

Boone County, MO

Hazard Mitigation Plan



The planning process for the update of the Boone County Hazard Mitigation Plan was led by the Mid-Missouri Regional Plan Commission through a contractual agreement with the MO State Emergency Management Agency and Boone County.

Mid-Missouri Regional Planning Commission
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CONTRIBUTORS

Boone County Hazard Mitigation Planning Committee

Jurisdictional Representatives of Boone County Mitigation Planning Committee

Name	Title	Department	Jurisdiction/Agency
Haley Campbell	Mitigation & Recovery	Emergency Management	Boone County
Tom Hurley	EMA Director	Emergency Management	Boone County
Sherril Gladney	Planning & Prep	Emergency Management	Boone County
Heather Russell	Administrator	City	Centralia
Eric Hempel	Housing Specialist	Sustainability	City of Columbia
Barbara Buffaloe	Manager	Sustainability	City of Columbia
Steve Crosswhite	Mayor	City	Sturgeon
Brianna Lennon	Clerk	County	Boone County
John Zondca	Mayor	City	Rocheport
David Kelb	Police Chief	Sturgeon Police Dep.	Sturgeon
Rebecca Estes	Planning Supervisor	Health Dep.	Boone County
Tom Ratterman	Manager	Sewer Dep.	Boone County
Justin Nichols	Manager	Administration	Hallsville School District
Brian Schultz	Police Chief	Hallsville Police Dep.	Hallsville
Geoff Neill	Superintendent	Administration	Sturgeon School District
Chris Femlee	Superintendent	Administration	Southern Boone School District
Ken Gregory	Assistant Director	Safety	Columbia Public Schools
Steve Chancellor	Superintendent	Administration	Centralia School District
Tony St Romaine	Administrator	City	Ashland
Bill Molendorp	Mayor	City	Hartsburg
Reggie Wilhite	Chairman	City	Harrisburg
Debby Lancaster	Mayor	City	Huntsdale
Doug Schwandt	Police Chief	MUPD	University of Missouri
Ken Hammond	Director	Campus Safety	Stephens College
Stakeholders			
Mike Parks	Manager		Columbia Regional Airport
Steve Walsh	Press Secretary		State-Rep Vicky Hartzler Office

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

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Executive Summary

Hazard mitigation, at its core, focuses on anticipating and lowering risks to lives and property. Natural hazards are taking an increasing toll on lives and property in the United States. The number of FEMA declared Presidential Disasters across the nation has increased drastically over the past handful of decades. Averaging 121 disaster declarations between 1999 – 2019 the numbers are more than showing an extreme uptake compared to an average of 45 per year as noted between the years 1979-1998. Between January 2014 to December 2018 alone, presidential disaster declarations have totaled 528 (FEMA.Gov). <https://www.fema.gov/disasters/year>.

The cost of these disasters has also increased in recent years, in part because of increased population and a larger built environment but also because of the magnitude of many recent disasters. Hazard mitigation, the cornerstone of emergency management, seeks to address these issues.

Hazard mitigation can save lives and property; it also makes good economic sense. A 2018 study by the National Institute of Building Sciences finds \$6 saved for every dollar invested in mitigation activities to reduce risk and disaster losses ,” In the case of riverine flood, the savings are a \$7-to-\$1 benefit for proactive mitigation steps such as acquiring or demolishing flood-prone buildings “(Laura Lightbody, 2018). Hazard mitigation is a good business practice for both the public and private sectors. [https://www.pewtrusts.org/en/research-and-analysis/articles/2018/01/11/every-\\$1-invested-in-disaster-mitigation-saves-\\$6](https://www.pewtrusts.org/en/research-and-analysis/articles/2018/01/11/every-$1-invested-in-disaster-mitigation-saves-$6)

The Plan: Boone County and its jurisdictions have had a FEMA approved hazard mitigation plan in place since 2005; the plan, and the mitigation strategy within it, is updated every five years as required by federal law. Since the 2015 update, the Boone County plan has been enhanced to an All Hazards Mitigation Plan. In addition to profiling eleven natural hazards, the plan now also profiles eleven technological/human-made hazards which are potential threats. A risk assessment is included for each potential hazard.

The risk assessment (Sections 4 and 5) indicates the natural hazards posing the greatest threat to Boone County are: tornado, thunderstorm, severe winter weather, and an earthquake of significant magnitude at the New Madrid Seismic Zone. Flood, levee failure, and dam failure are of particular concern for certain jurisdictions. Land subsidence/sinkhole development is of growing concern for some jurisdictions as development proceeds at a rapid pace.

The technological/human-made hazards posing the greatest potential threat are a public health emergency, utility service disruption, unwanted intruder incident which turns into an active shooter event, cyber-attack, and terrorism.

Mitigation Currently in Place: Much progress in mitigation has been made in Boone County since the first plan was written in 2005; many mitigation activities are in place in the regular operations of the county, its communities, educational institutions, and special districts. However, much remains to be done.

Several mitigation actions have been completed since the 2015 update of the plan: In unincorporated Boone County, Route 63 over Gans Creek, south of Discovery Parkway - Bridge rehabilitation in the southbound lanes continues. The Boone County Emergency management agency acquired a new 175kW generator as well as laptops for their Incident Response Trailer and the city of Sturgeon has started to place utilities underground in their new subdivisions.

2020 Mitigation Strategy: The current mitigation strategy, found in Section 4 of the plan, lays out a series of actions to be focused on during the coming five years. Each of the actions has been analyzed as to applicable jurisdiction(s), the agency or department which will lead the effort, and the means of implementing and financing the action. All these decisions were made by jurisdictional representatives participating as members of the hazard mitigation planning committee.

Not every action in the overall mitigation strategy applies to each jurisdiction. For example, “Continue to supply updated GIS base map information...” is an action carried out by Boone County with the help of the City of Columbia. Other jurisdictions do not need to do anything with this action, although they do benefit from it. An example of an action particular to only one jurisdiction is “encourage local water district to have adequate fire flow...” this action is specific to the City of Sturgeon. An example of an action applicable to many jurisdictions is “review and formalize relationships with cooling centers in each community”; this is an important action which many of the jurisdictions will be undertaking to address their own circumstances.

Each participating jurisdiction in the plan has resolved to execute some of the specific actions outlined in the strategy. Section 4 of the plan contains a subsection for each participating jurisdiction which outlines the actions for which that jurisdiction is responsible. Government officials can easily find their jurisdiction in Section 4 in order to thoroughly familiarize themselves with the tasks ahead.

While it is to be hoped that many of the mitigation actions in the strategy will have been completed before the next five-year update, nothing in the plan is legally binding on the participating jurisdictions.

The 2020 countywide mitigation strategy is shown in its entirety below, organized by the five major mitigation goals. (Actions continuing from the 2015 plan are in italics while new actions for 2020 are in regular text.)

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

- Mitigate the effects of flooding on public infrastructure
- Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
- Continue to supply updated GIS base map information to support changing/updating the D-FIRM maps using local, accurate data.
- Review building codes every three years for potential update.
- Continue to participate as a partner in FEMA's RISKMap process.
- Continue with monthly testing of warning systems in compliance with procedures set out by the Office of Emergency Management.
- The Public Works Department will adhere to a routine maintenance schedule for brush cutting and tree trimming to keep branches from overhanging roads.
- Conduct a flow study along major highway routes to help determine quantities of hazardous materials being transported through Boone County.
- Conduct detailed risk assessments and cost/benefit analyses of telecommunications and networking vulnerabilities in individual municipalities
- Investigate tools for automated notification system to be used collaboratively throughout Boone County and its jurisdictions.
- Develop Continuity of Operations Plans (COOPs).

- Ensure evacuation plans are adequate for nursing homes and special needs population
- Strategize and establish local source(s) of sustainable mitigation funding to be used by participating jurisdictions in the Boone County Hazard Mitigation Plan as direct project funding and/or as local match for outside grants.
- Encourage underground utilities where feasible.
- Review and formalize relationships with cooling and warming centers in each community.
- Establish agreements with cellular providers for "Cell on Wheels" units to be made available in case of telecommunications disruption.
- Encourage shelters to have an alternative heating source

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

- Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
- Review building codes every three years for potential update.
- Add sinkhole regulations to stream buffer/storm water ordinance.
- Develop policy and enforcement regulations concerning burning permits.
- Develop regulations for roads on dams.

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

- Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.
- Replace 2, 3, and 4-inch water lines with 6-inch lines to ensure adequate supply for fire flow.
- Secure high value equipment located outside county and municipal buildings (generators, signs, com-equipment)
- Mitigate the effects of flooding on public infrastructure.
- Ensure evacuation plans are adequate for nursing homes and special needs populations.
- Evaluate and maintain emergency preparedness plans.
- Continue to comply with requirements of FAA 139 and TSA 1542 at Columbia Regional Airport.
- Develop strategy for preparedness planning and 72-hour provisions for most vulnerable populations; include strategies for food, water, hygiene, and medical supplies.
- Conduct emergency preparedness exercises periodically throughout the year.
- Build tornado safe room(s) or harden part(s) of existing structure(s) to FEMA 361 standards.
- Encourage shelters to have alternative heating sources.
- Acquire generators and power transfer hookup equipment.
- Continue to increase capacity to prevent and respond to unwanted intruder/active shooter events.
- Host Psychological First Aid courses in order to create a local Psychological First Aid capacity.

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

- Continue to educate the public on all hazards.
- Promote the purchase and use of NOAA radios.
- Promote Ready-in-3 materials in-house at the Columbia/Boone County Dept. of Public Health and Human Services and at public events.

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

- Target Repetitive Loss Properties for flood buyout.
- Acquire properties susceptible to flood damage when buyout grants are available.

Funding and Funding Issues: Some actions in the current mitigation strategy can be put in place given minimal resources and some staff time. However, there are some very important mitigation activities which require major funding. For example, there is a serious lack of tornado safe rooms in the jurisdictions and tornadoes/high winds are one of the greatest threats in the area. More generators and power transfer hookups are also needed to mitigate power outages that often accompany damaging winds or severe winter storms.

The Federal Emergency Management Agency (FEMA) has both pre-disaster and post-disaster mitigation grant programs to help local jurisdictions with mitigation projects. These programs are outlined in Section 6.5 of the plan. The jurisdictions participating in the plan are eligible to apply for funding from these programs; a 25% local match is typically required for the funds received.

Unfortunately, there has been a severe decline in recent years in the amount of pre-disaster federal money available. This creates the unfortunate situation where most federal funding for local mitigation projects becomes available after a disaster has occurred - if a Presidential Disaster Declaration is declared. At that point, 20% of the total federal cost of the disaster is awarded to the state to be used for mitigation projects.

Given the current state of federal funding assistance, the 2020 hazard mitigation planning committee recognized the pressing need to establish reliable and sustainable sources of local funding for mitigation projects. An action has been included in the current mitigation strategy to Boone County Hazard Mitigation Plan 2020 strategize and establish such local funding sources; these local funding pools could be used both for projects and for local matches if/when federal funds become available.

Planning Process: A plan is only as good as the planning process which developed it. Boone County and its jurisdictions undertook a thorough update of this hazard mitigation plan over a nine-month period in 2019-2020. Jurisdictions from both within and surrounding Boone were invited to participate and give feedback during the plan update.

The update was completed with the **active participation of eighteen** jurisdictions in Boone County (the county itself, ten communities, five school districts, one college, and one university). Representatives from these jurisdictions comprised the hazard mitigation planning committee which met for four general sessions. In addition, meetings were held with other established committees in Boone County and with individuals particularly knowledgeable on specific topics. The draft plan was presented at one public meeting and published on the website of the Mid-MO Regional Planning Commission, to allow for input from the general public.

The plan will be evaluated and maintained on a yearly basis with the help of the planning committee; the next complete update will be undertaken in five years.

The ultimate test of a plan is the action taken on the roadmap presented. It is to be hoped that many of the mitigation actions in this plan will have been completed before the next five-year update. Action on the strategy in this plan will help to ensure a greater, and more cost-effective, level of protection for the citizens and property of Boone County and its jurisdictions.

The Boone County Hazard Mitigation Plan can be found online at: www.mmrpc.org/reports-library/hazard-mitigation-reports/.

Prerequisites

44 CFR requirement 201.6(c)(5): The local hazard mitigation plan shall include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan. For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

The participating jurisdictions adopted the plan following FEMA’s “approval pending adoption”. Adoption resolutions and adoption letters (school districts and institutes of higher learning) are included in this section.

The following jurisdictions participated in the planning process and have formally adopted the multi-jurisdictional hazard mitigation plan...

CERTIFIED COPY OF ORDER

STATE OF MISSOURI

} ea.

September Session of the July Adjourned

Term. 2020

County of Boone

In the County Commission of said county, on the

1st

day of

September

2020

the following, among other proceedings, were had, viz:

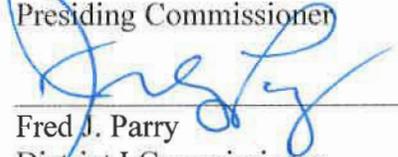
Now on this day, the County Commission of the County of Boone does hereby adopt the Boone County Hazard Mitigation Plan as this jurisdiction's Hazard Mitigation Plan as described in the attached executive summary with detailed descriptions available after adoption on the Boone County Office of Emergency Management webpage.

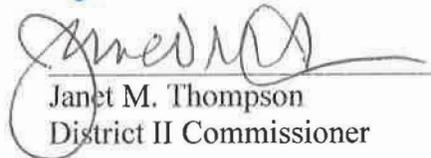
Done this 1st day of September 2020.

ATTEST:


Brianna L. Lennon
Clerk of the County Commission


Daniel K. Atwill
Presiding Commissioner


Fred J. Parry
District I Commissioner


Janet M. Thompson
District II Commissioner

The following resolution was adopted by Boone County, Missouri on

September 1, 2020.

RESOLUTION NO. 384-2020

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

WHEREAS, Boone County participated in the preparation of the Boone County Hazard Mitigation Plan; and

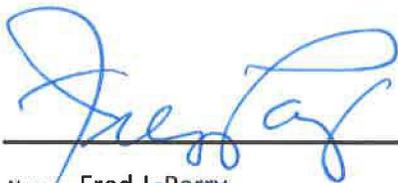
WHEREAS, the citizens of Boone County have been afforded an opportunity to comment and provide input on the Plan and the mitigation actions therein; and

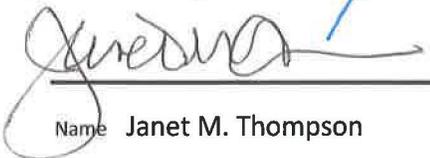
WHEREAS, Boone County has reviewed the Plan and affirms that the Plan will be updated no less than every five years

NOW THEREFORE, BE IT RESOLVED by the County Commission that Boone County adopts the Boone County Hazard Mitigation Plan as this jurisdiction's Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this 1st day of September, 2020 at the meeting of the County Commission.


 _____ 9.1.20
 Name Daniel K. Atwill Position Presiding Commissioner Date


 _____ 9.1.20
 Name Fred J. Parry Position District 1 Commissioner Date
 PARRY


 _____ 9/1/2020
 Name Janet M. Thompson Position District 2 Commissioner Date

A RESOLUTION OF THE City of Ashland Board of Aldermen, ADOPTING THE Boone Hazard Mitigation Plan 2020.

WHEREAS the City of Ashland Board of Aldermen recognizes the threat that natural hazards pose to people and property within the City of Ashland, Mo; and

WHEREAS the City of Ashland Board of Aldermen has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Boone Hazard Mitigation Plan 2020, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

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

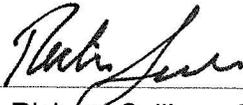
WHEREAS the City of Ashland Board of Aldermen recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the City of Ashland, Mo. will endeavor to integrate the *Plan* into the comprehensive planning process; and

WHEREAS adoption by the City of Ashland Board of Aldermen demonstrates their commitment to hazard mitigation and achieving the goals outlined in the *Plan*.

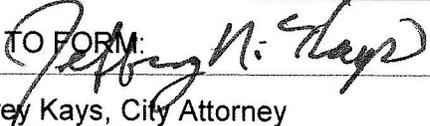
NOW THEREFORE, BE IT RESOLVED BY THE City of Ashland Board of Aldermen in the State of Missouri, THAT:

In accordance with the adoption of Resolutions of the City of Ashland Board of Aldermen adopts the final *FEMA-approved Plan*.

ADOPTED by a vote of 6 in favor and 0 against, and 0 abstaining, this 15th day of September, 2020.

By (Sig): 
Print name: Richard Sullivan, Mayor

ATTEST:
By (Sig.): 
Print name: Darla Sapp, City Clerk

APPROVED AS TO FORM:
By (Sig.): 
Print name: Jeffrey Kays, City Attorney

BILL TO CREATE A RESOLUTION ENTITLED:

A RESOLUTION OF THE CITY OF CENTRALIA, MISSOURI TO ADOPT THE BOONE COUNTY HAZARD MITIGATION PLAN 2020.

WHEREAS, the Centralia Board of Aldermen recognizes the threat that natural hazards pose to people and property within the City of Centralia, Missouri; and

WHEREAS, the Centralia Board of Aldermen has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Boone County Hazard Mitigation Plan 2020, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

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

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

WHEREAS, adoption by the Centralia Board of Aldermen demonstrates their commitment to hazard mitigation and achieving the goals outlines in the *Plan*.

NOW, THEREFORE, BE IT RESOLVED BY the Board of Aldermen of the City of Centralia, in the State of Missouri, THAT:

In accordance with Section 7-6 of the Centralia City Code, the Centralia Board of Aldermen adopts the final *FEMA-approved Plan*.

RESOLVED this 17th day of August, 2020 by the Board of Alderman of the City of Centralia, Missouri.

Alderman Wilkins: Absent
Alderman Hudson: Yes
Alderman Motley: Absent

Alderman Stevens: Yes
Alderman Rodgers: Yes
Alderman Magley: Yes



Mayor, Chris Cox

ATTEST:



City Clerk, Tara Strain

CENTRALIA R-VI SCHOOL DISTRICT, Missouri RESOLUTION NO. 001

A RESOLUTION OF THE CENTRALIA R-VI SCHOOL DISTRICT ADOPTING THE Boone Hazard Mitigation Plan 2020.

WHEREAS the CENTRALIA R-VI SCHOOL DISTRICT recognizes the threat that natural hazards pose to people and property within the (local governing body/school district); and

WHEREAS the CENTRALIA R-VI SCHOOL DISTRICT has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the BOONE HAZARD MITIGATION PLAN, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the *Plan* identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the CENTRALIA R-VI SCHOOL DISTRICT from the impacts of future hazards and disasters; and

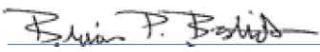
WHEREAS the CENTRALIA R-VI SCHOOL DISTRICT recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the CENTRALIA R-VI SCHOOL DISTRICT will endeavor to integrate the *Plan* into the comprehensive planning process; and

WHEREAS adoption by the CENTRALIA R-VI SCHOOL DISTRICT demonstrates their commitment to hazard mitigation and achieving the goals outlined in the *Plan*.

NOW THEREFORE, BE IT RESOLVED BY THE CENTRALIA R-VI SCHOOL DISTRICT, in the State of Missouri, THAT:

In accordance with (*local rule for adopting resolutions*), the CENTRALIA R-VI SCHOOL DISTRICT adopts the final *FEMA-approved Plan*.

ADOPTED by a vote of 6 in favor and 0 against and 0 abstaining, and 1 absent, this 9 day of November, 2020.

By (Sig): 
Print name: Brian Bostick

ATTEST:
By (Sig.): 
Print name: Vanessa Ridgel

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

Introduced by Treece Council Bill No. R 8-21

A RESOLUTION

adopting the 2020 Boone County, Missouri Hazard Mitigation Plan.

WHEREAS, the Boone County, Missouri Hazard Mitigation Plan (hereinafter "the Mitigation Plan") is a multi-jurisdictional hazard mitigation plan prepared in accordance with FEMA requirements of 44 CFR § 201.6; and

WHEREAS, City of Columbia staff members have participated in the preparation of the multi-jurisdictional Mitigation Plan, in accordance with the Disaster Mitigation Act of 2000; and

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

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

WHEREAS adoption of the Mitigation Plan demonstrates the City of Columbia's commitment to hazard mitigation and achieving the goals outlined in the Mitigation Plan; and

WHEREAS, the City of Columbia affirms that the Mitigation Plan will be updated no less than every five (5) years.

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF COLUMBIA, MISSOURI, AS FOLLOWS:

SECTION 1. The City Council adopts the 2020 Boone County, Missouri Hazard Mitigation Plan as the hazard mitigation plan of the City of Columbia, Missouri, a copy of which is attached hereto and marked "Exhibit A."

SECTION 2. The City of Columbia resolves to consider implementation of pertinent precepts of the Mitigation Plan by incorporation into other community plans and mechanisms where appropriate.

SECTION 3. The City of Columbia will evaluate and review the Mitigation Plan regularly or after a disaster as well as complete a mandated five-year update submitted to the State Emergency Management Agency and the Federal Emergency Management Agency for review.

Permanent Record
Filed in Clerk's Office

ADOPTED this 4th day of January, 2021.

ATTEST:



City Clerk



Mayor and Presiding Officer

APPROVED AS TO FORM:



City Counselor

RESOLUTION

A RESOLUTION OF THE COLUMBIA PUBLIC SCHOOL DISTRICT ADOPTING THE BOONE HAZARD MITIGATION PLAN 2020.

WHEREAS the Columbia Public School District recognizes the threat that natural hazards pose to people and property within the Columbia Public School District; and

WHEREAS the Columbia Public School District has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Boone Hazard Mitigation Plan 2020, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the *Plan* identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the Columbia Public School District from the impacts of future hazards and disasters; and

WHEREAS the Columbia Public School District recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the Columbia Public School District will endeavor to integrate the *Plan* into the comprehensive planning process; and

WHEREAS adoption by the Columbia Public School District demonstrates their commitment to hazard mitigation and achieving the goals outlined in the *Plan*.

NOW THEREFORE, BE IT RESOLVED BY THE COLUMBIA PUBLIC SCHOOL DISTRICT, in the State of Missouri, THAT:

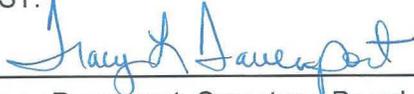
The Columbia Public School District adopts the final *FEMA-approved Plan*.

ADOPTED by a vote of 7 in favor and 0 against, and 0 abstaining, this 14th day of September, 2020.

By: 

Helen Wade, President, Board of Education

ATTEST:

By: 

Tracy Davenport, Secretary, Board of Education

RESOLUTION NO. 2020-2

A RESOLUTION OF THE CITY OF HALLSVILLE ADOPTING THE Boone Hazard Mitigation Plan 2020.

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

WHEREAS, the City of Hallsville has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Boone County Hazard Mitigation Plan, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

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

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

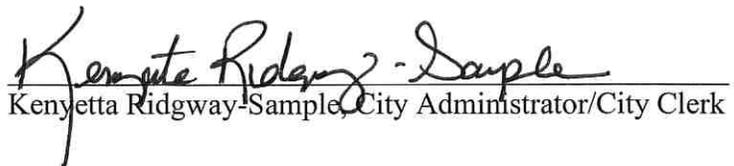
WHEREAS, adoption by the Board of Aldermen demonstrates their commitment to hazard mitigation and achieving the goals outlined in the *Plan*.

NOW THEREFORE, BE IT RESOLVED by the Board of Aldermen that the City of Hallsville, in the State of Missouri, adopts the *FEMA-approved Plan* as this jurisdiction's Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED by a vote of 3 in favor and 0 against, and 1 abstaining, this 20 day of August, 2020.


Logan Carter, Mayor

SEAL


Kenyetta Ridgway-Sample, City Administrator/City Clerk

Hallsville R-IV School District, Hallsville, Missouri

A RESOLUTION OF THE HALLSVILLE R-IV SCHOOL DISTRICT ADOPTING THE BOONE HAZARD MITIGATION PLAN 2020.

WHEREAS the Hallsville R-IV School District recognizes the threat that natural hazards pose to people and property within the Hallsville R-IV School District; and

WHEREAS the Hallsville R-IV School District has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Boone Hazard Mitigation Plan, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the *Plan* identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the Hallsville R-IV School District from the impacts of future hazards and disasters; and

WHEREAS the Hallsville R-IV School District recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the Hallsville R-IV School District will endeavor to integrate the *Plan* into the comprehensive planning process; and

WHEREAS adoption by the Board of Education of the Hallsville R-IV School District demonstrates their commitment to hazard mitigation and achieving the goals outlined in the *Plan*.

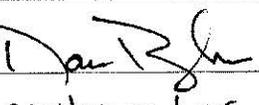
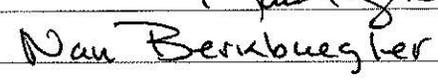
NOW THEREFORE, BE IT RESOLVED BY THE HALLSVILLE R-IV SCHOOL DISTRICT, in the State of Missouri, THAT:

The Hallsville R-IV School District adopts the final *FEMA-approved Plan*, subject to other obligations under the law.

ADOPTED by a vote of 7 in favor and 0 against, and 0 abstaining, this 16th day of December, 2020.

By (Sig): 
Print name: Jon M. Berube

ATTEST:
By (Sig.): 
Print name: David John Downs

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

A RESOLUTION OF THE VILLAGE OF HARRISBURG ADOPTING THE Boone Hazard Mitigation Plan 2020.

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

WHEREAS the Village of Harrisburg has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Harrisburg Mitigation Plan 2020 hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

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

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

WHEREAS adoption by the Village of Harrisburg demonstrates their commitment to hazard mitigation and achieving the goals outlined in the *Plan*.

NOW THEREFORE, BE IT RESOLVED BY THE VILLAGE OF HARRISBURG, in the State of Missouri, THAT:

In accordance with, the Village of Harrisburg adopts the final *FEMA-approved Plan*.

ADOPTED by a vote of 3 in favor and 0 against, and 0 abstaining, this 1ST day of October, 2020

By (Sig): Regenia Wilhite

Print name: Regenia Wilhite

ATTEST:
By (Sig.): Kathy Wilhite
Print name: Kathy Wilhite

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

(Harrisburg R VIII School District), Missouri RESOLUTION

NO. _____

A RESOLUTION OF THE (HARRISBURG R-VIII SCHOOL DISTRICT) ADOPTING THE [Boone] COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

WHEREAS the (Harrisburg R VIII School District) recognizes the threat that natural hazards pose to people and property within the (Harrisburg R VIII School District); and

WHEREAS the (Harrisburg R VIII School District) has participated in the preparation of a multi-hazard mitigation plan, hereby known as the [Boone] County Multi-Jurisdictional Hazard Mitigation Plan, hereafter referred to as the Plan, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the (Harrisburg R VIII School District) from the impacts of future hazards and disasters; and

WHEREAS the (Harrisburg R VIII School District) recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the (Harrisburg R VIII School District) will endeavor to integrate the Plan into the comprehensive planning process and

WHEREAS adoption by the (Harrisburg R VIII School District) demonstrates their commitment to hazard mitigation and achieving the goals outlined in the Plan

NOW THEREFORE, BE IT RESOLVED BY THE (HARRISBURG R-VIII SCHOOL DISTRICT), in the State of Missouri, THAT:

In accordance with (Harrisburg R VIII School District), the (Harrisburg R VIII School District) adopts the final FEMA-approved plan.

ADOPTED by a vote of 7 in favor and 0 against, and 0 abstaining, this 12 day of October 2020

By (Sig): [Signature]
Print name: Dawn Stiller

ATTEST:
By (Sig.): [Signature]
Print name: Dawn Malone

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

(VILLAGE OF HARTSBURG), Missouri RESOLUTION NO. 2012

A RESOLUTION OF THE (VILLAGE OF HARTSBURG) ADOPTING THE Boone Hazard Mitigation Plan 2020.

WHEREAS the (VILLAGE OF HARTSBURG) recognizes the threat that natural hazards pose to people and property within the (local governing body/school district); and

WHEREAS the (VILLAGE OF HARTSBURG) has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Boone Hazard Mitigation Plan 2020 hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the *Plan* identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the (VILLAGE OF HARTSBURG) from the impacts of future hazards and disasters; and

WHEREAS the (VILLAGE OF HARTSBURG) recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the (VILLAGE OF HARTSBURG) will endeavor to integrate the *Plan* into the comprehensive planning process; and

WHEREAS adoption by the (VILLAGE OF HARTSBURG) demonstrates their commitment to hazard mitigation and achieving the goals outlined in the *Plan*.

NOW THEREFORE, BE IT RESOLVED BY THE (VILLAGE OF HARTSBURG), in the State of Missouri, THAT:

In accordance with (*local rule for adopting resolutions*), the (VILLAGE OF HARTSBURG) adopts the final *FEMA-approved Plan*.

ADOPTED by a vote of 5 in favor and 0 against, and 0 abstaining, this 4 day of Nov., 2020

By (Sig): Bill Malendorp

Print name: Bill Malendorp

ATTEST: Sherri Thomas

By (Sig.): Sherri Thomas

Print name: Sherri Thomas

A RESOLUTION OF THE Village of Huntsdale, Missouri ADOPTING THE Boone County Hazard Mitigation Plan 2020.

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

WHEREAS the Village of Huntsdale has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Boone County Hazard Mitigation Plan 2020. Hereafter referred to as the Boone County Hazard Mitigation Plan 2020, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the Boone County Hazard Mitigation Plan 2020 identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the *Village of Huntsdale* from the impacts of future hazards and disasters; and

WHEREAS the Village of Huntsdale recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the Village of Huntsdale will endeavor to integrate the Boone County Hazard Mitigation Plan 2020 into the comprehensive planning process; and

WHEREAS adoption by the Village of Huntsdale demonstrates their commitment to hazard mitigation and achieving the goals outlined in the Boone County Hazard Mitigation Plan 2020.

NOW THEREFORE, BE IT RESOLVED BY THE VILLAGE OF HUNTSDALE, in the State of Missouri, THAT:

the Village of Huntsdale adopts the final *FEMA-approved Plan*.

ADOPTED by a vote of 5 in favor and 0 against, 0 abstaining,

This 30 day of September, 2020

By (Sig): Debby Lancaster
Print name: Debby Lancaster

ATTEST:
By (Sig.): [Signature]
Print name: Arc Lopez

APPROVED AS TO FORM: [Signature]
By (Sig.): [Signature]
Print name: Dorothy J. Eberhart



A RESOLUTION OF THE UNIVERSITY OF MISSOURI ADOPTING THE Boone Hazard Mitigation Plan 2020.

WHEREAS the University of Missouri recognizes the threat that natural hazards pose to people and property within the city of Columbia; and

WHEREAS the University of Missouri has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Boone Hazard Mitigation Plan 2020 hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

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

WHEREAS the University of Missouri recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the (*local governing body/school district*) will endeavor to integrate the *Plan* into the comprehensive planning process; and

WHEREAS adoption by the University of Missouri demonstrates their commitment to hazard mitigation and achieving the goals outlined in the *Plan*.

NOW THEREFORE, BE IT RESOLVED BY THE UNIVERSITY OF MISSOURI, in the State of Missouri, THAT:

The University of Missouri adopts the final *FEMA-approved Plan* on October 23, 2020.

By (Sig): Mark Diedrich
Print name: Mark Diedrich, Director Of Emergency Management, University of Missouri System

City of Rocheport, Missouri RESOLUTION NO. 2020-02

A RESOLUTION OF THE CITY OF ROCHEPORT ADOPTING THE Boone Hazard Plan 2020

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

WHEREAS the City of Rocheport has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Mitigation Plan 2020, hereafter referred to as the plan, in accordance with the Disaster Mitigation Act of 2020: and

WHEREAS the Boone Hazard Mitigation Plan 2020 identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the City of Rocheport from the impacts of future hazards and disasters: and

WHEREAS the City of Rocheport recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the City of Rocheport will endeavor to integrate the Mitigation Plan 2020 into the comprehensive planning process; and

WHEREAS adoption by the City of Rocheport demonstrated their commitment to hazard mitigation and achieving the goals outlined in the Mitigation Plan 2020.

NOW THEREFORE, BE IT RESOLVED BY THE City of Rocheport, in the State of Missouri, THAT:

In accordance with City of Rocheport resolutions, the City of Rocheport adopts the final FEMA-approved Plan

ADOPTED by a vote of 4 in favor and 0 against, and 15th, this day of October 15, 2020.

By (Sig): 
Print name: John S Zondca

ATTEST:
By (Sig): 
Print name: Shirley Jenkins-OLD

APPROVED As To FORM:

By (Sig): -----
Print name: _____

Southern Boone County R-I School District, Ashland, Missouri RESOLUTION NO. 1

A RESOLUTION OF THE SOUTHERN BOONE COUNTY R-I SCHOOL DISTRICT ADOPTING THE Boone County, MO Hazard Mitigation Plan 2020.

WHEREAS the Southern Boone County R-I School District recognizes the threat that natural hazards pose to people and property within the (local governing body/school district); and

WHEREAS the Southern Boone County R-I School District has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Boone County, MO Hazard Mitigation Plan 2020, hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the *Plan* identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the Southern Boone County R-I School District from the impacts of future hazards and disasters; and

WHEREAS the Southern Boone County R-I School District recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the (*local governing body/school district*) will endeavor to integrate the *Plan* into the comprehensive planning process; and

WHEREAS adoption by the Southern Boone County R-I School District demonstrates their commitment to hazard mitigation and achieving the goals outlined in the *Plan*.

NOW THEREFORE, BE IT RESOLVED BY THE SOUTHERN BOONE COUNTY R-I SCHOOL DISTRICT, in the State of Missouri, THAT:

In accordance with (*local rule for adopting resolutions*), the Southern Boone County R-I School District adopts the final *FEMA-approved Plan*.

ADOPTED by a vote of 7 in favor and 0 against, and 0 abstaining, this 19 day of October, 2020.

By (Sig): Steven Condon, Board President

Print name: _____

ATTEST

By (Sig.): Phyllis Weter, Board Secretary

Print name: _____

APPROVED AS TO FORM:

By (Sig.): _____

Print name: _____

Stephens College, Missouri RESOLUTION NO. 20201120

A RESOLUTION OF Stephens College ADOPTING THE Boone Hazard Mitigation Plan 2020.

WHEREAS Stephens College recognizes the threat that natural hazards pose to people and property within the (local governing body/school district); and

WHEREAS Stephens College has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Boone Hazard Mitigation Plan 2020 hereafter referred to as the *Plan*, in accordance with the Disaster Mitigation Act of 2000; and

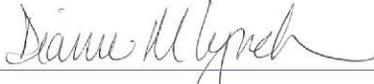
WHEREAS the *Plan* identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Stephens College from the impacts of future hazards and disasters; and

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

WHEREAS adoption by Stephens College demonstrates their commitment to hazard mitigation and achieving the goals outlined in the *Plan*.

NOW THEREFORE, BE IT RESOLVED, in the State of Missouri, THAT:

Stephens College adopts the final *FEMA-approved Plan* on 20 day of November, 2020.

By (Sig): 
Print name: Dianne Lynch, President

RESOLUTION NO. 08242020

“A RESOLUTION ADOPTING THE BOONE COUNTY, MISSOURI HAZARD MITIGATION PLAN OF 2020 AS THE HAZARD MITIGATION PLAN FOR THE CITY OF STURGEON, MISSOURI.”

WHEREAS, the Boone County, Missouri Hazard Mitigation Plan of 2020 is a multi-jurisdictional hazard mitigation plan prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and

WHEREAS, the City of Sturgeon, Missouri participated in the preparation of the Boone County, Missouri Hazard Mitigation Plan of 2000; and

WHEREAS, the citizens of the City of Sturgeon, Missouri have been afforded an opportunity to comment and provide input on the Plan and the mitigation action therein; and

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

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

NOW THEREFORE, BE IT RESOLVED BY THE BOARD OF ALDERMEN OF THE CITY OF STURGEON, MISSOURI, THAT:

In accordance with the City of Sturgeon adopts the final FEMA-approved Plan.

ADOPTED: by a roll call vote:

Alderman Janice Butler yes Alderman Kyle Schultz yes

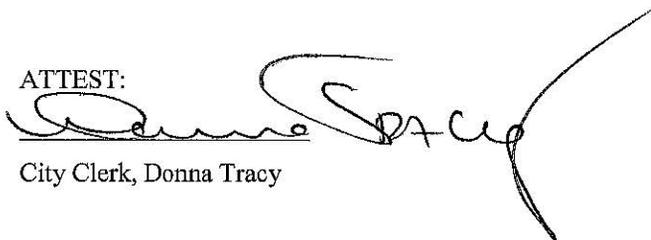
Alderman Ashley Long yes Alderman Stan Robinson yes

PASSED by the City of Sturgeon, Missouri Board of Aldermen and APPROVED by the City of Sturgeon, Missouri Mayor this 24th day of August



Mayor Steve Crosswhite

ATTEST:



City Clerk, Donna Tracy

Sturgeon R-V School District, Missouri RESOLUTION NO.

A RESOLUTION OF THE Sturgeon R-V School District ADOPTING THE Boone Hazard Mitigation Plan 2020.

WHEREAS the Sturgeon R-V School District recognizes the threat that natural hazards pose to people and property within the Sturgeon R-V School District; and

WHEREAS the Sturgeon R-V School District has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Boone Hazard Mitigation Plan 2020, hereafter referred to as the Plan, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the Sturgeon R-V School District from the impacts of future hazards and disasters; and

WHEREAS the Sturgeon R-V School District Board of Education recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the Sturgeon R-V School District Board of Education will endeavor to integrate the Plan into the comprehensive planning process; and

WHEREAS adoption by the Sturgeon R-V School District Board of Education demonstrates their commitment to hazard mitigation and achieving the goals outlined in the Plan.

NOW THEREFORE, BE IT RESOLVED BY THE Sturgeon R-V School District Board of Education, in the State of Missouri, THAT:

In accordance with board policies, the Sturgeon R-V School District Board of Education adopts the final FEMA-approved Plan.

ADOPTED by a vote of 7 in favor and 0 against, and 0 abstaining, this 9th day of September 2020.

By (Sig.): Misty Doss
Print name: MISTY DOSS

ATTEST:
By (Sig.): Peggy Leerhoff
Print name: Peggy Leerhoff

APPROVED AS TO FORM:
By (Sig.): Geoffrey E. Neill
Print name: GEORGEY ENELL

Section 1: Introduction and Planning Process

- Purpose.....1
- Background.....2
- Plan Organization.....4
- Planning Process.....4
 - Multi- Jurisdictional Participation
 - The Planning Steps

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, man-made, and technological hazards in Boone County. Each year natural, man-made, and technological hazards take a great toll in the United States. Boone County is not immune; it is subject to numerous natural, man-made, and technological 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 2018 study by the National Institute of Building Sciences finds \$6 saved for every dollar invested in mitigation activities to reduce risk and disaster losses.

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

BACKGROUND

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 initial plan was approved by FEMA and adopted by the participating jurisdictions in the spring of 2005.

The required 5-year update of the plan was undertaken in the spring of 2009 and the updated plan was approved by FEMA on November 8, 2010. Participation in the planning process within the county increased significantly; the updated plan included 14 “participating jurisdictions” adopting the mitigation plan as their own. In addition to Boone County, this included 8 incorporated communities, 4 school districts, and the University of Missouri-Columbia.

Maintenance of Hazard Mitigation Plan 2015-2020

The Boone County Hazard Mitigation Plan 2015 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.midmorpc.org) since it was approved and adopted in 2015.

The maintenance plan in the 2015 document called for an annual monitoring and review of the plan to be facilitated by the Mid-MO RPC. This monitoring and review were carried out in early 2017, again in the spring of 2018, and finally the fall of 2019 when the updating process ensued.

The process was as follows: The mitigation representative of each participating jurisdiction was sent an email with an attachment of the mitigation actions for the jurisdiction; a request was made for comments on the status of the actions and any other information regarding changes or development in the jurisdictions which might bear on hazard mitigation. Research was done by staff of the Mid-MO RPC on hazard events taking place since the last monitoring. After receiving responses from the participating jurisdictions, an addendum summary of the monitoring and review was included in the plan.

In addition to the yearly monitoring, the plan is available on the websites of the Columbia/Boone County Office of Emergency Management and the Mid-MO RPC. The Mid-MO RPC also disseminates information regarding mitigation grants when funding becomes available.

Jurisdictions that participated in the 2015 plan as well as the 2020 plan update include:

- Unincorporated Boone County
- Ashland
- Centralia
- Columbia

- Hallsville
- Hartsburg
- Harrisburg
- Huntsdale
- Rocheport
- Sturgeon
- Centralia R-VI School District
- Columbia Public Schools
- Hallsville R-IV
- Southern Boone School District
- Sturgeon R-V School District
- Columbia College
- Stephen's College
- University of Missouri

Jurisdictions that participated in the past but chose not to participate in this update include:

- Harrisburg R-VIII School District
- Columbia College

PLAN ORGANIZATION

The plan is formatted into 5 Sections with several sub-sections per section. The 2015 plan contained 6 sections. Planning Area Overview and Planning Area Assets and Capabilities were originally separate sections. For this plan the two sections were combined to match the updated outline for the local hazard mitigation plan released by the Missouri State Emergency Management Agency (SEMA) in 2017. The adjusted plan sections include:

- Section 1: Introduction and the Planning Process
- Section 2: Planning Area Overview, Assets, and Capabilities
- Section 3: Risk Assessment
- Section 4: Mitigation Strategy
- Section 5: Plan Implementation and Maintenance
- Appendices

PLANNING PROCESS

44 CFR 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 the emergency management planner from Mid-MO RPC (Sierra Thomas) as specified in a Memorandum of Agreement (MOA) with the Missouri State Emergency Management Agency (SEMA).

- Assist in establishing a Mitigation Planning Committee (MPC) as defined by the Disaster Mitigation Act (DMA),
- Organize Planning Committee Meetings locations and times
- Ensure the updated plan meets the DMA requirements as established by federal regulations and follows the most current planning guidance of the Federal Emergency Management Agency (FEMA),
- Facilitate the entire plan development process,
- Identify the data that MPC participants could provide and conduct the research and documentation necessary to augment that data,
- Assist in soliciting public input,
- Produce the draft and final plan update in a FEMA-approvable document and coordinate the Missouri State Emergency Management Agency (SEMA) and (FEMA) plan reviews.

The update process consisted of 4 planning committee meetings over the update period. Meeting announcements and sign-in sheets are included in Appendix A.

All hazard mitigation planning meetings were open to the public and public notice was provided in accordance with Missouri’s “Sunshine Law” (Revised Statutes of Missouri 610.010, 610.020, 610.023, and 610.024.) Notice of each meeting was posted at the Roger B. Wilson Boone County Government Center in Columbia, the Mid-MO RPC in Ashland, and on the website of the Mid-MO RPC (www.mmrpc.org).

Table 1.1 Jurisdictional Representatives of Boone County Mitigation Planning Committee

Name	Title	Department	Jurisdiction/Agency
Haley Campbell	Mitigation & Recovery	Emergency Management	Boone County
Tom Hurley	EMA Director	Emergency Management	Boone County
Sherril Gladney	Planning & Prep	Emergency Management	Boone County
Heather Russell	Administrator	City	Centralia
Eric Hempel	Housing Specialist	Sustainability	City of Columbia
Barbara Buffaloe	Manager	Sustainability	City of Columbia
Steve Crosswhite	Mayor	City	Sturgeon
Brianna Lennon	Clerk	County	Boone County
John Zondca	Mayor	City	Rocheport
David Kelb	Police Chief	Sturgeon Police Dep.	Sturgeon
Rebecca Estes	Planning Supervisor	Health Dep.	Boone County
Tom Ratterman	Manager	Sewer Dep.	Boone County
Justin Nichols	Manager	Administration	Hallsville School District
Brian Schultz	Police Chief	Hallsville Police Dep.	Hallsville
Geoff Neill	Superintendent	Administration	Sturgeon School District
Chris Femlee	Superintendent	Administration	Southern Boone School District
Ken Gregory	Assistant Director	Safety	Columbia Public Schools
Steve Chancellor	Superintendent	Administration	Centralia School District
Tony St Romaine	Administrator	City	Ashland
Reggie Wilhite	Chairman	City	Harrisburg
Bill Molendorp	Mayor	City	Hartsburg
Debby Lancaster	Mayor	City	Huntsdale
Doug Schwandt	Police Chief	MUPD	University of Missouri
Ken Hammond	Director	Campus Safety	Stephens College
Stakeholders			
Mike Parks	Manager		Columbia Regional Airport
Steve Walsh	Press Secretary		State-Rep Vicky Hartzler Office

Multi-Jurisdictional Participation

44 CFR Requirement §201.6(a)(3): Multi-jurisdictional plans may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan.

Multiple jurisdictions within Boone County participated in the development of this plan. Having a current and approved hazard mitigation plan is a prerequisite for participating jurisdictions to be eligible to apply for FEMA pre-disaster mitigation grants and the mitigation portion of post disaster mitigation grants. Invitations to participate in the development of the plan were sent to commissioners, incorporated community leaders, public schools and colleges, special districts, and various other stakeholders multiple times throughout the update to encourage participation in some manner. Each jurisdiction who participated will have to adopt the updated plan.

- Participation in a meeting was not required as long as other participation was had. Meeting participation could be in-person or by proxy.
- Each participating jurisdiction must provide sufficient information to support plan development by completion and return of surveys.
- For plan updates, eliminate from further consideration those actions from the previously approved plan that were not implemented because they were impractical, inappropriate, not cost-effective, or were otherwise not feasible.
- Review and comment on plan drafts
- Provide documentation to show time donated to the planning effort
- All participants should formally adopt the mitigation plan prior to submittal to SEMA and FEMA for final approval.

Table 1.2 Jurisdictional Participation in Planning Process

Jurisdiction	Kick-off Meeting	Meeting #2	Meeting #3	Meeting #4	Data Collection Questionnaire Response	Update/Develop Mitigation Actions
Boone County	X	X	X	X	X	X
Ashland					X	
Centralia	X				X	X
Columbia	X		X		X	X
Hallsville			X		X	X
Harrisburg					X	
Hartsburg				X		
Huntsdale					X	X
Rocheport	X					
Sturgeon	X		X		X	X
Centralia R-VI				X		
Columbia Public Schools				X	X	X
Hallsville R-IV			X			
Harrisburg R-VIII					X	
Southern Boone School Dist.			X	X		X

Sturgeon R-V				X		
Stephens College					X	
University of Missouri				X	X	X

The Planning Steps

Surveys and questionnaires were important in getting first-hand information from jurisdictions. One-on-one time, public meetings, and many emails produced a wealth of information taken into the plan. Many existing plans, studies, and reports were also consulted in the development of this plan. These include:

Development of the plan followed the 10-step planning process adapted from FEMA’s Community Rating System (CRS) and Flood Mitigation Assistance programs. The 10-step process allows the plan to meet funding eligibility requirements of the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, and Flood Mitigation Assistance Program as well as qualify for points under Activity 510 for Mitigation Plans, under the Community Rating System.

Table 1.3 County Mitigation Plan Update Process

Community Rating System (CRS) Planning Steps (Activity 510)	Local Mitigation Planning Handbook Tasks (44 CFR Part 201)
Step 1. Organize	Task 1: Determine the Planning Area and Resources
	Task 2: Build the Planning Team 44 CFR 201.6(c)(1)
Step 2. Involve the public	Task 3: Create an Outreach Strategy 44 CFR 201.6(b)(1)
Step 3. Coordinate	Task 4: Review Community Capabilities 44 CFR 201.6(b)(2) & (3)
Step 4. Assess the hazard	Task 5: Conduct a Risk Assessment 44 CFR 201.6(c)(2)(i) 44 CFR 201.6(c)(2)(ii) & (iii)
Step 5. Assess the problem	
Step 6. Set goals	Task 6: Develop a Mitigation Strategy 44 CFR 201.6(c)(3)(i); 44 CFR 201.6(c)(3)(ii); and 44 CFR 201.6(c)(3)(iii)
Step 7. Review possible activities	
Step 8. Draft an action plan	
Step 9. Adopt the plan	Task 8: Review and Adopt the Plan
Step 10. Implement, evaluate, revise	Task 7: Keep the Plan Current
	Task 9: Create a Safe and Resilient Community 44 CFR 201.6(c)(4)

Step 1. Organize

Contact lists were made for past participating jurisdictions and email notices were directly sent out to all jurisdictions and special districts in Boone County making sure to update contacts for positions who may have changed personnel. The notice consisted of a meeting announcement and short summary of what the meeting would be covering and its importance.

A kick-off meeting was hosted June 25, 2019 at the Boone County Emergency Management building. The foundation topic of this meeting was to outline the process of the hazard mitigation plan update and its importance. Surveys were passed out to each jurisdiction in attendance to identify what data the participants could provide. This meeting also served as an introduction to the types of hazards that would be included in the plan. Those in attendance were asked to sign in. Documentation can be found in the following appendices. They were instructed to either email the finished surveys to the lead planner or they had the option to return them in person at the next scheduled meeting. The date for the next meeting was set before everyone left the current meeting. Any jurisdictions not at the meeting were noted.

Meeting 2 took place on July 30, 2019 at the Boone County Emergency Management building. Anyone who wasn't at the first meeting was given a survey to fill out for their jurisdiction. Anyone done with their survey had the opportunity to turn it in if they had not emailed it prior to the meeting. There was discussion on parts of the survey that may not have been easily understood how to answer or where to get the information from. Risk Assessment results were shared with the group.

Meeting 3 took place October 1, 2019 at the Boone County Emergency Management building. Eric Hempel with Columbia Water and Light gave a presentation on the Columbia Climate Action and Adaptation Plan and climate change in our area. More surveys were turned in. There was discussion about making sure that everyone logs their hours to meet the "in-kind" match.

Meeting 4 took place December 10, 2019 at the Boone County Emergency Management building. Mitigation Actions list was discussed. Projects were either removed because they were done or no longer feasible, added, or listed as on-going.

Step 2. Public Involvement

44 CFR Requirement 201.6(b): An open public involvement process is essential to the development of an effective plan. 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.

Each of the 4 meetings of the MPC were open to the public. It was advertised through the Mid-MO RPC (www.mmrpc.org) website and posted at the office. The draft is available at the Mid-MO RPC website for anyone to review. Comments can be taken through email, phone, or in-person at the office. Individual invites and meeting notices were emailed to each jurisdiction for participation. Jurisdictions that did not show up or return email contact after the second meeting

were called directly and educated on the importance of their participation. Anyone who did not come in-person to a meeting was emailed a survey to fill out for their jurisdiction. At this time no public comments have been received.

Step 3. Coordinate

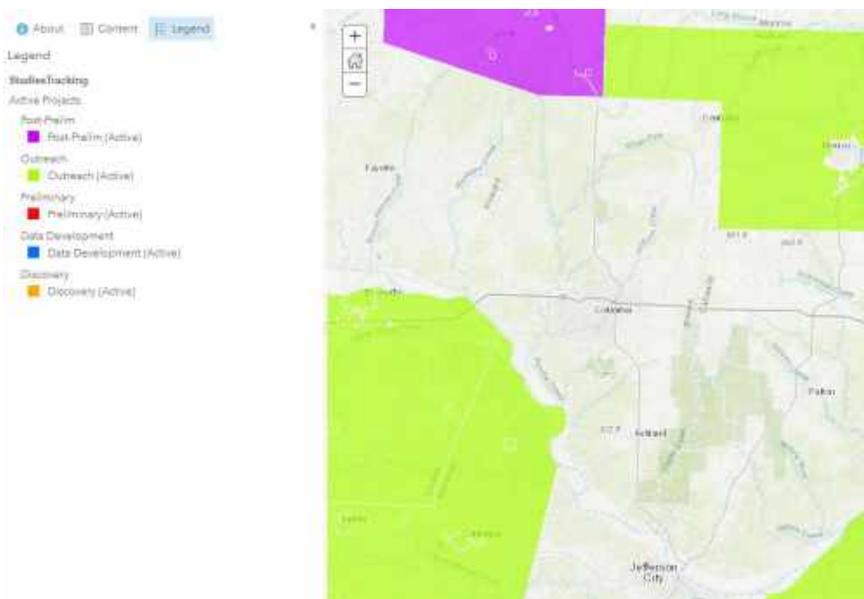
44 CFR Requirement 201.6(b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (2) An opportunity for neighboring communities, local 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. (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

Participants from all incorporated cities, towns, and villages were invited to every meeting, along with all school districts, colleges, fire departments, police agencies, county offices, etc. Once a draft of the plan was complete it was posted to the Mid-MO RPC website for review by all interested parties.

Coordination with FEMA Risk MAP Project

Figure 1.1 shows the status of Risk Mapping in Boone County. Currently there are no active projects or data development taking place in Boone County. The southern boundary of Boone is edged by the Missouri River which is prone to flooding. The risks of this will be more clearly defined in Section 3: Risk Assessment.

Figure 1.1 FEMA Risk Studies Tracker



Source: FEMA Mapping Information Studies Tracker

Integration of Other Data, Reports, Studies, and Plans

Several other sources and documents were used to update the Plan. Those documents and sources include:

- Flood Insurance Rate Maps (FIRMs)
- State Department of Natural Resources (DNR) dam information
- The National Inventory of Dams (NID)
- 2013 & 2018 Missouri State Hazard Mitigation Plans
- Wildland/Urban Interface and Intermix areas from the SILVIS Lab – Department of Forest Ecology and Management – University of Wisconsin
- United States Department of Agriculture – Census of Agriculture
- Corp of Engineers - National Levee Database *2040 Long-Range Transportation Plan*, Columbia Area Transportation Study Organization (CATSO), 2014
- *A Study of Active Shooter Incidents in the United States Between 2000 and 2013*, Federal Bureau of Investigation
- *Atlas of Missouri Ecoregions*, Missouri Department of Conservation
- *Bonne Femme Watershed Plan (2007)*
- *Boone County Emergency Operations Plan (2019)*
- *Columbia Imagined, 2013*
- *Communicating Before and After a Nuclear Power Plant Incident (June 2013)*, FEMA
- *Comprehensive Economic Development Strategy for the Mid-MO Region (2016)*, Mid-MO Regional Planning Commission
- *Hazard Vulnerability Analysis*, Columbia/Boone County Public Health and Human Services
- *Hinkson Creek Watershed Management Plan*
- *Long Range Transportation Plan (LRTP)*, Missouri Department of Transportation
- *Missouri Drought Plan (2002)*, Missouri Department of Natural Resources
- *Missouri – Region F Regional Communication Interoperability Plan (R-CIP)(2015)*
- *Missouri State Hazard Mitigation Plan (2018)*, Missouri State Emergency Management Agency (SEMA)
- *National Climate Assessment 2018*, U.S. Global Change Research Program (GlobalChange.gov)
- *Regional Transportation Plan (2016)*, Mid-MO Regional Planning Commission
- Situation Reports (online), Missouri SEMA
- *Source Water Protection Plan, City of Columbia Missouri, 2013*
- *FEMA's Local Mitigation Planning Handbook (March 2013)*
- *Online tools provided by SEMA and other State Agencies*

Step 4: Assess the Hazard

Risk Assessment surveys were compiled and discussed at the second meeting, July 30, 2019. The risk of hazards were based on previous disasters, hazards that were identified in the State Hazard Mitigation Plan, and hazards from the previously approved hazard mitigation plan. Hazards were prioritized by their likelihood and severity of impacts by each jurisdiction, then totaled to rate

each hazard on a whole. Additional details about the individual hazards can be found in the chapter on Risk Assessment.

Step 5: Assess the Problem

Assets for each jurisdiction were identified through the use of HAZUS, the data questionnaire, and Census. Losses were estimated by utilizing the HAZUS database and the 2018 State Hazard Mitigation Plan when needed.

Step 6: Set Goals

The goals set in the previous plan update were carried over for this plan. It was felt that the current set of goals were still relevant and necessary during the 4th meeting that took place December 10, 2019, when the Mitigation Actions List was discussed and updated. Those goals summarized are:

- Goal 1: Mitigation Planning - Mitigate the effects of future natural, technological, and humanmade hazards throughout the County through public and private action.
- Goal 2: Mitigation Policy - Develop policies that limit the impact of natural, technological, and human-made 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, technological, and humanmade 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.

Step 7: Review Possible Mitigation Actions and Activities

Mitigation Actions were discussed at the 4th meeting held December 10, 2019. Each action from the last update was reviewed and updated individually by the MPC. A link to the FEMA publication *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (2013)* was provided at the Kickoff meeting with the questionnaire to give everyone projects to think about for their jurisdiction. A focus for the MPC was the addition of safe rooms in schools and public places to the Mitigation Action Plan across the county.

Step 8: Draft an Action Plan

Based on the response from the final MPC meeting in December an Action Plan was formed from any on-going and remaining actions identified as well as actions added to the list. Possible grant opportunities to assist in achieving the set goals and actions were also discussed at the final

meeting. On-going efforts and mitigation achievements through projects and policy is a priority for stakeholders.

Step 9: Adopt the Plan

Throughout the whole update process it was reiterated in word and text that in order for participation in the plan to count a jurisdiction must participate by attending meetings or returning the survey/questionnaire, and lastly by signing an adoption resolution of the plan that can be included in the draft to SEMA.

Step 10: Implement, Evaluate, and Revise the Plan

Plan implementation was discussed at the final meeting while discussing grant and partnership opportunities to move the actions on the mitigation list along. Future revisions will be discussed in more detail one-on-one with the participating jurisdictions. Further details regarding implementation, monitoring and maintenance can be found in chapter 5, Plan Maintenance Process.

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Section 2: Boone County Planning Area Profile

Boone County is a steadily growing county in central Missouri. The 2010 census indicated a county of 162,551 people, which was a 20% increase over the 2000 census count of 135,454. According to the American Community Survey (ACS) estimates show the county should have continued to grow, though not nearly as rapidly. Estimates show the county with a 9.6% increase to 180,005 in 2018. In relation, the state of Missouri as well as national population numbers have also shown an increase, but to a much smaller extent with a state increase of only 2.2% and a national population increase of 5.6%.

Median income for Boone County has seen nearly a 12% increase to \$52,005 since 2010 and is slightly above the state median income of 51,542, which has only seen a 10.2% increase over the last decade. While Boone has a slightly lower medium income than the national \$57,652 average the national median income has shown growth more in line with the state's at about 10%.

With the rising income rates comes equally rising housing costs. The median home value in Boone County increased 15.5% from 2010 to 2017 according to ACS estimates. In 2010 homeowners would pay a median price of \$153,900 for a home. In 2017 the median price was around \$177,800, which is over the Missouri median home cost of only \$145,400. Missouri has seen a median price tick up slightly since 2010 but only by slightly over 5%. Both Boone County and the state of Missouri have seen more increase in median value than the national increase of 2.6%, but both remain significantly under the national median home price of \$193,500.

Geography, Geology, and Topography

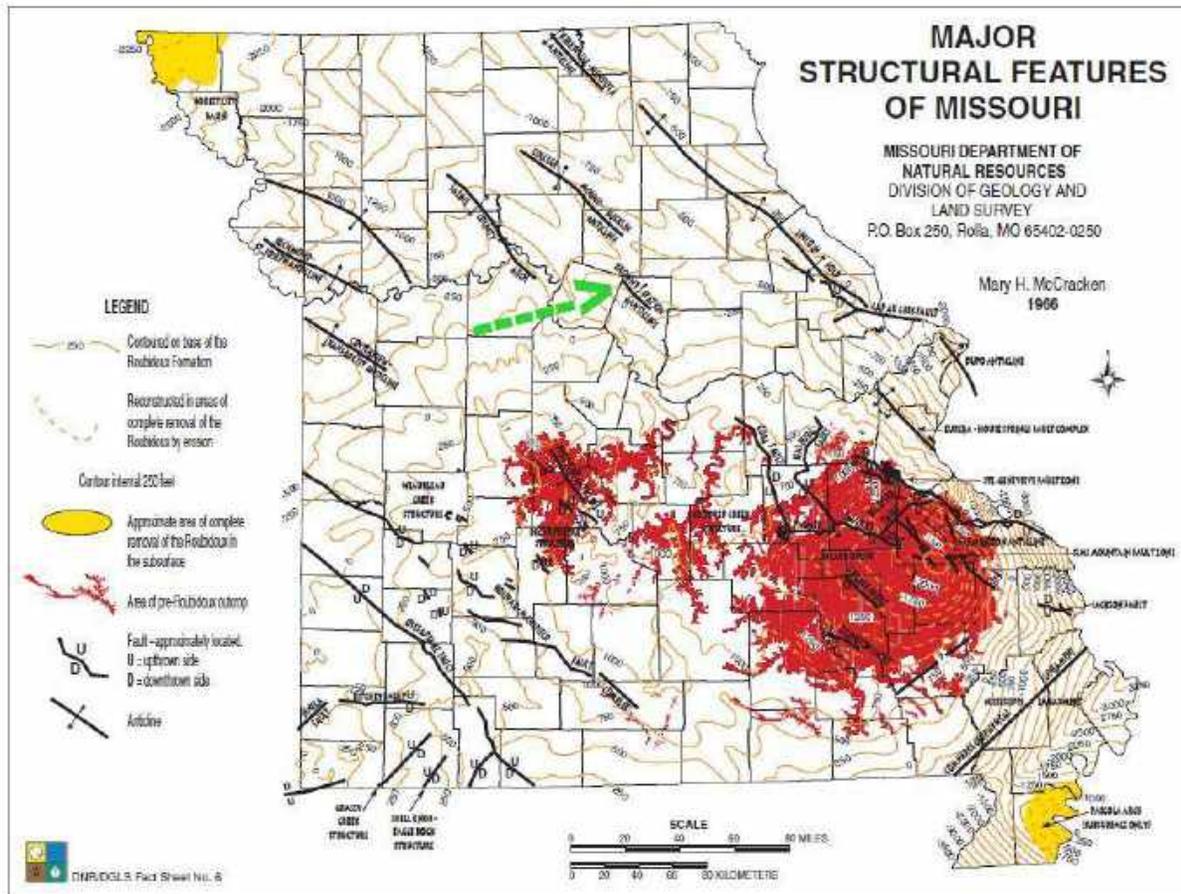
Boone County is located in central Missouri with an area covering 685 square miles. It is located midway between Kansas City to the west and St. Louis to the east. The City of Columbia is the county seat and largest population center. The incorporated communities in the county are: Ashland, Centralia, Columbia, Hallsville, Harrisburg, Hartsburg, Huntsdale, McBaine, Pierpont, Rocheport, and Sturgeon (Figure 2.2).



Figure 2. 1

Geologically, Boone County has been shaped by both the Ozark Uplift in the southeastern part of the state and glaciations from the north. The Browns Station Anticline is the one major structural feature found in Boone County; it extends across the northern part of the county (Figure 2.2).

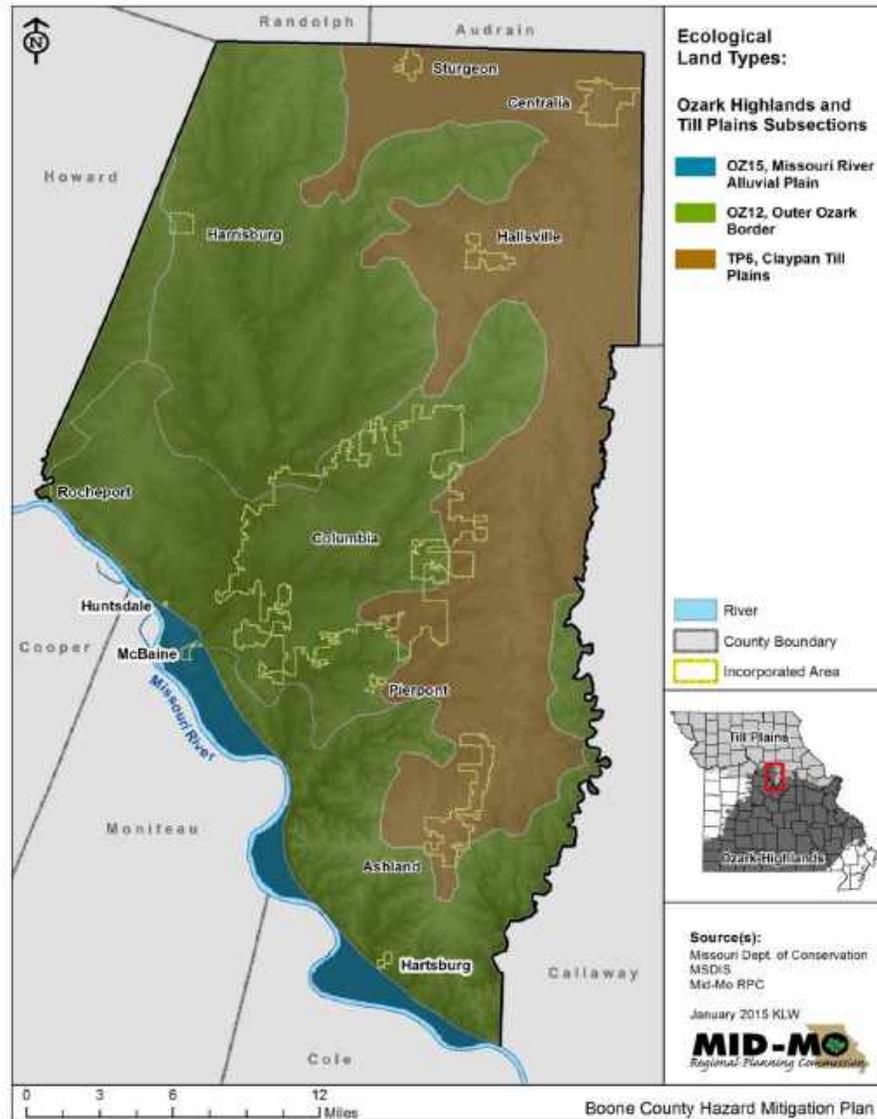
Figure 2.2



The geology of the planning area has implications for the hazards analyzed in this plan. Of particular concern is the New Madrid Seismic Zone (NMSZ) in the southeastern part of the state.

Boone County consists of three main ecological land types according to the MO Department of Conservation’s *Atlas of Missouri Ecoregions* (Figure 2.3): the Claypan Till Plains, the Outer Ozark Border of the Ozark Highlands, and the Missouri River Alluvial Plain.

Figure 2.3



Claypan Till Plains

The distinguishing feature of the Claypan Till Plains is the presence of well-developed claypan soils on a flat glacial till plain. Most of the surface is flat or gently rolling with local relief less than 100 feet. Bedrock exposures are rare. This area was formerly prairie, for the most part, with narrow belts of timber along streams. Most of the subsection is now farmland and primarily cropland.

Outer Ozark Border

The Outer Ozark Border consists of a belt of deeply dissected hills (relief mostly 200-350 feet) and bluff lands bordering the Missouri River. Slopes are steep and bedrock exposures are common. Loess, occasionally very thick,

mantles the uplands of the entire subsection. The area was historically timbered in oak savanna and woodland, oak and mixed-hardwood forests, and occasional prairie and glade openings.

Karst plains are also present. Karst is defined by the United States Geological Survey (USGS) as “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 3.

Current land use in the Outer Ozark Border is extremely varied and includes row crops, improved pasture, and densely wooded valleys. Urbanization pressures from Columbia are great.

Missouri River Alluvial Plain The Missouri River Alluvial Plain consists of the Missouri River channel and its adjoining alluvial plain. During the last half of the 20th Century, the river was narrowed, its banks were stabilized, and most of its islands were eliminated. Soils in the area are deep and loamy. Pre-settlement vegetation was mostly bottomland forest dominated by riverfront species including willow, cottonwood, sycamore, elm, silver maple, and hackberry. The alluvial plain is subject to flooding, although many bottoms have some degree of levee protection. Today land use is chiefly row crops.

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.

Flood control structures, power plants, and other engineering projects have profoundly changed the course of the river since Lewis and Clark first traversed it in the early 1800s. In recent years debates over the future of the Missouri River have taken place among the seven states through which it runs. Commercial river traffic, recreational use, environmental concerns, managing river levels to comply with the needs of endangered species, and the preservation of sacred and historical sites along the river and floodplain are all issues which make the management of the river a sensitive balancing act.

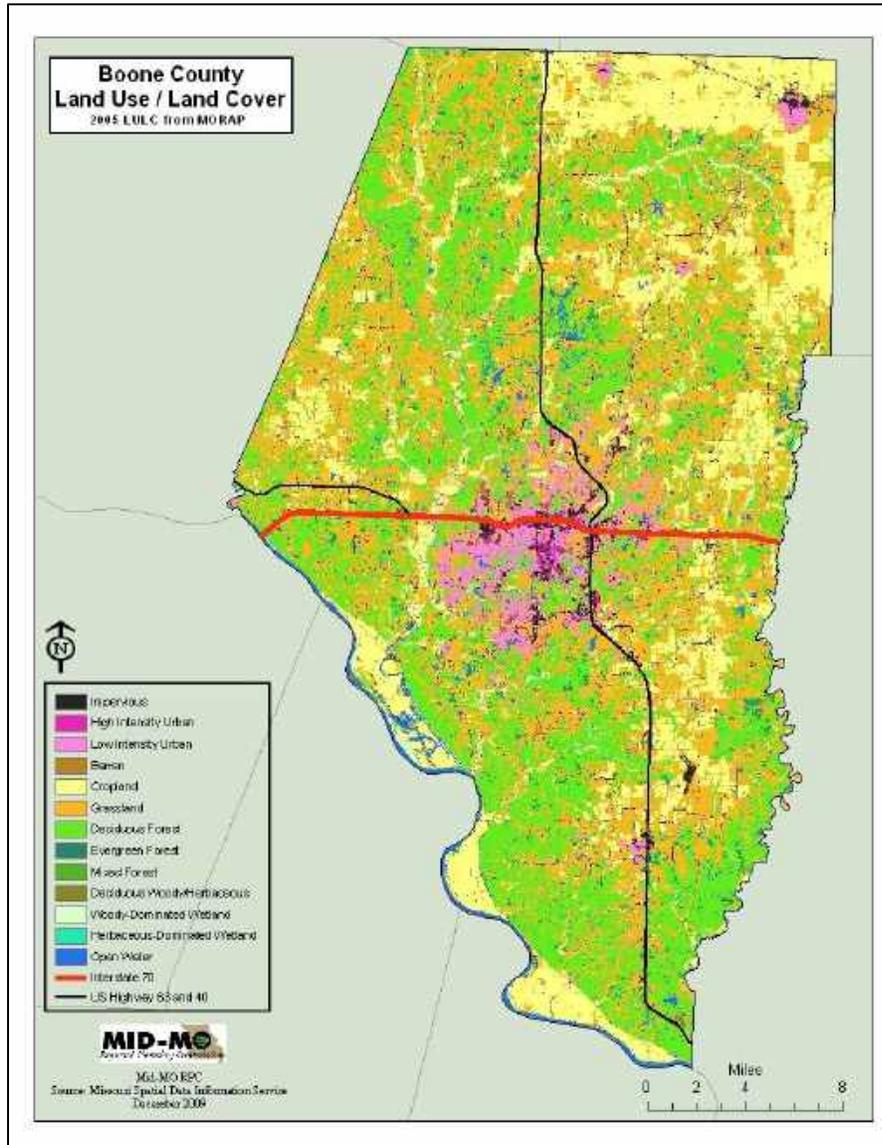
In both 1994 and 1995 the Missouri River was listed as one of the “10 Most Endangered Rivers in the Country” by American Rivers, a river conservation group (<http://www.americanrivers.org/>). This “Most Endangered” list does not reflect rivers in the worst condition; rather, it seeks to highlight rivers “confronted by decisions in the coming year that could determine their future.” The Missouri River was chosen for the list in the mid-1990s because of dam, channelization, navigation, and agricultural runoff issues.

The flooding of the river in 2011 brought the controversy over its management into sharp focus. Record snowfalls in the Rockies combined with heavy spring rains to result in record water releases from six reservoirs on the river. Flooding occurred along the river from Montana to Missouri. The U.S. Army Corps of Engineers came under sharp criticism for not releasing water earlier in the season so the reservoirs would be able to accommodate the snow melt and rains. Meetings were held throughout the Missouri River Basin where local frustration was voiced over species protection and recreation being prioritized over flood control in river management decisions.

Current Land Use

There is still significant deciduous forest in the western and southern parts of Boone County. This is interspersed with some grassland and cropland. Cropland predominates in the northernmost area of the county, in some eastern parts of the county, and in some areas along the Missouri River (Figure 2.4).

Figure 2.4



CLIMATE

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.

National Centers for Environmental Information (NCEI) releases “climate normals”, or averages of three decades of climate variables, every 10 years. Monthly temperature and precipitation data for the period 1981-2010 at the Columbia Regional Airport (1981-2010), located in southern Boone County, are shown in the accompanying charts (Figures 2.5-2.6).

During this period, the mean annual temperature was 54.6°F. The mean annual precipitation was 42.62 inches with a mean annual snowfall of 18.4 inches. The average January minimum temperature was 20.9°F and the average July maximum temperature was 87.6°F. The wettest months were May-September with 62.3 % of the annual precipitation occurring during these months.

Figure 2.5

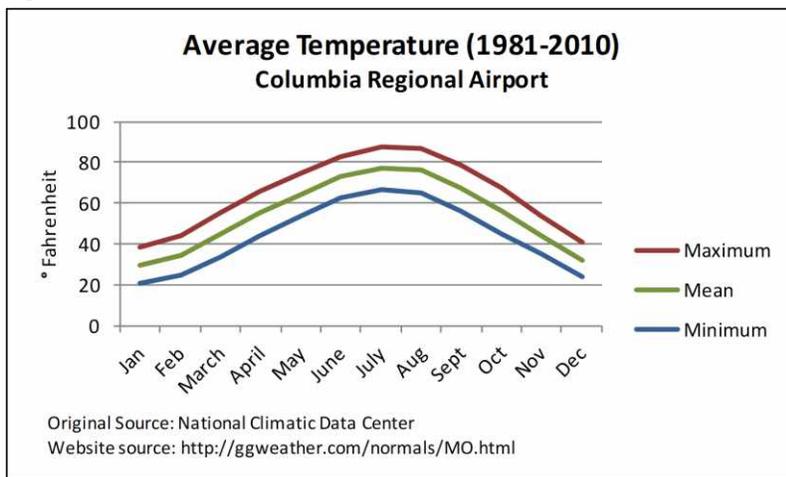
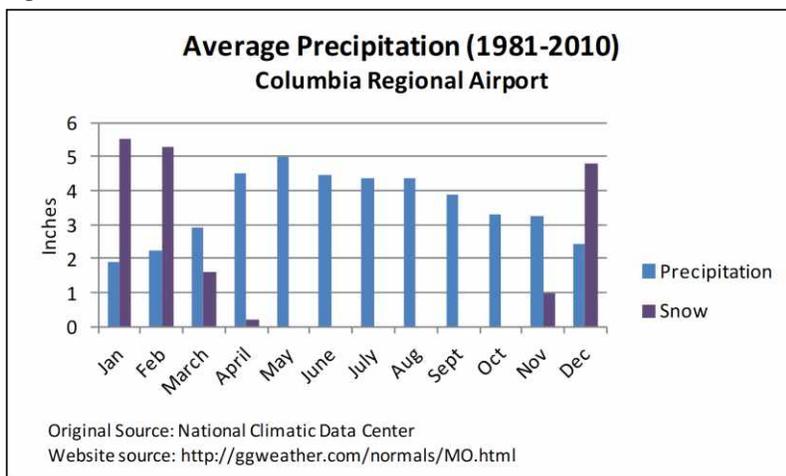


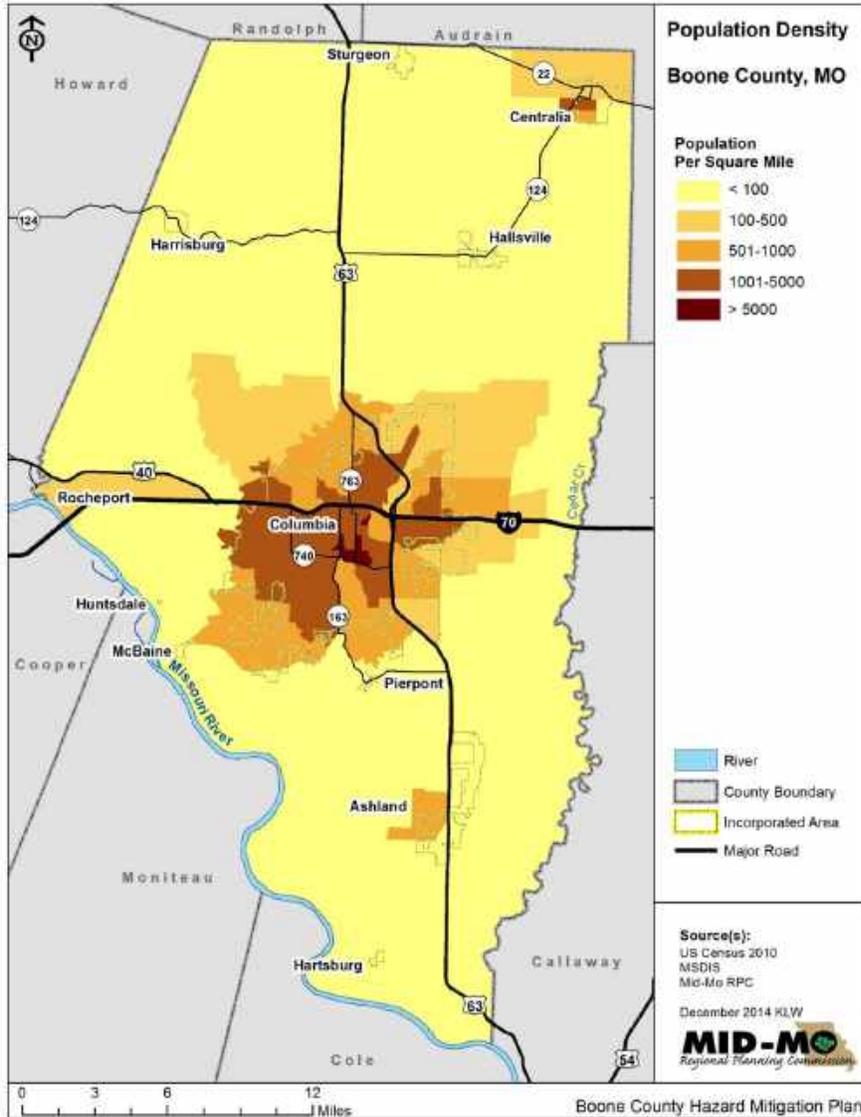
Figure 2.6



POPULATION/DEMOGRAPHICS

A mapping of Boone County's population (2010 Census) by block group clearly illustrates that the population is centered in and around City of Columbia (Figure 2.10).

Figure 2.7



The 2010 Census indicated a rapid rise in population since the 2000 census; the population increased by 20%.

An inspection of the data in Figure 2.1 indicates that the vast majority of population growth took place within the incorporated communities; unincorporated Boone County only saw a population growth of 1% with a housing unit increase of 6%.

The highest growth rate by far was in the City of Ashland which came close to doubling both population and housing. The City of Hallsville had a 52% increase in its population from 2000 to 2010. American Community Survey estimates have predicted a much slower growth rate since the 2010 census but the majority of all incorporated and unincorporated Boone County are estimated to have seen some level of increase in population.

Table 2.1 Boone County Population 2000-2010 by Jurisdiction

Jurisdiction	2000 Population	2010 Population	2018 Annual Population Estimate or ACS Population	# Change (2010-2018)	% Change (2010-2018)
Unincorporated Boone	42,841	43,377	45,467	2,090	4.7%
Ashland	1,869	3,707	3,947	240	6.2%
Centralia	3,774	4,027	4,244	217	5.2%
Columbia	84,531	108,500	123,180	14,680	12.6%
Hallsville	978	1,491	1,564	73	4.7%
Harrisburg	184	266	281	15	5.4%
Hartsburg	103	108	108	0	0%
Huntsdale	26	31	33	2	6.2%
Rocheport	208	239	251	12	4.8%
Sturgeon	944	872	930	58	6.4%
Total	135,454	162,699	180,005	17,306	10%

Source: U.S. Bureau of the Census, Decennial Census, annual population estimates/ 5-Year American Community Survey 2018;
 *population includes the portions of these cities in adjacent counties

Currently, a number of economic development projects are occurring along the Highway 63 corridor between Columbia and the City of Ashland. Given the past level of growth in the two cities, the level of commuting in the Mid-Missouri region, and the fact that the Highway 63 corridor connects with Jefferson City (the state capital) to the south, it can be expected that this area will see a strong growth in population in the coming years. This growth will be made possible by the loss in the agricultural land in the area. ACS 2017 data estimates that there are currently 39,527 family households in Boone county averaging just over 2 persons per household, which is in line with state and national averages.

Some sectors of the population are more vulnerable in general to the threat of hazardous events. Children need the help and guidance of adults, especially in extraordinary circumstances, and this is also true for some older citizens. 6% of the county’s estimated population in 2018 was under the age of 5, similar to the state and national percentage for that age bracket. Over 9% were shown as 65 years and older in 2010. Keeping in trend with an overall state uptick in aging population, 2018 estimates have nearly 11% of Boone’s population over 65 years old, which is

slightly under the state’s 15.5% rate of 65+. That national percentage of over 65 population sits at around 15%.

Table 2.2: Unemployment, Poverty, Education, and Language Percentage Demographics, Boone County, Missouri

Jurisdiction	Total in Labor Force	Percent of Population Unemployed	Percent of Families Below the Poverty Level	Percentage of Population (High School graduate)	Percentage of Population (Bachelor’s degree or higher)	Percentage of population with spoken language other than English
Boone County	97,293	4.4	9.5	93.5	45.9	7.5
Ashland	1,892	4.9	5.2	91.3	28.5	0.2
Centralia	1,871	4.7	11	88.7	21.9	1.9
Columbia	67,130	4.3	10.8	94.2	53.4	9.4
Hallsville	767	4.7	9.7	89.6	24	1.4
Harrisburg	153	3.3	10.2	90.2	21.2	2.3
Hartsburg	49	0	5.6	93.8	32.5	0
Huntsdale	15	0	0	86.4	13.6	4.2
Rocheport	127	3.9	3.2	93.8	31.3	0.9
Sturgeon	397	3.3	5.4	89	22.6	1.1
Missouri	3,062,657	5.8	10.3	89.2	28.2	6
United States	162,184,235	6.6	10.5	87.3	30.9	21.3

Source: U.S. Census, 2017 American Community Survey, 5-year Estimates.

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.

OCCUPATIONS

There are a high number of well-paying jobs available in Boone County in sectors such as government, higher education, and the medical field which draw workers from the surrounding counties. Table --- shows the breakdown of occupation percentages by jurisdiction. The majority of the workforce as a whole works in management, business, science, or art occupations.

Table 2.3: Occupation Statistics, Boone County, Missouri

Place	Management, Business, Science, and Arts Occupations	Service Occupations	Sales and Office Occupations	Natural Resources, Construction, and Maintenance Occupations	Production, Transportation, and Material Moving Occupations
Boone County	44.7	17.8	23.1	6.2	7.9
Ashland	36.2	13.2	36.7	6.2	7.5
Centralia	34.2	12.1	28	11.5	13.9
Columbia	46.1	19.4	22.5	4.9	6.8
Hallsville	34.6	16.6	25.9	9	13.6
Harrisburg	36.4	14.8	30.4	10.1	8.1
Hartsburg	34.6	20.4	26.5	10.2	8.1
Huntsdale	6.6	0	60	33.3	0
Rocheport	35.2	11.4	28.6	12.2	12.2
Sturgeon	34.2	15.4	23.5	11.5	15.1

Source: U.S. Census, 2017 American Community Survey, 5-year Estimates.

The vast majority of these jobs are located in Columbia, the urban core for the Columbia, Missouri Metropolitan Statistical Area (MSA).

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 any adjacent counties which have a high degree of social and economic integration with the urban core, as measured by commuting to work. (Metropolitan statistical 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.) The Columbia MSA is grouped with Audrain and Randolph Counties to the north to form a Combined Statistical Area (CSA).

Agriculture

Agriculture continues to be important in the economy of the planning area. However, agricultural land is being lost to development. A comparison of the 2017 and 2012 Agricultural Censuses (Figure 2.18) indicates 27,978 acres of farmland (-11.6%) lost during that 5-year period. Interestingly, the number of farms rose from 1,171 to 1,184. Over 212,000 acres (approximately 48.8%) of the county remains agricultural land.

Soybeans, corn, and wheat are the top three individual crops in the county. Other crops consist of hay, sorghum, berries, fruit and nut trees, and garden vegetables. Cattle and calves and hogs and pigs are the major livestock in production.

Total agricultural sales in the County rose significantly. The 2017 agricultural census showed over \$105 Million dollars in sales. Total sales as well as sales per farm both rose substantially between 2012 and 2017 with nearly double or greater than double in gains.

Nearly half of the land area in Boone County is farmland. Any hazard impacting the agricultural sector has the potential to significantly impact the area's economy.

Table 2.4			
Agricultural Overview - Boone County			
	2017	2012	Change
Approx. land area (acres)	438,739	438,739	
Land in farms (acres)	212,732	240,710	-11.6%
Percentage in farms	48.5%	54.9%	-11.6%
Number of farms	1184	1,171	1%
Avg size of farm (acres)	180	206	-12.6%
Estimated market value-land & buildings	\$1,202,754,000	\$877,218,000	37.1%
Avg value per farm	\$1,015,839	\$749,119	35.6%
Avg value per acre	\$5,654	\$3,644	55.2%
Total sales	\$105,007,000	\$52,185,000	101.2%
Average sales per farm	\$88,688,000	\$44,564,000	99%

Source: USDA Census of Agriculture 2012, 2017

Hazard Mitigation Assistance (HMA) Grants in Planning Area

There has been more than a half million dollars in Hazard Mitigation Assistance (HMA) provided to Boone County projects since 1993. The four projects listed below account for \$559,077.17 in funding.

Table 2.5: HMA Grants

Disaster Declaration	Project Type	Subgrantee	Project Total	Date Approved
995	200.1: Acquisition of Private Real Property (Structures and Land) - Riverine	BOONE	330356	6/29/1994
	402.1: Infrastructure Protective Measures (Roads and Bridges)	County of Boone	57026.17	2/11/2006
995	200.1: Acquisition of Private Real Property (Structures and Land) - Riverine	HARTSBURG	93595	6/10/1994
	402.1: Infrastructure Protective Measures (Roads and Bridges)	County of Boone	78100	9/14/2005

FEMA Public Assistance (PA) Grants in Planning Area

There has been nearly \$2 million in Public Assistance (PA) grants awarded in Boone County. Below is \$1,192,182.97 in projects that have varied in size and location through the county.

Table 2.6: PA Grants

disasterNumber	applicant	damageCategory	projectSize	projectAmount
1412	Hallsville	Roads and Bridges	Small	1847.67
1412	Columbia	Public Utilities	Large	86241.57
1412	Columbia	Public Utilities	Large	-37028.42
1412	Columbia	Public Utilities	Large	77000
1412	Columbia	Public Utilities	Large	-3050
1412	Columbia	Recreational or Other	Small	8978.26
1412	Boone County	Roads and Bridges	Small	16520.04
1412	Boone County	Roads and Bridges	Large	-64351.98
1412	Boone County	Roads and Bridges	Large	321451.05
1412	Boone County	Public Buildings	Large	15000
1412	Boone County	Roads and Bridges	Small	37431
1412	Boone County	Roads and Bridges	Small	2194.94
1412	Boone County	Public Buildings	Large	244629.5
1412	Boone County	Public Buildings	Large	-64907.37
1412	Boone County	Public Buildings	Small	48818.78
1412	Boone County	Public Buildings	Small	-12204.69
1412	Boone County	Roads and Bridges	Small	22981.56
1412	Boone County	Roads and Bridges	Large	57479.92
1412	Boone County	Roads and Bridges	Large	70065.28

JURISDICTIONAL PROFILES AND MITIGATION CAPABILITIES

The following is the individual profiles for each participating jurisdiction. Information regarding previous mitigation initiatives and ongoing efforts can be found in the summary tables below. These tables indicate specific capabilities of each jurisdiction that relate to their ability to implement mitigation opportunities. Unincorporated Boone County is profiled first, followed by the incorporated communities, the special districts, and the public schools and universities.

Unincorporated Boone County

Boone County consists of all the unincorporated areas with the county boundary.

The Boone 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, as well as supervises the operations of:

- Public Works
- Planning and Zoning
- Building Codes
- Human Resources
- Purchasing
- Information Technology
- Facilities and Grounds Maintenance

The commission also 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

In 2012, a Children’s Service Fund was established in the county “to protect the well-being and safety of children and youth nineteen years of age or less and to strengthen families”. The fund is financed by one-quarter of a cent sales tax increase which was passed by over 57% of the voters in the November election. A board appointed by the County Commission oversees the fund. The Boone Co. Schools Mental Health Coalition has a project which is one of many being funded with these monies. One of the goals of the project is to “train all school staff to recognize and respond appropriately to s students with signs and symptoms of mental health concerns.” Such training will function as mitigation for active shooter events; the Coalition’s work on this will be

further discussed in Section 5.8. The Boone County Emergency Operations Plan was updated in October 2019.

Another notable change is that the E-911 Columbia/Boone County Office of Emergency Management has separated from the City of Columbia's organizational structure and is now funded through a dedicated countywide sales tax passed in April of 2013. The three-eighths-cent sales tax generates an estimated \$9.3 million per year and will finance construction of a new 911 and emergency management center that will withstand an F5 tornado. The tax also allowed the county to hire more call-takers and to upgrade radio equipment and information technology hardware and software. The Boone County Emergency Communications Center (ECC) opened in 2016 and combines the 9-1-1 Communications Center and the Office Of Emergency Management functions into a single facility. The Office Of Emergency Management includes an Emergency Operations Center (EOC), and other critical incident response space and technological needs.

Boone County Joint Communications (BCJC) acts as the communication arm of the Emergency Operations Center whenever the Center is activated in the event of a natural disaster or a man-made emergency. As additional layers of responsibility, BCJC activates the early warning system; retrieves data from the National Crime Information Center (NCIC) and the Missouri Uniform Law Enforcement System (MULES) for the police departments they serve; and inputs information into the various records management systems for several public safety agencies.

Various security levels are required within the ECC. The public lobby for the ECC will be open during defined business hours and a secure reception point will be established to control public access to the ECC.

Access control to secure areas within the facility, either from staff entry points to the facility or for public cleared for entry from the lobby will be managed by card-type authorization. Use of electronic access control systems allows for zones of varying security levels to be created throughout the facility and for users to be granted or denied access to these areas with relative ease.

The primary concern for this area is tornadic activity, and the ECC is to be designed for survival of an EF-5. This means wind speeds in excess of 200 mph and impacts from debris at over 150 mph. Other sources of natural disaster will not have significant cost impact. Boone County is just out of the New Madrid earthquake zone. The ECC is designed to provide an appropriate level of protection from this particular threat. The threat of flooding was eliminated through site selection.

Also, the ability to have special filters on the HVAC system to protect the staff inside from accidental chemical spills or chemical/biological attack is another factor included in the build design. Redundant systems will be in place for non-interruption of power supply, back up heating and cooling, telephone, and radio transmission and reception.

Table 2.7: Unincorporated Boone County Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	Columbia Comprehensive Plan: 2013
Builder’s Plan	Proposed Budget Book: 2018
Capital Improvement Plan	N/A
City Emergency Operations Plan	N/A
County Emergency Operations Plan	Yes: Annual Review
Local Recovery Plan	In Progress
County Recovery Plan	In Progress
City Mitigation Plan	N/A
County Mitigation Plan	2015
Debris Management Plan	2018
Economic Development Plan	REDI
Transportation Plan	Regional Transportation Plan: 2015
Land-Use Plan	N/A
Flood Mitigation Assistance (FMA) Plan	N/A
Watershed Plan	Bonne Femme: 2007
Firewise or other fire mitigation plan	No
School Mitigation Plan	N/A
Critical Facilities Plan (Mitigation/Response/Recover)	EOP in review: 2017
Policies/Ordinance	
Zoning Ordinance	Yes
Building Code	N/A
Floodplain Ordinance	N/A
Subdivision Ordinance	Yes
Tree Trimming Ordinance	N/A
Nuisance Ordinance	N/A
Stormwater Ordinance	N/A
Drainage Ordinance	N/A

Site Plan Review Requirements	N/A
Historic Preservation Ordinance	N/A
Landscape Ordinance	N/A
Program	
Zoning/Land Use Restrictions	N/A
Codes Building Site/Design	N/A
Hazard Awareness Program	N/A
National Flood Insurance Program (NFIP)	Yes: Portions of County
NFIP Community Rating System (CRS) Program	N/A
National Weather Service (NWS) Storm Ready	Yes: 2019
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	N/A
ISO Fire Rating	Varies
Economic Development Program	N/A
Land Use Program	N/A
Public Education/Awareness	N/A
Property Acquisition	N/A
Planning/Zoning Boards	N/A
Stream Maintenance Program	Yes: DNR/Wastewater Management
Tree Trimming Program	N/A
Engineering Studies for Streams (Local/County/Regional)	N/A
Mutual Aid Agreements	N/A
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	N/A
Hazard Analysis/Risk Assessment (County)	N/A
Flood Insurance Maps	Yes
FEMA Flood Insurance Study (Detailed)	N/A
Evacuation Route Map	Yes
Critical Facilities Inventory	N/A
Vulnerable Population Inventory	N/A

Land Use Map	Yes
Staff/Department	
Building Code Official	Yes
Building Inspector	Yes
Mapping Specialist (GIS)	Yes
Engineer	Yes
Development Planner	Yes
Public Works Official	Yes
Emergency Management Director	Yes
NFIP Floodplain Administrator	Yes
Emergency Response Team	Yes
Hazardous Materials Expert	Yes
Local Emergency Planning Committee	Yes
County Emergency Management Commission	No
Sanitation Department	Yes
Transportation Department	Yes
Economic Development Department	Yes
Housing Department	N/A
Historic Preservation	Yes
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	Yes
Veterans Groups	Yes
Local Environmental Organization	Yes
Homeowners Associations	Yes
Chamber of Commerce	Yes
Community Organizations (Lions, Kiwanis, Etc.)	Yes
Local Funding Availability	
Apply for Community Development Block	Yes
Fund projects through Capital	Yes

Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	N/A
Ability to incur debt through general obligation bonds	N/A
Ability to incur debt through special tax bonds	N/A
Ability to incur debt through private activities	N/A
Withhold spending in hazard prone areas	N/A

ASHLAND

The City of Ashland is located in the southern portion of Boone County and straddles US Route 63. The Board of Aldermen is the policy making body of the city government and consists of two representatives from each of its three wards. The Board of Aldermen members and the Mayor is elected to two-year terms. Departments and positions managed and employed by the City of Ashland include:

- City Administrator
- City Clerk
- City Treasurer
- Police Department
- Public Works Department

Ashland has experienced robust growth in the past several years. The changes between the 2000 and 2010 censuses give a sense of the strong growth: the city population almost doubled (98% increase) between 2000 and 2010. Strong growth is expected for the 2020 census as well largely fueled by the Southern Boone School District.

Leadership strategies are focused on effectively managing growth. The Baptist Home, a private not-for-profit retirement community, has expressed intent to annex into City limits and connect to the Ashland sewer system. The sewer collection system will run north along U.S. Highway 63 with full intents and purposes of serving the Airport Planned Industrial and Airport Planned Commercial zoning districts. Industrial and commercial growth is proposed on the east side of U.S. Highway 63 off of Route Y. Plans for a YMCA with a designated FEMA rated safe room are currently in the works.

Table 2.8: Ashland Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	Yes: Update In Progress
Builder's Plan	N/A
Capital Improvement Plan	N/A
City Emergency Operations Plan	Yes
County Emergency Operations Plan	Yes
Local Recovery Plan	N/A
County Recovery Plan	In Progress
City Mitigation Plan	N/A
County Mitigation Plan	2015
Debris Management Plan	N/A
Economic Development Plan	N/A

Transportation Plan	2015: Regional Transportation Plan
Land-Use Plan	N/A
Flood Mitigation Assistance (FMA) Plan	N/A
Watershed Plan	N/A
Firewise or other fire mitigation plan	No
School Mitigation Plan	N/A
Critical Facilities Plan (Mitigation/Response/Recover)	N/A
Policies/Ordinance	
Zoning Ordinance	Yes
Building Code	Yes
Floodplain Ordinance	Yes
Subdivision Ordinance	Yes
Tree Trimming Ordinance	N/A
Nuisance Ordinance	N/A
Stormwater Ordinance	Yes
Drainage Ordinance	N/A
Site Plan Review Requirements	Yes
Historic Preservation Ordinance	N/A
Landscape Ordinance	N/A
Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	Yes
Hazard Awareness Program	N/A
National Flood Insurance Program (NFIP)	Yes
NFIP Community Rating System (CRS) Program	N/A
National Weather Service (NWS) Storm Ready	N/A
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	N/A
ISO Fire Rating	4
Economic Development Program	N/A

Land Use Program	N/A
Public Education/Awareness	N/A
Property Acquisition	N/A
Planning/Zoning Boards	Yes
Stream Maintenance Program	N/A
Tree Trimming Program	N/A
Engineering Studies for Streams (Local/County/Regional)	N/A
Mutual Aid Agreements	N/A
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	N/A
Hazard Analysis/Risk Assessment (County)	N/A
Flood Insurance Maps	Yes
FEMA Flood Insurance Study (Detailed)	N/A
Evacuation Route Map	County
Critical Facilities Inventory	N/A
Vulnerable Population Inventory	N/A
Land Use Map	
Staff/Department	
Building Code Official	N/A
Building Inspector	N/A
Mapping Specialist (GIS)	N/A
Engineer	N/A
Development Planner	N/A
Public Works Official	Yes
Emergency Management Director	N/A
NFIP Floodplain Administrator	N/A
Emergency Response Team	N/A
Hazardous Materials Expert	N/A
Local Emergency Planning Committee	N/A
County Emergency Management Commission	N/A

Sanitation Department	Yes
Transportation Department	N/A
Economic Development Department	N/A
Housing Department	N/A
Historic Preservation	No
Non-Governmental Organizations (NGOs)	
American Red Cross	N/A
Salvation Army	N/A
Veterans Groups	N/A
Local Environmental Organization	N/A
Homeowners Associations	N/A
Chamber of Commerce	Yes
Community Organizations (Lions, Kiwanis, Etc.)	Lions
Local Funding Availability	
Apply for Community Development Block	N/A
Fund projects through Capital	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	N/A
Ability to incur debt through general obligation bonds	Yes
Ability to incur debt through special tax bonds	Yes
Ability to incur debt through private activities	Yes
Withhold spending in hazard prone areas	Yes

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

Additional undergrounding has been accomplished and improvements to the electric grid are underway to minimize outages across town during significant, but not catastrophic, storms. In addition, a backup generator has been installed at the Fountain Street sanitary sewer lift station.

There are two subdivisions located in the southwest portion of the city which have not been fully built out.

Table 2.9: Centralia Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	Yes
Builder's Plan	N/A
Capital Improvement Plan	N/A
City Emergency Operations Plan	Yes
County Emergency Operations Plan	Yes
Local Recovery Plan	N/A
County Recovery Plan	In Progress
City Mitigation Plan	N/A
County Mitigation Plan	2015
Debris Management Plan	N/A
Economic Development Plan	CREDI
Transportation Plan	Regional Transportation Plan (Mid-MO)
Land-Use Plan	N/A
Flood Mitigation Assistance (FMA) Plan	N/A
Watershed Plan	N/A
Firewise or other fire mitigation plan	No

School Mitigation Plan	N/A
Critical Facilities Plan (Mitigation/Response/Recover)	N/A
Policies/Ordinance	
Zoning Ordinance	Yes
Building Code	Yes
Floodplain Ordinance	Yes
Subdivision Ordinance	Yes
Tree Trimming Ordinance	N/A
Nuisance Ordinance	Yes
Stormwater Ordinance	No
Drainage Ordinance	N/A
Site Plan Review Requirements	Yes
Historic Preservation Ordinance	N/A
Landscape Ordinance	N/A
Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	N/A
Hazard Awareness Program	N/A
National Flood Insurance Program (NFIP)	Yes
NFIP Community Rating System (CRS) Program	N/A
National Weather Service (NWS) Storm Ready	N/A
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	N/A
ISO Fire Rating	5
Economic Development Program	CREDI
Land Use Program	N/A
Public Education/Awareness	N/A
Property Acquisition	N/A
Planning/Zoning Boards	Yes
Stream Maintenance Program	N/A

Tree Trimming Program	N/A
Engineering Studies for Streams (Local/County/Regional)	N/A
Mutual Aid Agreements	N/A
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	N/A
Hazard Analysis/Risk Assessment (County)	N/A
Flood Insurance Maps	N/A
FEMA Flood Insurance Study (Detailed)	N/A
Evacuation Route Map	County
Critical Facilities Inventory	N/A
Vulnerable Population Inventory	N/A
Land Use Map	N/A
Staff/Department	
Building Code Official	County
Building Inspector	County
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	Yes
Emergency Management Director	County
NFIP Floodplain Administrator	Yes
Emergency Response Team	Yes
Hazardous Materials Expert	No
Local Emergency Planning Committee	Yes
County Emergency Management Commission	N/A
Sanitation Department	Yes
Transportation Department	Yes
Economic Development Department	Yes
Housing Department	No
Historic Preservation	N/A

Non-Governmental Organizations (NGOs)	
American Red Cross	N/A
Salvation Army	N/A
Veterans Groups	N/A
Local Environmental Organization	N/A
Homeowners Associations	N/A
Chamber of Commerce	Yes
Community Organizations (Lions, Kiwanis, Etc.)	Yes
Local Funding Availability	
Apply for Community Development Block	Yes
Fund projects through Capital	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	Yes
Ability to incur debt through general obligation bonds	Yes
Ability to incur debt through special tax bonds	Yes
Ability to incur debt through private activities	N/A
Withhold spending in hazard prone areas	N/A

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

The City of Columbia has continued in its efforts to bury electric lines and offer flood buyouts when possible.

It is anticipated that the City of Columbia will continue to grow. Growth is primarily expected to occur within the Urban Services Area (USA) boundary identified in Columbia Imagined, The City’s adopted comprehensive plan, as this area has sewer and often other utility infrastructure capacity. Most development is anticipated to occur in the southwest and northeast areas of Columbia, with areas on the southeast anticipated to also have some growth based upon recent platting activity.

The City’s Capital Improvement Program (CIP) describes planned capital improvements by type (streets and sidewalks, parks, public safety, airport, utilities, etc.) Notable future civic developments likely to occur in the next few years include a new airport terminal, Police headquarters, remodels of fire stations, and many expansions to stormwater and sewer handling. The City is also making efforts toward infrastructure that is not only resilient, but also green.

Table 2.10: City of Columbia Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	Yes: 2013
Builder’s Plan	N/A
Capital Improvement Plan	Yes: 2018
City Emergency Operations Plan	Yes
County Emergency Operations Plan	Yes
Local Recovery Plan	In Progress
County Recovery Plan	In Progress

City Mitigation Plan	N/A
County Mitigation Plan	2015
Debris Management Plan	N/A
Economic Development Plan	N/A
Transportation Plan	CATSO TIP: 2019-2022
Land-Use Plan	Yes
Flood Mitigation Assistance (FMA) Plan	N/A
Watershed Plan	Bonne Femme: 2007
Firewise or other fire mitigation plan	No
School Mitigation Plan	N/A
Critical Facilities Plan (Mitigation/Response/Recover)	N/A
Policies/Ordinance	
Zoning Ordinance	Yes
Building Code	Yes
Floodplain Ordinance	Yes
Subdivision Ordinance	Yes
Tree Trimming Ordinance	Yes
Nuisance Ordinance	Yes
Stormwater Ordinance	Yes
Drainage Ordinance	Yes
Site Plan Review Requirements	Yes
Historic Preservation Ordinance	Yes
Landscape Ordinance	N/A
Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	Yes
Hazard Awareness Program	N/A
National Flood Insurance Program (NFIP)	Yes
NFIP Community Rating System (CRS) Program	N/A
National Weather Service (NWS) Storm Ready	N/A

Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	N/A
ISO Fire Rating	2
Economic Development Program	REDI
Land Use Program	N/A
Public Education/Awareness	N/A
Property Acquisition	N/A
Planning/Zoning Boards	Yes
Stream Maintenance Program	N/A
Tree Trimming Program	N/A
Engineering Studies for Streams (Local/County/Regional)	N/A
Mutual Aid Agreements	N/A
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	N/A
Hazard Analysis/Risk Assessment (County)	N/A
Flood Insurance Maps	N/A
FEMA Flood Insurance Study (Detailed)	N/A
Evacuation Route Map	County
Critical Facilities Inventory	N/A
Vulnerable Population Inventory	N/A
Land Use Map	Yes
Staff/Department	
Building Code Official	Yes
Building Inspector	Yes
Mapping Specialist (GIS)	Yes
Engineer	Yes
Development Planner	N/A
Public Works Official	Yes
Emergency Management Director	N/A
NFIP Floodplain Administrator	N/A

Emergency Response Team	N/A
Hazardous Materials Expert	N/A
Local Emergency Planning Committee	Yes
County Emergency Management Commission	Yes
Sanitation Department	Yes
Transportation Department	Yes
Economic Development Department	REDI
Housing Department	Yes
Historic Preservation	N/A
Non-Governmental Organizations (NGOs)	
American Red Cross	Yes
Salvation Army	N/A
Veterans Groups	Yes
Local Environmental Organization	N/A
Homeowners Associations	N/A
Chamber of Commerce	Yes
Community Organizations (Lions, Kiwanis, Etc.)	N/A
Local Funding Availability	
Apply for Community Development Block	N/A
Fund projects through Capital	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	Yes
Ability to incur debt through general obligation bonds	Yes
Ability to incur debt through special tax bonds	Yes
Ability to incur debt through private activities	Yes
Withhold spending in hazard prone areas	Yes

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

Hallsville has pursued a policy of continued slow growth with careful planning. This has been important for the city as it is within commuting distance of Columbia where many jobs are located. Part of the approach to controlled growth is the infilling of empty lots and minimum lot sizes and setbacks.

Table 2.11: Hallsville Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
City Emergency Operations Plan	In Progress
County Emergency Operations Plan	Annual Review
Local Recovery Plan	No
County Recovery Plan	In Progress
City Mitigation Plan	No
County Mitigation Plan	N/A
Debris Management Plan	No
Economic Development Plan	No
Transportation Plan	Regional Transportation Plan: 2015
Land-Use Plan	No
Flood Mitigation Assistance (FMA) Plan	No
Watershed Plan	No
Firewise or other fire mitigation plan	No
School Mitigation Plan	N/A
Critical Facilities Plan (Mitigation/Response/Recover)	No
Policies/Ordinance	

Zoning Ordinance	Yes
Building Code	Yes: 2015
Floodplain Ordinance	Yes: 2016
Subdivision Ordinance	Yes
Tree Trimming Ordinance	No
Nuisance Ordinance	Yes
Stormwater Ordinance	Yes
Drainage Ordinance	Yes
Site Plan Review Requirements	Yes
Historic Preservation Ordinance	No
Landscape Ordinance	Yes
Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	Yes
Hazard Awareness Program	N/A
National Flood Insurance Program (NFIP)	Yes
NFIP Community Rating System (CRS) Program	N/A
National Weather Service (NWS) Storm Ready	N/A
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	N/A
ISO Fire Rating	4
Economic Development Program	N/A
Land Use Program	N/A
Public Education/Awareness	N/A
Property Acquisition	N/A
Planning/Zoning Boards	Yes
Stream Maintenance Program	N/A
Tree Trimming Program	No
Engineering Studies for Streams (Local/County/Regional)	N/A
Mutual Aid Agreements	Yes

Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	N/A
Hazard Analysis/Risk Assessment (County)	N/A
Flood Insurance Maps	Yes
FEMA Flood Insurance Study (Detailed)	N/A
Evacuation Route Map	In Progress/County
Critical Facilities Inventory	N/A
Vulnerable Population Inventory	No
Land Use Map	Yes
Staff/Department	
Building Code Official	No
Building Inspector	Boone County
Mapping Specialist (GIS)	Boone County
Engineer	Yes
Development Planner	No
Public Works Official	Yes
Emergency Management Director	Yes
NFIP Floodplain Administrator	Yes
Emergency Response Team	Yes/CERT
Hazardous Materials Expert	No
Local Emergency Planning Committee	Yes/CERT
County Emergency Management Commission	Yes
Sanitation Department	N/A
Transportation Department	N/A
Economic Development Department	No
Housing Department	No
Historic Preservation	No
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No

Veterans Groups	No
Local Environmental Organization	No
Homeowners Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, Etc.)	Yes
Local Funding Availability	
Apply for Community Development Block	Yes
Fund projects through Capital	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	Yes
Ability to incur debt through general obligation bonds	Yes
Ability to incur debt through special tax bonds	Yes
Ability to incur debt through private activities	No
Withhold spending in hazard prone areas	No

HARRISBURG

the Board of Trustees is the policy making body in Harrisburg. The village also has the following staff position:

- City Clerk

The Village of Harrisburg joined the NFIP in 2012. The Village also went through a strategic planning process during which it examined its infrastructure and what would be needed for growth. The Village is interested in preserving its historic structures while in the process of growth. With this in mind, the Village acquired the old hardware store and the Harrisburg School (“The Old School House”) and its grounds.

Table 2.12: Harrisburg Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder’s Plan	N/A
Capital Improvement Plan	N/A
City Emergency Operations Plan	Yes
County Emergency Operations Plan	Annual Review
Local Recovery Plan	N/A
County Recovery Plan	In progress
City Mitigation Plan	N/A
County Mitigation Plan	N/A
Debris Management Plan	No
Economic Development Plan	No
Transportation Plan	Regional Transportation Plan: 2015
Land-Use Plan	No
Flood Mitigation Assistance (FMA) Plan	N/A
Watershed Plan	N/A
Firewise or other fire mitigation plan	No
School Mitigation Plan	No
Critical Facilities Plan (Mitigation/Response/Recover)	N/A
Policies/Ordinance	
Zoning Ordinance	No

Building Code	Yes
Floodplain Ordinance	Yes
Subdivision Ordinance	No
Tree Trimming Ordinance	No
Nuisance Ordinance	N/A
Stormwater Ordinance	N/A
Drainage Ordinance	N/A
Site Plan Review Requirements	N/A
Historic Preservation Ordinance	Yes
Landscape Ordinance	N/A
Program	
Zoning/Land Use Restrictions	No
Codes Building Site/Design	N/A
Hazard Awareness Program	N/A
National Flood Insurance Program (NFIP)	Yes
NFIP Community Rating System (CRS) Program	N/A
National Weather Service (NWS) Storm Ready	N/A
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	N/A
ISO Fire Rating	N/A
Economic Development Program	N/A
Land Use Program	N/A
Public Education/Awareness	N/A
Property Acquisition	N/A
Planning/Zoning Boards	N/A
Stream Maintenance Program	N/A
Tree Trimming Program	N/A
Engineering Studies for Streams (Local/County/Regional)	N/A
Mutual Aid Agreements	N/A
Studies/Reports/Maps	

Hazard Analysis/Risk Assessment (Local)	N/A
Hazard Analysis/Risk Assessment (County)	N/A
Flood Insurance Maps	N/A
FEMA Flood Insurance Study (Detailed)	N/A
Evacuation Route Map	County
Critical Facilities Inventory	N/A
Vulnerable Population Inventory	No
Land Use Map	N/A
Staff/Department	
Building Code Official	No
Building Inspector	N/A
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	N/A
Emergency Management Director	N/A
NFIP Floodplain Administrator	N/A
Emergency Response Team	N/A
Hazardous Materials Expert	No
Local Emergency Planning Committee	N/A
County Emergency Management Commission	N/A
Sanitation Department	N/A
Transportation Department	N/A
Economic Development Department	N/A
Housing Department	No
Historic Preservation	N/A
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	No

Local Environmental Organization	No
Homeowners Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, Etc.)	No
Local Funding Availability	
Apply for Community Development Block	Yes
Fund projects through Capital	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	N/A
Impact fees for new development	N/A
Ability to incur debt through general obligation bonds	Yes
Ability to incur debt through special tax bonds	Yes
Ability to incur debt through private activities	N/A
Withhold spending in hazard prone areas	N/A

HARTSBURG

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

Table 2.13: Hartsburg Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	N/A
Capital Improvement Plan	N/A
City Emergency Operations Plan	Yes
County Emergency Operations Plan	Annual Review
Local Recovery Plan	N/A
County Recovery Plan	In Progress
City Mitigation Plan	N/A
County Mitigation Plan	Yes: 2015
Debris Management Plan	No
Economic Development Plan	N/A
Transportation Plan	Regional Transportation Plan? 2015
Land-Use Plan	N/A
Flood Mitigation Assistance (FMA) Plan	N/A
Watershed Plan	N/A
Firewise or other fire mitigation plan	No
School Mitigation Plan	N/A
Critical Facilities Plan (Mitigation/Response/Recover)	N/A
Policies/Ordinance	
Zoning Ordinance	Yes
Building Code	Yes
Floodplain Ordinance	Yes
Subdivision Ordinance	N/A
Tree Trimming Ordinance	N/A
Nuisance Ordinance	N/A

Stormwater Ordinance	N/A
Drainage Ordinance	N/A
Site Plan Review Requirements	N/A
Historic Preservation Ordinance	N/A
Landscape Ordinance	N/A
Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	N/A
Hazard Awareness Program	N/A
National Flood Insurance Program (NFIP)	Yes
NFIP Community Rating System (CRS) Program	N/A
National Weather Service (NWS) Storm Ready	N/A
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	N/A
ISO Fire Rating	5
Economic Development Program	N/A
Land Use Program	N/A
Public Education/Awareness	N/A
Property Acquisition	N/A
Planning/Zoning Boards	N/A
Stream Maintenance Program	N/A
Tree Trimming Program	N/A
Engineering Studies for Streams (Local/County/Regional)	N/A
Mutual Aid Agreements	N/A
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	N/A
Hazard Analysis/Risk Assessment (County)	N/A
Flood Insurance Maps	N/A
FEMA Flood Insurance Study (Detailed)	N/A
Evacuation Route Map	County

Critical Facilities Inventory	N/A
Vulnerable Population Inventory	No
Land Use Map	N/A
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	No
Emergency Management Director	No
NFIP Floodplain Administrator	N/A
Emergency Response Team	N/A
Hazardous Materials Expert	No
Local Emergency Planning Committee	N/A
County Emergency Management Commission	N/A
Sanitation Department	N/A
Transportation Department	No
Economic Development Department	N/A
Housing Department	No
Historic Preservation	N/A
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	No
Local Environmental Organization	No
Homeowners Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, Etc.)	No
Local Funding Availability	

Apply for Community Development Block	Yes
Fund projects through Capital	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	N/A
Impact fees for new development	N/A
Ability to incur debt through general obligation bonds	Yes
Ability to incur debt through special tax bonds	Yes
Ability to incur debt through private activities	N/A
Withhold spending in hazard prone areas	N/A

HUNTSDALE

The Mayor and the Board of Aldermen are the policy making bodies of the government. Some aldermen members have attended training to be CERT certified through the county. The Village of Huntsdale doesn't own any buildings or vehicles.

An engineering firm was hired to redesign the streets and stormwater ditches throughout the village. The project began in 2007 and construction was completed in 2012.

Since the last update a music venue and café have come to the Village of Huntsdale. A large portion of the Huntsdale city limits fall within the floodplain but the Katy Trail draws hikers and cyclists through and a boat ramp allows for visitors and residents access to the Missouri River.

Table 2.14: Huntsdale Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No: county
Builder's Plan	No
Capital Improvement Plan	No
City Emergency Operations Plan	N/A
County Emergency Operations Plan	Annual Review
Local Recovery Plan	N/A
County Recovery Plan	In Progress
City Mitigation Plan	N/A
County Mitigation Plan	Yes: 2015
Debris Management Plan	N/A
Economic Development Plan	N/A
Transportation Plan	Regional Transportation Plan: 2015
Land-Use Plan	N/A
Flood Mitigation Assistance (FMA) Plan	N/A
Watershed Plan	N/A
Firewise or other fire mitigation plan	No
School Mitigation Plan	No
Critical Facilities Plan (Mitigation/Response/Recover)	N/A
Policies/Ordinance	
Zoning Ordinance	Yes

Building Code	N/A
Floodplain Ordinance	N/A
Subdivision Ordinance	N/A
Tree Trimming Ordinance	N/A
Nuisance Ordinance	N/A
Stormwater Ordinance	N/A
Drainage Ordinance	N/A
Site Plan Review Requirements	N/A
Historic Preservation Ordinance	N/A
Landscape Ordinance	N/A
Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	No
Hazard Awareness Program	No
National Flood Insurance Program (NFIP)	Yes
NFIP Community Rating System (CRS) Program	N/A
National Weather Service (NWS) Storm Ready	No
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	10
Economic Development Program	No
Land Use Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	Yes
Stream Maintenance Program	No
Tree Trimming Program	No
Engineering Studies for Streams (Local/County/Regional)	N/A
Mutual Aid Agreements	N/A
Studies/Reports/Maps	

Hazard Analysis/Risk Assessment (Local)	N/A
Hazard Analysis/Risk Assessment (County)	N/A
Flood Insurance Maps	N/A
FEMA Flood Insurance Study (Detailed)	N/A
Evacuation Route Map	County
Critical Facilities Inventory	N/A
Vulnerable Population Inventory	N/A
Land Use Map	N/A
Staff/Department	
Building Code Official	Yes
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	No
Emergency Management Director	Yes: County
NFIP Floodplain Administrator	Yes: Part-time Volunteer
Emergency Response Team	Yes: BCFPD
Hazardous Materials Expert	Yes: BCFPD
Local Emergency Planning Committee	Yes: County
County Emergency Management Commission	N/A
Sanitation Department	No
Transportation Department	No
Economic Development Department	No
Housing Department	No
Historic Preservation	No
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	No

Local Environmental Organization	No
Homeowners Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, Etc.)	No
Local Funding Availability	
Apply for Community Development Block	Yes
Fund projects through Capital	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	No
Impact fees for new development	N/A
Ability to incur debt through general obligation bonds	Yes
Ability to incur debt through special tax bonds	Yes
Ability to incur debt through private activities	N/A
Withhold spending in hazard prone areas	N/A

ROCHEPORT

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

The City of Rocheport no longer owns or operates the wastewater treatment plant; it is now owned and operated by the Boone County Regional Sewer District. Past mitigation actions include exploring effective strategies to mitigate flooding at the wastewater treatment plant in Rocheport. In the spring of 2019 flooding reached more than 33 ft in June 2019. Sandbagging efforts were enacted to protect the town and the wastewater treatment plant. While businesses were not directly under water there was a marked decrease in economic activity due to Katy Trail closures.

Table 2.15: Rocheport Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	N/A
Capital Improvement Plan	N/A
City Emergency Operations Plan	Yes: Backup city hall
County Emergency Operations Plan	Annual Review
Local Recovery Plan	N/A
County Recovery Plan	In Progress
City Mitigation Plan	N/A
County Mitigation Plan	2015
Debris Management Plan	County: 2018
Economic Development Plan	N/A
Transportation Plan	Regional Transportation Plan: 2015
Land-Use Plan	N/A
Flood Mitigation Assistance (FMA) Plan	N/A
Watershed Plan	N/A
Firewise or other fire mitigation plan	No
School Mitigation Plan	N/A
Critical Facilities Plan (Mitigation/Response/Recover)	N/A
Policies/Ordinance	
Zoning Ordinance	Yes

Building Code	Yes
Floodplain Ordinance	N/A
Subdivision Ordinance	Yes
Tree Trimming Ordinance	N/A
Nuisance Ordinance	N/A
Stormwater Ordinance	No
Drainage Ordinance	N/A
Site Plan Review Requirements	N/A
Historic Preservation Ordinance	N/A
Landscape Ordinance	N/A
Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	N/A
Hazard Awareness Program	N/A
National Flood Insurance Program (NFIP)	Yes
NFIP Community Rating System (CRS) Program	N/A
National Weather Service (NWS) Storm Ready	N/A
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	N/A
ISO Fire Rating	5
Economic Development Program	N/A
Land Use Program	N/A
Public Education/Awareness	N/A
Property Acquisition	N/A
Planning/Zoning Boards	N/A
Stream Maintenance Program	N/A
Tree Trimming Program	N/A
Engineering Studies for Streams (Local/County/Regional)	No
Mutual Aid Agreements	N/A
Studies/Reports/Maps	

Hazard Analysis/Risk Assessment (Local)	N/A
Hazard Analysis/Risk Assessment (County)	N/A
Flood Insurance Maps	N/A
FEMA Flood Insurance Study (Detailed)	N/A
Evacuation Route Map	County
Critical Facilities Inventory	No
Vulnerable Population Inventory	No
Land Use Map	N/A
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	N/A
Emergency Management Director	N/A
NFIP Floodplain Administrator	N/A
Emergency Response Team	N/A
Hazardous Materials Expert	N/A
Local Emergency Planning Committee	N/A
County Emergency Management Commission	N/A
Sanitation Department	No
Transportation Department	No
Economic Development Department	No
Housing Department	No
Historic Preservation	No
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	No

Local Environmental Organization	No
Homeowners Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, Etc.)	No
Local Funding Availability	
Apply for Community Development Block	Yes
Fund projects through Capital	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	County
Impact fees for new development	N/A
Ability to incur debt through general obligation bonds	N/A
Ability to incur debt through special tax bonds	N/A
Ability to incur debt through private activities	N/A
Withhold spending in hazard prone areas	N/A

STURGEON

The Mayor and the Board of Aldermen are the policy making bodies in the city government. the City employs a City Clerk and Police Chief.

Since the last update the city project to change the wastewater system to a no discharge/land application system and the addition of a holding basin for treated wastewater from the lagoons has been completed. Residential development since 2015 includes the Sterling Meadows Subdivision and the Penkins Subdivision. Commercial additions include a Dollar General and the Sturgeon Meat Market.

Table 2.16: Sturgeon Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	Pending
Builder’s Plan	N/A
Capital Improvement Plan	N/A
City Emergency Operations Plan	N/A
County Emergency Operations Plan	Annual Review
Local Recovery Plan	N/A
County Recovery Plan	In Progress
City Mitigation Plan	N/A
County Mitigation Plan	2015
Debris Management Plan	N/A
Economic Development Plan	N/A
Transportation Plan	Regional Transportation Plan: 2015
Land-Use Plan	N/A
Flood Mitigation Assistance (FMA) Plan	Yes
Watershed Plan	Yes
Firewise or other fire mitigation plan	No
School Mitigation Plan	No
Critical Facilities Plan (Mitigation/Response/Recover)	No
Policies/Ordinance	
Zoning Ordinance	Yes
Building Code	County

Floodplain Ordinance	N/A
Subdivision Ordinance	Yes
Tree Trimming Ordinance	Yes
Nuisance Ordinance	Yes
Stormwater Ordinance	Yes
Drainage Ordinance	Yes
Site Plan Review Requirements	Yes
Historic Preservation Ordinance	Yes
Landscape Ordinance	Yes
Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	County
Hazard Awareness Program	Yes
National Flood Insurance Program (NFIP)	Yes
NFIP Community Rating System (CRS) Program	N/A
National Weather Service (NWS) Storm Ready	Yes
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	Yes
ISO Fire Rating	4
Economic Development Program	Yes
Land Use Program	No
Public Education/Awareness	Yes
Property Acquisition	No
Planning/Zoning Boards	Yes
Stream Maintenance Program	N/A
Tree Trimming Program	Yes
Engineering Studies for Streams (Local/County/Regional)	N/A
Mutual Aid Agreements	Yes
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	No

Hazard Analysis/Risk Assessment (County)	N/A
Flood Insurance Maps	N/A
FEMA Flood Insurance Study (Detailed)	N/A
Evacuation Route Map	County
Critical Facilities Inventory	N/A
Vulnerable Population Inventory	No
Land Use Map	No
Staff/Department	
Building Code Official	County
Building Inspector	County
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	Yes
Public Works Official	Yes
Emergency Management Director	Yes
NFIP Floodplain Administrator	Yes
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	No
County Emergency Management Commission	No
Sanitation Department	No
Transportation Department	No
Economic Development Department	No
Housing Department	No
Historic Preservation	Yes
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	No
Local Environmental Organization	No

Homeowners Associations	No
Chamber of Commerce	Yes
Community Organizations (Lions, Kiwanis, Etc.)	No
Local Funding Availability	
Apply for Community Development Block	Yes
Fund projects through Capital	No
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	Yes
Ability to incur debt through general obligation bonds	Yes
Ability to incur debt through special tax bonds	Yes
Ability to incur debt through private activities	No
Withhold spending in hazard prone areas	No

Table 2.17: Summary of Jurisdictional Capabilities

Capabilities	Uninc. Boone County	Ashland	Centralia	Columbia	Hallsville	Harrisburg	Hartsburg	Huntsdale	Rocheport	Sturgeon
Planning Capabilities										
Comprehensive Plan	Columbia Comprehensive Plan: 2013	Yes: Update In Progress	Yes	Yes: 2013	No	No	No	No: county	No	Pending
Builder's Plan	Proposed Budget Book: 2018	N/A	N/A	N/A	No	N/A	N/A	No	N/A	N/A
Capital Improvement Plan	N/A	N/A	N/A	Yes: 2018	No	N/A	N/A	No	N/A	N/A
City Emergency Operations Plan	N/A	Yes	Yes	Yes	In Progress	Yes	Yes	N/A	Yes: Backup city hall	N/A
County Emergency Operations Plan	Yes: Annual Review	Yes	Yes	Yes	Annual Review	Annual Review				
Local Recovery Plan	In Progress	N/A	N/A	In Progress	No	N/A	N/A	N/A	N/A	N/A
County Recovery Plan	In Progress	In Progress	In Progress	In Progress	In Progress	In progress	In Progress	In Progress	In Progress	In Progress
City Mitigation Plan	N/A	N/A	N/A	N/A	No	N/A	N/A	N/A	N/A	N/A
County Mitigation Plan	2015	2015	2015	2015	N/A	N/A	Yes: 2015	Yes: 2015	2015	2015
Debris Management Plan	2018	N/A	N/A	N/A	No	No	No	N/A	County: 2018	N/A
Economic Development	REDI	N/A	CREDI	N/A	No	No	N/A	N/A	N/A	N/A

Plan										
Transportation Plan	Regional Transportation Plan: 2015	2015: Regional Transportation Plan	Regional Transportation Plan (Mid-MO)	CATSO TIP: 2019-2022	Regional Transportation Plan: 2015	Regional Transportation Plan: 2015	Regional Transportation Plan? 2015	Regional Transportation Plan: 2015	Regional Transportation Plan: 2015	Regional Transportation Plan: 2015
Land-Use Plan	N/A	N/A	N/A	Yes	No	No	N/A	N/A	N/A	N/A
Flood Mitigation Assistance (FMA) Plan	N/A	N/A	N/A	N/A	No	N/A	N/A	N/A	N/A	Yes
Watershed Plan	Bonne Femme: 2007	N/A	N/A	Bonne Femme: 2007	No	N/A	N/A	N/A	N/A	Yes
Firewise or other fire mitigation plan	No	No	No	No	No	No	No	No	No	No
School Mitigation Plan	N/A	N/A	N/A	N/A	N/A	No	N/A	No	N/A	No
Critical Facilities Plan (Mitigation/Response/Recover)	EOP in review: 2017	N/A	N/A	N/A	No	N/A	N/A	N/A	N/A	No
Policies/Ordinance										
Zoning Ordinance	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Building Code	N/A	Yes	Yes	Yes	Yes: 2015	Yes	Yes	N/A	Yes	County
Floodplain Ordinance	N/A	Yes	Yes	Yes	Yes: 2016	Yes	Yes	N/A	N/A	N/A
Subdivision Ordinance	Yes	Yes	Yes	Yes	Yes	No	N/A	N/A	Yes	Yes

Tree Trimming Ordinance	N/A	N/A	N/A	Yes	No	No	N/A	N/A	N/A	Yes
Nuisance Ordinance	N/A	N/A	Yes	Yes	Yes	N/A	N/A	N/A	N/A	Yes
Stormwater Ordinance	N/A	Yes	No	Yes	Yes	N/A	N/A	N/A	No	Yes
Drainage Ordinance	N/A	N/A	N/A	Yes	Yes	N/A	N/A	N/A	N/A	Yes
Site Plan Review Requirements	N/A	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	Yes
Historic Preservation Ordinance	N/A	N/A	N/A	Yes	No	Yes	N/A	N/A	N/A	Yes
Landscape Ordinance	N/A	N/A	N/A	N/A	Yes	N/A	N/A	N/A	N/A	Yes
Program										
Zoning/Land Use Restrictions	N/A	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Codes Building Site/Design	N/A	Yes	N/A	Yes	Yes	N/A	N/A	No	N/A	County
Hazard Awareness Program	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A	Yes
National Flood Insurance Program (NFIP)	Yes: Portions of County	Yes								
NFIP Community Rating System (CRS) Program	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
National Weather	Yes: 2019	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A	Yes

Service (NWS) Storm Ready										
Firewise Community Certification	No	No	No	No	No	No	No	No	No	No
Building Code Effectiveness Grading (BCEGs)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A	Yes
ISO Fire Rating	Varies	4	5	2	4	N/A	5	10	5	4
Economic Development Program	N/A	N/A	CREDI	REDI	N/A	N/A	N/A	No	N/A	Yes
Land Use Program	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A	No
Public Education/Awareness	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A	Yes
Property Acquisition	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A	No
Planning/Zoning Boards	N/A	Yes	Yes	Yes	Yes	N/A	N/A	Yes	N/A	Yes
Stream Maintenance Program	Yes: DNR/Wastewater Management	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A	N/A
Tree Trimming Program	N/A	N/A	N/A	N/A	No	N/A	N/A	No	N/A	Yes
Engineering Studies for Streams (Local/County/Regional)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A
Mutual Aid Agreements	N/A	N/A	N/A	N/A	Yes	N/A	N/A	N/A	N/A	Yes

Studies/Reports/Maps										
Hazard Analysis/Risk Assessment (Local)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No
Hazard Analysis/Risk Assessment (County)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Flood Insurance Maps	Yes	Yes	N/A	N/A	Yes	N/A	N/A	N/A	N/A	N/A
FEMA Flood Insurance Study (Detailed)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Evacuation Route Map	Yes	County	County	County	In Progress/County	County	County	County	County	County
Critical Facilities Inventory	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A
Vulnerable Population Inventory	N/A	N/A	N/A	N/A	No	No	No	N/A	No	No
Land Use Map	Yes		N/A	Yes	Yes	N/A	N/A	N/A	N/A	No
Staff/Department										
Building Code Official	Yes	N/A	County	Yes	No	No	No	Yes	No	County
Building Inspector	Yes	N/A	County	Yes	Boone County	N/A	No	No	No	County
Mapping Specialist (GIS)	Yes	N/A	No	Yes	Boone County	No	No	No	No	No

Engineer	Yes	N/A	No	Yes	Yes	No	No	No	No	No
Development Planner	Yes	N/A	No	N/A	No	No	No	No	No	Yes
Public Works Official	Yes	Yes	Yes	Yes	Yes	N/A	No	No	N/A	Yes
Emergency Management Director	Yes	N/A	County	N/A	Yes	N/A	No	Yes: County	N/A	Yes
NFIP Floodplain Administrator	Yes	N/A	Yes	N/A	Yes	N/A	N/A	Yes: Part-time Volunteer	N/A	Yes
Emergency Response Team	Yes	N/A	Yes	N/A	Yes/CERT	N/A	N/A	Yes: BCFPD	N/A	No
Hazardous Materials Expert	Yes	N/A	No	N/A	No	No	No	Yes: BCFPD	N/A	No
Local Emergency Planning Committee	Yes	N/A	Yes	Yes	Yes/CERT	N/A	N/A	Yes: County	N/A	No
County Emergency Management Commission	No	N/A	N/A	Yes	Yes	N/A	N/A	N/A	N/A	No
Sanitation Department	Yes	Yes	Yes	Yes	N/A	N/A	N/A	No	No	No
Transportation Department	Yes	N/A	Yes	Yes	N/A	N/A	No	No	No	No
Economic Development Department	Yes	N/A	Yes	REDI	No	N/A	N/A	No	No	No
Housing Department	N/A	N/A	No	Yes	No	No	No	No	No	No
Historic Preservation	Yes	No	N/A	N/A	No	N/A	N/A	No	No	Yes

Non-Governmental Organizations (NGOs)										
American Red Cross	No	N/A	N/A	Yes	No	No	No	No	No	No
Salvation Army	Yes	N/A	N/A	N/A	No	No	No	No	No	No
Veterans Groups	Yes	N/A	N/A	Yes	No	No	No	No	No	No
Local Environmental Organization	Yes	N/A	N/A	N/A	No	No	No	No	No	No
Homeowners Associations	Yes	N/A	N/A	N/A	No	No	No	No	No	No
Chamber of Commerce	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes
Community Organizations (Lions, Kiwanis, Etc.)	Yes	Lions	Yes	N/A	Yes	No	No	No	No	No
Local Funding Availability										
Apply for Community Development Block	Yes	N/A	Yes	N/A	Yes	Yes	Yes	Yes	Yes	Yes
Fund projects through Capital	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Authority to levy taxes for a specific purpose	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fees for water, sewer, gas, or electric services	Yes	Yes	Yes	Yes	Yes	N/A	N/A	No	County	Yes
Impact fees for new	N/A	N/A	Yes	Yes	Yes	N/A	N/A	N/A	N/A	Yes

development										
Ability to incur debt through general obligation bonds	N/A	Yes	N/A	Yes						
Ability to incur debt through special tax bonds	N/A	Yes	N/A	Yes						
Ability to incur debt through private activities	N/A	Yes	N/A	Yes	No	N/A	N/A	N/A	N/A	No
Withhold spending in hazard prone areas	N/A	Yes	N/A	Yes	No	N/A	N/A	N/A	N/A	No

SPECIAL DISTRICT

There are numerous special districts in the planning area which are vital to the health and safety of the population. In addition to providing basic services, personnel of the Special Districts possess a wealth of knowledge and experience valuable for hazard mitigation planning.

ROAD AND BRIDGE DISTRICTS

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.

NON-GOVERNMENTAL AND VOLUNTEER ORGANIZATIONS

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 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.

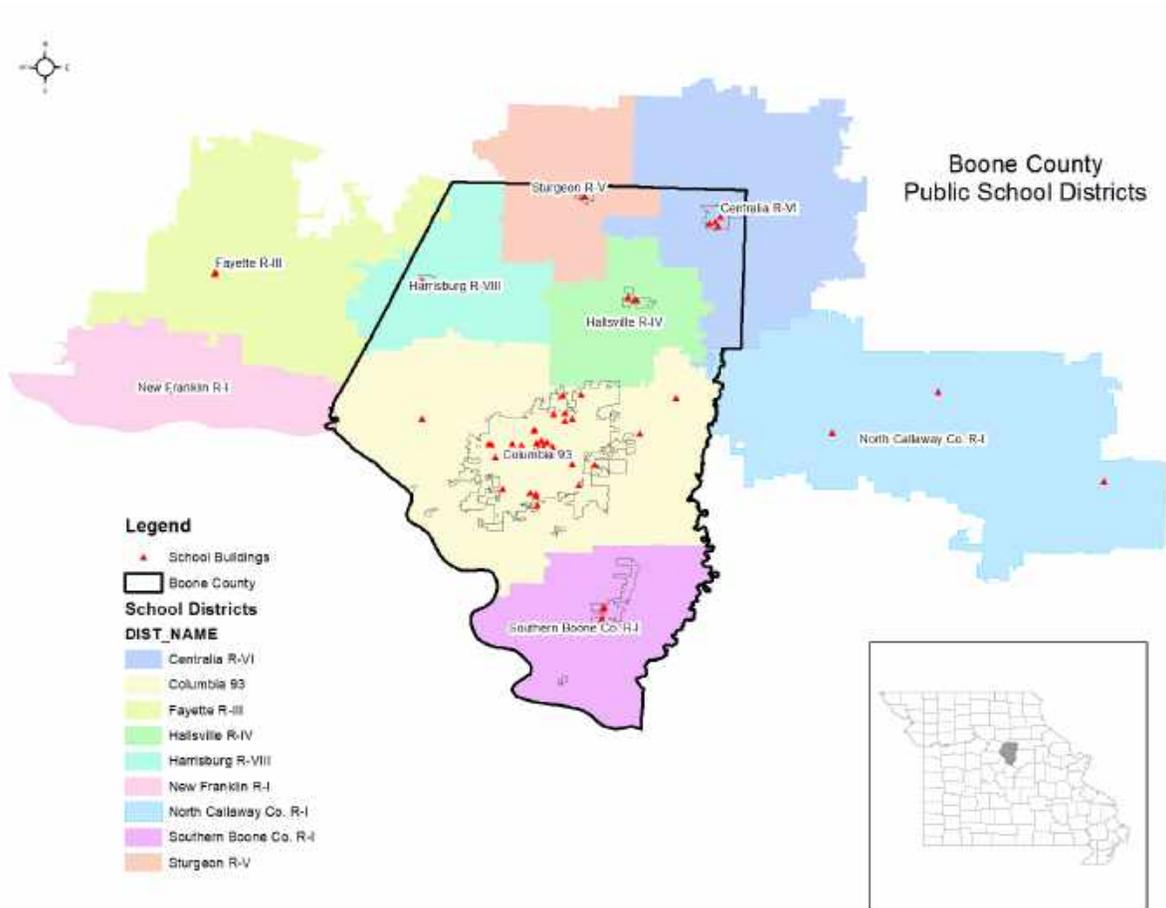
PUBLIC SCHOOL DISTRICT PROFILES AND MITIGATION CAPABILITIES

There are 9 public School districts that intersect the Boone County boundary. They are:

- Centralia R-VI
- Sturgeon R-V
- Fayette R-III
- Harrisburg R-VIII
- North Callaway R-I
- New Franklin R-I
- Southern Boone R-I
- Columbia Public Schools
- Hallsville R-IV

Figure 2.8 displays the school districts and how they are situated within and around the Boone County boundary.

Figure 2.8: Boone County School Districts



Of the 9 public school districts whose boundaries intersect Boone County only 6 of the districts have buildings and are primarily within Boone County jurisdiction. Centralia, Columbia Public Schools,

Hallsville, Harrisburg, Southern Boone, and Sturgeon own structures within Boone County. Of the 6 main districts only Harrisburg R-VIII did not participate in the planning process.

CENTRALIA R-VI SCHOOL DISTRICT

The District partnered with the City of Centralia in February 2013 to add a School Resource Officer who has been instrumental in all areas of school safety and disaster preparedness. There is great interest in adding a tornado safe room for the district.

Table 2.18			
Centralia R-VI School District			
School Name	Grades	Certified Staff	Enrollment 2019-20
Chance Elementary	PK-2	57	601
Centralia Intermediate	3-5		
Chester Boren Middle	6-8	35	320
Centralia High	9-12	42	451
	Total	134	1,372
Source: Missouri Department of Elementary and Secondary Education - Data as of 11/17/2019			
Property Valuation			
	Count	Replacement Value (including contents)	
Buildings	17	\$43,395,372	
Vehicles	27	na	
Source: School District Insurance Statement			

COLUMBIA PUBLIC SCHOOLS

There is a great need for satisfactory tornado sheltering at the district’s schools. This is a huge and expensive task, especially given the tight economic times and the size of the district. As remodels happen throughout the districts many buildings hardening efforts are added to facilities. The district continues to train all personnel on the various natural and man-made hazards that could face their students and faculty. Preparedness plans are reviewed and altered as needed.

Construction on the John Warner Middle School has begun. It will be taking pressure off the currently over capacity Gentry Middle School.

Table 2.19			
Columbia Public Schools - Overview			
	Schools	Certified Staff	Enrollment 2019-20
Elementary Schools	23	804	9,009
Middle Schools	6	383	4,135
High Schools	5	586	5,411
Total	34	1,773	18,555
Sources: Missouri Department of Elementary and Secondary Education - Data as of 11/17/2019; School District			
Property Valuation			
	Count	Replacement Value (including contents)	Insured Value
Buildings	38	Not available	
Vehicles	Not available		Not available
Sources: School District Insurance Statement			

Figure 2.2 is a list of school buildings that are part of the Columbia Public Schools district.

Table 2.2			
Columbia Public Schools - Schools and Administrative Buildings			
School Name	Grades	School Name	Grades
Alpha Hart Lewis Elementary	PK-05	Parkade Elementary	PK-05
Battle Elementary	PK-05	Rainforest Parkway Early Childhood Center	
Beulah Ralph Elementary*	PK-05	Robert E. Lee Elementary	PK-05
Blue Ridge Elementary	PK-05	Rock Bridge Elementary	PK-05
Cedar Ridge Elementary	PK-05	Russell Boulevard Elementary	PK-05
Derby Ridge Elementary	PK-05	Shepard Boulevard Elementary	PK-05
Fairview Elementary	PK-05	Thomas Benton Elementary	PK-05
Field Elementary/EEE	PK-05	Two Mile Prairie Elementary	K-05
John Ridgeway Elementary	K-05	Ulysses S. Grant Elementary	PK-05

Mary Paxton Keeley Elementary	PK-05	Early Childhood Education Center - Waco	PK
Midway Heights Elementary	PK-05	West Boulevard Elementary	PK-05
Mill Creek Elementary	PK-05	Discovery Early Childhood Center	PK
New Haven Elementary	PK-05	Center for Early Learning – North	PK
Ann Hawkins Gentry Middle	6-8	Oakland Middle	6-8
Jefferson Middle	6-8	Smithton Middle	6-8
John B. Lange Middle	6-8	West Middle	6-8
David H. Hickman High	9-12	John Warner Middle	6-8
Frederick Douglass High	9-12	Rock Bridge Sr. High	9-12
Columbia Area Career Center	10-12	Muriel W. Battle High	9-12
Aslin Administration Building		Facilities and Construction Services Building	
Center for Responsive Education		Center for Gifted Education/Title 1	
Source: School District			

HALLSVILLE R-IV SCHOOL DISTRICT

Table 2.21			
Hallsville R-IV School District			
School Name	Grades	Certified Staff	Enrollment 2019-20
Hallsville Primary	PK-1	68	700
Hallsville Intermediate	2-5		
Hallsville Middle	6-8	32	337
Hallsville High	9-12	41	389
	Total	141	1,426
Source: Missouri Department of Elementary and Secondary Education - Data as of 11/17/2019			
Property Valuation			
	Count	Replacement Value (including contents)	Insured Value
Buildings	5	Not available	
Vehicles	27		Not available
Source: School District staff			

The School District received the Fleet Excellence Award for its performance on bus safety inspections in 2019; the bus inspections achieved a 100% approval rate with all buses passing inspection and none out of service. The award is presented by the Missouri Highway Patrol. The Hallsville School District has had a track record of achievement in bus safety.

A science wing and a health and fitness classroom/weight room have been completed on the high school. In 2017 an operating levy increase passed to keep class sizes small, expand technology, and attract and retain quality educators. In 2018, a \$7 million bond issuance passed to construct a second-grade wing, gymnasium, and storm shelter at the primary school. These additions are currently underway and estimated to open in the 2020-2021 school year.

HARRISBURG R-VIII SCHOOL DISTRICT

The Harrisburg School District did not participate in the 2020 Boone County Hazard Mitigation update. According to the last update there are not any specific future development plans. Long-term facilities plan goals include the addition of a middle school building, addition of a softball field in the high school sports complex and the acquisition of land for future growth.

Table 2.22			
Harrisburg R-VIII School District			
School Name	Grades	Certified Staff	Enrollment 2019-20
Harrisburg Elementary	K-5	28	307
Harrisburg Middle	6-8	20	152
Harrisburg High	9-12	21	155
	Total	69	614
Source: Missouri Department of Elementary and Secondary Education - Data as of 11/17/2019			
Property Valuation			
	Count	Replacement Value (including contents)	Insured Value
Buildings	15	\$22,129,873	
Vehicles	15		\$47,487
Sources: School District Insurance Statement			

SOUTHERN BOONE COUNTY R-I SCHOOL DISTRICT

Southern Boone has had rapid growth in the last several years. In 2018 a bond initiative funded construction on a new elementary gymnasium, central office building, and high school baseball and softball fields. In 2019 voters approved a tax increase to build an addition onto the primary school. The addition will include 17 new classrooms and 6 additional teachers offices.

Future plans include a no-tax increase bond for 2021 that would focus on current overcrowding in the elementary and middle schools.

Table 2.23			
Southern Boone Co. R-I School District			
School Name	Grades	Certified Staff	Enrollment 2019-20
Southern Boone Primary	PK-2	87	866
Southern Boone Elementary	3-5		
Southern Boone Middle	6-8	39	394
Southern Boone High	9-12	49	482
	Total	175	1,742
Source: Missouri Department of Elementary and Secondary Education - Data as of 11/17/2019			
Property Valuation			
	Count	Replacement Value (including contents)	Insured Value
Buildings	5	\$51,000,000	
Vehicles	32		
Sources: School District Insurance Statement			

STURGEON R-V SCHOOL DISTRICT

Construction on two new classrooms, an outdoor track, and canopy at the high school have finished since the previous update. Safety upgrades to security cameras and the addition of shatterproof film at the Elementary, Middle, and High School are currently in the works.

A no-tax increase bond measure is set for June 2020. If passed, it would go toward upgrading door security features, installing ballistic film to exterior windows throughout the district, communications upgrades, as well as various other maintenance and remodel projects.

Table 2.24			
Sturgeon R-V School District			
School Name	Grades	Certified Staff	Enrollment 2019-20
Sturgeon Elementary	K-4	23	175
Sturgeon Middle	5-8	16	126
Sturgeon High	9-12	20	132
	Total	59	433
Source: Missouri Department of Elementary and Secondary Education - Data as of 11/17/2019			
Property Valuation			
	Count	Replacement Value (including contents)	
Buildings	3	\$15,895,192	
Vehicles	8		
Sources: School District Insurance Statement			

Table 2.25 Summary of Mitigation Capabilities for Boone County School Districts

Capability	Centralia R-VI	Columbia Public Schools	Hallsville R-IV	Southern Boone	Sturgeon R-V
Planning Elements					
Master Plan/Date	N/A	N/A	N/A	N/A	N/A
Capital Improvement Plan/Date	Yes: 2013	Yes:2018	Yes:2019	Yes:N/A	Yes: N/A
School Emergency Plan/Date	Yes: N/A	Yes:2014	Yes: N/A	Yes:N/A	Yes: N/A
Weapons Policy/Date	Yes: N/A	Yes	N/A	Yes	Yes
Personnel Resources					
Full-Time Building Official (Principal)	Yes	Yes	Yes	Yes	Yes
Emergency Manager	N/A	N/A	N/A	N/A	N/A
Grant Writer	N/A	N/A	N/A	N/A	N/A
Public Information Officer	N/A	Yes	Yes	N/A	
Financial Resources					
Capital Improvements Project Funding	Yes	Yes	Yes	Yes	Yes
Local Funds	Yes	Yes	Yes	Yes	Yes
General Obligation Bonds	Yes	Yes	Yes	Yes	Yes
Special Tax Bonds	N/A	N/A	N/A	N/A	N/A
Private Activities/Donations	N/A	N/A	N/A	N/A	N/A
State and Federal Funds/Grants	Yes	Yes	Yes	Yes	Yes
Other					
Public Education Programs	N/A	N/A	N/A	N/A	N/A
Privately or Self- Insured?	N/A	N/A	N/A	N/A	N/A
Fire Evacuation Training	Yes	Yes	Yes	Yes	Yes
Tornado Sheltering Exercises	Yes	Yes	Yes	Yes	Yes
Public Address/Emergency Alert System	Yes	Yes	Yes	Yes	Yes
NOAA Weather Radios	N/A	Yes	N/A	Yes	N/A
Lock-Down Security Training	Yes	Yes	Yes	Yes	Yes
Mitigation Programs	N/A	N/A	N/A	N/A	N/A
Tornado Shelter/Saferoom	Yes	Yes	Yes	Yes	Yes
Campus Police	SRO	Yes	SRO	N/A	N/A

Higher Education

COLUMBIA COLLEGE

Columbia college did not participate in the mitigation planning process for 2020. Past projects include construction on the Browder Science Center and a soccer field and facility, and improvements to parking structures and cooling towers.

There are plans to redevelop the central part of campus.

Table 2.26			
Columbia College (planning area only)			
		Property Valuation	
	Count	Replacement Value (including contents)	Insured Value
Student Population (planning area only)	1597	N/A	N/A
Faculty	157	N/A	N/A
Staff	483	N/A	N/A
Buildings	27	\$270,000,000	N/A
Vehicles	22	N/A	\$5,500,000
Sources: College staff, Insurance Statement			

STEPHENS COLLEGE

A large renovation project was conducted in 2015 on Sampson Hall. An existing portion of the building was demolished and rebuilt to include new classrooms, faculty offices, labs, and multiuse areas for the physician studies program.

Table 2.27		
Stephens College		
	Count	Property Valuation
Student Population	775 on-campus	Not available
	385 commuting	
Faculty and Staff	318	
Total Buildings	14	
Residential dorms	5	
Office & Operations facilities	4	
Learning Center	4 and the library	
Plant Facilities	1	
Source: Stephens College		

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. MU is a large city within the City of Columbia, with its own power generation capability and separate water system. MU Police Department is one of the very few fully accredited law-enforcement agencies in Missouri. MU has an emergency management coordinator who works directly with city and county government agencies to integrate collaborative planning and training opportunities. MU has worked cooperatively with the City and County in emergency preparedness efforts through collaboration on numerous committees.

The University has an updated master plan for all facilities and infrastructure in direct collaboration with the City of Columbia. This includes major renovations to historic buildings, refurbishing outdated infrastructure and building new state of the art facilities. Information about the most the recent MU Campus Master Plan can be found at: <https://masterplan.missouri.edu/mu-master-plan/>

Additional activities include working on the NWS Storm Ready designation and continued work on improving mass alert and warning systems to be compliant with Clery Act and accreditation requirements of the state and federal government.

Table 2.28		
University of Missouri - Columbia		
	Count	
Student Population	35,441	
Faculty	2,600	
Staff	5,500	
	Count	Total Property Valuation (estimate)
Buildings	357	\$3,209,097,047
Vehicles	967	
Sources: University staff		

Section 3: Risk Assessment.

- Hazard Identification.....88

- Multi-Jurisdictional Risk Assessment.....91
 - Assets At Risk

- Hazard Profiles, Vulnerability, and Problem Statements.....107
 - Flood
 - Levee Failure
 - Dam Failure
 - Earthquake
 - Land Subsidence/Sinkholes
 - Severe Thunderstorms (including Damaging Winds, Hail, and Lightning)
 - Tornado
 - Severe Winter Weather (including Ice, Snow, and Severe Cold)
 - Drought
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 - Public Health Emergency
 - Hazardous Materials Release
 - Transportation Incident
 - Nuclear Incident
 - Utility Service Disruption
 - Telecommunications Disruption
 - Cyber Attack
 - Unwanted Intruder/Active Shooter
 - Terrorism
 - Civil Disorder
 - Mass Casualty/Fatality Event

Section 3: Natural Hazard Risk Assessment

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

Risk assessment is a process of estimating the potential for injury, death, property damage, or economic loss which may result from a hazard. A risk assessment is only as valuable as the thoroughness and accuracy of the information on which it is based. As will be seen, there is a great variation between hazards in the amount and reliability of the data available for analysis.

- **Section 3.1 Hazard Identification** identifies the natural and man-made hazards that threaten the area and provides basis for the elimination of hazards from further consideration.
- **Section 3.2 Assets at Risk** provides the planning area's total exposure to natural and man-made hazards, considering critical facilities and other community assets at risk.
- **Section 3.3 Land Use and Development** discusses development that has occurred since the last plan update and any increased or decreased risk that resulted. There will also be discussion of areas of planned future development and implications of such development.
- **Section 3.4 Hazard Profiles and Vulnerability Analysis** provides more detailed information about the hazards impacting the planning area. Each hazard will have a Hazard Profile that provides a general description and threat discussion, a Vulnerability Assessment to further define and quantify populations, structures and other community assets at risk, and a Problem Statement that summarizes the problem and possible solutions.

Hazard Identification

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

As part of the planning process each jurisdiction was asked to evaluate the probability and potential severity of each hazard addressed in this plan. Those responses were used to evaluate mitigation options.

Review of Existing Mitigation Plans

There are certain other natural hazards which FEMA requires to be addressed in Hazard Mitigation Plans if they are applicable to the planning area. 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.

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

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

The Missouri State Hazard Mitigation Plan (2018) 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.

Review Disaster Declaration History

Severe storms and flooding are the most common events to warrant a disaster declaration in Boone County. In the event of flooding the declaration is brought on by mounting costs due to widespread water damage and the closure or destruction of several homes and businesses that impact the local economy of the affected area.

Table 3.1: FEMA Disaster Declaration that included Boone County, Missouri 1965-Present

Disaster Number	Description	Declaration Date Incident Period	Individual Assistance (IA) Public Assistance (PA)
3482	Covid-19 Pandemic	1/20/20-Ongoing	Ongoing
4451	Severe Storms and Flooding	4/29/19-7/5/19	IA/PA
4317	Severe Storms and Flooding	4/28/17-5/11/17	PA

3374	Severe Storms and Flooding	12/22/15-1/9/16	PA
3325	Missouri Flooding	6/1/11-8/1/11	PA
1961	Severe Winter Storm	1/31/11-2/5/11	PA
3303	Severe Winter Storm	1/26/09-1/28-09	PA
1809	Severe Storms and Flooding	9/11/08-9/24/08	IA
1749	Severe Storms and Flooding	3/17/08-5/9/08	PA
1736	Severe Winter Storm	12/6/07-12/15/07	PA
3281	Severe Winter Storm	12/8/07-12/15/07	PA
1676	Severe Winter Storm	1/12/07-1/22/07	PA
3232	Hurricane Katrina Evacuation	8/29/05-10/1/05	PA
1463	Severe Storms and Flooding	5/4/03-5/30/03	IA
1403	Ice Storm	1/29/02-2/13/02	IA
1054	Severe Storms and Flooding	5/13/95-6/23/95	IA/PA
995	Flooding	6/10/93-10/25/93	IA/PA
867	Severe Storms and Flooding	5/15/90-5/31/90	IA/PA
779	Severe Storms and Flooding	9/18/86-10/15/86	IA
3017	Drought	9/24/76	PA
372	Severe Storms and Flooding	44/19/73	IA/PA

Source: Federal Emergency Management Agency, <https://www.fema.gov/disasters>

Research Additional Sources

Sources utilized for information regarding past disaster incidents and research in the planning area include:

- Missouri Hazard Mitigation Plans (2013 and 2018)
- Previously approved Boone County Hazard Mitigation Plan (2015)
- Federal Emergency Management Agency (FEMA)
- Missouri Department of Natural Resources
- National Drought Mitigation Center Drought Reporter
- US Department of Agriculture’s Ag Census
- Data Collection Questionnaires completed by each jurisdiction
- State of Missouri GIS data
- Hazards US (Hazus)
- Missouri Department of Transportation
- County Emergency Management
- County Flood Insurance Rate Map, FEMA
- U.S. Army Corps of Engineers
- United States Geological Survey (USGS)

Hazards Identified

Profiled below is a summary of Natural Hazards in alphabetical order that have significant impacts on the planning area. Each jurisdiction is unique and may not be affected by every hazard. X indicates hazards that impact that jurisdiction.

Table 3.2: Natural Hazard Summary

Jurisdiction	Dam Failure	Drought	Earthquake	Extreme Temperatures	Flooding (River and Flash)	Land Subsidence/Sinkholes	Levee Failure	Severe Winter Weather	Thunderstorm/Lightning/Hail/High Wind	Tornado	Wildfire
Boone	x	x	x	x	x	x	x	x	x	x	x
Ashland		x	x	x	x	x		x	x	x	x
Centralia	x	x	x	x	x	x		x	x	x	x
Columbia	x	x	x	x	x	x	x	x	x	x	x
Hallsville		x	x	x	x			x	x	x	x
Harrisburg		x	x	x	x			x	x	x	x
Hartsburg		x	x	x	x		x	x	x	x	x
Huntsdale		x	x	x	x		x	x	x	x	x
Rocheport		x	x	x	x	x		x	x	x	x
Sturgeon		x	x	x	x			x	x	x	x
Schools and Special Districts											
Columbia Public Schools		x	x	x	x			x	x	x	x
Hallsville R-IV School District		x	x	x	x			x	x	x	x
Southern Boone School District		x	x	x	x			x	x	x	x
Sturgeon R-V School District		x	x	x	x			x	x	x	x
Stephens College		x	x	x	x			x	x	x	x
University of Missouri		x	x	x	x			x	x	x	x

Multi-Jurisdictional Risk Assessment

The 2020 Boone County Hazard Mitigation plan is an update of an earlier plan. The hazard profiles that follow are assessed on a county-wide basis but each jurisdiction will have unique levels of impact based on population and geographical location. The City of Columbia is the urban center of the planning area, with dense development and infrastructure that brings vulnerability state-wide if a hazard were to cause widespread destruction in the city.

Assets At Risk

There are four main types of facilities of concern in a hazard event. Critical Facility, essential facility, high potential loss facility, and transportation and lifeline facilities. These facilities are defined by FEMA 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.

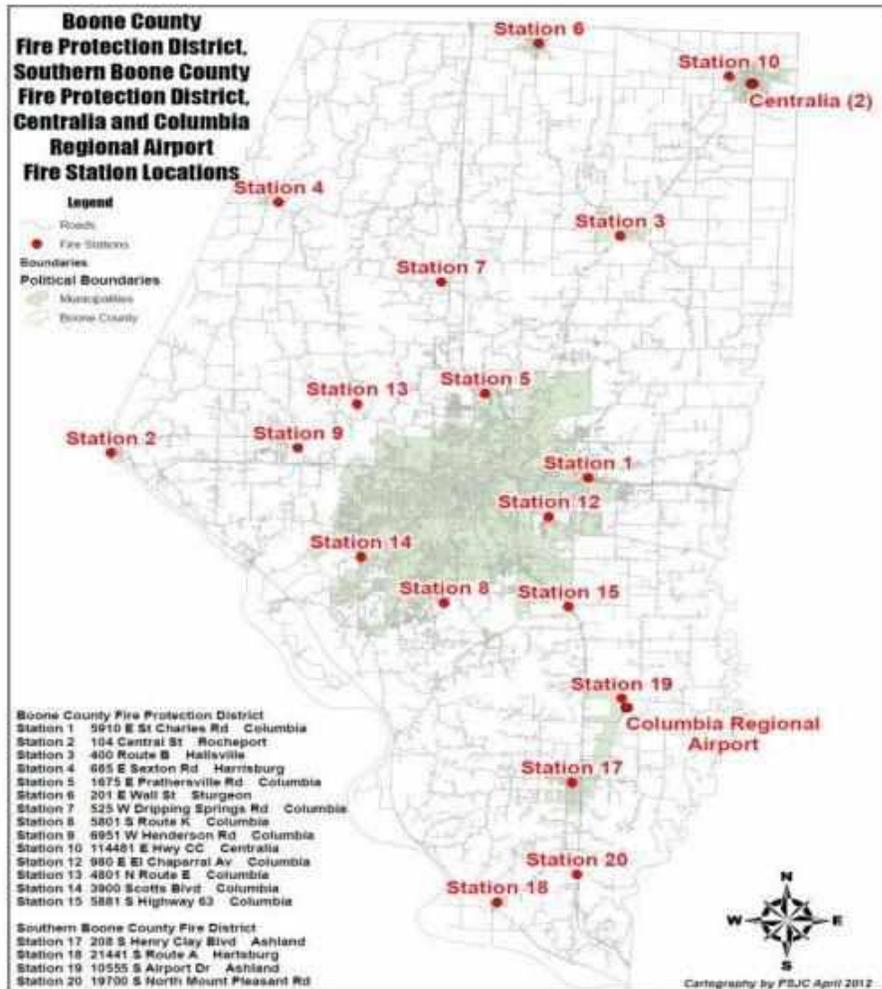
Government

The jurisdictions of Boone County, Ashland, Centralia, Columbia, Hallsville, Harrisburg, Hartsburg, Rocheport and Sturgeon all own buildings critical to the functioning of their jurisdictions. The City of Columbia is the county seat; both city and county buildings, which serves the entire county, are located there.

FIRE PROTECTION

There are two fire districts serving Boone County: the Boone County Fire Protection District and the Southern Boone County Fire Protection District (Figure 3.2).

Figure 3.1



The **Boone County Fire Protection District**, the third largest fire department in Missouri, is governed by a five-member board of directors elected by the public. Full service 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 a Hazardous Materials Division, a State Homeland Security Regional

Response Team, a FEMA Urban Search and Rescue Team, a Type II wildfire team, and a dive rescue unit.

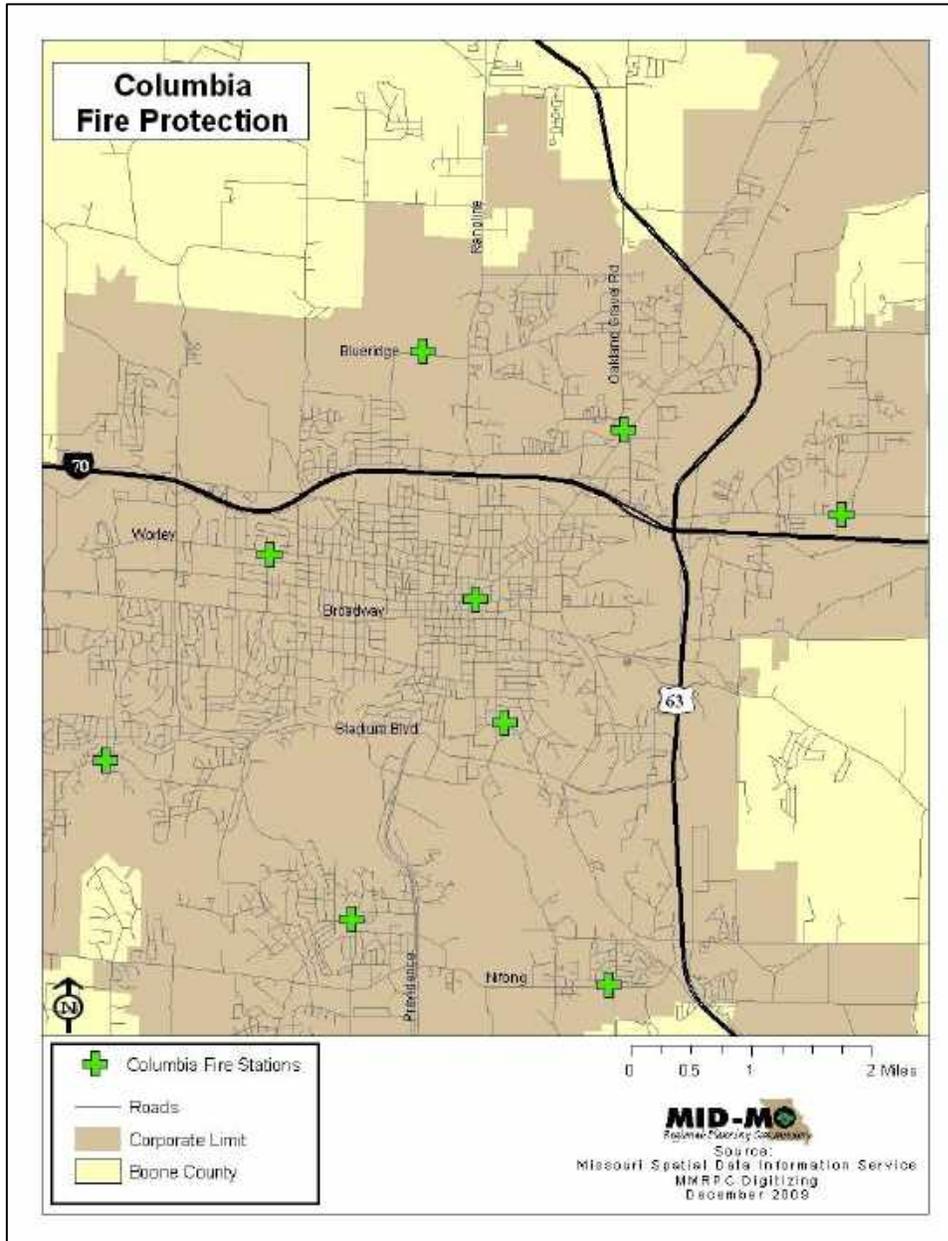
The Southern Boone County Fire Protection District is governed by a three-member elected body and serves the southern one-third of the county. It has a limited hazardous materials response capability. The district protects an area of 100 square miles and a population of approximately 10,000 from four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

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 Cities of Centralia and Columbia both support their own fire departments. The Centralia Fire Department provides service within the corporate limits but has limited response capability to hazardous material incidents and emergency medical calls.

The Columbia Fire Department is a full career fire department operating out of eight stations (Figure 3.3) with approximately 126 firefighters. It supports a hazardous materials team with response equipment tailored to the scene of an emergency incident.

Figure 3.2



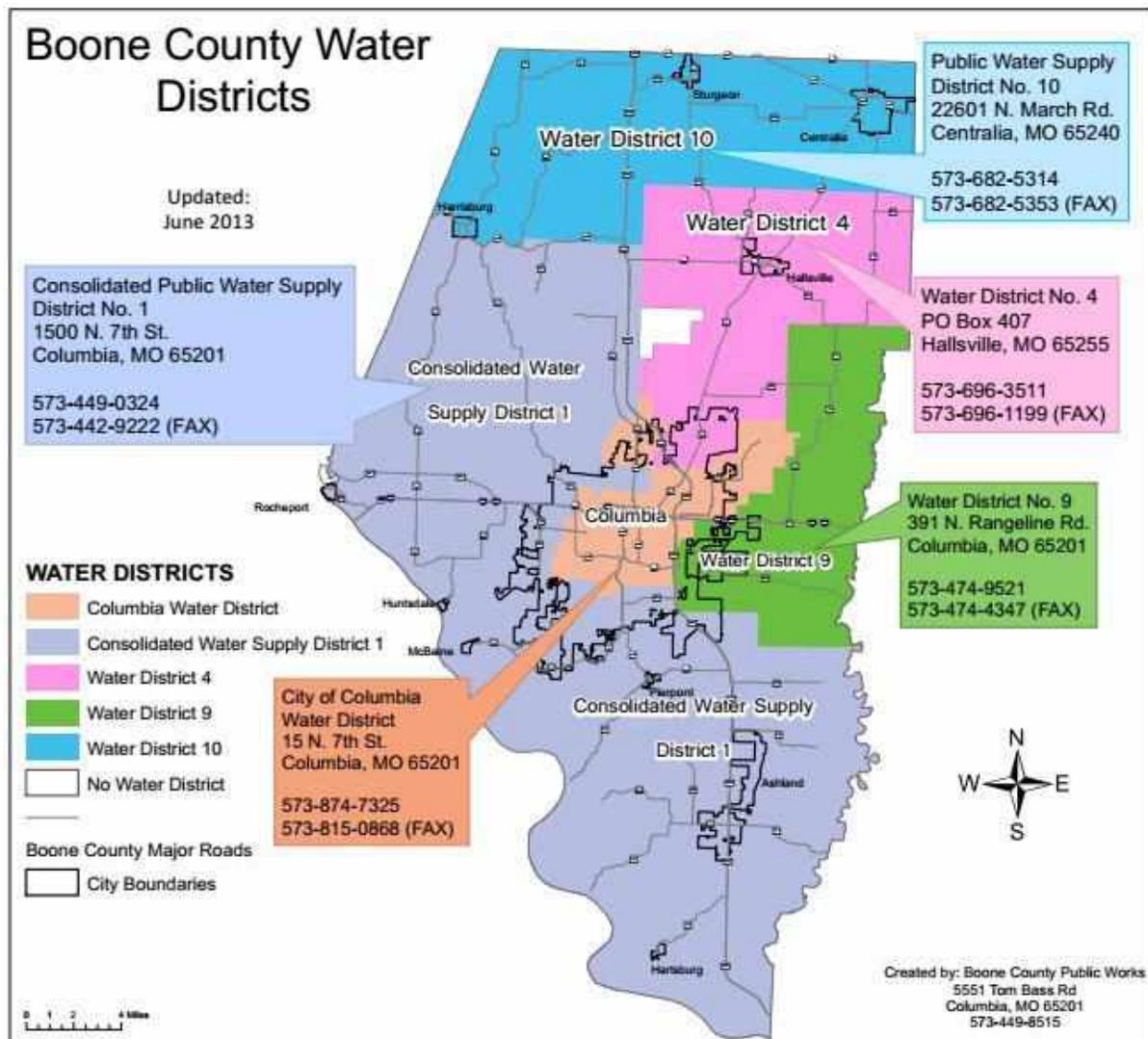
Public Water Supply Districts

Four Water Districts are responsible for distributing water throughout the County except in locations served by a municipality (Figure 3.4). Each water district is governed by an elected board.

The Cities of Ashland, Columbia, Centralia, Hallsville, Harrisburg, and Sturgeon all have their own water departments/districts.

Protecting water supply infrastructure from floodwaters is a critically important mitigation task. Connection of water supplies and/or cooperative agreements between districts and departments can be important for ensuring adequate water for fire fighting and in times of drought. The City of Columbia has cooperative water agreements with PWS #9 and the University of Missouri.

Figure 3.3



Wastewater Facilities

Boone County Regional Sewer District (BCRSD)

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 BCRSD now owns and operates the wastewater treatment facility for the Village of Rocheport; this was previously owned by the village.

The majority of the BCRSD system is gravity sewers. The Sewer District operates and maintains the following treatment/reclamation facilities:

- 14 mechanical plants
- 19 aerated lagoons
- 5 non-aerated lagoons
- 3 re-circulating sand filters
- 1 drip irrigation system

The BCRSD works with the City of Columbia which provides wholesale treatment for some of the subdivisions in the Sewer District's territory.

Municipal Wastewater Systems

The following municipalities all provide their own wastewater treatment: Ashland, Centralia, Columbia, Hallsville, Hartsburg, Harrisburg, and Sturgeon.

MEDICAL FACILITIES

There are numerous medical and healthcare facilities located in the planning area. Medical facilities in the City of Columbia serve not only the planning area and region but also patients from all over Missouri; the University Hospital is a Level 1 Trauma Center.

The nursing homes and some of the medical facilities house vulnerable populations. The *Boone County Emergency Operations Plan* clearly outlines procedures to ensure that these facilities are warned of impending hazard events in a timely manner.

Figure 3.4

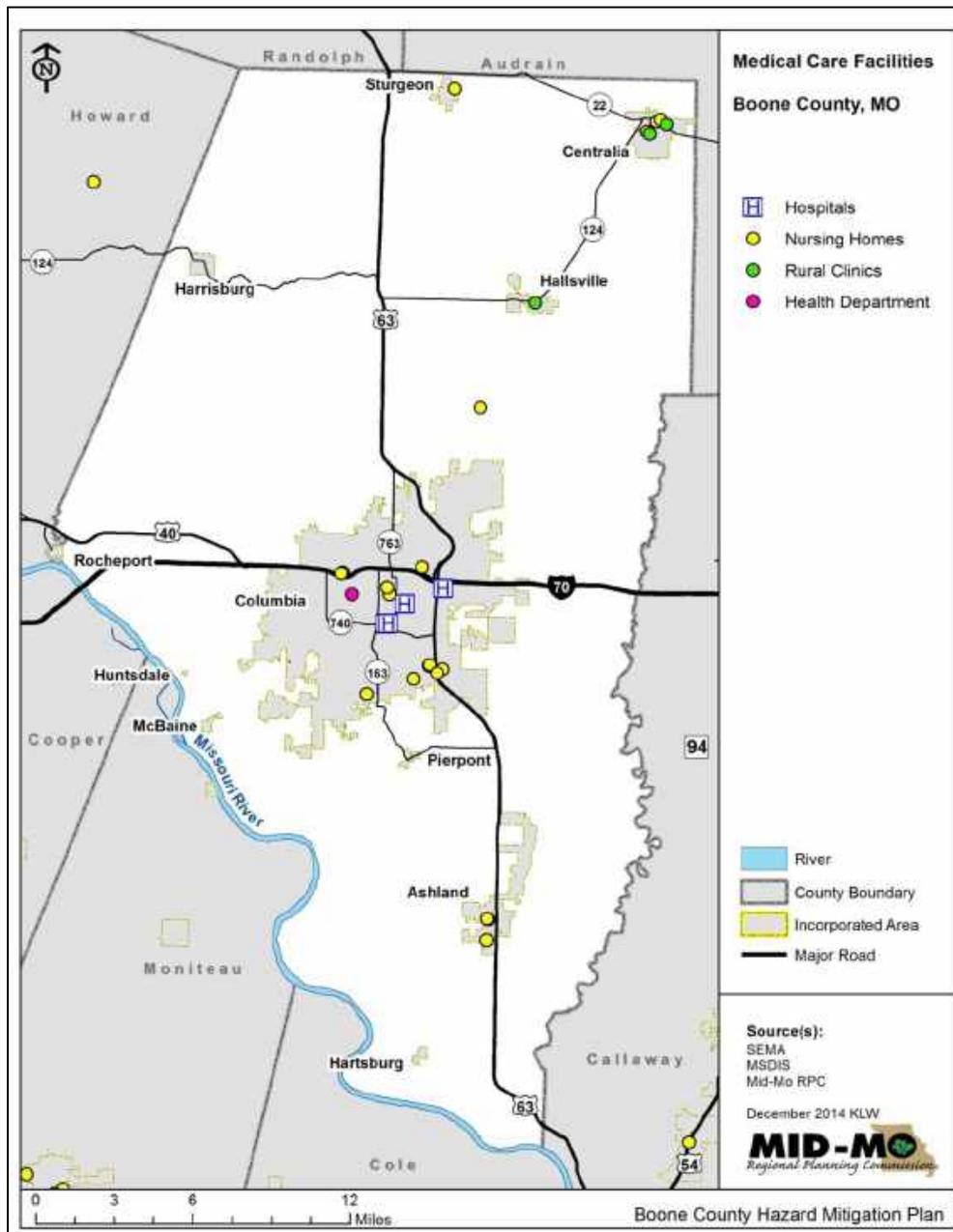


Table 3.3		
Critical Medical Facilities		
Type of Facility	Location	Beds
Level 1 Trauma Center		
University Hospital	Columbia	
Hospitals		
Boone Hospital Center	Columbia	397
Harry S. Truman Memorial Veterans Hospital	Columbia	na
Landmark Hospital of Columbia, LLC	Columbia	42
Rusk Rehabilitation Center (joint venture: HealthSouth & University of MO)	Columbia	60
University of Missouri Hospitals	Columbia	
University Hospital	Columbia	247
Missouri Psychiatric Center	Columbia	57
Women's and Children's Hospital	Columbia	na
Clinics and Health Centers		
Centralia Medical Clinic	Centralia	
Centralia Family Health Clinic	Centralia	
Family Health Center	Columbia	
J.W. "Blind" Boone Community Center	Columbia	
University of Missouri Clinics	Columbia	
Nursing Home Facilities		
Ashland Healthcare	Ashland	60
Ashland Villa-Assisted Living	Ashland	72
Bluegrass Terrace	Ashland	16
Bristol Manor of Centralia	Centralia	12
Heritage Hall Nursing Center	Centralia	60
Stuart House, The	Centralia	27
Bluff Creek Terrace-Assisted Living	Columbia	48
Bluffs, The	Columbia	132
Candlelight Lodge Retirement Center	Columbia	112
Columbia Healthcare Center	Columbia	97
Columbia Manor Care Center	Columbia	52
Daybreak Residential Treatment Center	Columbia	14
Harambee House	Columbia	15
Hillcrest Residential Care	Columbia	33
Lenoir Gardens	Columbia	30
Lenoir Health Care Center	Columbia	122
Lenoir Manor	Columbia	60
Parkside Manor	Columbia	120
South Hampton Place	Columbia	100
Tiger Place	Columbia	112
Sturgeon Rest Home	Sturgeon	20
Source: Missouri Department of Health and Senior Services Information Technology Services Division; hospital websites		

Office of Emergency Management

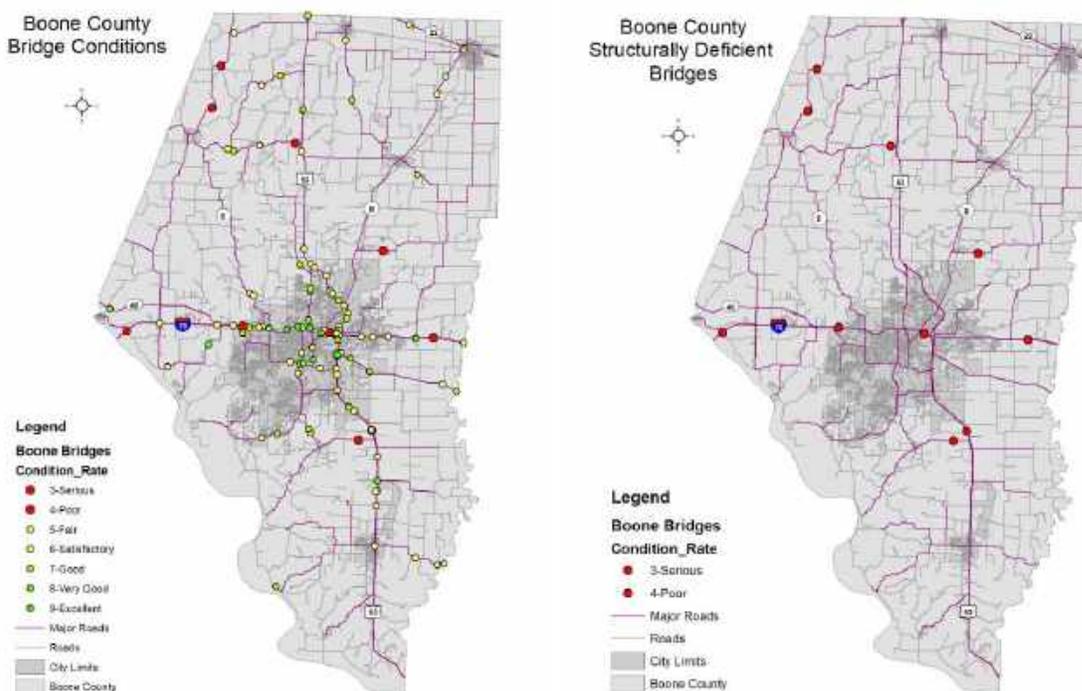
The Boone County Office of Emergency Management (OEM) is in charge of emergency management for the County and all its jurisdictions, with the exception of the Villages of McBaine and Pierpont (which are not participating jurisdictions in the Boone County Hazard Mitigation Plan).

Personnel of the OEM play a critical role in hazard mitigation due to their strong network of connections, awareness of hazard threats, wide-ranging experience of all facets of emergency management, and work with public education.

Transportation

Boone County is crossed by two major highway systems and has a regional airport. Easy accessibility to and from the population center of Columbia, and the proximity of the State Capital at Jefferson City in adjacent Cole County, results in a sizeable commuting population within, and to and from, the planning area.

Figure 3.5 Boone County Bridge Conditions



Bridges

Bridge conditions are described using a “scour index”. This index rates bridges on their vulnerability to scour during a flood and is based on a scale of 0 to 9. Zero are failed bridges. Bridge with a scour index of 9 are new bridges. An index rating of 1 to 3 are in critical condition.

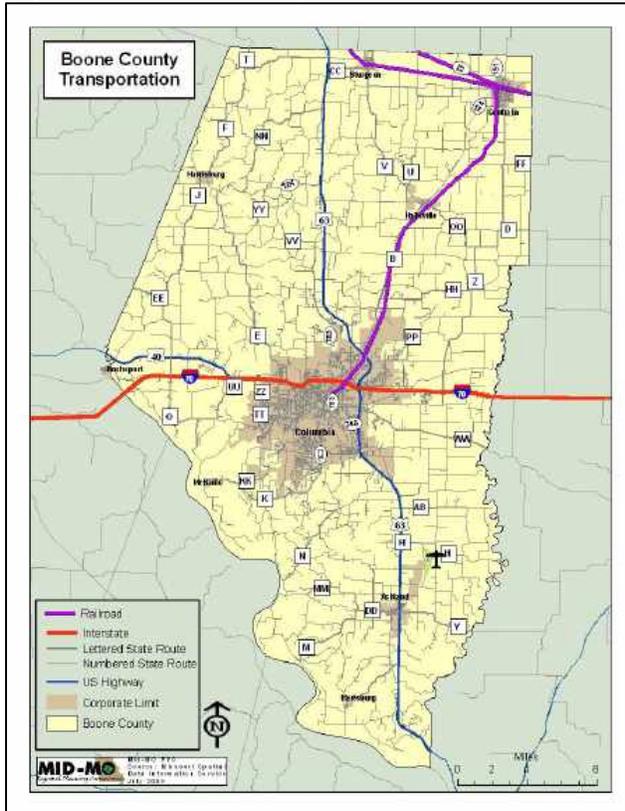
A rating of 4 is poor. Anything 5 and higher are fair to excellent. The only poor condition bridges that are located within a city jurisdiction are within the city limits of Columbia. In 2019 legislation passed the Governor’s Focus on Bridges program. Through this program 3 critical or poor condition bridges in Boone county are slated to be replaced between 2020-2023.

Roadways

Interstate 70 crosses the county from east to west. This system connects the metropolitan areas of St. Louis and Kansas City and is a major route of transport across the United States.

U.S. Highway 63, which runs north-south, intersects I-70 in Columbia. Highway 63 is also a major route for transporting goods and provides commuters access to work in both Columbia and Jefferson City to the south (Cole County). US Highway 63 also provides access to the Columbia Regional Airport.

Figure 3.6 Boone County Roads



Airports

Boone County has one airport, the Columbia Regional Airport, 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).

Railroads

There is no passenger rail service in the planning area; however, Amtrak passes through adjacent Cole and Moniteau Counties with a station located in Jefferson City.

The City of Columbia owns the Columbia Terminal Railroad (COLT), a freight railway between Columbia and the City of Centralia; the COLT passes through the City of Hallsville. The Department of Water & Light is in charge of operations.

The Norfolk Southern and Kansas City Southern pass through the northeastern part of Boone County and the City of Centralia (Figure 2.20).

Public Transportation

OATS, Inc., a private not-for-profit corporation, provides transportation on scheduled days within Boone County and the city of Columbia; it also provides connections to neighboring counties. OATS predominantly serves the elderly and disabled, but will serve anyone needing transportation. OATS operates in 87 counties in Missouri.

The City of Columbia operates Columbia Transit, a bus system which serves the city and the University of Missouri campus. Routing on the system was majorly overhauled in 2014 to better meet the needs of the community.

Total Exposure of Population and Structures

Unincorporated County and Incorporated Cities

The following tables provide population data based on the 2018 American Community Survey estimates which are calculated over a 5-year period. Building counts and building exposure values are based on data developed by the State of Missouri Geographic Information Systems (GIS) database. Contents exposure values were calculated by factoring a multiplier to the building exposure values based on usage type. The multipliers were derived from the Hazus and are defined below. Land values have been excluded from consideration due to the fact that land remains following disasters and any market devaluations are often short term and difficult to quantify. State and Federal assistance programs do not generally address loss of land outside that of crop insurance. The total valuation of buildings is based on county assessor’s data which may not be current and government-owned properties are usually taxed differently or not at all. This may cause some inaccuracies in the representation of true value. Public school district assets and special districts are included in the total exposure tables assets by community or county.

The following tables provide a look at population, building and content exposure by jurisdiction, as well as a look at exposure by usage type and building counts per each jurisdiction. The exposure and building information for each school district is also included

Table: 3.4 Maximum Population and Building Exposure by Jurisdiction

Jurisdiction	2018 Annual Population Estimate	Building Count	Building Exposure (\$)	Content Exposure (\$)	Total Exposure (\$)
Boone Unincorporated	45,155	18045	4603273	2663329	7266602
Ashland	3,893	1575	444767	261732	706499
Centralia	4,192	1765	523378	339639	863017
Columbia	118,620	36199	13112885	8816797	21929682
Hallsville	1,554	622	138379	79282	217661
Harrisburg	281	136	36868	24908	61776
Hartsburg	95	70	23554	15104	38658
Huntsdale	33	15	3574	1787	5361
Rocheport	247	145	35050	20929	55979
Sturgeon	833	400	81300	54427	135727

Grand Total	174903	58972	19003028	12277934	31280962
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Source: U.S. Bureau of the Census, Annual population estimates/ 5-Year American Community Survey 2017; Building Count and Building Exposure, Missouri GIS Database from SEMA Mitigation Management; Contents Exposure derived by applying multiplier to Building Exposure based on Hazus MH 2.1 standard contents multipliers per usage type as follows: Residential (50%), Commercial (100%), Industrial (150%), Agricultural (100%). For purposes of these calculations, government, school, and utility were calculated at the commercial contents rate.

Table: 3.5 Building Values/Exposure by Usage Type

Jurisdiction	Residential	Commercial	Industrial	Agriculture	Total
Boone Unincorporated	5911750	828499	234874	109142	7266602
Ashland	563448	80613	23784	1978	706499
Centralia	573973	118189	37477	5970	863017
Columbia	14387341	5071712	685403	65130	21929682
Hallsville	179300	17834	4503	908	217661
Harrisburg	35902	9500	166	1266	61776
Hartsburg	25348	3946	758	54	38658
Huntsdale	5361	0	0	0	5361
Rocheport	43696	8563	1824	0	55979
Sturgeon	82131	14529	2249	0	135727
Grant Total	21808250	6153385	991038	184448	31339934

Source: Missouri GIS Database, SEMA Mitigation Management Section

Table: 3.6 Building Counts by Usage Type

Jurisdiction	Residential	Commercial	Industrial	Agriculture	Total
Boone Unincorporated	16756	731	271	174	18045
Ashland	1466	69	16	3	1575
Centralia	1589	108	29	9	1765
Columbia	32954	2273	426	82	36199
Hallsville	573	28	9	2	622
Harrisburg	118	9	0	3	136
Hartsburg	60	4	1	0	70
Huntsdale	15	0	0	0	15
Rocheport	126	12	5	0	145
Sturgeon	367	21	4	0	400
Grant Total	54024	3255	761	273	58972

Source: Missouri GIS Database, SEMA Mitigation Management Section

While schools' total assets are included in the tables above, additional information gathered through the data questionnaires and school websites allow for further discussion. The table below shows enrollment and building information, including counts and replacement cost (exposure).

Table: 3.7 School District Building and Enrollment Summary

Public School District	Enrollment	Building Count	Building Exposure (\$)	Content Exposure (\$)	Total Exposure (\$)
Centralia R-VI	1,372	17	N/A	N/A	43,395,372
Columbia Public	18,555	38	N/A	N/A	N/A
Hallsville R-IV	1,426	5	N/A	N/A	N/A
Harrisburg R-VIII	614	15	N/A	N/A	22,129,873
Southern Boone R-I	1,742	5	N/A	N/A	51,000,000
Sturgeon R-V	433	3	N/A	N/A	15,895,192

Source: Missouri GIS Database, SEMA Mitigation Management Section. <http://mcids.dese.mo.gov/quickfacts/Pages/District-and-School-Information.aspx>

Table 3.8: Jurisdictional Assets Summary

Jurisdiction	Airport Facility	Bus Facility	Childcare Facility	Communications Tower	Electric Power Facility	Emergency Operations	Fire Service	Government	Housing	Shelters	Highway Bridge	Hospital/Health Care	Military	Natural Gas Facility	Nursing Homes	Police Station	Potable Water Facility	Rail	Sanitary Pump Stations	School Facilities	Stormwater Pump Stations	Tier II Chemical Facility	Wastewater Facility	TOTAL
Unincorporated Boone	0	0	0		0	1	20	3	16756	0		1	0	0	0	1	4	0		0		0	14	C
Ashland	0	0	5		0	0	0	2	1466	4		1	0	0	3	1	1	0	2	5		0	1	
Centralia	0	0	1		0	0	1	2	1589	7		2	0	0	3	1	1	3		17		0	1	
Columbia	1	1	71		1	1	9	2	32954	22		12	1	0	14	1	1	1		38		1	1	
Hallsville	0	0	3		0	0	0	2	573	8		0	0	0	0	1	1	1		5		0	1	
Harrisburg	0	0	1		0	0	0	1	118	0		0	0	0	0	0	1	0		15		0	0	
Hartsburg	0	0	0		0	0	0	1	60	2		0	0	0	0	0	0	0		0		0	1	
Huntsdale	0	0	0		0	0	0	0	15	0		0	0	0	0	0	0	0		0		0	0	
Rocheport	0	0	0		0	0	0	1	126	0		0	0	0	0	0	0	0		0		0	0	
Sturgeon	0	0	1		0	0	0	2	367	2		0	0	0	1	1	1	1		3		0	1	
Totals	1	1	82		1	2	30	16	54024	45		16	1	0	21	6	10	6		83		1	20	

Source: Data Questionnaire

Other Assets

Public Land

Boone County has several state-owned land areas and one National Forest (see Figure 3.17). 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.

The Katy Trail is the longest developed rail-trail in the country and portions of it runs through Boone County and some of its jurisdictions. Many sections of the Katy Trail were damaged and closed in 2019 due to flooding. Sections of the trail are still being worked on to remove flooding debris and repair the trail bed. Caution should be taken for rough surfaces and trail work.

Public Land in Boone County		
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
Katy Trail State Park	Missouri Department of Natural Resources	~30 miles

Source: Missouri Spatial Data Information Server (MSDIS)

Boone County Properties on the National Register of Historic Places

Boone county has several properties listed on the National Register of Historic Places and multiple jurisdictions have ordinances that address historic places. This registry is an official list of registered cultural resources that are worth preserving. The National Historic Preservation Act of 1966 authorized such a list as part of a national program. The program is administered by the National Parks Service and acts as a resource to coordinate public and private efforts to find, evaluate, and preserve historically and archeologically significant sites. Properties on the list include districts, buildings, structures, and sites that have significance through history, culture, architecture, archeology, and engineering. Table 3.10 is a list of historic sites located in Boone County.

Table 3.10: Boone County Historic Sites

Property	Address	City	Date Listed
Ballenger Building	27-29 S. 9 th St	Columbia	1/21/04
Bond's Chapel	MO Route A	Hartsburg	9/9/93
John Boone "Blind" House	4 th St	Columbia	9.4/80
Central Dairy Building	1104-1106 E. Broadway	Columbia	1/20/05
Albert Chance House	319 E Sneed St.	Centralia	7/3/79
Chatol	543 S. Jefferson	Centralia	4/20/79
Coca-Cola Bottling Co. Building	10 Hitt St.	Columbia	2/14/06
Columbia Cemetery	30 E. Broadway	Columbia	2/1/07
Columbia Nat. Guard Armory	701 E. Ash St.	Columbia	3/25/93
Sanford Conley House	602 Sanford Pl.	Columbia	12/18/73
Fred Douglas School	310 N. Providence Rd	Columbia	9/4/80
Downtown Columbia Historic District	7 th , 8 th , 9 th , 10 th , Broadway, etc.	Columbia	11/8/06
East Campus Neighborhood	College, University, High St.	Columbia	2/16/96
8 th Broadway	800-810 E. Broadway	Columbia	4/22/03
Samuel Elkins House	315 N. 10 th St.	Columbia	9/12/96
First Christian Church	101 N. 10 th St.	Columbia	10/29/91
Francis Quadrangle District	Red Campus	Columbia	12/18/73
Frederick Apartments	1001 University Ave.	Columbia	4/16/13
David Gordon/Collins Cabin	2100 E. Broadway	Columbia	8/29/83
Greenwood	3005 Mexico Gravel Rd.	Columbia	1/15/79
David Guitar House	2815 Oakland Gravel Rd.	Columbia	9/9/93
Samuel Hackman Building	30 S. St.	Hartsburg	12/10/98
Hamilton-Brown Shoe factory	1123 Wilkes Blvd	Columbia	7/19/02
Harrisburg School	140 S. Harris St.	Harrisburg	12/24/13
William Hunt House	8939 W. Terrapin Hills Rd.	Columbia	1/9/97
Kress Building	1025 E. Broadway	Columbia	3/9/05
Maplewood	Nifong Blvd/Ponderosa Dr	Columbia	4/13/79
McClain Furniture Store	916 E. Walnut	Columbia	8/17/05
MO, KS, TX Railroad Depot	402 E. Broadway	Columbia	1/29/79
MO Teachers Association	407 S. 6 th St.	Columbia	9/4/80
Missouri Theater	201-215 S. 9 th St.	Columbia	6/6/79
MO United Methodist Church	204 S. 9 th St.	Columbia	9/4/80
Mount Zion Church/Cemetery	11070 Mount Zion Rd.	Hallsville	1/14/13
N. 9 th Street Historic District	5-36 N. 9 th St.	Columbia	1/21/04
Moses Payne House	201 N. Roby Farm Rd.	Rocheport	10/7/94
Pierce Pennant Motor Hotel	1406 Old Hwy 40	Columbia	9/2/82
Rocheport Historic District	MO 240	Rocheport	10/8/76
St. Paul's AME Church	501 Park St.	Columbia	9/4/80
Sanborn Field & Soil Erosion Plots	University of Missouri Campus	Columbia	10/15/66
Second Baptist Church	407 E. Broadway	Columbia	9/4/80
Second Christian Church	401 N. 5 th St.	Columbia	9/4/80
Senior Hall	Stephens College Campus	Columbia	8/2/77
Sigma Alpha Epsilon Building	24 E. Stewart Rd.	Columbia	10/20/14
Stephens college, South Campus	1200 E. Broadway	Columbia	11/25/05
John Taylor House	716 W. Broadway	Columbia	5/25/01
Tiger Hotel	23 S. 8 th St.	Columbia	2/29/80

Virginia Building	111 S. 9 th St.	Columbia	3/13/02
Wabash Railroad Station/Freight House	126 N. 10 th St.	Columbia	10/11/79
West Broadway Historic District	300-922 W. Broadway	Columbia	4/27/10
Wright Brothers Mule Barn	1101-1107 Hinkson/501-507 Fay	Columbia	11/1/07

Source: Missouri Department of Natural Resources – MO National Register Listings by County.

<https://dnr.mo.gov/shpo/boone.htm>

The major, non-retail employers with more than 200 personnel employed are shown in Table 3.11

Table 3.11			
Major Employers in Boone County			
Employer	Employees	Employer	Employees
University of Missouri	5000 & up	State of Missouri (excludes MU)	500-749
University Hospitals & Clinics	2500-4999	ABC Laboratories, Inc.	250-499
Columbia Public Schools	1500-2499	U.S. Postal Service	250-499
Veterans United Home Loans	1500-2499	Missouri Employers Mutual Insurance	250-499
City of Columbia	1000-1499	Columbia Insurance Group	250-499
Harry S. Truman VA Hospital	1000-1499	3M	250-499
Shelter Insurance Companies	1000-1499	Boone County Government	250-499
Joe Machens Dealerships	750-999	Midway USA	250-499
MBS Textbook Exchange	750-999	Central Bank of Boone County	250-499
State Farm Insurance Companies	500-749	Woodhaven	250-499
Columbia College	500-749	MFA, Inc.	200-249
Hubbell Power Systems	500-749	Pepsico/Quaker Oats	200-249
IBM	750-999	Schneider Electric: Square D	200-249
Kraft Foods	500-749		
www.columbiaredi.com			

While agriculture plays a large roll in Boone County’s land use, the 222 farms listed in Boone County according to the 2017 USDA Ag Census only employ around 651 workers. The majority of the farms only have a couple workers each. The number of workers is down compared to the 2012 Ag Census when 669 workers were listed in Boone County.

Land Use and Development

Boone county and its jurisdictions have shown growth since the last census, with the most growth estimated to be in and around the City of Columbia. Amenities such as high-speed internet, municipal water and sewer, and job opportunities can drive such growth.

Table 3.12 County population Growth 2010-2018

Jurisdiction	2010 Total Population	2018 Total Population Estimate	# Change (2010-2018)	% Change (2010-2018)
Unincorporated	43,377	45,467	2,090	4.7%
Ashland	3,707	3,947	240	6.2%
Centralia	4,027	4,244	217	5.2%
Columbia	108,500	123,180	14,680	12.6%
Hallsville	1,491	1,564	73	4.7%
Harrisburg	266	281	15	5.4%
Hartsburg	108	108	0	0%
Huntsdale	31	33	2	6.2%
Rocheport	239	251	12	4.8%
Sturgeon	872	930	58	6.4%
Total	162,699	180,005	17,306	10%

Source: U.S. Bureau of the Census, Decennial Census, annual population estimates/ 5-Year American Community Survey 2018; *population includes the portions of these cities in adjacent counties

Growth translates into a need for more housing, and the expansion of local emergency capabilities to keep up with demand and added fuel to the system. While American Community Survey estimates a growth in population mostly across the board for Boone County and its jurisdictions it also estimates a decline for some jurisdictions in housing units. This could be due to more families choosing to live with multiple generations in a home or some homes being designated as businesses as the trend toward home businesses is on the rise.

Table 3.13 Change in Housing Units, 2010-2018

Jurisdiction	Housing Units 2010	Housing Units 2018	2010-2018 # Change	2000-2018 % Change
Unincorporated	17,956	19,031	1,075	5.9
Ashland	1,536	1,528	-8	-0.5
Centralia	1,723	1,955	232	13.4
Columbia	45,971	52,257	6,286	13.6
Hallsville	707	664	-43	-6
Harrisburg	130	138	8	23.7
Hartsburg	59	73	14	23.7
Huntsdale	13	6	-7	-53.8
Rocheport	83	153	70	84.3
Sturgeon	418	380	-38	-9
Total	68,596	76,185	7,589	11

Source: U.S. Bureau of the Census, Decennial Census, American Community Survey 5-year Estimates; Population Statistics are for entire incorporated areas as reported by the U.S. Census Bureau

Future Land Use and Development

Population growth is expected to continue in Boone County and its jurisdictions. Due to the transportation network that passes through Boone County it continues to be a major shipping corridor which is a draw for companies looking for a place to hub distribution centers which can employ several people. As has already been seen more and more farm land is being developed into housing and businesses throughout the county. With growth comes the need to expand protections such as fire services, storm warning devices, and runoff handling practices.

School District's Future Development

Columbia Public Schools and Southern Boone School District have experienced steady growth that has forced the need to build additional school buildings to help mitigate overcrowding in classrooms. As new buildings are built and old ones are remodeled it's a trend across all districts to employ hardening methods to construction to add resiliency against major storms and potential intruders.

Hazard Profiles, Vulnerability, and Problem Statements

A Risk Assessment has been conducted for each hazard identified as affecting the planning area. The remainder of this section includes these risk assessments which are discussed in alphabetical order and organized according to the following outline:

DESCRIPTION OF HAZARD

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.

Location

Extent - The extent of the hazard refers to the strength or magnitude of that hazard which can be expected in the planning area; extent is an attribute of the hazard alone and does not include its effect on humans or the built environment.

Previous Occurrences

Probability of Future Events (Natural Hazards) - The probability of future events is, for the most part, based on historical data while also taking into account the expected impact of climate change. It is assigned based on the following scale which was slightly modified from that found in the *Missouri State Hazard Mitigation Plan (2018)*:

- 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).

In the case of earthquakes, projections made by the USGS have also been taken into account in assessing the probability.

Probability of Future Events (Technological/Human-made Hazards) – There is a lack of historical data for most of the technological/human-made hazards profiled; in addition, some of them are evolving on a monthly basis as political and cultural events play a large role in some of the hazards.

For at least one technological/human-made hazard for which historical is available (hazardous materials release), the probability calculated using the same scale as used for natural hazards was considered ridiculous by those working closely with this hazard. (The calculated probability would have been high.) Representatives of the LEPC indicated that seeing a “high” probability associated with this hazard would make them question the validity of the entire hazard mitigation plan.

So, for these reasons, the probability of technological/human-made hazards was evaluated and assessed by those working most closely with these hazards in some emergency management or preparedness capacity.

IDENTIFICATION OF COMMUNITY ASSETS potentially affected by or helping to mitigate the effects of the hazard in each participating jurisdiction; this is covered in Section 2 of the plan.

ANALYSIS OF RISK presented by the hazard, including a **measure of severity** for each participating jurisdiction. The **measure of severity** is an estimate of the deaths, injuries, or damage (property or environmental) that could result from the hazard. It is also broadly based on the scale found in the Missouri State Hazard Mitigation Plan (2018):

Low – Few or minor damage or injuries are likely.

Moderate – Personal injuries and/or damage to property or the environment are expected.

High – Major injuries and/or death and/or major damage will likely occur.

VULNERABILITY ASSESSMENTS

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

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

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

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

A jurisdiction’s vulnerability to a hazard is connected to the extent of that hazard, the probability of future events, the estimated measure of severity, and mitigation measures already in place for that hazard.

In many cases, the potential severity of the hazard event contributes the greatest weight to the vulnerability rating. In some cases, however, a low severity event with high frequency can cause economic strain which translates into a higher vulnerability.

Existing Mitigation/Operating Assumptions: Both the measure of severity and overall vulnerability are greatly impacted by the mitigation already in place in the planning area; this existing mitigation is taken as an operating assumption when evaluating the vulnerability to a particular hazard. The following mitigation activities 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.

Other current mitigation activities are aimed at mitigating the effects of a specific hazard and are described under the specific hazard profile.

FLOODING (RIVERINE AND FLASH)

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 potential concern for the county. There are also numerous creeks throughout the county with year-round water flows draining into the Missouri River.

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 addition to the threat of **riverine flooding**, when a river or creek overflows its normal boundaries, the planning area is also susceptible to **flash flooding**. NOAA defines a flash flood as “an event that occurs within 6 hours following the end of the causative event (such as rains, ice jams, or dam breaks). . . .” Flash floods develop quickly and are responsible for more flood related deaths than any other type of flooding. The textual descriptions for flash flooding events in the NOAA database indicate that flash flooding in the planning area is usually triggered by 2-5 inches of rainfall within a “short period”.

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.

FEMA defines sheet flooding as “a type of flood hazard with flooding depths of 1 to 3 feet that occurs in areas of sloping land.”

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.

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. In addition, there are numerous creeks or branches throughout the planning area subject to small stream flooding. The City of Columbia can experience flooding from the backup of tributary branch of the Missouri River when river levels are high.

Varying levels of flood risk are designated by flood zones mapped on Flood Insurance Rate Maps (FIRMs).

The current FIRMs for Boone County have an effective date of 04/19/17. Overview maps showing the floodplains for the entire planning area (Figure 3.7) and for the City of Columbia (Figure 3.8) included in the following pages. For the smaller jurisdictions with significant flooding risk, the National Flood Hazard Layers from the online system are included (Figures 3.9-3.12).

Figure 3.7: Boone County Floodplain

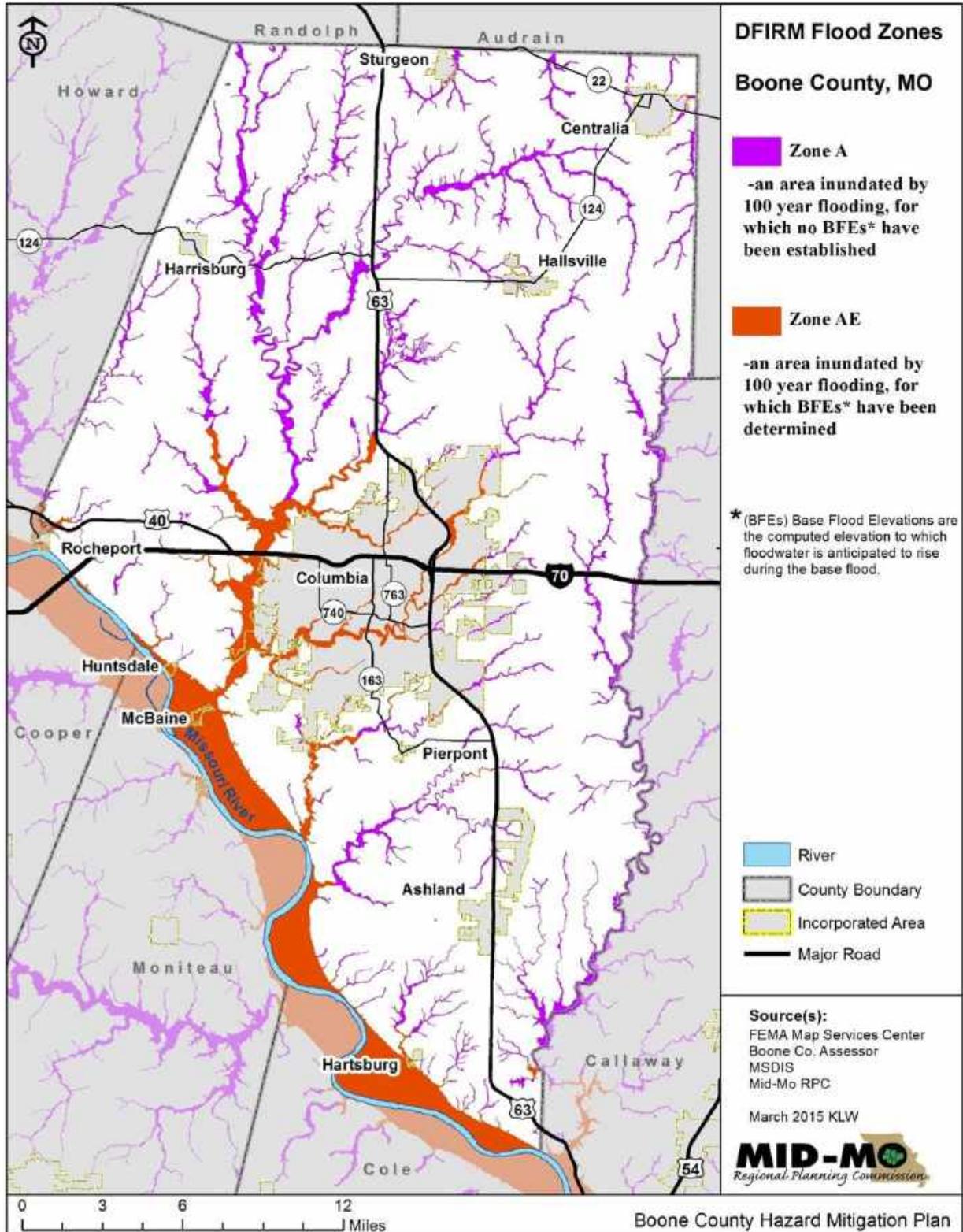


Figure 3.8: Columbia Floodplain

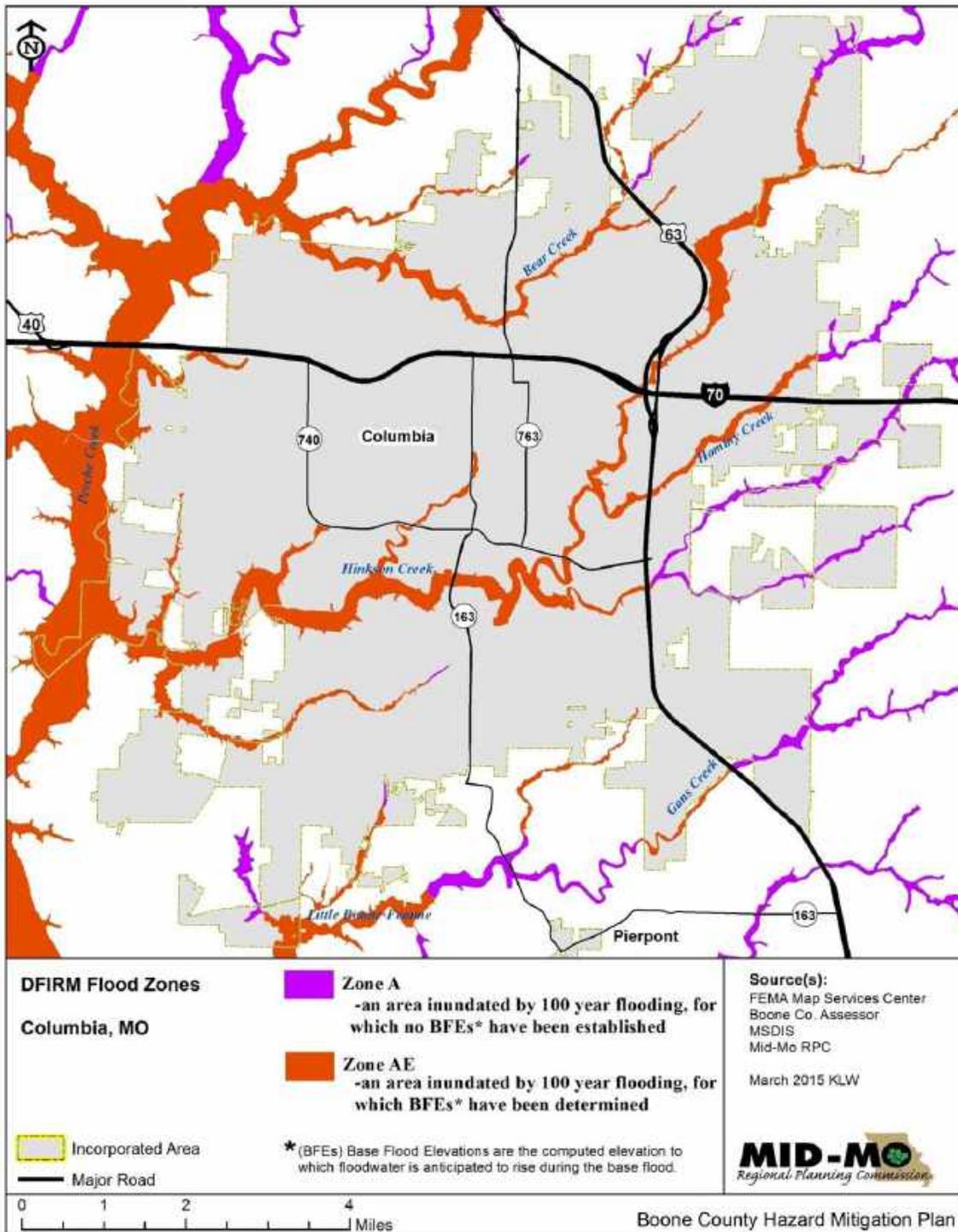


Figure 3.9: Hartsburg

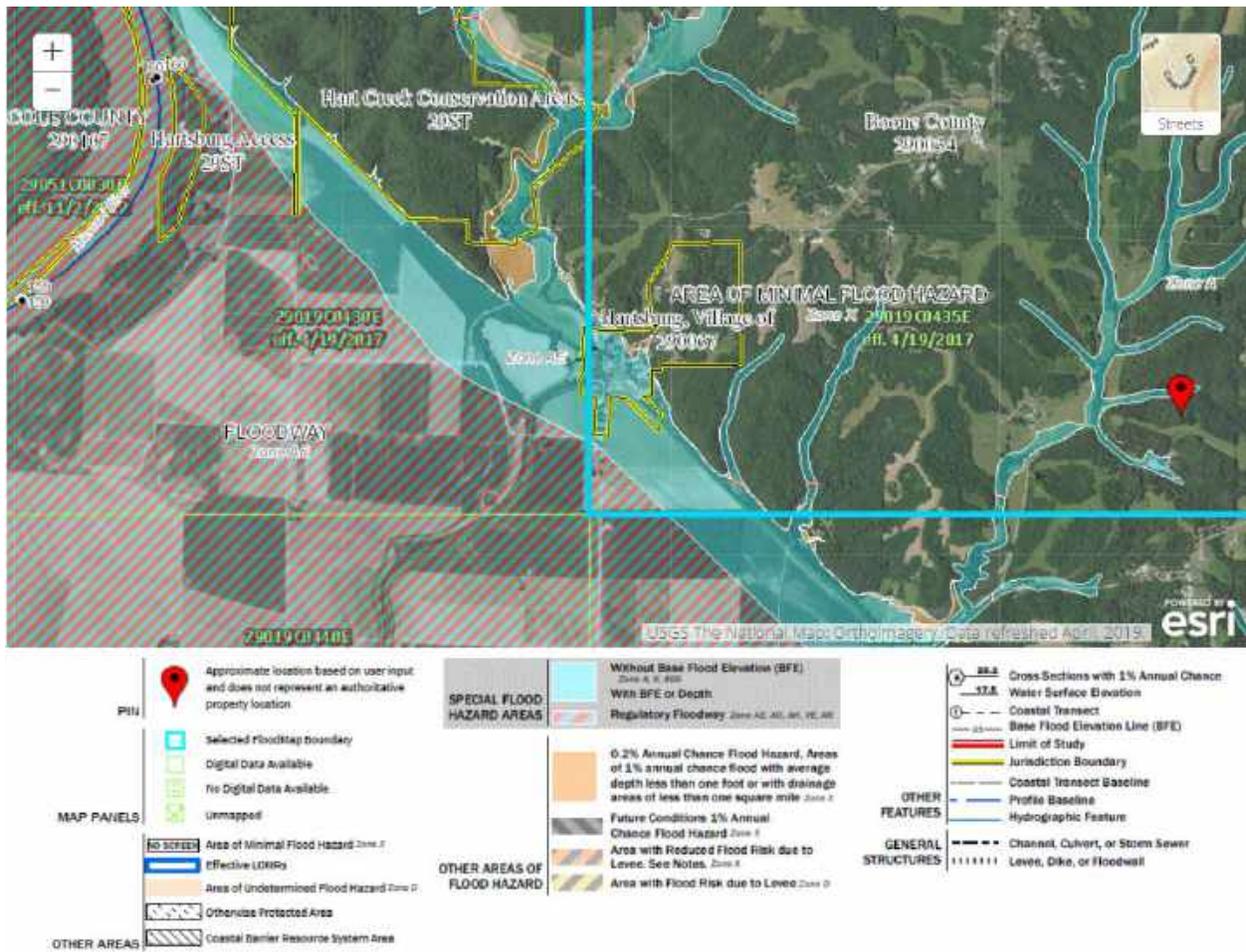


Figure 3.10: Huntsdale

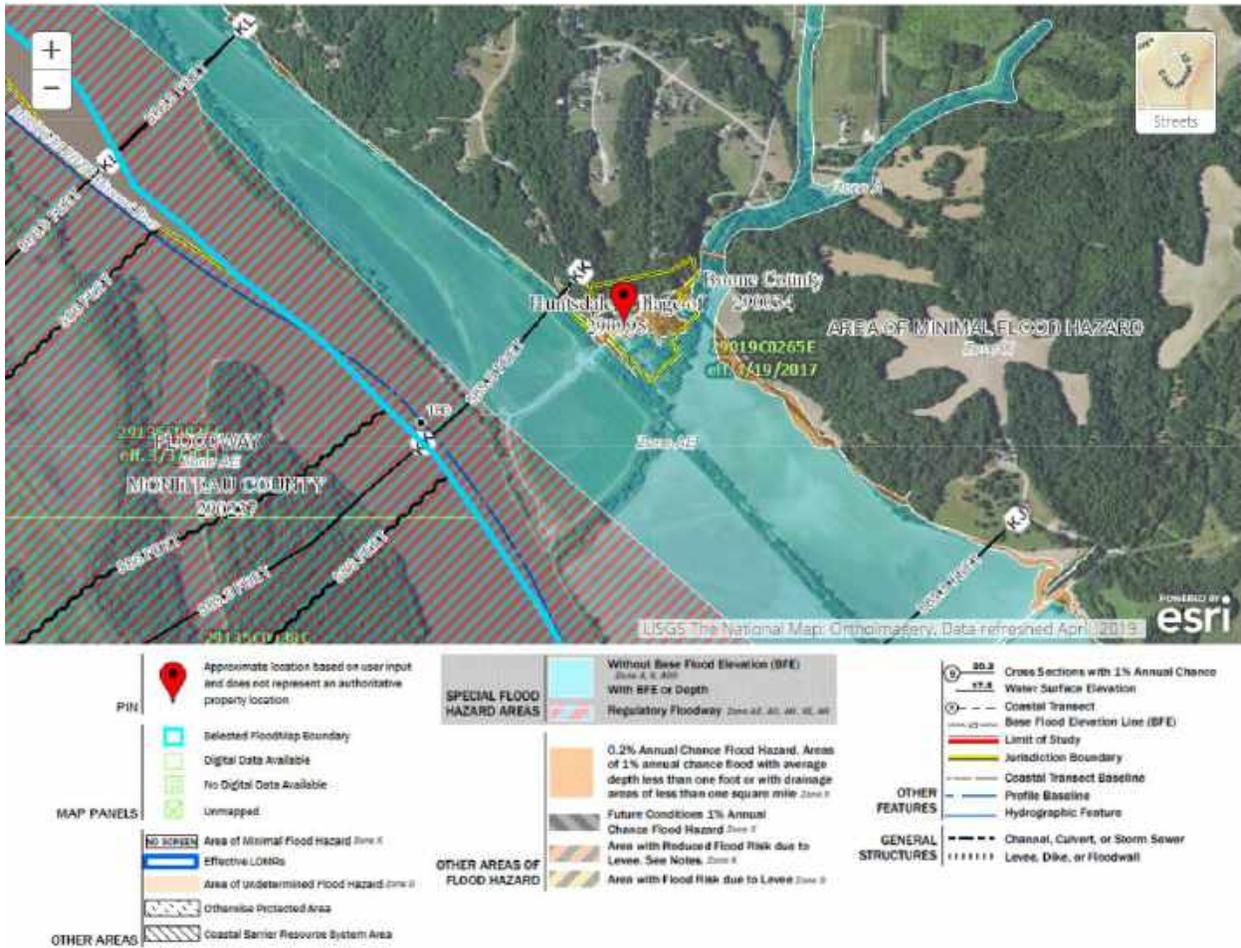


Figure 3.11: McBane

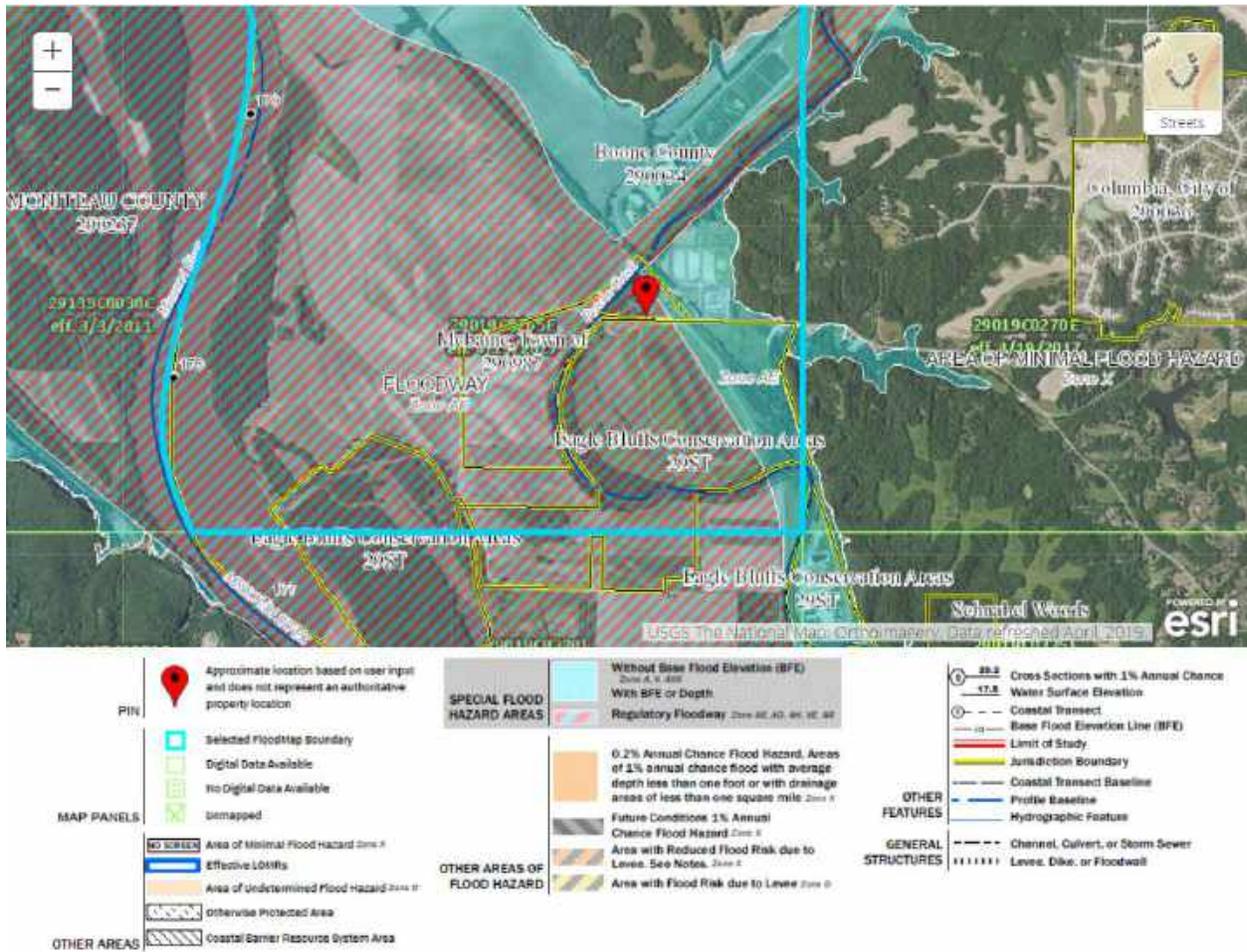
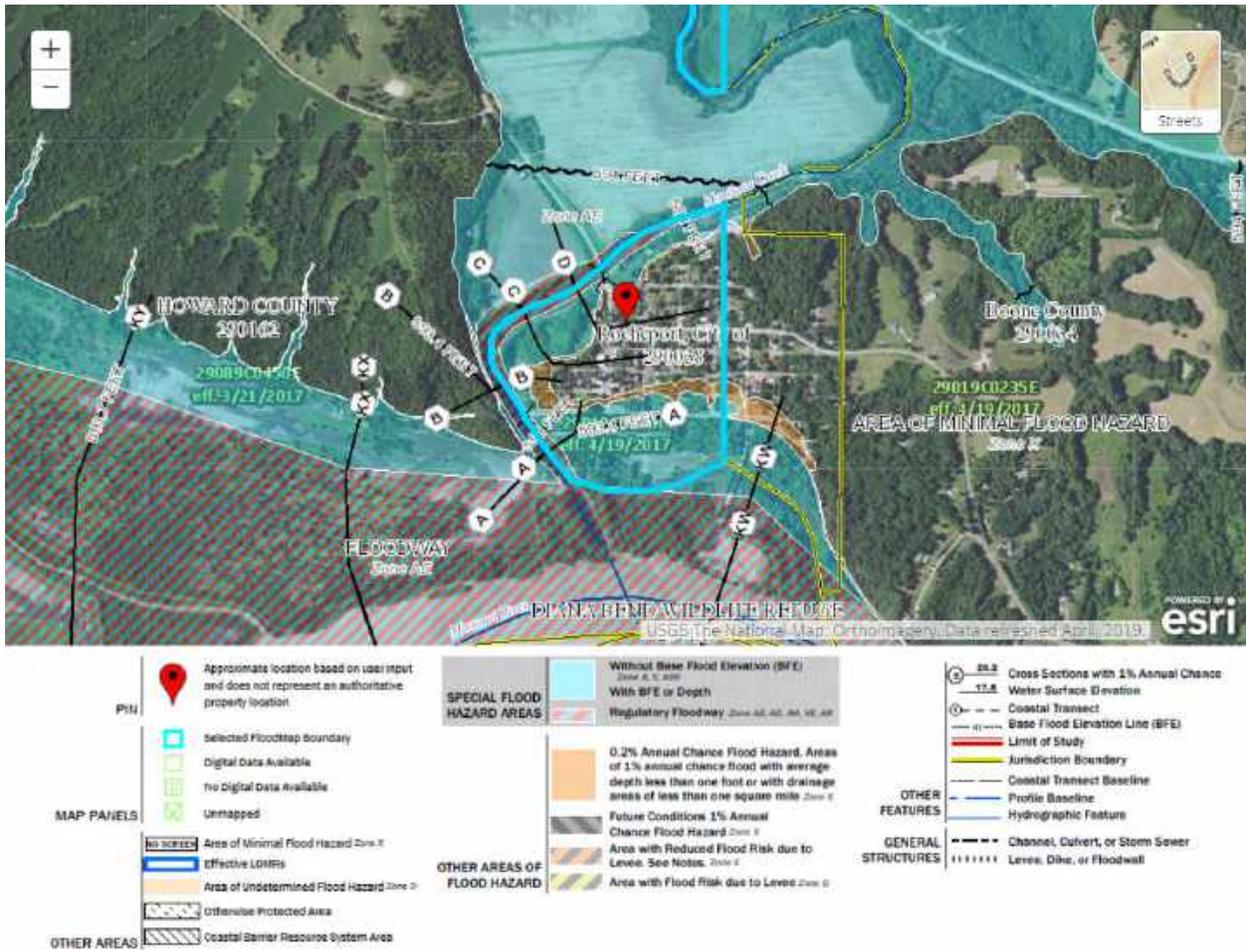


Figure 3.12: Rocheport



Road closures due to high water or flash flooding are common throughout the planning area. The map below indicates areas that are common to close due to flooding and flash floods.

Figure 3.13

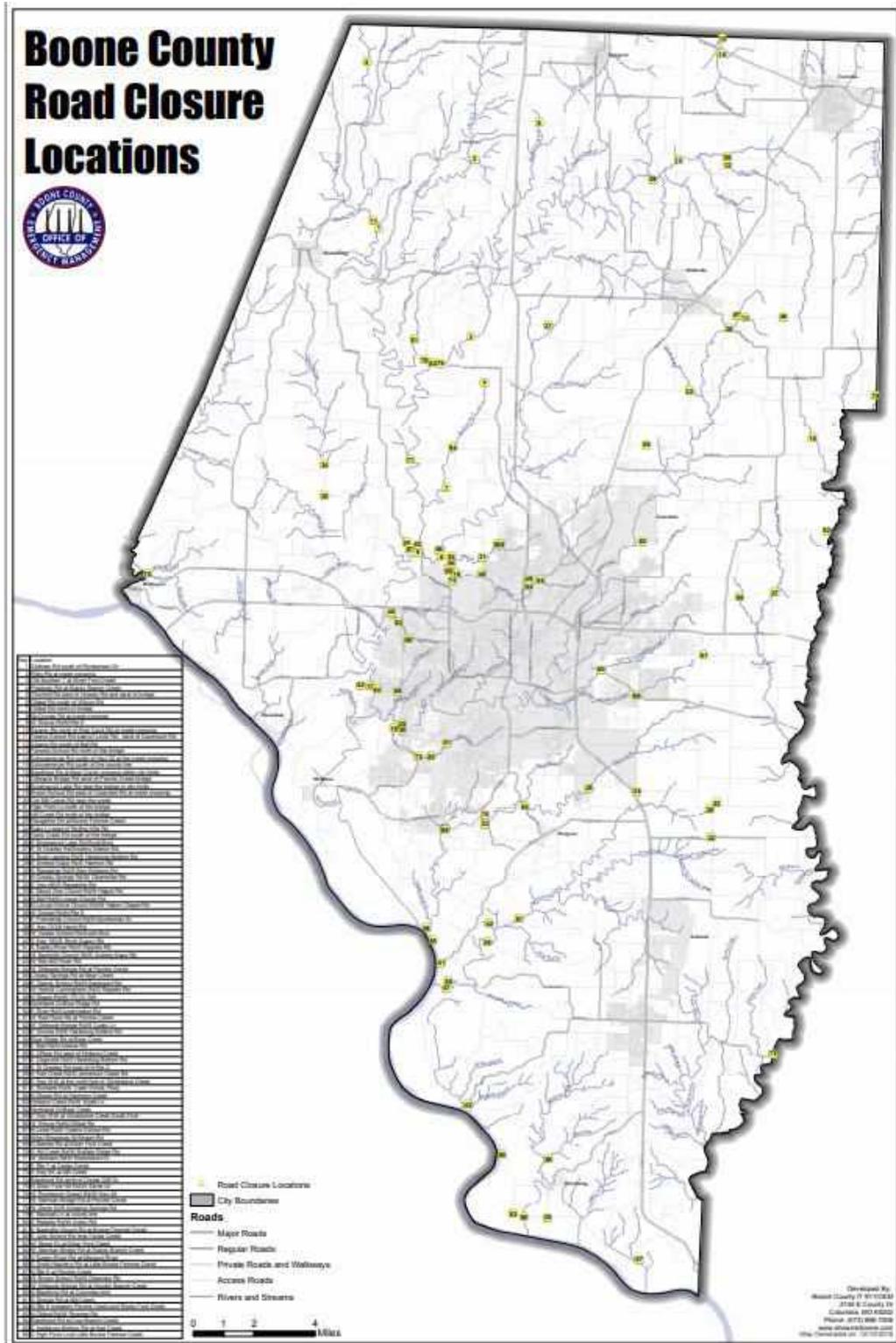


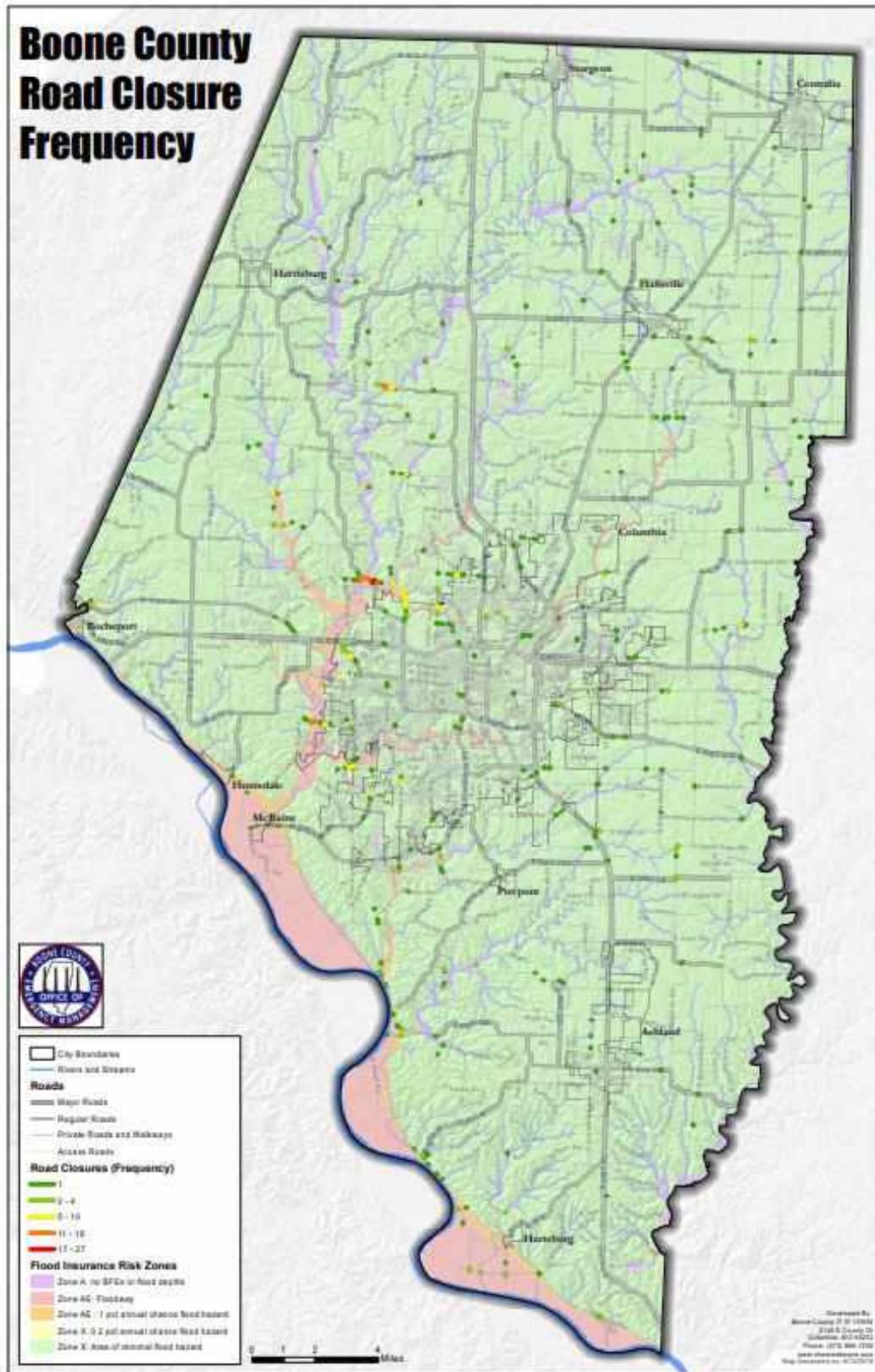
Table 3.14: Road Closure Locations

Key	Location
1	Stidham Rd south of Richardson Dr
2	Riley Rd at creek crossing
3	Old Number 7 at Silver Fork Creek
4	Peabody Rd at Slacks Branch Creek
5	Thornhill Rd east of Hussey Rd and west of bridge
6	ONeal Rd south of Wilcox Rd
7	ONeal Rd north of bridge
8	McComas Rd at creek crossing
9	W Wilcox Rd/N Rte E
10	Reams Rd north of Rob cook Rd at creek crossing
11	Owens School Rd east of Level Rd, west of Davenport Rd
12	Adams Rd south of Ball Rd
13	Farwest School Rd north of the bridge
14	Schunemeyer Rd south of Hwy 22 at the creek crossing
15	Schunemeyer Rd south of the county line
16	Blackfoot Rd at Bear Creek crossing within city limits
17	Gillespie Bridge Rd west of Perche Creek bridge
18	Brushwood Lake Rd near the bridge in city limits
19	Brown School Rd east of Clearview Rd at creek crossing
20	Old Mill Creek Rd near the creek
21	High Point Ln north of the bridge
22	Hill Creek Rd north of the bridge
23	Rangeline Rd at Bonne Femme Creek
24	Bass Ln east of Rolling Hills Rd
25	Gans Creek Rd south of the bridge
26	S Brushwood Lake Rd/Scott Blvd
27	E St Charles Rd/Doziers Station Rd
28	S Bush Landing Rd/E Hartsburg Bottom Rd
29	S Andrew Sapp Rd/S Harmon Rd
30	S Rangeline Rd/S Ben Williams Rd
31	N Creasy Springs Rd/W Obermiller Rd
32	E Hwy AB/S Rangeline Rd
33	E Mount Zion Church Rd/N Hague Rd
34	N Bell Rd/N Locust Church Rd
35	N Locust Grove Church Rd/W Hatton Chapel Rd
36	W Driskel Rd/N Rte E
37	E Friendship church Rd/N Sportsman Dr
38	E Hwy OO/N Hecht Rd
39	W Vawter School Rd/Scott Blvd
40	S Hwy 163/S Rock Quarry Rd
41	S Easley River Rd/S Rippeto Rd
42	W Nashville Church Rd/S Andrew Sapp Rd
43	W Rte M/S River Rd

44	W Gillespie Bridge Rd at Perche Creek
45	Creasy Springs Rd at Bear Creek
46	E Owens School Rd/N Davenport Rd
47	W Harold Cunningham Rd/S Rippetto Rd
48	N Strawn Rd/W 170 Dr SW
49	Northland Dr/Blue Ridge Rd
50	S River Rd/Conservation Rd
51	W Red Rock Rd at Perche Creek
52	W Gillespie Bridge Rd/S Coats Ln
53	E Grimes Rd/E Hartsburg Bottom Rd
54	Blue Ridge Rd at Bear Creek
55	E Ball Rd/N Adams Rd
56	E ORear Rd west of Hinkson Creek
57	E Claysville Rd/S Hartsburg Bottom Rd
58	E St Charles Rd east of N Rte Z
59	S Hart Creek Rd/S Jemerson Creek Rd
60	E Hwy WW at the north fork of Grindstone Creek
61	E Richland Rd/N Trade Winds Pkwy
62	N Strawn Rd at Harmony Creek
63	Hinkson Creek Rd/N Wyatt Ln
64	Northland Dr/Bear Creek
65	E Hwy WW at Grindstone Creek South Fork
66	W Wilcox Rd/N ONeal Rd
67	N Level Rd/E Owens School Rd
68	West Broadway St/Strawn Rd
69	N Barnes Rd at Silver Fork Creek
70	S Hill Creek Rd/W Buffalo Ridge Rd
71	W Stidham Rd/N Richardson Dr
72	E Rte Y at Cedar Creek
73	S Hwy KK at Mill Creek
74	Blackfoot Rd north of Cedar Cliff Dr
75	N Silver Fork Hill Rd/W Stone Dr
76	W Rocheport Gravel Rd/W Hwy 40
77	W Akeman Bridge Rd at Perche Creek
78	W Stone Dr/N Dripping Springs Rd
79	E Marshall Ln at county line
80	S Rippetto Rd/W Acton Rd
81	E Nashville Church Rd at Bonne Femme Creek
82	E Judy School Rd near Cedar Creek
83	W Stone Dr at Silver Fork Creek
84	W Akeman Bridge Rd at Slacks Branch Creek
85	S Easley River Rd at Missouri River
86	S Smith Hatcher Rd at Little Bonne Femme Creek
87	N Rte E at Perche Creek
88	W Brown School Rd/N Clearview Rd

89	W Gillespie Bridge Rd at Goodin Branch Creek
90	N Blackfoot Rd at Columbia limit
91	S Sinclair Rd at Mill Creek
92	N Re E between Perche Creek and Rocky Fork Creek
93	N ONeal Rd/W Roemer Rd
94	Blackfoot Td at Cow Branch Creek
95	E Hartsburg Bottom Rd at Hart Creek
96	S High Point Ln at Little Bonne Femme Creek

Figure 3.14: Road Closure Frequency



There are characteristic differences between riverine flooding and small stream/flash flooding in the planning area; these differences involve both the speed of onset and duration of flooding events.

Riverine flooding –

- Speed on Onset - Riverine flooding is a hazard which allows for mitigation, preparation, and potential evacuation because of the relatively long speed of onset.
- Duration - An examination of the NOAA data for riverine flooding 1996-2019 indicates an average duration of Missouri River flooding of over 13 days per event (Table 3.15).

Small Stream and Flash Flooding –

- Speed on Onset - In contrast to riverine flooding, small stream flooding and flash flooding occur very quickly with heavy rains.
- Duration - Small stream flooding in the planning area usually takes place within the span of one day, according to the NOAA data (Table 3.15). Information from Boone County Public Works indicates that many flash flooding events which cause road closures are confined to a few hours, although the water takes longer to recede in some locations.

Table 3.15		
Boone County Historic Data		
River and Small Stream Flood		
January 1 1996 - December 31, 2019		
Location	Date	Type of Flood
Southern Boone	1996: 5/1/96	Missouri River
Southern Boone	1998: 10/6/1998	Missouri River
Southern Boone	2001: 6/4/01	Missouri River
Southern Boone	2002: 5/8/02	Missouri River
Southern Boone	2007: 5/8/2007	Missouri River
Southern Boone	2010: 6/9/10	Missouri River
Central Boone	1997: 9/8/1997	Urban/Small Stream
Columbia	1998: 8/27/1998	Urban/Small Stream
Countywide	2001: 1/28/01 - 1/29/01	Urban/Small Stream
Countywide	2001: 6/6/2001	Urban/Small Stream
Countywide	2008: 9/13/2008	Urban/Small Stream
Central Boone	2015: 11/17/2015	Urban/Small Stream
Source: http://www.ncdc.noaa.gov/stormevents ; available data as of 12/31/2019		

Data from NOAA indicates 12 river or small stream floods in Boone County since the Missouri River flood of 1995 (Table 3.15). Six of these events were floods of the Missouri River. There have been 8 reported flash flood events since the last plan update (Table 3.16).

Table 3.16			
Boone County Historic Data			
Flash Flood			
January 1 1996 - December 31, 2019			
Location	Date	Location	Date
Eastern Boone	06/22/97	Countywide	09/12/08
Northern Boone	06/29/98	Countywide	09/13/08
Central Boone	07/04/98	Countywide	03/24/09
Countywide	10/05/98	Northern Boone	04/29/09
Northern Boone	06/12/99	Northern Boone	05/15/09
Southern Boone	05/27/00	Southern Boone	07/04/09
Central and Northern Boone	08/07/00	Countywide	10/08/09
Columbia	05/17/01	Countywide	10/22/2009
SW Columbia and North of McBaine	07/19/01	Columbia	4/23/2010
Countywide	05/07/02	Countywide	4/24/2010
Countywide	05/09/02	Columbia area	5/12/2010
Countywide	05/12/02	Columbia/Centralia	5/13/2010
Southern Boone	08/18/02	Countywide	7/7/2010
Columbia	08/20/02	Centralia	7/29/2010
Northern Boone	06/12/03	Columbia	8/20/2010
Northern Boone	06/25/03	Columbia area	5/25/2011
Countywide	03/26/04	Countywide	4/29/2012
Countywide	08/26/04	Midway/Columbia area	5/26/2013
Countywide	01/12/05	Easley	5/31/2013
Columbia	05/11/05	Southern Boone	4/3/2014
Columbia	08/26/05	Central Boone	9/1/2014
Columbia	09/19/05	Sturgeon	6/7/2015
Central Boone	06/11/06	Countywide	6/25/2015
Centralia	05/06/07	Countywide	7/1/2015
Columbia	05/06/07	Southern Boone	12/26/2015
Centralia	03/17/08	Central Boone	7/3/2016
Northern Boone	04/10/08	Southern Boone	8/1/2016
Central to Northern Boone	06/13/08	Centralia	8/2/2016
Central to Southern Boone	07/22/08	Northern Boone	4/29/2017
Northern Boone	07/25/08	Northern Boone	6/26/2018
Hallsville	07/27/08	Southern Boone	6/22/2019
		Countywide	8/12/2019

Source: <http://www.ncdc.noaa.gov/stormevents>; available data as of 12/31/19

There was one death from an urban/small stream flood in during this period. On Sept. 13, 2008, a 20-year old woman attempted to help a man who had been swept off Clark Lane into Hominy Creek on the east side of Columbia. She was swept away by the floodwaters to her death. The flooding in this period originated from the remnants of Hurricane Ike which swept across the Midwest causing widespread and extensive flooding.

Flooded roadways caused minor injuries to two people who were trapped in their car November 11, 2015 after nearly 5 inches of rain fell over a two-day period.

Strength/Magnitude/Extent

According to the 2018 State Hazard Mitigation Plan, Missouri has a long history of flooding. Flooding along Missouri’s major rivers generally results in slow-moving disasters. Since river crest levels are forecast several days in advance communities in these active areas are given time to take protective measures against heightened water levels through means of evacuation and/or sandbagging efforts. Flash-flooding by contrast is a rapid rise of flood waters and has a history of causing a higher number of deaths and property damage.

National Flood Insurance Program (NFIP) Participation

Table 3.17: NFIP Participation in Boone County

Community ID #	Community Name	NFIP Participant (Y/N/Sanctioned)	Current Effective Map Date	Regular- Emergency Program Entry Date
290034B	Boone County	Yes	04/19/17	06/15/83
290752#	Ashland	Yes	03/17/11	08/24/84
290035#	Centralia	Yes	03/17/11	04/15/77
290036B	Columbia	Yes	04/19/17	08/27/71
290712B	Hallsville	Yes	04/19/17	01/01/06
290246#	Harrisburg	Yes	03/17/11	06/08/12
290037B	Hartsburg	Yes	04/17/17	08/16/82
290995B	Huntsdale	Yes	04/19/17	06/11/15
290038B	Rocheport	Yes	04/19/17	08/02/82
290039#	Sturgeon	Yes	03/17/11	05/01/87

Source: NFIP Community Status Book, 09/24/19; BureauNet, <http://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book>; M= No elevation determined – all Zone A, C, and X; NSFHA = No Special Flood Hazard Area; E=Emergency Program

Table 3.18: NFIP Policy and Claim Statistics

Community Name	Policies in Force	Insurance in Force	Closed Losses	Total Payments
Uninc. Boone County	57	11,642,300		\$375,303
Centralia	2	420,000		
Columbia	156	38,706,500		\$2,250,809
Hartsburg	22	1,964,100		\$121,572
Rocheport	4	426,500		

Source: NFIP Community Status Book, [09/24/19]; BureauNet, <http://bsa.nfipstat.fema.gov/reports/reports.html>; *Closed Losses are those flood insurance claims that resulted in payment. Loss statistics as of 09/30/19.

Repetitive Loss/Severe Repetitive Loss Properties

Properties with at least two flood insurance payments of \$1,000 or more in a 10-year period are categorized as Repetitive Loss Properties. Properties that have repetitive loss fall within unincorporated Boone County, and the jurisdictions of Columbia and Hartsburg. They combine for a total of 58 losses. Due to federal restrictions on data sharing, the state was unable to provide full Repetitive Loss data or current Severe Repetitive Loss data. This also impacts information on Property Type and whether the properties are mitigated or non-mitigated.

Table 3.18: Repetitive Loss Payments

Jurisdiction	# of Properties	Type of Property	# Mitigated	Building Payments	Content Payments	Total Payments	Average Payment	# of Losses
Uninc. Boone County	5	N/A	N/A	\$366,233	\$9,069	\$375,303	\$16,318	23
Columbia	5	N/A	N/A	\$1,432,160	\$818,648	\$2,250,809	\$83,363	27
Hartsburg	4	N/A	N/A	\$121,572	\$0	\$121,572	\$15,197	8
Total	14	N/A	N/A	\$1,919,966	\$827,718	\$2,747,684	\$47,374	58

Source: Flood Insurance Administration as of 09/30/19

Severe Repetitive Loss (SRL): A SRL property is defined as a single family property that is covered under flood insurance by the NFIP; and has (1) incurred flood-related damage for which four or more separate claims payments have been paid under flood insurance coverage with the amount of each claim payment exceeding \$5,000 and with cumulative amounts of payments exceeding \$20,000; or (2) for which at least two separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property. A single-family property can consist of one-to-four residences. Boone County only has one such property

Table 3.19: Boone County Severe Repetitive Loss Property

County	Community Name	Number of SRL Properties	Number of Paid NFIP Claims	Total Paid Losses	Average Payment
Boone	Boone County	1	10	\$219,131.36	\$21,913.14

Source: 2018 Missouri State Hazard Mitigation Plan

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 (2013)*. 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.

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.

2019 saw near record flooding. Depths were reported within a couple feet of 1993 flood levels and on par with 1995 levels. Levees upstream and down-stream were breached. Those breaches outside of Boone County led to drops in depths that took pressure off multiple levees in Boone County.

Table 3.20: NCEI Boone County Flash Flood Events Summary 2000-2020

DATE	# of Events	# of Deaths	# of Injuries	Property Damage	Crop Damage
5/27/2000	1	0	0	0	0
8/7/2000	1	0	0	0	0
5/17/2001	1	0	0	0	0
7/19/2001	1	0	0	0	0
5/7/2002	1	0	0	0	0
5/9/2002	1	0	0	0	0
5/12/2002	1	0	0	0	0
8/18/2002	1	0	1	0	0
8/20/2002	1	0	0	0	0
6/12/2003	1	0	0	0	0
6/25/2003	1	0	0	0	0
3/26/2004	1	0	0	500000	0
8/26/2004	1	0	0	0	0
1/12/2005	1	0	0	0	0
5/11/2005	1	0	0	0	0
8/26/2005	1	0	0	0	0
9/19/2005	1	0	0	0	0
6/11/2006	1	0	0	0	0
5/6/2007	1	0	0	45000	0
5/6/2007	1	0	0	0	0
3/17/2008	1	0	0	0	0
4/10/2008	1	0	0	1000	0
6/13/2008	1	0	0	1000	0
7/22/2008	1	0	0	0	0
7/25/2008	1	0	0	0	0
7/27/2008	1	0	0	0	0
9/12/2008	1	0	0	0	0
9/13/2008	1	0	0	0	0
3/24/2009	1	0	0	0	0
4/29/2009	1	0	0	0	0
5/15/2009	1	0	0	0	0
7/4/2009	1	0	0	0	0
10/8/2009	1	0	0	0	0
10/22/2009	1	0	0	0	0

4/23/2010	1	0	0	0	0
4/24/2010	1	0	0	0	0
5/12/2010	1	0	0	0	0
5/13/2010	1	0	0	0	0
7/7/2010	1	0	0	0	0
7/29/2010	1	0	0	0	0
8/20/2010	1	0	0	0	0
5/25/2011	1	0	0	0	0
4/29/2012	1	0	0	0	0
5/26/2013	1	0	0	0	0
5/31/2013	1	0	0	0	0
4/3/2014	1	0	0	0	0
9/1/2014	1	0	0	0	0
6/7/2015	1	0	0	0	0
6/25/2015	1	0	0	0	0
7/1/2015	1	0	0	0	0
12/26/2015	1	0	0	0	0
7/3/2016	1	0	0	0	0
8/1/2016	1	0	0	0	0
8/2/2016	1	0	0	0	0
4/29/2017	1	0	0	0	0
6/26/2018	1	0	0	0	0
6/22/2019	1	0	0	0	0
8/11/2019	1	0	0	0	0
8/12/2019	1	0	0	0	0

Source: NCEI, 02/01/2000-02/29/2020

Table 3.21: NCEI Boone County Riverine Flood Events Summary 2000-2020

Date	# of Events	# of Deaths	# of Injuries	Property Damage	Crop Damage
1/28/2001	1	0	0	0	0
6/4/2001	1	0	0	0	0
6/6/2001	1	0	0	0	0
5/8/2002	1	0	0	0	0
5/8/2007	1	0	0	10000	25000
9/13/2008	1	1	0	0	0
6/9/2010	1	0	0	0	0
11/17/2015	1	0	2	0	0

Source: NCEI, 02/01/2000-02/29/2020

Probability of Future Events

Table: 3.22

Probability of Future Flooding Events			
EF-Scale	# of years with flood event (2000-2020)	Probability	Probability Rating
Missouri River flood	6	30%	High
Urban/small stream flood	5	25%	High
Flash flood	59	100%	High

While the probability of flooding of the Missouri River is high, the towns by the river (Hartsburg, Huntsdale and Rocheport) are all protected to varying degrees by levees. The Katy Trail State Park functions as a levee for all three jurisdictions; Hartsburg and Huntsdale are also protected by agricultural levees. For this reason, there is only a moderate probability of flooding in these three towns.

Boone County is vulnerable to both Missouri River floods and flash flooding; the City of Columbia is vulnerable to flash flooding and flooding from the backup of branches feeding into the Missouri River during times of river flooding. Flash flooding events happen at a high frequency and average 2.8 events a year. In a 20-year period there isn't a single year in which flash flooding hasn't happened.

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

VULNERABILITY

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

Potential Impact – Life

All types of flooding present a threat to human life and livelihood. Small stream/urban stream flooding and flash flooding are particularly hazardous due to their quick onset. It is an ongoing struggle to educate the public concerning the very real hazard presented by flooded low water crossings and other flash flooding situations.

In addition to the risk of drowning, exposure to flood waters can result in infection or injury from sewage, agricultural runoff, and industrial chemicals. Flooded buildings present health risks from mold, chemicals and electrical hazards.

Flooding also poses a threat to the livelihood of those farming in low lands; this is especially a problem near the Missouri River. When the river level is high for an extended period, water will seep up through the soil and cause additional flooding to that already caused by heavy rains. Standing water in fields may prevent planting at the optimal time for a successful harvest or damage/destroy crops during the growing season.

Potential Losses to Existing Development

Structures and infrastructure near the Missouri River are potentially vulnerable to damage from riverine flooding; many of these structures are protected by levees and sandbagging at times of high river levels but there is the potential for floodwaters to top the levees or for levee failure.

Flash flooding events present a risk of damage to roadways, drainage systems, and culverts. In addition, there are homes at risk of flash flooding, especially in the City of Columbia.

Potential Losses to Previous and Future Development

There is a high level of awareness in the planning area regarding the dangers and potential of flooding. Participation in the NFIP by Boone County and all the major communities means that floodplain ordinances are in place regulating development in the floodplain. In addition, Boone County and the City of Columbia have storm water management plans and requirements in place.

However, development is vigorous in the planning area, especially in and around the City of Columbia. The city is already vulnerable to flash flooding and an increase in impervious surface means an increase in runoff. It is important that development projects are closely monitored to ensure compliance with all storm water requirements and regulations in order to minimize increases to flash flooding from development. This is increasingly crucial as it is now known that climate change is causing an increase in the type of heavy downpours which trigger flash flooding.

Hazard Summary by Jurisdiction

The Missouri River floods of 1993 and 1995 were devastating events for many parts of the Midwest United States. Changes in river management, including major wetland restoration projects along the river's long course, the buildup of some levee sections in parts of the planning area, and the buyout of properties in the river floodplain (Figure 4.17) have all helped to mitigate risk associated with riverine flooding in the planning area.

Boone 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.

Columbia

The City of Columbia Water Treatment Plant is located in the Missouri River floodplain. After the floods of 1993 and 1995, the following mitigation was put in place to protect the water supply: the well platforms were raised seven feet; secondary power and waterlines were run from the well field to the water treatment plant and a concrete flood protection wall was constructed around the plant.

Lagoons for the city’s wastewater treatment system are also located in the floodplain and surrounded by a berm for flood protection.

The Public Works Department staff reviews all subdivision plans to ensure structures are not built in the floodway and are 2 feet above the 100-year flood elevation when placed in the flood fringe.

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 with revisions in 2013. The manual includes the following specifications for road classifications and their respective levels of safety against flooding (Figure 4.20).

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

Flash flooding is of particular concern in the City of Columbia; flood buyouts in the city have been outside of the floodplain in Zone X where the properties were repeatedly affected by flash flooding. Columbia still has a significant number of NFIP repetitive loss properties.

Rocheport

The City of Rocheport relies on the County in times of major flooding to provide sandbags or concrete barriers which are placed on the north side of the Katy Trail to protect the city. This has been effective but is an expensive venture for the County. There are also four houses on the south (river) side of the Katy Trail which could sustain damage in times of flooding and would not be assisted by the sandbagging; the city has targeted three of these houses for potential flood buyouts; one house has been elevated. The city park on the south side of town will flood with lower river levels but this is not a major concern for the city. The Boone County Regional Sewer District now owns and operates the wastewater treatment facility serving the city; it is located in the floodplain.

Huntsdale

While Huntsdale is located near the river and has a significant area in the floodplain, the main part of the town is almost totally surrounded by levees. There is a campground along the river outside of the levee protection area, but it is not used in the event of potential flooding. The town sandbags a small area along the Grocery Branch on the southeast edge of town but has not experienced severely problematic flooding since the 1993 floods.

Hartsburg

Hartsburg also has levee protection from both the agricultural Hartsburg Levees and a section of the Katy Trail which runs through the village. This section was elevated to 32 feet following the 1993 flood and provides extra protection for about half of the village, including the business section. In times of flood threat, Hartsburg sandbags on this part of the Katy Trail but more than half of the town residences (11 houses) are on the river side of the trail and protected only by one of the agricultural levees. If flooding overtops the agricultural levees, the consequences for these 11 houses would be severe. There have been a number of times in the past 15 years when the village sandbagged on the trail but no levees were overtopped in that period.

SUMMARY OF VULNERABILITY

The entire planning area is at risk from some type of flooding. The most common types of flooding in the area are flash and sheet flooding associated with heavy downpours. This is of particular concern in the unincorporated parts of Boone County, where roads can become impassable, and in the City of Columbia, where flash flooding affects a number of NFIP repetitive loss properties. Climate change is causing an increase in heavy downpours and this will, in turn, most likely increase the frequency and/or severity of flash flooding.

Flooding of the Missouri River is a potential problem for the areas near the river: the unincorporated areas of Boone County, the jurisdictions of Hartsburg, Huntsdale, and Rocheport and also the City of Columbia, which has significant infrastructure situated in the river bottoms.

Some county roads near the river become impassable during times of high water levels. The incorporated areas of Hartsburg and Huntsdale are protected both by agricultural levees and the Katy Trail, which acts as a levee, but the levees and trail require sandbagging at times of high river levels. Most of Rocheport is also protected by the Katy Trail; the trail is also sandbagged at this location at times of potential flooding. The levees, along with the sandbagging efforts, have kept these towns safe from flooding for the past few decades; however, there is always the possibility that the levees could be overtopped, or fail, with very high river levels.

The City of Columbia's infrastructure near the river is protected by berms and the McBaine Levee; again, there is always the potential for the levee to be overtopped or fail. Columbia can also experience flooding from the backup of a major tributary branch when the Missouri River is high.

All major jurisdictions of the planning area are members of the NFIP and have floodplain regulations in place. In addition, Boone County and the City of Columbia have put extensive time, energy, and resources into developing storm water plans and regulations. These factors,

plus a high awareness of the threat of potential flooding, all act to help mitigate the vulnerability to this hazard.

Problem Statement

Flooding and flash flooding are frequent occurrences in the planning area that pose a threat to life, livelihood, property, and infrastructure. Risk to these things vary across the planning area with highest risk being to lands and jurisdictions along the Missouri River and creeks and streams that feed it. While all jurisdictions in the planning area are part of the NFIP, portions of Boone County, Columbia, Hartsburg, Huntsdale, and Rocheport have the most risk due to their proximity to the river and how much of their infrastructure is located in flood and flash flood prone areas. As a result of past events ordinances and guidance has been put in place by Boone County and the City of Columbia to help control development in hazard areas. Proper stormwater handling, warning systems, elevated low-water crossings, and river bank restoration are all actions to aid in reduction of flood damage in the planning area.

LEVEE FAILURE

DESCRIPTION OF HAZARD

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.”

Federally authorized levees are typically designed and built by the US Army Corps of Engineers 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.

There is no single agency with responsibility for levee oversight. The Corps of Engineers has specific and limited responsibilities for approximately 2,000 levees nationwide through their Levee Program.

The responsibilities of local levee owners or sponsors are broad and 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 and some non-federal levees may be eligible for Corps of Engineers rehabilitation assistance funding.

This assessment discusses the major levees in the planning area; these levees are owned and operated by levee districts. There are also several privately owned levees which are maintained by their owners; official data on the locations of these private levees is not available.

The USACE notes that there is 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.”

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.

Location

Boone County, the Villages of Hartsburg and Huntsdale, and the City of Columbia are all vulnerable to levee failure.

The major levees in the planning area, the McBaine and Hartsburg Levees, are located along the southwestern border of Boone County on the left descending bank of the Missouri River between river miles 180 and 150 (Figures 4.22-4.23). They protect agricultural land, the communities of McBaine, Huntsdale, and Hartsburg, and critical infrastructure of the City of Columbia from Missouri River flooding.

Figure 3.15

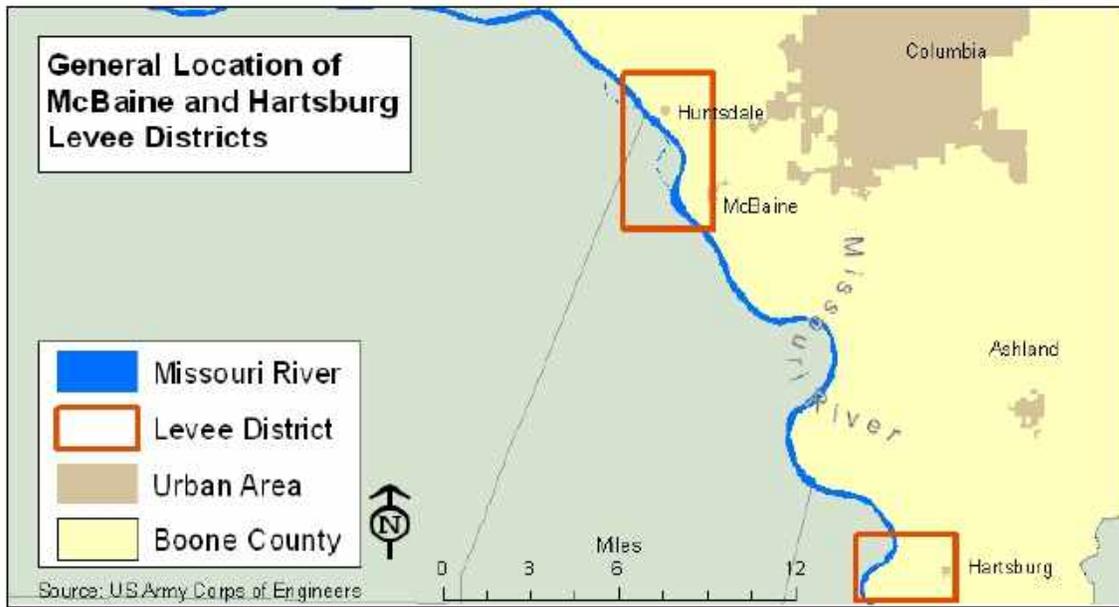


Table 3.24			
Major Levees in Planning Area			
Levee Name	MO River Mile Location (left descending bank)	Segment Length (miles)	Leveed Area Acreage
McBaine Levee	179.6 to 175.0	10.59	2492.94
Hartsburg Levee District Section 1	160.5 to 155.3	7.32	2,071.05
Hartsburg Levee District Section 2	155.2 to 153.6	5.60	1,341.90
Hartsburg Levee District Section 3	153.6 to 150.8	6.53	739.14
Sources: USACE National Levee Database; USACE Levee Inspection Reports			

The McBaine and Hartsburg levees together protect over 6,000 acres of land; they are earthen levees which were locally constructed and are locally operated and maintained. The levees were built as agricultural levees to withstand 50 year floods; none are NFIP certified. The sponsoring levee districts are separate taxing entities organized by the Boone County Circuit Court.

The levees are part of the Army Corps of Engineers Rehabilitation Program and were last inspected in 2014. According to the USACE, “The rating is based on the levee inspection checklist, which includes 125 specific items dealing with operation and maintenance of levee embankments, floodwalls, interior drainage, pump stations, and channels.” The McBaine Levee received an “acceptable” rating during the most recent inspection and the Hartsburg Levees received “minimally acceptable” ratings. This is based on a 3-tier scale ranging from acceptable to unacceptable.

Levee System Inspection Ratings	
Acceptable	All inspection items are rated as Acceptable.
Minimally Acceptable	One or more inspection items are rated as Minimally Acceptable or one or more items are rated as Unacceptable and an engineering determination concludes that the Unacceptable inspection items would not prevent the segment/system from performing as intended during the next flood event.
Unacceptable	One or more inspection items are rated as Unacceptable and would prevent the segment/system from performing as intended, or a serious deficiency noted in past inspections (previous Unacceptable items in a Minimally Acceptable overall rating) has not been corrected within the established timeframe, not to exceed two years.

As part of the USACE Levee Program, the levee districts are eligible for Corps of Engineers levee rehabilitation assistance should their levees receive damage during a flood event. The levee must maintain a *minimally acceptable* standard to remain eligible for the assistance.

More detailed views of the major levees are shown in Figures 3.25 and 3.26.

MCBAINE LEVEE

Figure 3.25A



Source: McBaine Levee District President, John Sam Williamson and Joe Gibbs PE

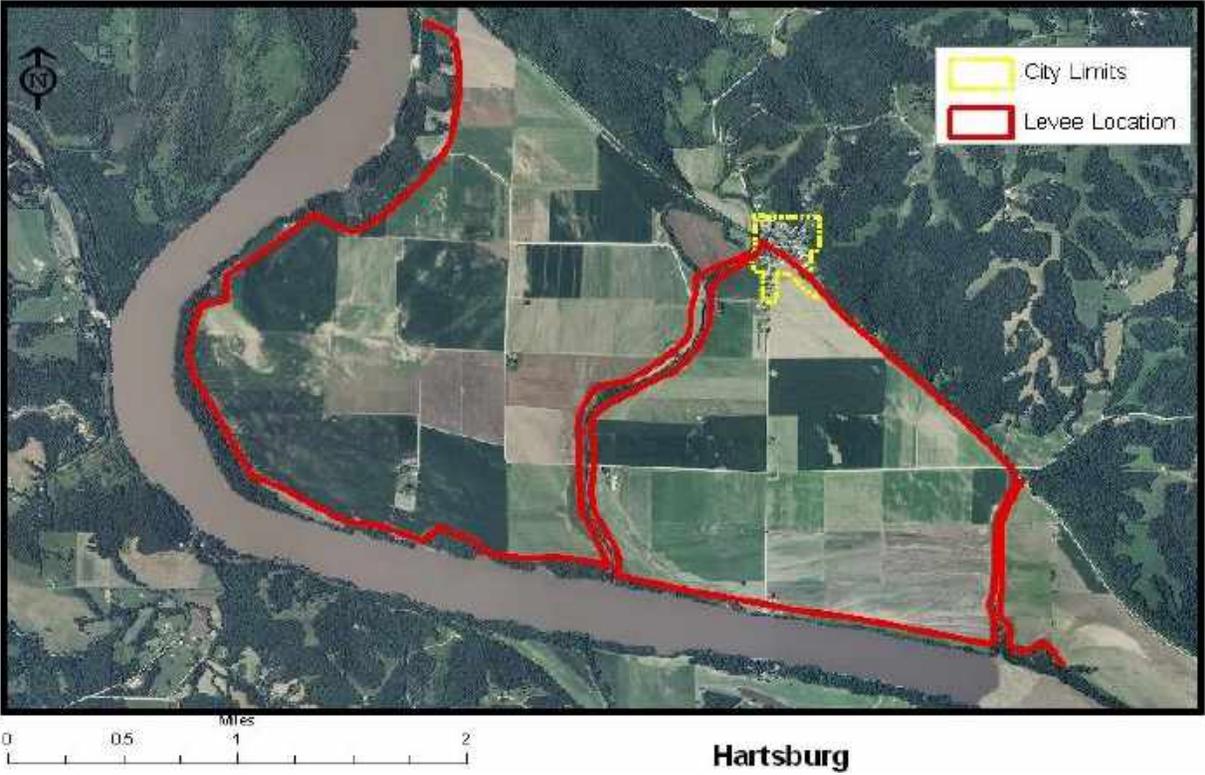
Figure 3.25B



Source: USACE

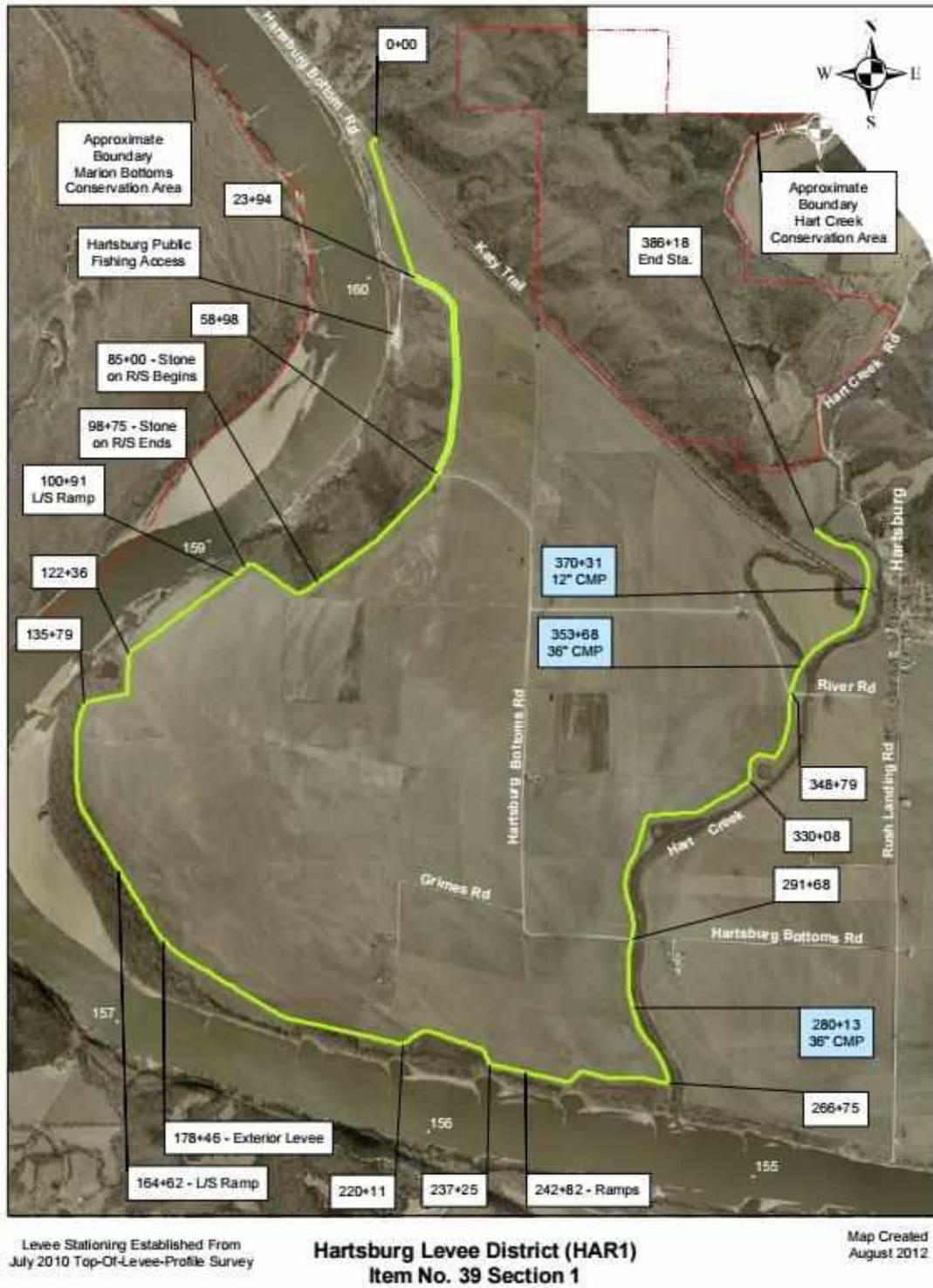
HARTSBURG LEVEES

Figure 3.26A



Source: Hartsburg Floodplain Administrator Mike Rodemeyer

Figure 3.26B



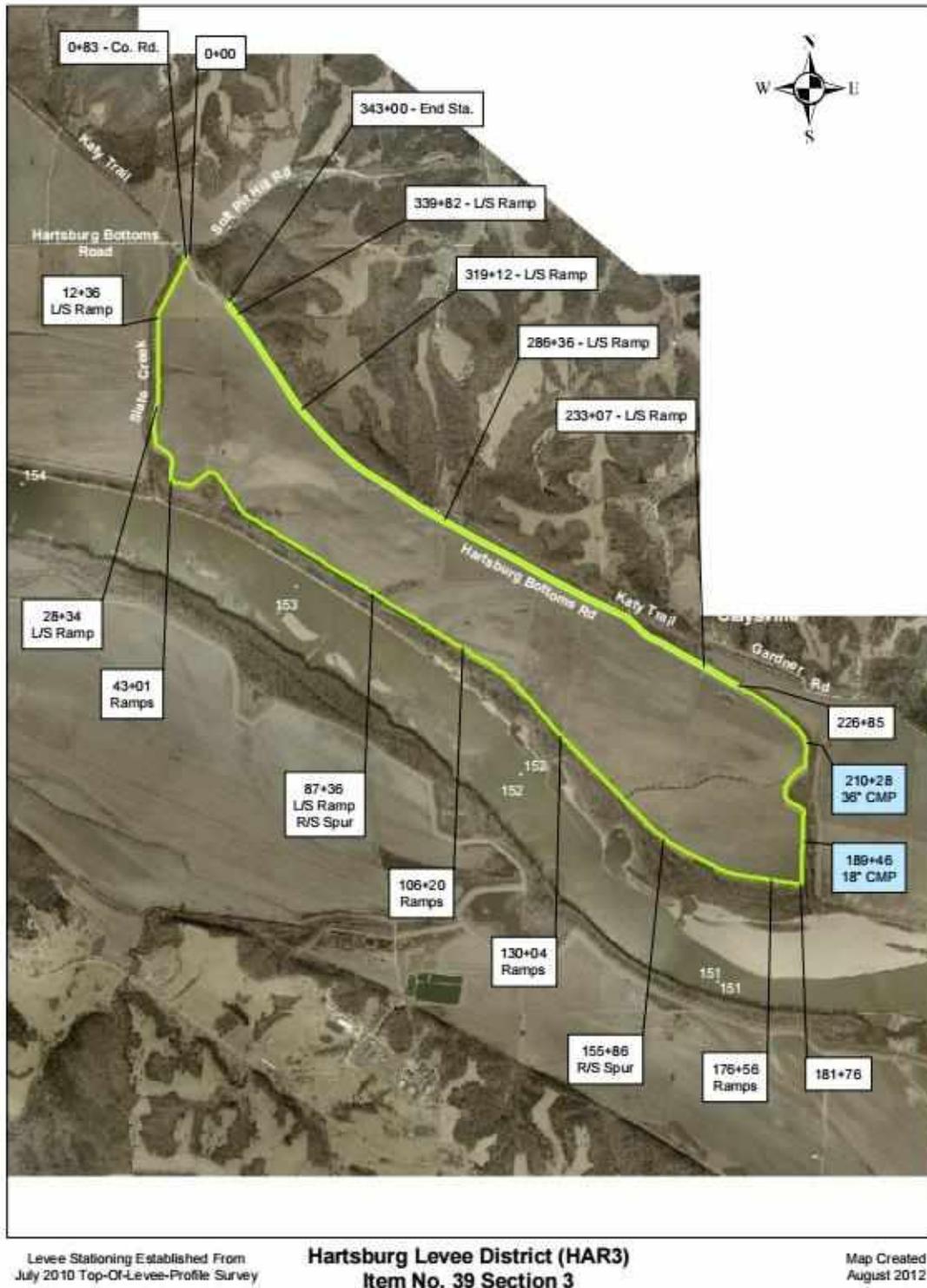
Source: USACE

Figure 3.26C



Source: USACE

Figure 3.26D



Source: USACE

In addition to receiving protection from the Hartsburg Levees, the Village of Hartsburg receives add levee protection from a section of the Katy Trail State Park (owned and maintained by the MO Department of Natural Resources) which runs through the town. This section was elevated to 32 feet following the 1993 flood and provides extra protection for about half of the village, including the business district. The Katy Trail also provides added levee protection for the Village of Huntsdale and the City of Rocheport.

Extent

Levee failure is typically an additional or secondary impact of another disaster such as flooding or earthquake. Levee failure often occurs during a flood event, causing destruction in addition to what would have been caused by flooding alone. A breach on an agricultural levee can not only cause immediate crop loss but sand and silt brought in from a levee break can impact the growing medium for years to come.

Regular maintenance and inspection of the levees is critical. For the major levees in the planning area, the potential of major failure is connected to flooding of the Missouri River, a hazard with a longer speed of onset than many other hazards. This longer speed of onset allows time to mitigate and prepare for potential failure as flooding threatens.

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.

In 2019 levees in Boone County were tested by nearing record level river levels that stayed high for a prolonged period of time. The extended time in which the levees were under pressure caused scouring in places but due to breaks in upstream levees the pressure was reduced to levees in the planning area before they broke.

Probability of Future Occurrence

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

There haven't been any levee breaches in the planning area in the last 20 years. With regular maintenance the probability of a levee break is low but with the high rate of flooding along the Missouri river the potential for a break is never zero.

Changing Future Conditions Considerations

As precipitation is projected to increase, and in more extreme events, the risk of flooding could increase. Prolonged elevated water levels can make maintenance and repairs difficult to accomplish only increasing the risk for a break through scouring and seepage.

VULNERABILITY

Severity: Moderate – Boone County, Hartsburg, Huntsdale
Low – Columbia

The severity rating for Columbia has been assessed as low because there is additional protection in place for the critical infrastructure protected by the McBaine Levee.

Impact - Future Development

Almost all of the land protected by the major levees in the planning area is within the Missouri River floodplain and any development would be subject to the floodplain regulations of either Boone County or the Village of Hartsburg and Huntsdale. It is highly unlikely that development, other than necessary infrastructure, will take place in these areas

Existing Mitigation Activities

The McBaine and Hartsburg Levees are maintained by the levee districts. They receive regular inspections as part of the USACE Rehabilitation and Inspection Program.

Hazard Summary

Boone County, the Villages of Hartsburg and Huntsdale, and the City of Columbia are all vulnerable to levee failure.

The Villages of Huntsdale and Hartsburg are both protected from Missouri River flooding by major agricultural levees (the McBaine Levee and Hartsburg Levees, respectively). These levees also protect some county roads and agricultural lands; in addition, the McBaine Levee protects some of Columbia's critical infrastructure and significant public utilities located in the floodplain.

These levees failed during the 1993 Missouri River flood. Changes in management of the Missouri River, including major wetland restoration projects along the river's long course, have helped to control flood levels on the lower Missouri since that time. In addition, some properties in the floodplain were abandoned, moved, or bought out following that flood; this reduced the number of structures vulnerable to flooding/levee failure. Regular maintenance and inspection of the levees has helped to ensure their integrity to withstand the pressures of rising river levels.

The risk of flooding from levee failure remains, however. The warning time afforded by a hazard such as levee failure, which has a long period of onset, will allow for preparations and evacuations to take place, should the need arise.

Problem Statement

Levee failure is not a common occurrence in the planning area. The last instance of levee failure in the planning area was in 1993 when records were set across the state for flooding levels.

Levee failure is usually a slow process that gives people time to evacuate areas at risk. Keeping up with maintenance and frequent inspections are actions of mitigation to help prevent such breakages that could lead to property damage and crop loss.

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 is:

1. more than 6 feet high and stores 50 acre feet or more or
2. 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.

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.

Failure - 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;

Overtopping – inadequate spillway design, debris blockage of spillways, or settlement of the dam crest.

Piping, erosion, and structural 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 Hazard Classification - 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.

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 4.28.

Table 3.27				
Dam Hazard Classification Systems				
Federal (NID)		State (MoDNR)		
Classification	Criterion	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

Dam Regulation in Missouri

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. According to the Association of State Dam Safety Officials, 5,113 dams in Missouri have been classified and only 685 are regulated by the state.

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.

The DNR National Dam Inventory database lists 126 dams in Boone County; one of these (Moon Valley Lake Dam) is no longer in existence due to failure. The database 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. One additional dam (McNew Lake Dam) was brought to the attention of the hazard planning committee; it is located outside of Hartsburg.

Of the known dams, only seventeen are regulated by the state (Figure 4.29).

State Classification and Regulation of Dams in the planning area					
	State Hazard Classification				Total
	1	2	3	NA	
Regulated	4	10	3	0	17
Non-regulated	34	6	69	0	109
Total dams	47	7	72	0	126

One must use caution in assuming the classifications of non-regulated dams are currently accurate. It is very probable that, for most of the non-regulated dams, the classification does not take into account almost 30 years of development and change in Boone County.

Geographic Location

The locations of dams in the planning area are shown in the following series of maps and associated data charts:

- An overview of all known dams in the planning area (Figure 3.16)
- State Regulated dams (Figures 3.17)
- Non-regulated dams (Figures 3.18)
- Non-regulated dams in the City of Columbia (Figure 3.19)
- Dams located in or near other incorporated communities (Figure 3.20)

Figure 3.16

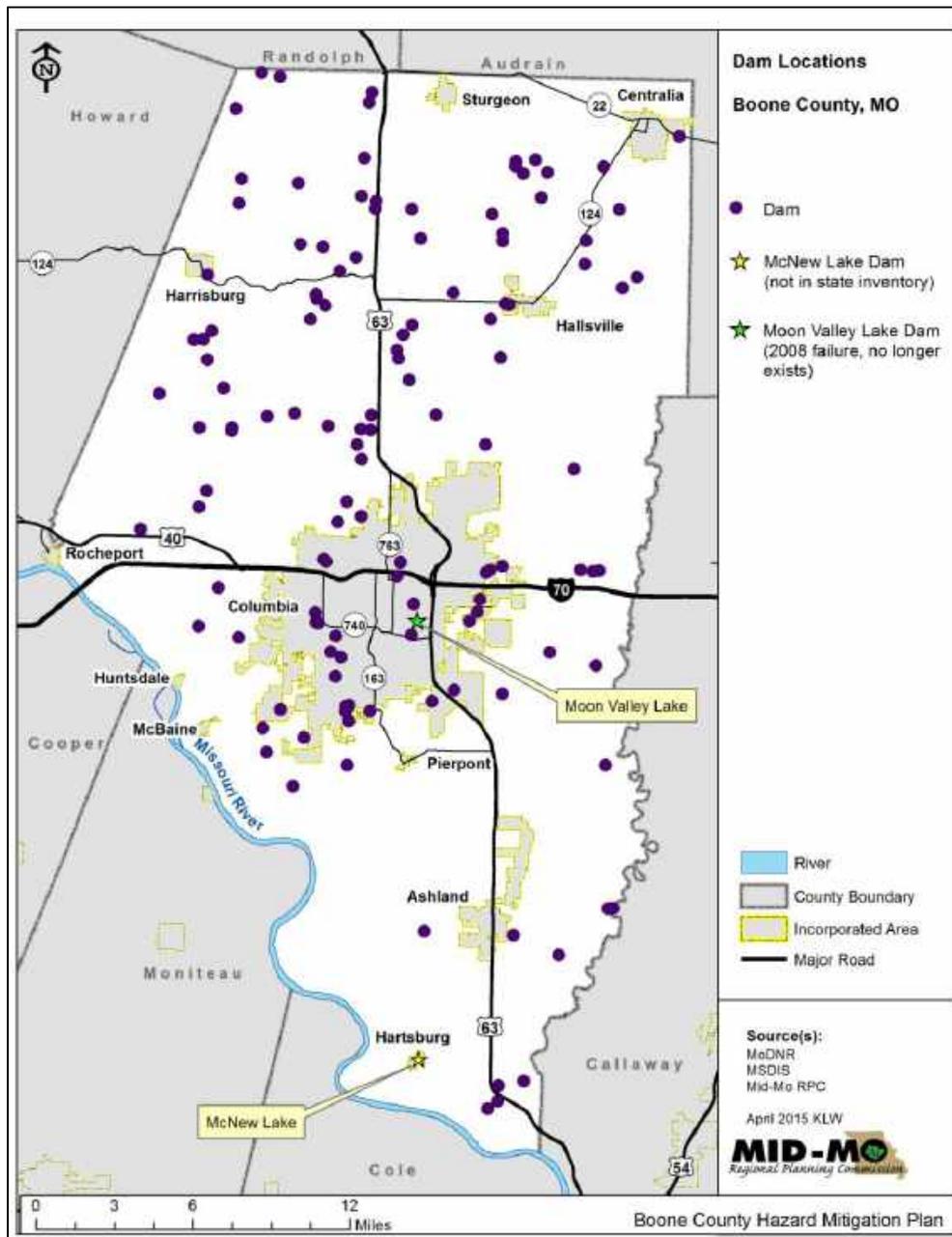


Figure 3.17

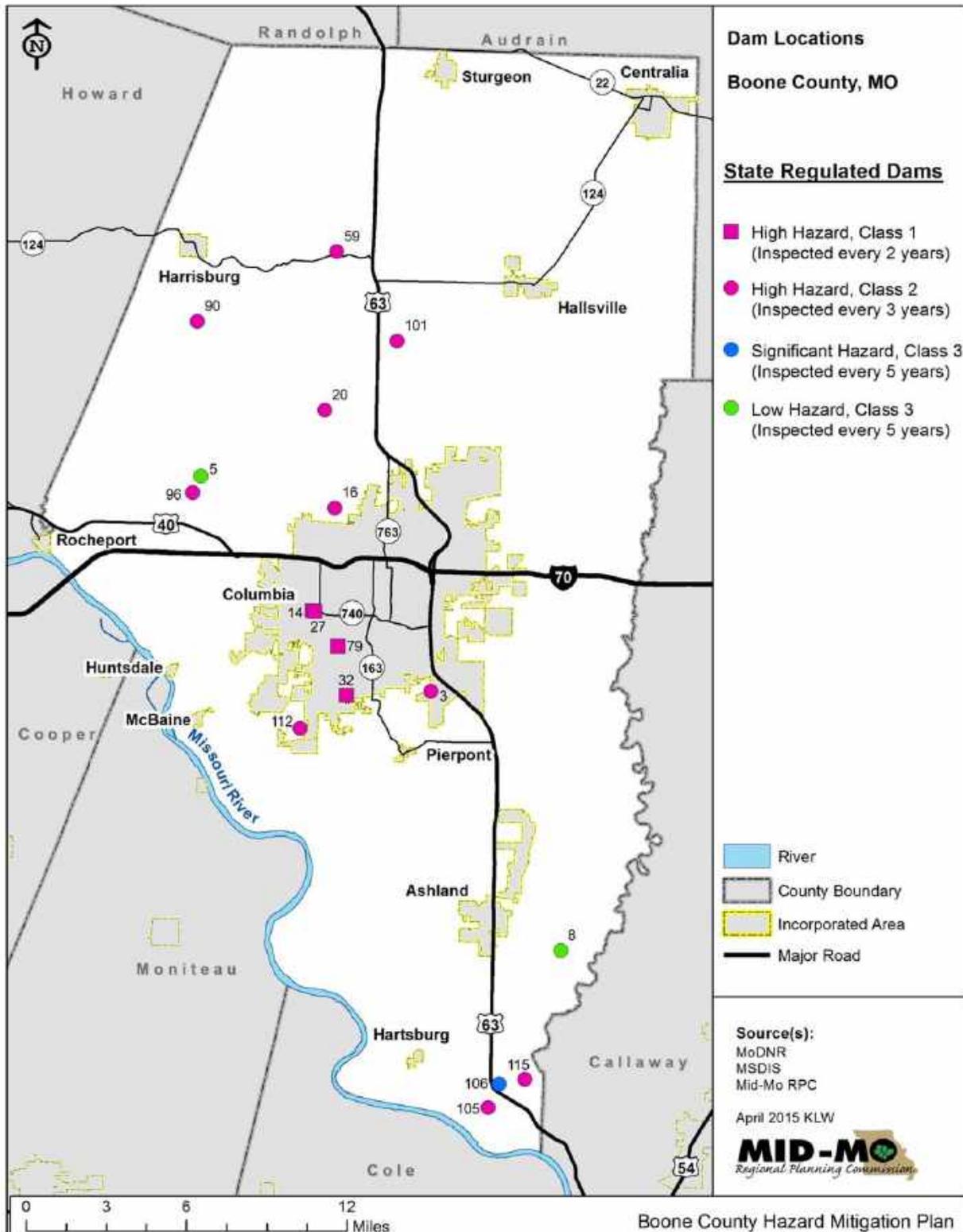


Figure 3.18

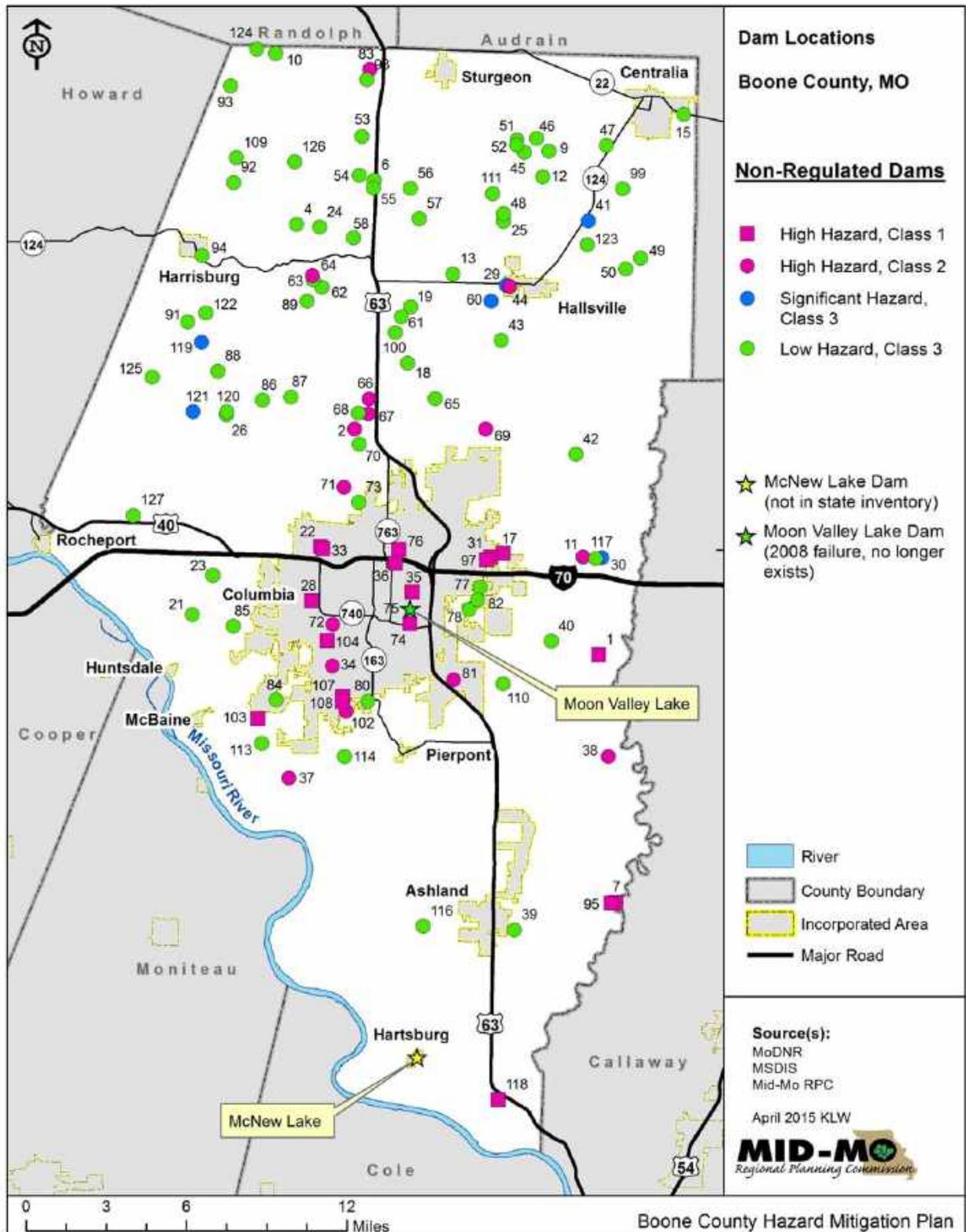


Figure 3.19

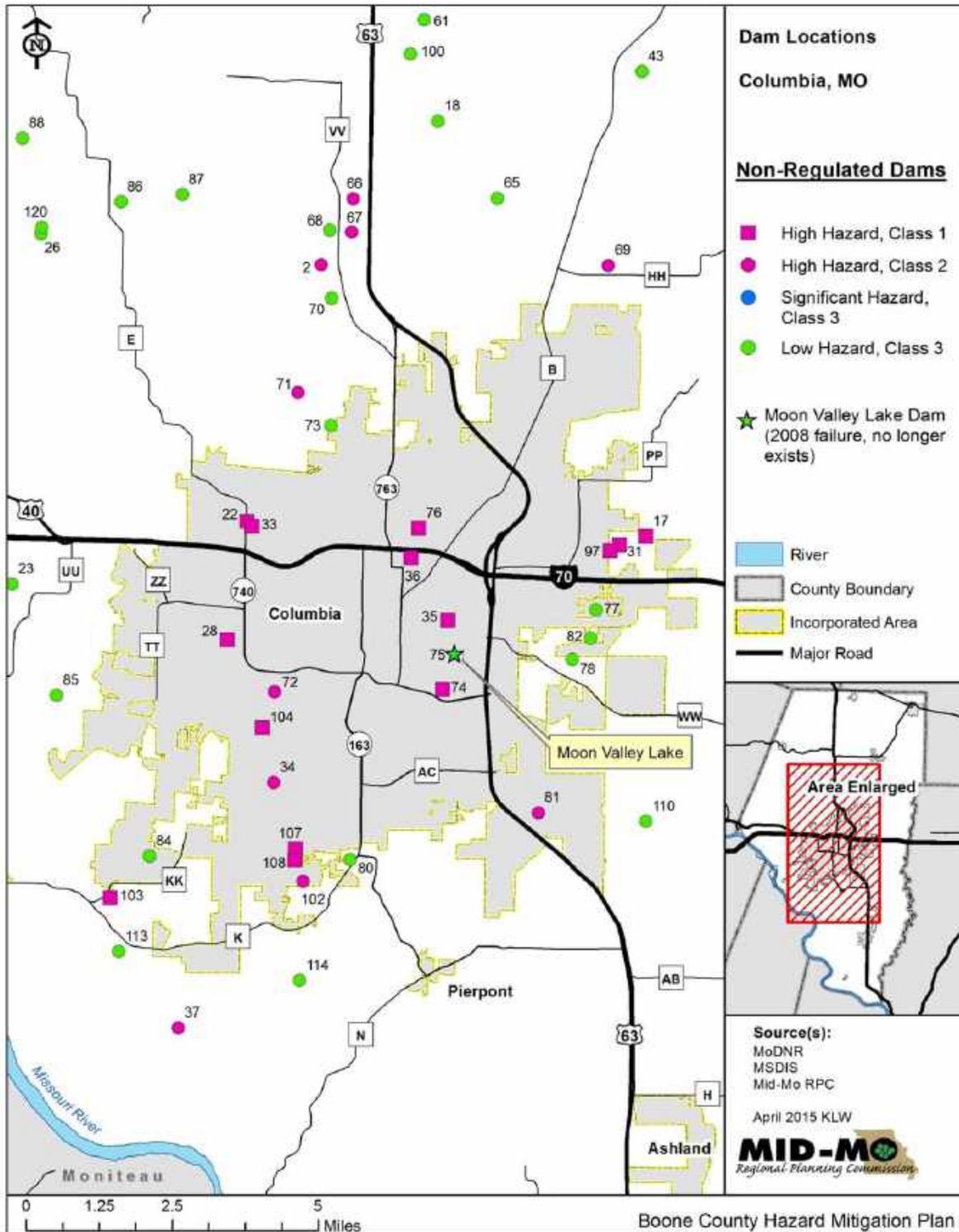


Table 3.29 Dam Summary

DAM NAME	RIVER	Nearest Downstream City	DISTANCE to Nearest City	Dam Owner	Dam Height	Normal Storage (Acre-ft)	Emergency Action Plan (EAP)	Last Inspection Date
LAKE CHATEAU DAM	TR-LITTLE CEDAR CREEK	COLUMBIA	9	LAKE CHATEAU INC	31	183	NR	5/31/1979
COUNTY DOWNES LAKE DAM	TR ROCKY FORK	MCBAINE	13	COUNTY DOWNS HOME.ASSOC.	30	275	NR	
PHILIPS PARK LAKE DAM	TR-CLEAR CREEK	COLUMBIA	5	THE CITY OF COLUMBIA	46	653	Y	4/26/2016
WINDMILLER DAM #1	TR-CEDAR CREEK	CEDAR CITY	20	ELIZABETH WINDMILLER	30	260	NR	5/31/1979
TURKEY FARM LAKE DAM	TR LITTLE CEDAR CREEK	JEFFERSON CITY	28	UNIVERSITY OF MISSOURI	20	78	NR	
HULEN LAKE WEST DAM	TR COUNTY HOUSE BRANCH	COLUMBIA	0	LAKESHORE ESTATES	50	255	Y	4/26/2016
ROEMER'S LAKE DAM	TR COW BRANCH	MCBAINE	10	ROEMER FAMILY LLC	37	277	Y	4/6/2016
WELCH LAKE DAM	HOMINY BRANCH	COLUMBIA	2	EDW,INC.	22	49	NR	3/10/1981
BOCO MO DAM	TR-SLACKS BR CR	COLUMBIA	8		39	759	Y	3/20/2018
COLUMBIA MUN GOLF COURSE LOWER L. DAM	TRIBUTARY TO HARMONY CREEK	MCBAINE	0	CITY OF COLUMBIA	15	9	NR	9/13/1978
HULEN LAKE EAST DAM	TR COUNTY HOUSE BRANCH	COLUMBIA	0	LAKESHORE ESTATES	50	171	Y	4/26/2016
FAIRVIEW LAKE DAM	TR-COUNTY HOUSE BRANCH	COLUMBIA	0	FAIRVIEW LAKE ASSOCIATIO	34	25	NR	4/13/1978
HAGAN LAKE DAM	HOMINY BRANCH	COLUMBIA	0	DAN HAGAN	19	66	NR	6/3/1980
CEDAR LAKE DAM	TR-LITTLE BONNE FEMME CREEK	EASLEY	0	CEDAR LAKE HOA	42	188	Y	7/5/2017
COLUMBIA MUM. GOLF COURSE DAM	TR-HARMONY CREEK	COLUMBIA	0	COLUMBIA PARK & REC DEPT	17	29	NR	9/13/1978
COUNTRY CLUB OF MO LAKE DAM	TR-MILL CREEK	COLUMBIA	0	COUNTRY CLUB OF MISSOURI	30	69	NR	
STEPHENS LAKE DAM	TR HINKSON CREEK	COLUMBIA	0	STEPHENS COLLEGE	23	63	NR	7/11/1980
MOORES LAKE DAM	TR-BEAR CREEK	COLUMBIA	0	CITY OF COLUMBIA	30	51	NR	7/11/1980

SMITH HATCHERY LAKE DAM	TR-MAYHAN BR	EASLEY	0	SMITH HATCHERY	25	40	NR	
GINN LAKE DAM	TR-CEDAR CREEK	JEFFERSON CITY	0	STANLEY GINN	30	80	NR	
COUNTRY BOY ESTATES LAKE DAM 2	TR-SILVER FORK	MCBAINE	0	COUNTRY BOY ESTATES HOA	37	32	Y	3/7/2017
LEWIS LAKE NORTH DAM	TR-REEDER CR	MCBAINE	0	MARY A LEWIS	25	100	NR	
WALNUT CREST LAKE DAM	TR-ROCKY FORK CR	MCBAINE	0	WALNUT CR/M P RINES	25	22	NR	
WEIL LAKE DAM	TR-ROCKY FORK CREEK	MCBAINE	14	GARY WEIL	25	25	NR	
SELTSAM LAKE DAM	TR-HINKSON CREEK	COLUMBIA	2	DARRELL SELTSAM	25	20	NR	
RAYFIELD LAKE DAM	TR-ROCKY FORK CREEK	MCBAINE	0	RAYMOND WIGGINS	25	20	NR	
MILLS LAKE DAM	TR-HINKSON CREEK	COLUMBIA	0	THOMAS L MILLS	30	22	NR	
LAKE CYRENE DAM	TR-HINKSON CREEK	COLUMBIA	0	LAKE CYRENE,INC.	25	50	NR	3/11/1981
MOON VALLEY LAKE DAM	HOMINY BRANCH	COLUMBIA	0	E.L. ROGERS	18	74	NR	3/11/1981
SHADY LAKE DAM	BEAR CREEK	COLUMBIA	0	DOROTHY M. CLARY	26	49	NR	6/2/1980
WOODRAIL LAKE DAM	HINKSON CREEK	HINKSON	7	KYLE E RUSSELL	54	324	Y	6/2/2016
UNIV OF MO-R1 DAM	TR GANS CREEK	WILTON	0	UNIVERSITY OF MISSOURI	18	60	NR	
TINCHER LAKE NORTH DAM	TR-LICK FORK	MCBAINE	0	HUGH TINCHER	25	35	NR	
CALLAHAN CREEK A-1	CALLAHAN CR	MCBAINE		CALLAHAN CR WTRSD SUBDST	35	77	Y	8/12/2015
WINDMILLER DAM #2	TR-CEDAR CREEK	CEDAR CITY	20	ELIZABETH WINDMILLER	20	67	NR	5/31/1979
CALLAHAN CREEK C-2	BARCLAY BR	MCBAINE		CALLAHAN CR WTRSD SUBDST	54	55	Y	5/7/2015
WATERS EDGE ESTATES LAKE DAM	HOMINY BRANCH	COLUMBIA	4	WATERS EDGE ESTATES INC.	25	122	NR	7/12/1980
FINGER LAKES DAM SOUTH	ROCKY FORK CK.	COLUMBIA	17	MO. DNR PARKS	44	398	Y	7/15/2014
HIGHLANDS LAKE DAM	ROCK CREEK	COLUMBIA	0	HIGHLAND PROPERTIES CO.	34	57	NR	7/16/1986
B & C SUBDIVISION DAM	PERCHE CREEK	MCBAINE	2	B & C SUBDIVISION CORP	34	431	NR	
LIMERICK LAKE DAM	TRIBUTARY HINKSON	COLUMBIA	6	LIMERICK HEIGHTS, INC.	31	21	NR	
CLAYSVILLE LAKE DAM	UNNAME TRIB TO MO.RIVER	CLAYSVILLE	1		42	273	Y	1/25/2018
HIGHLANDS LOWER LAKE DAM	TRIB TO CEDAR CREEK	COLUMBIA	7	INNOVATIVE MGT & INVESTM	30	40	NR	

HIGHLANDS SOUTH LAKE DAM	TRIB TI CEDAR CREEK	COLUMBIA	7	INNOVATIVE MGT & INVESTM	30	10	NR	
ARROWHEAD LAKE DAM		COLUMBIA	0	ARROWHEAD LAKE EST H/0	37	382	Y	4/6/2016
LAKE CHAMPETRA DAM	TR,TO CEDAR CREEK	CEDAR CITY	0	LAKE CHAMPETRA HOA	60	1530	Y	6/2/2016
DEMARCO LAKE DAM	TR-MISSOURI RIVER	CLAYSVILLE	2	GUY DEMARCO	31	26	NR	7/1/1980

Sources: Missouri Department of Natural Resources, <https://dnr.mo.gov/geology/wrc/dam-safety/damsinmissouri.htm> and National Inventory of Dams, http://nid.usace.army.mil/cm_apex/f?p=838:12. Contact the MoDNR Dam and Reservoir Safety Program at 800-361-4827 to request the inundation maps for your county to show geographic locations at risk, extent of failure and to perform GIS analysis of those assets at risk to dam failure.

Strength/Magnitude/Extent

The speed of onset of a dam failure can vary considerably. In most cases, regular inspections, either formal or informal, will promote a longer period of onset and allow for possible mitigation. Unfortunately, the current lack of required dam inspections increases the likelihood of dam conditions being ignored by owners – a situation which promotes a quicker speed of onset and an increased threat from the hazard.

The extent of hazard which a dam failure poses is also influenced by the reservoir size.

Previous Occurrences

Boone County experienced its first widely known dam failure in March 2008 when Moon Valley Lake Dam in Columbia failed. 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 and Class 1 in the state classification; 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. 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 3.20



In addition to the Moon Valley Lake Dam failure, the NOAA database reports the failure of a “small earthen dam on a neighborhood lake” in southern Boone County on August 18, 2002. This resulted in the flooding of streets and some basements and a minor injury from an electrical shock in a flooded basement.

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.

Probability of Future Events

Based on known historical occurrences, there have been two dam failures in the planning area since 2002, one in unincorporated Boone County and one in Columbia. This gives a probability of 5.5% ($1/18 \times 100$) for these jurisdictions where the failing dams were located. The probabilities for the other jurisdictions are either low, if they have dams, or nonexistent if they are not vulnerable to the hazard.

McNew Lake Dam, located within the Village of Hartsburg, is not currently considered to pose much of a threat for a number of reasons, according to village officials. Physically, the dam has a wide base with a low angled slope; a metal culvert, approximately 3 feet wide, allows for overflow. Driving is not allowed on top of the dam. The dam owner is responsible in maintain the dam and cooperates well with the City Council.

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

Changing Future Conditions considerations

The future of climate change on dam failure is largely tied to future precipitation events. Since precipitation is predicted to increase in the future with potential for more vigorous rainfall events, this creates an elevated risk of flooding and pressure on dams and spillways to handle the extra water amounts. This elevated pressure brings about the importance for regular inspections and maintenance, as well as the need for engineering with higher flood levels in mind.

VULNERABILITY

VULNERABILITY 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.

Fifty-two (52) dams in Boone County are considered to pose a high hazard should there be a dam break. Of these dams, forty-one (41) of them are not regulated by the state and thus not subject to inspection requirements. The Missouri State Hazard Mitigation Plan (2007) quoted Jim Alexander, chief engineer for the DNR's Dam Safety Program, who says that many of the non-regulated dams have gone without inspections for years. "There are accidents out there waiting to happen," he notes.

The Dam Inventory for the state of Missouri was compiled in the late 1970's to early 1980's. Of the High Hazard dams in Boone County, 31 are non-regulated. Only half of those 31 non-regulated 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 non-regulated High Hazard dams have been inspected, not counting the ones that were never inspected. Second, because these are *non-regulated* 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. Non-regulated 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 non-regulated 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 dam is listed as High Hazard according to the state database, but according to 2009 aerial imagery they no longer exist or hold water: Moon Valley Lake Dam (non-regulated)

McNew Lake Dam, located within the Village 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.

Hallsville has both a non-regulated high hazard dam and a non-regulated significant hazard dam within its corporate boundaries. Centralia has a non-regulated low hazard dam just at the edge of the city; it would drain towards Centralia if a failure would occur.

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. Again, inundation information is not available to accurately quantify vulnerability.

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

Potential Impact – Life

There is the very real danger of injury or loss of life with a dam failure event. This threat is recognized and built into the dam classification system.

Potential Impact - Existing Structures

The potential impact on structures downstream from a dam failure directly correlates to the amount of water and/or debris that is behind the dam. As previously discussed, it is important to take into account the age of the data that has been compiled on state regulated and non-regulated dams in the county and in the state. Because data on non-regulated 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.

The downstream areas and parcels within a half mile of the State Hazard Class 1 dams and a number of the State Hazard Class 2 dams in the planning area have been mapped (Figures 3.21A-K). All figures were created using the same scale.

Table 3.30A		
Location Guide for Aerial View Maps of High Hazard Dams		
Map ID #	Dam Name	Figure 4.37
103	B & C Subdivision Dam	C
20	BOCO Mo Dam	J
32	Cedar Lake Dam	C
22	Columbia Municipal Golf Course Lower Dam	I
33	Columbia Municipal Golf Course Upper Dam	I
118	Demarco Lake Dam	D
28	Fairview Lake Dam	F
31	Hagan Lake Dam	K
107	Highlands Lake Lower Dam	B
27	Hulen Lake East Dam	F
14	Hulen Lake West Dam	F
115	Lake Champetra Dam	D
1	Lake Chateau Dam	G
74	Lake Cyrene Dam	K
104	Limerick Lake Dam	I
128	McNew Lake Dam	L
36	Moores Lake Dam	E
3	Philips Park Lake Dam (Perry Philips Dam)	G
76	Shady Lake Dam	E
35	Stephens Lake Dam	H
97	Waters Edge Estates Lake Dam	K
17	Welch Lake Dam	K
7	Windmiller Dam #1	B
95	Windmiller Dam #2	B
79	Woodrail Lake Dam	I

Figure 3.21A

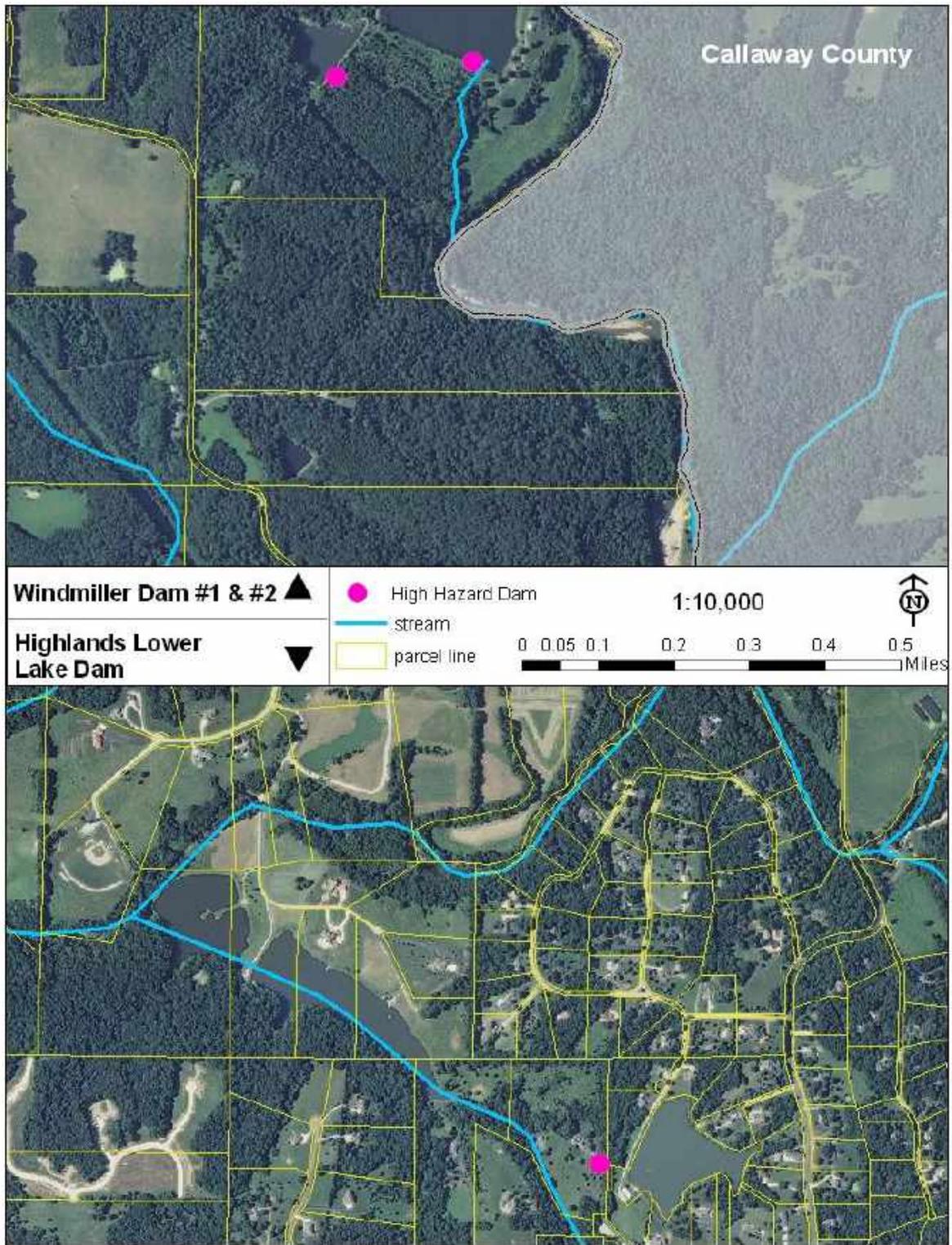


Figure 3.21B



Figure 3.21C

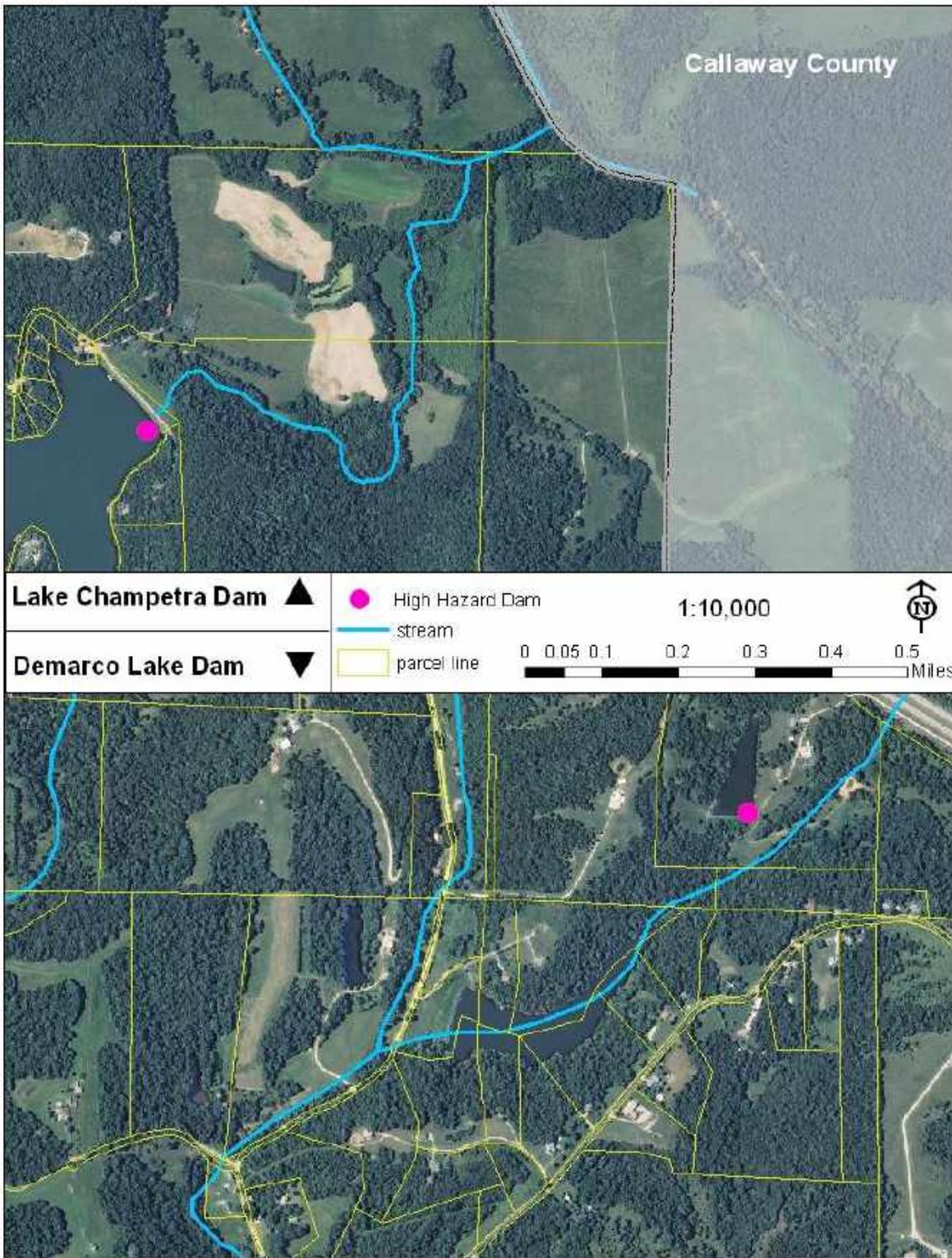


Figure 3.21D

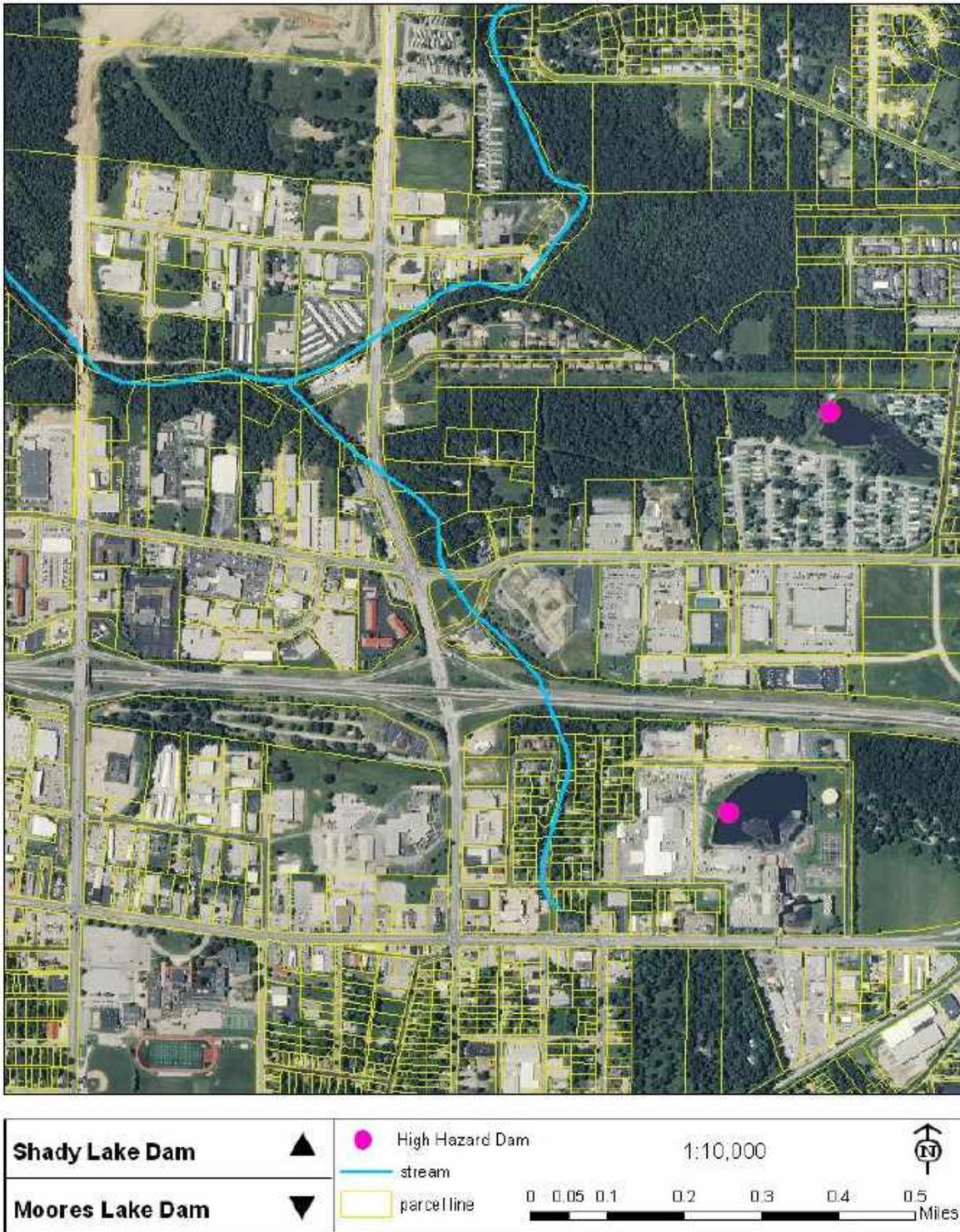


Figure 3.21E

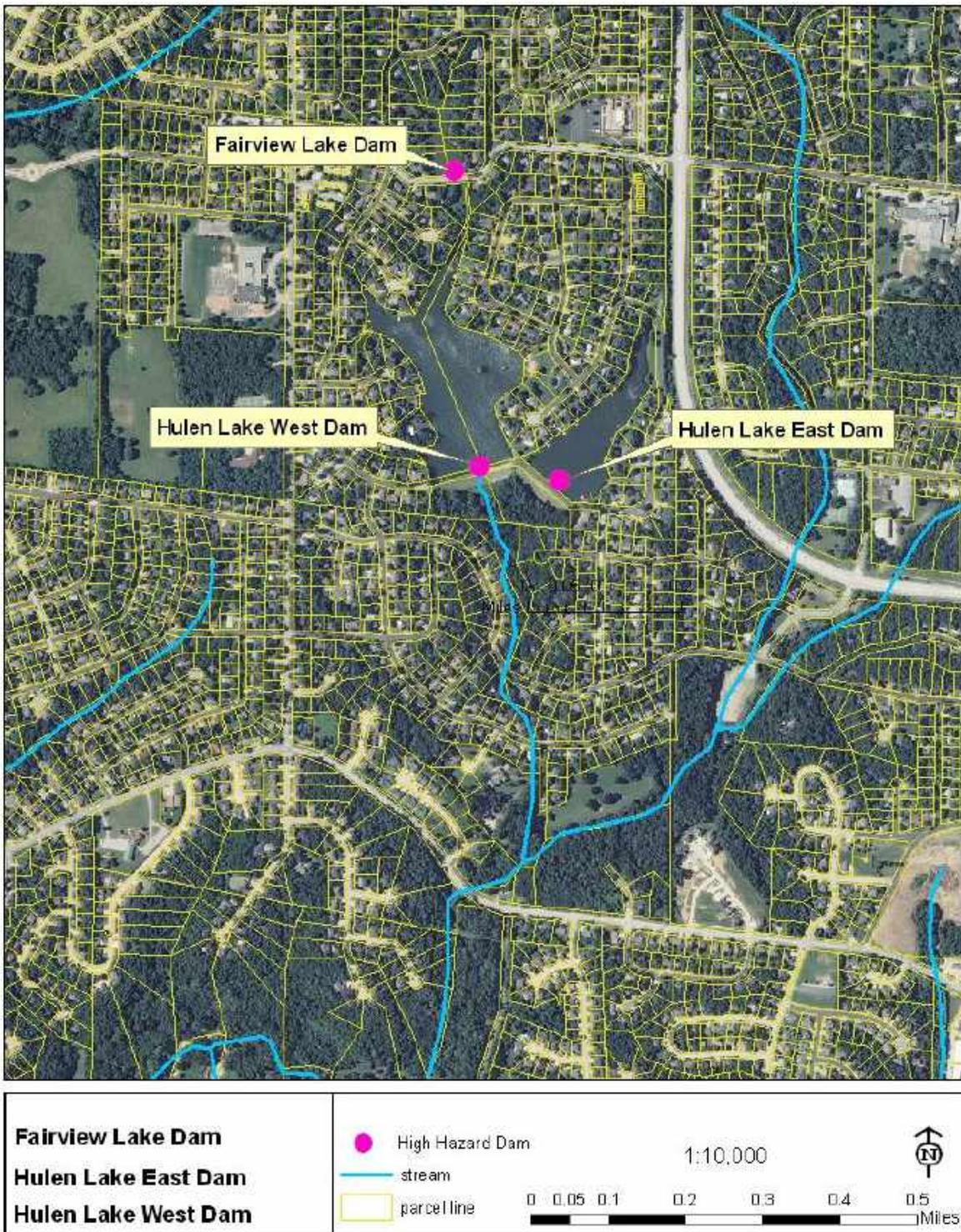


Figure 3.21F

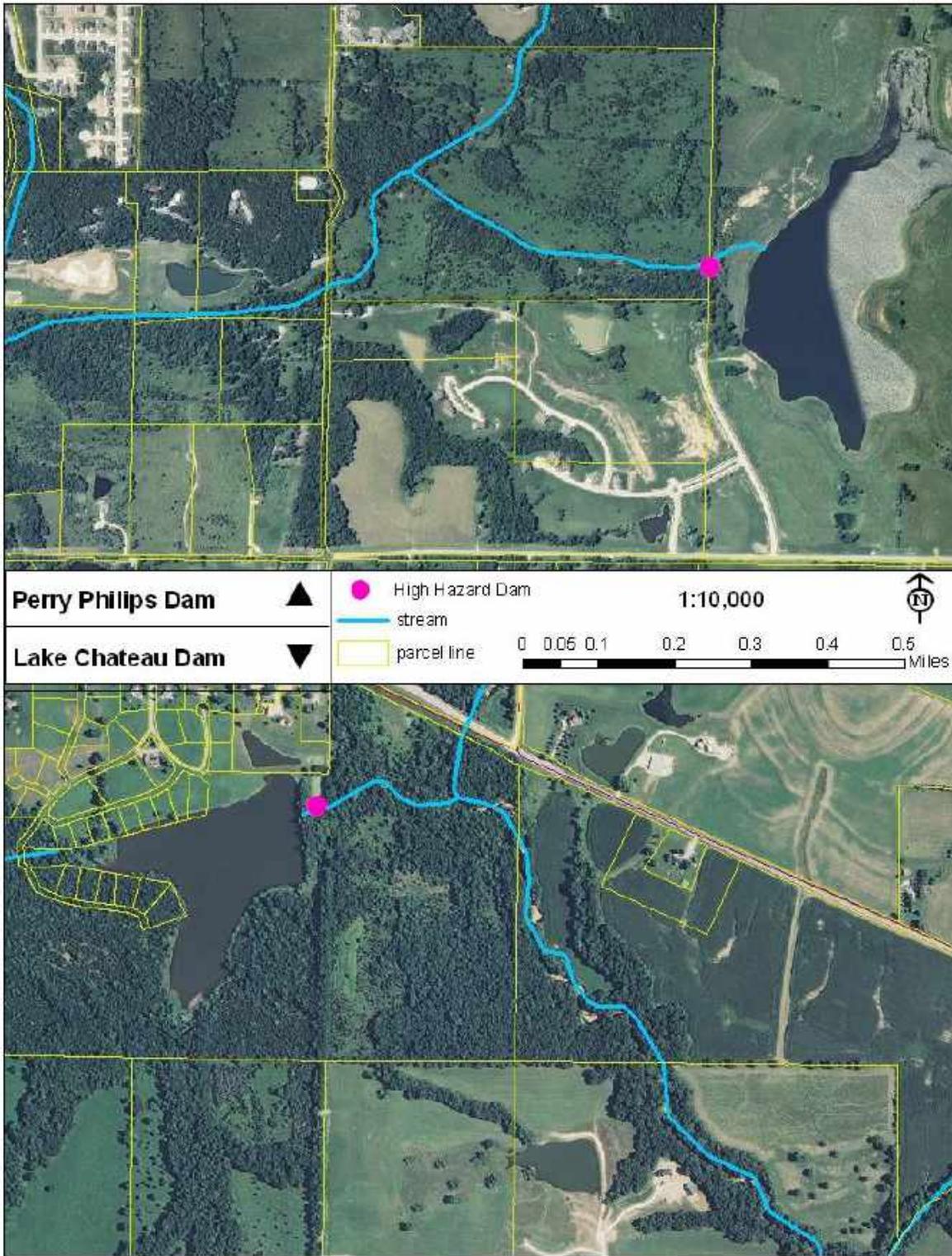


Figure 3.21G

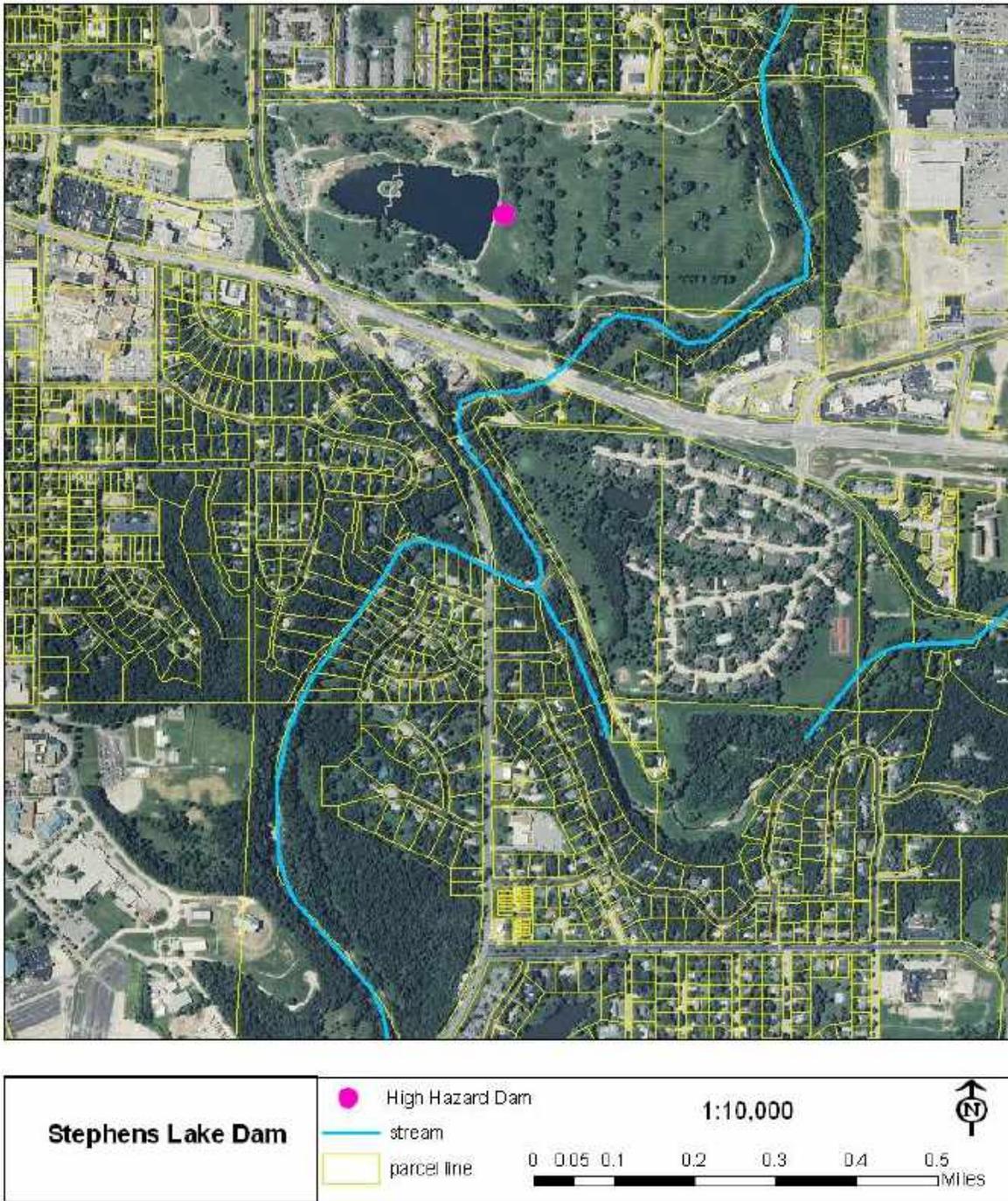


Figure 3.21H

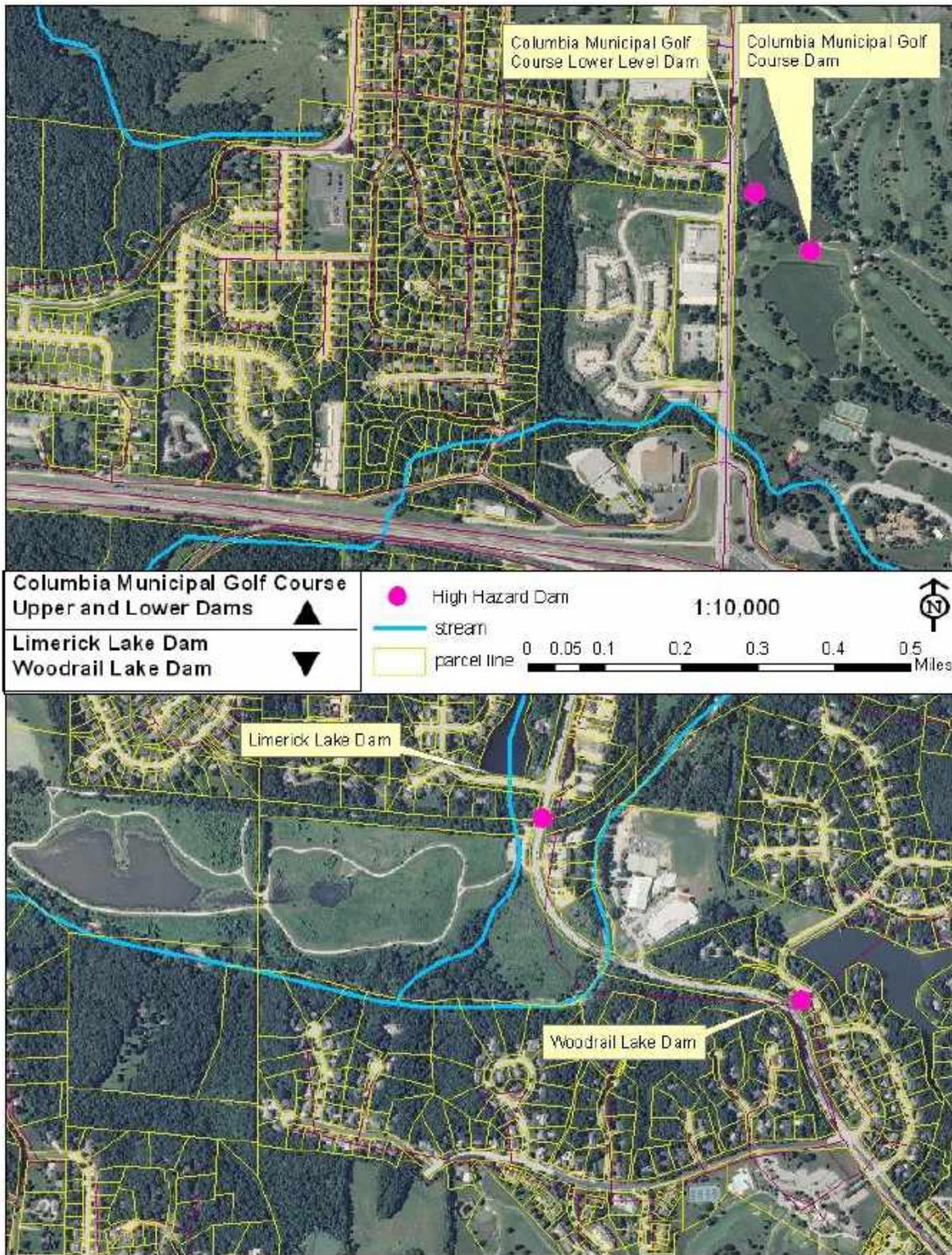


Figure 3.21I

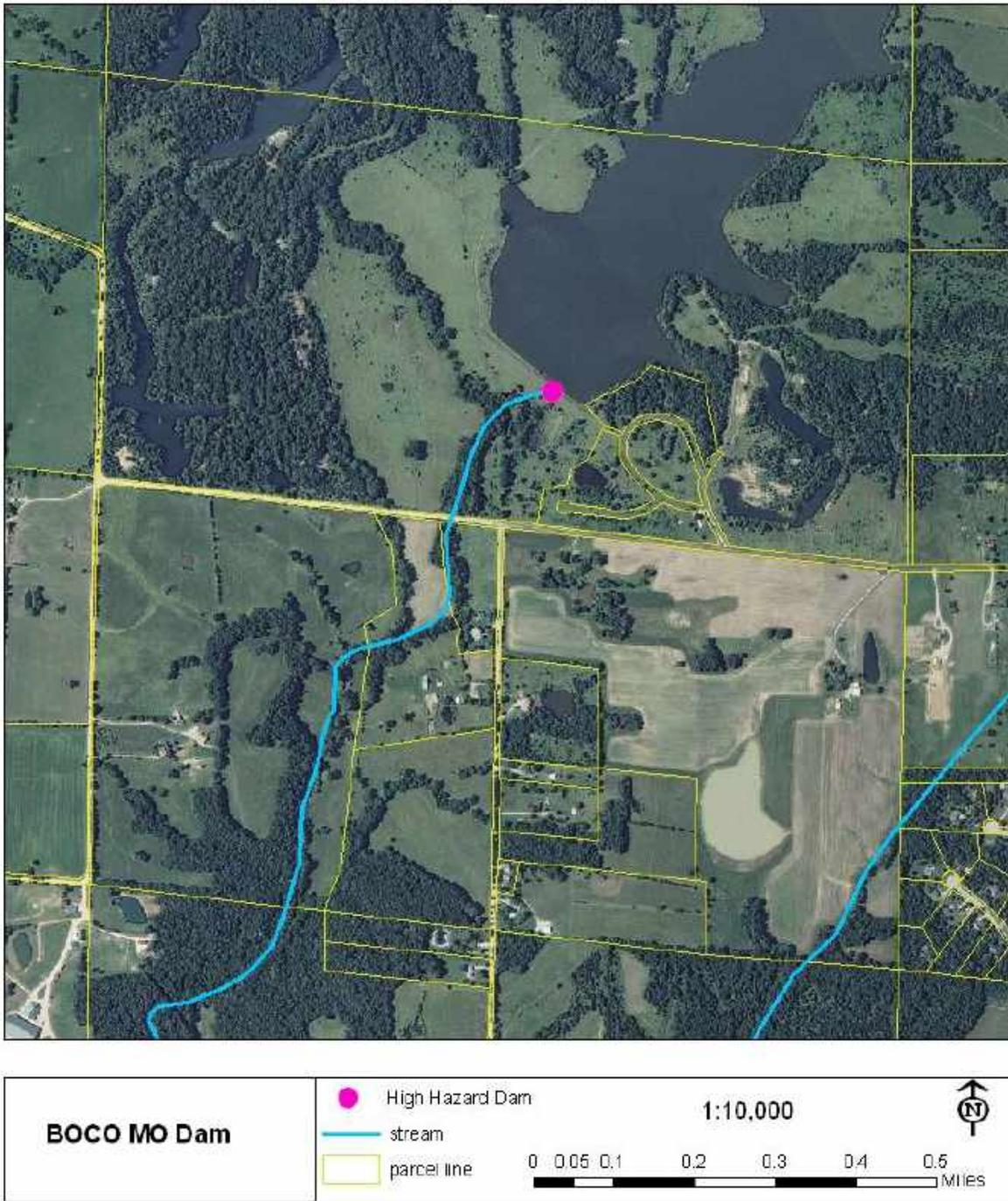


Figure 3.21J

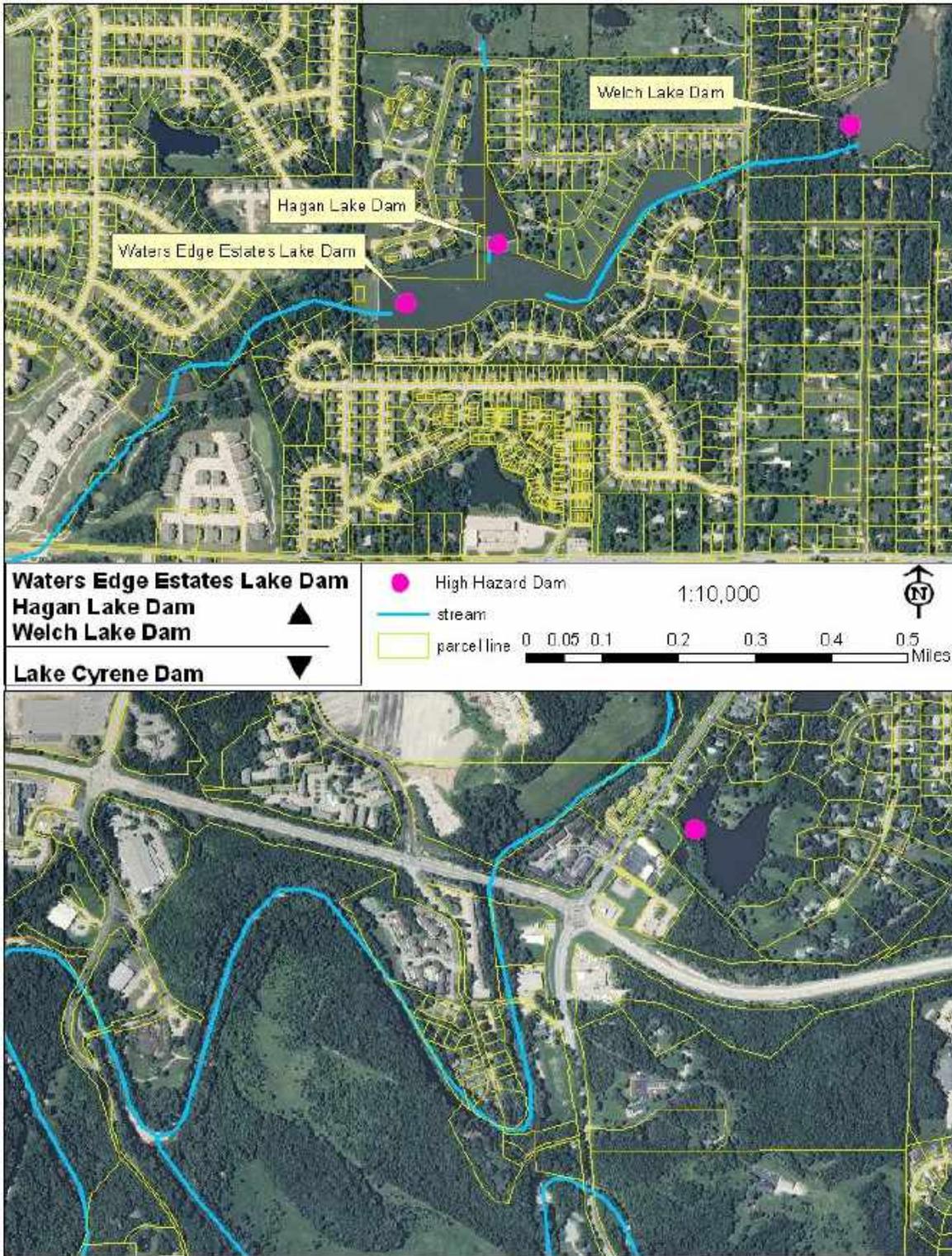
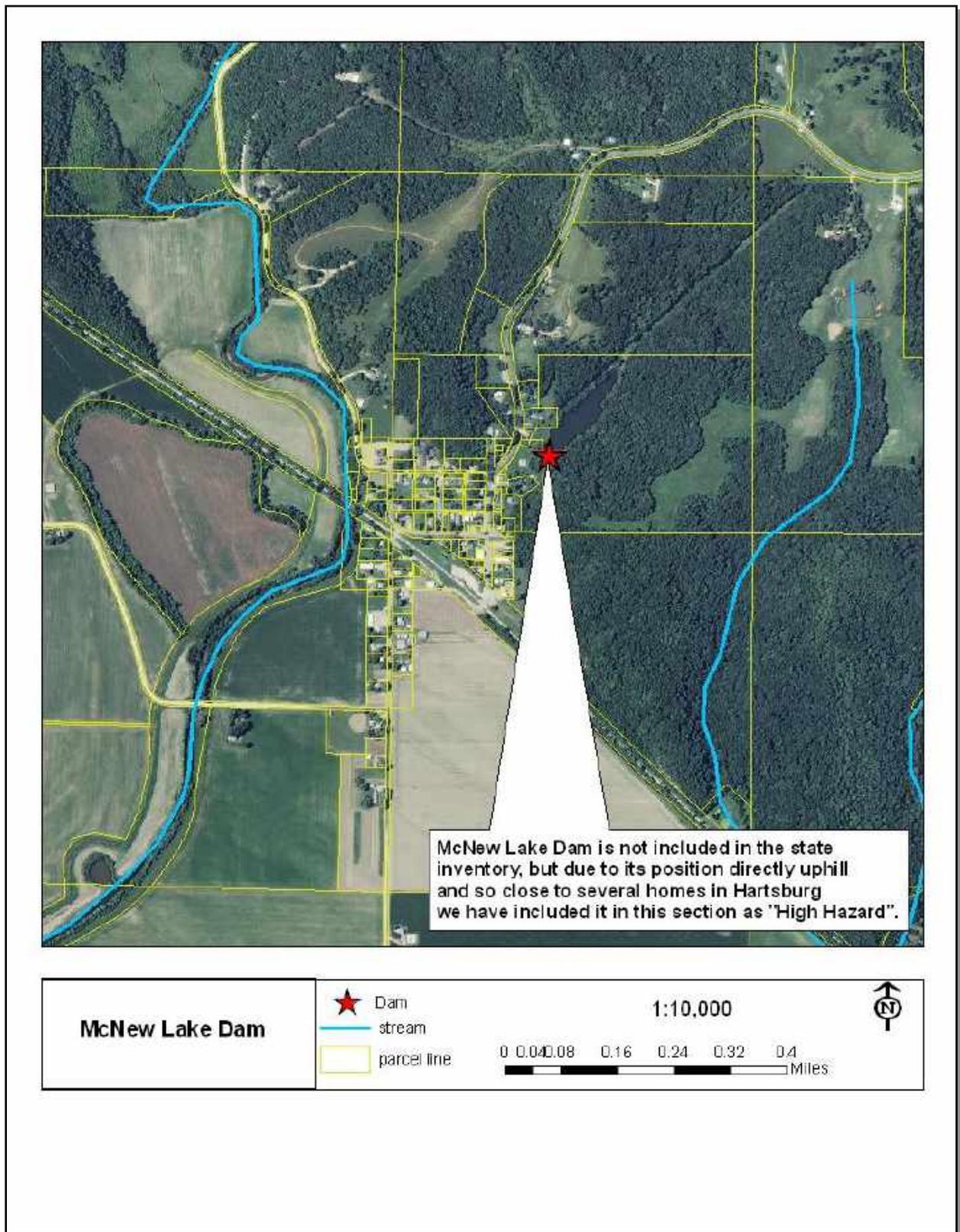


Figure 3.21K



Impact - Future Development

Since many dams in Boone County are privately owned and not regulated by the state, the dangers of development below aging or unsafe dams is an issue that needs to be addressed. If development occurs without knowledge of a potentially unsafe dam upstream, both lives and the development are put in jeopardy.

Better information for the inundation areas of the state regulated high hazard dams will be available in the near future. Inundation studies are being carried out by the Natural Resources Conservation Service's Water Resources Center and Emergency Action Plans (EAPs) are being written for the dams; this project is nearing completion. Future federal funding of state dam safety programs will be linked to the completion of these EAPs for regulated dams. As of this update EAPs have been written for all of the state regulated high hazard dams in the planning area.

Existing Mitigation Activities

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

Boone County updated its subdivision regulations in May 2014 to include the following regulations on Dams:

Dams to be constructed in excess of 25 feet tall within or adjacent to any subdivision or development must be designed by a registered professional engineer and built in accordance with accepted engineering standards and existing dams shall be certified by a registered professional engineer as safe for inhabitants within or near the subdivision. Design and as-built drawings for any newly constructed dam in excess of 25 feet tall shall be submitted to the County engineer for permanent county records. Roads may not be constructed on dams except upon review and approval of the County engineer. Dams in excess of 35 feet tall shall be inspected and approved by the Missouri Department of Natural Resources or other governmental regulatory agency having jurisdiction prior to the issuance of any building permits for lots situated below the lake formed by such dam. The provisions for maintenance and supervision of common lands contained in this Appendix shall be applicable to all dams within or adjacent to subdivisions or developments when owned or controlled by the subdivider.

The provisions for maintenance and supervision of common lands referred to are found in Section 1.4 and read as follows:

When common land is to be included in or adjacent to a subdivision or development, a private trust agreement shall be recorded concurrently with the plat which shall provide for the proper and continuous maintenance and supervision of said common land by a trustee and payment for such maintenance and supervision by means of annual or more frequent assessments against lots and provision for assessment secured by assessment liens enforceable by foreclosure. No common land shall be dedicated to public use or otherwise conveyed to the public or any public agency or other public or private entity without recorded contractually binding agreement conferring financial responsibility and liability for maintenance and supervision of such common land with any such agency or entity.

The Dam Safety Program is offering to assist County Emergency Management Agencies who are interested in having EAPs written for non-regulated high hazard dams. If the county is able to

persuade dam owners to participate, Dam Safety Program personnel will attend a County-hosted meeting and explain the EAP template to the dam owners. It would then be the responsibility of the EMA to conduct follow up. Boone County has included an action in the mitigation strategy to promote the writing of these EAPs.

HAZARD SUMMARY BY JURISDICTION

The jurisdictions of Boone County, Centralia, Columbia, Hallsville, and Hartsburg are all vulnerable to dam failure. There are 126 known dams in the planning area; of these, only 17 are regulated by the state. (A dam must be 35 feet or higher to fall under state regulations.) The rest of the 126 dams do not fall under any regulatory authority.

Boone County, Columbia, Hallsville, and Hartsburg all have high hazard dams which would affect their jurisdictions if failure occurred. (The high hazard classification indicates the presence of permanent dwellings in the downstream environment and the probable loss of human life from dam failure.) The non-regulated dam situated on the city limits of Centralia poses less of a threat due to its downstream environment.

The Dam Safety Program of the Missouri Department of Natural Resources has been working with the owners of state regulated high hazard dams to develop Emergency Action Plans (EAPs). These plans are a great aid for local governments in planning for growth and development.

A major looming issue remains concerning the unregulated dams in the planning area. The data for unregulated dams in the DNR National Dam Inventory, including their ownership and hazard classification, dates back to the late 1970s and early 1980s. A high number of these unregulated dams are in Boone County and Columbia where the pace of growth and development is strong; their classifications may not accurately reflect current downstream conditions. In addition, there is a lack of knowledge of the physical condition and maintenance of these dams.

The DNR Dam Safety Program has offered to assist county governments in conducting meetings for owners of non-regulated dams who are interested or willing to develop EAPs. A mitigation action has been included in this plan for the jurisdiction of Boone County to follow up on this offer and work with the owners of these dams.

In 2014, Boone County updated its subdivision regulations to regulate the construction and maintenance of new dams greater than 25 feet in height located within or adjacent to new subdivisions or developments. These regulations will help mitigate the risk posed by some new dams in the future.

Problem Statement

Much like flash flooding, the risk in a dam failure to life and property comes from the sudden rush of water downstream. Development in the Columbia area and parts of Boone County pose the highest risk. Dams such as Hulen Lake Dam that have dense subdivisions built up around them threaten several structures and populations if a failure was to occur.

Many dams in the planning area are not regulated and inspections may be infrequent or not at all. Boone County already has regulations in place for new dams over 25 ft. Continued review of such regulations and making sure that businesses and residents downstream from such dams have access to any emergency plans that maybe available for the particular dam that could affect them.

EARTHQUAKE

Hazard Profile

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.

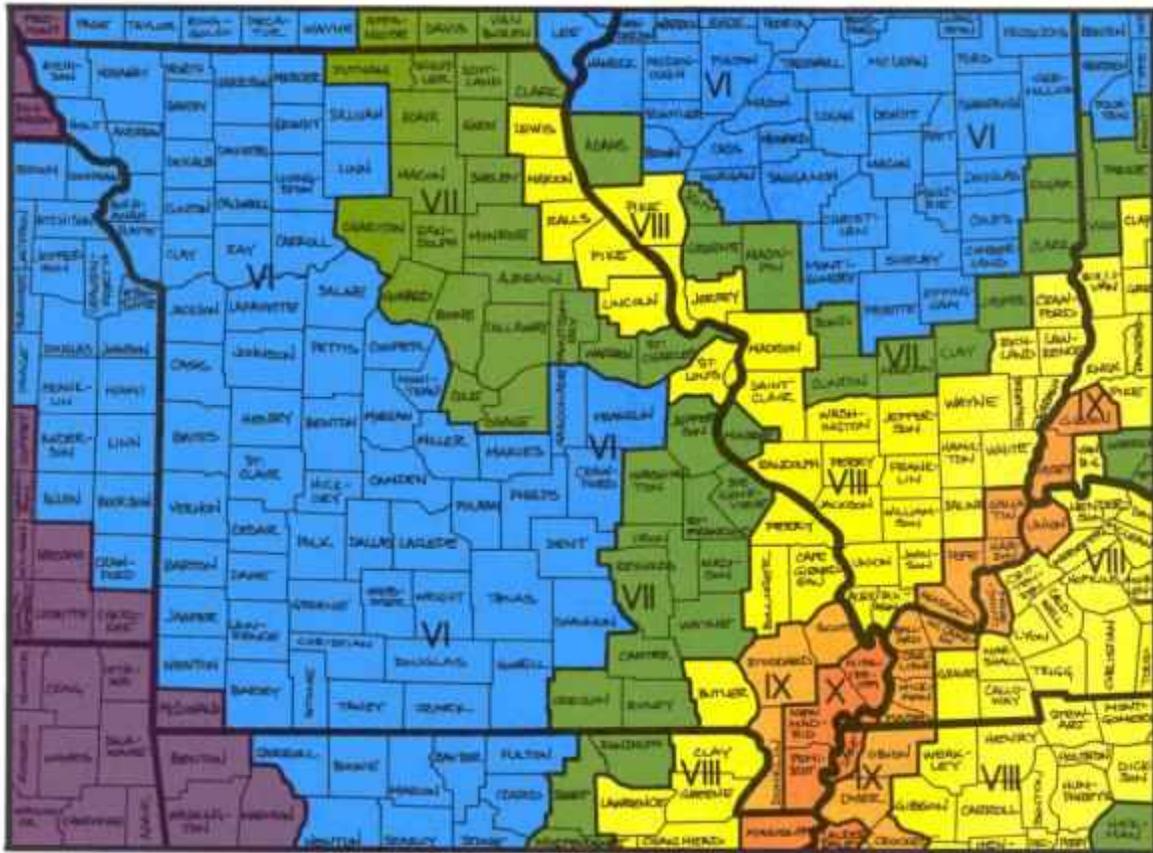
The New Madrid Seismic Zone (NMSZ), which runs through southeastern Missouri, is the most active seismic zone east of the Rocky Mountains. Any hazard mitigation planning in Missouri must, of necessity, take possible earthquakes into account.

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.

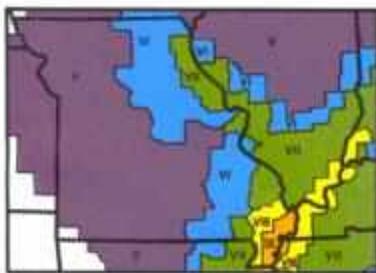
Geographic Location

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. While the Nemaha Ridge runs through Kansas and Oklahoma seismic activity along this ridge does not overly impact the planning area.

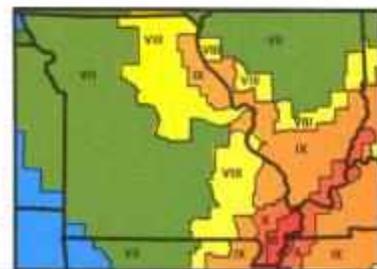
Figure 3.22: Seismic Zones



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.

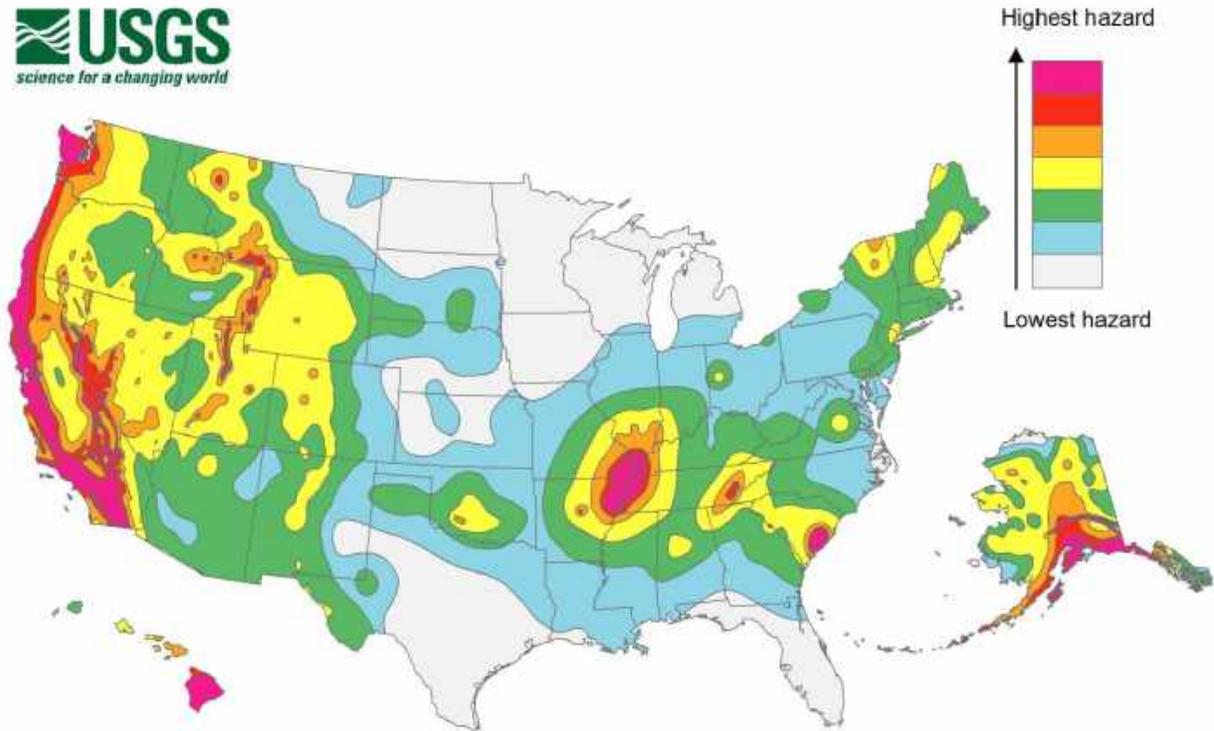
Source: https://sema.dps.mo.gov/docs/EQ_Map.pdf

Figure 3.23: Projected Earthquake Intensities

Figure 4.38	
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-favourable conditions. Dishes and windows may break and large bells will ring. Vibrations like large train passing close to house.
VI. Strong	Felt by all; many frightened and run outdoors, walk unsteadily. Windows, dishes, glassware broken; books fall off shelves; some heavy furniture moved or overturned; a few instances of fallen plaster. Damage slight.
VII. Very Strong	Difficult to stand; furniture broken; damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken. Noticed by people driving motor cars.
VIII. Destructive	Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture moved.
IX. 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	

The below map shows the seismic hazards across the United States. The planning area located in the center of the United States is included in zone VII, which is displayed in green.

Figure 3.24: United States Seismic Hazard Map



Source: United States Geological Survey at https://earthquake.usgs.gov/hazards/hazmaps/conterminous/2014/images/HazardMap2014_1g.jpg

Strength/Magnitude/Extent

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. 4.0).

Earthquakes along the New Madrid Seismic Zone with magnitudes around 6.0 or greater would be of concern for the planning area.

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.

While there have been no large-scale earthquakes felt in the planning area in more than 200 years there are a multitude of shocks undetectable by anything other than special equipment that emanate from the New Madrid region many times throughout the year, but they are so minor they cannot be felt in the planning area.

Probability of Future Events - Moderate

It is difficult to predict the probability of an earthquake occurring along the New Madrid Seismic Zone which would be significant enough to affect the planning area. The following information from MO DNR helps to illustrate why this is difficult:

The active faults in the NMSZ are poorly understood because they are not expressed at the ground surface where they can be easily studied. The faults are hidden beneath 100- to 200-foot thick layers of soft river deposited soils called alluvium.

Microseismic earthquakes (magnitude less than 1.0 to about 2.0), measured by seismographs but not felt by humans, occur on average every other day in the NMSZ (more than 200 per year).

Active faults that have generated dangerous earthquakes in historic times or the recent geologic past (the last 10,000 years) are not always microseismically active. In fact, in some settings these quiet faults are considered the most dangerous ones because high built up stress has locked the two sides of the fault together thereby preventing the microseismic earthquakes. This is thought to happen as a prelude to a major rupture of the fault. It is not known if faults of this type exist in the NMSZ. If they do exist there is no easy way to locate them.

If one looks strictly at the historical record for earthquakes of 6.5 magnitude or greater, there have been 2 years (1811 and 1812) out of the last 209 years in which such earthquakes have occurred. This equals less than 1% probability in any given year ($\text{Probability} = \frac{2}{209} * 100 = 0.95\%$). However, there were many serious quakes in just the two years of 1811 and 1812, according to MO DNR.

In 2002, U.S. Geological Survey (USGS) and the Center for Earthquake Research and Information (CERI) at the University of Memphis released the following expectations for earthquakes in the NMSZ 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 information provided by MO SEMA, the above expectations can be translated into the following likelihoods for a given year in the 50 year period:

- 1.0-1.6% likelihood of a magnitude 6.0 and greater earthquake
- 0.28-0.40% likelihood of a magnitude 7.5-8.0 earthquake

Since a magnitude 6.0 earthquake would affect the planning area (see Figures 4.38-4.39 for an estimate of the effects in the planning area of a 6.7 earthquake in the NMSZ), the probability has been determined to be moderate.

Vulnerability

Vulnerability Overview

Severity: High

Potential Impact - Existing Structures

The intensity of an earthquake refers to the potentially damaging effects of a quake at any particular site. An earthquake of a specific magnitude will have different intensities depending on a location’s distance from the epicenter of the quake, intervening soil type, and other factors.

Intensity is measured by the Modified Mercalli Intensity Scale (MMI) and expressed by a Roman numeral (Figure 3.23).

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.

The pertinent information for Boone County is summarized in Table 3.31.

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

In 2008, the Mid-America Earthquake Center mapped the expected probability of at least moderate damage to electric power facilities from a 7.7 magnitude earthquake in the NMSZ;

Missouri State Hazard Mitigation Plan (2013) Analysis: Specific modeling of damage and loss from earthquake scenarios has been conducted for the state using HAZUS 2.1 software; the findings are included in the *Missouri State Hazard Mitigation Plan (2013)*. HAZUS software is used by FEMA to compare relative risk from earthquakes and other natural hazards.

The earthquake vulnerability analysis in the *MO State Hazard Mitigation Plan (2013)* used demographic data based on the 2010 Census; site-specific essential facility data was based on the 2011 HSIP inventory data. Two types of analysis were done:

Annualized Loss Scenario based on eight earthquake return periods (100, 200, 500, 750, 1000, 1500, 2000, and 2500 years)

2% Probability of Exceedance in 50 Years Scenario – a “worst case scenario”

Annualized Loss Scenario

The *MO State Hazard Mitigation Plan (2018)* explains the annualized loss scenario as follows:

HAZUS defines annualized loss as the expected value of loss in any one year. The software develops annualized loss estimates by aggregating the losses and their exceedance probabilities from the eight return periods. Annualized loss is the maximum potential annual dollar loss resulting from various return periods averaged on a ‘per year’ basis. It is the summation of all HAZUS-supplied return periods multiplied by the return period probability (as a weighted calculation).

Table 3.32 Hazus-MH Earthquake Loss Estimate: Annualized Loss Scenario

County	Total Losses, in \$ Thousands	Loss Per Capita, in \$ Thousands	Loss Ratio, in \$ Per Million
Boone	\$552	\$0.0034	\$30

The building inventory in Boone County is both relatively large and high in value so there is the potential for costly damage even at a considerable distance from the New Madrid Fault. However the percentage of buildings sustaining damage and/or the level of damage sustained would be much lower than in a county adjacent to the fault. The loss ratio reflects this and gives an indication of both the potential economic impact of an earthquake and the difficulty of recovery in the county. Boone County is better equipped to deal with the economic loss it would be expected to incur than most other counties in the state.

2% Probability of Exceedance in 50 Years Scenario

This analysis models a worst case scenario using a level of ground shaking recognized in earthquake design. The *MO State Hazard Mitigation Plan (2013)* gives the following explanation of the modeling:

The methodology is based on probabilistic seismic hazard shaking grids developed by the U.S. Geological Survey (USGS) for the National Seismic Hazard Maps that are included with HAZUS-MH. The USGS maps provide estimates of peak ground acceleration and spectral acceleration at periods of 0.3 second and 1.0 second, respectively that have a 2% probability of exceedance in the next 50 years. The International Building Code uses this level of ground shaking for building design in seismic areas. This scenario used a 7.7 driving magnitude in HAZUS-MH, which is the magnitude used for typical New Madrid fault planning scenarios in Missouri. While the 2% probability of exceedance in the next 50 years ground motion maps incorporate the shaking potential from all faults with earthquake potential in and around Missouri, the most severe shaking is predominately generated by the New Madrid Fault.

Table 3.33 HAZUS-MH Earthquake Loss Estimation 2% Probability of Exceedance in 50 Years Scenario Direct Economic Losses

County	Cost Structural Damage	Cost Non-Structural Damage	Cost Content Damage	Inventory Loss	Loss Ratio	Relocation Loss	Capital Related Loss	Wage Losses	Rental Income Loss	Total Loss
Boone	\$47,799	\$129,199	\$44,304	\$679	0.96	\$29,990	\$11,430	\$15,490	\$14,373	\$293,265

It can be seen that in the modeling of a “worst case scenario”, Boone County’s loss ratio and loss ratio rank get higher. In addition, Boone County moves to the #19 rank in estimated building damage in actual dollars.

The modeling suggests that damages from a worst case scenario earthquake in the NMSZ (7.7 magnitude) would be greater in Boone County than the Modified Mercalli map of Missouri suggests. Caution indicates that mitigation and preparedness be focused on the most conservative estimates (in this case, those which predict greater injury and damage) unless these have been shown to be incorrect.

Even a significant earthquake event in the NMSZ which does not cause great damage in Boone County could still very possibly cause cascading economic losses in the county. There is the very real potential for disruption of road and rail traffic to the eastern part of the state, including the metropolitan area of St. Louis. Regions of the state outside of the severely damaged areas would probably be called upon for emergency and recovery assistance.

Potential Impact - Life

The potential for loss of life goes up as the magnitude of the earthquake goes up. Areas with a high rate of older or historical structures with construction methods not designed to withstand such an event pose a higher risk for loss of lives that work or live within such buildings.

The potential for “emotional aftershocks” exists with any earthquake event. Major earthquake events require mental health services for people dealing with loss, stress, anxiety, fear, and other difficult emotions. Even a smaller quake, however, has the potential for emotional repercussions; the sudden movement of something experienced as stable for one’s entire life (the earth itself) can be very traumatic.

Potential Impact - Future Development

The standards followed in new construction will impact vulnerability to earthquake damage. Building new structures according to more stringent earthquake resistant codes will lessen the potential damage should an earthquake occur, just as poor construction will increase vulnerability. However, this type of mitigation activity may not be cost effective for many communities.

Hazard Summary by Jurisdiction

Boone County, Ashland, Centralia, Columbia, Hallsville all have building codes so there is a mechanism whereby earthquake resistant codes could be put in place. The Boone County Building Code does cover building earthquake resistant structures.

Columbia has a large quantity of historical buildings and multi-story buildings that could be vulnerable to larger magnitude earthquakes. Infrastructure damage to roads would cause transportation backups that could impact much farther from the planning area.

School Districts - The Revised Statutes of MO, Section 160.451 require that:

The governing body of each school district which can be expected to experience an intensity of ground shaking equivalent to a Modified Mercalli of VII or above from an earthquake occurring along the New Madrid Fault with a potential magnitude of 7.6 on the Richter Scale shall establish an earthquake emergency procedure system in every school building under its jurisdiction.

All educational institutions in Boone County are subject to these statutory requirements and must provide training and exercises to students in preparation for a large earthquake. This is implemented throughout the county.

Public Information - 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 Bridges - All county bridges are inspected by the MODOT on a 2-year cycle; if an earthquake impacted the planning area, MODOT would be in charge of county bridge inspection post-earthquake.

State-funded buildings - RSMo Section 319.200 requires that, for “cities and counties subject to earthquake”, all state-funded buildings built after January 1, 2000 must “comply with the standards for seismic design and construction of the 1990 or later edition of either the uniform building code or the building officials and code administrators code.” (The statute established a percentage schedule for state-funded buildings constructed between January 1, 1994 and December 31, 1999 which were also subject to this requirement.) As a result of this statute, many of the newer buildings at the University of MO are built to seismic standards.

PROBLEM STATEMENT

The entire planning area is vulnerable to the risk of damage from an earthquake in the New Madrid Seismic Zone (NMSZ) located in southeastern Missouri. Boone County is one of 46 “critical counties” where school districts are required by state law to establish earthquake emergency procedure systems in every school.

Studies and predictions indicate that there would be significant damage to poorly built structures in the planning area from a 7.6 magnitude (Richter) quake in the NMSZ. In addition to structural damage, and possible injury/loss of life, the planning area could be affected by an influx of people needing sheltering, disruption of the flow of goods, calls for assistance from other areas, and the psychological traumatization of the population.

There is extensive ongoing education and preparation in the planning area for the possibility of an earthquake event.

LAND SUBSIDENCE/SINKHOLES

HAZARD PROFILE

HAZARD DESCRIPTION

“Land subsidence is a geological hazard caused by the sinking of the earth’s surface due to the movement of earth materials below the surface. This sinking can be sudden or gradual and is generally attributed to the removal of subsurface water or the draining of organic soils. In Missouri, subsidence is primarily associated with sinkholes but they can also occur from void space left by mining and natural caves.” (*MO State Hazard Mitigation Plan, 2018*)

Gradual or sudden land subsidence is a key sign of sinkhole formation. The Boone County Stormwater Design Manual distinguishes between two types of sinkholes associated with karst topography:

- Depression sinkholes which have a defined drainage area and are generally shown as closed contours on a topographic map; best management practices are required to protect groundwater when runoff from development drains into these areas
- Collapse sinkholes are areas of “karst-related subsidence with no defined drainage area when occurring outside of a depression sinkhole. Collapse sinkholes can occur in the bottom of a depression sinkhole and are commonly referred to as the ‘eye’ of the sinkhole”

Construction excavation and well drilling can also cause sinkholes, according to the Missouri Department of Natural Resources (DNR).

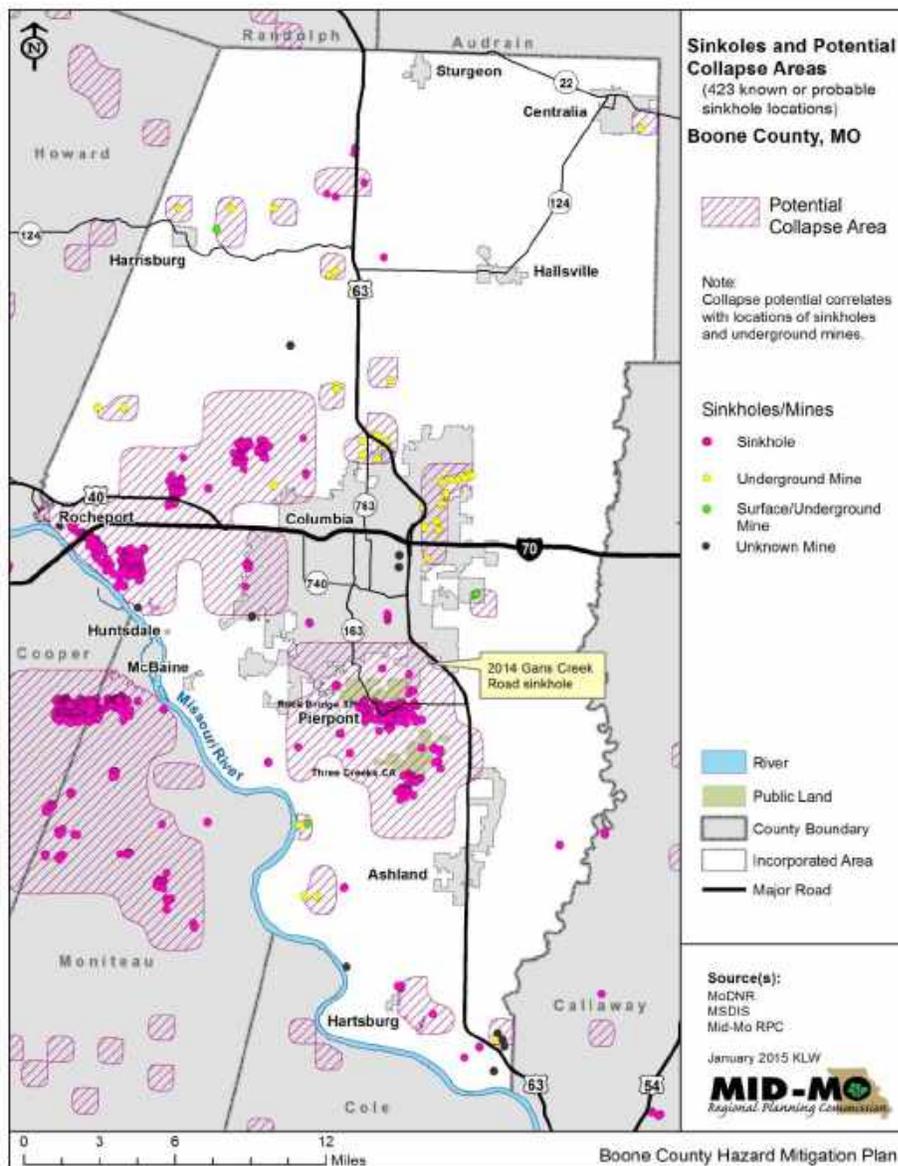
In addition to being at risk for land subsidence and sinkhole collapse associated with karst topography, the planning area is at risk from land subsidence/collapse associated with underground mining and exploratory drilling for petroleum.

Location

There are 397 known sinkholes in the planning area. The karst areas of the Ozark Highlands in the western and southern sections of the planning area (Figure 2.3) are where the majority of sinkholes are located (Figure 3.26). Large clusters exist southeast of Rocheport and to the northwest and south of Columbia. Eight known sinkholes are located within the city limits of Columbia.

The MO DNR has mapped potential collapse areas around the known sinkholes and underground mines (Figure 3.26). These may not be the only potential sinkhole collapse areas however; further development may bring to light previously unknown sinkhole areas in the karst regions and also more abandoned underground mines.

Figure 3.26



The potential for collapse from underground mining is primarily in the northern part of Boone County and associated with coal fields (Figure 3.27). Prior to larger open pit mining activities in Boone County, there were numerous “Mom and Pop” underground coal mining operations; these were small mines using a series of tunnels and pillars. There are 200 known mining locations in the planning area.

Figure 3.27



Source: MO DNR

There is very little documentation on where these operations were located; they do not appear, for the most part, on the collapse potential areas mapped by the DNR (Figure 3.26). In 2011, the Missouri Geological Survey (MO DNR) received funding from the Department of the Interior’s Office of Surface Mining to “investigate, collect and scan maps of underground coal mines to make the national inventory of Missouri mine lands as complete as possible.” They solicited the public’s help in finding old mine maps which might be kept in family records through public announcements, including a YouTube video.

In addition to coal mines, there were also test holes for petroleum drilled in northern Boone County in the Browns Station Anticline (Figure 2.2) and a few underground lead mines in the southern part of Boone County.

Strength/Magnitude/Extent

Sinkholes can vary “from a few feet to hundreds of acres and from less than one to more than 100 feet deep,” according to the USGS.

There have been 15,981 sinkholes identified in the State of Missouri. One hundred and sixty sinkhole collapses examined by the MO Department of Natural Resources between 1970 and 2007 were less than 10 feet in diameter and less than 10 feet deep. However, there were also some very large collapses within the state: one collapse drained a lake near St. Louis, one drained a sewage lagoon in West Plains, and one in Nixa swallowed a garage with a car in it.

Petroleum drill holes such as found in northern Boone County could be the cause for a localized collapse; one would not want to set a foundation on top of one of them.

Previous Occurrences

There is ample evidence of sinkhole collapse in the planning area but most of it is on public land or in less developed areas. A hiking trail in Rockbridge State Park, located south of Columbia, winds its way around collapsed sinkholes; it is aptly named “The Sinkhole Trail”.

A sinkhole collapse in the planning area did impact the built environment. On May 12, 2014, a sinkhole collapsed a roadway in southern Columbia (see labeled location on Figure 4.45). East Gans Creek Road between Ponderosa St. and Discovery Parkway was closed for a day by the Columbia Public Works Department for evaluation of the sinkhole and repair of the roadway.

Engineers from the Public Works Department measured the sinkhole at about 6 feet in diameter and 8 feet deep and assessed its formation as due to the karst topography in the area. There were no buried utilities under the section of roadway and storm water under the roadway did not appear to be a causative factor. The sinkhole was filled with concrete and rock before the road was repaired.

Probability of Future Occurrences

High – Boone County, Columbia

Low – Ashland, Centralia, Hartsburg, Rocheport

Not applicable - All other participating jurisdictions

In the last 20 years there has been one major sinkhole collapse that impacted the planning area. ($1/20 * 100 = 5\%$) If all sinkhole collapses were documented a much higher rate of collapse would be reflected, but many collapses are either minor and go unnoticed or are in areas that are unpopulated and impact little. New analysis and mapping by MO DNR indicates either close proximity to or overlap of potential collapse areas with the jurisdictions of Ashland, Centralia, Hartsburg and Rocheport. In Ashland, Hartsburg and Rocheport, the collapse potential is associated with known sinkholes; in Centralia, it is associated with underground mines.

The City of Rocheport is actually located completely within a mapped collapse potential area associated with a large number of sinkholes. However, according to information from the city, there is no known history of sinkhole collapse within Rocheport.

CHANGING FUTURE CONDITIONS CONSIDERATIONS

With expected rainfall events to happen more frequently and with higher intensity with climate change, instances of sinkhole collapse could go up in the planning area due to erosion from flooding and severe runoff exposing depressions below. Periods of rain followed by drought also elevate potential for sinkholes to open up with the fluctuating water table.

VULNERABILITY

VULNERABILITY OVERVIEW

Severity: Low to High

The planning area has 397 known sinkholes and 200 known mines dispersed across many jurisdictions. It is very difficult to predict the severity of a sinkhole collapse due to their great variance in size, varying speeds of collapse onset, and proximity to the built environment.

Potential Impact – Life

Sinkhole collapse poses a potential threat to human life; there have been numerous news stories in recent years of collapsing sinkholes swallowing up people. In 2013, a man hunting in southern Missouri lost his life when he stepped in a sinkhole which had possibly opened up due to recent heavy rain.

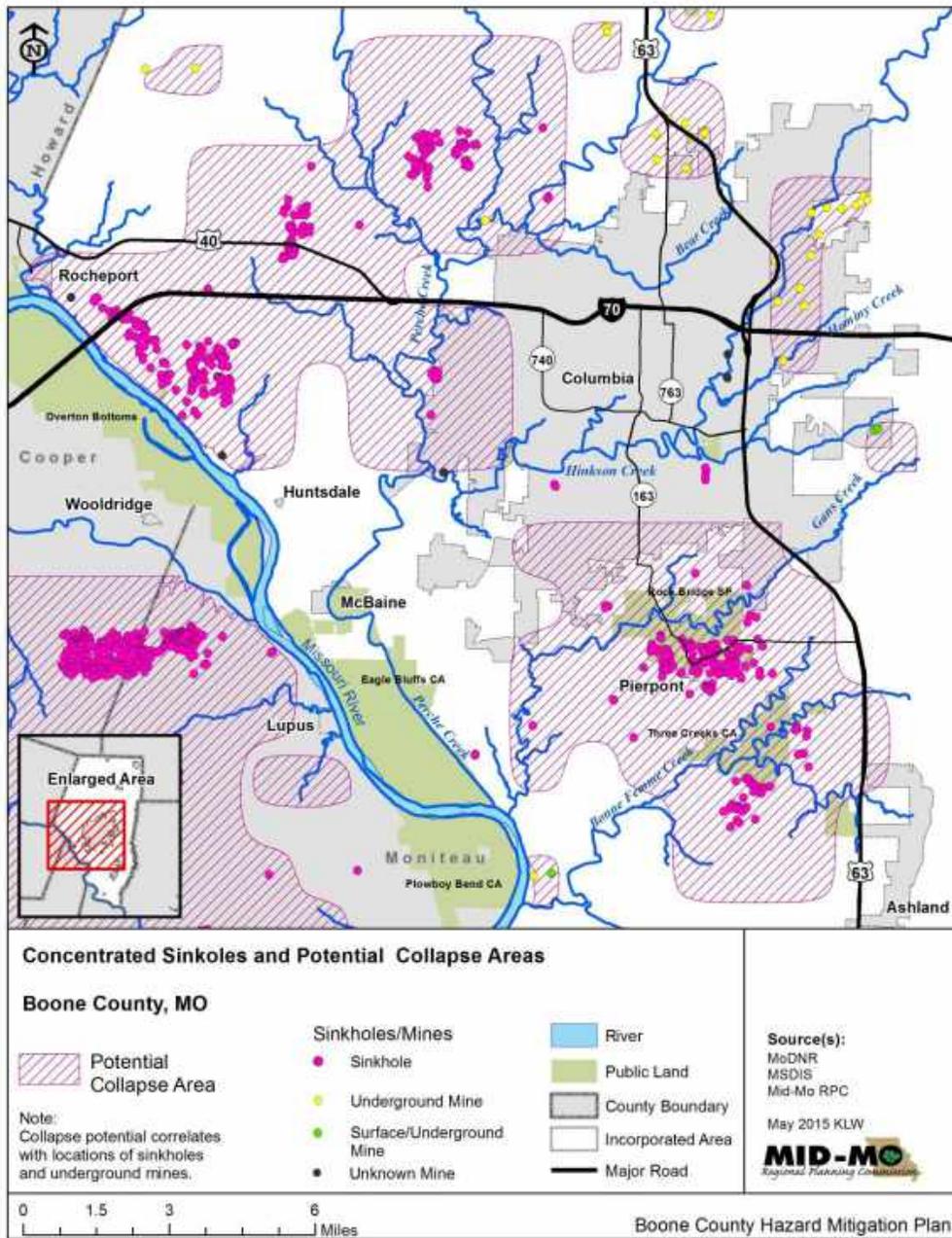
Sinkhole collapse potentially poses a threat to public health via contamination of the water supply. According to information from the Missouri DNR, a 1978 sinkhole collapse in southern Missouri drained the West Plains lagoon, resulting in sewage draining directly into underground water sources. More than 800 local residents reported illness and Mammoth Spring in Arkansas was contaminated.

According to the Boone County Stormwater Design Manual, groundwater in karst systems can move as much as a mile per day; this is contrasted to non-karst areas where groundwater may only move a few feet per year. Obviously, the potential for quick and widespread contamination of groundwater is a major concern in karst areas; “a contaminant may reach some springs or wells within a few hours after entering the groundwater system.”

Another characteristic of karst topography is the presence of losing streams. A losing stream is a surface stream with a direct connection to the groundwater in a local area; this connection has often been formed by the collapse of a sinkhole. According to the Stormwater Design Manual, “Protection of water quality in and near losing streams is critical for protection of groundwater quality in wells and springs.”

The proximity of clusters of sinkholes, and associated potential collapse areas, to losing streams in the planning area is shown in Figure 3.28.

Figure 3.28



Potential Impact - Existing Structure

Sinkholes vary in size and can potentially cause damage to roads, water/sewer lines, buildings, and lagoons. It is difficult to determine the potential impact of land subsidence and sinkholes on existing structures for a number of reasons:

There is a lack of data on historic damages caused by land subsidence and sinkhole collapse in Missouri.

Even with the mapping of known and possible sinkhole locations, it is difficult to predict where a sinkhole will collapse and if the collapse will be significant enough to damage any structures in the vicinity.

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

Potential Impact - Future Development

The threat of sinkhole collapse is poised to potentially become a more serious issue for Boone County and the city of Columbia. The areas to the south and west of Columbia had over 50% population growth in the period 2000-2010 (Figure 2.12). Much of this area is considered to have sinkhole collapse potential (Figure 4.46) and there is every reason to believe that the growth trend in these areas will continue.

Construction in these karst topography areas can cause shifts in soil, change drainage patterns, and promote the sinkhole formation. In addition, soil disturbance and changes in drainage patterns may lead to blockage of sinkholes and unforeseen flooding problems.

Hazard by Jurisdiction

The majority of the known sinkholes and potential collapse areas in the planning area are in unincorporated Boone County. The southern part of the planning area is especially vulnerable to this hazard due to the karst topography. Boone County adopted a new Stormwater Ordinance in 2010. The ordinance contains provisions that seek to mitigate the impact of construction on sensitive areas such as sinkholes. The ordinance requires a land disturbance permit for any land disturbance activity within a sinkhole.

A number of the mapped potential collapse areas overlap the boundaries of the City of Columbia. The presence of potential collapse areas in and around the City of Columbia (especially to the south, west, and north) is an important consideration for the jurisdictions of both Boone County and the City of Columbia due to vigorous growth and development in those areas.

Mapped potential collapse areas associated with known sinkholes also overlap the boundaries of a number of other jurisdictions. However, none of these jurisdictions have known sinkholes located within their boundaries.

- Ashland – There is a mapped potential collapse area in the northwest part of the city associated with a large number of known sinkholes.
- Hartsburg – There is mapped potential collapse area in the easternmost part of the city associated with known sinkholes to the north and southeast.

- Rocheport – The city is located within a potential collapse area associated with a large number of sinkholes to the southeast. However, according to city officials, there has never been a known collapse within the city.

PROBLEM STATEMENT

Boone County, Columbia, Ashland, Centralia, Hartsburg, and Rocheport are all vulnerable to land subsidence/sinkholes.

Sinkhole collapse in karst areas poses the threat of contamination of the groundwater over a wide region. The new Boone County Stormwater Ordinance, adopted in 2010, has put permitting regulations in place for any type of land disturbance within sinkhole areas.

Mapped potential collapse areas associated with underground mines exist in the northern part of the planning area. One of these areas lies adjacent to the southeast boundary of the City of Centralia and another within a quarter mile of the northern boundary of the Village of Harrisburg; others lie within the northern and northeastern parts of the City of Columbia.

The potential for land subsidence or collapse from underground mines in northern Boone County is greater than the current mapping would indicate. Historically, there were numerous small underground coal mining operations in the area but the locations of most of these operations are unknown.

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 through overuse of water which outpaces what the surrounding environment can naturally support (water use droughts). 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 (Figure 4.64). The most common type of drought in Mid-Missouri is the agricultural drought.

Table 3.34	
Drought Categories	
Agricultural	Defined by soil moisture deficiencies
Hydrological	Defined by declining surface and groundwater supplies
Meteorological	Defined by precipitation deficiencies
Socioeconomic	Defined as drought impacting supply and demand of some economic commodity

Source: *Missouri Drought Plan, 2002* (Mo DNR)

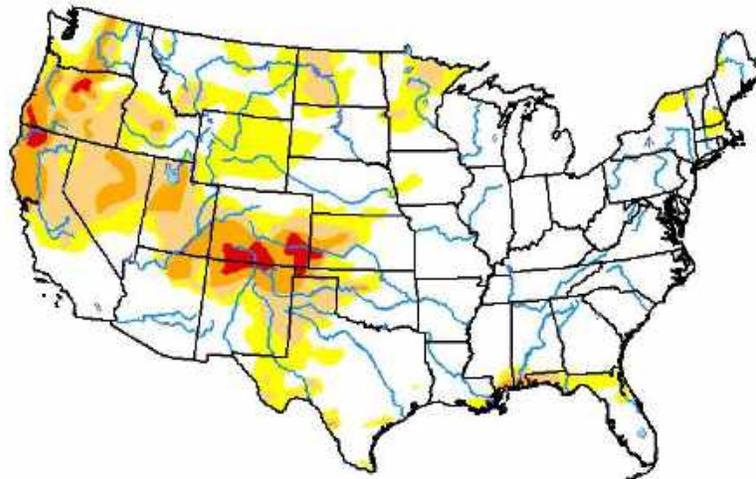
Geographic Location

The entire planning area is potentially at risk for drought. However, since agricultural drought is most common in Missouri, the unincorporated agricultural areas of Boone County are most at risk. Drought can mean crop failure in these areas and the resulting immediate, and potentially severe, economic loss.

Figure 3.29 U.S. Drought Monitor Map

**U.S. Drought Monitor
Continental U.S. (CONUS)**

June 2, 2020
(Released Thursday, Jun. 4, 2020)
Valid 8 a.m. EDT



Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <http://droughtmonitor.unl.edu/About.aspx>

Author:

Curtis Riganiti
National Drought Mitigation Center



droughtmonitor.unl.edu

Source: <https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?conus>

Strength/Magnitude/Extent

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

Palmer Drought Severity Index: One of the oldest and most widely used indices is the Palmer Drought Severity Index (PDSI, Figure 4.65), which is published jointly by NOAA and the U.S. Department of Agriculture (USDA).

Table 3.35			
Palmer Drought Severity Index (PDSI)			
Score	Description	Score	Description
Greater than 4	Extreme moist spell	0 to -0.4	Near normal conditions
3.0 to 3.9	Very moist spell	-0.5 to -0.9	Incipient drought
2.0 to 2.9	Unusual moist spell	-1.0 to -1.9	Mild drought

1.0 to 1.9	Moist spell	-2.0 to -2.9	Moderate drought
0.5 to 0.9	Incipient moist spell	-3.0 to -3.9	Severe drought
0.4 to 0	Near normal conditions	Below -4.0	Extreme drought

According to the National Integrated Drought Information System (NIDIS), the PDSI "...uses temperature and precipitation data to calculate water supply and demand, incorporates soil moisture, and is considered most effective for unirrigated cropland. It primarily reflects long-term drought and has been used extensively to initiate drought relief."

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

Standardized Precipitation Index: A newer index 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.

The NDMC uses the PDSI, SPI, and three other indicators to classify the severity of droughts throughout the country on a 5-point scale ranging from D0 Abnormally Dry to D4 Exceptional Drought for reports on the U.S. Drought Monitor (Figure 4.66).

U.S. Drought Monitor - Drought Severity Classification							
Category	Description	Ranges					
		Possible Impacts	Palmer Drought Index	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Short and Long-term Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered	-1.0 to -1.9	21-30	21-30	-0.5 to -0.7	21-30

D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested	-2.0 to -2.9	11-20	11-20	-0.8 to -1.2	11-20
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed	-3.0 to -3.9	6-10	6-10	-1.3 to -1.5	6-10
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions	-4.0 to -4.9	3-5	3-5	-1.6 to -1.9	3-5
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0-2	0-2	-2.0 or less	0-2
Source: http://droughtmonitor.unl.edu							

Based on the Drought Severity Classification from the NDMC, Boone County is subject to droughts ranging from D1 (Moderate Drought) to D4 (Exceptional Drought). The most common droughts are in the D1-D2 range.

Previous Occurrences

The Dust Bowl years of the 1930s and early 1940s were dry in Missouri but not as dry as the period 1953-57. A major nationwide drought in the late 1980s resulted in low water and decreased barge traffic on the Mississippi and Missouri Rivers. The fall of 1999 was another serious drought period in the state; in October of that year, all counties in Missouri were declared agricultural disaster areas by the USDA.

Information for droughts since the year 2000 is available online via weekly maps prepared by the U.S. Drought Monitor. Drought events for Boone County, and information about their severity, are shown in Figure 4.69. The drought which affected the entire state beginning in the summer 2012 was the worst drought in 30 years, according to the *MO State Hazard Mitigation Plan (2018)*.

While short periods of drought have been recorded in localized areas in the past few years the last reported crop loss was in 2019. According to USDA’s Risk Management section there was a single insurance claim for \$5,328 that was due to drought in August.

Probability of Future Occurrences

In the 20-year period 2000-2020, there were 8 years without any level of drought in the planning area, according to the U.S. Drought Monitor. Based on this data, the calculated probability of having at least a Moderate (D1) drought in some month of the year is 60%. (Probability calculation: $1 - (8/20) = .60$)

The probability of occurrence of the different drought severities in any given year, based on the 2000-2020 data, has also been calculated (Figure 3.37).

Table 3.37				
Probability of Future Drought Events				
Severity Scale	Drought Description	# of years with drought event (2000-2020)	Probability	Probability Rating
D1	Moderate	8	40%	High
D2	Severe	4	20%	High
D3	Extreme	3	15%	High
D4	Exceptional	2	10%	High

Changing Future Conditions Considerations

Droughts are naturally occurring events in the planning area. While overall precipitation is predicted to rise with climate change the intensity of rainfall events at a given time could mean less rainfall at other times throughout the season leading to more frequent droughts and crop failures. Raising global temperatures could lead to more severe droughts.

VULNERABILITY

Severity

Moderate – Boone County (unincorporated)
 Low - all other participating jurisdictions

The primary affect of drought in the planning area is on the economic livelihood of those in the agricultural sector. According to the *2017 US Census of Agriculture*, 48.8% of Boone County land use is tied to farming activities. In 2017 the market value of Boone County farm products was estimated at \$105,007,000 Million.

Both crops and livestock are at risk from drought. During the Exceptional Drought conditions in 2012, there were large sell-offs of livestock in some counties surrounding the planning area.

Potential Impact – Life

While drought itself does not have a direct affect on human health or life, its impacts can indirectly cause damage to health. The psychological and economic stresses involved for those working directly in the agricultural sector can be great in times of drought. Uncertainty, high stress and fear are not compatible with optimal health.

Potential Impact - Existing Structures

Excessive drought can cause damage to roads, streets, water mains, and building foundations. This is especially true in the Claypan Till Plains area (Figure 2.3) which includes the jurisdictions of Ashland, Centralia, Hallsville, Sturgeon and eastern portions of Columbia. The clay soils expand and contract to a high degree depending on moisture or lack thereof; this soil movement can cause structural movement, settlement, and breaks. During the drought of 2012, local media carried stories encouraging homeowners to water their foundations.

The arid conditions created by drought also pose an increased risk of fire and wildfire.

Drought can also have far reaching economic consequences beyond the agricultural sector; businesses dependent upon that sector can also suffer serious losses. A severe drought can affect the economics of an entire region.

Potential Impact - Future Development

Drought is primarily an issue of water supply for the rural and agricultural parts of the planning area. Almost 55% of the land in Boone County is agricultural and agriculture plays an important role in the life and economy of the area. This makes drought mitigation an especially important concern as population increases.

Boone County experienced 20% population growth between 2000 and 2010, according to the U.S. Census. This growth rate is far above the Missouri state average (7%). However, census data indicates that almost all of this growth occurred in the incorporated cities. There was only a 1% growth rate in unincorporated Boone County, the area most affected by drought.

Were there to be a large increase in growth in the rural areas of the county, the interconnection of water supplies and good land management techniques would become increasingly important in mitigating the impacts of drought.

Hazard Summary by Jurisdiction

All jurisdictions in the planning area can be impacted by drought. Incorporated cities may see a drain on their water supply in times of extreme drought and wear on roads under cracking and shrinking dry ground can become damaged. The largest impact to drought though comes to unincorporated Boone County due to the agriculture based nature of its economy and land usage. Crop losses deal large economic blows and the potential for wildfire pose a risk to those living nearby.

PROBLEM STATEMENT

Drought of some degree is a common occurrence in the planning area. The unincorporated agricultural areas of Boone County are the most vulnerable but all jurisdictions are potentially vulnerable to both direct structural damage and cascading economic effects during extended and serious drought conditions.

Based on recent data (2000-2020), the most common drought in the planning area is a Moderate Drought (D1); the average drought during this period lasted 4.4 months. Droughts in the planning area can be more severe and long-lasting, however. An extended nine-month drought in 2012-2013 was rated D4 (Exceptional Drought) at its severest point.

Drought conditions are carefully monitored at the state and national levels; state law requires the Missouri Department of Natural Resources to implement a drought response system to ensure the quantity and quality of available water resources.

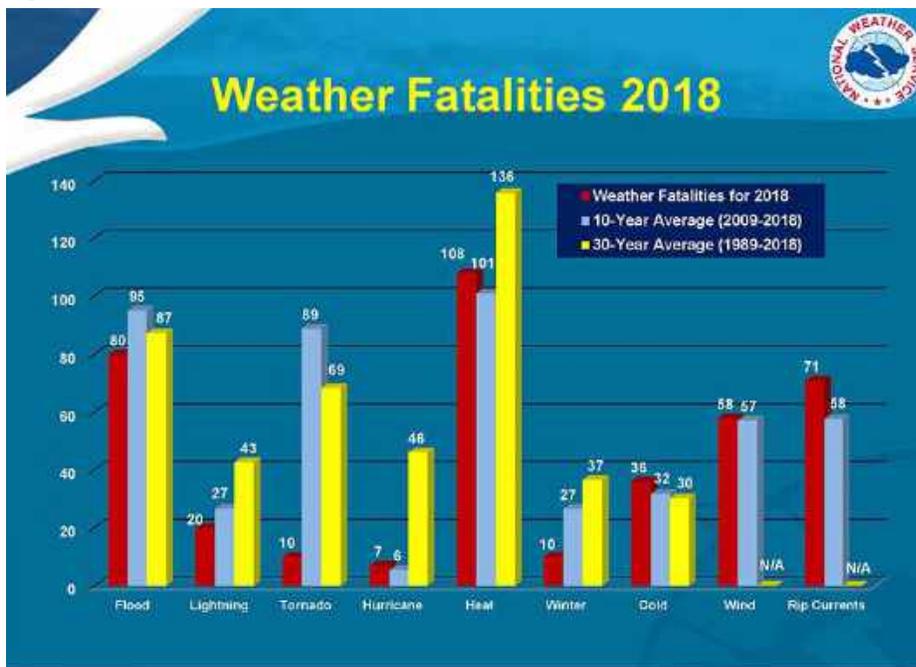
EXTREME TEMPERATURES

HAZARD PROFILE

DESCRIPTION OF HAZARD

Extreme temperature events, both hot and cold, can impact human health and mortality, natural ecosystems, agriculture, and other economic sector. Extreme heat is the number one weather-related killer in the United States, according to the National Weather Service (Figure 3.30). In contrast to the visible, destructive, and violent nature of floods, hurricanes, and tornadoes, extreme heat is a silent killer.

Figure 3.30



As can be seen in the NWS graph, there are no 30-year averages for heat fatalities or a number of other weather-related fatalities. Fatality data on these hazards began to be recorded more recently than fatalities from the more dramatic causes of death such as flood, lightning, tornado, and hurricane.

As the data shows, extreme heat resulted in an average of 101

deaths per year when looked at over a 10-year period; this is 6 more deaths per year than the number cause by flood, the next most frequent cause of death.

Extreme cold often accompanies severe winter storms and can lead to hypothermia and frostbite in people without adequate clothing protection. Cold can also cause issues with power sources by freezing fuel lines and overwhelming heating systems. It can also freeze and bust pipes in homes and businesses.

Geographic Location

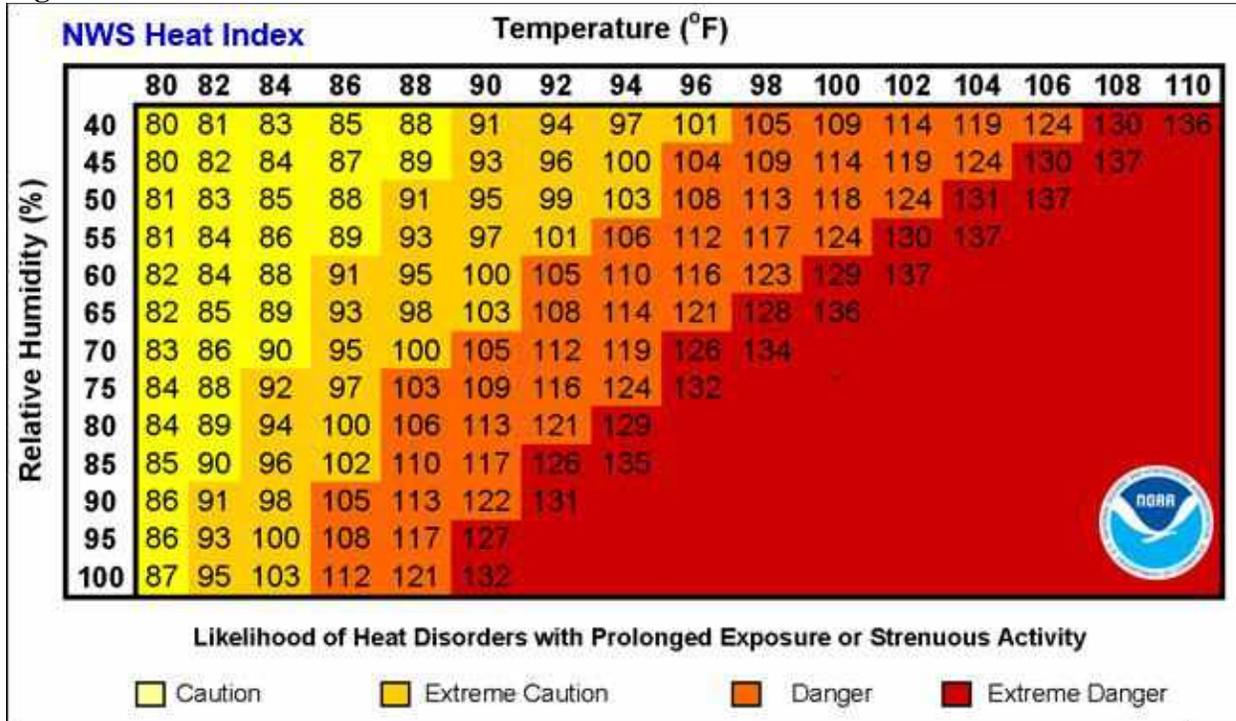
The entire planning area is at risk from extreme temperature events.

Strength/Magnitude/Extent

The planning area routinely experiences prolonged periods with temperatures in the 90s and 100s (Figure 3.31). The duration of these periods of extreme heat can range from just one day to

weeks. The National Weather Service (NWS) has an alert system in place to alert people when the Heat Index is expected to have a significant impact on public safety. The severity decides whether an advisory or a warning is issued.

Figure 3.31

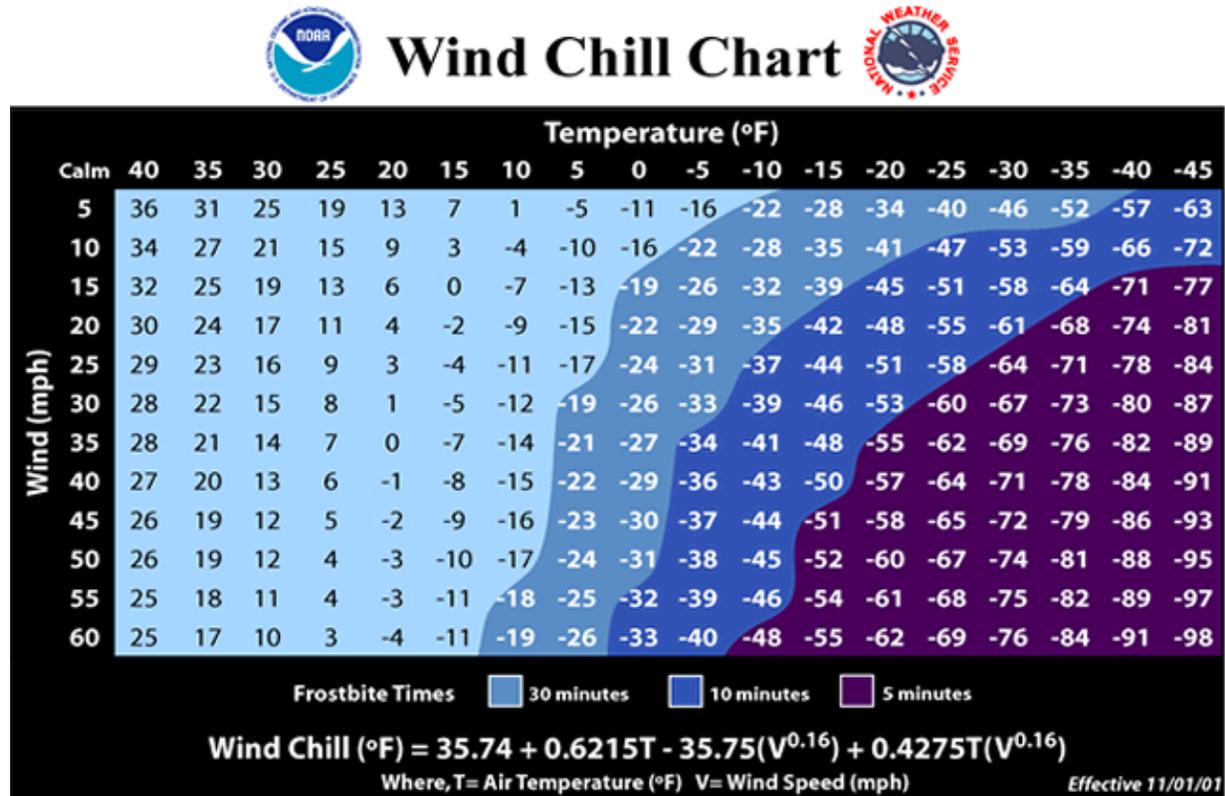


Source: National Weather Service (NWS) <https://www.weather.gov/safety/heat-index>

Note: Exposure to direct sun can increase Heat Index values by as much as 15°F. The shaded zone above 105°F corresponds to a HI that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

Similar to heat index the NWS also has an index for wind chill. It uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from winter winds and freezing temperatures. The figure below shows wind chill temperatures which are based on the rate of heat loss from exposed skin caused by wind and cold. When wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Figure 3.32



Previous Occurrences

Table 3.38

Periods of Extreme Heat in Boone County, 2000-2020

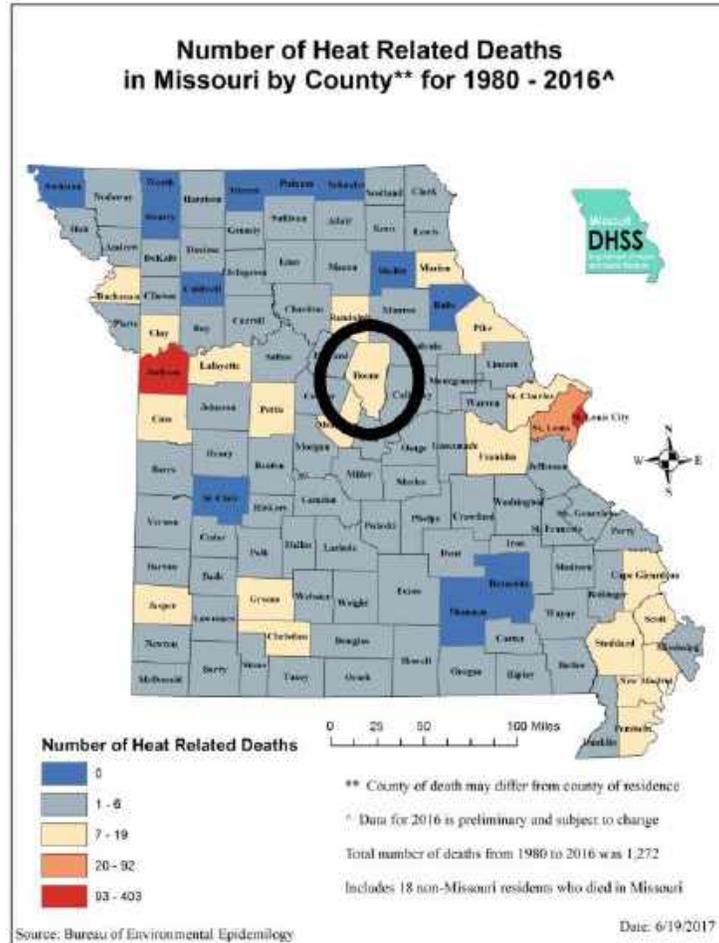
Date	Air Temp	Deaths*	Injuries*	Length (days)
12/16/00	9	0	0	2
08/05/07	100-103	8	1300+	12
06/21/09	90s	0	0	7
06/18/10	mid 90s	0	0	6
07/14/10	100 - 103	8	941	3
07/17/10	mid-90s	0	13	1
07/22/10	mid-upper 90s	0	23	3
08/02/10	100 -102	0	13	3
08/08/10	upper 90s - 100	2	85	7
07/17/11	lower 90s - 100	8	100+	18
06/27/12	100 -109	19	212	11
07/16/12	100 -106	1	53	4
07/22/12	up to 108	0	75	6

08/01/12	105	0	6	2
08/20/14	Upper 90s	0	56	7
07/12/15	Upper 90s	0	0	2
07/17/15	Mid 90s	0	0	1
07/25/15	Mid 90s	0	0	4
07/18/16	Upper 90s	1	70	5
07/18/17	Upper 90s – 108	0	51	5
Total Deaths/Injuries and Average Length		47	2998+	5.5
* Deaths and injuries are for entire area in MO affected by extreme heat event.				
Source: www.ncdc.noaa.gov/stormevents/ (Available data as of 2/29/2020)				

In recent years, there have been some notable periods of extreme heat and new temperature records set in the planning area:

- 2007 - Over 100 on six days in August (Columbia)
- 2007 - New record for August 16th of 103 degrees (Columbia)
- 2011 - New record for August 2nd of 108 degrees (Columbia)
- 2012 - Over 100 degrees from June 27-July 7 (Columbia)

Figure 3.33



Source: <https://health.mo.gov/living/healthcondiseases/hyperthermia/pdf/stat-report.pdf>

Probability of Future Occurrence

– High for all participating jurisdictions

- NOAA data dating back to 1994 indicates only 6 years without extreme heat events (1996, 1997, 2008, 2013, 2018 and 2019). In most years during that period, there were multiple extreme heat events. Based on this historical data, the calculated probability of an extreme heat event in any year is 76%. (Probability calculation: $1 - (6/26) = 0.76$)
- NOAA data dating back to 1994 indicates that there was only 1 year with an extreme cold event. That event took place in 2000. This makes for a probability of an extreme cold event in any year 1%. (Probability calculation: $1 - (1/26) = 0.96$)

The chances of an extreme heat event are much higher and happen much more frequently than extreme cold but cool snaps that may not bother humans can bother crops. Insurance claims for 2019 show \$234,542 in damages due to cold weather.

VULNERABILITY

VULNERABILITY OVERVIEW

Measure of Severity - Moderate for all participating jurisdictions

Potential Impact – Life

Heat kills by overloading a body’s capacity to cool itself. The human body cools itself by perspiring; the evaporation of perspiration carries excess heat from the body. High humidity often accompanies heat in Missouri and increases the danger to warm-blooded humans and animals. High humidity makes it difficult for perspiration to evaporate and thus interferes with this natural cooling mechanism.

The Heat Index devised by the NWS (Figure 4.74) is a measure of how hot it really feels. The Heat Index takes into account both air temperature and relative humidity. It also gives an indication of the added risk presented by high humidity to bodies attempting to cool.

Table 3.39 Typical Health Impacts of Extreme Heat

Heat Index (HI)	Disorder
80-90° F (HI)	Fatigue possible with prolonged exposure and/or physical activity
90-105° F (HI)	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and/or physical activity
105-130° F (HI)	Heatstroke/sunstroke highly likely with continued exposure

Source: National Weather Service Heat Index Program, www.weather.gov/os/heat/index.shtml

Many factors, such as age, general level of health, outdoor activity level, alcohol and drug consumption, and availability of air conditioning, affect the actual risk level. The elderly in general are vulnerable to the effects of extreme and/or prolonged heat; the 2010 Census recorded 15,072 citizens in Boone County (9.3% of the population) as 65 years and older. However, any residents without access to air conditioning, or shade and water if outside, are very vulnerable to this hazard. One known death occurred in the planning area in August 2002, when a 59-year-old Boone County man died from heat exhaustion after collapsing while doing yard work.

Extreme heat events can also result in livestock deaths and fish kills; drought in conjunction with extreme heat exacerbates the situation.

Potential Impact - Existing Structures

While illness and loss of life are of the most concern with extreme heat, structural impacts may also occur. Structural impacts depend on the length of the period of extreme heat and exacerbating factors such as concurrent drought. Road damage and electrical infrastructure damage may occur with intense and prolonged heat.

Potential Impact - Future Development

Thoughtful future development has the potential to include mitigation for extreme heat in its design. This is true on all levels ranging from actions by individual homeowners to larger redevelopment projects planned by cities. Properly placed shade trees can contribute greatly to lowering inside temperatures and the load placed on cooling systems. Planning for adequate green space as cities infill allows for air movement and shaded locations.

Hazard Summary by Jurisdiction

Those at greatest risk for heat-related illness and deaths include children under 5 years of age and people over the age of 65. To determine jurisdictions within the planning area with populations more vulnerable to extreme heat, demographic data was obtained from the 2018 American Community Survey estimates for populations 5-years-old and younger, as well as ages 65 and older. Since students and faculty of school districts are not typically part of the vulnerable age groups they have been left out of the following table.

Table 3.4: Boone County Population by Age

Jurisdiction	Population Under 5 yrs	Population 65 yrs and over
Unincorporated Boone County	10,403	19,080
Ashland	282	520
Centralia	368	845
Columbia	7,053	11,588
Hallsville	65	215
Harrisburg	33	32
Hartsburg	1	21
Huntsdale	0	5
Rocheport	21	64
Sturgeon	28	190

Source: American Community Survey 5-year Estimates 2012-2017

The City of Columbia, the major population center in the planning area, is well equipped with cooling centers to help protect those most vulnerable. Warnings regarding the dangers of extreme heat are widely broadcast during times of threat.

The following locations in Columbia are used as cooling centers during business hours:

- Activity & Recreation Center (ARC)
- Armory Sports and Community Center
- Boone County Government Center
- Columbia/Boone County Health Department
- Columbia Public Library
- Salvation Army
- Salvation Army Harbor House
- St. Francis House

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. Schools in the planning area have air conditioning in their main buildings and many of their detached buildings, but warnings should be taken into consideration for outdoor sports and practices. Many schools in the planning area are closed for summer session during the more hot portions of the summer season.

The Missouri Department of Health and Senior Services announces statewide hot weather health alerts.

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.)

PROBLEM STATEMENT

All jurisdictions are vulnerable to the effects of extreme heat. Extreme heat is already responsible for more weather-related deaths than any other hazard in the country; it is also one of the hazards shown to be increasing with changes in the climate.

Heat stroke and loss of life are the most significant consequences 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.

The elderly in general are vulnerable to the effects of extreme and/or prolonged heat; the 2010 Census recorded 15,072 citizens in Boone County (9.3% of the population) as 65 years and older. However, any residents without access to air conditioning, or shade and water if outside, are very vulnerable to this hazard.

In addition to the human toll, prolonged extreme heat can result in livestock deaths, fish kills, and infrastructure damage; drought in conjunction with extreme heat exacerbates the situation.

SEVERE THUNDERSTORMS (INCLUDING DAMAGING WINDS, HAIL, AND LIGHTNING)

DESCRIPTION OF HAZARD

A thunderstorm is a rainstorm with thunder and lightning present. Warm, humid climates, such as that in mid-Missouri, are favorable for the formation of thunderstorms. Thunderstorms can occur during any season in Missouri but they are more frequent in the spring and summer.

The average Missourian is well aware of the hazards of the thunderstorm season; these include heavy rains and, potentially, strong winds, tornadoes, hail, and lightning strikes. The effects of heavy rains have been considered in the sections on flooding and tornadoes.

Thunderstorms can range in complexity from single cell storms through multicell cluster storms, multicell line storms (squall lines), and on to supercell storms. A single cell thunderstorm typically lasts 20-30 minutes but when numerous cells are generated, as in a multicell storm, the thunderstorm can last for hours. Supercell storms include rotation and are responsible for the generation of severe tornadoes.

Severe and damaging winds in the planning area are usually, but not always, associated with thunderstorms. Thunderstorm winds can reach speeds up to 100 mph and produce damage paths for hundreds of miles. According to the National Oceanic and Atmospheric Administration (NOAA), property and crop damage from thunderstorm winds is more common, and can be more severe, than damage from tornadoes. Thunderstorm wind damage accounts for half of all the NOAA reports of severe weather events in the lower 48 states.

Thunderstorm winds are often called "straight-line" winds to distinguish them from tornadoes, which have a rotational element. The following are the distinctions made between different thunderstorm winds:

- Gust front - Gusty winds out ahead of a thunderstorm; characterized by a wind shift and temperature drop.
- Downbursts – A strong downdraft with a width of greater than 2.5 miles which results in an outward burst of damaging winds near the ground; may possibly produce damage similar to that of a strong tornado.
- Microbursts – A small concentrated downburst with a width less than 2.5 miles; generally short-lived, lasting only 5-10 minutes, with maximum wind speeds up to 168 mph.

A derecho is a widespread, massive, and violent thunderstorm wind event producing straight-line winds in excess of 70 mph and moving quickly over large areas. These are not common events; however, in the spring of 2009, a massive derecho almost as large as the state of Missouri caused extensive damage in southern Missouri and Illinois.

Much of the damage caused by high winds occurs because of falling trees; people, buildings, and vehicles may be damaged by falling trunks and branches. Power lines may be blown or knocked down and people left without electricity. In some cases, roofs are directly blown off buildings and windows are shattered.

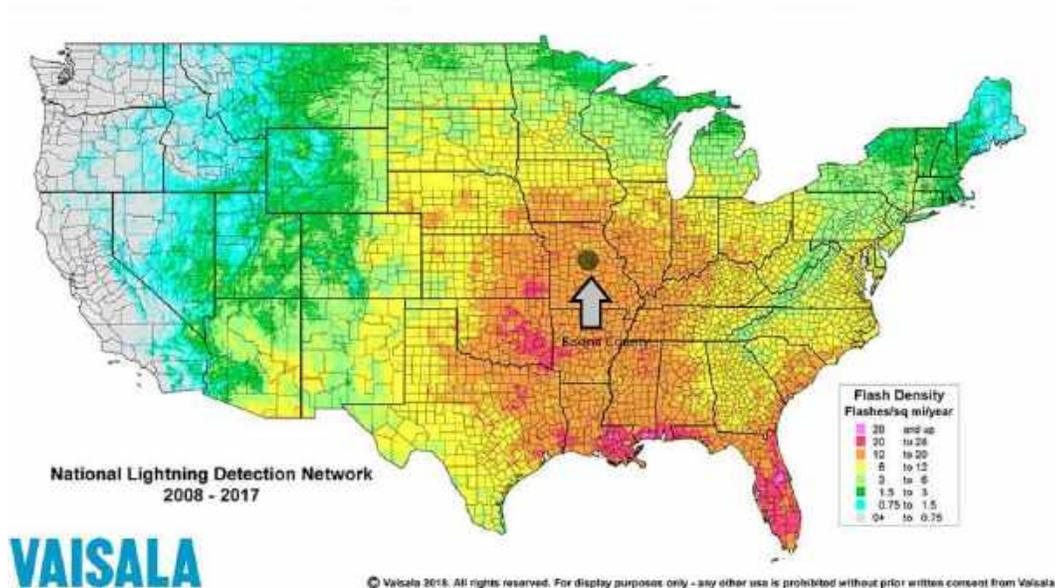
Hail is formed when updrafts in thunderstorms carry raindrops up to very high and cold areas where they freeze into ice. Hail, especially large sized hail, can cause severe damage and presents a threat to automobiles, airplanes, roofs, crops, livestock, and even humans.

Lightning, a massive electrical discharge, is produced by all thunderstorms. The electrical discharge can be within a cloud, between clouds, or between a cloud and the ground.

Location

The entire planning area is at risk from severe thunderstorms and all the related threats accompanying them. Although these events occur similarly throughout the planning area damages are more likely to occur in more densely developed areas and areas with older homes. Boone County is located in central Missouri and has a medium flash density of 6-12 Flashes/square mile/year.

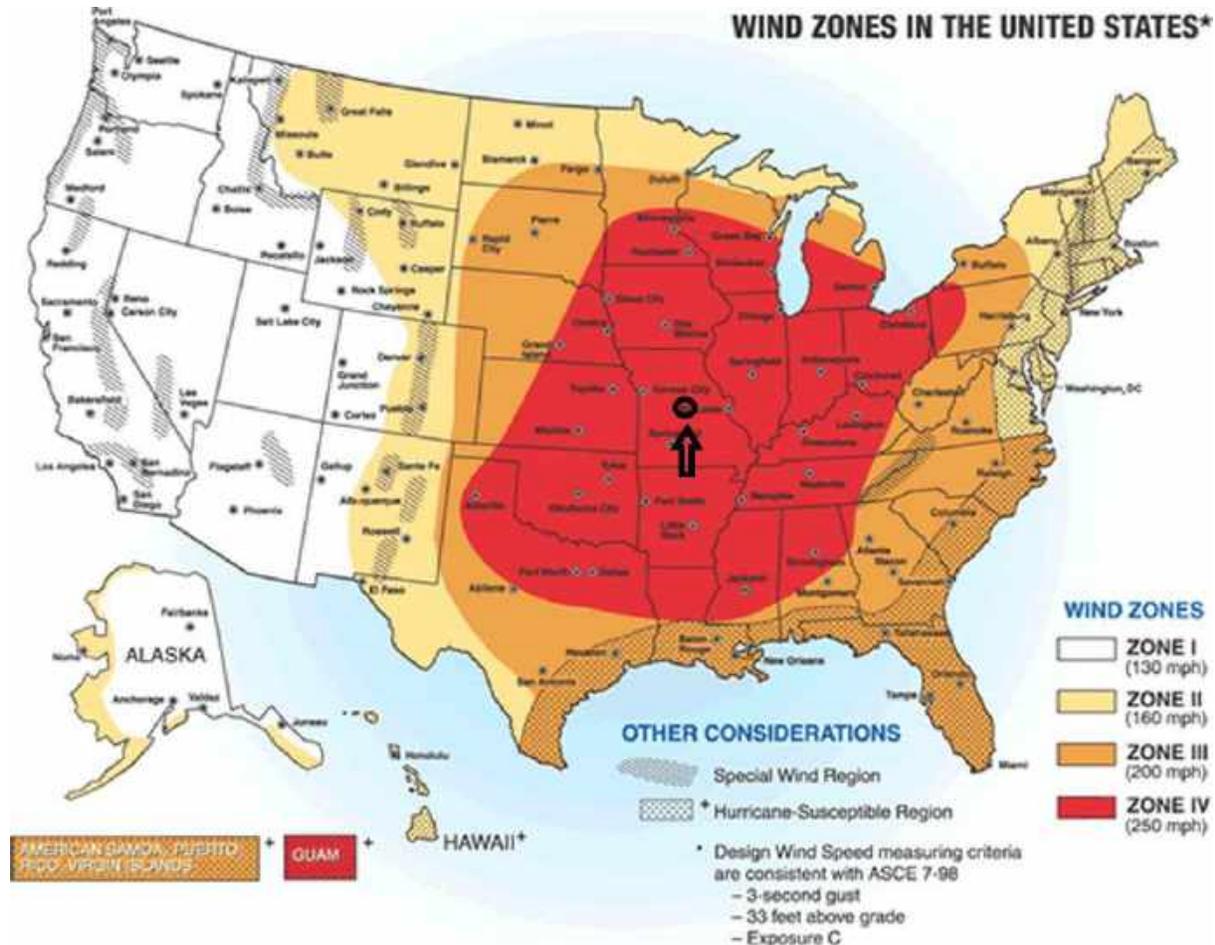
Figure 3.34: Location and Frequency of Lightning in Missouri



Source: National Weather Service, <http://www.vaisala.com/en/products/thunderstormandlightningdetectionsystems/Pages/NLDN.aspx> . Note: indicate location of planning area with a colored square or arrow.

The Planning area is in a high wind zone according to FEMA. All of the planning area is located in Zone IV and can see winds of 250 mph.

Figure 3.35 Wind Zones in the United States



Source: FEMA 320, Taking Shelter from the Storm, 3rd edition, https://www.fema.gov/pdf/library/ism2_s1.pdf

Strength/Magnitude/Extent

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, or a tornado. The NOAA database records thunderstorm events which fall into this severe classification.

Based on information provided by the Tornado and Storm Research Organization (TORRO), Table 3.41 below describes typical damage impacts of the various sizes of hail.

Table 3.41: Hail Damage by Size

Intensity Category	Diameter (mm)	Diameter (Inches)	Size Description	Typical Damage Impacts
Hard Hail	5-9	0.2-0.4	Pea	No damage
Potentially Damaging	10-15	0.4-0.6	Mothball	Slight general damage to plants, crops
Significant	16-20	0.6-0.8	Marble, grape	Significant damage to fruit, crops, vegetation
Severe	21-30	0.8-1.2	Walnut	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
Severe	31-40	1.2-1.6	Pigeon's egg > squash ball	Widespread glass damage, vehicle bodywork damage
Destructive	41-50	1.6-2.0	Golf ball > Pullet's egg	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
Destructive	51-60	2.0-2.4	Hen's egg	Bodywork of grounded aircraft dented, brick walls pitted
Destructive	61-75	2.4-3.0	Tennis ball > cricket ball	Severe roof damage, risk of serious injuries
Destructive	76-90	3.0-3.5	Large orange > Soft ball	Severe damage to aircraft bodywork
Super	91-100	3.6-3.9	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
Hailstorms				
Super	>100	4.0+	Melon	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
Hailstorms				

Source: Tornado and Storm Research Organization (TORRO), Department of Geography, Oxford Brookes University

Notes: In addition to hail diameter, factors including number and density of hailstones, hail fall speed and surface wind speeds affect severity. <http://www.torro.org.uk/site/hscale.php>

According to information from NOAA, a lightning bolt can contain 100 million to 1 billion volts of electricity and billions of watts of energy. This energy can heat the air around the lightning 18,000 to 60,000 °F.

Previous Occurrences

The NCEI is limited in its reporting of lightning due to the fact that only lightning events that result in fatality, injury and/or property and crop damage are in the NCEI. There were no direct reports of lighting for the review period in the planning area. The tables below summarize past crop damages as indicated by crop insurance claims and give insight into the magnitude of the impact on the planning area's agricultural economy.

Table 3.42 Crop Insurance Claims Paid in Boone County from Thunderstorms, 2009-2019

Crop Year	Crop Name	Cause of Loss Description	Insurance Paid
2016	Corn	Other, storms	58,485
2014	Wheat	Other, storms	1,983
Total			60,468

Source: USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/data/cause>

Table 3.43 Crop Insurance Claims Paid in Boone County from High Winds, 2009-2019

Crop Year	Crop Name	Cause of Loss Description	Insurance Paid
2016	Corn	Wind	185
2011	Corn	Hot Wind	112
Total			297

Source: USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/data/cause>

Table 3.44 Crop Insurance Claims Paid in Boone County from Hail, 2009-2019

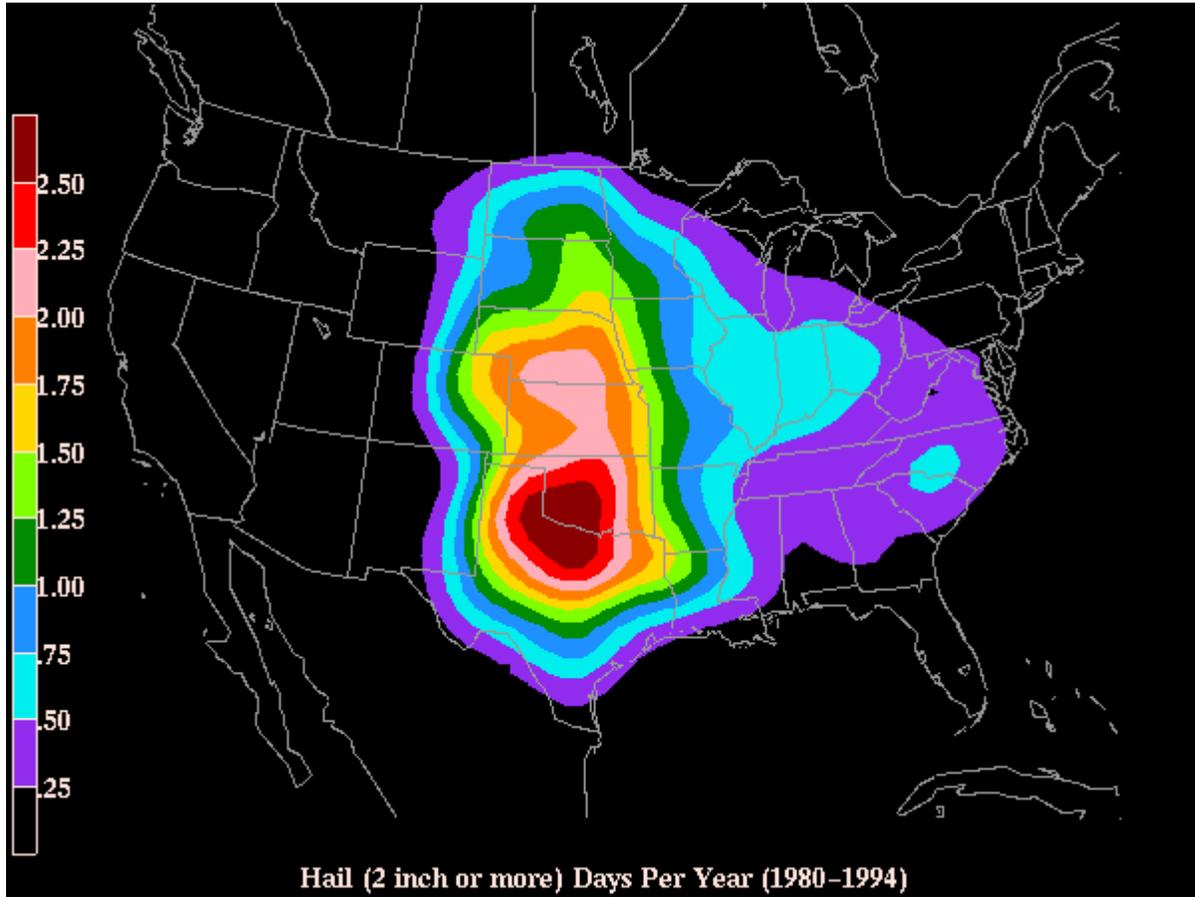
Crop Year	Crop Name	Cause of Loss Description	Insurance Paid
2016	Corn	Hail	926
2011	Wheat	Hail	387
2009	Corn	Hail	317
Total			1,630

USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/data/cause>

Probability of Future Events

High for damaging winds, hail, and lightning – All participating jurisdictions

Figure 3.36 Annual Hailstorm Probability (2" diameter or larger) 1980-1994

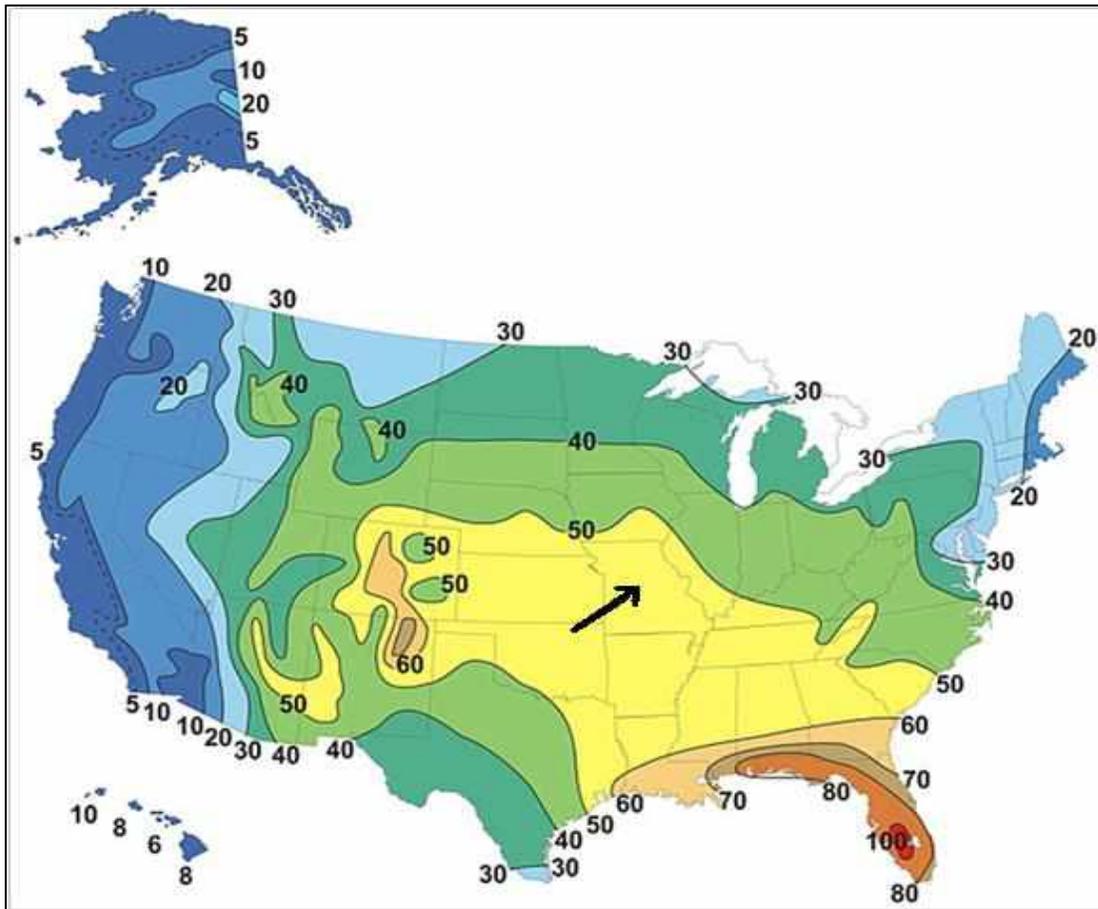


Source: NSSL, http://www.nssl.noaa.gov/users/brooks/public_html/bighail.gif

The planning area is indicated to have at least 1 hailstorm event a year according to NOAA.

National Weather Service data indicates an average 50-60 thunderstorm days per year in Missouri (Figure 3.37).

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



Source: NOAA

Data from NOAA for the 10-year period (2009-2019) indicates 48 severe thunderstorm wind events in Boone County. There was only one year in this period (2013) without a reported severe thunderstorm wind event in the planning area. Based on this data, the calculated probability of a future severe thunderstorm wind event in any given year is 90%.

Data from NOAA for the 10-year period 2009-2019 indicates 42 severe hail events in Boone County. There were numerous severe hail events in the planning area each of these years. Based on this data, the calculated probability of a future severe hail event in any given year is 100%.

Data from NOAA for the 10-year period 2009-2019 indicates 5 lightning events in Boone County which caused property damage, injury, or death. There were six years during this period without such a reported event in the planning area. Based on this data, the calculated probability of a future lightning event causing property damage, injury, or death in any given year is 40%.

CHANGING FUTURE CONDITIONS CONSIDERATIONS

According to the State Hazard Mitigation Plan 2018, “Predicted increases in temperature could help create atmospheric conditions that are fertile breeding grounds for severe thunderstorms and tornadoes in Missouri.” These changing conditions will affect the entire planning area and should be considered when building new structures.

VULNERABILITY

Vulnerability Overview

Measure of Severity –

Moderate to High for damaging winds, hail, and lightning – all participating jurisdictions

Potential Impact - Life

Severe thunderstorms and their related hazards pose a threat to both people and animals. Windblown debris, falling trees and branches, and lightning are very dangerous to those who are exposed. Excessive damage to utilities can leave people without electricity for long periods – an especially dangerous situation for vulnerable populations.

In the NOAA data examined for Boone County, there were 2 recorded injuries due to damaging winds in a 10-year period. One instance occurred in 2011 when a tent was blown down at the fairgrounds injuring one person. The second person was injured in 2015 when a tree was blown over in a storm onto a mobile home. The person inside suffered multiple broken bones.

The NOAA data also indicates that a woman was struck and killed by lightning in 2009 while crossing a field at Rocky Forks Conservation area, located north of Columbia. Another woman was injured in 2011 when lightning struck her cell phone in Cosmo Park in Columbia.

Hail also presents a potential bodily threat to humans and livestock. In 2000, a man in Texas died from softball size hail. (The 4-inch hail recorded in Harrisburg in 2005 was only slightly smaller than this.) According to NOAA’s National Severe Storms Laboratory, it has been estimated that a 3.25 inch hailstone weighing 1.5 pounds has a falling velocity of about 106 mph. There have been no reported hail injuries in the planning area in the last 10 years.

Potential Impact - Existing Structures

Damaging wind on July 7, 2014 caused widespread damage in Columbia. Six 80-foot transmission line poles were snapped in half and large trees were uprooted over a widespread area. There were 14,000 residents who lost power in the storm; some were without power for a little over 100 hours/4.5 days. The area most badly hit included commercial businesses.

Hail events of a large magnitude do not happen every year in the planning area. When they do, they can cause extensive damage to roofs and windows on buildings, and dent and bust glass on vehicles that cost residents and business owners in repairs.

Property damage due to fires and shorts to electrical systems caused by lightning strikes can cost thousands of dollars per incident and affect electronic equipment located inside buildings and damage crops and farm structures.

Potential Impact - Future Development

There has been a rapid growth in population and housing in the planning area in recent years. A larger population and more extensive built environment increase the risk of injury, loss of life, and damage from severe thunderstorms.

While the housing growth rate might be expected to be somewhat lower between since the last plan update due to a slow recovery from the recent economic recession, a significant growth rate overall is still expected; construction is once again vigorous. In Columbia, home to the University of Missouri, there has been a recent tremendous growth in housing development for student rental. Recent and planned student housing developments are transforming the downtown area of the city.

It would be wise to consider mitigation strategies for severe thunderstorms during the planning phase of any new development. The type of construction affects vulnerability to damaging winds, hail, lightning, and tornadoes. Design and construction choices, inclusion of safe rooms in projects, adequate warning sirens, and NOAA radios can all save lives.

Hazard Summary by Jurisdiction

Boone County has been recognized by the National Weather Service as a StormReady® Community. In order to become recognized as StormReady®, the Emergency Management Agency is evaluated on its abilities to do the following:

- receive real time weather information from the NWS
- disseminate that information to the public,
- transmit real time information to the NWS
- educate the public regarding weather hazards/protection

Boone County has a large population of Mobile Homes. There is no requirement in Boone County for tie-downs on mobile homes; however, updated electric service cannot be obtained for a mobile home in the county unless the home is tied down.

The City of Columbia is a densely populated area that incurs high costs when damaging storm events move through. While the city has done much to help mitigate losses through underground utilities in portions of the city and educating residents about shelter sites its density and number of aging structures make it vulnerable to storm damage.

There is a storm siren located in or near each jurisdiction in the planning area that can be sounded remotely from the EOC if a storm of damaging proportions is coming.

PROBLEM STATEMENT

Thunderstorms with damaging winds, hail, and lightning are common, dangerous, and often costly occurrences in the planning area. These weather events can be expected almost every year and every jurisdiction is highly vulnerable to these hazards.

Both human life and the built environment are at risk; the impact on the built environment has been quite costly in the past and this can be expected to continue into the future.

Public awareness education, excellent weather coverage by the local media, an excellent outdoor warning system, and regular emergency exercises in the schools help mitigate the risk to human life. However, there is a great need throughout the planning area for more safe rooms to protect from high wind events; this is especially true in the schools. Additionally, more vigorous promotion of NOAA radio use would help protect the general public. Additional generators and power transfer hookups are needed in case of widespread and/or lengthy power outages. All of these identified needs have been targeted for action in the mitigation strategy; funding remains an issue for the more costly safe rooms and generators/power transfer hookups.

SEVERE WINTER WEATHER (INCLUDING ICE, SNOW, AND SEVERE COLD)

HAZARD PROFILE

Hazard Description

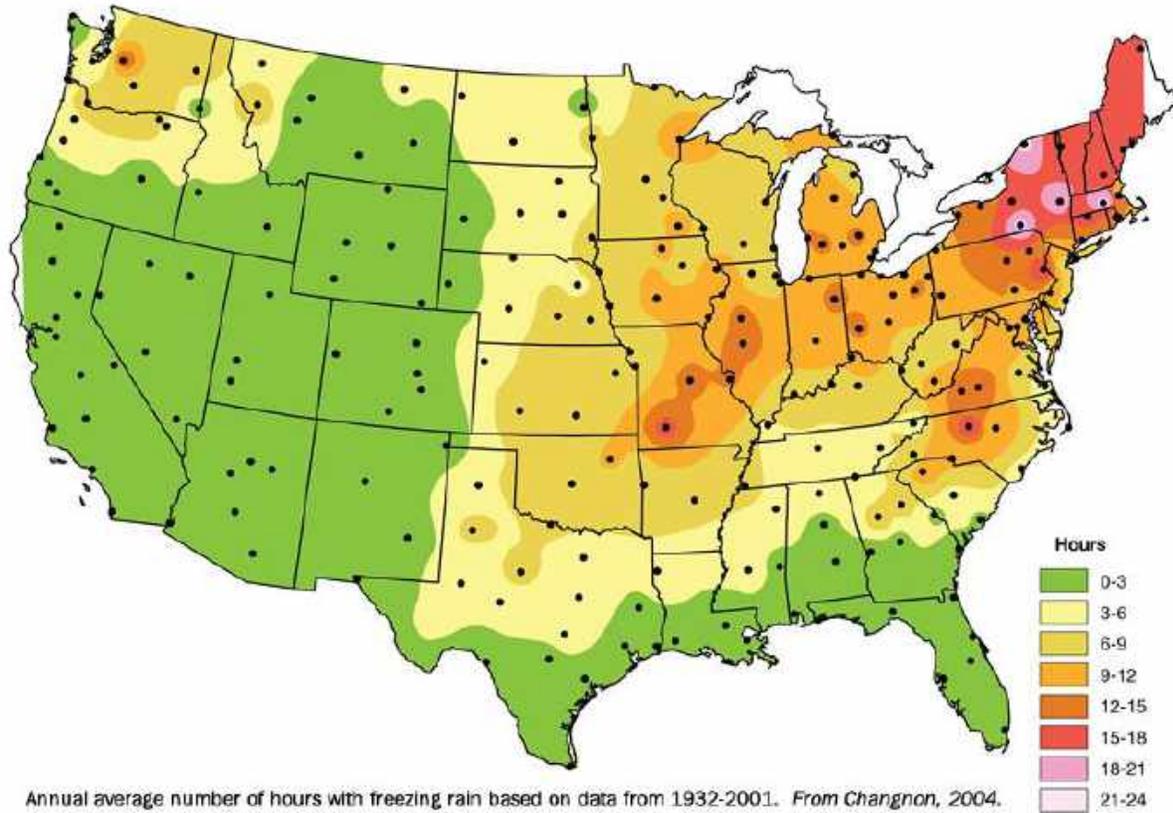
Winter storms in central Missouri contain ice, snow, severe cold, sleet, and wind; each of these associated factors has the potential to disrupt life in the region by making normal activity difficult and/or dangerous. The National Weather Service describes different types of winter storm events as follows:

- Blizzard – Winds of 35 miles per hour or more with snow and blowing snow reducing visibility to less than ¼ mile for at least three hours.
- Blowing Snow – Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
- Snow Squalls – Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant.
- Snow Showers – Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
- Freezing Rain – Measurable rain that falls onto a surface with a temperature below freezing. This causes it to freeze to surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Most freezing-rain events are short lived and occur near sunrise between the months of December and March.
- Sleet – Rain drops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects.

Geographic Location

The entire planning area is at risk from severe winter weather. This includes heavy snow, ice, extreme cold temperatures, and freezing rain. The planning area falls in the 9-12 hours a year average for freezing rain.

Figure 3.38 Average Hours of Freezing Rain a Year



Source: https://mrcc.illinois.edu/living_wx/icestorms/

Strength/Magnitude/Extent

The entire planning area is at risk for a variety of winter weather. There are various levels of alerts for various conditions of winter weather. The National Weather Service may issue any of the following as conditions warrant.

Table 3.45	
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.

Ice storm Warning	Dangerous accumulations of ice are expected with generally over one quarter inch of ice on exposed surfaces. Travel is impacted, and widespread downed trees and power lines often result.
Wind Chill Advisory	Combination of low temperatures and strong winds will result in wind chill readings of –20 degrees F or lower
Wind Chill Warning	Wind chill temperatures of –35 degrees F or lower are expected. This is a life-threatening situation.

As the duration of a winter weather event goes longer, the potential for increased severity also rises. Prolonged events tax resources for residents and businesses.

Previous Occurrences

Table 3.46 NCEI Boone County Winter Weather Events Summary, 2009-2019

Date	Event Type	Injuries
01/01/2010	Cold/Wind Chill	0
01/06/2010	Winter Weather	0
01/19/2011	Heavy Snow	0
01/31/2011	Winter Storm	0
02/01/2011	Winter Storm	0
02/01/2011	Blizzard	0
02/21/2013	Heavy Snow	0
02/25/2013	Heavy Snow	0
03/24/2013	Heavy Snow	0
12/21/2013	Winter Storm	0
01/05/2014	Winter Storm	0
01/06/2014	Cold/Wind Chill	0
02/04/2014	Winter Storm	0
11/25/2018	Blizzard	0
01/11/2019	Heavy Snow	0
02/06/2019	Ice Storm	0
12/15/2019	Winter Storm	0

Source: <https://www.ncdc.noaa.gov/stormevents/listevents>

2019 was an active winter weather season. In January 2019 the planning area saw several rounds of snowfall leading to a depth recording at the Columbia Regional Airport of 16.9 inches. Numerous traffic incidents were reported during and after the round of heavy snow. In February of the same year the northern half of the planning area saw a quarter inch of ice that downed power lines and tree limbs in the Centralia area.

Winter weather can also take a toll on crops in the area. Unseasonable cold snaps and late frosts can kill and damage crops costing thousands of dollars in insurance claims.

Table 3.47 Crop Insurance Claims Paid in Boone County as a Result of Cold Conditions and Snow 2009-2019

Crop Year	Crop Name	Cause of Loss Description	Insurance Paid (\$)
2009	Wheat	Cold/Wet	14,095
2010	Wheat	Cold/Winter	355
2010	Wheat	Cold/Winter	2,222
2010	Wheat	Cold/Wet	11,598
2010	Wheat	Cold/Wet	28599
2010	Wheat	Cold/Wet	-
2010	Corn	Cold/Wet	495
2011	Wheat	Cold/Winter	20,791
2011	Wheat	Cold/Winter	6,206
2011	Wheat	Cold/Wet	7,751
2011	Wheat	Cold/Wet	1,265
2011	Corn	Cold/Wet	2,212
2011	Corn	Cold/Wet	7,395
2011	Soybeans	Cold/Wet	1,477
2012	Corn	Cold/Wet	2,272
2012	Corn	Cold/Wet	1,818
2013	Wheat	Cold/Winter	2,627
2013	Wheat	Cold/Winter	94
2013	Wheat	Cold/Winter	1,255
2013	Wheat	Cold/Winter	3,616
2013	Wheat	Cold/Winter	15,313
2013	Wheat	Cold/Wet	216
2013	Corn	Cold/Wet	904
2014	Wheat	Cold/Winter	1,434
2014	Wheat	Cold/Winter	10,108
2014	Wheat	Cold/Winter	196
2014	Wheat	Cold/Winter	23,558
2014	Wheat	Cold/Winter	214
2014	Wheat	Cold/Wet	6,271
2014	Wheat	Cold/Wet	1,113
2014	Soybeans	Cold/Wet	546
2015	Wheat	Cold/Wet	35,778
2015	Soybeans	Cold/Wet	1,385
2017	Corn	Cold/Wet	6,168
2017	Soybeans	Cold/Wet	5,295
2018	Wheat	Cold/Wet	4,095
2018	Wheat	Cold/Wet	493
2018	Corn	Cold/Wet	7,824
2018	Corn	Cold/Wet	83,377
2018	Grain Sorgham	Cold/Wet	11,364
2018	Soybeans	Cold/Wet	6,845
2019	Wheat	Cold/Wet	128,876
2019	Wheat	Cold/Wet	19,130

2019	Corn	Cold/Wet	47,077
2019	Corn	Cold/Wet	33,792
2019	Soybeans	Cold/Wet	5,667

Source: <https://www.ncdc.noaa.gov/stormevents/listevents>

Probability of Future Occurrence

– High for all participating jurisdictions

The historical data indicates there were 5 years (2009, 2012, 2015, 2016, 2017) without a severe winter weather event in the period 2009-2019, a 10-year period; most years witnessed multiple events. Based on this historical data, the calculated probability of a severe winter weather event in any year is 50%. (Probability calculation: $1 - (5/10) = 0.5$)

Changing Future Conditions Considerations

As temperatures rise and shorten the winter season there could be ecological impacts to plant and animal species that could cause them to shift their native territory. An increase in precipitation events throughout the winter months and a general saturation of the ground could increase the likelihood of flooding events and freezing rain or ice storm events in the planning area.

VULNERABILITY

Vulnerability Overview

Measure of Severity - Moderate to High for all participating jurisdictions

Severe winter weather presents a risk to both life and property in the planning area. Some of the damage is direct but some comes in the form of economic losses due to closed businesses and schools and slowed or halted transportation.

Potential Impact - Life

Many deaths and injuries from winter storms are a result of traffic accidents caused by a combination of poor driving surfaces and speeds too fast for the conditions. Accidents during winter storms can be particularly devastating because of multiple car involvement. Response times for emergency vehicles may also be slowed by poor road conditions.

Strenuous outdoor activity in extreme cold can also be life threatening. In March 1998, an 84-year old woman in Columbia died of a heart attack while shoveling snow. The elderly are especially vulnerable to excessive and/or prolonged cold or heat.

Potential Impact - Existing Structures

Much of the property damage that occurs from severe winter weather is due to some type of utility failure:

Power Lines - Ice storms often adversely impact consistent power supplies. Ice buildup on wires can cause them to fall; downed tree limbs downed can knock out power lines. Prolonged power outages can be a threat for those relying on electricity for heat. This is a particular concern for more vulnerable populations such as the elderly.

Water Lines - Winter storms and the associated cold weather can be problematic for water lines, especially if a rapid freeze/thaw cycle is involved. As the ground freezes and thaws, pipes can shift and sometimes break causing a lack of potable water. Broken pipes can cause extensive and expensive damage to property. Frozen and burst water pipes are a real concern for the homeowner; the pipes in many homes in the planning area were not insulated in the past to protect from the low temperatures currently experienced.

Potential Losses to Future Development

The rapid growth in the planning area, especially in and around the cities of Ashland and Columbia is increasing the vulnerability to severe winter weather. As utility and infrastructure increases, so does the vulnerability to this hazard.

Previous and Future Development

Measure have been taken by some jurisdictions to help mitigate future impacts on community growth. 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. Such jurisdictions, including Ashland and Hallsville, also have policies in place regarding moving electrical lines underground when possible.

Hazard Summary by Jurisdiction

Unincorporated Boone County is at high risk for winter weather impacts. It has miles of above ground utility lines that can be brought down by heavy snow or ice and even more miles of road network to clear for travelers and first responders. A large portion of Boone County is dedicated to agriculture leaving tender crops susceptible to late season frosts.

The City of Columbia's dense nature leaves a large population vulnerable in the event of a power outage from winter weather. Both Columbia and Ashland have experienced rapid growth opening them up for vulnerability, but also the opportunity to build in resiliency through building codes and the requirement to underground new utilities.

Lack of growth and aging systems in smaller jurisdictions such as Huntsdale, Hartsburg, and Harrisburg leaves them vulnerable to power outages. Older homes can have trouble carrying snow loads during heavier storms.

PROBLEM STATEMENT

Severe winter weather is one of the most common and costly natural hazards to affect the planning area; it has been responsible for three federal Emergency Disaster Declarations and five Presidential Disaster Declarations for Boone County since 2002. In addition, climate data

indicates that winter storms are increasing due to changes in the climate. All participating jurisdictions are vulnerable to this hazard.

Some of the worst problems from severe winter weather occur when ice storms affect the area; widespread and lengthy power outages can occur. In addition, traffic accidents are a major source of injuries during severe winter weather.

The planning area has numerous mitigation activities in place which help mitigate the hazards associated with severe winter weather: active tree trimming programs to protect power lines; excellent media coverage of winter weather advisories and warnings; a snowplowing plan whereby streets critical for emergency procedures receive first priority; and abundant Red Cross certified shelters.

TORNADO

DESCRIPTION OF HAZARD

A tornado is a violently rotating column of air which is usually generated by a supercell thunderstorm. The movement speed of a tornado is typically around 10-20 mph but can range from almost stationary to more than 60 mph, according to NOAA's National Severe Storms Laboratory. They often travel from southwest to northeast but can move in any direction.

Tornadoes occur most frequently in late afternoon and early evening but can occur at any time; they 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. The seasonal, temporal, and spatial uncertainties surrounding thunderstorms and tornadoes make widespread and year round preparedness essential.

Location

The entire planning area is at risk from tornadoes. All of Missouri is located in the zone known as Tornado Alley where the occurrence of tornadoes of varying intensities are common.

Strength/Magnitude/Extent

The Enhanced Fujita or EF-Scale (Table 3.46) is currently used in the United States to classify tornadoes. It is based on engineering studies of the wind effects on 28 different types of structures (buildings, towers, poles, trees). This indirect measurement of speed is used because it is currently not possible to measure ground-level speeds in strong tornadoes; the winds destroy the instruments needed for measurement.

In addition to estimated wind speeds, averaged data from tornadoes can give an idea of the length and width of tornadoes in the different classifications.

Table 3.46 Enhanced F Scale for Tornado Damage

FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
F Number	Fastest ¼-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust	EF Number	3 Second Gust
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135

3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

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

The EF-Scale has been in use since February 1, 2007. It uses the same ratings as the original Fujita Scale (F-Scale) which it replaced, but the wind speeds have been adjusted to reflect current knowledge and give a more realistic estimate of wind speeds for all tornadoes, including historical ones in the NOAA database. The ratings of tornadoes prior to 2007 were not changed in the NOAA database with the adoption of the EF-Scale.

There continue to be limitations even with the EF-Scale since the scale is based on sustained damage. The table below list damage summaries for their respective EF rating.

Table 3.47 Enhanced Fujita Scale with Potential Damage

Enhanced Fujita Scale			
Scale	Wind Speed (mph)	Relative Frequency	Potential Damage
EF0	65-85	53.5%	Light. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e. those that remain in open fields) are always rated EF0).
EF1	86-110	31.6%	Moderate. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	10.7%	Considerable. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes complete destroyed; large trees snapped or uprooted; light object missiles generated; cars lifted off ground.
EF3	136-165	3.4%	Severe. Entire stores of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	0.7%	Devastating. Well-constructed houses and whole frame houses completely levelled; cars thrown and small missiles generated.
EF5	>200	<0.1%	Explosive. Strong frame houses levelled off foundations and swept away; automobile-sized missiles fly through the air in excess of 300 ft.; steel reinforced concrete structure badly damaged; high rise buildings have significant structural deformation; incredible phenomena will occur.

Source: NOAA Storm Prediction Center, <http://www.spc.noaa.gov/efscale/ef-scale.html>

Another issue with tornadoes is speed of onset. 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.

Previous Occurrences

The planning area has experienced thirty-two tornado events since July 1954, as officially recorded by NOAA (Figure 3.48). This includes five “significant” F2 tornadoes and three “severe” F3 tornadoes.

The historical record in the planning area over this 60+ period indicates tornadoes in the EF0 to EF3 range. While history is informative, it is not necessarily predictive of the future; there is the possibility that the planning area could experience a tornado above the EF3 level in the future.

In addition, many historical tornadoes may have been stronger than the data indicates. According to the NOAA website, “...because the only way we can compare all tornadoes is by whatever damage they caused, and EF5/F5 damage is only possible when tornadoes hit well-built structures, the true ‘violence’ of most historical tornadoes is unknown—especially before the middle to late 20th century.”

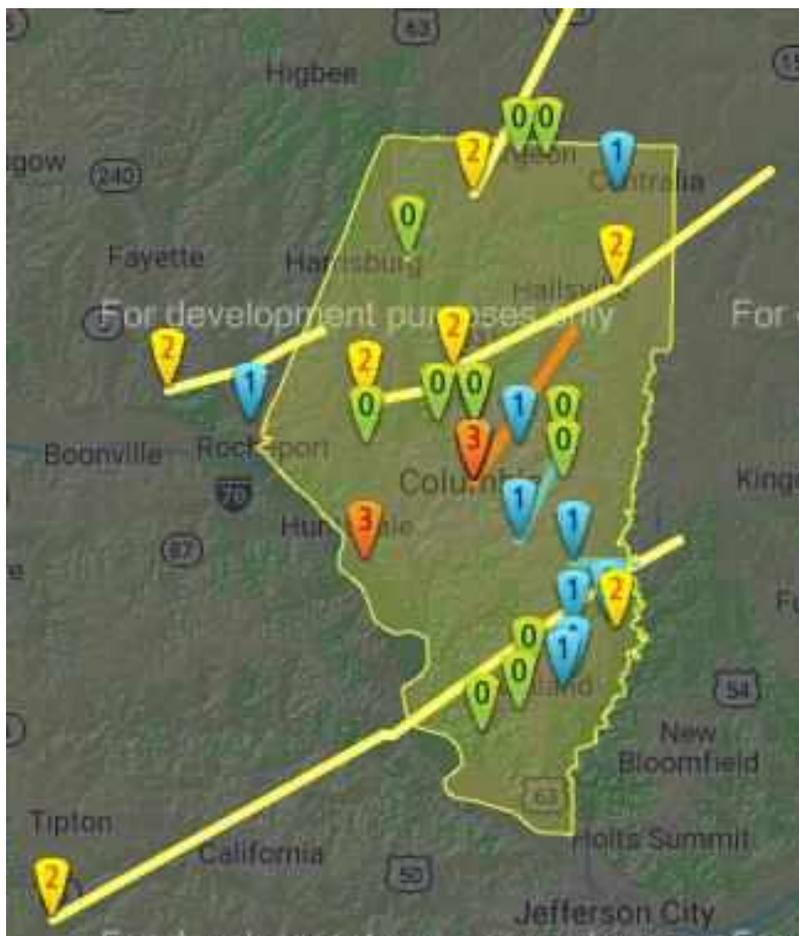
Table 3.48

Historical Tornado Occurrences

Location	Date	Length (miles)	Width (Yard)	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Boone County	04/30/54	89.6	100	F2	0	0	50K	0
Boone County	12/04/56	11.1	400	F2	0	0	250K	0
Boone County	09/27/59	6.4	50	F2	0	0	50k	0
Boone County	09/28/59	0.1	10	F1	0	0	3K	0
Boone County	10/04/59	0.2	17	F0	0	0	3K	0
Boone County	10/04/59	0.2	10	F0	0	0	3K	0
Boone County	01/25/65	0.1	10	F0	0	0	0K	0
Boone County	12/08/66	2.5	73	F1	0	0	25K	0
Boone County	09/07/72	0.1	33	F1	0	0	25K	0
Boone County	03/13/73	6.1	50	F1	0	0	25K	0
Boone County	05/26/73	3	50	F2	0	1	250K	0
Boone County	12/04/73	0.1	10	F0	0	0	25K	0
Boone County	05/12/80	42.7	50	F2	0	0	25K	0
Boone County	04/16/82	0.3	50	F0	0	0	0K	0
Boone County	05/29/82	0.1	20	F1	0	0	3K	0
Boone County	04/03/84	0.3	27	F1	0	0	0K	0
Boone County	04/29/84	0.3	10	F1	0	0	25K	0
Boone County	10/16/84	4	50	F1	0	0	25K	0
Boone County	06/17/85	1	100	F1	0	0	2.5M	0
Boone County	06/02/87	1	20	F0	0	1	0K	0
Boone County	11/27/90	1	50	F3	0	0	250K	0
Boone County	11/27/90	12	50	F3	0	3	25.0M	0
Boone County	07/02/92	0.5	50	F1	0	0	250K	0
Boone County	07/02/92	0.2	23	F0	0	0	0K	0
Columbia	07/08/95	0.2	80	F0	0	0	0	0
Columbia	11/10/98	2	70	F3	0	16	6.0M	0
Midway	04/08/99	4	120	F2	0	5	0	0
Hinton	04/08/99	10	120	F2	0	0	0	0

Ashland	02/25/00	0.2	50	F0	0	0	0	0
Centralia	03/26/00	0.3	150	F1	0	0	50K	0
Midway	05/17/01	0.1	50	F0	0	0	0	0
Harrisburg	07/07/16	0.34	50	EF0	0	0	0	0
TOTALS:					0	26	34.81M	0

Figure 3.39 Boone County Map of Historic Tornado Events



Crop losses from 2009-2019 total around \$60,765 for storm and wind damage. While USDA’s Risk Management division doesn’t list tornado as the cause for any of those damages high winds and thunderstorm-like conditions often accompany systems that can produce tornados.

Probability of Future Occurrences

High - all participating jurisdictions

For the period 1954-2019, a 66-year period, the NOAA database reports 20 years with at least one tornado event in the planning area. Based on this historical data, the calculated probability of a future tornado event of any magnitude in a year is 30%.

The probabilities of occurrence of the different magnitudes of tornadoes in any given year, based on historical data, has also been calculated (Figure 4.54). While the calculated probabilities for an EF4 or EF5 tornado are 0%, this does not mean tornadoes of these magnitudes could not occur in the planning area; it just means they have not occurred in the historical record.

EF-Scale	# of years with tornado event (1954-2019)	Probability	Probability Rating
All	20	30%	High
EF0	8	12%	High
EF1	10	15%	High
EF2	6	9%	Moderate
EF3	2	3%	Moderate
EF4	0	0%	Low
EF5	0	0%	Low

Changing Future Conditions Considerations

It is not confidently known how the change in climate could impact the frequency or severity of future tornadic activity. While the activity zone has not expanded according to the State Hazard Mitigation Plan 2018 the number of tornados has gone up since the 1950s. More studies will be needed to know the true impact over time.

Vulnerability

Vulnerability Overview

Measure of Severity

High - all participating jurisdictions

The destructive effects of a tornado depend on the strength of the winds, proximity to people and structures, the strength of structures, and how well a person is sheltered. They are obviously a hazard with the potential to cause both great loss of life and catastrophic destruction. The whole planning area is located in “Tornado Alley” where historically dangerous and destructive tornados occur frequently.

Figure 3.40 Tornado Alley in the U.S.



Potential Losses to Existing Development

Potential Impact - Life

While tornadoes can strike anywhere, there is a greater chance of injury and loss of life (and destruction of property) in population centers. This is especially true of a tornado with a large path.

There have been 26 reported injuries associated with recorded tornadoes in the planning area.

Potential Impact - Existing Structures

Tornadoes cause the most costly physical destruction when they touch ground in urban areas. High winds affect all structure types differently; non-permanent and wood framed structures are especially vulnerable to destruction.

In addition to a direct hit on a building by a tornado, damage to trees poses a serious threat. People, buildings, power lines, and vehicles are all at risk from falling branches, uprooted trees and windblown debris.

There has been \$34.81 million in reported property damages associated with recorded tornadoes in the planning area.

Missouri State Hazard Mitigation Plan (2018) Analysis: The State Hazard Mitigation Plan looked at four variables to determine tornado vulnerability in the counties of Missouri:

- Likelihood of future tornado impacts
- Average annual property loss ratio (total building exposure value divided by average annualized historic losses)
- Population Density
- Social vulnerability
- Percent mobile home

Since tornadoes are random in their location, it was decided to consider the low end of the vulnerability scale to have a Moderate Risk and the high end to have a Very High Risk. The planning area/Boone County was rated as medium vulnerability.

The State Plan set the Total Building Exposure in the planning area at \$18,473,209,000.

Previous and Future Development

There has been a rapid growth in population and housing in the planning area in recent years. A larger population and more extensive built environment increase the risk of injury, loss of life, and damage from tornadoes. Census figures indicate an overall population growth rate of 20% in the planning area (Boone County) between 2000 and 2010; housing units increased by 23% during this period.

While the housing growth rate might be expected to be somewhat lower between 2010 and 2020 due to a slow recovery from the recent economic recession, a significant growth rate overall is still expected; construction is once again vigorous. In Columbia, home to the University of Missouri, there has been a recent tremendous growth in housing development for student rental. Recent and planned student housing developments are transforming the downtown area of the city.

It would be wise to consider mitigation strategies for tornadoes and other high wind situations during the planning phase of any new development. The type of construction greatly affects vulnerability to tornadoes and high winds. Design and construction choices and the inclusion of hardened areas for safe rooms can save lives.

Hazard Summary by Jurisdiction

There are a variety of strategies in place in the planning area by which the public can be informed of the threat of tornadoes. Each jurisdiction has a storm siren inside or near their city limits to warn residents of incoming inclement weather. All jurisdictions have a designated shelter places. There is a lack of FEMA rated saferooms in the planning area though.

3.9% of homes in Boone County are listed as mobile homes. There is no requirement in Boone County for tie-downs on mobile homes; however, updated electric service cannot be obtained for a mobile home in the county unless the home is tied down.

The City of Hallsville uses the large basement of the Hallsville Baptist Church as a tornado safe room. There is one mobile home park in the city which is located very close to the church; all residents of the park are aware that this is the safe location in event of a tornado.

SUMMARY OF VULNERABILITY

The entire planning area is highly vulnerable to the potentially devastating impact of tornadoes. Their random nature and potentially quick speed of onset pose particular risks for human life. Tornadoes of the magnitude known to historically occur in the area can wreak extensive and costly structural damage.

Public awareness education, excellent weather coverage by the local media, an excellent outdoor warning system, and regular emergency exercises in the schools help mitigate the risk to human life. However, there is a great need throughout the planning area for more safe rooms to protect from high wind events; this is especially true in the schools. Additionally, more vigorous promotion of NOAA radio use would help protect the general public. Additional generators and power transfer hookups are needed in case of widespread and/or lengthy power outages. All of these identified needs have been targeted for action in the mitigation strategy; funding remains an issue for the more costly safe rooms and generators/power transfer hookups

WILDFIRE

HAZARD PROFILE

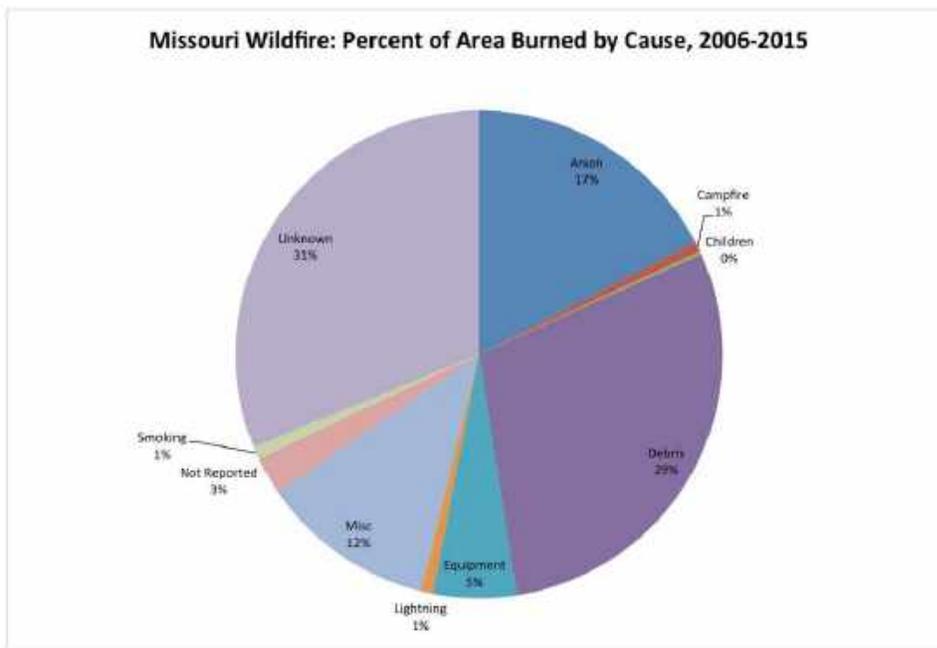
HAZARD DESCRIPTION

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

These fires may take place at any time of the year but the majority 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 (Figure 3.41).



Source: Missouri Department of Conservation

Geographic Location

The rural areas of Boone County are most at risk from wildfires because that is where the primary causative factor, debris burning, is most common.

In addition to the risk faced by rural areas, there is an increased risk of wildfire in areas called the Wildland Urban Interface (WUI). The National Wildfire Coordinating Group (NWCG) defines the WUI as "...the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuel."

Within the WUI there are three defined Community types 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.

An overview of the WUI for the planning area is shown in Figure 3.42. Columbia, Harrisburg, Hartsburg, and Rocheport all incorporate significant areas of medium or high-density wildland interface and/or intermix (Figures 3.42-3.46). Huntsdale incorporates only a small portion of medium density intermix (Figure 3.47).

Figure 3.42

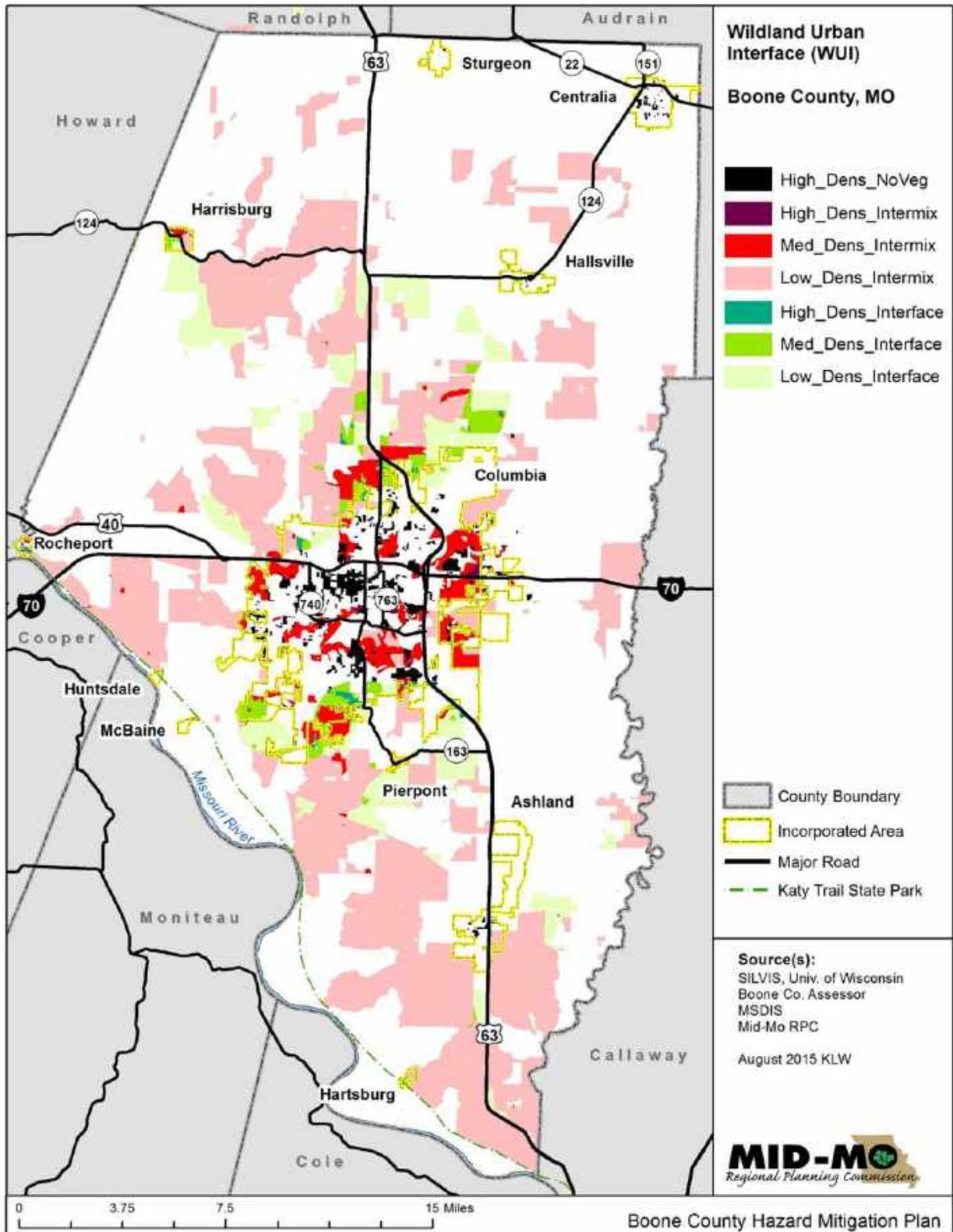


Figure 3.43

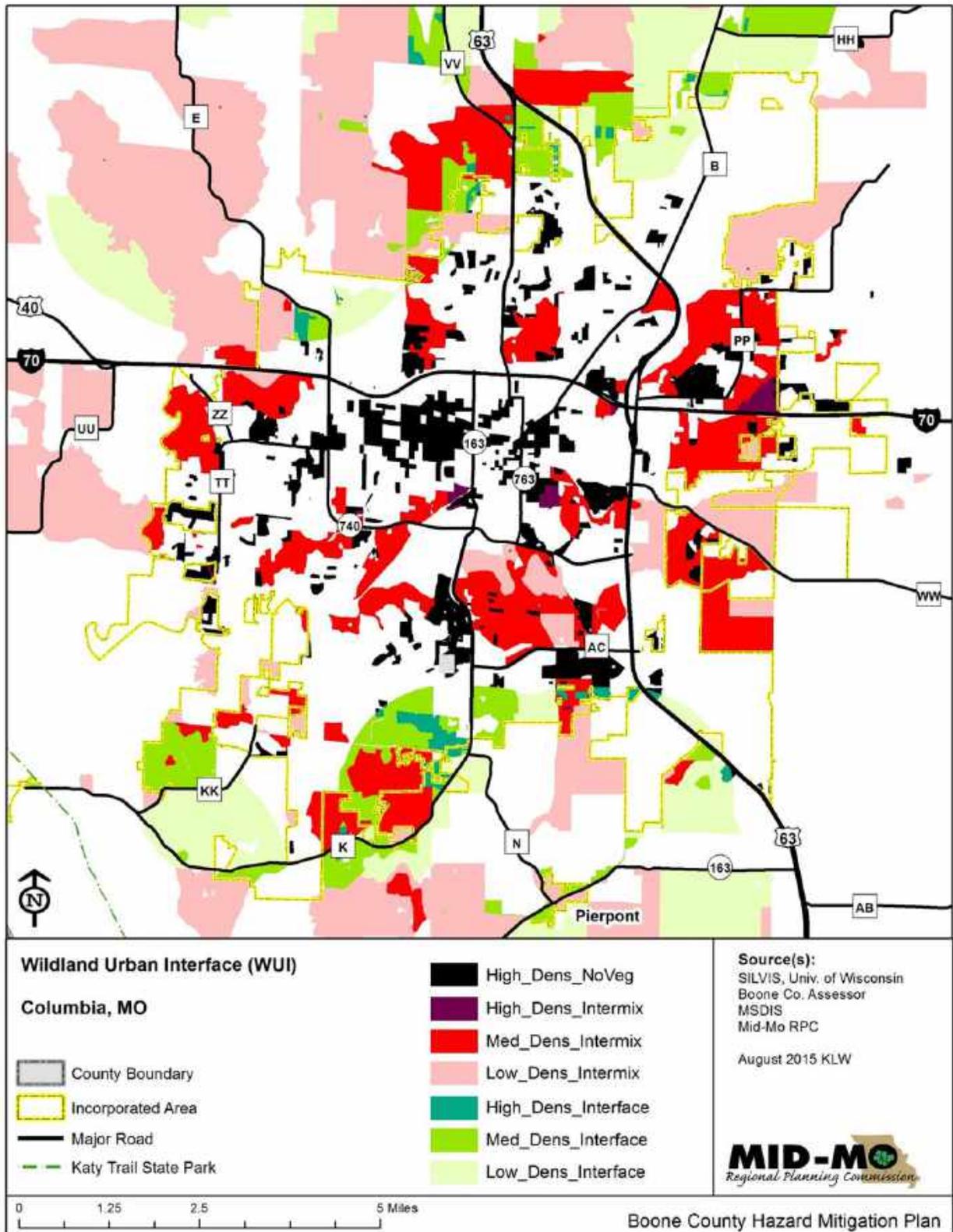


Figure 3.44

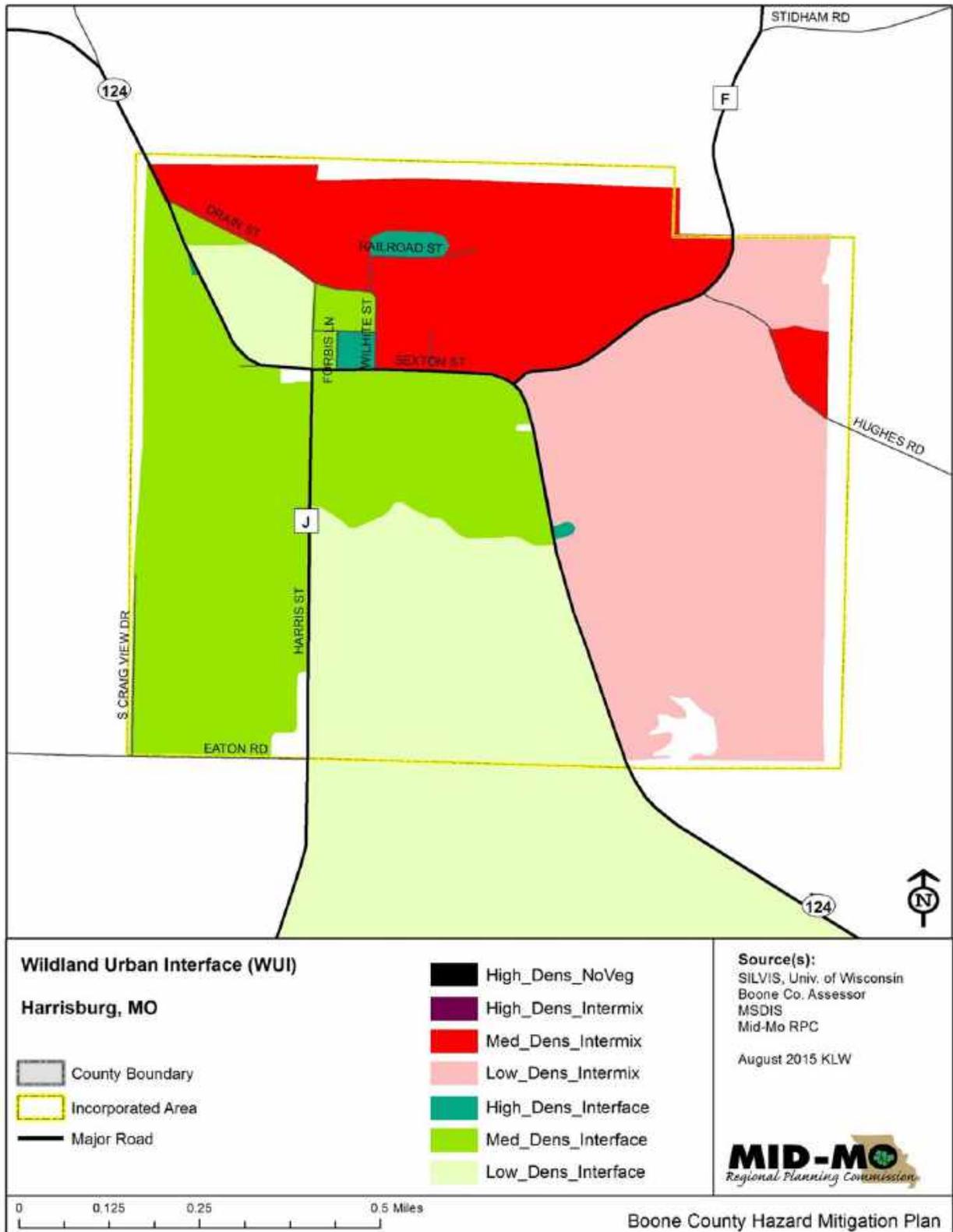


Figure 3.45

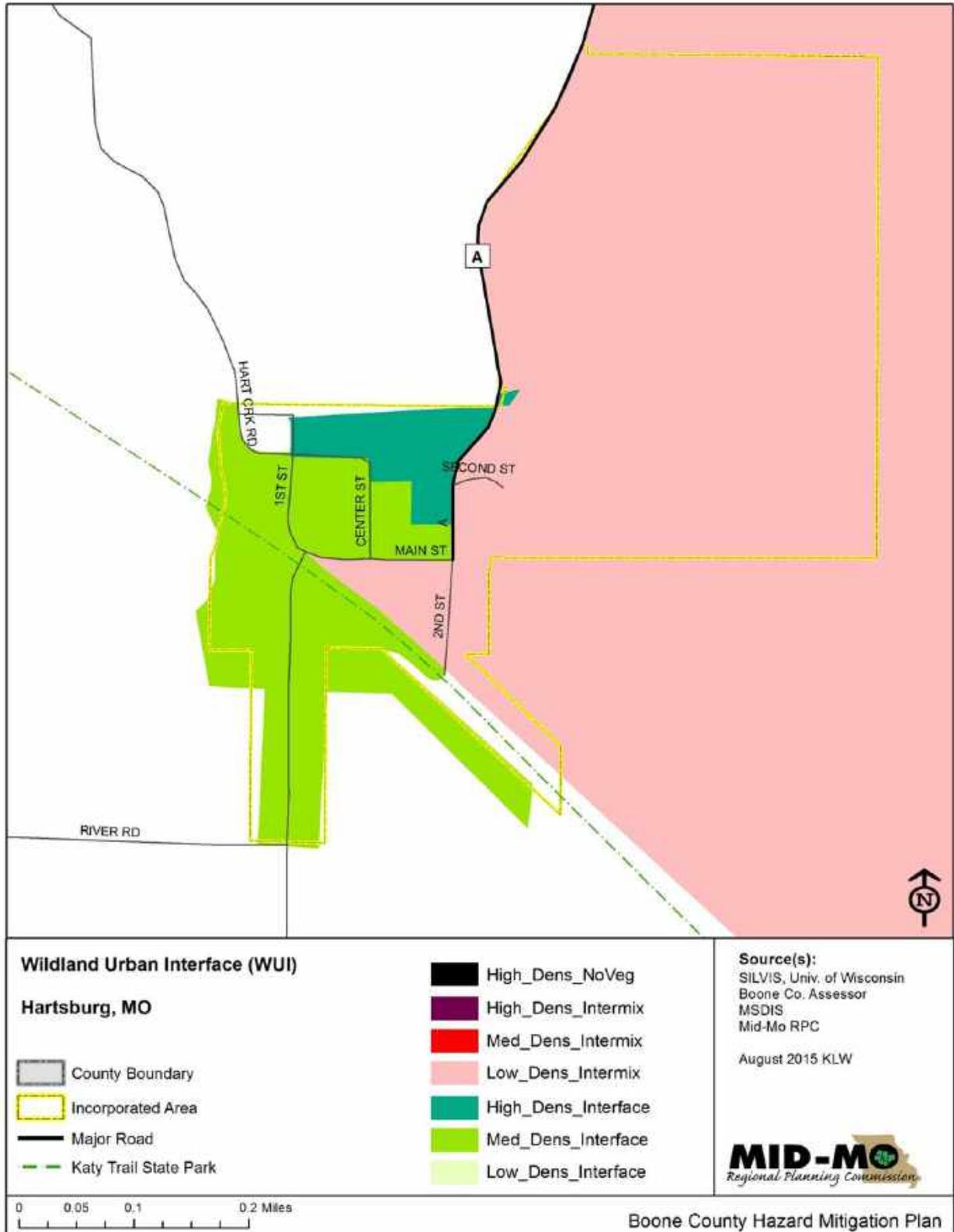


Figure 3.46

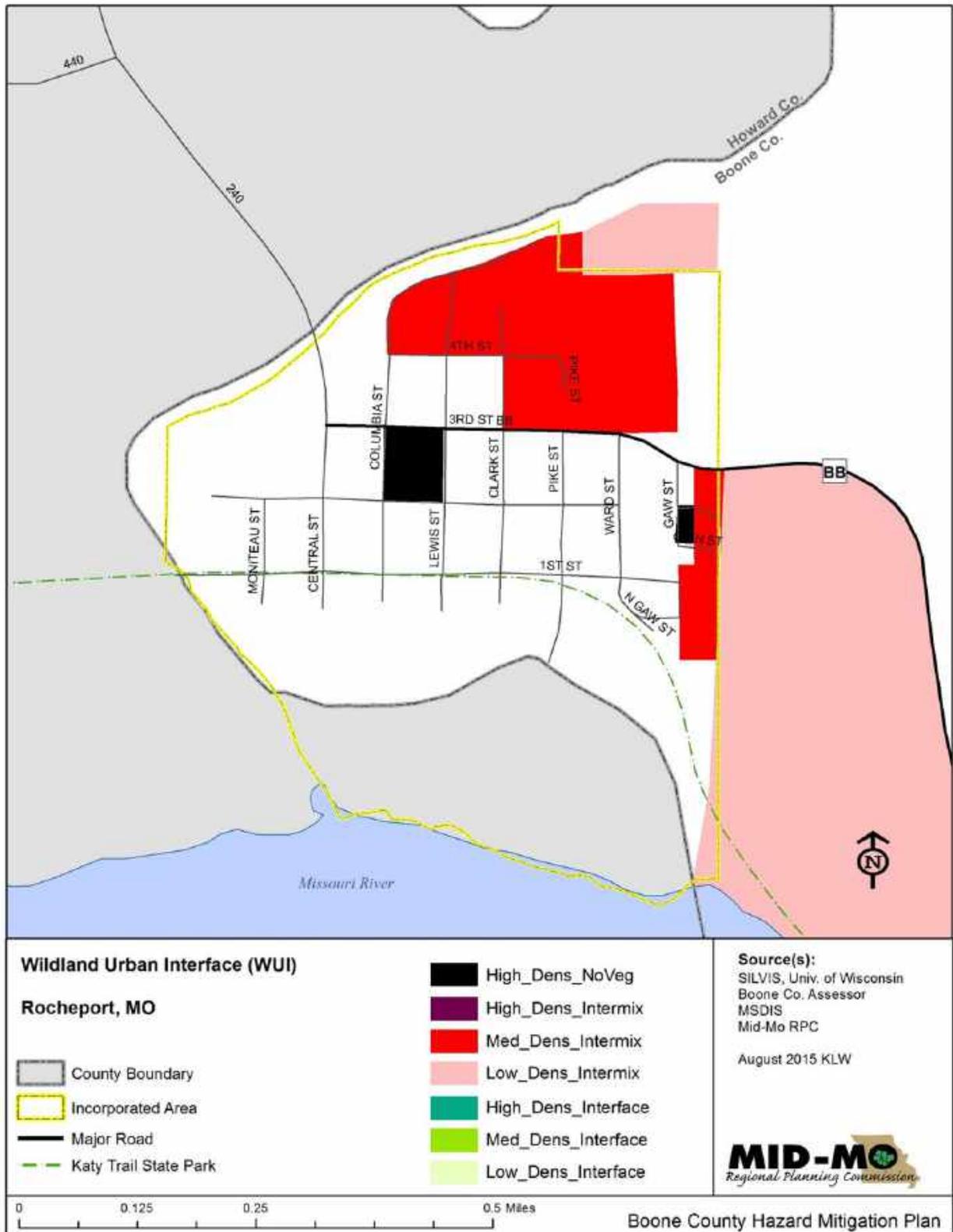
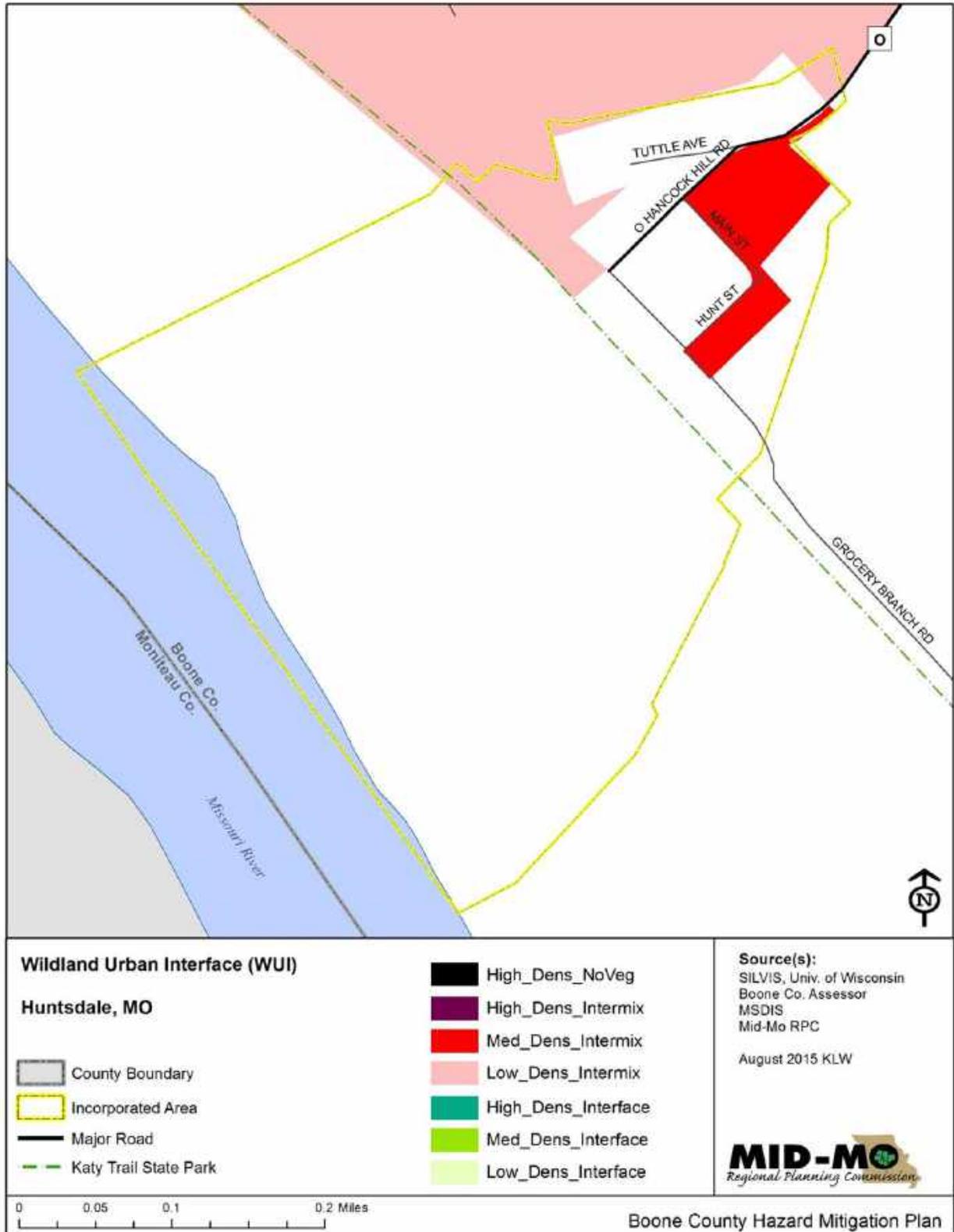


Figure 3.47



Strength/Magnitude/Extent

Most wildfires in the planning area are of limited duration due to the quick response of the fire districts. Wildfires in the area still damage the environment by killing some plants and occasionally animals. Damage to plants can heighten the risk of soil erosion and landslides. Wildfires in the planning area could also impact recreation and tourism, or reduce visibility on roadways with heavy smoke making it dangerous to drive too close to a blaze.

Wildfires are very common in the planning area. According to information from the Boone County Fire Protection District (BCFPD), there are hundreds every year. Most of these fires only require 50' by 50' fire lines; however, there are perhaps ten fires a year which burn over 10 acres. Fires of this size require a large amount of resources to put out.

Previous Occurrences

Wildfires in the planning area typically destroy crops, hay fields, green space, and woods; there have also been losses of barns, farming equipment and trucks from some fires. During the 2012 drought, a grass fire caused fire damage to a house in the City of Columbia.

Probability of Future Occurrences

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

The probability of wildfires increases during conditions of excessive heat, dryness, and drought. The probability is also higher in spring and late fall. There's only been 1 reported structure fire caused by a grass fire in the last 20 years for a probability of 5% on any given year.

Changing Future Conditions Considerations

Raising temperatures and more sporadic rains with longer periods of dry between rain events could affect vegetation and the number of days prescribed burns can safely be performed. With increased rainfall can be expected to come an abundance of plant growth that won't be able to be renewed with less prescribed burns making more fuel for fires that potentially get out of control. An increase in droughts and dry vegetation not only in the forest but around homes in the form of depleted landscaping material creates heightened risk for structures to overtaken by wildfires.

VULNERABILITY

Vulnerability Overview

Severity: Moderate – Boone County, Columbia, Harrisburg, Hartsburg, Rocheport
Low – All other participating jurisdictions

There are limitations to the data concerning wildfires. Current presentations utilize data from the National Fire Incident Reporting System (NFIRS) from 2004 to 2008 to determine vulnerability for the State Plan. With only 61 percent of fire departments in Missouri reporting to NFIRS it is hard to get a thorough overview of the rate at which fires happen and how much damage they truly cause.

Potential Losses to Existing Structures

While wildfires in the central Missouri area have the potential to destroy buildings, data from the entire Mid-MO RPC region indicates that this is more the exception than the rule. While there has been damage to built structures and vehicles in Boone County, wildfires are usually quickly suppressed and the damage to the built environment is minimal.

Potential Losses to Future Development

As development proceeds in the planning area, there is the potential for the increase in the Wildland Urban Interface (WUI); this interface puts more of the built environment at risk for structural damage from wildfire.

Hazard Summary by Jurisdiction

Columbia, Harrisburg, Hartsburg, and Rocheport all incorporate significant areas of medium or high-density wildland interface and/or intermix. This makes them more susceptible to damages from out of control burning. Huntsdale incorporates only a small portion of medium density intermix and is slightly less susceptible. Columbia has a burning ordinance in place to help control when, where, and what is being burnt in an effort to promote smart burning practices and good communication to responders if a controlled burn were to become less under control.

Many wildfires in the planning area take place in unincorporated Boone County where burning has less oversight in general. The Missouri Revised Statute 49.266, adopted in August 2013, confers the right of county commissions to adopt an order or ordinance issuing a burn ban.

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

PROBLEM STATEMENT

Wildfire is not a major threat in the planning area; however, all participating jurisdictions are potentially vulnerable. While wildfires occur on a regular basis, they are usually easily suppressed by a quick response from the fire districts and thus limited in their spread and destruction.

The threat is greatest in unincorporated Boone County, where most of the fires occur, and in Columbia, Harrisburg, Hartsburg, and Rocheport which incorporate significant areas of medium or high-density wildland urban interface or intermix.

Technical and Human-Made Risk Assessment

TECHNOLOGICAL AND HUMAN-MADE HAZARDS AFFECTING THE PLANNING AREA

In addition to natural hazards, the following technological/human hazards have been identified as posing potential risk in Boone County and are profiled in this plan in Section 5:

- Public Health Emergency
- Hazardous Materials Release
- Transportation Incident
- Nuclear Incident
- Utility Service Disruption
- Telecommunications Disruption
- Cyber Attack
- Unwanted Intruder/Active Shooter
- Terrorism
- Civil Disorder
- Mass Casualty/Fatality Event

A summary of the Probability and Severity ratings for technological/human-made hazards in each of the participating jurisdictions is shown in Figure 4.1.

PUBLIC HEALTH EMERGENCY

HAZARD PROFILE

HAZARD DESCRIPTION

Public health emergencies straddle the divide between natural and human-made hazards. There are any number of potential situations which can give rise to a public health emergency including:

- Communicable disease epidemic
- Radiological, chemical or biological terrorism
- Hazardous material release
- Nuclear incident
- Water or food contamination
- Extended utility disruption
- Wide scale destruction from any natural hazard

The Columbia/Boone County Department of Public Health and Human Services (PHHS) has the lead responsibility for protecting public health in the planning area. In recent years, much of the

planning focus has been on preparing for response to communicable disease epidemics and radiological, chemical or biological terrorism. There is a fulltime emergency management planner at PHHS in a position funded by the Center for Communicable Diseases (CDC) through the Public Health Emergency Preparedness Grant contracted by Missouri Department of Health and Senior Services.

Geographic Location

The entire planning area is at risk from a Public Health Emergency. Residence halls and student housing associated with the location of the University of Missouri, Columbia College, and Stephens College in Columbia provide the opportunity for a quicker spread of communicable diseases within that city.

Strength/Magnitude/Extent

A public health emergency can range from a short duration event in a small population to a longer duration event involving entire states, regions, the nation, or the world.

The PHHS has made the assumption in its planning that an influenza pandemic may occur in waves of 6-8 weeks and last for 12-24 months.

Previous Occurrences

There have been contained outbreaks of communicable diseases, such as shigella, and food poisoning incidents in the planning area. Larger public health emergencies have been separated by a number of years.

Historically, in 1918, the planning area was affected by the flu pandemic sweeping the world. Certain movement restrictions were placed on citizens and students at the University of Missouri. The flu pandemic resulted in 9,677 deaths statewide in 1918, according to the *MO State Hazard Mitigation Plan (2018)*; the death rate dropped by half in the subsequent year.

In December 2019 Chinese Health officials reported the first cases of what we would come to know as Covid-19. This new form of Coronavirus would swiftly move into a worldwide pandemic. March 13, 2020 Governor Mike Parson signed an executive order declaring a state of emergency for Missouri. Only 4 days later, Boone County reported its first case of Covid-19 on March 17, 2020. As of June 18, 2020 there had been 232 recorded cases of Covid-19 in Boone County.

Probability of Future Events

Moderate for all participating jurisdictions. The uptick in travel throughout the country as well as worldwide elevates the risk of disease spread to large regions of people very quickly.

VULNERABILITY

Vulnerability Overview

Measure of Severity – Moderate to High for all participating jurisdictions

The measure of severity is variable due to the varying impact of the wide-range of events which could trigger a public health emergency. For example, a limited hazardous material release or a utility disruption might result in only some injuries and property damage. On the other hand, an influenza pandemic would have the high probability of resulting in major injury and death in the planning area.

In addition to direct impacts on life and existing structures, a public health emergency has the potential for large economic effects. A CDC model suggests that about 20% of the work force will be absent due to illness or caring for family at the height of a pandemic. There is also the possibility of the population being asked or required to “shelter at home” and businesses and schools being shut down.

Potential Losses to Life

Information modeled for the PHS Pandemic Flu Plan in 2006 gives an indication of the potential impact of varying levels of flu pandemic on the planning area (Figure 3.48). It should be noted that the population of the planning area has increased by over 20,000 since this modeling was done.

Figure 3.48

IMPACT ESTIMATE OF A PANDEMIC ON BOONE COUNTY

Potential impact of a 1918-like “major pandemic” Pandemic – U. S. and Boone County					
	Population	Clinically Ill (30%)	Outpatient Care (50% of ill)	Hospitalized (11% of ill)	Deaths (2.1%)
U.S.	297.7 million	90 million	45 million	3.9 million	1.3 million
Missouri	6 million	1.8 million	900,000	188,000	39,510
Boone County	141,361	42,410	21,205	4,666	899
Boone Co. + college students	153,067	45,720	22,860	5,679	1,066
Boone Co. + college students + regional draw to healthcare service ¹	661,101	198,332	99,166	21,817	4,166

¹FluSurge Estimates of a mild pandemic (similar to 1957 and 1968 pandemics)

Population	Hospitalized (15-35%)	Deaths (15-35%)
Boone County	358-835	87-203
Boone Co. + college students	425-992	103-241
Boone Co. + college students + regional draw to healthcare service ¹	1833-4278	458-1068

¹ Estimation of regional draw from Boone Hospital Center discharge data to include a 25 county area around Boone County.

² FluSurge is a Center for Disease Control computer program for estimating pandemic flu impacts on a community. The program utilizes projections based on the 1957 and 1968 pandemics.

Source: *Pandemic Influenza and Highly Infectious Respiratory Disease Response Plan for Boone County Missouri*

Potential Losses to Existing Development

The organism which causes Legionnaire’s Disease can reside in hot water systems; a thorough decontamination of the system must take place in this situation. There is the possibility that other existing or emerging diseases may be found to have a relationship to the built environment which results in costs or economic losses.

Potential Impact - Future Development

The planning area has seen rapid growth and development in the past decades; indications suggest that this growth will continue. Population growth increases the overall risk for communicable diseases, especially in areas where crowding occurs.

In addition, the past decades have witnessed an incredible increase in air travel and global movement. This new “global community” allows for the introduction of diseases not endemic to the area and the reemergence of previously eradicated diseases.

Following a large pandemic that has forced businesses to close and people to shelter in place the potential for a recession is heightened which can slow or even halt growth.

Hazard Summary by Jurisdiction

The population density of Columbia and the rapid growth of the Ashland area make it vulnerable to the spread of disease. As Columbia is the center for employment in the region anyone who works in Columbia or does their shopping their run the risk of catching and spreading illnesses out of the city center and into unincorporated Boone and surrounding areas. The City of Columbia is also the source for medical attention in the region which draws people with illnesses and ailments from all over to the planning area. Boone County and Columbia have several plans in place to help mitigate and control the spread of diseases and illnesses in the planning area.

Centralia, Hartsburg, and Huntsdale have 20% or more of their population that is 65 or older according to American Community Survey estimates. Illnesses such as the flu tend to be harder on aging populations. Covid-19 was especially hard on those over the age of 65 or anyone with preexisting medical conditions.

All school districts run a special risk for certain diseases and illnesses due to the number of children that come in close contact with each other throughout the school day. Young children can be challenging to get to understand the impacts the spread of germs can have on others. Mandatory vaccination plays a role in school districts efforts to suppress certain diseases as well as diligent teachers and custodial staff.

PROBLEM STATEMENT

A public health emergency can come in many sizes and shapes. The entire planning area is vulnerable; the greatest known threats are an epidemic/pandemic or an emergency arising from radiological, chemical or biological terrorism. There is a high chance that a public health emergency might evolve in the midst of another disaster, complicating both response and recovery.

The planning area is probably better prepared to meet a public health emergency than many locales. The excellent work of the Columbia/Boone County Department of Public Health and Human Services (PHHS) has resulted in extensive planning and provisioning for a wide variety of possible emergencies. There are significant medical and hospital resources in the planning area. Coordination between PHHS and federal, state, and local agencies is excellent.

Nonetheless, a significant risk still exists; the potential sources of a public health emergency are numerous, varied, dangerous, and continually evolving.

HAZARDOUS MATERIALS RELEASE

HAZARD PROFILE

HAZARD DESCRIPTION

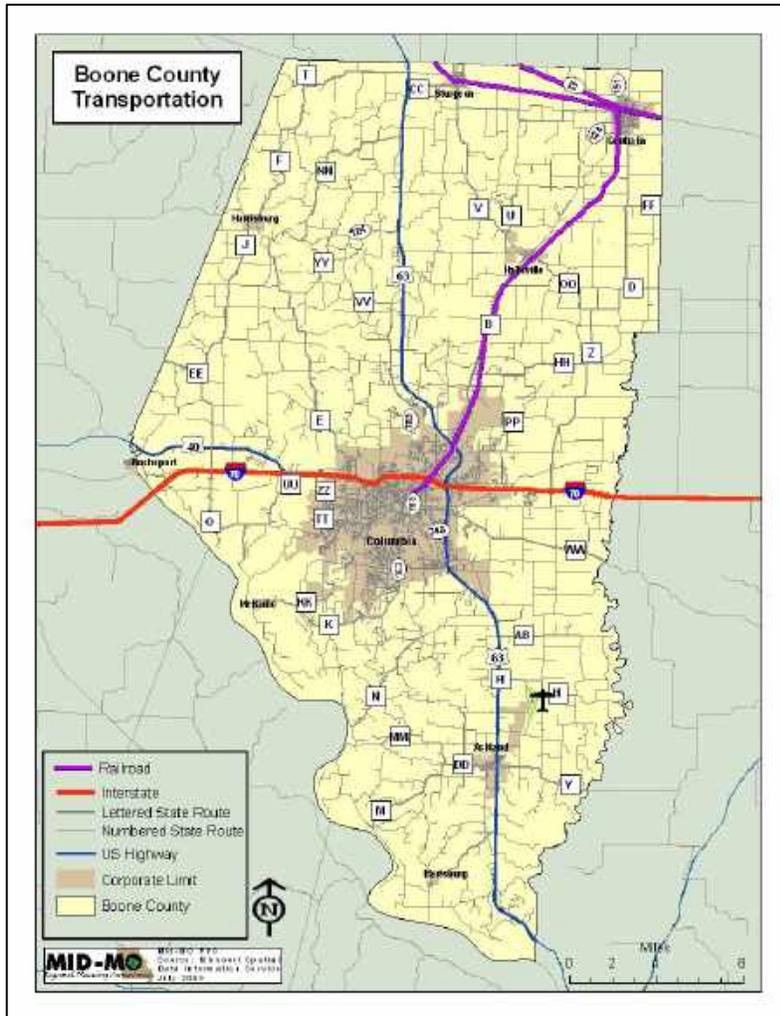
The Department of Homeland Security defines a hazardous materials release as “The improper leak, spillage, discharge, or disposal of hazardous materials or substances (such as explosives, toxic chemicals, and radioactive materials) poses a significant threat to human health and safety, campus property, and the surrounding environment.”

Geographic Location

The entire planning area is at risk from a Hazardous Materials Release. This could originate from a transportation incident along the highway system, railways, or pipelines or at a fixed facility using or generating hazardous materials in its operation. The following information is taken from Annex H of the *Boone County Emergency Operations Plan*.

Transportation Routes There are multiple transportation modes and routes in the planning area which may be used to transport hazardous materials (Figure 3.49).

Figure 3.49



Two major highways, I-70 (east-west) and Highway 63 (north-south), traverse the planning area. These highways intersect each other within the City of Columbia and are common routes for the transportation of hazardous substances, the majority of which are petroleum-based products.

Three railroads, the Columbia Terminal (COLT), Norfolk Southern and Kansas City Southern Railroad, run through the planning area. The two latter railroads serve the northern portion of Boone County and may transport cars containing hazardous or extremely hazardous substances.

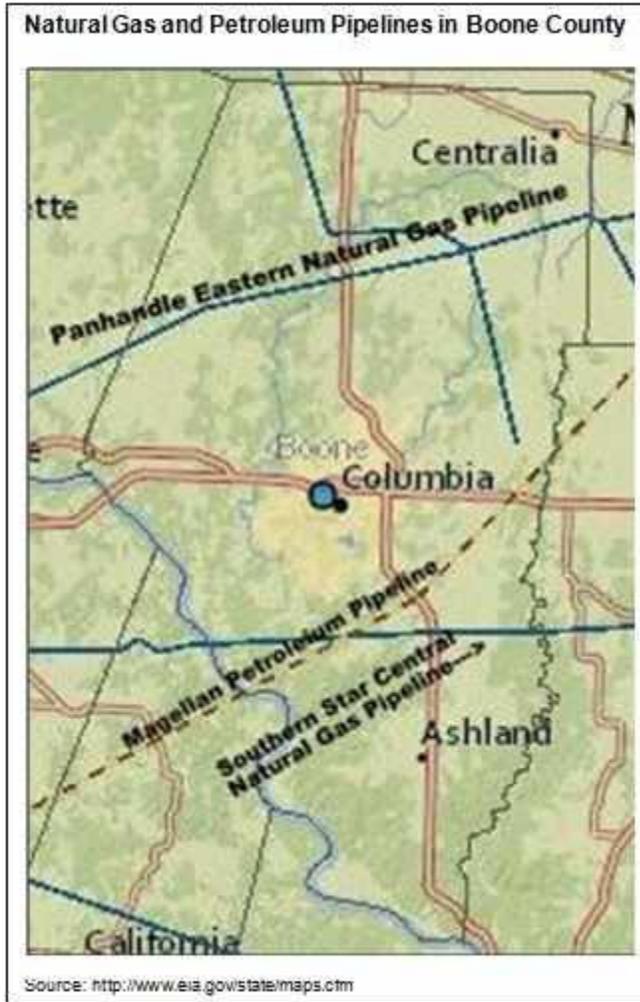
Columbia Regional Airport, located between Columbia and Ashland, serves Boone County and Central Missouri.

The Missouri River, which defines the southwestern

boundary of Boone County, is a commercially navigable river.

Pipelines There are three natural gas lines and a major petroleum pipeline that run through planning area (Figure 3.5).

Figure 3.5



Panhandle Eastern has two natural gas pipelines running through the northern part of Boone County. A Southern Star Central natural gas pipeline crosses the county in the south, between Columbia and Ashland. A Magellan petroleum pipeline also crosses the county south of Columbia.

The two southern pipelines run near the City of Columbia’s water source in the alluvial floodplain of McBaine Bottoms, according to the city’s *Source Water Protection Plan (2013)*

In addition to the major pipelines, there is a network of pipelines carrying natural gas and other materials throughout the county.

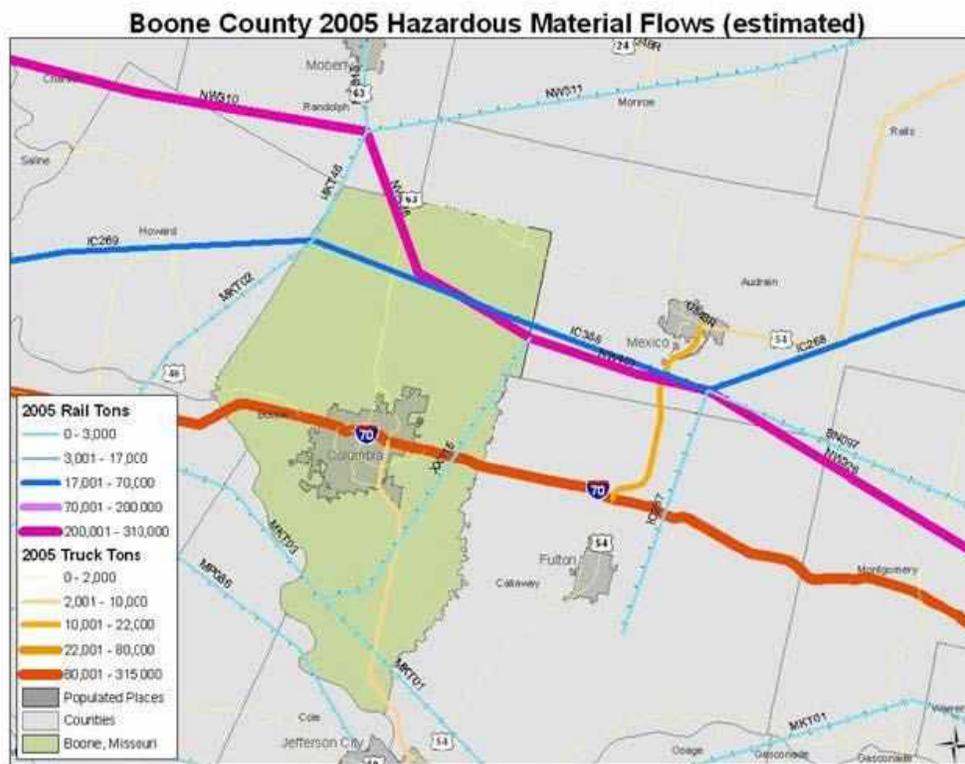
Fixed Facilities: There are a large number of fixed facilities in the planning area that use, produce and/or store hazardous materials. There are a small number of facilities in the planning area that use or store extremely hazardous substances (EHS). The University of Missouri operates the University of Missouri-Columbia Research Reactor (MURR) that produces and stores nuclear waste until it can be shipped off for regulated disposal.

Strength/Magnitude/Extent

Hazardous materials emergencies can range from small fuel spills to large-scale releases.

Estimated material flows on transportation routes through the planning area were made in 2005 (Figure 3.51) and give some idea of the potential extent of the issue. However, the LEPC questions the accuracy of these estimates; in addition, the map shows an incorrect placement of the railways in northern Boone County. Understanding the true extent of the potential threat from the transportation sector has been identified as a need by the LEPC.

Figure 3.51



Previous Occurrences

Information from the Missouri State Hazard Mitigation Plan (2018) shows release incidents from 2007-2016 Boone County had:

- 15- fixed facility
- 1- airplane/airport
- 1- railroad/railyard
- 129- roadway
- 23- waterway
- 18- pipeline/pump station

Probability of Future Events – Low for all participating jurisdictions

The online MEERTS search rendered 819 incidents in Boone County between 2000-2020. This averages to ~41 events per year. The Boone County Fire Protection District (BCFPD), Columbia Fire Department and Southern Boone County Fire Protection District respond to about 15,000-16,000 calls per year, according to an estimate from BCFPD personnel. If all of these hazardous material incidents resulted in emergency calls, the calls would still only make up 0.3% of the total calls.

Vulnerability

Vulnerability Overview

Measure of Severity – Low for all participating jurisdictions

According to the Boone County LEPC (Local Emergency Planning Committee), injuries/casualties associated with hazardous material spills in the Planning Area are very low.

The greatest areas of concern from an emergency management perspective are: 1) petroleum releases from commercial vehicles on highways and 2) accidents/spills or fires in residential garages that may contain disproportionate amounts of consumer quantities of hazardous materials. The reporting threshold for a petroleum release is 50 gallons; e.g. a typical accident that might require an emergency response would be when saddle tank(s) get ripped open on a commercial vehicle which may contain greater than 50 gallons of petroleum product.

There are no reporting requirements for releases at private residences; these incidents are only reported if responders are called. Emergency response is usually called once someone has already been affected by the release. One of the main dangers posed in the residential incidents is the potential mixing together of various stored, and possibly out-of-date and degraded, chemicals; this random mixing can result in increased toxicity, flammability or reactivity.

Fixed facilities have a vested economic interest in the responsible management of their hazardous materials in order to prevent accidents and releases. While personnel are typically well trained and good stewards of the materials, the levels of hazardous materials at some facilities

still present high risks should an earthquake, tornado, or some other hazard damage the facility. These facilities are monitored to mitigate the impact should an unavoidable disaster affect the facilities.

Potential Losses to Life

According to the LEPC, the risk to human life is very low from most hazardous chemical releases. It would only be extreme situations which would pose a great threat. The potential is there, however, and is explained as follows in the Boone County Emergency Operations Plan:

A release or threatened release of hazardous material could result in serious and quickly escalating threats to the public. Determination of the type of hazard involves knowing what hazardous material is involved and its potential impact and containment status. The physical or chemical characteristics of hazardous materials may include toxicity, flammability or reactivity. These factors require technical analysis by qualified and approved specialists in order to determine existing hazards, the anticipated course of the incident and any cascading hazards.

(EOP, Annex H)

Potential Losses to Existing Development

There is the potential for structures to be impacted by hazardous substance releases. A release involving an explosion could impact the HVAC system and therefore the entire facility. A major release at a fixed facility has the potential to require road closures and restricted access during environmental assessment and cleanup; in addition to inconvenience, this would result in financial losses.

Potential Losses to Future Development

More development is expected in the future at the University of Missouri's Discovery Ridge Research Park which is located in southeastern Columbia, adjacent to Highway 63 and close to the Columbia Regional Airport.

Plans are currently underway for Northwest Medical Isotopes (NWMI) to locate at the research park; NWMI is intended to break ground in the summer of 2020. NWMI will be working closely with the University of Missouri-Columbia Research Reactor (MURR). A central part of NWMI's mission is to provide a domestic, secure, and reliable supply of Mo⁹⁹ for medical diagnostics. This will be done with a reactor fission method using LEU (low-enriched uranium) targets shipped to irradiation facilities (MURR, etc) then transported back to NWMI for processing of target for Mo⁹⁹ for medical use.

The Mo⁹⁹ isotope decays very rapidly and must be continuously produced on a weekly basis and shipped to hospital end users. NWMI will be producing, processing, storing, and shipping volumes of materials; this will result in significant numbers of shipments containing increased radioactivity, above the current level of transits on the local transportation corridors. Additional impacts to the environment and public within future Exposure Planning Zones (EPZ) and Ingestion Pathway Zones (IPZ) may impact current assumptions regarding potential exposure and future needs for responder training; this should all be reassessed when more information is made available and future revisions of this document are due.

As more businesses locate at Discovery Ridge, additional evaluations (and possibly trainings) will be needed to understand the classification of materials involved, transportation routes of materials, and handling by emergency response agencies.

Hazardous materials also affect future development in another significant way; spills on parcels in the past can affect the desire to develop the parcels. The Boone County Fire Protection District regularly receives calls requesting a check of their database for HazMat spills.

Hazard Summary by Jurisdiction

All jurisdictions in the planning area experience some risk of a spill due to the various transportation networks that run throughout the planning area. Columbia has the most roads and intersections that are used to transport hazardous materials. Busy intersections and a high density of traffic brings opportunity for crashes that can cause hazardous materials being transported through the region to leak or spill.

Columbia is also home to major medical centers that produce hazardous medical waste and the University of Missouri that has the University of Missouri Research Reactor (MURR). With the convenient location of Columbia located centrally to areas of interest and the road network making it quick to transport goods from the area Columbia will continue to draw new business that may create or transport hazardous materials.

Centralia has several rail lines that run through town that can carry various loads, some potentially hazardous that makes them vulnerable to railway accidents.

All jurisdictions with gas stations can have underground tank leaks that can form over time or from poor maintenance.

PROBLEM STATEMENT

The entire planning area is vulnerable to a hazardous materials release. However, hazardous materials are highly regulated by federal law; multiple safeguards and emergency response teams are in place to mitigate the potential threat of a hazardous material incident.

The Boone County Local Emergency Planning Committee (LEPC) identifies residential garages as one major concern in hazardous material spills. This is due to the potential toxic, flammable, or reactive mix which may be created where numerous chemicals are stored in close proximity. Petroleum-based spills on the highways are the other major area of concern.

As some of the more rural areas of the county experience a transition from agriculture to urban development, past hazardous material spills may be a roadblock, or at least an added expense, on the way to development.

TRANSPORTATION INCIDENT

HAZARD PROFILE

HAZARD DESCRIPTION

This section of the plan deals with major accidents involving air or passenger rail travel which result in injury or death. The risks associated with highway transportation accidents involving hazardous materials are covered in the section on Hazardous Materials Release.

Columbia Regional Airport is located between Columbia and Ashland, to the east of U.S. Highway 63. The airport is served by American Airline and United, with daily flights to and from Chicago, Dallas/Fort Worth, and Denver. In addition, there are numerous charter flights associated with athletics and other activities at the University of Missouri. At the present time, there is not a lot of freight activity at the airport.

There is currently no passenger rail operating in the planning area.

Geographic Location

Boone County and the City of Columbia are at risk from a transportation incident. The airport is located within the corporate boundaries of Columbia; the city and the surrounding areas in Boone County are flown over during the most likely times for an accident: takeoff, ascent, descent, and landing.

Strength/Magnitude/Extent

Extent is defined as an attribute of the hazard alone which does not include its effect on humans or the built environment”; a transportation incident, for the purpose of this plan, is defined as an accident resulting in injury or death. There is not, therefore, a possible way to describe the extent of a transportation incident.

Previous Occurrences

Historically, there have been some deaths resulting from small aircraft crashes in the planning area, but there have been no major crashes.

In January of 2019 a flight from Dallas/Fort Worth slid off the runway as it was taxiing off the main runway back to its terminal. There were no injuries or fuel/fluid leaks reported with the incident.

Probability of Future Occurrences

Low – Boone County and City of Columbia
Not applicable – all other participating jurisdictions

VULNERABILITY

VULNERABILITY OVERVIEW

By the definition established for this plan, a transportation incident is a passenger rail or air accident which results in injury or death.

Potential Losses of Life

While airplane accidents are extremely rare given the high volume of traffic, when they do occur they usually result in injuries and at least some loss of life. As the airport expands to take on larger flights the risk for loss of life in larger quantities in the event of an accident goes up.

Potential Losses of Existing Structures

There is the possibility of an aircraft crashing into a building. This is a rare event which is impossible to predict or assess.

Potential Losses of Future Development

The Columbia Regional Airport is expanding its runways to allow service from larger jets. This will probably increase both passenger service and will also open the door for cargo operations. These developments would statistically increase the risks of a transportation incident; however, the probability of an incident would remain low.

Hazard Summary by Jurisdiction

The Columbia Regional Airport is located within the jurisdiction of Columbia, but resides close to Ashland. The airline industry is highly regulated to ensure passenger safety. The Columbia Regional Airport complies with all requirements of the Federal Aviation Administration (FAA) and Transportation Safety Administration (TSA). The airport Emergency Plan is regularly updated; a complete exercise of the plan is carried out every three years.

No other jurisdictions are located near a commercial airport.

Problem Statement

While the potential exists for a major air transportation incident in the planning area, the probability of its occurrence is quite low. The jurisdictions at risk, should an accident occur, are the City of Columbia, where the regional airport is located, and the surrounding areas in Boone County which are flown over at lower altitudes during takeoff, ascent, descent, and landing.

A transportation incident involving an airplane is a low probability/high severity event. While an accident involving a large plane would most probably result in injuries and at least some loss of life, the vulnerability to this hazard has been assessed as low due to the extreme rarity of such events.

NUCLEAR INCIDENT

HAZARD PROFILE

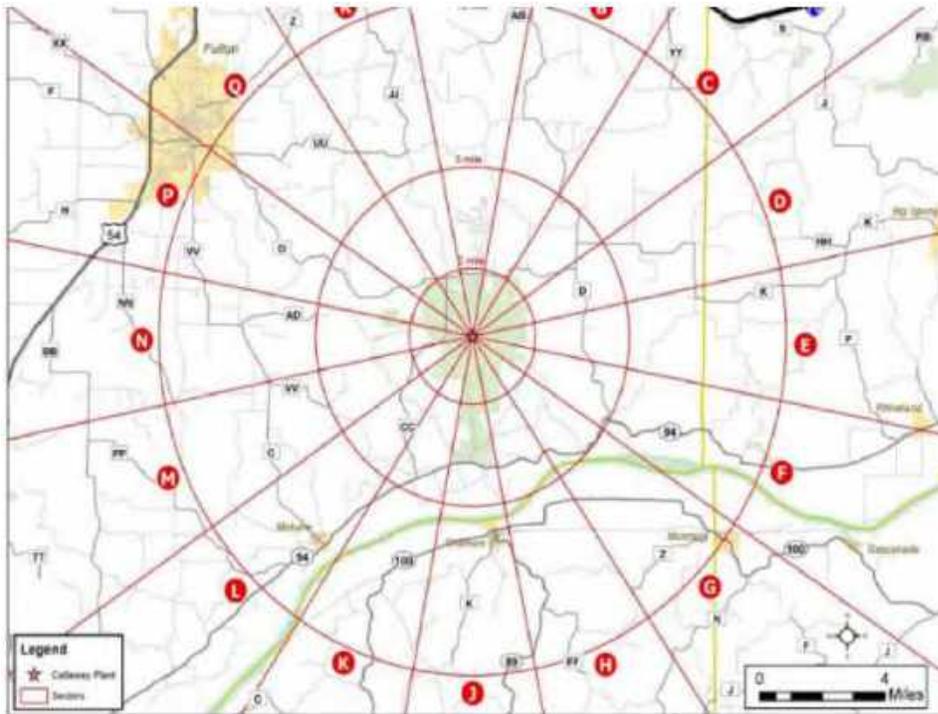
HAZARD DESCRIPTION

This section will deal specifically with the risks posed by a nuclear incident at a nuclear reactor.

Geographic Location

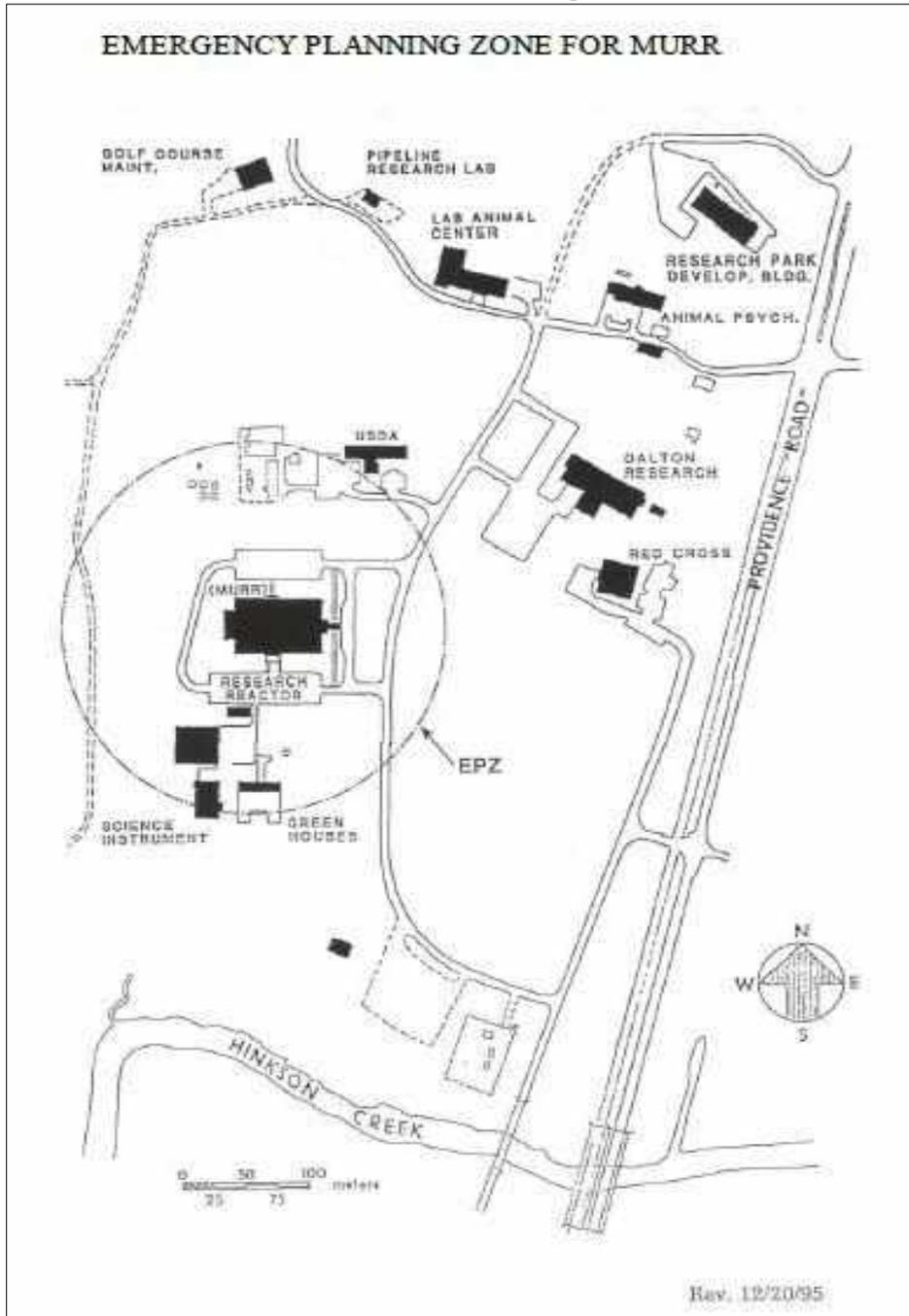
The entire Planning Area is outside of the 10-mile radius Emergency Planning Zone for the Callaway Nuclear Plant in adjacent Callaway County, but it is within the 10-50 mile radius Ingestion Exposure Pathway Zone (Figure 3.52).

Figure 3.52



Source: Missouri Nuclear Power Plant Accident Plan, 2015

In addition, the University of Missouri-Columbia Research Reactor (MURR) is located within the City of Columbia. The Emergency Planning Zone for the MURR is the area within a 100-meter radius of the reactor's exhaust stack. Figure 3.53 below shows this zone.



Source: Missouri Hazard Analysis 2013

Strength/Magnitude/Extent

There are four classes of Emergency Action Levels used for early notification of incidents at nuclear reactors:

A. Notification of Unusual Event - This indicates a potential degradation of the safety level of the plant; no releases of radioactive material requiring off-site response or monitoring are expected unless safety systems are further degraded.

B. Alert - Unusual events are in process or have occurred and indicate a potential degradation of the level of plant safety; any releases are expected to be limited to small fractions of the Environmental Protection Agency (EPA) Protective Action Guideline (PAG) exposure levels.

C. Site Area Emergency – Events are in process or have occurred that involve actual or likely major failures of the plant functions needed to protect the public; no releases are expected to exceed EPA PAG exposure levels except near the site boundary.

D. General Emergency - An event is in process or has occurred that involves actual or imminent substantial core degradation or melting, with the potential for loss of containment integrity; releases can reasonably be expected to exceed the EPA PAG exposure levels off-site for more than the immediate site area

Callaway Nuclear Plant - Only the most serious incident (General Emergency) has the potential to have a direct effect on the Planning Area. Whether a General Emergency would result in contamination in the Planning Area would depend on the nature of the incident and meteorological conditions during the release.

University of Missouri-Columbia Research Reactor (MURR) - With regard to a potential incident at the MURR, it has been determined that “no credible potential accidents have been identified...that would result in exceeding the classification of Notification of Unusual Events” (*Missouri Hazard Analysis*). The greatest risk posed by activities at the MURR is that resulting from the transport of radiopharmaceuticals produced at the reactor. This issue falls under the purview of the LEPC which deals with hazardous materials (Section 5.2).

Previous Occurrences

The only nuclear incident in the United States equivalent to a General Emergency was the leaking of radioactive materials at Three Mile Island in Pennsylvania in 1979. According to 2013 information from FEMA, there have been five Site Area Emergencies with no release of radioactive materials at commercial nuclear power plants and four at non-commercial reactors.

Callaway Nuclear Reactor - The Callaway Nuclear Reactor has been in operation since 1984 and has had no major safety concerns in that time. It was originally licensed to operate until 2024 and the Nuclear Regulatory Commission (NRC) has extended its license to 2044.

MURR - “The MURR has been in operation since October 1967. The reactor averages 8,060 hours of operation per year (155 hours per week) at peak flux due to the service work that it

performs. During its history of operation, the MURR has never had an incident that would be considered an emergency action level” (*Missouri Hazard Analysis*).

Probability of Future Events – Low

“The Reactor Safety Study conducted by the NRC rated the chances of a major nuclear disaster as very low (a probability of one in one million per plant operating year). The report concluded that the worst accident type that could affect a nuclear power plant would be one resulting in a meltdown, which could be expected to occur once in 20,000 years of reactor operation. The report also stated that a meltdown would likely cause less than one fatality or injury. This low hazard rating is due to all of the added safety engineered instrumentation used to monitor and shut down nuclear plant systems before any severe damage occurs” (*Missouri Hazard Analysis*).

In addition, following the 2011 nuclear accident at Fukushima in Japan, the NRC increased requirements for nuclear plants in the United States. This has resulted in major upgrades to the Callaway Nuclear Reactor site including a new hardened facility sited next to the original facility; the Callaway Plant now has backup systems for its backup systems.

VULNERABILITY

VULNERABILITY OVERVIEW

With regard to a potential incident at the MURR, it has been determined that “no credible potential accidents have been identified...that would result in exceeding the classification of Notification of Unusual Events” (*Missouri Hazard Analysis*). The Notification of Unusual Events classification indicates “no releases of radioactive material requiring off-site response or monitoring”.

In the case of a General Emergency at the Callaway Nuclear Reactor, the major impact in the Planning Area (aside from the possible need for some decontamination) would be the sheltering of persons from the exposure zone in Callaway County. The Hearn Center at the University is a designated shelter location for some of the evacuees. Should sheltering and services be required for a lengthy time, this could have an economic effect on the Planning Area.

The Planning Area would be involved in other ways should a General Emergency occur: the Columbia Regional Airport, located in the Planning Area, would be used to fly in equipment and personnel; law enforcement and public works departments in the Planning Area might be called upon for assistance.

Potential Losses to Life

If contamination occurred in the Planning Area, it could pose a threat to the health and safety of humans, animals, and agricultural production.

The nature of the incident and extent of contamination would determine the state or federal resources activated to address contamination concerns as well as methods for decontamination, sheltering in place or evacuation of members of the public, and isolation of contaminated areas. While portions of the planning area may be impacted by wind spread radiological contamination,

it is expected that the contamination will be minimal due to the distance travelled from source of contamination, nature of particle size and mass, and deposition mechanics of the height of plume, including wind speed and direction.

Should contamination of the planning area occur, it is very likely that the Missouri State Emergency Management Agency, along with initial responders from the Missouri Department of Health and Human Services, Missouri Department of Natural Resources and other local offsite organizations such as local fire departments and radiological technical experts from the University, would be the initial group to begin response and assessment of contamination. This initial response would soon be followed up by a mobilization of numerous response teams from federal agencies such as the EPA and U.S. Nuclear Regulatory Commission, U.S. Department of Agriculture, U.S. FDA etc. to determine the nature and extent of the radiological contamination as well as recommend “Early” “Intermediate”, and “Late or Recovery” phase response actions.

The initial assessments would attempt to estimate the levels of internal or external exposure for a member of the public from plume contaminants (radioactive iodines, strontiums, etc.) as well as contamination of drinking water supplies and food stuffs. Once those levels of contamination and projected worst case exposures are estimated then it is likely that the state and federal response agencies will make recommendations to local and state policy makers of impacted areas on action to be taken to protect the public, animals, pets, etc. In most cases the guidelines and protective actions as established in the EPA Manual “Protective Action Guides and Protective Actions for Nuclear Incidents” (PAG 400 Manual) would be used.

Potential Losses to Existing Structures

There would be no physical damage to existing structures in the Planning Area from a nuclear incident. However, buildings would need to be assessed for external and internal contamination and remediated, if needed. This would be supported on the local, state, and federal levels.

Potential Losses to Future Development

Theoretically, the expected population growth in the Planning Area will put more people at risk from contaminated food and water should there be a General Emergency level incident at the Callaway Nuclear Reactor which results in contamination in the Planning Area. However, this needs to be viewed in the context of the likelihood of the occurrence of such an event; the likelihood is extremely low.

Hazard Summary by Jurisdiction

The nuclear industry is heavily regulated with many safeguards in place. The MURR and Callaway Nuclear Plant are in compliance with all regulations. Missouri SEMA and the Callaway Nuclear Plant run exercises/drills throughout the year. Should an event occur at the Callaway plant Columbia would likely feel the most impact from evacuees from the fallout zone coming to their medical centers or seeking shelter.

PROBLEM STATEMENT

While there is one research nuclear reactor located in the planning area, and a large commercial reactor in an adjacent county, all jurisdictions in the planning area have a very low vulnerability to adverse effects from a nuclear incident.

The location of the University of Missouri-Columbia Research Reactor (MURR) within the City of Columbia poses virtually no threat due to the type of reactor and radioactive materials being used.

There is an extremely low probability of an incident occurring at the Callaway Nuclear Plant in adjacent Callaway County due to extensive industry regulations industry and the numerous safeguards in place. Should a major incident occur, there is the possibility of contamination of food and water in the planning area but this would be dependent on the nature of the incident and meteorological conditions at the time of release. There are extensive guidelines in place at the state and federal level to deal with such a possibility.

In the case of a major incident occurring at the Callaway Plant, some personnel and facilities in the planning area would potentially function in a supportive role for the emergency response.

UTILITY SERVICE DISRUPTION

HAZARD PROFILE

DESCRIPTION OF HAZARD

A utility service disruption may involve electrical power, natural gas, public water, wastewater treatment, or telecommunications systems. Telecommunications disruptions will be covered separately in Section 4.6.

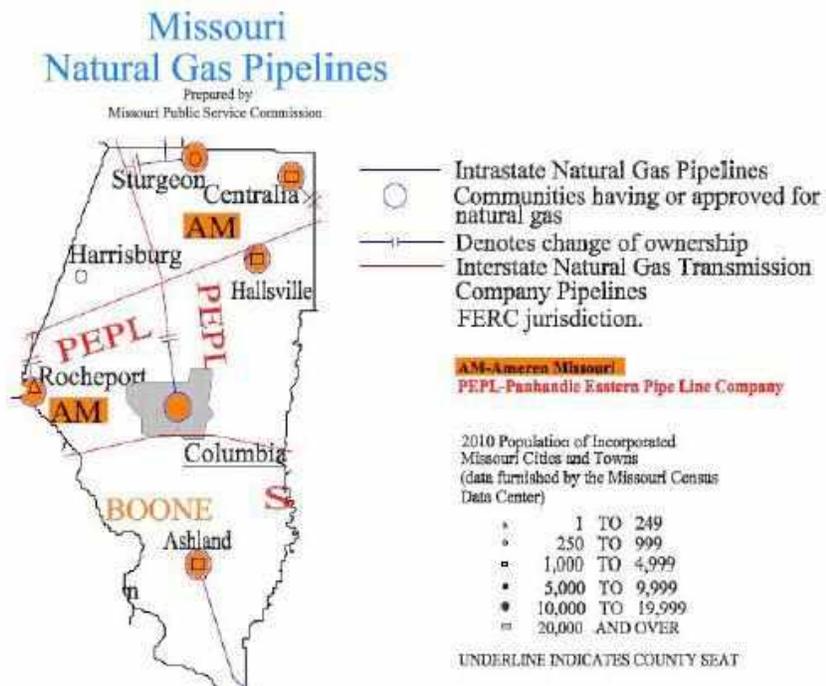
Electrical: A number of the natural hazards profiled in this plan, especially severe winter weather (heavy snow and ice), thunderstorms (wind, hail, lightning), and tornadoes, pose threats to above ground electric utilities. Solar flares are increasingly being recognized as a threat to the power grid. Motor vehicle accidents and animals can cause outages. Digging and construction are a potential threat to buried utilities of all type. In 2008, the Mid-America Earthquake Center mapped the expected probability of at least moderate damage to electric power facilities from a 7.7 magnitude earthquake in the NMSZ; such damage was considered “highly unlikely” in the planning area.

Natural Gas: Natural gas disruption is a very serious concern; it can lead to explosions and fires. Since it is carried in underground pipelines, natural gas is protected from some of the threats to aboveground electrical utilities. However, according to the U.S. Energy Department, “Severe storms, flooding, and earthquakes can expose and break pipes. When disruptions do occur, it can take weeks or even months to restore.” In addition to damage from major events, natural gas pipelines can be damaged from digging or excavation activities,

Figure 3.54

Ameren Missouri is the local natural gas provider for the planning area. In addition to these delivery pipelines, there are three interstate gas pipelines, owned by Panhandle Eastern Pipe Line Company, which pass through Boone County (Figure 3.54).

Public Water: There are many hazards (both natural and technological/human-made) which can cause problems for the public water supply.



Drought, earthquakes, and flooding can result in broken pipes and/or other equipment failure. Many parts of the planning area have clay soils which often cause pipe breakage as they expand and contract.

Electrical power outages will cause problems for most water delivery systems if the power is not restored in a timely fashion. The water supply can also face contamination as a result of internal system failures or hazardous material spills or as a direct target of domestic or foreign terrorism.

The water supply districts in the planning area are CPWSD #1, WD #4, WD #9, WD #10, and the City of Columbia WD (Figure 3.4). In northern Boone County, extensive use of water for fire suppression could severely limit the public water available in the area served by Water District #10.

Wastewater: Wastewater treatment can be crippled by extended power outages and by flooding; significant ground displacement from a strong earthquake could break wastewater lines.

Geographic Location

The entire planning area is at risk from all types of utility service disruptions.

Strength/Magnitude/Extent

Electrical:

There was a power outage in Columbia on July 7, 2014 due to damaging thunderstorm winds which resulted in some outages which lasted a little over 100 hours (4.5 days).

Some data exists on the recent maximum duration of electrical outages due to ice storms in some parts of Missouri. The *Missouri State Hazard Mitigation Plan (2013)* gives the following information:

- December 1994 – ice storm – power outages, rural areas (northern MO) - 7 days
- December 2007 – ice storm - power outages (northern MO) - almost 2 weeks
- February 2008 – ice storm –power outages (southern MO) - almost 2 weeks
- January 2009 – ice storm – power outages (southern MO) - over 3 weeks

These are worst case scenarios; power is usually restored in a matter of hours, rather than days or weeks. However, a widespread outage with a lot of damage to infrastructure can cause lengthy restore times. This is especially true if large geographical areas are affected at the same time and mutual aid must travel from long distances.

Natural Gas: Major disruptions of natural gas are fairly rare events. When one does occur, it can take weeks or even months to restore service, according to the U.S. Department of Energy.

Public Water: The duration of a water supply disruption will vary according to the cause of the disruption.

Boil orders in Missouri are issued by the MO DNR when there is a question of the safety of the drinking water; these are typically issued due to a major pipe break or other event resulting in low pressure and possible contamination in the system. The duration of these orders vary, but typically last a day or two.

A major disruption of the system due to a natural disaster or terrorism might last many days or even weeks. The CDC recommends that citizens store at least a 72-hour supply of water (1 gallon/person or pet/day) and up to a two-week supply, if possible.

Wastewater: Smaller wastewater disruption problems are usually resolved quickly. When wastewater utilities suffer a major infrastructure damage, such as during Hurricane Katrina, full restoration of service can stretch into months.

Previous Occurrences

There is not a definitive reporting system for utility outages in the State of Missouri, so limited data on disruptions is available.

Electrical: Some information on electrical outages is available from SEMA Situation Reports filed at the time of events. In December 2007, ice storms caused approximately 200 power outages in the Ashland area. The City of Hartsburg was without power. Shelters were opened in both Ashland and Hartsburg.

Heavy snow falls in February 2013 resulted in widespread power outages throughout the planning area. Some outages lasted 3-4 days. Data from Boone Electric Coop (BEC) for this period indicates that almost 2,800 of their customers lost power. The average outage for BEC lasted about 36 hours with some power being restored within 24 hours and the longest outage lasting almost 65 hours.

Storms on July 7, 2014 in Columbia resulted in 14,000 residents (most in the vicinity of West Broadway) losing power. The longest without power went a little over 100 hours/4.5 days. Six 80-foot transmission line poles were snapped in half and trees were uprooted over a widespread area.

Natural Gas: Natural gas distribution can be disrupted by pipeline failures and accidents. The Pipeline and Hazardous Materials Safety Administration (PHMSA) of the U.S. Department of Transportation has data going back to 1994 on significant and serious accidents involving the nation's natural gas gathering, transmission, and distribution pipelines. The data shows 13 transmission pipeline incidents and 46 distribution pipeline incidents in the State of Missouri during that 20-year period (Figures 5.13-5.14).

The Planning Committee recalled some natural gas fires in the County:

- In 2009, there was a rupture and explosion in a Panhandle Eastern pipeline in Howard County, about 15 miles northeast of Columbia and near the border with Boone County.
- There have been two natural gas incidents in or near Centralia; one gas explosion in the

late 1970s (?) burned down significant structures in the city. There was also a natural gas incident ignited by static electricity sometime in the past few decades.

According to information from the *Columbia Daily Tribune* newspaper, “In 1997, Centralia was rocked by a similar explosion from a Panhandle Eastern pipeline. The blast occurred in a farmer’s field near Cline Road and threw a fireball so high it was reportedly visible as far away as Quincy, Ill.”

Public Water: Data is not available but boil advisories/orders are not uncommon in the planning area.

Wastewater: Data is not available.

Probability of Future Events:

Electrical outage – High for all participating jurisdictions

Natural gas disruption – Moderate for all participating jurisdictions

Public Water disruption– Moderate/High for all participating jurisdictions

Wastewater disruption – Moderate for all participating jurisdictions

Public Water: Water utility disruption can run the gamut from contamination requiring boil orders to full disruption of service. If all such possible disruptions are considered, then a high probability rating is appropriate. For more widespread disruptions, a moderate probability rating is more appropriate.

A widespread disruption of the water utility is tied to the availability of electrical power. The city of Columbia has a dual electrical feed to both its water and wastewater plants. This allows for continuity if only one of the electrical substations is compromised.

For most of the planning area, an electrical power outage of 8-10 hours would require the assistance of backup generators to avoid larger problems with water. Some backup generators are available but more are needed.

Wastewater: The wastewater utility is also tied to availability of electrical power. Most municipal wastewater systems in the planning area would begin having problems within 1-1½ days of loss of electrical power. There is a need for more generators and transfer switches in the planning area.

The Boone County Regional Sewer District indicated that their system would begin to experience problems within 4-24 hours of loss of power. With a countywide power outage, pump stations would start to overflow around 4 hours. If an outage persisted for over 24 hours, the treatment process at some of the smaller treatment plants without backup generators or wiring for portable generators would begin to degrade. The BCRSD did indicate that they have a lot of generators and a few portable generators but not all of the wiring/transfer switches needed.

VULNERABILITY

Vulnerability Overview

Impacts from utility disruptions are moderate for all participating jurisdictions. Above ground utilities are vulnerable to weather impacts and man-made disruptions either through vandalism, carelessness from homeowners potentially hitting something while digging, or even car accidents that leave the road. Jurisdictions who underground their utilities help lessen the chances for disruption from certain events.

Potential Impacts to Life

Utility service disruption can have widespread and cascading effects on many segments of society. Extended loss of electrical power will affect the ability of the water and wastewater utilities to function at full capacity. Even short-term loss of electrical power is a threat to the home and commercial food supply. Loss of electrical power in the winter months is a threat to life and safety, especially that of the most vulnerable populations.

Natural gas disruption is a very real threat to human and animal life. Disruption of the public water utility poses a risk for fire protection and for health. Disruption of the wastewater utility poses threats to health and the environment.

Potential Impacts to Existing Structures

Electrical: Boone Electric Cooperative: BEC began keeping records on outages in 2006. During planning for the *Multi-Jurisdictional Hazard Mitigation Plan for Missouri's Electric Cooperative (May 2012)*, an analysis was conducted of outages between January 2006 and April 2011 and the cost to BEC infrastructure (Table 3.5).

Table 3.5

Cause of Outage	# of Events	Average Cost to BEC/event
Thunderstorm/high wind	22	\$3,236
Hail	18	\$1,452
Severe Winter Weather	2	\$ 115

BEC personnel stressed that, during the time period for which outage data is available, there were no major ice storms. Ice storms are not uncommon in the BEC service area and are one of the most damaging natural hazards which can impact the cooperative. FEMA estimates the standard value of loss to the economy for every day without electric service is \$126 per person per day. Large outages for extended periods of time in high density areas such as Columbia has large monetary impacts. Based on numbers in the Missouri State Hazard Mitigation Plan (2018) if 10% of the planning area's population (based on 2015 estimates) were to be out of power for one day it would have an impact of \$2,204,672.

Natural Gas: The PHMSA data for Missouri indicates that the average property damage cost (in current year dollars) was \$782,660 for a transmission pipeline incident and \$650,526 for a distribution pipeline incident (Table 3.51-3.52).

Table 3.51

Transmission Lines:

PHMSA Pipeline Incidents: (1994-2013)
 Incident Type: Significant System Type: GAS TRANSMISSION State: MISSOURI Offshore Flag : ALL

Calendar Year	Number	Fatalities	Injuries	Property Damage Current Year Dollars
1994				
1995				
1996	1	0	0	\$252,479
1997	1	0	0	\$689,298
1998				
1999				
2000				
2001	1	0	0	\$469,907
2002				
2003	1	0	0	\$4,040,197
2004				
2005	1	0	0	\$110,866
2006	3	0	0	\$523,390
2007				
2008	2	0	0	\$1,096,446
2009	1	0	0	\$745,234
2010				
2011				
2012	1	0	0	\$240,986
2013	1	0	0	\$2,005,775
Grand Total	13	0	0	\$10,174,577

Table 3.52

Distribution Lines:

PHMSA Pipeline Incidents: (1994-2013)
 Incident Type: Significant System Type: GAS DISTRIBUTION State: MISSOURI

Calendar Year	Number	Fatalities	Injuries	Property Damage Current Year Dollars
1994	2	0	0	\$437,904
1995	1	0	0	\$114,368
1996	5	2	3	\$1,837,486
1997	5	0	4	\$372,221
1998	4	0	2	\$786,786
1999	4	1	4	\$116,365
2000	3	1	3	\$250,382
2001	2	0	0	\$1,223,046
2002	1	0	1	\$31,554
2003	2	1	2	\$352,883
2004	2	0	0	\$276,117
2005	2	0	0	\$877,575
2006	3	0	0	\$763,967
2007	1	0	2	\$85,911
2008				
2009	3	0	1	\$230,719
2010	2	0	0	\$338,417
2011	2	0	0	\$267,360
2012	1	0	0	\$93,782
2013	1	1	4	\$0
Grand Total	46	6	26	\$8,456,843

Potential Impacts to Future Development

Utility outages can be more problematic in higher population areas; a higher population means more people impacted by a major outage and more people competing for limited local supplies of generators, food, bottled water, blankets, etc. This is just one of the reasons that reliable infrastructure and services must keep pace with development.

Some areas of new development in the planning area are required by law to have underground utilities. Underground utilities are required in both Ashland and Centralia subdivisions. The City of Columbia Water and Light Department continues its policies of undergrounding electric in new developments as well as actively undergrounding approximately one mile of existing overhead electric each year.

Hazard Summary by Jurisdiction

Unincorporated Boone County has several miles of overhead power lines vulnerable to outages. They also have public water supply districts they manage and maintain. Many rural residents are on private wastewater systems so mass outages are less concerning.

Many jurisdictions in the planning area have their own water and wastewater facilities to care for. The City of Columbia is vulnerable to all forms of utility outages due to their population density. Any outage has potential to impact a large number of people.

PROBLEM STATEMENT

All participating jurisdictions in the planning area are vulnerable to a utility service disruption. Electrical power is the most commonly disrupted utility; this is usually due to severe winter weather or damaging winds. The duration of these outages can last from hours to days.

Water utilities are periodically disrupted in the planning area to the level of “boil orders” being issued for drinking water. The expansion and contraction of the clay soils which predominate in many areas can cause pipe breakage; this in turn lowers pressure and opens a gateway to possible contamination in the system. This is especially a problem in times of severe drought.

Natural gas and wastewater are also vulnerable to disruption although these are less common occurrences.

The numerous backup systems, other mitigation activities, and strong working relationships in the planning area help to lessen the risks associated with all utility disruptions.

TELECOMMUNICATIONS DISRUPTION

HAZARD PROFILE

HAZARD DESCRIPTION

Modern telecommunications is a complex system which is both sophisticated and fragile. The sector has undergone massive transformation in the past few decades and each year brings greater expansion and complexity. Almost all aspects of modern life are highly dependent on telecommunications and disruptions of these networks can have large and widespread impacts. This is especially troublesome as the most likely time for a telecommunications disruption is at the time of an emergency or disaster.

New York University conducted an analysis of the interaction of disasters and telecommunications infrastructure through studying large urban disasters of the 1990s and early 2000s. The findings were published in *Telecommunications Infrastructure in Disasters: Preparing Cities for Crisis Communications (April 2005)* which has been used to frame and inform much of the discussion in this section.

There were three primary causes of telecommunications disruptions identified. They are:

1. Physical destruction of network components: This can cause severe and lengthy disruptions due to the time and funds needed to repair the infrastructure. In the planning area, aboveground infrastructure is vulnerable to ice storms, damaging winds, tornadoes; underground components are vulnerable to flooding and earthquakes.
2. Disruption in supporting network infrastructure: Telecommunication networks rely on many other systems which are often older and lack resiliency. The primary supporting infrastructure is the electrical distribution system; this can fail as can needed cooling systems. In addition, disruption of transportation routes can have a cascading effect whereby fuel is not available for electrical generation and electricity is not available for telecommunications.

While telecommunications disruption from failure of supporting infrastructure is less common it can be more widespread and pose greater challenges for response and recovery.

3. Network congestion: Most networks are designed to support peak loads far below those which occur during a crisis or emergency. In times of disaster, there are almost always problems caused by network congestion as people try to make contact either into or out of the affected area. In addition, network congestion can be a deliberate tactic employed as part of a terrorist attack.

Geographic Location

The entire planning area is at risk from a telecommunications disruption.

Extent

A telecommunications disruption can range in length from a short disruption lasting only minutes to one which may take days, weeks, or even months to fully resolve. Many disruptions can be restored rapidly due to the multiple redundancies built into the systems; however, in the case of major disasters where telecommunications infrastructure and supporting infrastructure are damaged or destroyed, it can take much longer.

Previous Occurrences

Telecommunications systems have been vulnerable to disruption since their inception. Within a few decades of its invention in 1844, the telegraph system was a target for destruction in the Civil War; attempted disruption of communication tools is often one of the first actions in a war.

Some level of telecommunications disruption accompanies most major disasters. There were serious telecommunications disruptions associated with the September 11 attacks in 2001. Much of lower Manhattan was disconnected from the telephone landline grid when a routing hub near the World Trade Center was damaged. In addition, the cellular telephone network in New York City suffered severe disruption; Washington D.C.'s cellular network was also congested but to a lesser degree.

All the major cell phone networks in the Northeastern U.S. failed during Hurricane Sandy (2012). In Hoboken, NJ, officials relied on whiteboards outside City Hall to keep citizens informed. Cellular telephone networks were also overloaded after the bombing at the Boston Marathon (2013). Some users saw impacts to cell and data usage at the start of the 2020 Covid-19 Pandemic in the US as people began working from home on their data plans and using the network more to keep in contact with relatives and employers they would usually see in-person.

Probability of Future Events

As technology changes outages are expected intermittently. 5G now looms on the horizon with a massive expansion of the network needed for it to work by adding towers more frequently and at higher densities. As more towers are added in more locations, many in heavily populated areas, the risk of towers being vulnerable to vandalism and accidents increases which can increase the instances of localized outages. It should however reduce large outages.

VULNERABILITY

Vulnerability Overview

The greatest threat for a serious telecommunications problem in the planning area is a disruption of the commercial telecommunications systems. In general, the commercial providers are co-located on towers; damage to one tower can often affect two or three providers.

Potential Impact to Life

Telecommunications disruptions can have a serious impact on life through the delay or disruption of emergency services. In addition, a serious lack of symmetry can develop between information coming out of the affected area and that which can reach those within the area. This is a recipe for the spreading of false rumors and panic which may interfere with response and relief efforts. Telecommunications breakdown can also delay the mobilization of broader relief efforts and thus contribute to greater suffering and loss of life.

Telecommunications disruptions can also put emergency personnel at greater risk due to the lack of accurate and current situational information. A 2013 United Nations Report indicates that at least 300 firefighters in New York City lost their lives due to communication failures.

Potential Impact to Existing Structures

The delay or disruption of emergency response because of telecommunications disruptions can also result in greater than necessary damage to the built environment and infrastructure.

Potential Impact to Future Development

There has been a rapid growth in population and housing in the planning area in recent years. A larger population and more extensive built environment increase the risk of injury, loss of life, and damage should a serious and widespread telecommunications disruption occur.

In addition, development requires that vigilance is maintained in assuring that new areas of development are fully operational in terms of telecommunications. This issue was highlighted at the start of the Covid-19 Pandemic in the US when students and teachers were forced to go to classes online and students across the planning area had little or no cellular or internet access to continue their learning.

Hazard Summary by Jurisdiction

Areas outside major growth zones like Columbia and Ashland are vulnerable to gaps in communication as the growth outruns communications expansion.

All of unincorporated Boone is at risk if commercial telecommunication systems were to go down. As the system expands and technology changes rural areas could be at risk for disruptions as current trends in tower blanketing could run into coverage roadblocks in the more rugged rural areas.

PROBLEM STATEMENT

All participating jurisdictions in the planning area are vulnerable to telecommunications disruption. The greatest threat for a serious telecommunications disruption is damage to the commercial telecommunications systems. Telecommunications towers are vulnerable to ice storms, damaging winds, tornadoes and terrorism. Commercial providers are often co-located on these towers so damage to one tower can affect two or three providers. Underground telecommunication components are vulnerable to flooding and earthquakes.

Various federal programs and services, mutual aid agreements, and an active amateur radio organization in Boone County all help to ensure that communications for emergency services stay intact.

CYBER ATTACK

HAZARD PROFILE

HAZARD DESCRIPTION

Cyber attack is the targeting of computer systems and networks for malicious purposes. The rapid development and reliance on computers networks and the internet makes this threat a serious concern for government, business, and individuals.

Cyber attacks are carried out for a variety of reasons: cybercrime, espionage, political activism (“hacktivism”), and “just for fun”. Local governments are probably most vulnerable to hacktivists seeking to make a statement or individuals just set on disruption.

Geographic Location

The entire planning area is at risk from a cyber-attack. While some of the smaller local governments may not use their own networks to carry out local government functions, they still rely on other networked systems to support the health and safety of their citizens.

The website hackmagedon.com collects data on disclosed cyber-attacks from the news. As the website states repeatedly, its data represents an overview of “the tip of the iceberg”.

With that caveat in mind, the purplesec.us site indicates that social media faced the largest number of attacks (56%) followed by government (27%), industries (8%), retail (4%), and technology records (4). In addition, the 2014 statistics indicate the motivation behind the attacks as follows: cybercrime (56%), accidental loss (34%), malicious insider (7%), Hactivism (2%), unknown (1%).

Strength/Magnitude/Extent

There is a broad range of methods used for cyber-attacks. Some of the methods include:

- Phishing
- Malware
- Distributed Denial of Service (DDoS) – this attack floods an internet domain with large amounts of data thus either slowing its service for legitimate use or blocking it all together; often used to make a political statement to or about the owner of the domain
- Advanced Persistent Threat (APT) – this is a high level, coordinated attack which seeks to infiltrate and remain undetected on the target system; often used for corporate and intelligence espionage

As more and more people rely on cloud technology and the internet to house data and even control major components of their homes and businesses the impact of any kind of technological attack becomes greater.

Previous Occurrences

Cyber attacks have been occurring since the very early days of the internet; one of the first known attacks, the Morris worm, took place in 1988. Since that time the number of attacks has increased exponentially and become a very serious concern for government, business, and individuals.

In 2014 alone, there were numerous major attacks on Target, J.P. Morgan, Home Depot, Staples, Healthcare.gov. The year 2015 began with the hacking of two social media accounts run by the U.S. military's Central Command; this was followed by the discovery of a huge breach at Anthem/Blue Cross-Blue Shield with the potential to affect an estimated 80 million customers and employees.

Locally, in December 2014, the City of Columbia's website became a target for cyber attack. The site was hit with a DDoS attack; the website of KOMU, the University of Missouri's commercial television station, was struck a few days later in what was claimed to be a related attack. The attempted disruption to the city's website continued into 2015 with a wave of DDoS attacks; due to security measures put into place, disruption has been minimal.

In 2017 147.9 million consumers were affected by a breach at Equifax.

106 million records were stolen from Capital One in 2019 that contained personal and financial information.

Probability of Future Events

As more and more information and business is conducted online the more value there will be for hackers to attack and steal that information.

VULNERABILITY

Vulnerability Overview

The severity of a cyber attack varies depending upon the type of attack and the target. Some damage would be expected from any attack, as staff time and resources are required to deal with an attack and implement higher levels of security for the future.

Successful attacks targeting utilities or hospitals could potentially put public safety at risk, depending upon the type of attack(s) and the backup systems in place. The cascading effects from a serious attack could have wide-ranging impacts.

Potential Impact to Life

There is the potential for a threat to health and safety from a well-planned attack, or series of attacks, on a utility or hospital system.

Potential Impact to Existing Structures

At this point in time, most cyber attacks have been focused on stealing information, damaging files or shutting down networks. However, there have been two confirmed cases of cyber attacks which caused actual physical damage:

- Stuxnet, a computer worm discovered in 2010, is thought to be responsible for ruining about one-fifth of all the nuclear centrifuges in Iran.
- In 2014, hackers gained control of a blast furnace at a German steel plant and caused massive damage at the plant.

While these were high level attacks aimed at strategic targets, the developing capability to cause actual physical destruction is of great concern for the future.

Potential Impact to Future Development

As reliance on computer networks increases throughout the planning area, so does the threat of greater disruption of daily life and operations from cyber-attack. Continually updating security measures is vital but cyber criminals' methods and strategies continually evolve to meet new challenges. For this reason, it is extremely important to have backup systems and continuity of operations plans in place for all essential functions potentially disrupted by cyber-attack.

Hazard Summary by Jurisdiction

All jurisdictions in the planning area are vulnerable to a cyber-attack. While some of the smaller jurisdictions such as Hartsburg, Harrisburg, and Huntsdale may have less cyber infrastructure to attack they still maintain some online presence such as email communications.

The City of Columbia is of interest to cyber-attackers. They maintain a large online presence and technology department. A large attack on the City of Columbia could cause large disruptions to many people living or traveling through the community.

All school districts face vulnerability to cyber-attacks and malware.

PROBLEM STATEMENT

The entire planning area is vulnerable to cyber-attack in some fashion; it is an increasingly serious threat in the planning area, as it is throughout the developed world. It is important that local governments have both backup systems and continuity of operations plans in place to help mitigate the risk associated with this hazard. Cyber-security risks critical information and physical operations if a hacking attempt is successful.

UNWANTED INTRUDER/ACTIVE SHOOTER

HAZARD PROFILE

HAZARD DESCRIPTION

The United States government defines an active shooter as “an individual actively engaged in killing or attempting to kill people in a confined and populated area.” Some government agencies, such as the FBI, now reject the “confined” term in the definition as recent events show that active shooter events can take place in open areas and move between buildings.

Mitigating for active shooter events is essentially mitigating for unwanted intruders; the intention of intruders cannot always be known at the outset.

Geographic Location

The entire planning area is at risk from an Unwanted Intruder/Active Shooter event. This is of particular concern for the school districts, colleges, and University who are responsible for large numbers of students and staff. However, an active shooter event can take place in any location. The FBI puts out studies and documents that look at active shooter situations across the U.S. The figure below comes from their “Active Shooter Incidents: Topical One-Pager, 2000-2018”.

Figure 3.55

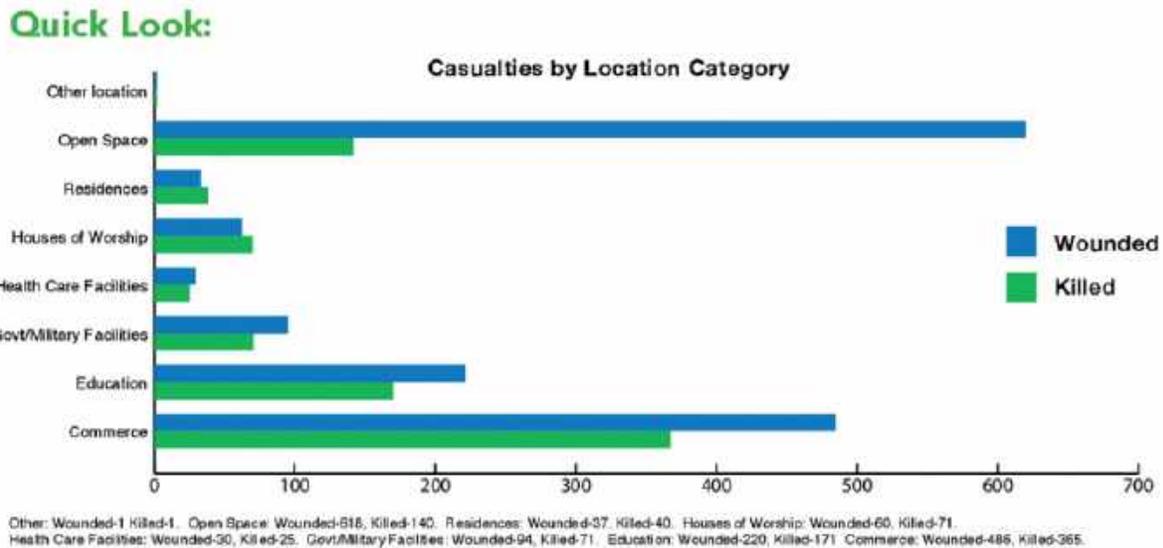
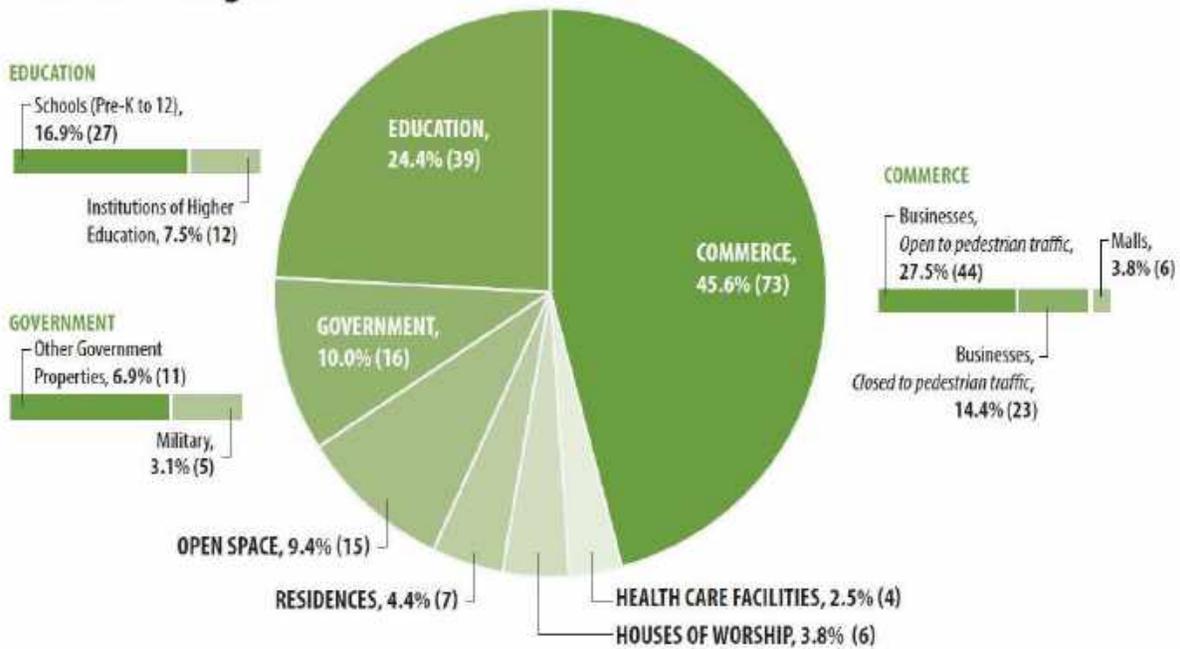


Figure 3.56

A Study of 160 Active Shooter Incidents in the United States Between 2000 - 2013: Location Categories



Source: Federal Bureau of Investigation, 2014

Source: <https://www.fbi.gov/file-repository/active-shooter-one-page-summaries-2000-2018.pdf/view>

Strength/Magnitude/Extent

The 2013 FBI report “A Study of Active Shooter Incidents in the United States Between 2000 and 2013” had the following key findings regarding the nature of the active shooter events studied:

Evolution of the event -

- Active shooter incidents develop very rapidly. In 64 of the incidents where the duration could be determined, 69% of the incidents ended in 5 minutes or less with 36% of the incidents ending in 2 minutes or less.
- 67% of the events ended before police arrived and could engage the shooter
- In 28% of the incidents, law enforcement and the shooter exchanged gunfire
- In 13% of the incidents, unarmed individuals successfully and safely restrained the shooter.
- In 40% of the incidents, the shooters committed suicide

Characteristics of the shooter -

- 99% of the events involved a single shooter
- 96% of the events were carried out by men
- In incidents occurring in businesses closed to pedestrian traffic (23 incidents), all but one of the incidents were carried out by current or previous employees.
- In incidents in businesses open to pedestrian traffic and malls, the shooters generally had no relationship to the businesses.
- In high school and middle school incidents, the shooter was usually a student; the elementary school incidents did not involve a student at the school.

Previous Occurrences

According to information from the Boone County Office of Emergency Management, unwanted intruders occur regularly in the planning area; however, there have been no active shooter events.

Nationwide, the FBI study identified 277 active shooter events in the nation in the period 2000-2018. This was an average of 15.4 events per year.

Probability of Future Events - High

An unwanted intruder is a common event in the planning area and intention cannot be known at the outset. For this reason, the probability of an unwanted intruder/active shooter event has been rated high. Mitigation for active shooters is, first and foremost, mitigation for unwanted intruders.

VULNERABILITY

Vulnerability Overview

During the period 2000-2018, 277 active shooter events in the U.S. resulted in 884 deaths and 1,546 injuries, according to the 2000-2018 FBI Topical One-Pager.

Potential Losses to Life

The main impact of active shooter events is the loss of and/or injury to human life. In addition, there is the psychological trauma experienced by all those directly involved in an event, by the families of those involved, and by the wider community.

Potential Losses to Existing Structures

Active shooter events often involve some damage to buildings from the gunfire involved. In addition, a decision is often made after an event to either renovate areas where most of the incident took place or to totally demolish a building.

Potential Losses to Future Development

Educational institutions must take the possibility of active shooter events into account in all future development. One issue brought up in the Planning Committee meetings is that schools must be designed differently than they were in the past. This has caused a problem for at least one school district in the planning area which struggled to get architects to understand the imperative need to prioritize safety over aesthetics.

Hazard Summary by Jurisdiction

All jurisdictions in the planning area are vulnerable to an active shooter situation. The City of Columbia is the government seat for the county and hosts large events that can become targets for an active shooter.

All school districts and education facilities are potential targets for attack.

Hartsburg has a pumpkin festival in the fall that draws large crowds to a rural outdoor venue that could be difficult to get additional emergency personnel into if a mass shooting event were to occur.

PROBLEM STATEMENT

The entire planning area is vulnerable to an unwanted intruder/active shooter event. There has been an intensive focus in the planning area on preventing, mitigating, and preparing to respond to this type of event. Programs have been put in place which will continue to expand on the current capabilities.

While the risk of an unwanted intruder/active shooter event is of special concern to the educational institutions with their responsibility for large numbers of students, the data indicates that over 75% of incidents actually occur outside of school settings. The prevention, mitigation, and preparedness activities in the planning area are addressing this reality through the widespread training of all emergency personnel and a widening focus beyond the schools.

TERRORISM

HAZARD PROFILE

HAZARD DESCRIPTION

The Federal Bureau of Investigation (FBI) defines terrorism as “the unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.”

The RAND Corporation, which has been compiling data on terrorism since 1968, provides the following definition for the acts included in its Database of Worldwide Terrorism Incidents (RDWTI):

Terrorism is defined by the nature of the act, not by the identity of the perpetrators or the nature of the cause; key elements include:

- Violence or the threat of violence
- Calculated to create fear and alarm
- Intended to coerce certain actions
- Motive must include a political objective
- Generally directed against civilian targets
- Can be a group or an individual

Terrorism can be perpetrated by either domestic or international/internationally-directed individuals or groups. International terrorism is an evolving threat which, due to recent events, has come into greater focus for local communities.

Geographic Location

The entire planning area is vulnerable to terrorism. The City of Columbia is the largest population center and hosts many large-scale events; there are also large festivals and gatherings in numerous other places throughout Boone County. Major pipelines, a potential target, also run through the planning area and major highway systems, allowing easy access, intersect in Columbia.

Strength/Magnitude/Extent

Terrorist acts can take many forms. Many of the methods of terrorism have been addressed separately in other sections of this plan: active shooter incident, hazardous materials release causing a public health emergency, transportation incident, utility service disruption, telecommunications disruption, cyber-attack, and bombing causing a mass casualty/fatality event; civil unrest may generate terrorist acts. In addition, terrorist acts may take the form of arson, kidnapping, and assassination.

Previous Occurrences

There is a long history of terrorist acts, both domestic and international, in the United States.

Domestic terrorist incidents have been perpetrated from both sides of the political spectrum and by religious groups, white supremacist groups, and disaffected individuals.

While not the first international terrorist incidents in the U.S., the 1993 bombing of the World Trade Center in New York City and subsequent Sept. 11, 2001 attacks brought international terrorism into the spotlight for the general public. Events following the 9/11 attacks ushered in a dramatic increase in global terrorism.

There have been no known terrorist attacks in the planning area.

Probability of Future Events

While terrorism has been increasing dramatically worldwide since about 2004 (Figure 3.57), incidents in the U.S. declined since the 1990s, but have started to go back up in recent years according to data from the Global Terrorism Database. The database, which was created by the Center for Terrorism and Intelligence Studies in collaboration with academic institutions and government agencies, currently has data available for the years 1970-2017.

Figure 3.57

Number of terrorist attacks, 1970 to 2017

The source defines a terrorist attack as: "the threatened or actual use of illegal force and violence by a non-state actor to attain a political, economic, religious, or social goal through fear, coercion, or intimidation." The perpetrators of the incidents must be sub-national actors; data does not include acts of state terrorism.



Source: Global Terrorism Database (2018)

OurWorldInData.org/terrorism/ • CC BY

Vulnerability

Vulnerability Overview

While the potential for a terrorist attack is low in the planning area the City of Columbia's location at the crossroads of major transportation avenues make it a possible target. Damage to

the road network running through Columbia could cause large delays in transportation of goods and services, not only in Central Missouri, but across the state and for the Central U.S.

Potential Losses to Life

Terrorism is a serious threat to life. Even if a terrorist event is thwarted and does not result in injury or death, it is still a great psychological trauma for a population.

Potential Losses to Existing Structures

Terrorism is a serious threat to existing structures. Bombs have been and continue to be a frequent tactic of both domestic and international terrorists.

Potential Losses to Future Development

Future development could provide new structural targets for terrorism but, overall, does not really impact the threat.

Hazard Summary by Jurisdiction

The City of Columbia is at greatest risk for terrorism since it is the largest urban area in the region and houses the most critical infrastructure. There is little terroristic threat to other jurisdictions within the region.

Information gathering and surveillance of suspected terrorists are major mitigation actions for this hazard. However, due to the nature of the hazard, information on this type of mitigation is not publicly available. All mitigation activities in place in the planning area for hazards which might be used as tools by terrorists also serve as mitigation for this hazard.

PROBLEM STATEMENT

Terrorism within the U.S. is a fairly rare event when looked at from the perspective of the size of the country. While terrorism has been dramatically increasing worldwide since about 2004, it has been declining in the U.S. since the 1990s. But terrorism is, by its nature and continual evolution, unpredictable. It can take many forms and all jurisdictions in the planning area are vulnerable.

Given the rarity of a terrorist event in the U.S., the planning area would be considered to have a low vulnerability to this hazard; however, that is not zero vulnerability. It is important to be aware of and monitor any potential threats on the local level. As political tensions rise within and throughout the country acts of domestic terrorism could become an increasing factor for locals to consider.

CIVIL DISORDER

HAZARD PROFILE

HAZARD DESCRIPTION

The rights of free assembly and free speech are protected under the U.S. Constitution. However, at times throughout history, such assemblies have turned destructive and violent; such behavior conflicts with the government’s role, outlined in the Preamble of the Constitution, to “promote domestic tranquility”. This transformation of a peaceful gathering to a violent crowd or mob is almost always preceded by some actual or perceived triggering event.

The Revised Statutes of MO, Section 574.070, define civil disorder as “any public disturbance involving acts of violence by assemblages of three or more persons, which causes an immediate danger of or results in damage or injury to the property or person of any other individual”.

Geographic Location

If a civil disorder event were to occur in the planning area, it would most probably take place in the major population center, the City of Columbia, or at the institutes of higher education in Columbia (Columbia College, Stephens College, or the University of Missouri).

Strength/Magnitude/Extent

Civil disorder can range from minor infractions of law to large scale rioting.

Previous Occurrences

There were two notable historic instances of civil disorder in the planning area. They both resulted in lynching:

- In 1853, a slave who had been accused of attempting to rape a 15-year old white girl was dragged from the Boone County jail and lynched on the outskirts of Columbia. The lynching occurred after another lynching mob had been persuaded from their action the day before (*Missouri’s Black Heritage*, Lorenzo J. Green, Gary R. Kremer, Antonio F. Holland, University of Missouri Press, 1993).
- On April 29, 1923, a black janitor at the University of Missouri was lynched by a crowd for the alleged rape of a 15-year old white girl. The man had been forcibly removed from the Boone County jail by the mob. The lynching on the Stewart Street Bridge in Columbia occurred despite the pleas of the girl’s father who said he believed the man was innocent (“Legacy of a Lynching”, *Columbia Missourian*, May 3-8, 2003).
- In May 1960, large anti-war rallies were held at the University of Missouri (MU) in Columbia after four students were shot and killed by National Guardsmen at Kent State in Ohio. Some arrests of MU students and faculty were made but the protests were largely non-violent (“Panelists recount Vietnam War-era protests on MU campus”, *Columbia Tribune*, April 22, 2014).

- In 1986, there was civil unrest for a few days which involved rock throwing along Providence Road in Columbia. Also in the mid-1980s, there were rallies at the University of Missouri promoting the University's divestiture in South African investments; shanties were set up on campus but the demonstrations remained peaceful.
- In 2014, there was prolonged civil unrest resulting in deaths, injuries, and destroyed property in Ferguson, Missouri, in the wake of the shooting death of a black teenager by a police officer. Protests took place in Columbia after the Ferguson shooting but they remained peaceful.
- In 2020, protests across the country over the police killing of a man in Minneapolis brought protests to the streets of Columbia. While protests elsewhere occasionally broke out in looting, riots, and the burning of local business, protest in Columbia remained calm. Minor injuries were reported when a driver hit a couple of protesters who were standing in a road intersection.

Probability of Future Events - Low

The *Missouri Hazard Analysis* concluded that there will continue to be protests and demonstrations in the state which could erupt into civil disorder. "However, based on the state's general history of civil disturbance...the probability that such incidents will develop into full-scale riots is considered low."

VULNERABILITY

VULNERABILITY OVERVIEW

There is a large range of impacts which could occur with civil disorder based on many variable factors. Some disturbances might result in minor infractions/property damage while large disturbances can result in major injuries, death, extensive property damage, high economic losses and high emergency management costs.

Potential Losses to Life

Civil disorder poses a risk of injury and possibly even death in large scale rioting.

Potential Losses to Existing Structures

There is the potential for significant damage to buildings and property from civil disorder which becomes violent.

Potential Losses to Future Development

Development, in and of itself, should not impact civil unrest. However, it is very important that citizens feel they have a voice in any development which will impact their lives and homes. Unfair treatment, real or perceived, could become a triggering event for civil unrest.

Hazard Summary by Jurisdiction

The City of Columbia and University Campuses have the highest risk for civil unrest. The planning area is well prepared for a multi-agency response should civil unrest pose a threat.

The University of Missouri encourages marches on campus to avoid greater problems which might occur if students felt they had not been allowed to express their ideas. The University works with the leaders of marches and clearly outlines the boundaries of acceptable/unacceptable behavior and uses social media to communicate with students.

Unincorporated Boone and its smaller jurisdictions are low risk for major civil unrest.

PROBLEM STATEMENT

Civil disorder is not a major concern for the planning area; the historical record would indicate a mostly peaceful history of protests and demonstrations through some very challenging times. The last major incident of civil unrest, a lynching, took place almost 100 years ago.

While there is a low probability of civil disorder, the City of Columbia, Columbia College, Stephens College, and the University of Missouri are vulnerable to this hazard. The University of Missouri has adopted a proactive approach to civil disorder by working with demonstration leaders to assure freedom of speech rights while clearly delineating the boundaries of appropriate conduct.

MASS CASUALTY/FATALITY EVENT

HAZARD PROFILE

HAZARD DESCRIPTION

Mass casualty/fatality is a potential cascading effect from many of the hazards profiled in this plan. Notably, an earthquake, damaging winds, tornado, public health emergency, transportation incident, active shooter, terrorism, and civil disorder have the potential to cause mass casualties/fatalities in the planning area. In addition, the planning area includes major transportation corridors running both east/west and north/south. Vehicle accidents are another potential cause of a mass casualty/fatality event.

Mass casualty/fatality is being profiled as its own event to allow for specific analysis of potential effects of multiple injury/loss of life in the planning area.

Geographic Location

The entire planning area is vulnerable to a mass casualty/fatality event.

Strength/Magnitude/Extent

The term “extent” is meaningless for a mass casualty/fatality event by the definition used in this plan which is “an attribute of the hazard alone ... (which) does not include its effect on humans”. By definition, a mass casualty/fatality event has affected humans.

Previous Occurrences

There have been numerous incidents of mass casualty/fatality in the planning area. The rate of school bus accidents averages approximately one every other year, according to an estimate from the Boone County Fire Protection District.

In 2005, there was a van accident on I-70 to the west of Columbia which involved 17 people; there were numerous injuries and some fatalities.

In 2013, there were over 100 medical emergency incidents at University of MO football game. Most of the incidents were related to dehydration which was exacerbated by alcohol.

During the Covid-19 Pandemic MU medical centers prepared for an influx of coronavirus patients from all over the region. Luckily, they did not see the crippling levels of patients that hospitals in other states and regions were subjected to.

Probability of Future Events

Many things can lead to mass casualties ranging from severe weather events, to car accidents, to pandemics and targeted attacks. With the past incidents combined with the high number of opportunities to see fatalities the probability of them is high.

VULNERABILITY

Vulnerability Overview

The entire jurisdiction is vulnerable to mass casualties. A major accident strains emergency personnel in the vicinity of the accident, road crews if a road is shut down or damaged, and the medical professionals who have to triage and help those coming in injured. Jurisdictions where medical and first responder facilities are located and well-traveled roads that run through towns or blind intersections are vulnerable to mass casualties.

Potential Losses to Life

By definition, a mass casualty/fatality event has caused injury and/or loss of life. In analyzing further effects of mass casualties/fatalities, the psychological effect is paramount. In addition to traumatic shock to the population as a whole, those who have lost loved ones will be dealing with grief and potential loss of income for life maintenance. There will be a great need for a variety of types of support for those directly affected.

Potential Losses to Existing Structures

Mass casualty/fatality events are not a threat to infrastructure although there may have been structural damage from the precipitating incidents. However, mass casualty/fatality events do put a strain on emergency and medical personnel/facilities.

Potential Losses to Future Development

As populations grow and increase in density, it is important that supporting infrastructure and services increase accordingly; this is important at all times but lack of appropriate balance will be highlighted in times of extreme duress such as mass casualty/fatality events.

Hazard Summary by Jurisdiction

All jurisdictions are vulnerable to mass casualty events from a variety of sources. Major road accidents, severe weather mentioned in earlier sections, heat exhaustion at sporting events or other large gatherings can pose serious risks to a large number of people at one time.

School districts must take care at sporting events to ensure students and spectators are safe.

PROBLEM STATEMENT

Mass casualty/fatality events are a fairly common occurrence in the planning area; all participating jurisdictions are vulnerable to such events.

Historically, the majority of mass casualty/fatality events have been related to vehicular accidents on roads and highways. However, many of the hazards profiled in this plan could cause mass casualties or fatalities; mitigation for those hazards also helps to mitigate for these events.

Section 4: Mitigation Strategy

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- Identification and Analysis of Mitigation Actions.....295
 - Boone County
 - Ashland
 - Centralia
 - Columbia
 - Hallsville
 - Harrisburg
 - Hartsburg
 - Huntsdale
 - Rocheport
 - Sturgeon
 - Centralia R-VI School District
 - Columbia Public Schools
 - Hallsville R-IV School District
 - Harrisburg R-VIII School District
 - Southern Boone School District
 - Sturgeon R-V School District
 - Stephens College
 - University of Missouri

Section 4: Mitigation Strategy

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

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

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

GOALS

44 CFR 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.

The hazard mitigation goals first developed during the 2004 planning process were updated in 2015 to reflect the inclusion of technological and human-made disasters in the mitigation plan. The planning committee chose to not change the goals for this update as they felt they were still feasible and relevant to challenges facing the planning area.

The five goals for the Boone County Hazard Mitigation Plan (2020) are:

- Goal 1: Mitigation Planning - Mitigate the effects of future natural, technological, and human-made hazards throughout the County through public and private action.
- Goal 2: Mitigation Policy - Develop policies that limit the impact of natural, technological, and human-made 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, technological, and human-made 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.

Identification and Analysis of Mitigation Actions

44 CFR 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.

Update of Mitigation Actions

The Planning Committee for the 2020 update reviewed and evaluated the status of the mitigation actions from the original plan. 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. Most actions were retained for the 2020 update; some were deleted as unrealistic or inappropriate and some were removed for completion.

For the 2020 update, the actions in the plan were reviewed by the planning committee and categorized as follows:

- Completed with a description of the progress.
- Some uncompleted actions were removed from the strategy action plan for various reasons.
- Many of the 2015 actions were kept in the 2020 strategy action plan either because they have not yet been completed or because they are ongoing actions which the committee wanted to highlight in the overall plan.

Table 4.1 Action Status Summary

Jurisdiction	Completed Actions	Continuing Actions (ongoing or modify)	Deleted Actions
All	4	4	3

Table 4.2 Summary of Completed and Deleted Actions from the previous Plan

Completed Actions	Completion Details
Conduct a phased flow study along major highway routes to help determine quantities of hazardous materials being transported	2017

through Boone County	
Investigate tools for automated notification system to be used collaboratively throughout Boone County and its jurisdictions.	RAVE
Acquire generators and power transfer hookup equipment.	RHSOC funding
Conduct survey of generator needs of critical infrastructure in planning area; include information on sizing, hookup, and fuel storage.	2016
Deleted Actions	Reason for Deletion
Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.	This is being done since it's required
Evaluate and maintain emergency preparedness plans.	This is being done since it's required
Conduct emergency preparedness exercises periodically throughout the year.	This is being done and is not measurable

IMPLEMENTATION OF MITIGATION ACTIONS

44 CFR Requirement §201.6(c)(3)(ii): The mitigation strategy shall include an action strategy describing how the actions identified in paragraph (c)(2)(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 benefits review of the proposed projects and their associated costs.

Jurisdictional MPC members were encouraged to meet with members of their community to finalize actions to be submitted for the updated mitigation strategy. The Disaster Mitigation Act requires benefit-cost review as the primary method by which mitigation projects should be prioritized. The committee was asked to take this into account when discussing actions for their jurisdiction. It was decided that projects will be prioritized by when and where damage occurs, available funding, and political will. Details of projects at the planning stage are not in-depth benefit/cost reviews and further details will be refined as there is project development

STAPLEE AND BENEFIT/COST REVIEWS

STAPLEE Review – The process for selecting and prioritizing action items did not change for the update. The Planning Committee conducted a STAPLEE review of the ongoing and possible new mitigation actions using key questions for each of the STAPLEE categories:

Figure 4.3

S	Social	Community Acceptance	Is the action generally acceptable to the community?
		Effect on Segment	Will this action have an adverse effect on any one segment of the community?
T	Technical	Technically Feasible	Is the action technically feasible?
		Long-term Solution	Does the action represent a long-term solution or is it more of a band-aid?
		Secondary Impacts	Are there any negative secondary impacts to the action?
A	Administrative	Staffing	Is there staffing available to lead and carry out the action?
		Maintenance	Can the jurisdiction provide any maintenance required?
P	Political	Political Support	If the action requires political action, is the political support there?
		Local Champion	Is there a local champion to promote the action?
		Public Support	Will the public support the political action needed to accomplish the mitigation?
L	Legal	Existing Local Authority	Does the local jurisdiction have authority to carry out the action?
		Potential Legal Challenge	Does the action run the risk of potential legal challenge?
E	Economic	Contribute to Economic Goals	Does the action contribute to other economic goals, such as capital improvements or economic development?
		Project Funding	Is funding already allocated or is outside funding required?
E	Environmental	Effects - Land/Water	How will this action affect land and water resources?
		Effects- Endangered Species	How will this action affect endangered species?

Each action was scored for each criterion according to the following scale:

-1	0	1	na
Less Favorable	Mixed	Favorable	(not applicable)

After the actions were evaluated, the following formula was used to calculate the percentage of points scored out of points available for each individual action: % score = (total points/total of applicable criteria) * 100

Benefit/Cost Review

The benefit of each action was evaluated by awarding two (2) points for each of the following *avoided* damages (8 points maximum = highest benefit):

- Injuries and/or casualties (IC)
- Property damages (PD)
- Loss-of-function (LF) – includes loss of utility services, impact of road/bridge closures, loss of income, cost of displacement
- Emergency management costs/community costs (EM)

The cost of each action was according to the following scale (-4 points maximum = highest cost):

- Already in place or easily put into work program (-1)
- Low/moderate cost – could be worked into operating budget (-2)
- Moderate/high cost –help with funding possibly needed depending on specifics of project (-3)
- High cost – outside help with funding definitely needed (-4)

Note: For the Benefit/Cost Review, the benefit and cost of actions which used the word “Encourage” were evaluated *as if* the action or strategy being encouraged was actually to be carried out.

Prioritization

The Planning Committee reviewed the % STAPLEE score and benefit/cost review for all of the actions and prioritized them 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

It was understood that some of these priorities might be changed by the individual jurisdictions due to funding or staffing constraints as they developed their plans for action implementation.

It should be noted that a number of high priority actions scored somewhat low on both the STAPLEE review and the benefit/cost review due to their high cost which figures into both reviews. These actions remain a high priority with the hope that funding will become available.

Figure 6.7

Prioritization of Mitigation Actions using STAPLEE and Benefit/Cost Analysis

Action #	Mitigation Action	STAPLEE ANALYSIS																	BENEFIT/COST			Priority		
		Social		Technical			Admin		Political		Legal		Econ		Env		Total		Losses Avoided (2 pts. Each)	Benefit	Cost		B/C Total	
		Community Acceptance	Effect on Segment	Technically Feasible	Long-term Solution	Secondary Impacts	Staffing	Maintenance	Political Support	Local Champion	Public Support	Existing Local Authority	Potential Legal Challenge	Contribute to Economic Goals	Outside Funding Required	Effects - Land/Water	Effects- Endangered Species	Total Applicable						STAPLEE % Score
1.1.1	Continue to supply updated GIS base map information to support changing/updating the D-FIRM maps using local, accurate data.	1	na	1	0	1	1	1	1	1	1	1	na	na	1	na	na	11	90.9%	IC,PD,LF,EM	8	-1	7	H
1.1.2	Continue to participate as a partner in FEMA's RISKMap process.	1	na	1	1	1	1	1	1	1	na	1	na	1	1	na	na	11	100.0%	IC,PD,LF,EM	8	-1	7	H
1.1.3	Continue monthly testing of outdoor warning sirens in compliance with procedures set by the Office of Emergency Management.	1	na	1	1	1	1	1	1	1	1	na	na	1	na	na	11	100.0%	IC,EM	4	-1	3	H	
1.1.4	The Public Works Department will adhere to a routine maintenance schedule for brush cutting and tree trimming to keep branches from overhanging roads.	0	na	1	1	1	1	1	1	1	0	1	na	na	1	na	na	11	81.8%	IC,PD,LF,EM	8	-1	7	H
1.1.5	Encourage the local water district to have adequate fire flow.	1	na	1	1	1	1	na	1	1	1	na	na	na	0	1	1	11	90.9%	IC,PD,LF,EM	8	-3	5	M
1.1.6	Conduct a flow study along major highway routes to help determine quantities of hazardous materials being transported through Boone County.	1	na	1	1	1	1	na	na	na	na	1	na	1	0	na	na	8	87.5%	IC,PD,LF,EM	8	-2	6	H

Figure 6.7 (cont.)

Prioritization of Mitigation Actions using STAPLEE and Benefit/Cost Analysis																								
Action #	Mitigation Action	STAPLEE ANALYSIS																	BENEFIT/COST			Priority		
		Social		Technical			Admin		Political			Legal		Econ		Env		Total		Losses Avoided (2 pts. Each)	Benefit		Cost	B/C Total
Community Acceptance	Effect on Segment	Technically Feasible	Long-term Solution	Secondary Impacts	Staffing	Maintenance	Political Support	Local Champion	Public Support	Existing Local Authority	Potential Legal Challenge	Contribute to Economic Goals	Outside Funding Required	Effects - Land/Water	Effects- Endangered Species	Total Applicable	STAPLEE % Score							
1.1.7	Conduct a survey of generator needs of critical infrastructure in Planning Area; include information on sizing, hookup, and fuel storage.	1	na	1	1	1	0	0	na	na	na	1	na	1	1	na	na	9	77.8%	IC,PD,LF,EM	8	-2	6	M-H
1.1.8	Conduct detailed risk assessments and cost/benefit analyses of telecommunications and networking vulnerabilities in individual municipalities.	1	na	1	1	1	0	0	na	na	na	1	na	1	1	na	na	9	77.8%	IC,PD,LF,EM	8	-1	7	M-H
1.1.9	Investigate tools for automated notification system to be used collaboratively throughout Boone County and its jurisdictions.	1	na	1	1	1	1	1	na	na	na	1	na	1	0	na	na	9	88.9%	IC,PD,LF,EM	8	-2	6	M
1.1.10	Develop a Continuity of Operations Plans (COOP).	1	na	1	1	1	0	0	1	1	1	1	na	1	0	na	na	12	75.0%	IC,PD,LF,EM	8	-2	6	H
1.1.11	Strategize and establish local source(s) of sustainable mitigation funding to be used by participating jurisdictions in the Boone County Hazard Mitigation Plan as direct project funding and/or as local match for outside grants.	0	na	1	1	1	1	na	1	1	0	1	na	1	na	1	na	11	81.8%	IC,PD,LF,EM	8	-2	6	H

Figure 6.7 (cont.)

Prioritization of Mitigation Actions using STAPLEE and Benefit/Cost Analysis																								
Action #	Mitigation Action	STAPLEE ANALYSIS																BENEFIT/COST				Priority		
		Social		Technical			Admin		Political		Legal		Econ		Env		Total		Losses Avoided (2 pts. Each)	Benefit	Cost		B/C Total	
		Community Acceptance	Effect on Segment	Technically Feasible	Long-term Solution	Secondary Impacts	Staffing	Maintenance	Political Support	Local Champion	Public Support	Existing Local Authority	Potential Legal Challenge	Contribute to Economic Goals	Outside Funding Required	Effects - Land/Water	Effects- Endangered Species	Total Applicable						STAPLEE % Score
1.2.1	Encourage underground utilities where feasible.	1	na	1	1	0	1	na	na	na	na	na	na	1	1	-1	na	8	62.5%	IC,PD,LF,EM	8	-2	6	H
1.2.2	Review and formalize relationships with cooling and warming centers in each community.	1	1	na	na	1	0	0	na	na	na	1	na	na	1	na	na	7	71.4%	IC,EM	4	-1	3	H
1.2.3	Establish agreements with cellular providers for "Cell on Wheels" units to be made available in case of telecommunications disruption.	1	na	1	1	1	1	1	na	na	na	1	na	1	1	na	na	9	100.0%	IC,PD,LF,EM	8	-1	7	H
1.2.4	Work with owners of dams not regulated by the State who are willing to develop Emergency Action Plans (EAPs).	0	na	1	1	1	0	0	1	1	1	1	na	1	1	1	na	13	76.9%	IC,PD,LF,EM	8	-1	7	L-M
2.1.1	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.	0	na	1	1	1	1	1	1	1	0	1	na	na	1	1	na	12	83.3%	IC,PD,LF,EM	8	-1	7	H
2.1.2	Add sinkhole regulations to stream buffer/storm water ordinance.	0	na	1	1	1	1	na	1	1	0	1	na	na	1	1	na	11	81.8%	IC,PD,LF,EM	8	-2	6	M

Figure 6.7 (cont.)

Prioritization of Mitigation Actions using STAPLEE and Benefit/Cost Analysis																								
Action #	Mitigation Action	STAPLEE ANALYSIS																	BENEFIT/COST			Priority		
		Social		Technical			Admin		Political		Legal		Econ		Env		Total		Losses Avoided (2 pts. Each)	Benefit	Cost		B/C Total	2015 Plan
Community Acceptance	Effect on Segment	Technically Feasible	Long-term Solution	Secondary Impacts	Staffing	Maintenance	Political Support	Local Champion	Public Support	Existing Local Authority	Potential Legal Challenge	Contribute to Economic Goals	Outside Funding Required	Effects - Land/Water	Effects- Endangered Species	Total Applicable	STAPLEE % Score							
2.1.3	Develop policy and enforcement regulations concerning burning and/or encourage development of burn permit procedure.	0	na	1	1	1	0	na	1	1	0	1	na	na	1	1	1	12	75.0%	IC,PD,LF,EM	8	-2	6	M
2.2.1	Review building codes every two/three years for possible update.	0	na	1	1	1	1	1	na	na	na	1	na	na	1	na	na	8	87.5%	IC,PD,LF,EM	8	-1	7	H
2.2.2	Develop regulations for roads on dams.	-1	na	1	1	1	1	na	1	1	0	1	na	na	1	1	na	11	72.7%	IC,PD,LF,EM	8	-2	6	H
3.1.1	Secure high value equipment located outside county and municipal buildings (e.g. HVAC, generators, communication equipment).	1	na	1	1	1	0	1	na	na	na	1	na	na	1	na	na	8	87.5%	IC,PD,LF,EM	8	-2	6	H
3.1.2	Replace 2, 3, and 4 inch water lines with 6 inch lines to ensure adequate supply for fire flow.	1	na	1	1	1	1	1	1	1	1	1	na	na	-1	1	na	12	83.3%	IC,PD,LF,EM	8	-4	4	M
3.1.3	Mitigate the effects of flooding on public infrastructure.	1	na	1	1	1	1	1	na	na	na	1	na	na	0	na	na	8	87.5%	IC,PD,LF,EM	8	-3	5	H
3.1.4	Move the salt dome at the University of Missouri to protect Hinks on Creek in case of damage from high winds or tomadoes.	1	na	1	1	1	1	na	1	1	na	1	na	1	-1	1	1	12	83.3%	IC,PD	4	-4	0	H

the mitigation actions suggested for the specific participating jurisdictions were handed over to the representatives or governing bodies of those jurisdictions for implementation and administration decisions.

It was recognized that participating jurisdictions might choose to either change the prioritization of or exclude some suggested mitigation actions based on current specifics of time, resources, and capabilities. In addition, new mitigation actions might be added based on specific issues.

The mitigation actions for which each participating jurisdiction is the lead are shown in the following pages. The Boone County Office of Emergency Management is the lead on many actions which mitigate hazards for the entire planning area; these actions are indicated in Figure 6.6 by the use of an asterisk (*) for jurisdictions benefiting from such actions.

A description of the method for integrating the hazard mitigation actions into other planning processes in the jurisdiction is included after the actions.

BOONE COUNTY

Action #	1.1.1
Mitigation Action	Continue to supply updated GIS base map information to support changing/updating the D-FIRM maps using local, accurate data.
Priority	High
Lead Department or Agency	County Commission
Partners, if any	City of Columbia, GIS Departments
Plan for Implementation and Administration	The County will be meeting with FEMA staff to work on the next step of their digitization project.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	GIS information supplied
Action #	1.1.2
Mitigation Action	Continue to participate as a partner in FEMA's RISKMap process.
Priority	High
Lead Department or Agency	Boone County Resource Management Dept
Partners, if any	FEMA
Plan for Implementation and Administration	This is an ongoing activity with the Boone County Resource Management Dept
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal funds/grants
Projected Completion Date	Ongoing
Criterion for Completion	Ongoing
Action #	1.1.3
Mitigation Action	Continue monthly testing of outdoor warning sirens in compliance with procedures set by the Office of Emergency Management.
Priority	High
Lead Department or Agency	Office of Emergency Management
Partners, if any	BCJC
Plan for Implementation and Administration	BCJC conducts monthly tests of the outdoor warning sirens on the first Wednesday of the month (barring inclement weather); a check system is in place to ensure that the sirens went off. An annual maintenance agreement is in place to resolve any mechanical issues that should arise throughout the year.
Benefits (Losses Avoided)	IC, EM
Projected Cost	Moderate
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	Regular testing

Action #	1.1.4
Mitigation Action	The Public Works Department will adhere to a routine maintenance schedule for brush cutting and tree trimming to keep branches from overhanging roads.
Priority	High
Lead Department or Agency	Public Works Department
Partners, if any	
Plan for Implementation and Administration	This is an ongoing activity within the Public Works Department
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	Brush and trees are trimmed.
Action #	1.1.8
Mitigation Action	Conduct detailed risk assessments and cost/benefit analyses of telecommunications and networking vulnerabilities in individual municipalities.
Priority	Medium to High
Lead Department or Agency	Office of Emergency Management
Partners, if any	All incorporated communities
Plan for Implementation and Administration	Conduct workshop with IT leaders to identify issues and trends in network and telecommunication continuity. Identify potential strategies and secure training on selected topics for local leaders.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Low
Potential Funding Sources	Internal Funds
Projected Completion Date	12/31/2017
Criterion for Completion	Risk Assessment Completed
Action #	1.1.10
Mitigation Action	Develop a Continuity of Operations Plan (COOP).
Priority	High
Lead Department or Agency	Office of Emergency Management
Partners, if any	All stakeholders
Plan for Implementation and Administration	Provide training on benefits of COOP plans for local agencies. Assign OEM Planner to work with local disaster stakeholders to develop individual continuity of operations plans.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Low
Potential Funding Sources	Internal
Projected Completion Date	2020
Criterion for Completion	COOP plans developed

Action #	1.1.11
Mitigation Action	Strategize and establish local source(s) of sustainable mitigation funding to be used by participating jurisdictions in the Boone County Hazard Mitigation Plan as direct project funding and/or as local match for outside grants.
Priority	High
Lead Department or Agency	Office of Emergency Management
Partners, if any	All participating jurisdictions in Boone County Hazard Mitigation Plan; economic development groups; insurance companies and other business stakeholders; Mid-MO RPC
Plan for Implementation and Administration	Meet with officials and stakeholder groups to: 1. Educate regarding mitigation needs in Boone County, economic benefits of mitigation, and challenges of funding. 2. Strategize possible avenues of funding. 3. Develop method for funding applications.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Low-Moderate
Potential Funding Sources	Internal
Projected Completion Date	2016
Criterion for Completion	Local source(s) of sustainable funding for mitigation is established.
Action #	1.2.1
Mitigation Action	Encourage underground utilities where feasible.
Priority	High
Lead Department or Agency	Resource Management Dept.
Partners, if any	
Plan for Implementation and Administration	The County and developers work together to encourage underground utilities for new development.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	
Potential Funding Sources	No funds necessary
Projected Completion Date	Ongoing
Criterion for Completion	Utilities are underground in new developments
Action #	1.2.2
Mitigation Action	Review and formalize relationships with cooling and warming centers in each community.
Priority	High
Lead Department or Agency	Office of Emergency Management
Partners, if any	All incorporated communities
Plan for Implementation and Administration	Review listing of current warming/cooling centers and identify gaps within community. Work with stakeholders to fill gaps.
Benefits (Losses Avoided)	IC,EM
Projected Cost	Low
Potential Funding Sources	Internal
Projected Completion Date	12/31/2017
Criterion for Completion	Agreements in place
Action #	1.2.3

Mitigation Action	Establish agreements with cellular providers for "Cell on Wheels" units to be made available in case of telecommunications disruption.
Priority	High
Lead Department or Agency	Office of Emergency Management
Partners, if any	
Plan for Implementation and Administration	Work with vendors to establish agreements and request procedures to ensure quick deployment of cellular networks.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Low
Potential Funding Sources	Internal
Projected Completion Date	12/31/2016
Criterion for Completion	Agreements in place and request procedures established.
Action #	1.2.4
Mitigation Action	Work with owners of dams not regulated by the State who are willing to develop Emergency Action Plans (EAPs).
Priority	Low - Medium
Lead Department or Agency	Office of Emergency Management
Partners, if any	Dam and Reservoir Safety Program (MO DNR, Rolla)
Plan for Implementation and Administration	Use GIS to identify potential unregulated dams throughout the county. Contact landowners and provide an overview of the dam risks and benefits of EAP's. Assign Planner to work with dam owners to develop EAP concurrent with the hazard posed by the dam.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Low
Potential Funding Sources	Internal
Projected Completion Date	12/31/2020
Criterion for Completion	Dams identified, mapped, and plans established

Action #	2.1.1
Mitigation Action	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
Priority	High
Lead Department or Agency	Resource Management Dept.
Partners, if any	
Plan for Implementation and Administration	This is an ongoing activity within the Planning and Building Department.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	Ordinances are enforced
Hazards Addressed	FL
Action #	2.2.1
Mitigation Action	Review building codes every three years for possible update.
Priority	High
Lead Department or Agency	County Planning & Building Inspections
Partners, if any	County Commission
Plan for Implementation and Administration	The County is currently in the process of reviewing the most recent code.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	Codes are reviewed and updated (if update is appropriate)
Hazards Addressed	EQ, WW, T, WF
Action #	3.1.1
Mitigation Action	Secure high value equipment located outside county and municipal buildings (e.g. HVAC, generators, communication equipment).
Priority	High
Lead Department or Agency	Office of Emergency Management
Partners, if any	
Plan for Implementation and Administration	Office of Emergency Management will make recommendations on this.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	Equipment is secured
Hazards Addressed	EQ, T

Action #	3.1.3
Mitigation Action	Mitigate the effects of flooding on public infrastructure.
Priority	High
Lead Department or Agency	Depts. of Public Works and Planning
Partners, if any	County Commission
Plan for Implementation and Administration	Departments of Public Works and Planning will make recommendations on this.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Moderate to High
Potential Funding Sources	Internal Funds and Grants
Projected Completion Date	Ongoing
Criterion for Completion	Public infrastructure is protected
Hazards Addressed	FL
Action #	3.2.1
Mitigation Action	Ensure evacuation plans are adequate for nursing homes and special needs populations.
Priority	High
Lead Department or Agency	Office of Emergency Management
Partners, if any	Red Cross
Plan for Implementation and Administration	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.
Benefits (Losses Avoided)	IC, EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	Evacuation plans are in place
Hazards Addressed	EQ, WW, T
Action #	3.2.6
Mitigation Action	Encourage shelters to have alternative heating sources.
Priority	Low
Lead Department or Agency	Office of Emergency Management
Partners, if any	Red Cross
Plan for Implementation and Administration	This is part of the overall Emergency Operations Plan which covers the entire Planning Area.
Benefits (Losses Avoided)	IC, EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	Alternative heating is available
Hazards Addressed	EQ, T, WW

Action #	3.2.8
Mitigation Action	Develop strategy for preparedness planning and 72-hour provisions for most vulnerable populations; include strategies for food, water, hygiene, and medical supplies.
Priority	Medium-Low
Lead Department or Agency	Columbia/Boone County Dept. of Public Health and Human Services
Partners, if any	Office of Emergency Management; community-based organizations; faith-based organizations
Plan for Implementation and Administration	Survey for preparedness levels and obstacles to preparedness; analyze obstacles and develop strategy to overcome.
Benefits (Losses Avoided)	IC, EM
Projected Cost	Moderate
Potential Funding Sources	Grants; the Medical Reserve Corps (MRC) Capacity Building Grant is one potential funding source
Projected Completion Date	2020
Criterion for Completion	Strategy is in place.

Action #	3.2.10
Mitigation Action	Host Psychological First Aid courses in order to create a local Psychological First Aid capacity.
Priority	High
Lead Department or Agency	Office of Emergency Management
Partners, if any	All stakeholders
Plan for Implementation and Administration	Work with State Department of Health and Senior Services to deliver Psychological First Aid courses to local stakeholders and volunteers. Establish a trained cadre of community members to be utilized during disaster response.
Benefits (Losses Avoided)	IC, LF, EM
Projected Cost	Low
Potential Funding Sources	Internal
Projected Completion Date	12/31/2017
Criterion for Completion	Classes delivered
Action #	4.0.1
Mitigation Action	Continue to educate the public on all hazards.
Priority	High
Lead Department or Agency	Office of Emergency Management
Partners, if any	Local Media
Plan for Implementation and Administration	This is an ongoing activity of the Office of Emergency Management and is carried out through press releases and available literature.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Program Funds
Projected Completion Date	Ongoing
Criterion for Completion	Natural hazard education for public occurs.
Action #	4.0.2
Mitigation Action	Promote the purchase and use of NOAA radios.
Priority	High
Lead Department or Agency	Office of Emergency Management
Partners, if any	
Plan for Implementation and Administration	Develop marketing plan to promote use of NOAA radios. Secure outside funding to allow provision of radios to community members at risk.
Benefits (Losses Avoided)	IC, PD, LF, EM
Projected Cost	Low - Medium
Potential Funding Sources	Grants, Internal
Projected Completion Date	Ongoing
Criterion for Completion	Ongoing

Action #	4.0.3
Mitigation Action	Promote Ready-in-3 materials in-house at the Columbia/Boone County Dept. of Public Health and Human Services and at public events.
Priority	Medium
Lead Department or Agency	Columbia/Boone County Dept. of Public Health and Human Services
Partners, if any	OEM, community-based organizations, MO DHSS
Plan for Implementation and Administration	Ensure material is available and on display at the Columbia/Boone County Dept. of Public Health and Human Services. Identify community events for distribution; explore Medical Reserve Corps potential role in distribution; make plan for distribution and distribute at events.
Benefits (Losses Avoided)	IC, EM
Projected Cost	Low
Potential Funding Sources	In budget
Projected Completion Date	Ongoing
Criterion for Completion	Materials are available, on display, and being distributed.

Integration into Other Planning Mechanisms

The mitigation actions will be reviewed annually as part of the budget and priority setting process. During the EOP review, the additional hazards identified in the mitigation plan will be reviewed to ensure they are dealt with in the EOP.

With regards to permitting and codes/regulations: 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

Action #	1.1.10
Mitigation Action	Develop a Continuity of Operations Plan (COOP).
Priority	High
Lead Department or Agency	City Hall
Partners, if any	RPC
Plan for Implementation and Administration	Internal, ongoing, meet with departments
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	LOW
Potential Funding Sources	N/A
Projected Completion Date	12/31/2015
Criterion for Completion	Plan to be adopted by Board of Aldermen
Action #	1.2.1
Mitigation Action	Encourage underground utilities where feasible.
Priority	High
Lead	Utilities
Partners	Local Government
Plan for Implementation and Administration	Encourage through development approval
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	No Funds Necessary
Projected Completion Date	Ongoing
Criterion for Completion	Utilities are underground in new developments
Hazards Addressed	WW, T, WF
Action #	2.1.1
Mitigation Action	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
Priority	High
Lead	Code Official
Partners	Boone County
Plan for Implementation and Administration	This is an ongoing activity
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	Ordinances are enforced

Action #	3.2.5
Mitigation Action	Build tornado safe room(s) or harden part(s) of existing structure(s) to FEMA 361 standards.
Priority	Medium
Lead	Board of Aldermen
Partners	School/Community Groups
Plan for Implementation and Administration	Work with other organizations to create a site for the community
Benefits (Losses Avoided)	IC,EM
Projected Cost	\$1.5 million
Potential Funding Sources	FEMA Pre-disaster Mitigation Grant Program, Local Match
Projected Completion Date	Ongoing
Criterion for Completion	Safe room is built.

Integration into Other Planning Mechanisms

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

Action #	1.1.3
Mitigation Action	Continue monthly testing of outdoor warning sirens in compliance with procedures set by the Office of Emergency Management.
Priority	High
Lead Department or Agency	Centralia PD and Centralia Electric Department
Partners, if any	Boone County Joint Dispatch
Plan for Implementation and Administration	Ongoing
Benefits (Losses Avoided)	IC,EM
Projected Cost	No additional cost
Potential Funding Sources	na
Projected Completion Date	Ongoing
Criterion for Completion	Sirens are being tested monthly
Action #	1.1.10
Mitigation Action	Develop a Continuity of Operations Plan (COOP).
Priority	High
Lead Department or Agency	City Administrator
Partners, if any	All departments
Plan for Implementation and Administration	This is currently in development.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Low
Potential Funding Sources	City funds
Projected Completion Date	4/1/2017
Criterion for Completion	Plan is written and approved by the Board of Aldermen
Action #	1.2.1
Mitigation Action	Encourage underground utilities where feasible.
Priority	Medium to High
Lead	City Administrator
Partners	-
Plan for Implementation and Administration	This is being done and will continue.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Electric Fund
Projected Completion Date	Ongoing
Criterion for Completion	Utilities are underground in new developments

Action #	2.1.1
Mitigation Action	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
Priority	High
Lead	City Administrator
Partners	-
Plan for Implementation and Administration	This is an ongoing process when issuing building permits and reviewing subdivision plans.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	Ordinances are enforced
Action #	2.1.3
Mitigation Action	Develop policy and enforcement regulations concerning burning permits.
Priority	Low
Lead	City Administrator
Partners	Volunteer Fire Department
Plan for Implementation and Administration	Regulations are in place concerning when and how burning can take place.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	Policy is in place and enforced

Integration into Other Planning Mechanisms

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

Action #	1.1.1
Mitigation Action	Continue to supply updated GIS base map information to support changing/updating the D-FIRM maps using local, accurate data.
Priority	High
Lead Department or Agency	Public Works Department
Partners, if any	County Commission GIS Departments
Plan for Implementation and Administration	Public Works staff will provide flood plain modeling info and Letter of Map Review (LOMR) applications to SEMA as they come available.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	GIS information supplied
Action #	1.1.2
Mitigation Action	Continue to participate as a partner in FEMA's RISKMap process.
Priority	High
Lead Department or Agency	Public Works Department
Partners, if any	County Commission GIS Departments
Plan for Implementation and Administration	Attend meetings and contribute as possible.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	Ongoing
Action #	1.1.10
Mitigation Action	Develop a Continuity of Operations Plan (COOP).
Priority	High
Lead Department or Agency	Committee; City Manager's Office; Enterprise Departments
Partners, if any	
Plan for Implementation and Administration	Business continuity plans have been developed at the departmental level in 12 of 19 departments; these are considered the "mission critical" departments; some of the plans have not been tested yet.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	Committee adoption with regular updates

Action #	1.2.2
Mitigation Action	Review and formalize relationships with cooling and warming centers in each community.
Priority	High
Lead Department or Agency	Columbia/Boone County Department of Health & Human Services
Partners, if any	Local non-profits and service organizations
Plan for Implementation and Administration	Ongoing
Benefits (Losses Avoided)	IC,EM
Projected Cost	Minimal
Potential Funding Sources	Internal; Grants
Projected Completion Date	Ongoing
Criterion for Completion	Ongoing with feedback and adjustments as needed
Action #	2.1.1
Mitigation Action	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
Priority	High
Lead Department or Agency	Public Works Department
Partners, if any	
Plan for Implementation and Administration	Public Works staff reviews all development plans to ensure ordinances are followed.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	Ordinances are enforced
Action #	2.1.2
Mitigation Action	Add sinkhole regulations to stream buffer/storm water ordinance.
Priority	Medium
Lead Department or Agency	Public Works Department
Partners, if any	
Plan for Implementation and Administration	Staff will draft sinkhole regulations for City Council consideration.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	2020
Criterion for Completion	Regulations are added

Action #	2.2.1
Mitigation Action	Review building codes every two years for possible update.
Priority	High
Lead Department or Agency	Public Works Department
Partners, if any	
Plan for Implementation and Administration	Staff will review codes along with Building Code Commission and adopt current regulations as directed.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	Codes are reviewed and updated (if update is appropriate)
Action #	2.2.2
Mitigation Action	Develop regulations for roads on dams.
Priority	High
Lead Department or Agency	Public Works Department
Partners, if any	
Plan for Implementation and Administration	Staff will develop ordinance for City Council consideration that addresses the placement of public roadways on non-regulated dams.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	2015
Criterion for Completion	Regulations are adopted
Hazards Addressed	DF
Action #	3.1.1
Mitigation Action	Secure high value equipment located outside county and municipal buildings (e.g. HVAC, generators, communication equipment).
Priority	High
Lead Department or Agency	Public Works
Partners, if any	
Plan for Implementation and Administration	Facilities Planning as new facilities are built
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Part of project costs; Enterprise funds; Bonds
Projected Completion Date	Ongoing
Criterion for Completion	Ongoing

Action #	3.1.3
Mitigation Action	Mitigate the effects of flooding on public infrastructure.
Priority	High
Lead Department or Agency	Depts. of Public Works and Planning
Partners, if any	City Council
Plan for Implementation and Administration	Departments of Public Works and Planning will make recommendations on this.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Moderate to High
Potential Funding Sources	Internal Funds and Grants
Projected Completion Date	Ongoing
Criterion for Completion	Public infrastructure is protected
Action #	3.2.8
Mitigation Action	Develop strategy for preparedness planning and 72-hour provisions for most vulnerable populations; include strategies for food, water, hygiene, and medical supplies
Priority	Medium-Low
Lead Department or Agency	Columbia/Boone County Dept. of Public Health and Human Services
Partners, if any	Office of Emergency Management; community-based organizations; faith-based organizations
Plan for Implementation and Administration	Survey for preparedness levels and obstacles to preparedness; analyze obstacles and develop strategy to overcome.
Benefits (Losses Avoided)	IC, EM
Projected Cost	Moderate
Potential Funding Sources	Grants; the Medical Reserve Corps (MRC) Capacity Building Grant is one potential funding source
Projected Completion Date	2020
Criterion for Completion	Strategy is in place.
Action #	3.2.11
Mitigation Action	Continue to comply with requirements of FAA 139 and TSA 1542 at Columbia Regional Airport.
Priority	High
Lead Department or Agency	Columbia Regional Airport
Partners, if any	
Plan for Implementation and Administration	This is part of the normal operating procedures of the airport.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal - normal operating expenses
Potential Funding Sources	na
Projected Completion Date	Ongoing action
Criterion for Completion	All activities are in compliance with requirements.

Action #	4.0.3
Mitigation Action	Promote Ready-in-3 materials in-house at the Columbia/Boone County Dept. of Public Health and Human Services and at public events.
Priority	Medium
Lead Department or Agency	Columbia/Boone County Dept. of Public Health and Human Services
Partners, if any	OEM, community-based organizations, MO DHSS
Plan for Implementation and Administration	Ensure material is available and on display at the Columbia/Boone County Dept. of Public Health and Human Services. Identify community events for distribution; explore Medical Reserve Corps potential role in distribution; make plan for distribution and distribute at events.
Benefits (Losses Avoided)	IC, EM
Projected Cost	Low
Potential Funding Sources	In budget
Projected Completion Date	Ongoing
Criterion for Completion	Materials are available, on display, and being distributed.
Action #	5.0.1
Mitigation Action	Target Repetitive Loss Properties for flood buyout.
Priority	High
Lead Department or Agency	Public Works Department
Partners, if any	
Plan for Implementation and Administration	Columbia Storm Water Utility will evaluate properties that are repeatedly flooded and make decision whether to buy out or improve drainage systems.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Program Funds
Projected Completion Date	Ongoing
Criterion for Completion	Properties are targeted.

Integration into Other Planning Mechanisms

The mitigation actions will be implemented by each department as part of the city's annual Capital Improvement Project (CIP) budgeting process.

HALLSVILLE

Action #	1.1.10
Mitigation Action	Develop a Continuity of Operations Plan (COOP).
Priority	High
Lead Department or Agency	Board of Aldermen
Partners, if any	Mid-MO RPC
Plan for Implementation and Administration	This is will be discussed at a Board of Aldermen meeting; if the BOA approves development of a plan, a work session of the BOA will be held along with the appropriate commissions to determine the process for developing the COOP.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	COOP is in place

Integration into Other Planning Mechanisms

Mitigation actions in the plan will be integrated into the City's work program by forming a work session of the Board of Aldermen and relevant commissions; plans for proceeding with the actions will be developed at the work session. (Enforcement of NFIP floodplain regulations is already in the work program.)

HARRISBURG

Action #	1.1.10
Mitigation Action	Develop a Continuity of Operations Plan (COOP).
Priority	High
Lead Department or Agency	City Clerk and Board of Trustees
Partners, if any	Boone County Emergency Management
Plan for Implementation and Administration	The city clerk and the trustees will coordinate the salvage of city records, recovery of accounts payable and receivable, and restoration of sewer and water. OEM will coordinate any emergency response actions.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Cost to develop the COOP is LOW. Cost to implement actual continuity would be Med/High and is currently unknown and will be determined by the event itself.
Potential Funding Sources	General Fund , Grants and Loans
Projected Completion Date	2017
Criterion for Completion	The original document can show completion but annual maintenance is required to a COOP so it will be ongoing.
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Action #	1.2.1
Mitigation Action	Encourage underground utilities where feasible.
Priority	High
Lead Department or Agency	Board of Trustees/City Clerk
Partners, if any	
Plan for Implementation and Administration	Pursue possibility of ordinance requiring underground utilities in new development.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	City Budget
Projected Completion Date	2017
Criterion for Completion	Utilities are underground in new developments
Hazards Addressed	WW, T, WF, UTIL
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Action #	2.1.1
Mitigation Action	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
Priority	High
Lead Department or Agency	City Clerk
Partners, if any	MO SEMA
Plan for Implementation and Administration	
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	City Budget
Projected Completion Date	Ongoing
Criterion for Completion	Floodplain management ordinance is enforced.

Action #	3.2.5
Mitigation Action	Build tornado safe room(s) or harden part(s) of existing structure(s) to FEMA 361 standards.
Priority	High
Lead Department or Agency	Board of Trustees/City Clerk
Partners, if any	
Plan for Implementation and Administration	Discuss at Strategic Planning Meeting
Benefits (Losses Avoided)	IC,EM
Projected Cost	Significant
Potential Funding Sources	FEMA Pre-disaster Mitigation Grant Program, Local Match
Projected Completion Date	2017
Criterion for Completion	Safe room is built.

Integration into Other Planning Mechanisms

The Village of Harrisburg is undergoing a Strategic Planning process and will be including discussion of the mitigation actions from this plan in that process.

HARTSBURG

Action #	2.1.1
Mitigation Action	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
Priority	High
Lead	City Council
Partners	Boone County
Plan for Implementation and Administration	Be available to town residents when building or remodeling; permits are issued through the County.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	Ordinances are enforced

Integration into Other Planning Mechanisms

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

Action #	1.2.1
Mitigation Action	Encourage underground utilities where feasible.
Priority	High
Lead	Board of Aldermen
Partners	Boone Electric Coop
Plan for Implementation and Administration	If the opportunity arises, the city would like to work with Boone Electric COOP to put utilities underground.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	High
Potential Funding Sources	FEMA mitigation grants (HMGP)
Projected Completion Date	Ongoing
Criterion for Completion	Utilities are underground.
Hazards Addressed	WW, T, WF
Action #	2.1.1
Mitigation Action	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
Priority	High
Lead Department or Agency	Floodplain Manager
Partners, if any	SEMA
Plan for Implementation and Administration	Review any proposed development to ensure compliance with the floodplain ordinance.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	na
Projected Completion Date	Ongoing
Criterion for Completion	Total compliance with floodplain ordinance in Huntsdale

Integration into Other Planning Mechanisms

The Town Council is kept well informed of any activities involving the city; implementing the hazard mitigation actions will be included in the discussion of village concerns.

ROCHEPORT

Action #	1.2.1
Mitigation Action	Encourage underground utilities where feasible.
Priority	Medium
Lead Department or Agency	Mayor
Partners, if any	Aldermen
Plan for Implementation and Administration	This is something the city has talked about and would be interested in pursuing if some additional sources of funding could be found. Undergrounding has been discussed with the electric provider (Boone Electric Coop).
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	High
Potential Funding Sources	Grants, internal funds
Projected Completion Date	Ongoing
Criterion for Completion	Ongoing
Action #	2.1.1
Mitigation Action	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
Priority	High
Plan for Implementation and Administration	Enforcement is an ongoing process
Lead Department or Agency	Mayor and City Aldermen
Partners, if any	Planning and Zoning Commission
Potential Funding Sources	Internal Funds
Projected Cost	Minimal
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Completion Date	Ongoing
Criterion for Completion	Ordinances are enforced
Action #	5.0.3
Mitigation Action	Acquire properties susceptible to flood damage when buyout grants are available.
Priority	Medium to Low
Lead Department or Agency	City Aldermen
Partners, if any	Planning and Zoning Commission
Plan for Implementation and Administration	This will be done if, and when, grant money becomes available.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	FEMA Grant Funds
Projected Completion Date	Ongoing
Criterion for Completion	Properties are acquired.
Hazards Addressed	FL

Integration into Other Planning Mechanisms

The City annually reviews its capital improvement program and future planning needs; hazard mitigation actions will be reviewed during this process.

STURGEON

Action #	1.1.5
Mitigation Action	Encourage the local water district to have adequate fire flow.
Priority	Medium
Lead Department or Agency	Mayor
Partners, if any	Board of Aldermen
Plan for Implementation and Administration	Water District #10 has passed a \$2.5 Million bond issue and will be putting in bigger lines; talk with the water district to ensure that fire flow is considered in decisions re: location of line upgrades.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	None
Potential Funding Sources	No funds necessary
Projected Completion Date	Ongoing
Criterion for Completion	Water district has adequate fire flow
Action #	1.1.10
Mitigation Action	Develop a Continuity of Operations Plan (COOP).
Priority	High
Lead Department or Agency	Mayor
Partners, if any	City Staff
Plan for Implementation and Administration	This is in progress; most city documents are now backed up on the Cloud; City will continue to put other parts of a COOP in place.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	City budget
Projected Completion Date	2016
Criterion for Completion	All areas of Continuity of Operations have been addressed by the City.
Action #	1.2.1
Mitigation Action	Encourage underground utilities where feasible.
Priority	High
Lead Department or Agency	Mayor/Board of Aldermen
Partners, if any	AmerenUE
Plan for Implementation and Administration	Ameren UE will be encouraged to go underground when possible.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	No Funds Necessary
Projected Completion Date	Ongoing
Criterion for Completion	All utilities are underground.

Action #	2.1.1
Mitigation Action	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
Priority	High
Lead Department or Agency	Mayor/Board of Aldermen
Partners, if any	
Plan for Implementation and Administration	Will continue the floodplain program the city has in place.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Minimal
Potential Funding Sources	Internal Funds
Projected Completion Date	Ongoing
Criterion for Completion	Ordinances are enforced
Action #	3.1.2
Mitigation Action	Replace 2, 3, and 4 inch water lines with 6 inch lines to ensure adequate supply for fire flow.
Priority	Medium
Lead Department or Agency	Mayor/Board of Aldermen
Partners, if any	WD #10
Plan for Implementation and Administration	Plan to have additional meetings with WD #10 to insure we have adequate water. Working with Mid-MO RPC on water grants.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	High
Potential Funding Sources	Federal grants/local match
Projected Completion Date	Unknown due to high cost and financing issues
Criterion for Completion	Water lines replaced
Action #	3.2.5
Mitigation Action	Build tornado safe room(s) or harden part(s) of existing structure(s) to FEMA 361 standards.
Priority	High
Lead Department or Agency	Public Safety Committee
Partners, if any	Mayor/Board of Aldermen
Plan for Implementation and Administration	Being discussed with Mid-MO RPC.
Benefits (Losses Avoided)	IC,EM
Projected Cost	High
Potential Funding Sources	FEMA Pre-disaster Mitigation Grant Program, Local Match
Projected Completion Date	Unknown due to high cost and financing issues
Criterion for Completion	Safe room is built.

Integration into Other Planning Mechanisms

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.

CENTRALIA R-VI SCHOOL DISTRICT

Action #	1.1.10
Mitigation Action	Develop a Continuity of Operations Plan (COOP).
Priority	High
Lead Department or Agency	Safety Committee
Partners, if any	Administration, School Board
Plan for Implementation and Administration	The Safety Committee will determine a procedure for developing the COOP and oversee its completion.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Low
Potential Funding Sources	Internal funds
Projected Completion Date	2016
Criterion for Completion	A Continuity of Operations Plan is in place.
Action #	3.2.2
Mitigation Action	Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.
Priority	High
Lead Department or Agency	Safety Coordinator
Partners, if any	Centralia Police Department
Plan for Implementation and Administration	Continue to instruct and train the students and staff of Centralia R-6
Benefits (Losses Avoided)	IC,EM
Projected Cost	None
Potential Funding Sources	NA
Projected Completion Date	Ongoing
Criterion for Completion	Actions outlined in RSMO are carried out
Action #	3.2.3
Mitigation Action	Evaluate and maintain emergency preparedness plans.
Priority	High
Lead Department or Agency	Safety Coordinator
Partners, if any	District Safety Committee
Plan for Implementation and Administration	Centralia R-6 safety committee will continue to evaluate plans and drills
Benefits (Losses Avoided)	IC,EM
Projected Cost	None
Potential Funding Sources	NA
Projected Completion Date	Ongoing
Criterion for Completion	Plans are evaluated and maintained

Action #	3.2.4
Mitigation Action	Conduct emergency preparedness exercises periodically throughout the year.
Priority	High
Lead Department or Agency	Safety Committee
Partners, if any	Local emergency agencies
Plan for Implementation and Administration	Centralia R-6 safety committee will continue to conduct drills and include local emergency agencies
Benefits (Losses Avoided)	IC,EM
Projected Cost	None
Potential Funding Sources	NA
Projected Completion Date	Ongoing
Criterion for Completion	Plans and drills are conducted
Action #	3.2.5
Mitigation Action	Build tornado safe room(s) or harden part(s) of existing structure(s) to FEMA 361 standards. Consideration of Fine Arts/Storm Shelter
Priority	Medium
Lead Department or Agency	Safety Committee
Partners, if any	Administration
Plan for Implementation and Administration	Increase the safeness of our tornado refuge areas
Benefits (Losses Avoided)	IC,EM
Projected Cost	Significant
Potential Funding Sources	Grants
Projected Completion Date	Unknown
Criterion for Completion	Building project completed
Action #	3.2.9
Mitigation Action	Continue to increase capacity to prevent and respond to unwanted intruder/active shooter events.
Priority	High
Lead Department or Agency	Safety Committee
Partners, if any	Centralia Police Department
Plan for Implementation and Administration	Increase Safety Features and Communication
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	\$10,000 yearly
Potential Funding Sources	District Budget
Projected Completion Date	On-Going
Criterion for Completion	Building Safety Audits and Intruder Drills

Integration into Other Planning Mechanisms

The district's safety committee has become extremely active. It meets on a monthly basis and has an annual budget that updates safety features district-wide.

COLUMBIA PUBLIC SCHOOLS

Action #	1.1.10
Mitigation Action	Develop a Continuity of Operations Plan (COOP).
Priority	High
Lead Department or Agency	Columbia Public Schools Administration
Partners, if any	N/A
Plan for Implementation and Administration	Implementation of Emergency/Crisis Plan
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	0
Potential Funding Sources	N/A
Projected Completion Date	2016
Criterion for Completion	Train all Admin in NIMS based Crisis plan
Action #	3.2.2
Mitigation Action	Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.
Priority	High
Lead Department or Agency	Columbia Public School Administration, Building Principals/Directors/Coordinators/Staff
Partners, if any	
Plan for Implementation and Administration	Columbia Public Schools will carry out the requirements of the Revised Statutes.
Benefits (Losses Avoided)	IC,EM
Projected Cost	0
Potential Funding Sources	NA
Projected Completion Date	Ongoing
Criterion for Completion	Actions as outlined in Revised Statutes are carried out
Action #	3.2.3
Mitigation Action	Evaluate and maintain emergency preparedness plans.
Priority	High
Lead Department or Agency	Columbia Public School Administration
Partners, if any	
Plan for Implementation and Administration	Columbia Public School administration will meet on a regular basis to evaluate our crisis plans.
Benefits (Losses Avoided)	IC,EM
Projected Cost	0
Potential Funding Sources	NA
Projected Completion Date	Ongoing
Criterion for Completion	Emergency preparedness plans are evaluated and maintained

Action #	3.2.4
Mitigation Action	Conduct emergency preparedness exercises periodically throughout the year.
Priority	High
Lead Department or Agency	Columbia Public School Administration, Building Principals/Directors/Coordinators/Staff
Partners, if any	
Plan for Implementation and Administration	Columbia Public Schools will continue to conduct emergency preparedness drills periodically per state mandates and recommendations.
Benefits (Losses Avoided)	IC,EM
Projected Cost	0
Potential Funding Sources	NA
Projected Completion Date	Ongoing
Criterion for Completion	Emergency preparedness exercises are conducted
Action #	3.2.5
Mitigation Action	Build tornado safe room(s) or harden part(s) of existing structure(s) to FEMA 361 standards.
Priority	Medium
Lead Department or Agency	Columbia Public School Administration
Partners, if any	
Plan for Implementation and Administration	Build tornado safe rooms as funding becomes available.
Benefits (Losses Avoided)	IC,EM
Projected Cost	High
Potential Funding Sources	FEMA Mitigation Grants/Local Matching Funds
Projected Completion Date	2018
Criterion for Completion	Tornado safe rooms are built.
Action #	3.2.9
Mitigation Action	Continue to increase capacity to prevent and respond to unwanted intruder/active shooter events.
Priority	High
Lead Department or Agency	Columbia Public Schools Safety and Security
Partners, if any	Columba Police and Boone County Sheriff's Department
Plan for Implementation and Administration	Columbia Public Schools Emergency/Crisis Plan
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	0
Potential Funding Sources	N/A
Projected Completion Date	Immediately
Criterion for Completion	Yearly drills conducted with LE and training for every employee

Integration into Other Planning Mechanisms

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.

HALLSVILLE R-IV SCHOOL DISTRICT

Action #	1.1.10
Mitigation Action	Develop a Continuity of Operations Plan (COOP).
Priority	High
Lead Department or Agency	Superintendent
Partners, if any	School Board, Admin Team
Plan for Implementation and Administration	Meet with stakeholders and identify priorities; research possible solutions for some of the tougher issues; write and test plan.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Moderate
Potential Funding Sources	Local funding
Projected Completion Date	July 1, 2016
Criterion for Completion	COOP is in place and is being tested periodically.
Action #	3.2.2
Mitigation Action	Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.
Priority	High
Lead Department or Agency	Admin Team
Partners, if any	Teachers
Plan for Implementation and Administration	Required drills are carried out and literature distribution takes place yearly.
Benefits (Losses Avoided)	IC,EM
Projected Cost	Low
Potential Funding Sources	Internal
Projected Completion Date	Ongoing
Criterion for Completion	Ongoing
Action #	3.2.3
Mitigation Action	Evaluate and maintain emergency preparedness plans.
Priority	High
Lead Department or Agency	Admin Team
Partners, if any	
Plan for Implementation and Administration	Forms are filled out after each drill or exercise re: any problems and/or changes needed; forms are evaluated by the administrative team; emergency plans are updated as needed
Benefits (Losses Avoided)	IC,EM
Projected Cost	Minimal
Potential Funding Sources	Internal
Projected Completion Date	Ongoing
Criterion for Completion	Ongoing

Action #	3.2.4
Mitigation Action	Conduct emergency preparedness exercises periodically throughout the year.
Priority	High
Lead Department or Agency	Admin Team
Partners, if any	Teachers
Plan for Implementation and Administration	Exercises are conducted yearly
Benefits (Losses Avoided)	IC,EM
Projected Cost	Minimal
Potential Funding Sources	Internal
Projected Completion Date	Ongoing
Criterion for Completion	Ongoing
Action #	3.2.5
Mitigation Action	Build tornado safe room(s) or harden part(s) of existing structure(s) to FEMA 361 standards.
Priority	Medium
Lead Department or Agency	School Board
Partners, if any	Superintendent, Admin Team, City of Hallsville
Plan for Implementation and Administration	Build tornado safe room if/when funding becomes available.
Benefits (Losses Avoided)	IC,EM
Projected Cost	High
Potential Funding Sources	FEMA mitigation grants
Projected Completion Date	Ongoing
Criterion for Completion	Tornado safe room is built.
Action #	3.2.9
Mitigation Action	Continue to increase capacity to prevent and respond to unwanted intruder/active shooter events.
Priority	High
Lead Department or Agency	School Resource Officer
Partners, if any	Administrative Team
Plan for Implementation and Administration	All employees go through active shooter at least once a year; bus drivers go through this training more than once a year.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Low
Potential Funding Sources	Internal
Projected Completion Date	Ongoing
Criterion for Completion	Ongoing

Integration into Other Planning Mechanisms

A number of the mitigation actions are ongoing school priorities and will remain so. The actions re: developing a COOP and building a tornado safe room will be discussed at School Board meetings and action plans developed.

HARRISBURG R-VIII SCHOOL DISTRICT

Action #	1.1.10
Mitigation Action	Develop a Continuity of Operations Plan (COOP).
Priority	High
Lead Department or Agency	Harrisburg R-VIII Administration
Partners, if any	Unknown
Plan for Implementation and Administration	A committee of local business people, parents, and school staff will be convened to begin the process of developing a COOP. Development of this plan will be an ongoing process throughout the upcoming school year.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Unknown at this time
Potential Funding Sources	Unknown
Projected Completion Date	8/1/2017
Criterion for Completion	Adoption by Board of Education
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Action #	3.2.2
Mitigation Action	Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.
Priority	High
Lead Department or Agency	Harrisburg Superintendent of Schools
Partners, if any	None
Plan for Implementation and Administration	Ongoing
Benefits (Losses Avoided)	IC,EM
Projected Cost	None
Potential Funding Sources	N/A
Projected Completion Date	Ongoing
Criterion for Completion	Documented communications and annual drill documentation
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Action #	3.2.3
Mitigation Action	Evaluate and maintain emergency preparedness plans.
Priority	High
Lead Department or Agency	Harrisburg R-VIII Administration
Partners, if any	Boone County Sheriff's Department, Boone County Fire Protection District
Plan for Implementation and Administration	Ongoing review and revisions (as necessary) of emergency plans
Benefits (Losses Avoided)	IC,EM
Projected Cost	None
Potential Funding Sources	N/A
Projected Completion Date	Ongoing
Criterion for Completion	Board of Education Approved Emergency Preparedness Plan

Action #	3.2.4
Mitigation Action	Conduct emergency preparedness exercises periodically throughout the year.
Priority	High
Lead Department or Agency	Harrisburg R-VIII Administration
Partners, if any	None
Plan for Implementation and Administration	Ongoing bi-annual drills for bus evacuations, severe weather, fire/bomb threats, intruders/active shooters, and earthquakes
Benefits (Losses Avoided)	IC,EM
Projected Cost	None
Potential Funding Sources	N/A
Projected Completion Date	Ongoing
Criterion for Completion	Completed emergency Drill Logs
Action #	3.2.5
Mitigation Action	Build tornado safe room(s) or harden part(s) of existing structure(s) to FEMA 361 standards.
Priority	Medium
Lead Department or Agency	Harrisburg Board of Education
Partners, if any	possibly Village of Harrisburg; SEMA/FEMA
Plan for Implementation and Administration	Build tornado safe room(s) or harden part(s) of existing structure(s) to FEMA 361 standards.
Benefits (Losses Avoided)	IC,EM
Projected Cost	High
Potential Funding Sources	Grants
Projected Completion Date	Unknown
Criterion for Completion	Tornado Safe Rooms are completed
Action #	3.2.9
Mitigation Action	Continue to increase capacity to prevent and respond to unwanted intruder/active shooter events.
Priority	High
Lead Department or Agency	Harrisburg R-VIII Administration
Partners, if any	Boone County Sheriff's Department & Boone County Fire Protection District
Plan for Implementation and Administration	Annual training and bi-annual drills will be conducted on an ongoing basis
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Unknown at this time; will depend on strategies pursued
Potential Funding Sources	Unknown
Projected Completion Date	Ongoing
Criterion for Completion	Completed training and drill logs

Integration into Other Planning Mechanisms

Each of the mitigation actions for the school district will be incorporated into both the ongoing School Improvement Plan process and ongoing safety review/planning process. A committee of local business people, parents, and school staff will be convened to begin the process of developing a COOP. It is anticipated this will be a lengthy process as we will be starting from scratch.

The school district has had some very preliminary conversations with the Harrisburg City Council regarding the potential for a joint effort to construct a tornado safe room/facility that could be utilized by the school and community members. These conversations will continue and hopefully a plan will be developed to complete such a project if/when funds become available.

SOUTHERN BOONE SCHOOL DISTRICT

Action #	1.1.10
Mitigation Action	Develop a Continuity of Operations Plan (COOP).
Priority	High
Lead Department or Agency	Southern Boone County School District
Partners, if any	Southern Boone County Economic Development and Chamber, Cities of Ashland and Hartsburg, Mid-MO Regional Planning Commission, and MU ExCEED, local faith based organizations
Plan for Implementation and Administration	Multiple meetings with area stakeholders to develop commitments in the event of a regional emergency
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	\$5,000
Potential Funding Sources	Local and grant
Projected Completion Date	2018
Criterion for Completion	A Continuity of Operations Plan in place
Action #	3.2.2
Mitigation Action	Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.
Priority	High
Lead Department or Agency	Southern Boone Administration
Partners, if any	N/A
Plan for Implementation and Administration	Continue to instruct and train students and staff on earthquake emergency preparedness including sending out information concerning earthquake procedures.
Benefits (Losses Avoided)	IC,EM
Projected Cost	0
Potential Funding Sources	N/A
Projected Completion Date	Ongoing
Criterion for Completion	Actions outlined in Revised Statutes are carried out
Action #	3.2.3
Mitigation Action	Evaluate and maintain emergency preparedness plans.
Priority	High
Lead Department or Agency	Southern Boone Administration
Partners, if any	Boone County Sheriff's Department
Plan for Implementation and Administration	Southern Boone Administration will continue to meet regularly to evaluate the crisis plan and flipchart.
Benefits (Losses Avoided)	IC,EM
Projected Cost	0
Potential Funding Sources	N/A
Projected Completion Date	Ongoing
Criterion for Completion	Emergency Preparedness plans are evaluated and maintained

Action #	3.2.4
Mitigation Action	Conduct emergency preparedness exercises periodically throughout the year.
Priority	High
Lead Department or Agency	Southern Boone Principals/Staff
Partners, if any	Boone County Sheriff's Department
Plan for Implementation and Administration	Southern Boone School District will conduct emergency preparedness drills periodically per state mandates and recommendation.
Benefits (Losses Avoided)	IC,EM
Projected Cost	0
Potential Funding Sources	N/A
Projected Completion Date	Ongoing
Criterion for Completion	Emergency Preparedness drills are conducted
Action #	3.2.5
Mitigation Action	Build tornado safe room(s) or harden part(s) of existing structure(s) to FEMA 361 standards.
Priority	Medium
Lead Department or Agency	Southern Boone Administration
Partners, if any	
Plan for Implementation and Administration	Build tornado safe rooms as funding becomes available.
Benefits (Losses Avoided)	IC,EM
Projected Cost	High
Potential Funding Sources	FEMA Mitigation Grants/Local Matching Funds
Projected Completion Date	2018
Criterion for Completion	Tornado safe rooms are built.
Action #	3.2.9
Mitigation Action	Continue to increase capacity to prevent and respond to unwanted intruder/active shooter events.
Priority	High
Lead Department or Agency	Southern Boone Administration
Partners, if any	
Plan for Implementation and Administration	Install key card system campus wide.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	\$200,000
Potential Funding Sources	Local
Projected Completion Date	2018
Criterion for Completion	System in place

Integration into Other Planning Mechanisms

The Superintendent has been working closely with the members of the board and has conducted walk through tours of each of the facilities. A needs assessment has been conducted and projects have been prioritized. A facilities plan will be in place by January 2016 to address the identified needs.

STURGEON R-V SCHOOL DISTRICT

Action #	1.1.10
Mitigation Action	Develop a Continuity of Operations Plan (COOP).
Priority	High
Lead Department or Agency	Superintendent's office
Partners, if any	other admin. and ancillary staff
Plan for Implementation and Administration	Begin the process of involving stakeholders in the process of accomplishing the steps necessary for a comprehensive COOP.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Unknown at this time - probably low/moderate
Potential Funding Sources	Local funds
Projected Completion Date	Ongoing
Criterion for Completion	Completed COOP document
Action #	3.2.2
Mitigation Action	Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.
Priority	High
Lead Department or Agency	Sturgeon R-V School Administration
Partners, if any	
Plan for Implementation and Administration	Continue to instruct and train students and staff on earthquake emergency preparedness including sending out information concerning earthquake procedures.
Benefits (Losses Avoided)	IC,EM
Projected Cost	0
Potential Funding Sources	N/A
Projected Completion Date	Ongoing
Criterion for Completion	Actions outlined in Revised Statutes are carried out.
Action #	3.2.3
Mitigation Action	Evaluate and maintain emergency preparedness plans.
Priority	High
Lead Department or Agency	Crisis Committee Chairperson
Partners, if any	Administration
Plan for Implementation and Administration	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.
Benefits (Losses Avoided)	IC,EM
Projected Cost	0
Potential Funding Sources	N/A
Projected Completion Date	Ongoing
Criterion for Completion	Emergency preparedness plans are evaluated and maintained.

Action #	3.2.4
Mitigation Action	Conduct emergency preparedness exercises periodically throughout the year.
Priority	High
Lead Department or Agency	Sturgeon R-V School Principals/Staff
Partners, if any	
Plan for Implementation and Administration	Sturgeon R-V School District will conduct emergency preparedness drills periodically per state mandates and recommendation.
Benefits (Losses Avoided)	IC,EM
Projected Cost	0
Potential Funding Sources	N/A
Projected Completion Date	Ongoing
Criterion for Completion	Emergency preparedness plans are conducted.
Action #	3.2.9
Mitigation Action	Continue to increase capacity to prevent and respond to unwanted intruder/active shooter events.
Priority	High
Lead Department or Agency	Superintendent's office
Partners, if any	BoCoMo Sheriff's Dept, Sturgeon Local police
Plan for Implementation and Administration	The district will continue and expand efforts to ensure the constant safety of our students, staff, and visitors.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	\$ 3,000 annually
Potential Funding Sources	Rural Education Achievement Program (REAP) funding
Projected Completion Date	Ongoing
Criterion for Completion	Constant safe climate in both of our district's buildings

Integration into Other Planning Mechanisms

The district will train staff to carry out plan objectives. 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.

STEPHENS COLLEGE

Action #	3.2.2
Mitigation Action	Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.
Priority	High
Lead Department or Agency	Campus Security and the Emergency Management Team
Partners, if any	
Plan for Implementation and Administration	Stephens College will instruct and train staff and faculty on earthquake emergency preparedness. In addition, information will be posted concerning campus earthquake procedures.
Benefits (Losses Avoided)	IC,EM
Projected Cost	0
Potential Funding Sources	NA
Projected Completion Date	Ongoing
Criterion for Completion	Actions outlined in Revised Statutes are carried out.
Action #	3.2.3
Mitigation Action	Evaluate and maintain emergency preparedness plans.
Priority	High
Lead Department or Agency	Stephens College Emergency Management Team, College President
Partners, if any	
Plan for Implementation and Administration	Stephens College will continue to conduct regular meetings of the Emergency Management Team to evaluate our Emergency Operations Plan.
Benefits (Losses Avoided)	IC,EM
Projected Cost	0
Potential Funding Sources	NA
Projected Completion Date	Ongoing
Criterion for Completion	Emergency preparedness plans are evaluated and maintained.
Action #	3.2.4
Mitigation Action	Conduct emergency preparedness exercises periodically throughout the year.
Priority	High
Lead Department or Agency	Stephens College Emergency Management Team
Partners, if any	
Plan for Implementation and Administration	Stephens College will continue to conduct emergency preparedness drills and exercises per state and federal mandates and recommendations.
Benefits (Losses Avoided)	IC,EM
Projected Cost	0
Potential Funding Sources	NA
Projected Completion Date	Ongoing
Criterion for Completion	Emergency preparedness exercises are conducted.

Action #	3.2.9
Mitigation Action	Continue to increase capacity to prevent and respond to unwanted intruder/active shooter events.
Priority	High
Lead Department or Agency	Stephens College Emergency Management Team
Partners, if any	Local emergency responders
Plan for Implementation and Administration	Stephens College conducts training campuswide for response to active armed intruder situations
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	0
Potential Funding Sources	NA
Projected Completion Date	Ongoing
Criterion for Completion	Training and preparedness ongoing

Integration into Other Planning Mechanisms

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 College maintains a working relationship with the City and County with regards to emergency planning and exercises.

UNIVERSITY OF MISSOURI

Action #	3.1.4
Mitigation Action	Move the salt dome at the University of Missouri to protect Hinkson Creek in case of damage from high winds or tornadoes.
Priority	High
Lead Department or Agency	Campus Facilities
Partners, if any	MU Division of Design & Construction, City of Columbia
Plan for Implementation and Administration	The MU Division of Design & Construction will research a new location for the salt dome, taking into account such things as ingress/egress, laws and regulations, and safety of new location. Engineering plans will be developed for new facility.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	\$ 0.5 Million (estimate)
Potential Funding Sources	Insurance funds (University is self-insured)
Projected Completion Date	2020
Criterion for Completion	Salt dome is moved to safer location.
Action #	3.2.2
Mitigation Action	Continue to meet Revised Statutes of Missouri concerning earthquake emergency system and earthquake safety in schools.
Priority	High
Lead Department or Agency	Vice Chancellor for Operations
Partners, if any	
Plan for Implementation and Administration	Earthquake emergency preparedness is part of the MU Emergency Operations Plan.
Benefits (Losses Avoided)	IC,EM
Projected Cost	Minimum
Potential Funding Sources	General operating funds
Projected Completion Date	Ongoing - emergency plans are reviewed periodically.
Criterion for Completion	Earthquakes are addressed in both the MU Emergency Operations Plan and in building specific emergency plans that have been prepared for each campus building.
Action #	3.2.3
Mitigation Action	Evaluate and maintain emergency preparedness plans.
Priority	High
Lead Department or Agency	MU Emergency Management
Partners, if any	MU Police, MU Campus Facilities, MU Environmental Health & Safety
Plan for Implementation and Administration	Emergency Operations Plan has been prepared and is a format very similar to the City/County Emergency Plan.
Benefits (Losses Avoided)	IC,EM
Projected Cost	Moderate
Potential Funding Sources	General operating funds
Projected Completion Date	Ongoing
Criterion for Completion	Emergency preparedness plans are evaluated and maintained.

Action #	3.2.4
Mitigation Action	Conduct emergency preparedness exercises periodically throughout the year.
Priority	High
Lead Department or Agency	Drills are usually developed and controlled by the local MU department.
Partners, if any	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.
Plan for Implementation and Administration	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.
Benefits (Losses Avoided)	IC,EM
Projected Cost	Moderate
Potential Funding Sources	Departmental budgets
Projected Completion Date	Ongoing
Criterion for Completion	Emergency exercises are conducted.
Action #	3.2.5
Mitigation Action	Build tornado safe room(s) or harden part(s) of existing structure(s) to FEMA 361 standards.
Priority	High
Lead Department or Agency	MU Emergency Management
Partners, if any	MU Division of Finance
Plan for Implementation and Administration	Research and apply for grants for hardening select parts of existing buildings or constructing new buildings to FEMA 361 standards.
Benefits (Losses Avoided)	IC,EM
Projected Cost	High
Potential Funding Sources	Grants; operating budget for local match
Projected Completion Date	Ongoing
Criterion for Completion	Existing buildings have areas hardened to FEMA 361 standards or new buildings with safe rooms are constructed.

Action #	3.2.9
Mitigation Action	Continue to increase capacity to prevent and respond to unwanted intruder/active shooter events.
Priority	High
Lead Department or Agency	MU Police Dept.
Partners, if any	Boone Co. OEM, City of Columbia Police Dept., other institutions of higher learning
Plan for Implementation and Administration	Prevention and response to unwanted intruders/active shooters is part of the MU Emergency Management overall plan, part of the alert warning capability and is written into all building plans. Continue with regularly scheduled trainings for faculty, staff, and students.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	Moderate
Potential Funding Sources	Operating budget
Projected Completion Date	Ongoing
Criterion for Completion	Prevention of and response to unwanted intruders/active shooters is a continued focus for the University of MO.
Action #	3.2.12
Mitigation Action	Enhance alert and warning capabilities.
Priority	High
Lead Department or Agency	MU Emergency Management
Partners, if any	MU Division of Information Technology
Plan for Implementation and Administration	Improve the software and hardware associated with the current system. Continue to expand the system across campus to buildings currently not served.
Benefits (Losses Avoided)	IC,PD,LF,EM
Projected Cost	High
Potential Funding Sources	Grants; operating budget
Projected Completion Date	2020
Criterion for Completion	System is fully functional.

Section 5: PLAN MAINTENANCE PROCESS

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Section 5: Plan Maintenance Process

This chapter provides an overview of the overall strategy for plan maintenance and outlines the method and schedule for monitoring, updating and evaluating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

Monitoring, Evaluating, and Updating the Plan

44 CFR Requirement 201.6(c)(4): 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.

The MPC has served as an advisory committee for the duration of the update and is not a standing committee. Oversight responsibility could fall to such entities as the Boone County emergency management agency, The Regional Planning Commission, or local jurisdiction representatives. Responsibility for maintenance falls to the local emergency management officials.

Maintenance should involve agreement of the participating jurisdictions, including school and special districts, to:

- Meet annually, and after a disaster event, to monitor and evaluate the implementation of the plan;
- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high priority, low- or no-cost recommended actions;
- Maintain vigilant monitoring of multi-objective, cost-share, and other funding opportunities to help the community implement the plan's recommended actions for which no current funding exists;
- Monitor and assist in implementation and update of this plan;
- Keep the concept of mitigation in the forefront of community decision making by identifying plan recommendations when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters;
- Report on plan progress and recommended changes to the County Board of Supervisors and governing bodies of participating jurisdictions; and
- Inform and solicit input from the public.

The (MPC or other designated responsible entity) is an advisory body and can only make recommendations to county, city, town, or district elected officials. Its primary duty is to see the plan successfully carried out and to report to the community governing boards and the public on the status of plan implementation and mitigation opportunities^{10(a)}. Other duties include reviewing and promoting mitigation proposals, hearing stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information in areas accessible to the public.

Plan Maintenance Schedule

The MPC agrees to meet annually or after a state or federally declared hazard event as appropriate to monitor progress and update the mitigation strategy. The Boone County Emergency Management Director will be responsible for initiating the plan reviews and will invite members of the MPC to the meeting.

In coordination with all participating jurisdictions, the Emergency Management Director will be responsible for initiating a five-year written update of the plan to be submitted to the Missouri State Emergency Management Agency (SEMA) and FEMA Region VII per Requirement §201.6(c)(4)(i) of the Disaster Mitigation Act of 2000, unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule.

Plan Maintenance Process

Progress on the proposed actions can be monitored by evaluating changes in vulnerabilities identified in the plan. The MPC during the annual meeting should review changes in vulnerability identified as follows:

- Decreased vulnerability as a result of implementing recommended actions,
- Increased vulnerability as a result of failed or ineffective mitigation actions,
- Increased vulnerability due to hazard events, and/or
- Increased vulnerability as a result of new development (and/or annexation).

Future 5-year updates to this plan will include the following activities:

- Consideration of changes in vulnerability due to action implementation,
- Documentation of success stories where mitigation efforts have proven effective,
- Documentation of unsuccessful mitigation actions and why the actions were not effective,
- Documentation of previously overlooked hazard events that may have occurred since the previous plan approval,
- Incorporation of new data or studies with information on hazard risks,
- Incorporation of new capabilities or changes in capabilities,
- Incorporation of growth data and changes to inventories, and
- Incorporation of ideas for new actions and changes in action prioritization.

In order to best evaluate any changes in vulnerability as a result of plan implementation, the participating jurisdictions will adopt the following process:

- Each proposed action in the plan identified an individual, office, or agency responsible for action implementation. This entity will track and report on an annual basis to the jurisdictional MPC member on action status. The entity will provide input on whether the action as implemented meets the defined objectives and is likely to be successful in reducing risk.

- If the action does not meet identified objectives, the jurisdictional MPC member will determine necessary remedial action, making any required modifications to the plan.

Changes will be made to the plan to remedy actions that have failed or are not considered feasible. Feasibility will be determined after a review of action consistency with established criteria, time frame, community priorities, and/or funding resources. Actions that were not ranked high but were identified as potential mitigation activities will be reviewed as well during the monitoring of this plan. Updating of the plan will be accomplished by written changes and submissions, as the MPC deems appropriate and necessary. Changes will be approved by the Boone County Commission and the governing boards of the other participating jurisdictions.

Incorporation into Existing Planning Mechanisms

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

Where possible, plan participants, including school and special districts, will use existing plans and/or programs to implement hazard mitigation actions. Those existing plans and programs were described in Section 2 of this plan. Based on the capability assessments of the participating jurisdictions, communities in Boone County will continue to plan and implement programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through the following plans:

- General or master plans of participating jurisdictions;
- Ordinances of participating jurisdictions;
- County Emergency Operations Plan;
- Capital improvement plans and budgets;
- Other community plans within the County, such as water conservation plans, storm water management plans, and parks and recreation plans;
- School and Special District Plans and budgets; and
- Other plans and policies outlined in the capability assessment sections for each jurisdiction in Chapter 2 of this plan.

The MPC members involved in updating these existing planning mechanisms will be responsible for integrating the findings and actions of the mitigation plan, as appropriate. The MPC is also responsible for monitoring this integration and incorporation of the appropriate information into the five-year update of the multi-jurisdictional hazard mitigation plan.

Additionally, after the annual review of the Hazard Mitigation Plan, the Boone County Emergency Management Director will provide the updated Mitigation Strategy with current status of each mitigation action to the County Commission as well as all Mayors, City Clerks, and School District Superintendents. The Emergency Manager Director will request that the mitigation strategy be incorporated, where appropriate, in other planning mechanisms.

Table 5.1 below lists the planning mechanisms by jurisdiction into which the Hazard Mitigation Plan will be integrated.

Jurisdiction	Planning Mechanisms	Integration Process for Previous Plan	Integration Process for Current Plan
Unincorporated Boone	Annual Budget Process	Annual Budget Process	Annual Budget Process
Ashland	Annual Budget Process	Annual Budget Process	Annual Budget Process
Centralia	Annual Budget Process	Annual Budget Process	Annual Budget Process
Columbia	Annual Budget Process	Annual Budget Process	Annual Budget Process
Hallsville	Annual Budget Process	Annual Budget Process	Annual Budget Process
Harrisburg	Annual Budget Process	Annual Budget Process	Annual Budget Process
Hartsburg	Annual Budget Process	Annual Budget Process	Annual Budget Process
Huntsdale	Annual Budget Process	Annual Budget Process	Annual Budget Process
Rocheport	Annual Budget Process	Annual Budget Process	Annual Budget Process
Sturgeon	Annual Budget Process	Annual Budget Process	Annual Budget Process
Centralia R-IV	Centralia R-IV District Planning Committee & Board of Education	Centralia R-IV District Planning Committee & Board of Education	Centralia R-IV District Planning Committee & Board of Education
Columbia Public Schools	Columbia Public Schools District Planning Committee & Board of Education	Columbia Public Schools District Planning Committee & Board of Education	Columbia Public Schools District Planning Committee & Board of Education
Hallsville R-IV	Hallsville R-IV Planning Committee & Board of Education	Hallsville R-IV Planning Committee & Board of Education	Hallsville R-IV Planning Committee & Board of Education
Southern Boone School District	Southern Boone School Planning Committee & Board of Education	Southern Boone School Planning Committee & Board of Education	Southern Boone School Planning Committee & Board of Education
Sturgeon R-V	Sturgeon R-V Planning Committee	Sturgeon R-V Planning Committee	Sturgeon R-V Planning Committee

	& Board of Education	& Board of Education	& Board of Education
Stephens College	Stephens College Planning Committee & Board of Education	Stephens College Planning Committee & Board of Education	Stephens College Planning Committee & Board of Education
University of Missouri	MU Planning Committee & Board of Education	MU Planning Committee & Board of Education	MU Planning Committee & Board of Education

Continued Public Involvement

44 CFR 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 hazard mitigation plan update process provides an opportunity to publicize success stories resulting from the plan’s implementation and seek additional public comment. Information about the annual reviews will be posted on the Boone county website following each annual review of the mitigation plan and will solicit comments from the public based on the annual review. When the MPC reconvenes for the five-year update, it will coordinate with all stakeholders participating in the planning process. Included in this group will be those who joined the MPC after the initial effort, to update and revise the plan. Public notice will be posted and public participation will be actively solicited, at a minimum, through available website postings and press releases to local media outlets, primarily newspapers.