2.2, 3.2.3, and 3.2.4 – Established at the Educators Meeting that these actions are already being covered in the operating budgets of all educational institutions because their benefit is so great. • 3.2.5 - Tornado preparedness always comes out very high when assessing needs and priorities and the cost is minimal at this point. 			

Figure 4.20 b

Mitigation Actions for University of Missouri

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.2	Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.	EQ	High	Earthquake emergency preparedness is part of the MU Emergency Operations Plan.	Vice Chancellor for Administrative Services		General operating funds	Minimum	Avoidance of injury and death in earthquake situation.	Ongoing - emergency plans are reviewed periodically.	Earthquakes are addressed in both the MU Emergency Operations Plan and in building specific emergency plans that have been prepared for each campus building.
3.2.3	Evaluate and maintain emergency preparedness plans.	EQ, T	High	Emergency Operations Plan has been prepared and is a format very similar to the City/County Emergency Plan.	Vice Chancellor for Administrative Services	MU Police, MU Campus Facilities, MU Environmental Health & Safety	General operating funds	Moderate	Overall safety of students, staff, and faculty	Ongoing	Emergency preparedness plans are evaluated and maintained.

Figure 4.20 c

Mitigation Actions for University of Missouri

Action #	Mitigation Action	Hazards Addressed	Priority	Plan for Implementation and Administration	Lead Department or Agency	Partners, if any	Potential Funding Sources	Projected Cost	Benefits (Losses Avoided)	Projected Completion Date	Criterion for Completion
3.2.4	Conduct emergency preparedness exercises periodically throughout the year.	EQ, T	High	Six home football games, fire drills at residence halls and Greek houses each semester, periodic drills at the Research Reactor, Hospital, Athletics, and other departments.	Drills are usually developed and controlled by the local MU department.	MU Police, MU Campus Facilities and/or MU Environmental Health and Safety usually involved; City and/or County emergency response agencies also involved in some drills.	Departmental budgets	Moderate	The exercises increase the efficiency and effectiveness of emergency response at MU.	Ongoing	Emergency exercises are conducted.
3.2.5	Build tornado safe rooms.	T	High	Identify safe tornado refuge areas in each campus building.	MU Environmental Health and Safety	Contacts within each campus building	General campus operating budget	Minimum	Students, faculty, and staff have a place of safe refuge in each campus building.	Completed	Safe refuge locations are identified in each building. (Note: MU has been designated as a Storm Ready Campus by the National Weather Service.)

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 non-governmental 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 (see Figure 4.25). All potential projects must match the stated goals and objectives of the Boone County Hazard Mitigation Plan and the State of Missouri Hazard Mitigation Plan.

Figure 4.25

Eligible Activities for FEMA Mitigation Grant Programs

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

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; planners at the Mid-MO RPC are 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 in Figure 4.26. 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.

Figure 4.26

FEMA Mitigation Grant Programs			
Grant Program	Cost Share		Application
	Federal/Local Match	Notes	
HMGP	75/25		Paper
PDM	75/25		e-grants
PDM (Small Impoverished Community)	90/10	Qualification Requirements for "small impoverished": <ul style="list-style-type: none"> • A community of 3,000 or fewer individuals identified by the State as a rural community that is not a remote area within the corporate boundaries of a larger city • An average per capita annual income not exceeding 80 percent of the national per capita income, based on best available data. (For current information: http://www.bea.gov) • A local unemployment rate exceeding by 1 percentage point or more the most recently reported, average yearly national unemployment rate. (For current information: http://www.bls.gov/eag/eag.us.htm) • Meet other criteria required by the State/Tribe/Territory in which the community is located 	e-grants
FMA	75/25		e-grants
FMA (Severe Repetitive Loss Property)	90/10	In Missouri, this cost share is less than the usual 75/25 because the State has an approved "Enhanced" State Mitigation Plan.	e-grants
RFC	100/0	RFC is only available to applicants who cannot meet the cost share requirement of FMA.	e-grants
SRL	90/10	In Missouri, this cost share is less than the usual 75/25 because the State has an approved "Enhanced" State Mitigation Plan.	e-grants

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.

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

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

The Boone County Hazard Mitigation Plan will be monitored and evaluated on a yearly basis during the months of January and February, beginning in the year following approval and adoption. This would mean there will be four monitoring/evaluation periods (January/February 2011, January/February 2012, January/February 2013, and January/February 2014). The last monitoring and evaluation in 2014 will lead into the 5-year update process.

The monitoring and evaluation will be facilitated through the Mid-MO Regional Planning Commission. It will consist of the following:

1. Surveys will be sent to all participating jurisdictions for information including: mitigation actions which have been implemented in the jurisdiction, changes in priorities of mitigation actions within the jurisdiction, needs not addressed by the current plan. A sample survey is shown in Figure 5.1.
2. Survey information will be collated by planners at the Mid-MO RPC.
3. Meeting(s) of the Hazard Mitigation Technical Steering Committee will be convened by the Mid-MO RPC to discuss survey feedback, any changes in hazard risks in the county, and any other pertinent information.
4. A yearly report will be written and included as an addendum to the current plan.

Figure 5.1								
Yearly Survey of Mitigation Actions for (Sample)								
Action #	Mitigation Action	Priority	Plan for Implementation and Administration	Lead Department or Agency	Projected Completion Date	Criterion for Completion	Current Status of Mitigation Action	Comments
1.2.2	Encourage underground utilities in improvements and new development.	High	This is being done and will continue.	City Administrator	Ongoing	Utilities are underground in new developments		
2.1.6	Develop policy and enforcement regulations concerning burning permits.	Medium	Will write regulations for adoption by City Council	Dept of Public Works	2017	Policy is in place and enforced		
5.0.1	Adopt procedures for review of subdivision plans to minimize flood problems.	High	Adoption will come before Council in 2010	City Administrator	2010	Procedures are adopted.		
<p>Please indicate the current status of each mitigation action on the above chart. Please note any change to the priorities of actions.</p>								
<p>Are there any changes in your jurisdiction which may affect the content of the Boone County Hazard Mitigation Plan? If so, please describe.</p>								

5.2 Plan Updating

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

Assuming approval and adoption of the current plan occurs in the spring of 2010, the Boone County Hazard Mitigation Plan will need to be updated and reapproved by FEMA in the spring of 2015. A proposed schedule for the update is shown in Figure 5.2.

Figure 5.2		
Proposed Schedule for 5-year Update of Hazard Mitigation Plan		
KEY: PED = Plan Expiration Date		
Activity	Timeline to Begin	Responsible Party
Preliminary update of data	Yearly during maintenance/review of plan	Mid-MO RPC
Prepare cost estimates for update of plan and submit to SEMA	PED - 13 months	Mid-MO RPC
Receive Memorandum of Agreement from SEMA for update	PED - 11 months	SEMA
Review data for any additional updates	PED - 11 months	Mid-MO RPC
Contact participating jurisdictions re: representation on Technical Steering Committee for update of plan	PED - 10 months	Mid-MO RPC
Survey to participating jurisdictions re: capabilities, vulnerable assets, future development	PED - 10 months	Mid-MO RPC
Meetings to conduct preliminary review and update of plan	PED - 9 months	Technical Steering Committee
Public Meeting #1 for comment and input on draft update	PED - 7 months	Mid-MO RPC/Technical Steering Committee
Draft of update due at SEMA	PED - 6 months	Mid-MO RPC
Participating jurisdictions hold meetings to discuss plan and mitigation actions	PED - 6 months	Participating Jurisdictions
Public Meeting #2 for comment and input on final update	PED - 4 months	Mid-MO RPC/Technical Steering Committee
Final plan due at SEMA for review before submission to FEMA	PED - 3 months	Mid-MO RPC
Plan reviewed by SEMA	PED - 3 months	SEMA
Required changes/additions made to plan	PED - 2.5 months	Mid-MO RPC
Plan submitted to FEMA	PED - 2 months	SEMA
Participating jurisdictions adopt approved plan	PED - 1 month	Participating Jurisdictions

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

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

Dam Failure

Information from the mapping of the 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

HAZUS mapping is not currently available for Huntsdale. If this becomes available, it should be incorporated into the 2015 update.

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>

5.3 Integration of Hazard Mitigation into Other Planning Mechanisms

Requirement §201.6(c)(4)(ii):	<i>[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.</i>
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The Boone County Hazard Mitigation Plan will be integrated into the Boone County Emergency Operations Plan when it is updated each April. The EOP update is the responsibility of the Emergency Management Director and staff. The Emergency Operations Plan covers all jurisdictions within Boone County.

Specific information on integration of the plan into other planning mechanisms in the participating jurisdictions is shown in Figure 5.3 a-b.

Figure 5.3 a	
Integration of Mitigation Actions into Other Planning Mechanisms	
Participating Jurisdiction	Plan for Integration
Boone County	Prior to issuing any permit it is reviewed to determine proximity to designated flood areas. Critical sites are rejected and permits are not issued until an acceptable site is approved. Codes and regulations are annually scrutinized for currency and compliance with regulatory directions. Permitting staff receive periodic training on site location requirements and are trained to recognize potential conflicts during intake of permits.
Ashland	The Hazard Mitigation Plan will be reviewed annually when the Board of Aldermen sets priorities through the budgetary process; it will be reviewed during discussion of the 3-5 year Capital Improvement Program; it will be reviewed annually along with the Comprehensive Plan.
Centralia	In Centralia, recognition of the flood plain hazard is part of the comprehensive plan and current subdivision regulations. Studies have been performed for expansion of and improvements to the electric and water supply utilities. The recommendations of these studies are being incorporated into drafts of an updated comprehensive plan and capital improvement plans and budgets.
Columbia	The mitigation actions will be implemented by each department as part of the city's annual Capital Improvement Project (CIP) budgeting process.
Hallsville	The City of Hallsville will provide staff review of planned actions, ordinances, policies or development to formally evaluate their impact on the risks or consequences of the occurrence of natural hazards that occur in this area and any planned, existing or subsequent mitigation.
Hartsburg	Hartsburg is required to place FEMA/SEMA laws and regulations onto our books so we comply with their requirements. We have and will continue to put any relevant plans into our code and regulations and would enforce them as we do all others.
Huntsdale	Huntsdale has established/adopted permitting and building codes. Town council members attend training sponsored by the MML and any community training provided by OEM, Fire District, & Red Cross.
Rochepoint	The City annually reviews its capital improvement program and future planning needs; hazard mitigation actions will be reviewed during this process.
Sturgeon	Sturgeon keeps a priority list of things being worked on along with names of people responsible for the work and expected completion dates; the hazard mitigation actions will be added to this list as priority dictates.

Figure 5.3 b	
Integration of Mitigation Actions into Other Planning Mechanisms	
Participating Jurisdiction	Plan for Integration
Centralia R-VI School District	The items outlined in the mitigation plan are on-going and part of the current emergency plans.
Columbia Public Schools	The earthquake emergency planning and other emergency preparedness plans/exercises are ongoing and integrated in the Emergency Response Plans; the action concerning building tornado safe rooms will be looked at and prioritized in the general planning process.
Southern Boone School District	The mitigation actions are ongoing and integrated into the Southern Boone Crisis Management Plan.
Sturgeon R-V School District	The district may use plan info in long range planning document. The district may incorporate policy changes using plan info. The district can help regulate district spending using plan info. Incorporating plan strategies can change job duties. The district will train staff to carry out plan objectives.
Stephens College	Stephens College is a separate private entity for most practical purposes. Stephens does try to have planning documents and policies consistent with those of Boone County and the City of Columbia; however it may be necessary to establish individual policies based on circumstance. Stephens College complies with all local, state and federal permitting requirements and regulations. The information in the plan has little relevance, if any, to Stephens job descriptions. Stephens College staff training is conducted on a regular basis to meet the college needs. Stephens maintains a working relationship with the City and County with regards to emergency planning and exercises.
University of Missouri	The University of Missouri (MU) is a separate government entity for most practical purposes. MU strives to have planning documents and policies consistent with those of the City of Columbia and Boone County. For example, if MU policies are not followed, MU has administrative procedures to apply corrective actions; for the City and County, the governing body usually needs to take legal action against a private party. MU complies with state and federal permitting requirements; however, the City and County rarely have jurisdiction. Information in the Plan rarely has relevance to MU job descriptions. Staff training is generally performed to meet specific MU needs. MU has worked cooperatively with the City and County in emergency preparedness drills and planning.

5.4 Public Participation in Plan Maintenance

Requirement
§201.6(c)(4)(iii):

[The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

The Boone County Hazard Mitigation plan will remain continually available on the website of the Mid-Missouri Regional Planning Commission (www.mmrpc.org) 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 Boone 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
- Boone County Commissioners/Directors
- 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 Mid-MO RPC website and through the Mid-MO RPC 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.)

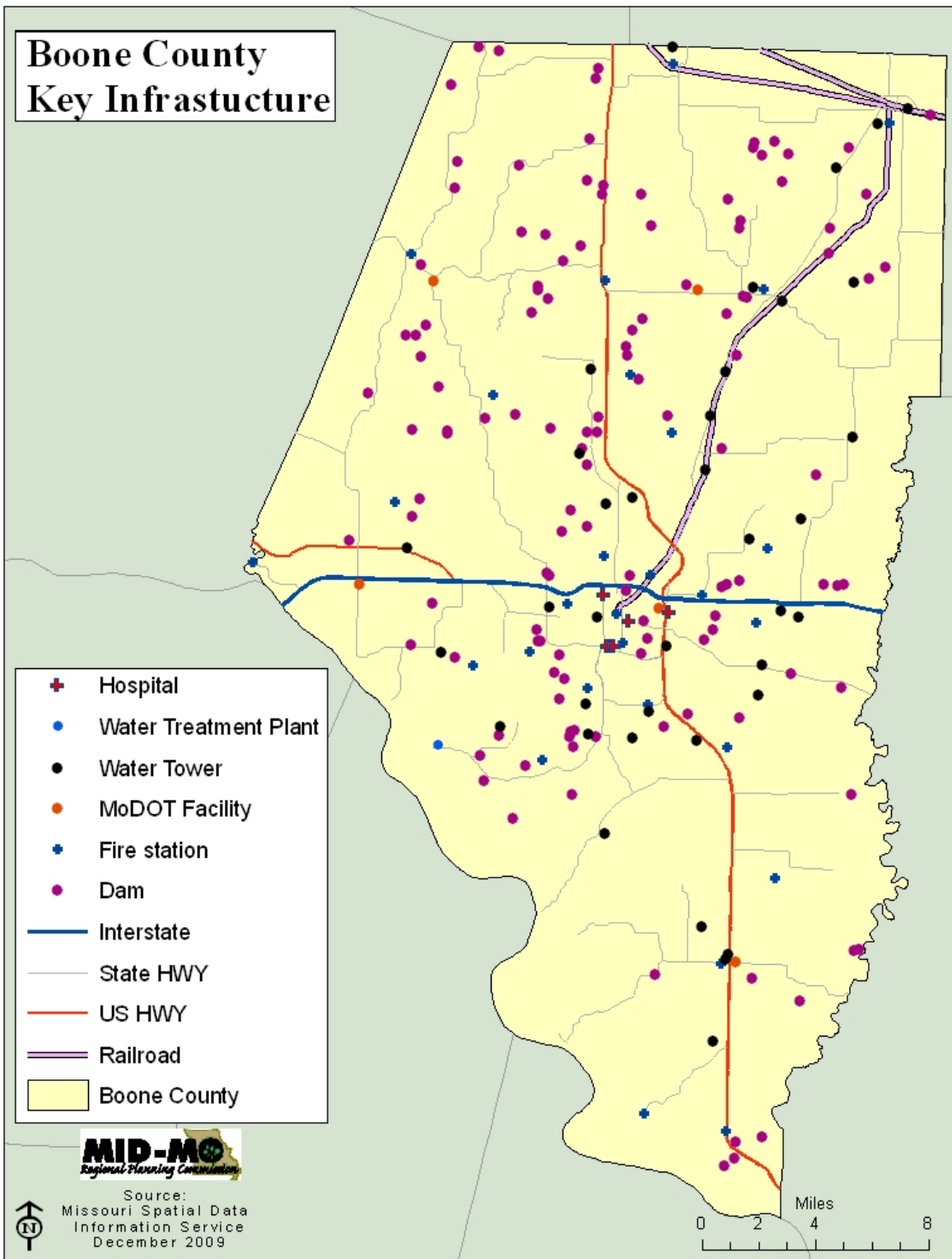
Section 6: Maps

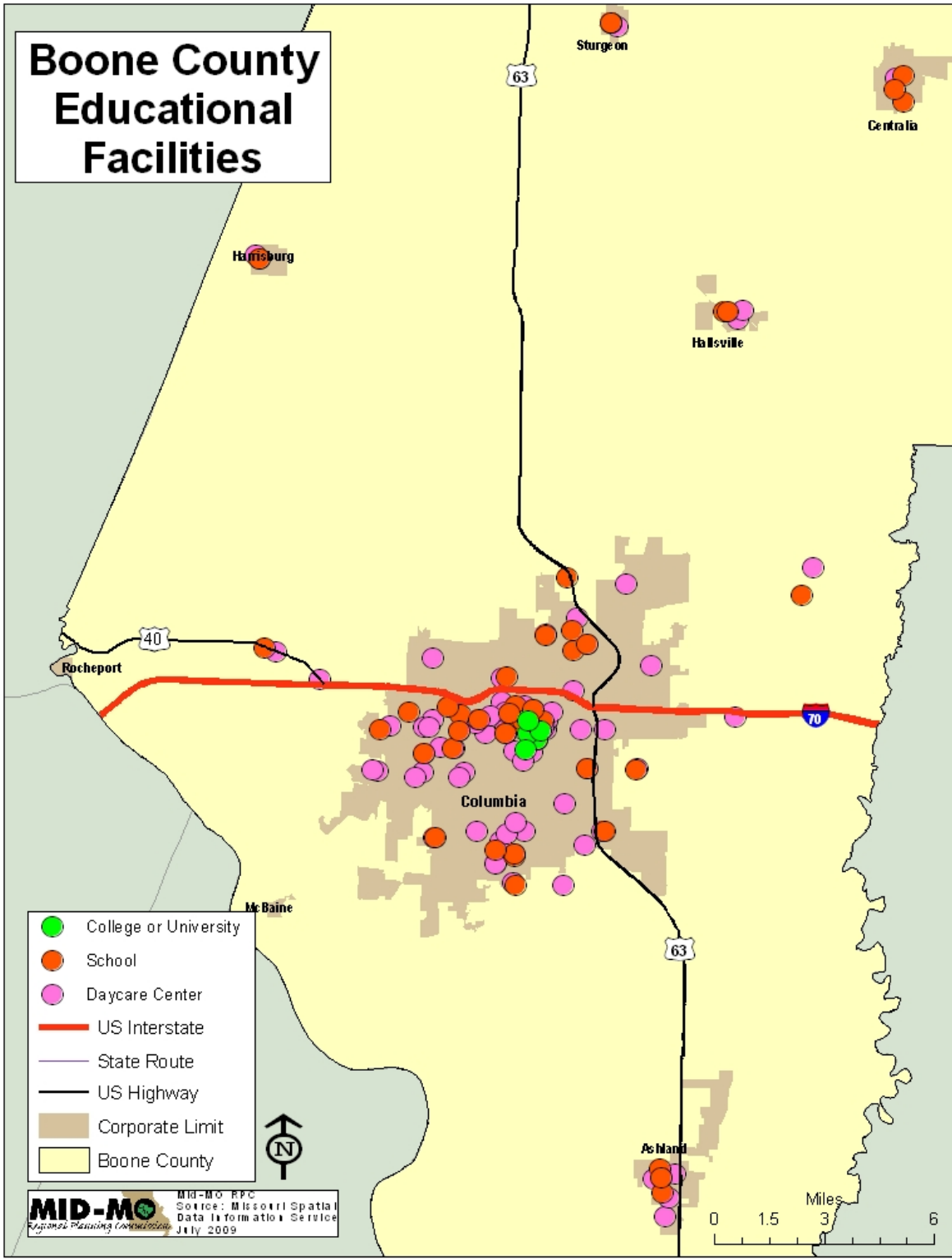
Planning Area - General

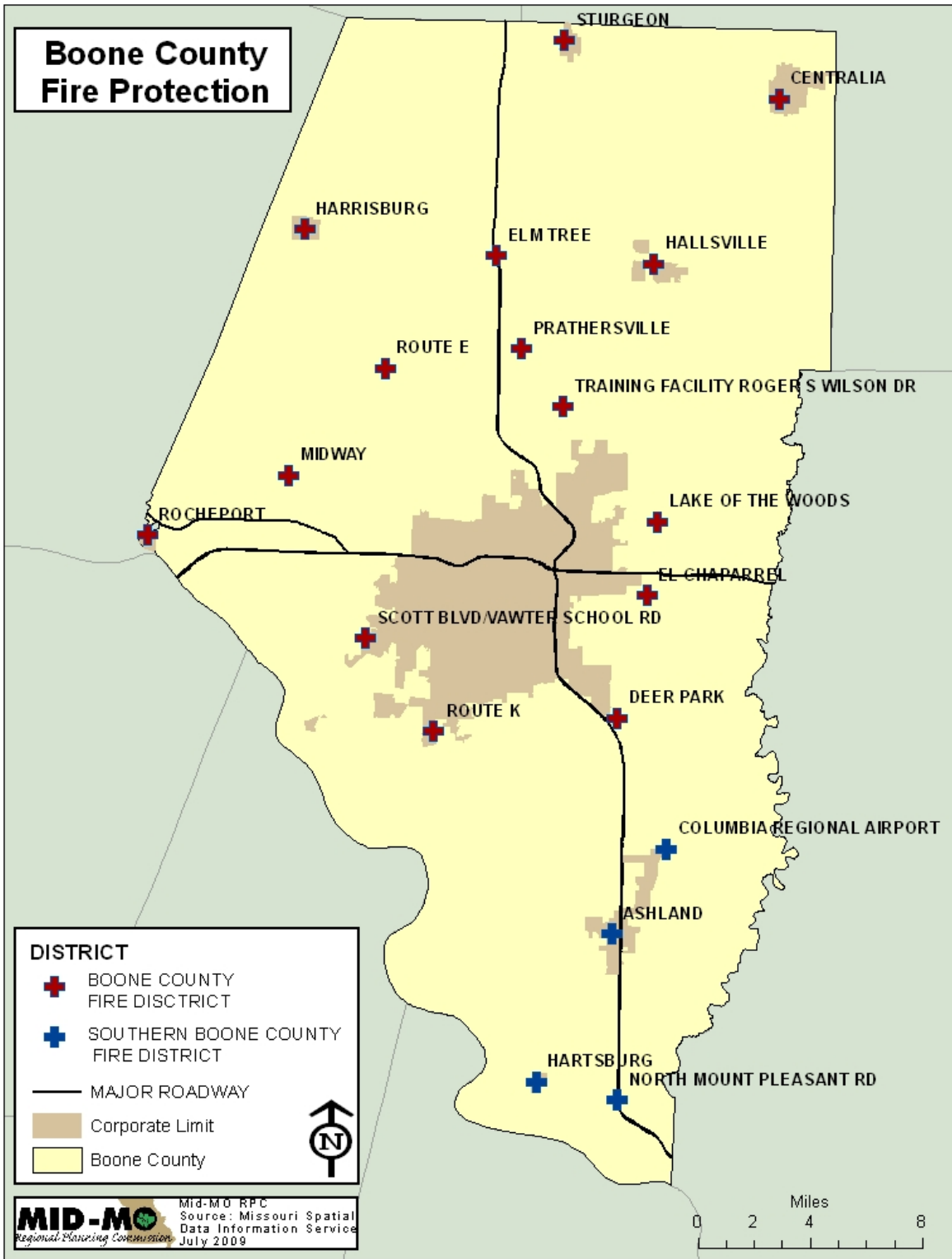
- **Boone County Key Infrastructure**
- **Boone County Educational Facilities**
- **Boone County Fire Protection**
- **Columbia Fire Protection**
- **Boone County Population Density**
- **Boone County Land Use/Land Cover**
- **Boone County Floodplains**
- **Boone County Healthcare Centers**
- **Boone County Transportation**

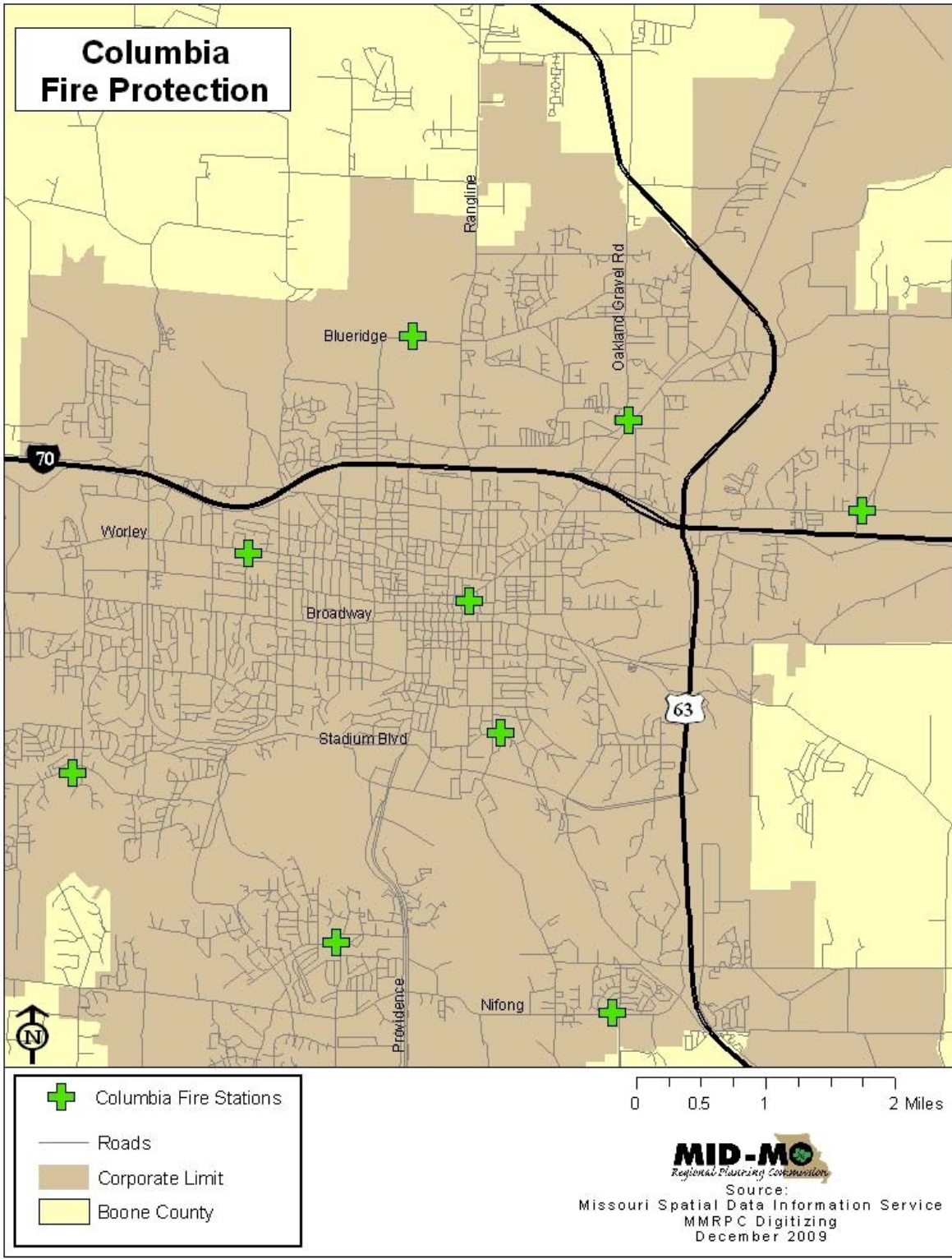
HAZUS Maps

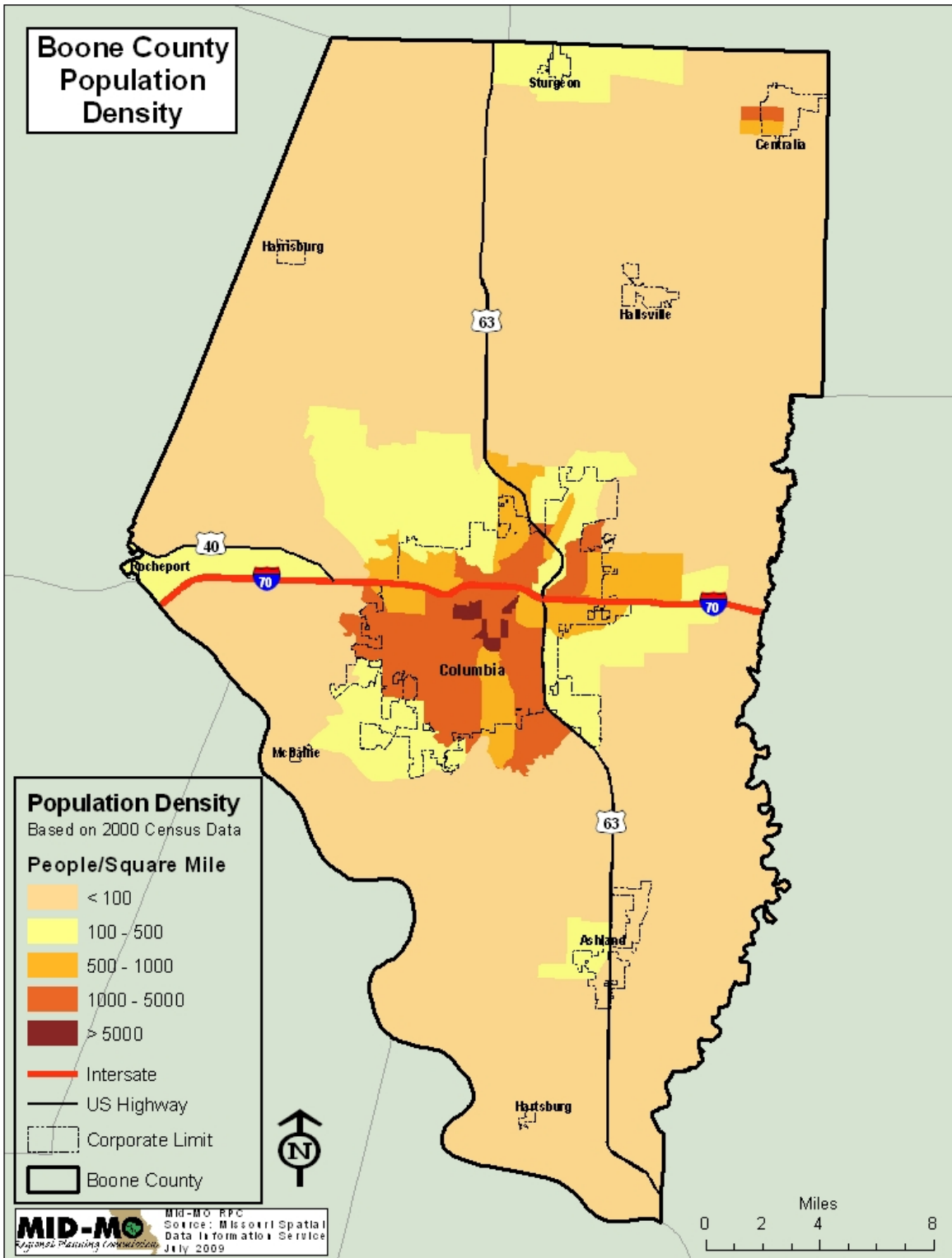
- **HAZUS Flood Map – Boone County**
- **HAZUS Flood Map – Centralia**
- **HAZUS Flood Map – Columbia**
- **HAZUS Flood Map – Columbia (NE)**
- **HAZUS Flood Map – Columbia (NW)**
- **HAZUS Flood Map – Columbia (SW)**
- **HAZUS Flood Map – Columbia (SE)**
- **HAZUS Flood Map – Hartsburg**
- **HAZUS Flood Map – Huntsdale**
- **HAZUS Flood Map – McBaine**
- **HAZUS Flood Map – Rocheport**
- **HAZUS Flood Map – Sturgeon**

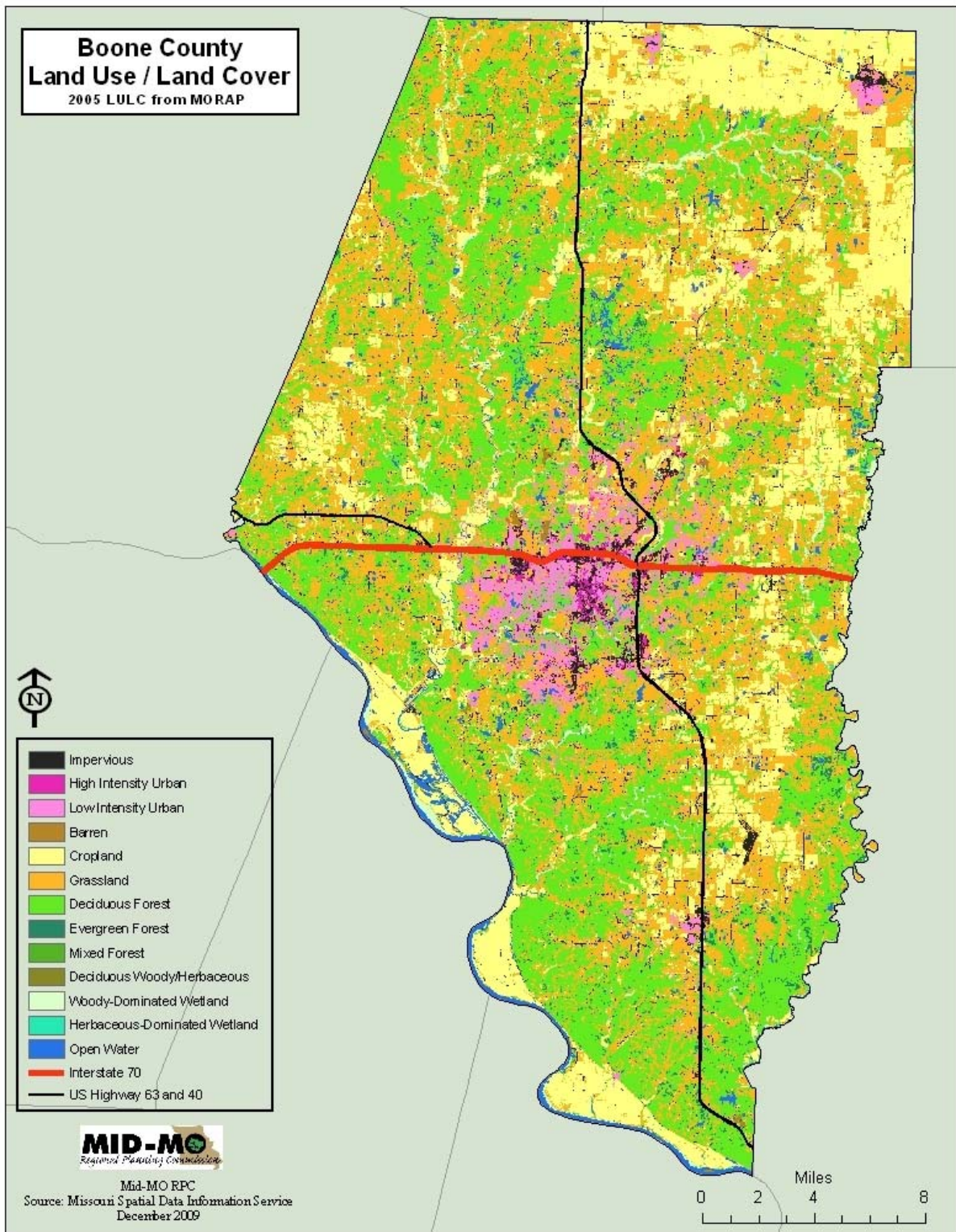


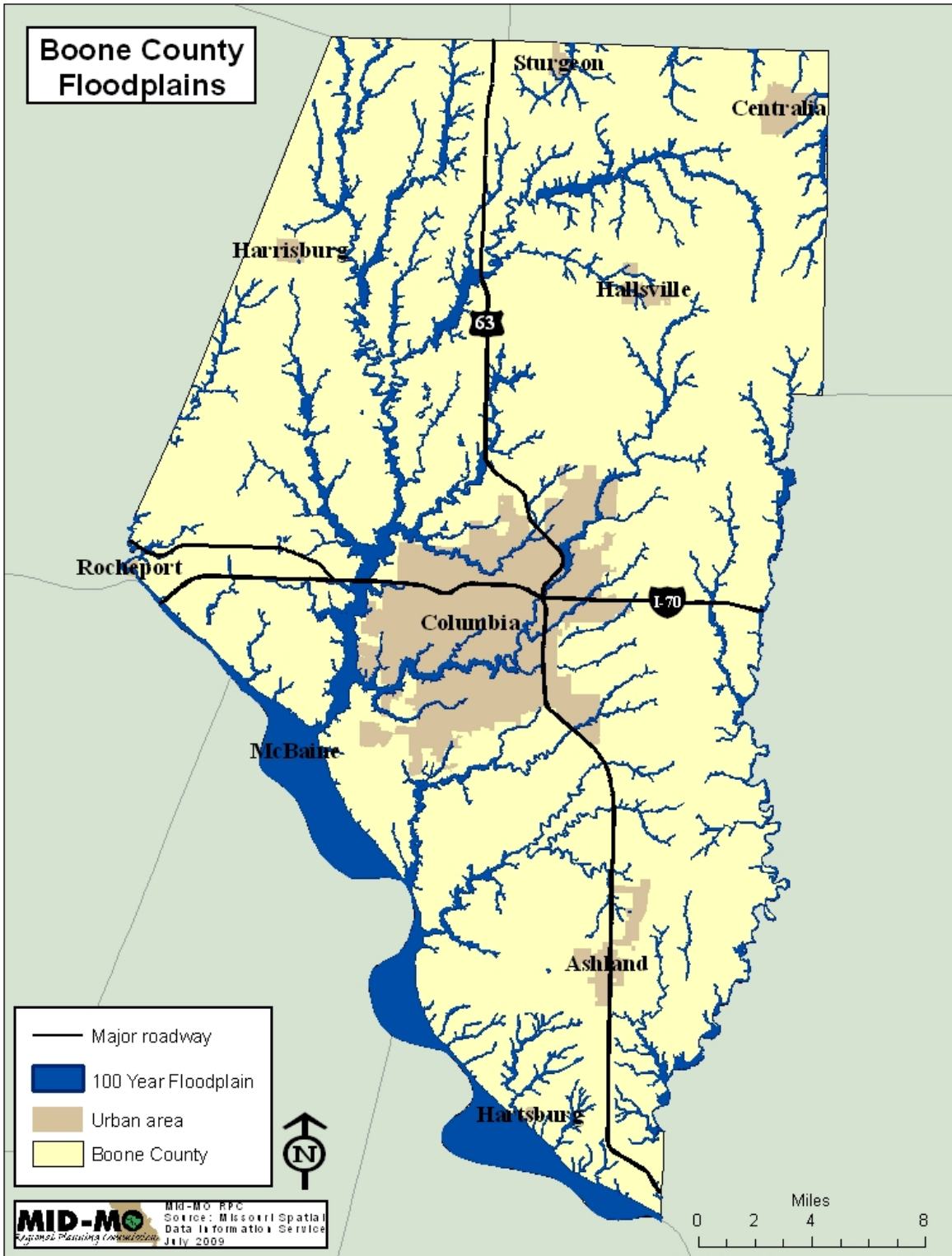


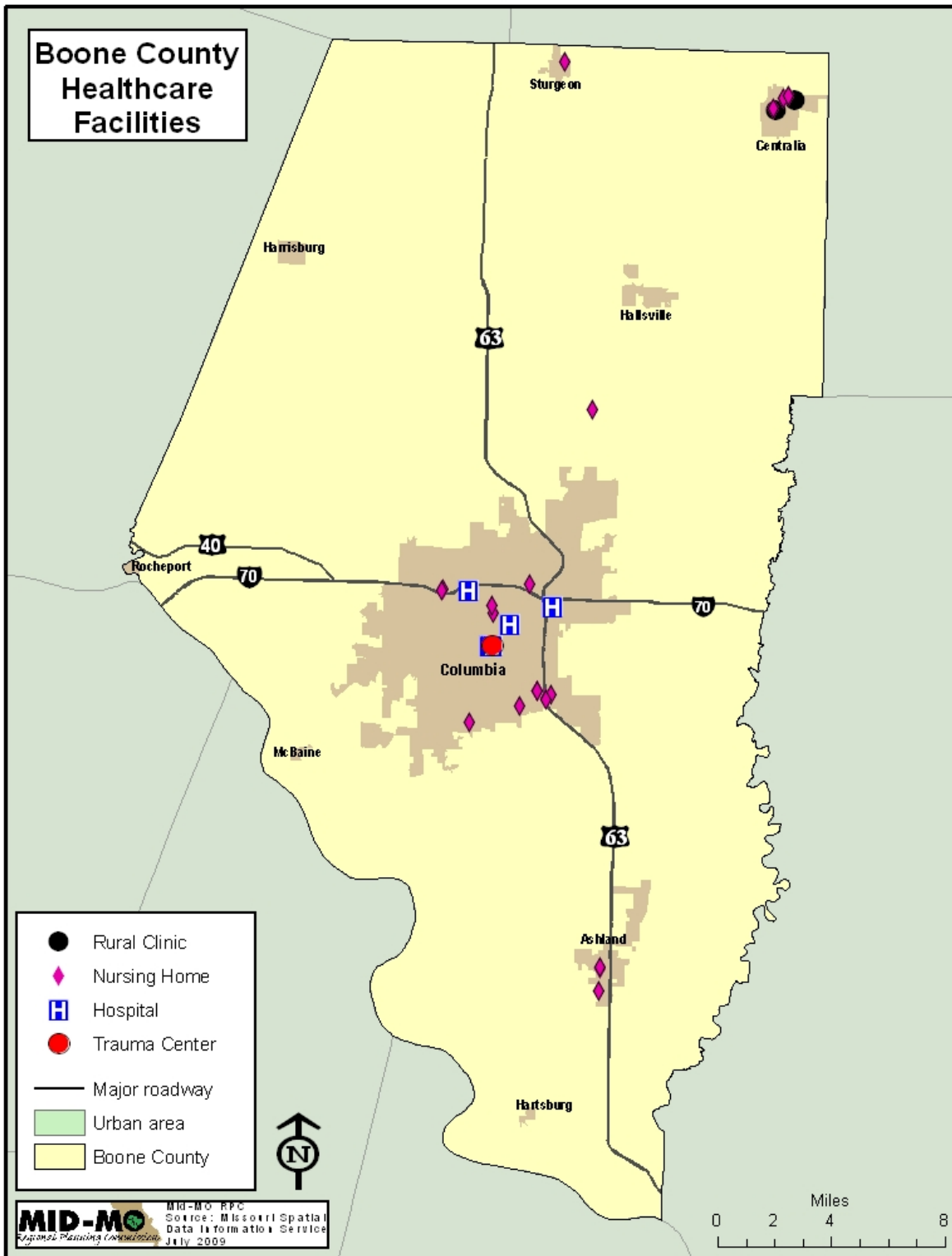


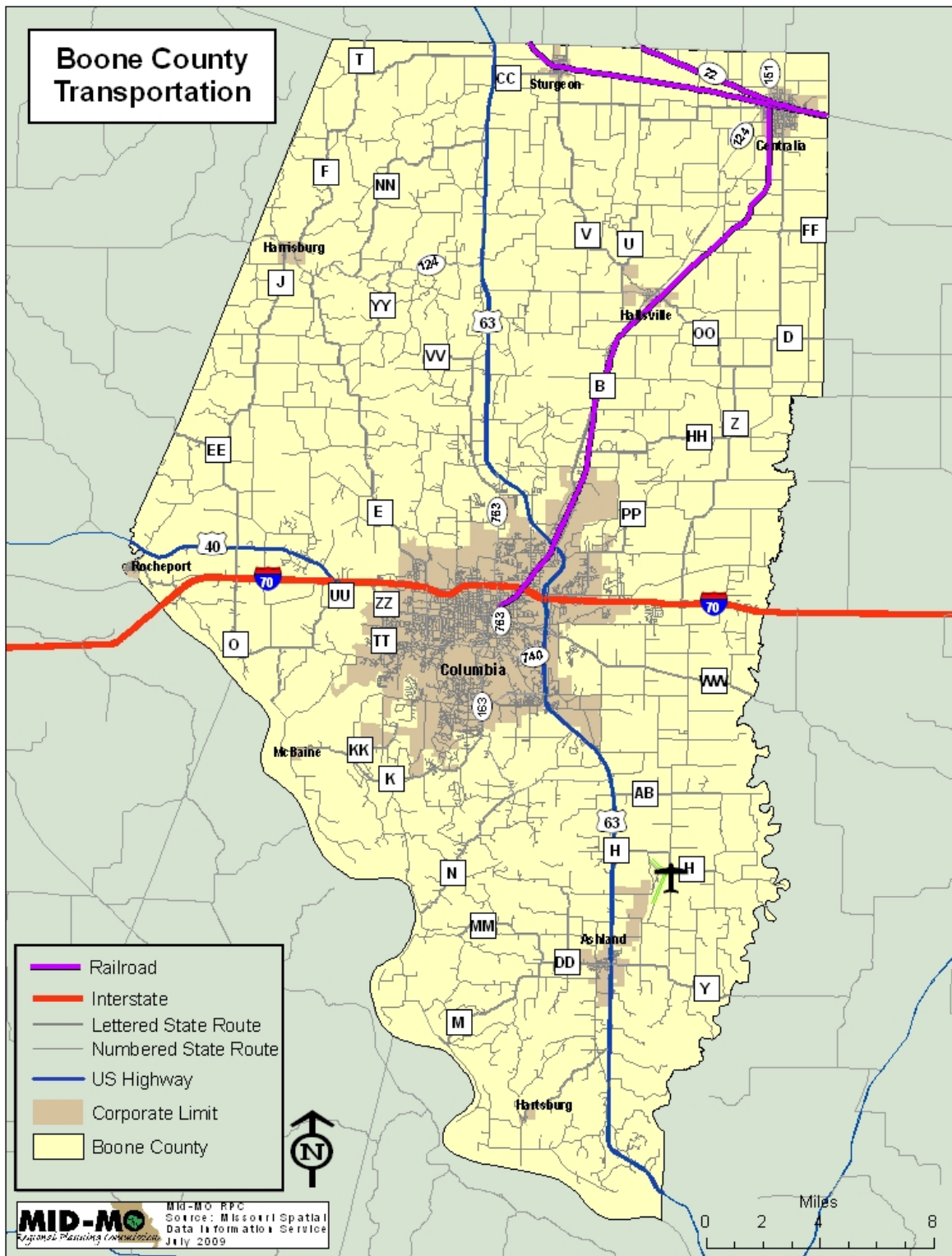




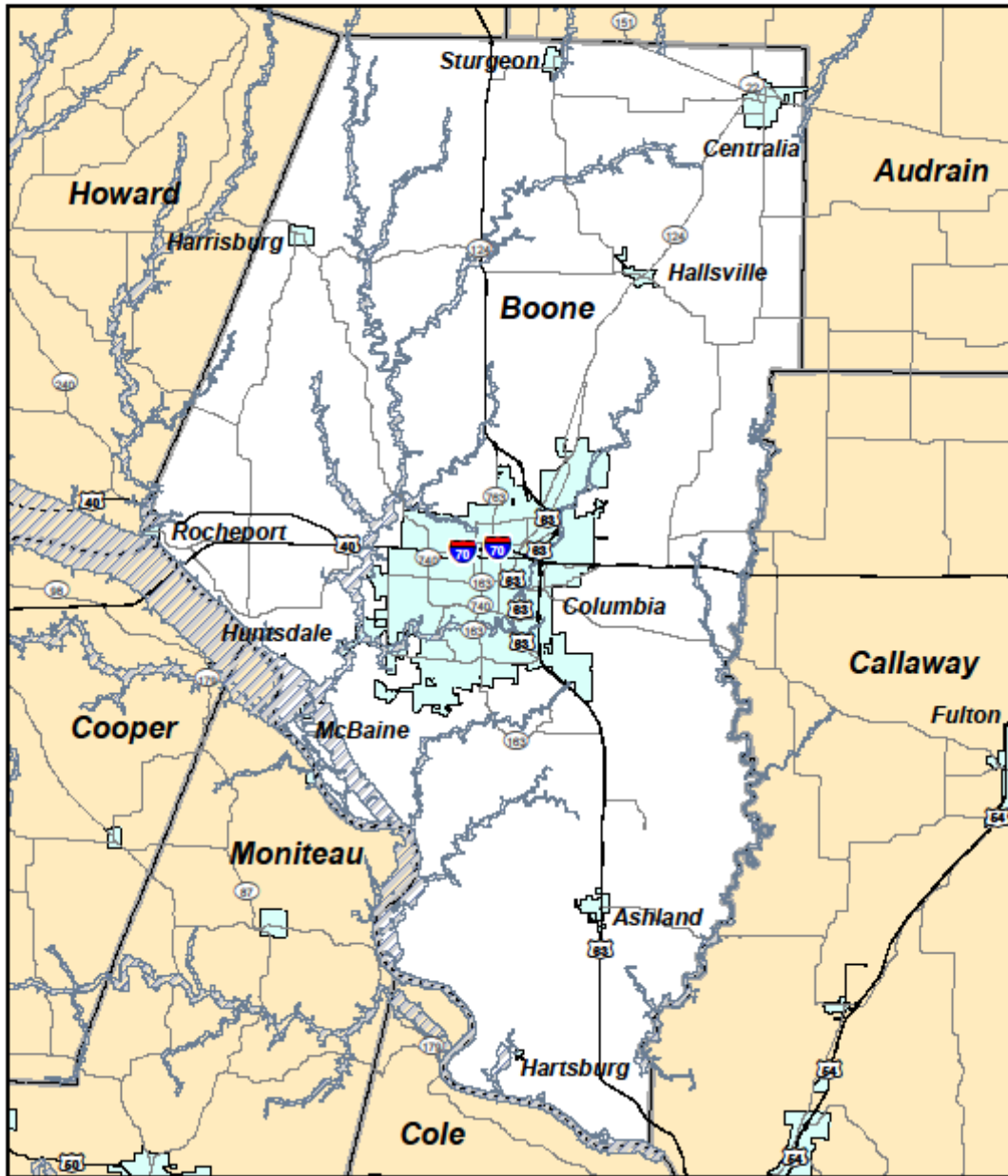






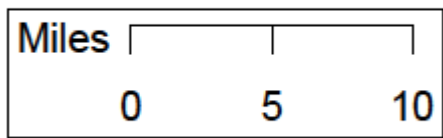




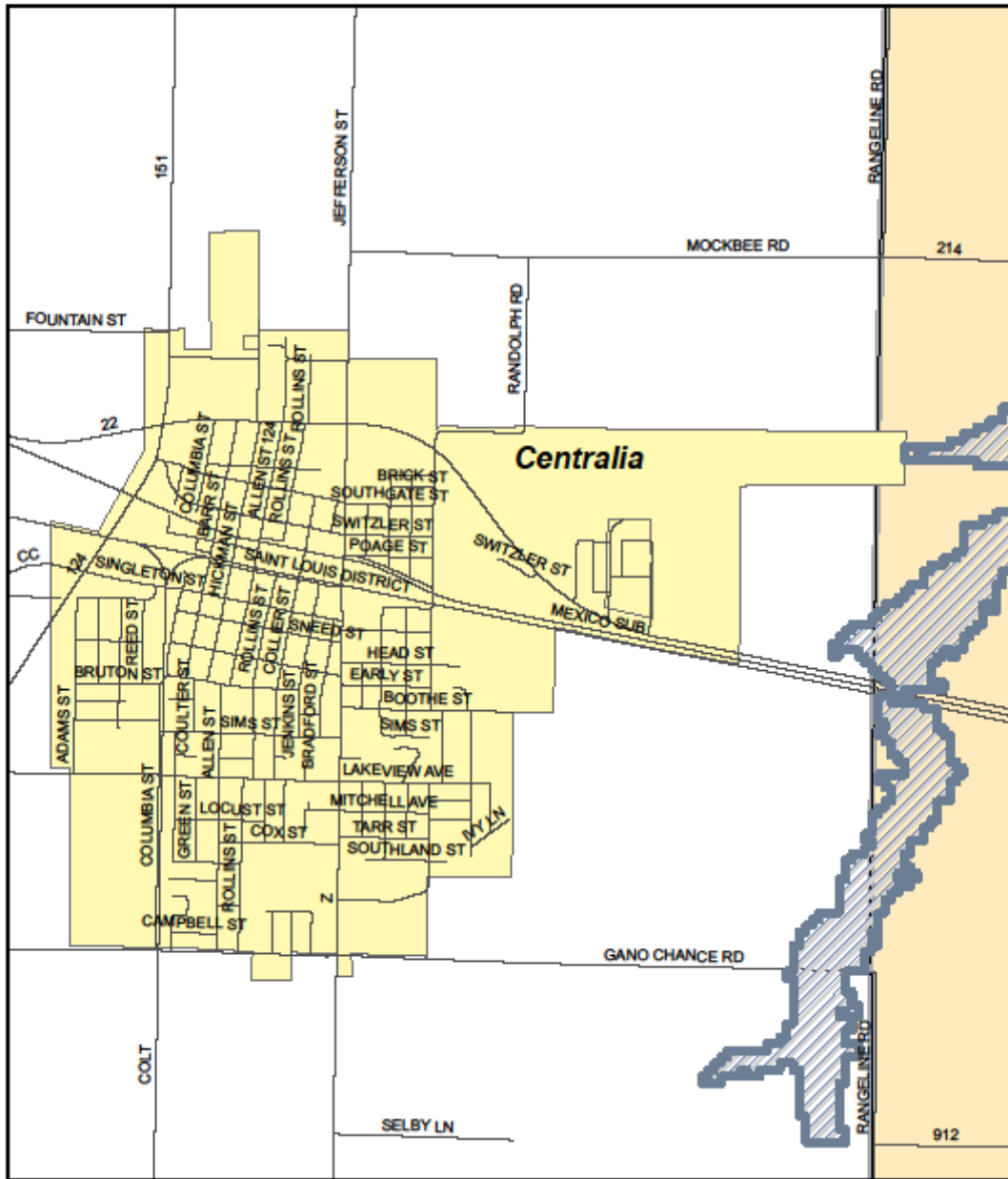
Boone County HAZUS Flood Map





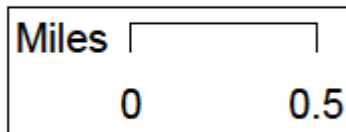
-  Flood Boundary
-  Incorporated Areas



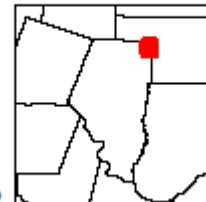
Centralia HAZUS Flood Map



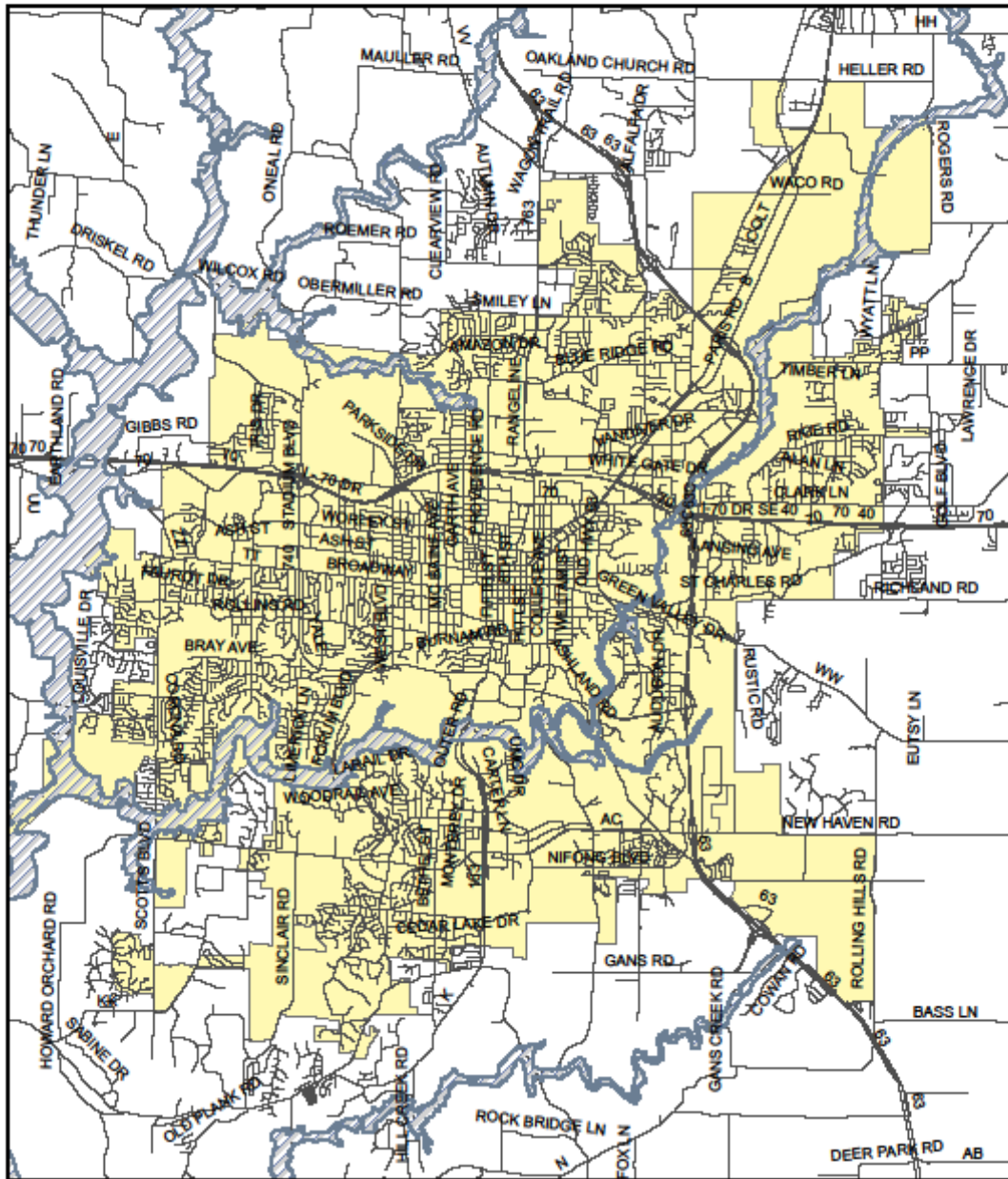
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-  Incorporated Areas





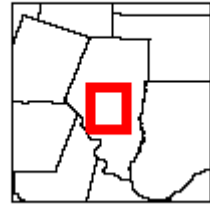
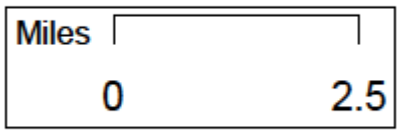
Key Map



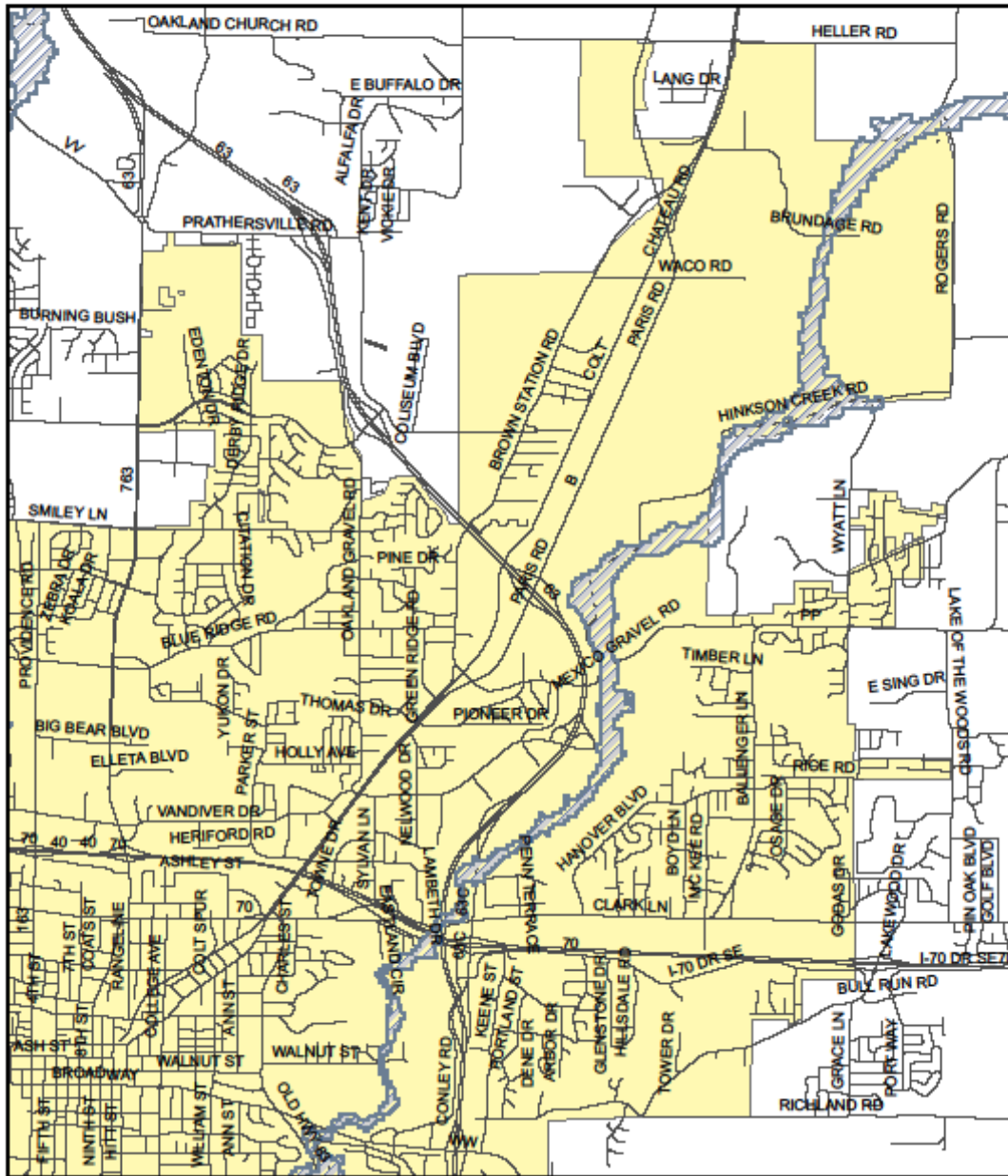
Columbia HAZUS Flood Map





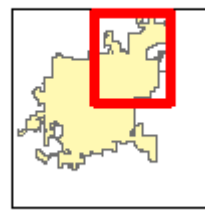
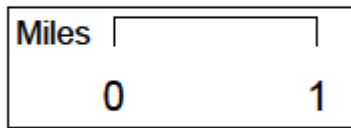
-  Flood Boundary
-  Incorporated Areas



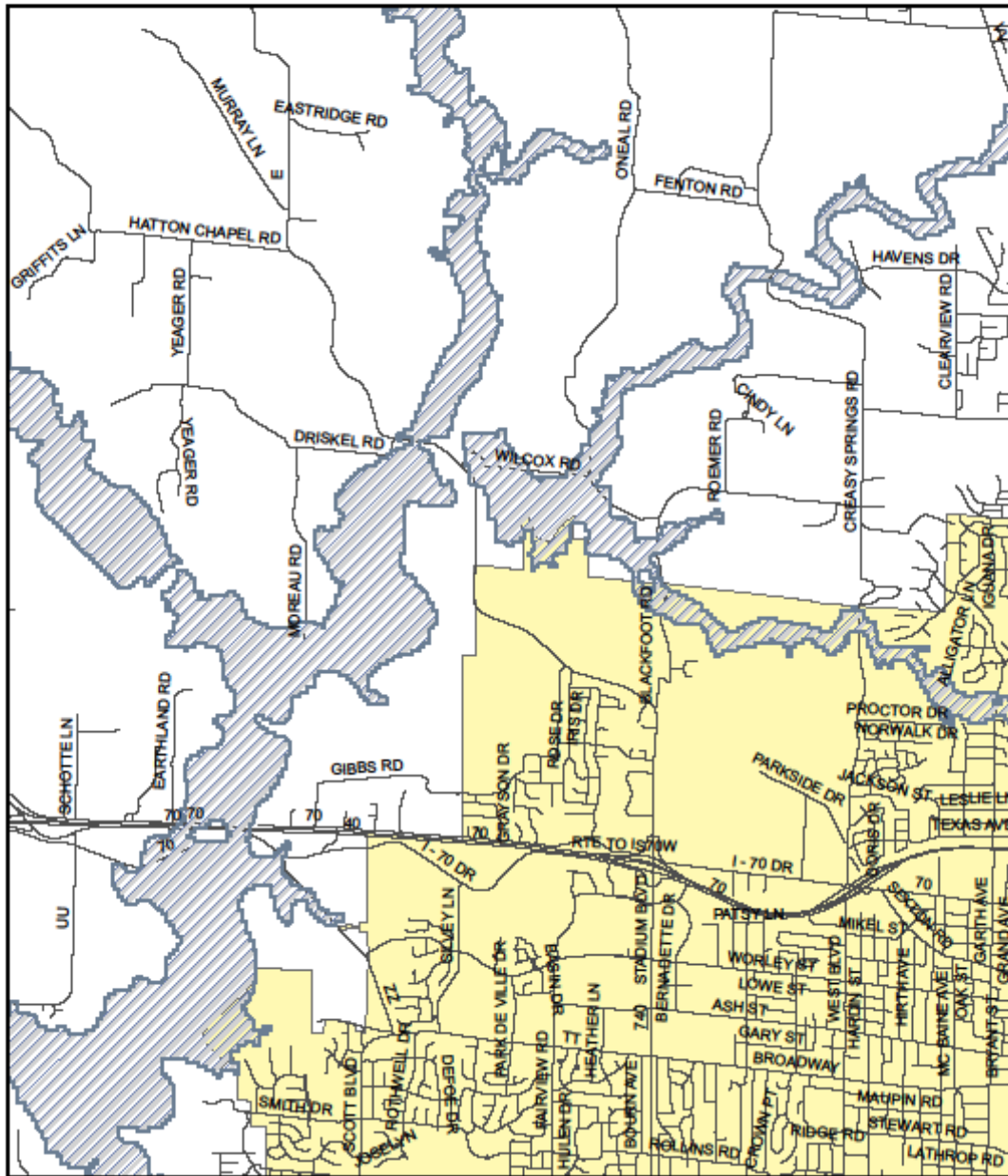
Columbia HAZUS Flood Map





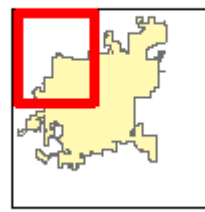
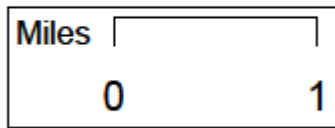
-  Flood Boundary
-  Incorporated Areas



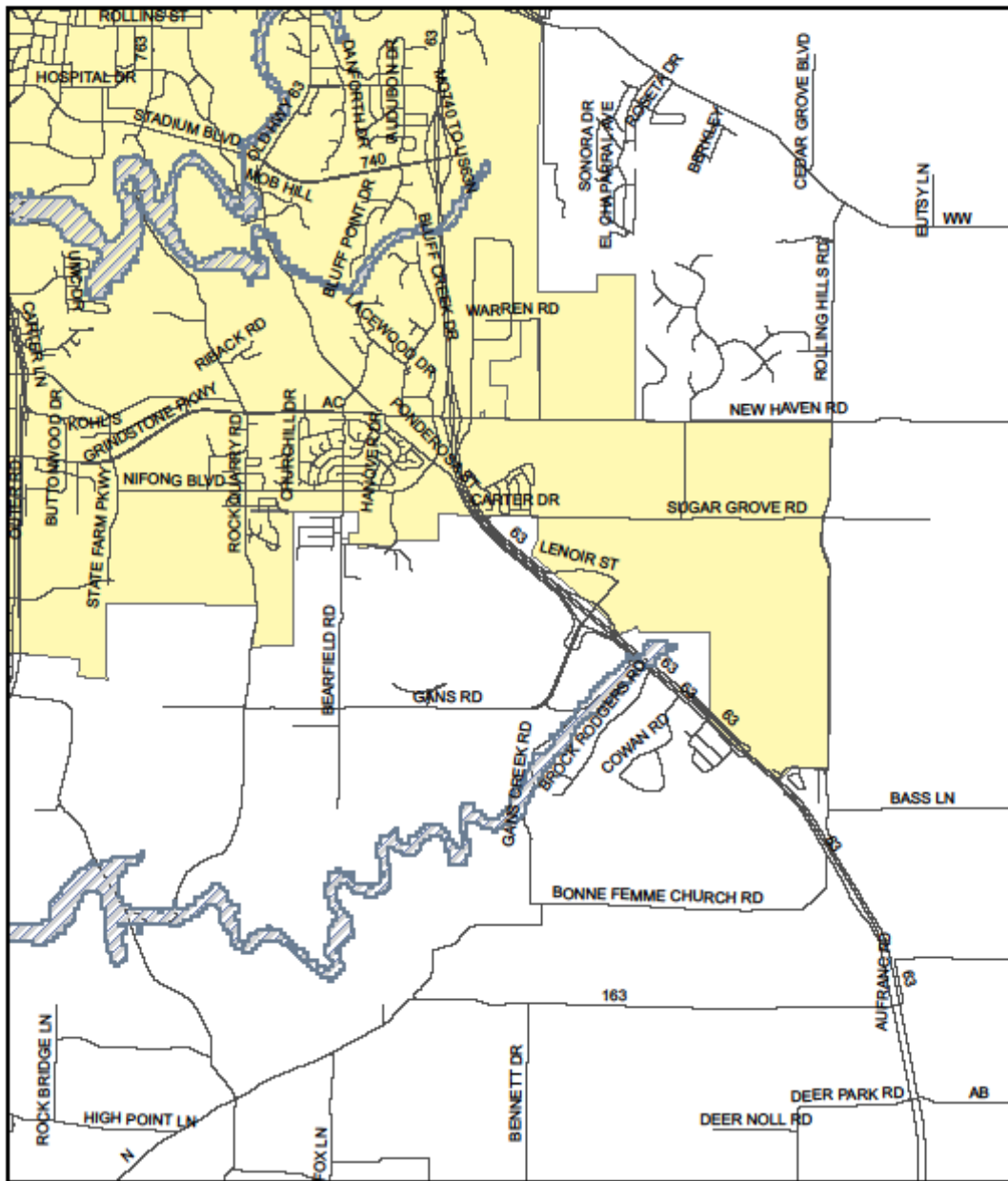
Columbia HAZUS Flood Map





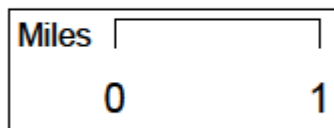
-  Flood Boundary
-  Incorporated Areas



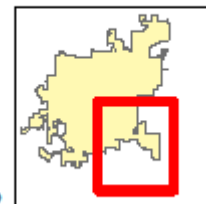
Columbia HAZUS Flood Map



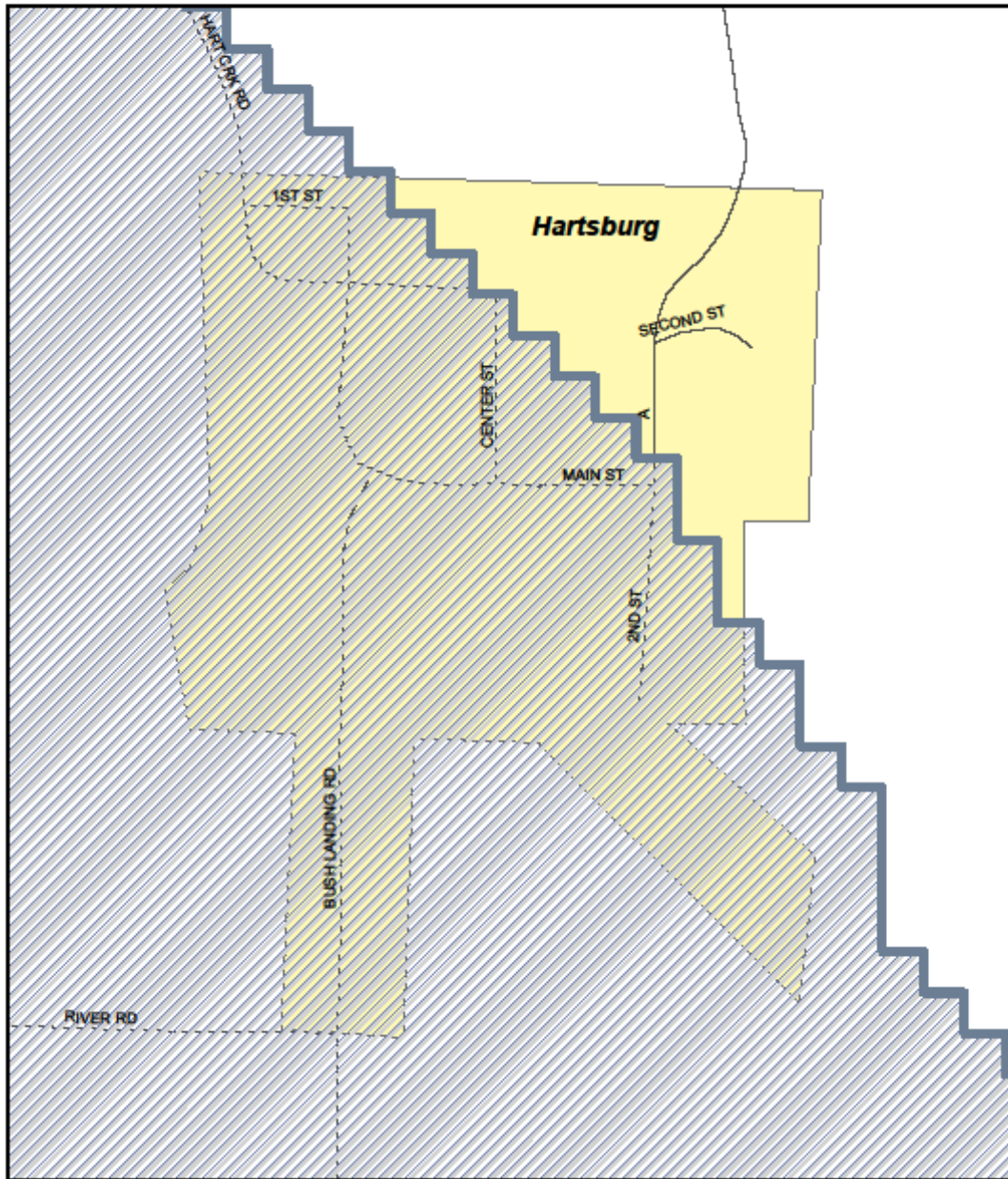
-  Flood Boundary
-  Incorporated Areas





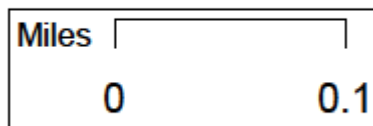
Key Map



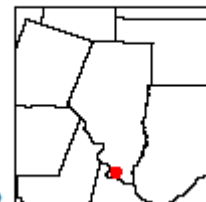
Hartsburg HAZUS Flood Map



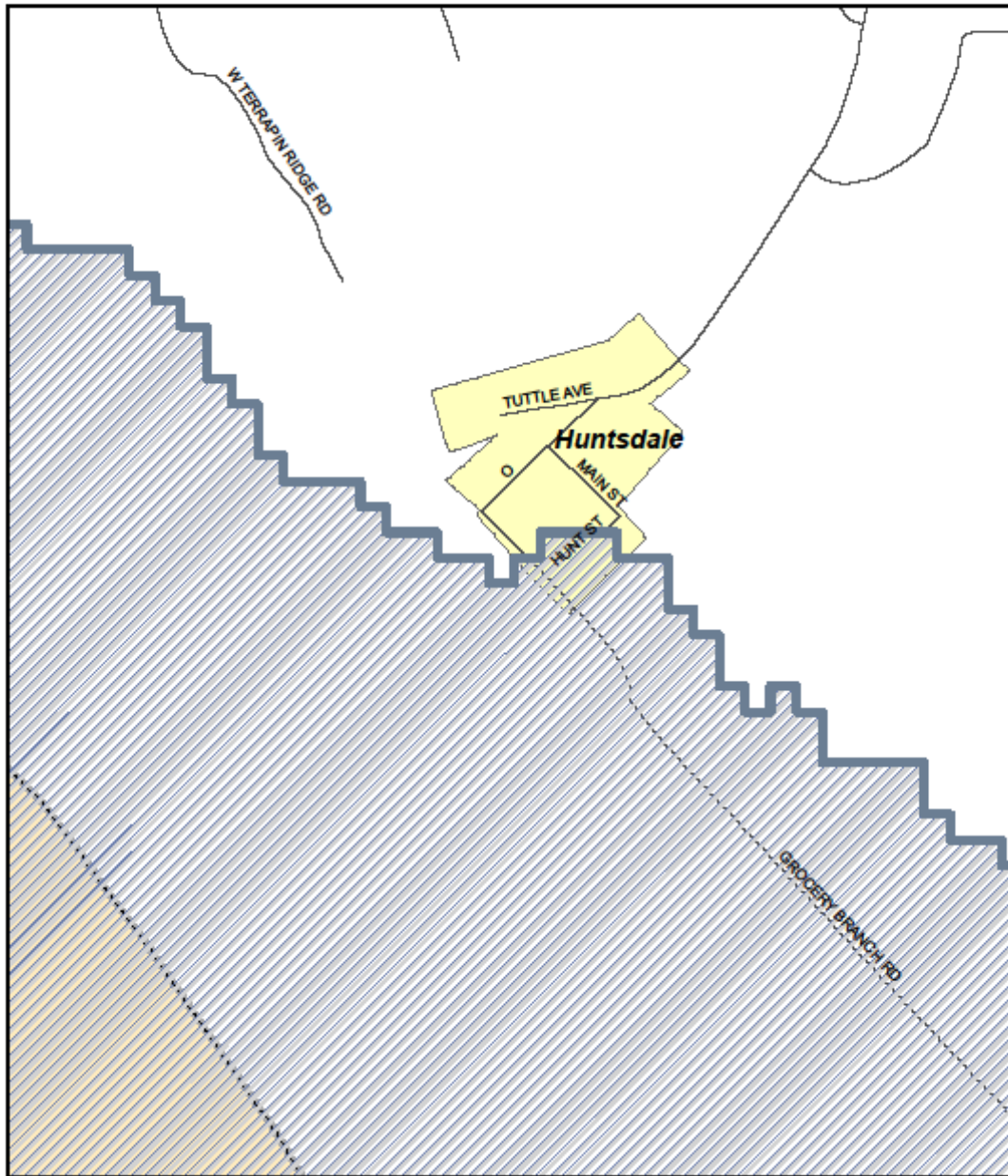
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-  Incorporated Areas





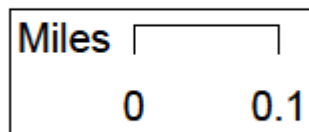
Key Map



Huntsdale HAZUS Flood Map



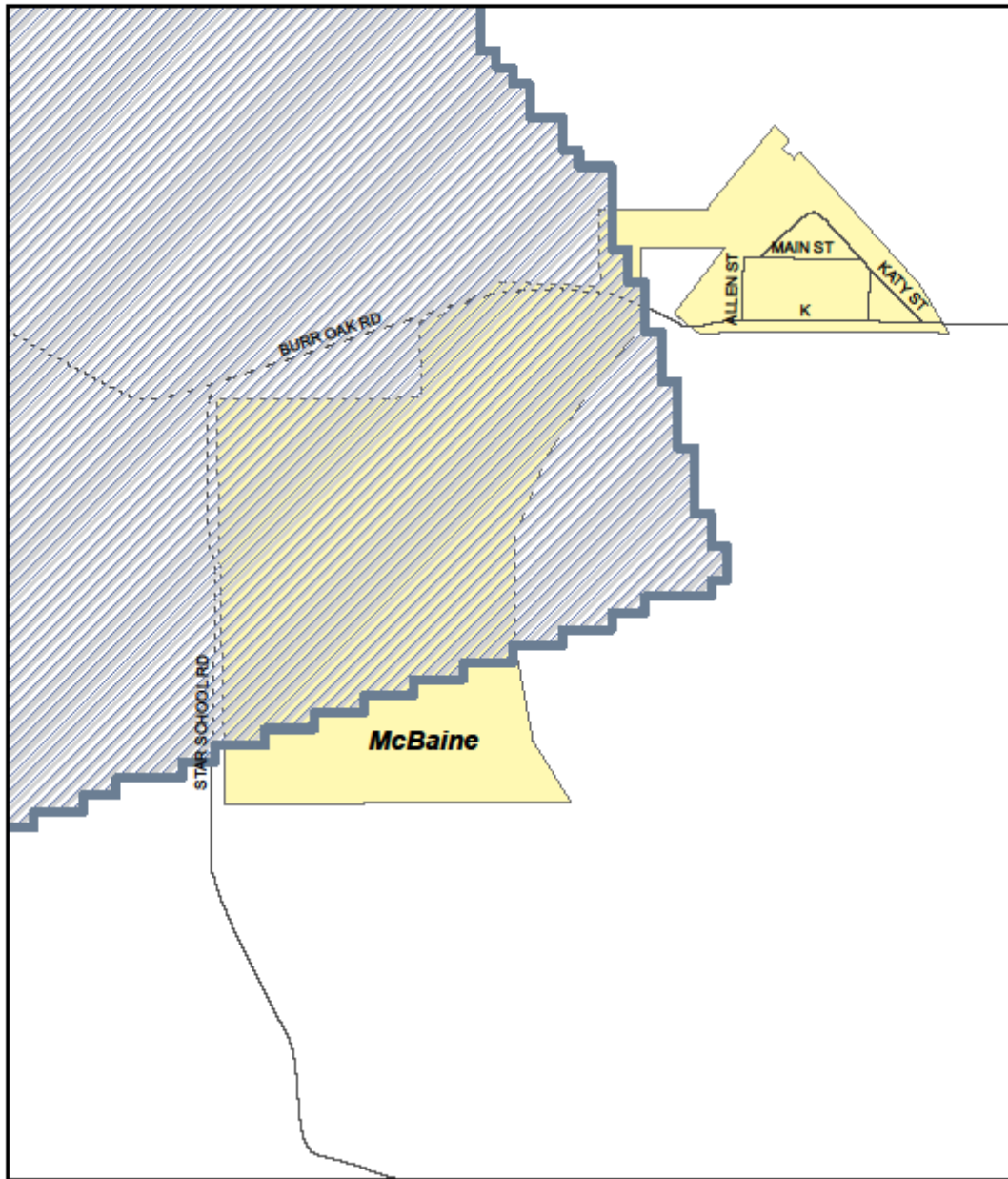
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


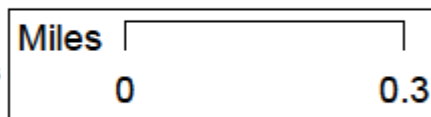
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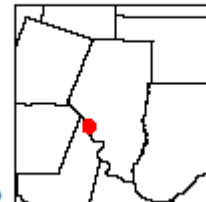
McBain HAZUS Flood Map



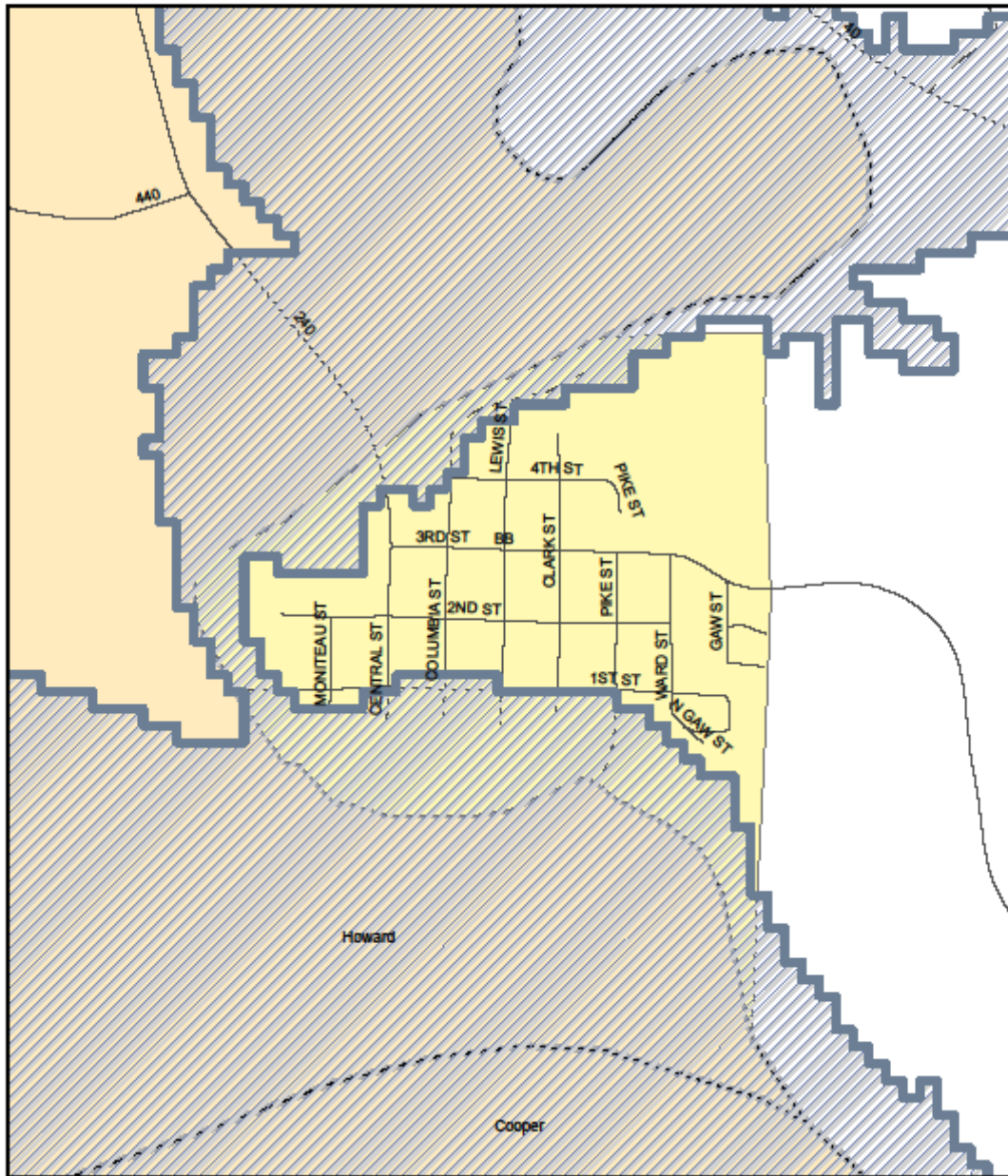
-  Flood Boundary
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


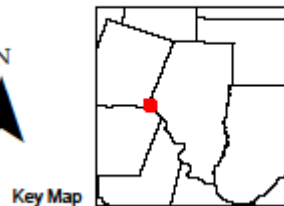
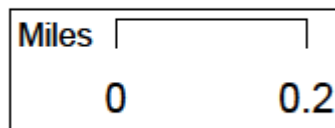
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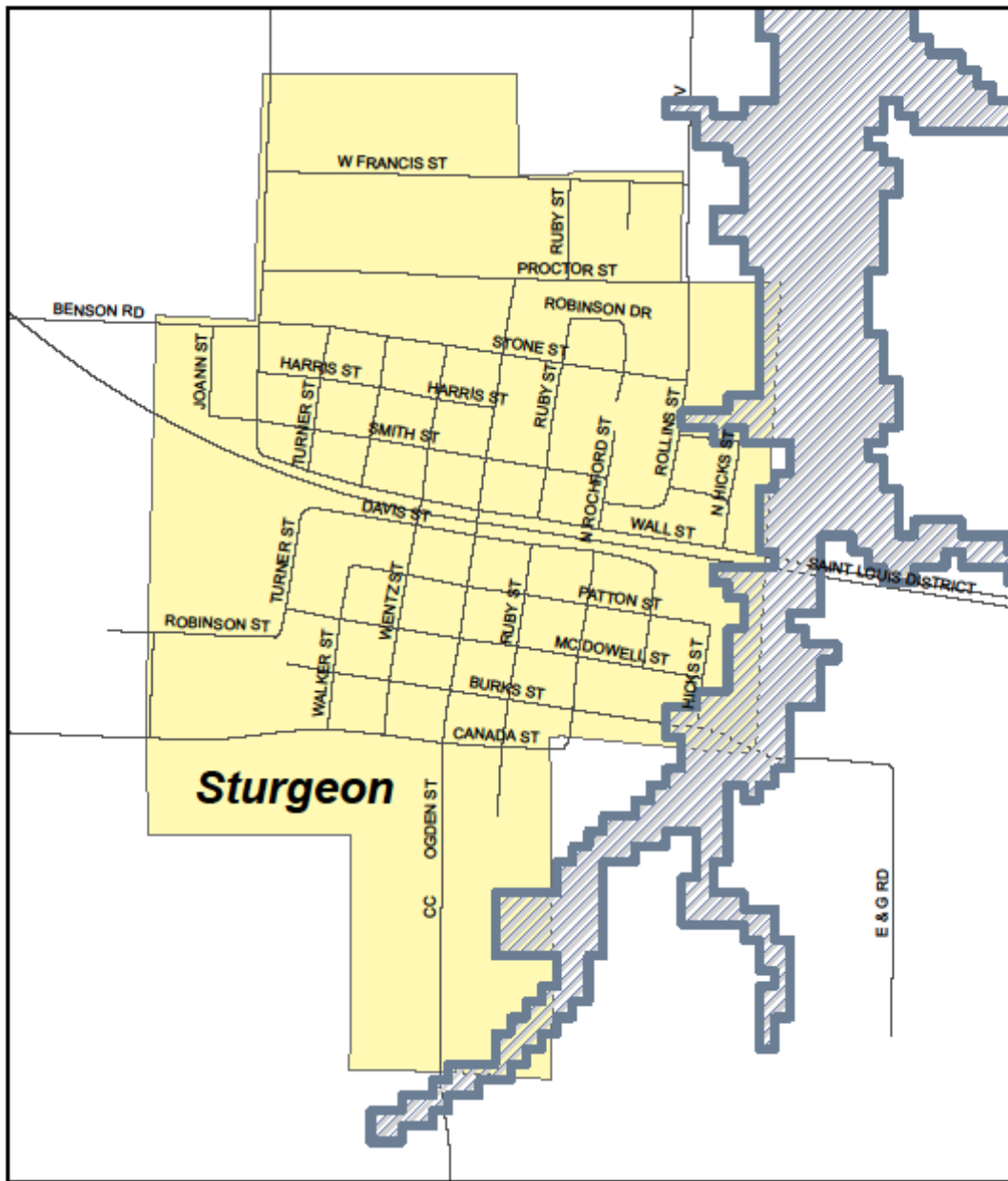
Rocheport HAZUS Flood Map





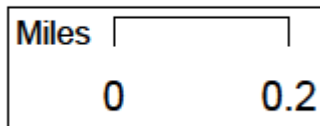
-  Flood Boundary
-  Incorporated Areas



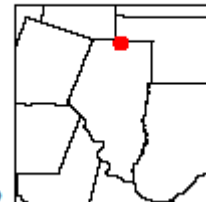
Sturgeon HAZUS Flood Map



-  Flood Boundary
-  Incorporated Areas



Key Map



Appendix A

Adoption Resolutions

ADOPTION RESOLUTIONS TO BE INSERTED HERE

Appendix B

Sign-in Sheets from Meetings

In-kind Eligible

In-kind hours for meeting:
 8 people x 1 hr =
 8 hrs.

**Boone County Hazard Mitigation Plan Update
 Technical Steering Committee Meeting #1**

10:30 am
 Sept. 16, 2009 9:30 - 11 am
 Daniel Boone Regional Library Columbia

Name	Representing	Signature
Chris Heard	City of Ashland	
Curtis Owens	Mid-MO Regional Planning Commission	<i>Curtis Owens</i>
✓ Derin Campbell	Boone County Public Works	<i>Derin Campbell</i>
Ed Siegmund	Mid-MO Regional Planning Commission	<i>Ed Siegmund</i>
✓ Jason Warzinik	Boone County	<i>Jason Warzinik</i>
Karen Miller	Boone County Commission	<i>Karen M. Miller</i>
Mitch Skov	City of Columbia Planning and Development	
✓ Preston Bass	Columbia Public Schools	<i>Preston C. Bass</i>
✓ Rachel Bacon	City of Columbia Planning and Development	<i>Rachel Bacon</i>
✓ Rick Briedwell	Southern Boone School District	<i>Rick Briedwell</i>
✓ Ryland Rodes	Boone County Planning & Building Dept	<i>Ryland Rodes</i>
✓ Steve Hunt	City of Columbia Dept. of Public Works	<i>Steve Hunt</i>
Susan Galeota	Mid-MO Regional Planning Commission	<i>Susan Galeota</i>
✓ Zim Schwartze	JGIG PSJC / EMD	<i>Zim Schwartze</i>

In-kind
eligible

In-kind hrs
for meeting:
8 people x 2 hrs =
16 hrs

**Boone County Hazard Mitigation Plan Update
Technical Steering Committee Meeting #2**

Oct. 9, 2009
10AM - 12 NOON
~~Sept 16, 2009 930 - 11am~~
~~Boone Regional Library Columbia~~
Boone Co. Gov.
Center

Name	Representing	Signature	In-kind hrs since last meeting
✓ Chris Heard	City of Ashland	<i>[Signature]</i>	1
✓ Derin Campbell	Boone County Public Works	<i>[Signature]</i>	1
Jason Warzinik	Boone County (GIS)		
Karen Miller	Boone County Commission	<i>[Signature]</i>	NA
Katrina Thomas	Mid-MO Regional Planning Commission	<i>[Signature]</i>	
Preston Bass	Columbia Public Schools		
✓ Rachel Bacon	City of Columbia Planning and Development	<i>[Signature]</i>	2
✓ Rick Briedwell	Southern Boone School District	<i>[Signature]</i>	1
✓ Ryland Rodes	Boone County Planning & Building Dept	<i>[Signature]</i>	2
✓ Steve Hunt	City of Columbia Dept. of Public Works	<i>[Signature]</i>	2
Susan Galeota	Mid-MO Regional Planning Commission	<i>[Signature]</i>	
✓ Zim Schwartz	OEM/PSJC	<i>[Signature]</i>	13 hrs
✓ Tyler Beauchamp	OEM Intern	<i>[Signature]</i>	N/A

Ignore -
have
filled
out
time
sheet

(includes 2
other staff
members)

In-kind hrs. for meeting:
 9 people x 2 hrs = 18 hrs.

In-kind & eligible

**Boone County Hazard Mitigation Plan Update
 Technical Steering Committee Meeting #3**

Oct. 16, 2009 9 - 11 am
 Boone Co. Government Center
 Columbia

Name	Representing	Position	Signature	In-kind hrs since last mtg
✓ Chris Heard	City of Ashland	City Administrator	<i>[Signature]</i>	1
✓ Derin Campbell	Boone County Public Works	Acting Director	<i>[Signature]</i>	1
✓ Jason Warzinek	Boone County	GIS Manager	<i>[Signature]</i>	1
Karen Miller	Boone County Commission	Commissioner	<i>[Signature]</i>	NA
Katrina Thomas	Mid-MO RPC	Planner	<i>[Signature]</i>	NA
✓ Preston Bass	Columbia Public Schools	Coord. of Safety and Security	<i>[Signature]</i>	1 hr.
✓ Rachel Bacon	City of Columbia Planning & Development	Planner	<i>[Signature]</i>	1
✓ Rick Briedwell	Southern Boone School District	Building, Grounds & Transp. Director	<i>[Signature]</i>	1
✓ Ryland Rodes	Boone County Planning & Building Dept	Planner	<i>[Signature]</i>	1
✓ Steve Hunt	City of Columbia Dept. of Public Works	Mgr. of Environ. Services	<i>[Signature]</i>	1
Susan Galeota	Mid-MO RPC	Admin Asst	<i>[Signature]</i>	NA
✓ Zim Schwartze	Office of Emergency Management/Public Safety Joint Communications	Director	<i>[Signature]</i>	NA
Tyler Beauchamp	Office of Emergency Management	Intern		

Ignore have filled out timesheets

In-kind hrs.
for meeting:
5 people x 1hr =
5 hrs.

Boone County Hazard Mitigation Plan Update
Technical Steering Committee
Storm Water Subcommittee Meeting

Oct. 20, 2009 9:30 - 10:30 am
Boone Co. Government Center
Columbia

In-kind
Eligible

Name	Representing	Position	Signature	In-kind hrs since last mtg
✓ Chris Heard	City of Ashland	City Administrator		1/2
✓ Derin Campbell	Boone County Public Works	Acting Director		1/2
✓ Jason Warzinik	Boone County	GIS Manager		1/2
Katrina Thomas	Mid-MO RPC	Planner		NA
✓ Ryland Rodes	Boone County Planning & Building Dept	Planner		1/2
✓ Steve Hunt	City of Columbia Dept. of Public Works	Mgr. of Environ. Services		1
Susan Galeota	Mid-MO RPC	Admin Asst		NA

Ignore -
have filled
out time
sheets

In kind eligible

Meeting In-kind Hours
 7 people x 2 hrs =
 14 hrs.

**Boone County Hazard Mitigation Plan Update
 Technical Steering Committee Meeting #4**

Nov. 6, 2009 9:30 - 11:30 am
 Boone Co. Government Center
 Columbia

Name	Representing	Position	Signature
Chris Heard	City of Ashland	City Administrator	
✓ Derin Campbell	Boone County Public Works	Acting Director	<i>Derin Campbell</i>
Jason Warzinik	Boone County	GIS Manager	
Karen Miller	Boone County Commission	Commissioner	<i>Karen Miller</i>
Katrina Thomas	Mid-MO RPC	Planner	<i>Katrina Thomas</i>
✓ Preston Bass	Columbia Public Schools	Coord. of Safety and Security	<i>Preston C. Bass</i>
✓ Rachel Bacon	City of Columbia Planning & Development	Planner	<i>Rachel Bacon</i>
✓ Rick Briedwell	Southern Boone School District	Building, Grounds & Transp. Director	<i>Rick Briedwell</i>
✓ Ryland Rodes	Boone County Planning & Building Dept	Planner	<i>Ryland Rodes</i>
Steve Hunt	City of Columbia Dept. of Public Works	Mgr. of Environ. Services	
Susan Galeota	Mid-MO RPC	Admin Asst	<i>Susan Galeota</i>
✓ Zim Schwartze	Office of Emergency Management/Public Safety Joint Communications	Director	<i>Zim Schwartze</i>
Tyler Beauchamp	Office of Emergency Management	Intern	

✓ *Lindsey Schaefer* (for Steve Hunt) City of Columbia - Public Works Sanitary Sewer Engineer *Lindsey Schaefer* LLSCHAEF@CoColumbia.MD.com

In-kind hours for meeting:
 6 people x 2.5 hrs = 15 hrs.

In-kind eligible

**Boone County Hazard Mitigation Plan Update
 Technical Steering Committee Meeting #5**

Nov. 30, 2009 9:00 - 11:30 am
 Boone Co. Government Center
 Columbia




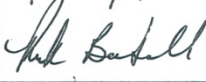







Name	Representing	Position	Signature
Chris Heard	City of Ashland	City Administrator	
Derin Campbell	Boone County Public Works	Acting Director	
✓ Jason Warzinik	Boone County	GIS Manager	<i>Jason Warzinik</i>
Karen Miller	Boone County Commission	Commissioner	<i>Karen Miller</i>
Katrina Thomas	Mid-MO RPC	Planner	<i>Katrina Thomas</i>
Preston Bass	Columbia Public Schools	Coord. of Safety and Security	
✓ Rachel Bacon	City of Columbia Planning & Development	Planner	<i>Rachel Bacon</i>
✓ Rick Briedwell	Southern Boone School District	Building, Grounds & Transp. Director	<i>Rick Briedwell</i>
✓ Ryland Rodes	Boone County Planning & Building Dept	Planner	<i>Ryland Rodes</i>
✓ Steve Hunt	City of Columbia Dept. of Public Works	Mgr. of Environ. Services	<i>Steve Hunt</i>
Susan Galeota	Mid-MO RPC	Admin Asst	<i>Susan Galeota</i>
✓ Zim Schwartze	Office of Emergency Management/Public Safety Joint Communications	Director	<i>Zim Schwartze</i>
Tyler Beauchamp	Office of Emergency Management	Intern	

In-kind hours for meeting:
 9 people x 1.5 hrs = 13.5 hrs

In-kind eligible:

**Boone County Hazard Mitigation Plan Update
 Educators Meeting**

Dec. 11, 2009
 10:30 am - 12:00 pm
 Boone County Government Center, Room 208

Name	Representing	Position	Signature
Darin Ford	Centralia R-VI	Superintendent	
✓ Preston Bass	Columbia	Coordinator of Safety and Security	
✓ Don Lewis	Hallsville R-IV	District Safety Coordinator	
✓ Tony Perkins	Harrisburg R-VIII	School Resource Officer	
✓ Rick Briedwell	Southern Boone	Building, Grounds & Transportation Director	
✓ Shawn Schultz	Sturgeon R-V	Superintendent	
✓ Bob Klausmeyer	Columbia College	Director of Campus Safety	
✓ Tony Coleman	Stephens College	Director of Campus Security	
✓ Peter Ashbrook	University of Missouri	Director of Environmental Health & Safety	
✓ Zim Schwatze	Office of Emergency Management/Public Safety Joint	Director	
Katrina Thomas	Mid-MO RPC	Regional Planner/GIS	
Susan Galeota	Mid-MO RPC	Administrative Assistant	

Low-kind hrs
 4 people x 1 hr =
 4 hrs

Low-kind
 Eligible

Boone County Hazard Mitigation Plan Update

Public Meeting 12/15/2009 4:30 pm Boone County Government Center

Community	Position/Title	Name (Printed)	Signature
✓ Airport	Chairman	JUSTIN JOHN	<i>Justin John</i>
✓ HARRISVILLE	City Admin	BOB HARPLE	<i>Bob Harple</i>
✓ Centralia	City Administrator	LYNN P. BETHENS	<i>Lynn P. Bethens</i>
Sturgeon	Mayor Pro Tem	Kevin Abrahamson	<i>Kevin Abrahamson</i>
Mid-Mo	Director	Ed Siegmund	<i>Ed Siegmund</i>
✓ Col / Boone County	OEM Director	Zim Schwartz	<i>Zim Schwartz</i>
COLUMBIA	REPORTER	CHRIS CANDE	<i>Chris Cande</i>
COLUMBIA	Reporter	Jodie Jackson Jr	<i>Jodie Jackson Jr</i>
Barne	Commissioner	SKIP SLKIN	<i>Skip Slkin</i>
"	"	Tara M. Miller	<i>Tara M. Miller</i>
✓ Ashland	Administrator	Chris Heard	<i>Chris Heard</i>
Mid-MO RPC	Admin Asst	SUSAN GALOTA	<i>Susan Galota</i>
Mid MO RPC	Planner	Katrina Thomas	<i>Katrina Thomas</i>

✓ In-kind eligible In-kind hours
 for meeting =
 1 person x 1 hour = 1 hr.

Boone County Hazard Mitigation Plan Update Public Meeting

Jan. 19, 2010 3:00-6:30

Mid-Mo Regional Planning Commission Office

Ashland

Name	Representing	Position	Signature
✓ Kathy Wilkite	Harrisburg	City Clerk	<i>Kathy Wilkite</i>
Katrina Thomas	Mid-Mo RPC	Planner	<i>[Signature]</i>

Appendix C

Press Releases/Meeting Announcements

Notices of Dec. 15, 2009 Public Meeting

Text of article in Mid-MO RPC e-newsletter - Dec. 2009:

Public Meeting to Review Update of Boone County Hazard Mitigation Plan

December 15th at Boone County Government Center

The current draft of the update of the Boone County Hazard Mitigation Plan will be presented to community officials and any interested parties on Tuesday, Dec. 15, 4:30-5:30 PM in the Commission Chambers, Boone County Government Center, 801 E. Walnut in Columbia. A short presentation on the plan will be given; members of the Hazard Mitigation Technical Steering Committee and planners from the RPC will be present to answer questions on the plan.

The Hazard Mitigation Technical Steering Committee has been meeting since mid-September to draft an update of the plan. The planning process is now moving into specific details with the communities and educational institutions/school districts of Boone County. This meeting is a chance for communities and the public to give input on the plan.

Hazard mitigation plans will be updated for all six counties of the Mid-MO RPC area within the next year and a half. Officials and community members from throughout the region are invited to this public meeting on the Boone County Hazard Mitigation Plan. Hazards often affect the entire region; knowledge of the issues and mitigation strategies being used within other counties benefits everyone. For more information, please call Katrina or Susan at the Mid-MO RPC (573-657-9779).

Public Service Announcement Submitted to KOPN Radio:

A public meeting on the update of the Boone County Hazard Mitigation Plan will be held on Tuesday, December 15, 4:30-5:30 pm, in the County Commission Chambers, Boone County Government Center, 801 E. Walnut. The plan sets guidelines for policy and actions to lessen the impact of natural hazards throughout the county. The public are invited to hear a brief presentation on the plan, view a draft of the update, and offer feedback. For further information, please call 573-657-9779.

Public Notice Posted in Roger B. Wilson Boone County Government Center:

Public Meeting

Update of
Boone County Hazard Mitigation Plan

Tuesday, December 15
4:30 - 5:30 PM

County Commission Chambers
Boone County Government Center

This plan sets guidelines for policy and actions to lessen the impact of natural hazards throughout the county. The public are invited to hear a brief presentation on the plan, view a draft of the update, and offer feedback.

For further information, please call 573-657-9779.

Notices of Jan. 19, 2010 Public Meeting

Text of article in Mid-MO RPC e-newsletter – Jan. 2010:

Public Review of Update of Boone County Hazard Mitigation Plan

January 19, 2010 Open House Scheduled

Work on the update of the Boone County Hazard Mitigation Plan is in its final stages. The public is invited to an Open House to view and give final input on the plan before it is submitted for approval by the Federal Emergency Management Agency.

The open house will be held from 3:00 - 6:30 PM on Tuesday, January 19, 2010 at the Mid-MO Regional Planning Commission (206 E. Broadway, Ashland). RPC planners will be present to answer any questions and receive comments and feedback. The Boone County Hazard Mitigation Plan sets forth a strategy of actions to be undertaken to lessen the impact of natural disasters in the county, its communities, school districts, and institutions of higher learning. Those involved in economic development, business, the non-profit sector, academia, and the general public in Boone County and the surrounding region are all invited to view the plan and give input.

The current draft of the update is available for viewing in the Reference Sections of the Columbia Public Library and the Southern Boone County Public Library in Ashland. It is also available online at: www.mmrpc.org (Library Section). To give feedback or comment on the plan, contact: 573-657-9779 (Katrina or Susan) or mmrpc@mmrpc.org.

Announcement in calendar on Mid-MO RPC website (mmrpc.org):

January 19, 2010 -- 3:00 - 6:30 pm

The public is invited to comment on the current draft of the update for the Boone County Hazard Mitigation Plan. A meeting/open house to answer questions and receive comment on the draft will be held at the Mid-MO RPC on Tuesday, January 19, 3:00 to 6:30 pm. Comments can also be emailed to mmrpc@mmrpc.org.

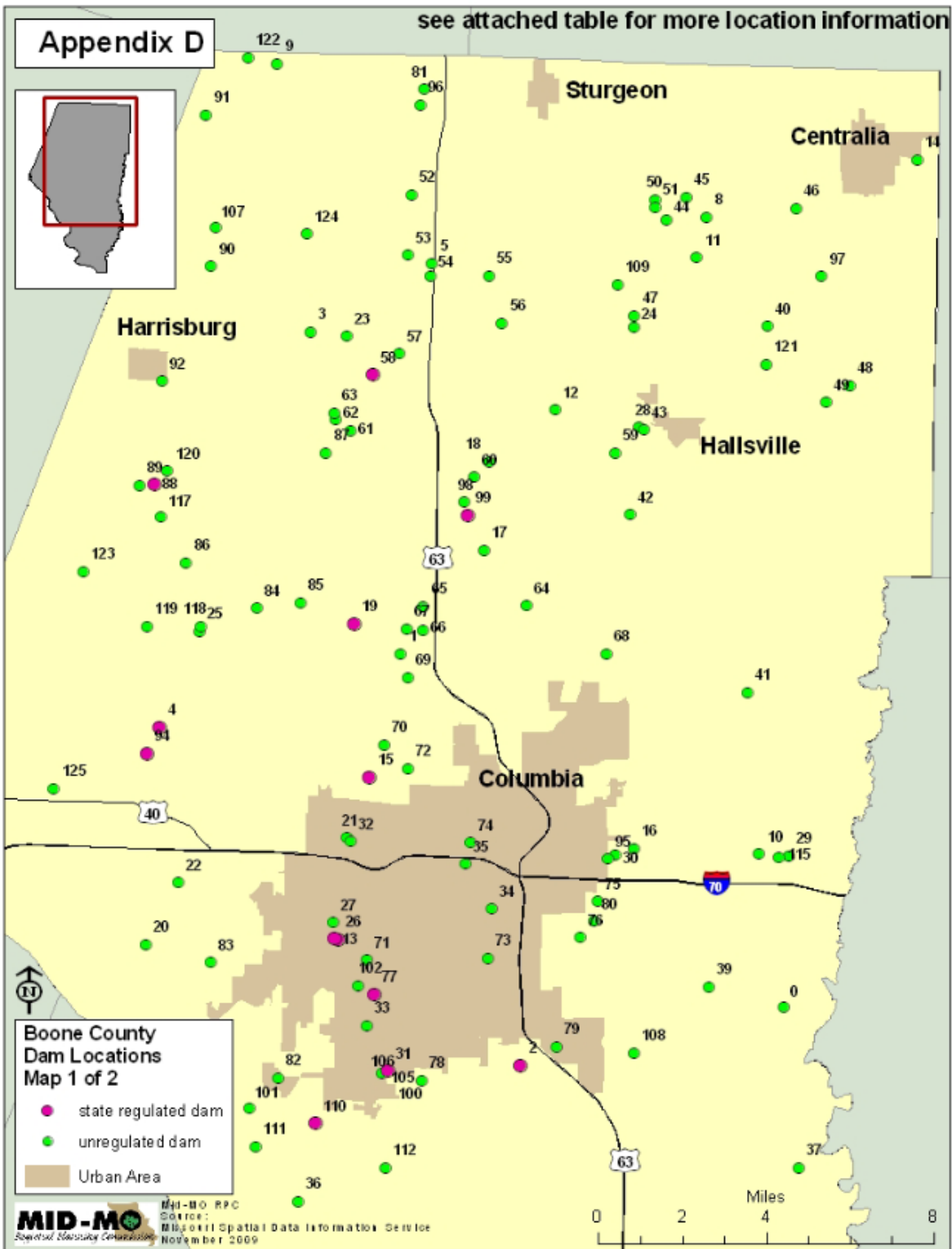
Text of Public Service Announcement/Press Release Sent to Radio and Newspapers:

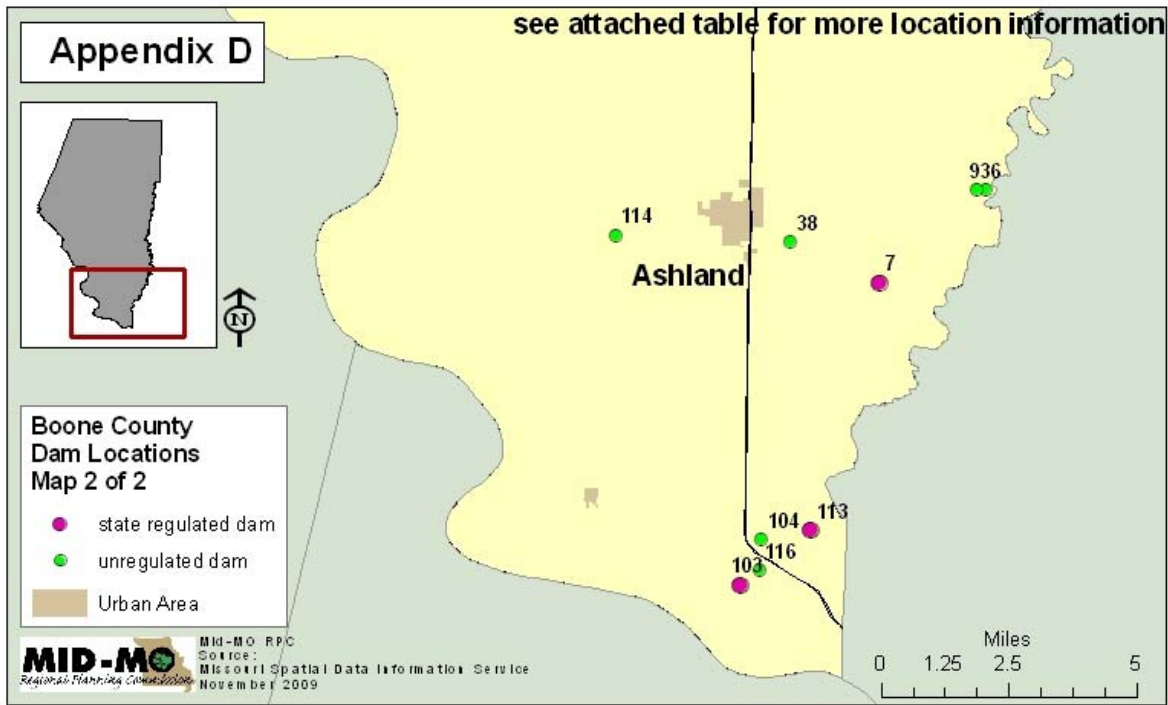
An open house for the public to comment on the draft of the update of the Boone County Hazard Mitigation Plan will be held on Tuesday, Jan. 19, 3:00-6:30 pm at the Mid-Missouri Regional Planning Commission, 206 E. Broadway, in Ashland. The draft plan is available in the Reference Sections of the Public Libraries in Columbia and Ashland or can be seen online at www.mmrpc.org (in the Library Section). For further information, call (573) 657-9779.

Appendix D

Dam Inventory

Regulated and Unregulated





Appendix D							
REGULATED Boone County Dams							
Map ID #	Name	Year Built	Ht (feet)	Reservoir Area (Acres)	Drainage Area (Acres)	Federal Class	State Class
2	BRISTOL LAKE DAM	1965	46	33	360	H	2
4	CALLAHAN CREEK C-1	1966	42	16	3600	L	3
7	ASHLAND WILDLIFE AREA DAM	1937	44	29	2475	L	3
13	HULEN LAKE WEST DAM	1948	50	18	160	H	1
15	ROEMER'S LAKE DAM	1963	37	26	245	H	2
19	BOCO MO DAM	1974	39	64	2000	H	2
26	HULEN LAKE EAST DAM	1948	50	7	51	H	1
31	CEDAR LAKE DAM	1975	42	21	530	H	1
58	COUNTRY BOY ESTATES LAKE DAM 2	1977	37	8	60	H	2
77	WOODRAIL LAKE DAM	1968	54	12	240	H	1
88	CALLAHAN CREEK A-1	1979	35	15	1523	L	3
94	CALLAHAN CREEK C-2	1979	54	36	980	H	2
99	FINGER LAKES DAM SOUTH	1800	44	79	540	H	2
103	CLAYSVILLE LAKE DAM	1979	42	13	245	H	2
110	ARROWHEAD LAKE DAM	1950	37	42	506	H	2
113	LAKE CHAMPETRA DAM	1970	60	47	597	H	2

Source: http://www.dnr.mo.gov/env/wrc/damsft/Crystal_Reports/boone_dams.pdf

Appendix D

UNREGULATED Boone County Dams

Map ID #	Name	Year Built	Ht (feet)	Reservoir Area (Acres)	Drainage Area (Acres)	Federal Class	State Class
0	LAKE CHATEAU DAM	1964	31	25	808	H	1
1	COUNTY DOWNES LAKE DAM	1968	30	26	120	H	2
3	GURWIT LAKE DAM	1963	22	13	130	L	3
5	BAILEY LAKE DAM	1967	15	12	150	L	3
6	WINDMILLER DAM #1	1962	30	23	850	H	1
8	TRI-CITY COMMUNITY LAKE DAM	1957	25	28	400	L	3
9	HOOD LAKE DAM	1968	25	20	170	L	3
10	TURKEY FARM LAKE DAM	1957	20	13	70	H	2
11	MONTGOMERY LAKE DAM	1957	25	6	30	L	3
12	MCKENZIE LAKE DAM	1958	25	8	120	L	3
14	WABASH LAKE DAM	1890	15	35	261	L	3
16	WELCH LAKE DAM	1960	22	9	2100	H	1
17	ROCKY FORK CREEK DAM	1965	15	55	55	L	3
18	COLUMBIA SPORTSMANS CLUB LAKE DAM	1972	20	23	1300	L	3
20	CEDAR LAKE DAM-SEC 23	1971	30	8	120	L	3
21	COLUMBIA MUN GOLF COURSE LOWER L. DAM	1953	15	3	150	H	1
22	SMARR LAKE DAM	1967	25	2	45	L	3
23	BUMGARNER LAKE DAM-SEC 3	1972	25	10	250	L	3
24	UPPER LAKE CHAPPERAL DAM	1972	25	22	215	L	3
25	LITTLE LEECH DAM	1973	21	3	40	L	3
27	FAIRVIEW LAKE DAM	1948	34	2	46	H	1
28	ANDY LAKE DAM	1974	25	4	28	S	3
29	LAKE LAVISTA DAM	1973	25	22	130	S	3
30	HAGAN LAKE DAM	1960	19	7	160	H	1
32	COLUMBIA MUM. GOLF COURSE DAM	1950	17	7	46	H	1
33	COUNTRY CLUB OF MO LAKE DAM	1972	30	8	110	H	2
34	STEPHENS LAKE DAM	1939	23	11	40	H	1
35	MOORES LAKE DAM	1904	30	7	29	H	1
36	SMITH HATCHERY LAKE DAM	1974	25	6	120	H	2
37	GINN LAKE DAM	1800	30	8	37	H	2
38	PETERSON LAKE DAM	1800	30	6	160	L	3
39	LANDHUIS LAKE DAM	1800	25	19	100	L	3
40	MUSGRAVES LAKE DAM	1974	23	11	277	S	3
41	CUMMINGHAMS LAKE DAM	1978	25	10	150	L	3
42	WASLEY LAKE DAM	1800	25	4	75	L	3
43	SCOTT LAKE DAM	1974	25	5	34	H	2
44	SCHNARRE LAKE DAM SEC 23	1975	25	13	125	L	3

Appendix D

UNREGULATED Boone County Dams

Map ID #	Name	Year Built	Ht (feet)	Reservoir Area (Acres)	Drainage Area (Acres)	Federal Class	State Class
45	SCHNARRE DAM SEC 24	1800	20	11	120	L	3
46	FORREST LAKE DAM	1963	25	6	150	L	3
47	LOWER LAKE CHAPPAREL DAM	1976	27	45	840	L	3
48	BUNN'S LAKE DAM EAST	1978	15	14	220	L	3
49	BUNN S LAKE DAM WEST	1977	25	24	85	L	3
50	FOUNTAIN LAKE DAM	1975	25	8	90	L	3
51	ROBERTS LAKE DAM	1969	25	4	110	L	3
52	NORTH 40 LAKE DAM	1936	25	4	80	L	3
53	ANGEL LAKE DAM	1968	29	8	55	L	3
54	WAYLAND LAKE DAM	1800	25	5	47	L	3
55	POLLOCK LAKE DAM	1971	25	10	120	L	3
56	SALMONS' LAKE DAM	1960	25	3	110	L	3
57	BUMGARNER LAKE DAM-SEC 11	1973	24	10	218	L	3
59	AARON LAKE DAM	1974	20	10	28	S	3
60	SILVER CREEK LAKE DAM	1975	24	20	910	L	3
61	COUNTRY VIEW ACRES LAKE DAM	1800	25	6	65	L	3
62	LEWIS LAKE DAM SOUTH	1800	25	2	15	L	3
63	LEWIS LAKE NORTH DAM	1977	25	13	120	H	2
64	GARRETT LAKE DAM	1968	25	5	31	L	3
65	WALNUT CREST LAKE DAM	1969	25	3	71	H	2
67	HOPPER DAM	1800	25	3	50	L	3
68	SELTSAM LAKE DAM	1979	25	3	17	H	2
69	BON-GOR LAKE DAM	1950	20	9	240	L	3
70	RAYFIELD LAKE DAM	1964	25	3	13	H	2
71	MILLS LAKE DAM	1947	30	3	12	H	2
72	AUSBURN'S LAKE DAM	1965	19	8	80	L	3
73	LAKE CYRENE DAM	1930	25	7	70	H	1
74	SHADY LAKE DAM	1968	26	4	220	H	1
75	LIDDELL DAM	1800	25	3	45	L	3
76	FLETCHALL LAKE DAM	1977	25	2	39	L	3
78	SMITH LAKE DAM SEC 1	1950	25	3	15	L	3
79	UNIV OF MO-R1 DAM	1959	18	12	140	H	2
80	SMITH LAKE DAM	1959	30	9	160	L	3
81	TINCHER LAKE NORTH DAM	1950	25	5	80	H	2
82	SAPP LAKE DAM	1977	25	6	87	L	3

Appendix B

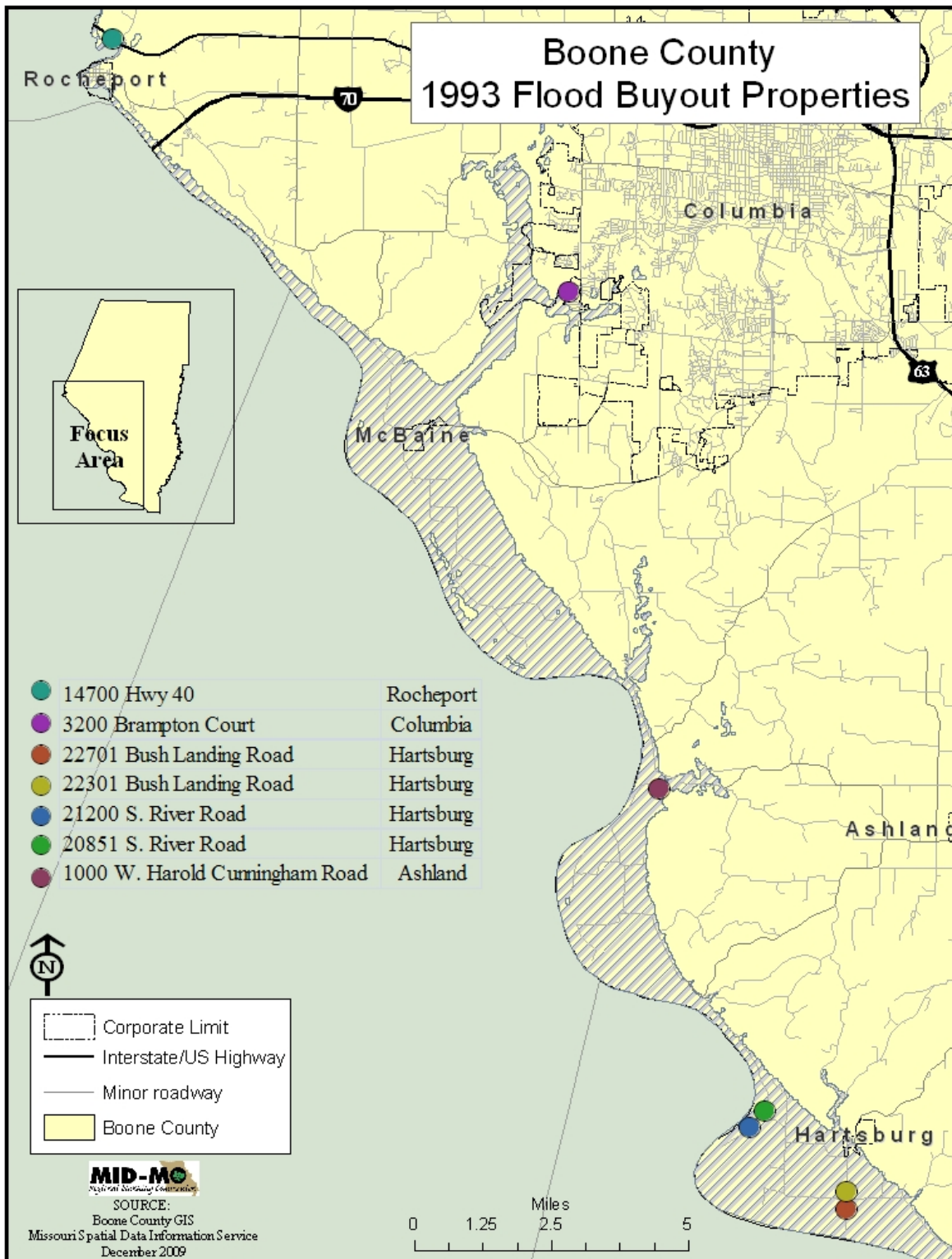
UNREGULATED Boone County Dams

Map ID #	Name	Year Built	Ht (feet)	Reservoir Area (Acres)	Drainage Area (Acres)	Federal Class	State Class
83	RAPP LAKE DAM	1968	30	4	300	L	3
84	KIMMY LAKE DAM	1970	25	5	60	L	3
85	DEXTER LAKE DAM	1800	25	3	20	L	3
86	CALLAHAN CREEK WATERSHED DAM A-4	1975	27	11	750	L	3
87	BENNETT LAKE DAM	1973	20	13	290	L	3
89	CALLAHAN CREEK WATERSHED DAM A-6	1977	25	6	267	L	3
90	LOHMAR LAKE DAM	1800	30	8	65	L	3
91	LLORENS LAKE DAM	1957	30	8	80	L	3
92	BLAKEMORE LAKE DAM	1963	30	4	21	L	3
93	WINDMILLER DAM #2	1962	20	5	155	H	1
95	WATERS EDGE ESTATES LAKE DAM	1980	25	17	2500	H	1
96	TINCHER LAKE SOUTH DAM	1979	25	20	210	L	3
97	RODDY LAKE DAM	1967	25	11	65	L	3
98	FINGER LAKES DAM NORTH	1800	26	48	740	L	3
101	B & C SUBDIVISION DAM	1989	34	38	280	H	1
102	LIMERICK LAKE DAM	-	31	2	180	H	1
105	HIGHLANDS LOWER LAKE DAM	1989	30	4	91	H	1
107	WINDMILLER LAKE DAM	1980	25	5	120	L	
108	HORNER LAKE DAM	1980	26	5	48	L	
109	HARRISON LAKE DAM	1985	24	2	111	L	3
111	WOODBINE LAKE DAM	1965	25	3	150	L	3
112	HILL CREEK ACRES LAKE DAM	1969	32	7	40	L	3
114	HERNY DAM	1965	15	8	145	L	3
115	CHENG LAKE DAM	1971	15	10	190	L	3
116	DEMARCO LAKE DAM	1800	31	3	42	H	1
117	CALLAHAN CREEK A-2	1975	29	5	593	S	3
118	CALLAHAN CREEK B-1	1967	26	6	650	L	3
119	CALLAHAN CREEK B-3	1980	33	6	582	S	3
120	FIELDS DAM	1989	28	1	0	L	
121	GREG BUNN LAKE	1979	18	1	0	L	
122	HARGIS DAM	1989	26	1	0	L	
123	KREISEL LAKE DAM	1977	21	15	150	L	3
124	SILAS MCCUBBIN LAKE DAM	1979	28	1	0	L	
125	YATES DAM	1990	23	1	0	L	

Source: http://www.dnr.mo.gov/env/wrc/damsft/Crystal_Reports/boone_dams.pdf

Appendix E

Flood Buyouts



Appendix F

Hazard Probability, Severity, and Vulnerability Worksheet by Jurisdiction

Appendix F

Hazard Probability, Severity, and Vulnerability Worksheet by Jurisdiction*

KEY:

P=Probability S=Severity V=Vulnerability

H=High M=Moderate L=Low

Participating Jurisdiction	Dam Failure			Drought			Earthquake			Extreme Heat			Flood			Land Subsidence/ Sinkhole			Levee Failure			Severe Winter Weather			Tornado and Thunderstorm			Wildfire		
	P	S	V	P	S	V	P	S	V	P	S	V	P	S	V	P	S	V	P	S	V	P	S	V	P	S	V	P	S	V
Planning Area	L	M	M	M	M	M	H	H	H	M	M	M	M	M	M	H	L - H*	M	M	M	M	H	M	M	H	H	H	M	M	M
Boone County	L	M	M	M	M	M	H	H	H	M	M	M	M	M	M	H	L - H*	M	M	M	M	H	M	M	H	H	H	M	M	M
Ashland	na	na	na	L	L	L	H	H	H	M	M	M	L	L	L	na	na	na	na	na	na	H	M	M	H	H	H	L	L	L
Centralia	L	L	L	L	L	L	H	H	H	M	M	M	L	L	L	na	na	na	na	na	na	H	M	M	H	H	H	L	L	L
Columbia	L	M	M	L	L	L	H	H	H	M	M	M	M	M	M	H	L - H*	M	na	na	na	H	M	M	H	H	H	L	L	L
Hallsville	L	L	L	L	L	L	H	H	H	M	M	M	L	L	L	na	na	na	na	na	na	H	M	M	H	H	H	L	L	L
Hartsburg	L	M	M	L	L	L	H	H	H	M	M	M	H	H	H	na	na	na	M	M	M	H	M	M	H	H	H	M	M	M
Huntsdale	na	na	na	L	L	L	H	H	H	M	M	M	H	H	H	na	na	na	M	M	M	H	M	M	H	H	H	L	L	L
Rocheport	na	na	na	L	L	L	H	H	H	M	M	M	H	H	H	na	na	na	na	na	na	H	M	M	H	H	H	M	M	M
Sturgeon	na	na	na	L	L	L	H	H	H	M	M	M	L	L	L	na	na	na	na	na	na	H	M	M	H	H	H	L	L	L
Centralia R-VI School District	na	na	na	L	L	L	H	H	H	M	M	M	L	L	L	na	na	na	na	na	na	H	M	M	H	H	H	L	L	L
Columbia Public Schools	na	na	na	L	L	L	H	H	H	M	M	M	L	L	L	na	na	na	na	na	na	H	M	M	H	H	H	L	L	L
Southern Boone School District	na	na	na	L	L	L	H	H	H	M	M	M	L	L	L	na	na	na	na	na	na	H	M	M	H	H	H	L	L	L
Sturgeon R-V School District	na	na	na	L	L	L	H	H	H	M	M	M	L	L	L	na	na	na	na	na	na	H	M	M	H	H	H	L	L	L
Stephens College	na	na	na	L	L	L	H	H	H	M	M	M	L	L	L	na	na	na	na	na	na	H	M	M	H	H	H	L	L	L
University of Missouri	na	na	na	L	L	L	H	H	H	M	M	M	L	L	L	na	na	na	na	na	na	H	M	M	H	H	H	L	L	L

* Definitions of ratings for Probability, Severity, and Vulnerability can be found in Section 3.5

** Depending on levels of contamination, if any

Appendix G

Updating of Boone County FIRM

Ken Pearson, Presiding Commissioner
Karen M. Miller, District I Commissioner
Skip Elkin, District II Commissioner



Roger B. Wilson
Boone County Government Center
801 East Walnut Room 245
Columbia, MO 65201-7732
573-886-4305 • FAX 573-886-4311

Boone County Commission

November 30, 2009

Mr. Paul Parmenter
State Emergency Management Agency
PO Box 116
Jefferson City, MO 65102

RE: FOIA request – Boone County Digitized FEMA maps

Dear Mr. Parmenter,

As you are aware, Boone County, City of Columbia and the rural communities met on November 19, 2009 with SEMA and FEMA to review and discuss the new maps we have all been anxiously awaiting. Much to our surprise, none of the enhanced information provided is being incorporated into the maps, such as the City of Columbia's 2 foot contours and current engineered modeling. This information was submitted by the City of Columbia approximately three years ago. Boone County and its communities do not have the same topography as they did in 1983. Many of the creeks have changed course and land has been leveled or elevated. Consequently, places that were in need of flood insurance may not need it today, but new areas may now need flood insurance.

Boone County recently had the rest of the county flown for 2 foot contours, and that information is expected to be available in April. We feel it is imperative that all updated data be incorporated into the set of maps.

The accuracy of these maps is critical to all of our citizens who utilize or who, because of outdated information, may not be aware they should utilize the national flood insurance. We were informed the contractor is only required to digitize the existing maps. We expect that FEMA and SEMA would want to utilize the most current information. In that regard, this is an official Freedom of Information Act request for a copy of the contract with Watershed Concepts and its sub-contractor, AECOM. We need to know the scope of the contract in order to determine our next course of action as digitization of the old outdated maps is not acceptable.

Respectfully requested,

Handwritten signature of Kenneth M. Pearson.

Kenneth M. Pearson
Presiding Commissioner

Handwritten signature of Karen M. Miller.

Karen M. Miller
District I Commissioner

Handwritten signature of Skip Elkin.

Skip Elkin
District II Commissioner

CC: Senator Claire McCaskill
Senator Christopher Bond
Congressman Blaine Luektemeyer
Senator Kurt Schaefer
Representative Steven Webber
Representative Chris Kelly
Representative Mary Still
Representative Steve Hobbs
Representative Paul Quinn
Mayor Darwin Hindman
Bill Watkins

Appendix H

Information and Guidelines for Assessing Mitigation Actions

Information and Guidelines for Assessing Mitigation Actions for Your Jurisdiction

The Hazard Mitigation Technical Steering Committee suggested mitigation actions (with priority ratings) for all of the participating jurisdictions.

Please fill out the matrix for the suggested actions which you wish to include in the plan for your jurisdiction unless...

- ♦ Action already taking place in your jurisdiction? Please indicate that on the matrix.
- ♦ Action not appropriate or you choose not to include? Please cross it out.
- ♦ Action listed with the Office of Emergency Management as the Lead Agency? These are actions which will be included for your jurisdiction since the OEM covers the entire area of Boone County. You do not need to fill out anything about these actions **unless** Local Government is listed as a Partner for the action.

NOTE: Where the lead agency is listed as "(local government)", please change to the specific position in your government which will in charge of leading this action.

NFIP Actions

Do you participate in the National Flood Insurance Program (NFIP)?

- ♦ Yes – All actions concerning the NFIP must remain in the actions for your jurisdiction.
- ♦ No - There is an action concerning participation, if you would like to participate. Participation is voluntary. Should you choose not to participate, please provide an explanation as to why you have made this choice. This explanation is required.

Prioritization Guidelines The actions were prioritized according to the following guidelines:

High – Work should begin as soon as possible; action should be accomplished in the next 5 years

Medium – Work could begin within the next 5 years, if time and resources allow

Low – Long-range goal, if time and resources allow; work within the next 5 years is possible, but not probable

You may want to make a change in the priorities for your jurisdiction. Benefit vs. cost must be taken into consideration in the prioritization process. A sheet is provided for feedback re: the prioritization and benefit/cost considerations. Please note that we need this information from you even if you choose to accept the Steering Committee's priority rankings.

Projected Cost Field on Matrix If actual cost estimates are not available, you may use comparative costs. A suggested scale is the following:

Minimal – Little or no cost to the jurisdiction involved

Moderate – A definite cost involved but this cost could likely be worked into the operating budget of the jurisdiction involved

Significant – A cost that may be above and beyond most operating budgets; would require some type of extra appropriation to finance or to meet matching funds for a grant