

PUTNAM COUNTY

MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

DAILY NEWS
**NATURAL
DISASTER!**



1 INTRODUCTION AND PLANNING PROCESS

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1.1 PURPOSE

Hazard mitigation is defined as “any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards”. While natural hazards will continue to occur and at their worst will result in death and destruction of both property and infrastructure, this plan was undertaken to minimize the impact that these hazards will have on the people and property of Putnam County. Putnam County and the participating jurisdictions and school districts developed this multi-jurisdictional local hazard mitigation plan update to reduce future losses from inevitable hazardous events.

The jurisdictions participating in this plan are the unincorporated areas of Putnam County, the City of Bethany, the City of Blythedale, the City of Cainsville, the City of Eagleville, the City of Gilman City, the City of Ridgeway, North Putnam R-III School District, Ridgeway R-V School District, and South Putnam R-II School District.

The following legislation gives FEMA authority to require these plans: Robert T Stafford Disaster and Emergency Act (Public Law 93-288) as amended by the Disaster Mitigation Act of 2000 (Public Law 106-390), The implementing regulations set forth by the Interim Final Rule published in the *Federal Register* on February 26, 2002, (44 CFR §201.6) and finalized on October 31, 2007. All entities participating in the development of the update to the Putnam County Hazard Mitigation Plan have been made aware that in order to be eligible for grants for hazard mitigation they must adopt the plan prior to its submission to SEMA and FEMA.

The following publications from FEMA were used as guidance in the development of this hazard mitigation plan for Putnam County. FEMA’s Local Mitigation Planning Handbook, 2025, FEMA’s Local Mitigation Plan Review Guide, October 1, 2011, and the Local Mitigation Planning Policy Guide 2025. The previous Putnam County Hazard Mitigation Plan, which was approved on May 3, 2021, was also used in the development of this update.

1.2 BACKGROUND AND SCOPE

The Putnam County Hazard Mitigation Plan is the update of a plan that was approved on May 3, 2021. Hazard Mitigation Plans must be renewed every five years and then must be adopted by the participating jurisdictions within the plan. Both the plan and the update were prepared pursuant to the requirements of the Disaster Mitigation Act of 2000. This plan once completed

and adopted will result in eligibility for the Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance Grant Programs.

The following local governments and school districts participated in both the original plan as well as the plan updates. This will allow them to adopt the plan and secure eligibility for Hazard Mitigation Grant Funding.

- Putnam County
- Livonia
- Lucerne
- Unionville
- Putnam County R-I

Putnam County and the participating entities listed above developed a Multi-Jurisdictional Hazard Mitigation Plan that was approved by FEMA in May of 2021 (hereafter referred to as the 2021 Hazard Mitigation Plan). This current planning effort serves to update that previously approved plan.

The information that is contained in the Putnam County Hazard Mitigation Plan will be used to help guide and coordinate mitigation activities for local land use policy and decisions in the future.

1.3 PLAN ORGANIZATION

This latest (2026) updated version of the Putnam County Hazard Mitigation Plan involved review, evaluation, and amendment of the existing plan. It addresses the same natural hazards that were addressed in the original plan, with changes outlined in the table below (See Table 1.1). Following is a breakdown of the organization of the 2026 Putnam County Hazard Mitigation Plan Update.

- **Chapter 1: Introduction and Planning Process**
This section of the plan provides an introduction to the multi-jurisdictional planning process and a detailed look at the participation of the local jurisdictions and school districts. It also detailed the purpose of local hazard mitigation planning and outlined the requirements enacted by the Federal Emergency Management Agency.
- **Chapter 2: Planning Area Profile and Capabilities**
This section of the plan provides general background information and demographic statistics for Putnam County and its various jurisdictions as well as the disaster response and recovery capabilities found in the county. This section identifies key personnel, organizational leaders, and outlines existing emergency plans. Additionally, it provides a brief assessment of each municipality's readiness regarding hazard mitigation.
- **Chapter 3: Risk Assessment**
This section of the plan, the risk assessment, identifies and explores the types of natural hazards that pose a risk to the county, and the likelihood that each hazard will occur. It provides a profile of identified hazards and explains the impact to the County and the various jurisdictions should such hazards occur.
- **Chapter 4: Mitigation Strategy**
This section of the plan presents the multi-jurisdiction mitigation strategies in response to the risk assessment. This chapter outlines the overall goals to reduce a disaster's impact, specific objectives toward achieving those goals, and implementation plans for

the county to complete.

- Chapter 5: Plan Implementation and Maintenance
The final chapter outlines the Hazard Mitigation Plan maintenance procedures.
- Appendix A: Sources
- Appendix B: Planning Documentation & Invitations
- Appendix C: Questionnaires, Surveys, Public Comment, and STAPLEE Worksheets
- Appendix D: List of Critical Facilities (Redacted from Public View)
- Appendix E: Resolutions of Adoptions, Floodplain Ordinances, Dam Inspection Report

The following table (Table 1.1) below identifies significant changes in the 2026 update of the Hazard Mitigation Plan for Putnam County.

Table 1.1. Changes Made in Plan Update

Plan Section	Summary of Updates
Chapter 1 - Introduction and Planning Process	• Updated members of the Mitigation Planning Committee (MPC) and participating jurisdictions formally adopted the MPC.
Chapter 2 - Planning Area Profile and Capabilities	• Changes include updating maps, identifying most current state plan, and updating demographic data using 2020 Census and American Community Survey Information. • Inviting neighboring jurisdictions to participate. • Updated charts, graphs, tables, maps, and other information where necessary.
Chapter 3 - Risk Assessment	• Combined extreme heat and extreme cold into one hazard: extreme temperatures. • Updated section with current Census information, agriculture summary, and confirming that current data is correct. • Incorporated information from the current 2023 Missouri State Hazard Mitigation Plan. • Previous events updated for each hazard. • Discussion of each hazard's impact updated to include Changing Future Conditions.
Chapter 4 - Mitigation Strategy	• 2021 mitigation goals and strategies reviewed by planning committee and updated. • The mitigation category of each action was added to the action worksheets.
Chapter 5 - Plan Implementation and Maintenance	• Updated MPC meetings for evaluating and updating the plan to annually.

1.4 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.

Putnam County, Missouri contracted with the Green Hills Regional Planning Commission (GHRPC) to facilitate and coordinate the update of the multi-jurisdictional, local hazard mitigation plan. In fulfillment of the role, GHRPC:

- Assisted in establishing a Mitigation Planning Committee (MPC) as defined by the Disaster Mitigation Act (DMA),
- Assessed whether there was adherence to the process set forth in the previously approved plan for maintenance (example, did the MPC meet regularly as specified in the previously approved plan), and explain how adherence occurred, and/or why it did not occur,
- Ensured 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),
- Facilitated the entire plan development process,
- Identified the data that MPC participants could provide and conduct the research and documentation necessary to augment that data,
- Assisted in soliciting public input,
- Produced the draft and final plan update in a FEMA-approvable document and coordinate the Missouri State Emergency Management Agency (SEMA) and (FEMA) plan reviews.

This plan was developed after the release of *FEMA's Local Mitigation Planning Policy Guide, Effective 2025*.

The following table (**Table 1.2**) shows the MPC members and the entities they represent, along with their titles. Each of the following representatives participated directly with the development of the plan. They attended the meetings and actively participated in the development of the plan. The MPC was comprised of representatives from each jurisdiction on a voluntary basis rather than as an official act by any of the jurisdictions. Each member of the MPC was actively involved in the meetings and the decisions for the Hazard Mitigation Plan. These members were either present at the public meetings or met individually with the GHRPC staff member in charge of developing the plan. All jurisdictions met their responsibilities for the planning process by:

- Attending at least one meeting
- Completing the Data Questionnaire to the best of their ability
- Reviewing the Action Worksheets and participating in discussion about whether to retain, modify, or remove existing actions, and participating in development of any new actions recommended by their jurisdiction
- Returning the Adoption Resolution (Found in Appendix E)

Table 1.2. Jurisdictional Representatives of Putnam County Mitigation Planning Committee

Name	Title	Department	Jurisdiction
Christy Brooks	County Clerk	County Government	Putnam County
Jonnie Beavers	Superintendent	School District	Putnam County R-I

Paul Andrew	Putnam County – EMD	Emergency Management	Putnam County
Charley Bill Pittman	Mayor	City Government	City of Unionville
Jim Blanchard	Trustee	City Government	Village of Lucerne
David Jonaitis	Chairman	City Government	Village of Livonia

Table 1.3. MPC Capability with Six Mitigation Categories

Community Department/Office	Preventive Measures	Structure and Infrastructure Projects		Natural Resource Protection	Public Information	Emergency Services
		Property Protection	Structural Flood Control Projects			
County Zoning Administrator	✓	✓		✓	✓	
County Floodplain Manager						
County Public Works						
Building Permits						

Table 1.4. Participants of the Putnam County Hazard Mitigation Plan

Name	Title	Jurisdiction/Agency/Organization
Christy Brooks	County Clerk	Putnam County
Denese Bankus	Employee	Putnam County Water Dept
Donald Hamilton	Employee	Putnam County Water Dept
Michael Gillum	Employee	Putnam County Water Dept
Paul Andrew	Employee/Volunteer	Putnam Emergency Manager/Elm Fire Protection District
Brad Daniels	Employee	North Central Mo Electric Coop
Jonnie Beavers	Superintendent	Putnam County R-I School District
Charley Bill Pittman	Mayor	City of Unionville
Jim Blanchard	Trustee	Village of Lucerne
Jill Blanchard	Treasurer	Village of Lucerne
David Jonaitis	Chairman	Village of Livonia

1.4.1 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.

The Disaster Mitigation Act requires that each jurisdiction participate in the planning process and officially adopt the plan. Minimum criteria for participation were determined at the planning meeting that each jurisdiction must attend one meeting to be considered a “participant.” These plan participation requirements include:

- Designation of a representative to serve on the MPC;
- Participation in at least one meeting, including planning, MPC meetings, by either direct participation or authorized representation, or one-on-one with planning staff;

- Provision of sufficient information to support plan development by completion and return of Data Collection Questionnaires and validating/correcting critical facility inventories;
- Provision of progress reports on mitigation actions from the previously approved plan and identified additional mitigation actions for the plan;
- 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;
- Actively solicit input from the public, local officials, and other interested parties about the planning process and provide an opportunity for them to comment on the plan;
- Provide documentation to show time donated to the planning effort; and
- Formally adopt the mitigation plan.

Data for this plan was gathered in part through a series of meetings held within Putnam County and virtual meetings. The planning process for the Putnam County Hazard Mitigation Plan began during the summer of 2025, with discussions involving elected officials, school district officials, emergency and health service providers, community members, and other interested parties, and the planning committee was formed. (See Table 1.2 and Table 1.3)

Participants that were involved were asked to identify critical infrastructure, rank the likelihood of disaster occurrence, perform a susceptibility analysis based on these factors, and determine appropriate mitigation strategies for each individual disaster. This data was recorded and assimilated into this plan by GHRPC staff. The MPC membership showed a range of knowledge and abilities to address the mitigation categories shown in Table 1.4.

In accordance with Missouri’s “sunshine law” (RSMo 610.010, 610.020, 610.023, and 610.024), the public was notified each time the plan was presented for review. Input from each public official (city and county) was solicited by email or mailing an explanatory letter with notice of the posted draft on the Green Hills Planning Commission’s website. These were disbursed on a schedule that allowed officials sufficient time to review the draft prior to the next public County Commission or City Council meeting. Participation was solicited by letter or email from each of the following jurisdictions:

- Putnam County
- Livonia
- Lucerne
- Powersville
- Unionville
- Worthington
- Putnam County R-I

Finally, city and county officials were encouraged to invite others from any county, state, or federal agency as well as local businesses that had interest in contributing to the planning process. Input from the public was solicited through reminders at public gatherings, press releases, letters to various businesses and community organizations, and a Public Survey. Surrounding and participating jurisdictions were invited to review the county’s plan draft via the GHRPC website. The plan draft was available for review for 30 days. The plan was posted to the GHRPC website on November 20, 2025. Area news outlets were sent a press release regarding the plan’s availability for review and/or comment.

Table 1.5 below shows the representation of each participating jurisdiction at the planning meetings, the provision of responses to the Data Collection Questionnaire, and update or

development of mitigation actions. Sign-in sheets and other documentation for participation are in Appendix B.

Table 1.5. Jurisdictional Participation in Planning Process

Jurisdiction	Kick-off Meeting	Meeting #2	Meeting #3	Data Collection Questionnaire Response	Update/Develop Mitigation Actions
Putnam County	X	X			X
Village of Livonia	Special Phone Call				X
Village of Lucerne			X		X
City of Unionville			X		X
Putnam County R-I	X				X

1.4.2 The Planning Steps

The sources utilized for the plan and development process used the following: FEMA's Local Mitigation Planning Handbook (2025), Local Mitigation Plan Review Guide (October 1, 2011), Local Mitigation Planning Policy Guide (2025), and Integrating Hazard Mitigation Into Local Planning: Case Studies and Tools for Community Officials (March 1, 2013). The United States Census Bureau, the United States Geological Society, the United States Army Corps of Engineers, the Missouri Department of Natural Resources, the Missouri Department of Conservation, the Center for Agriculture, Resources and Environmental Systems at the University of Missouri-Columbia, Putnam County HAZUS data, the National Climatic Data Center, and the Missouri State Hazard Mitigation Plan provided additional information regarding severe thunderstorm and winter weather, wildfire, tornado, earthquake, and flood hazards effecting Putnam County. Other sources utilized for this plan are included in Section 3.

The development of this plan update followed the 10-step planning process adapted from FEMA's Community Rating System (CRS) and Flood Mitigation Assistance programs, so to ensure funding eligibility requirements for the Hazard Mitigation Grant Program, Building Resilient Infrastructure and Communities, Community Rating System, and Flood Mitigation Assistance Program.

Table 1.6. County Mitigation Plan Update Process

Community Rating System (CRS) Planning Steps (Activity 510)	Local Mitigation Planning Handbook (2023) 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 5: Review Community Capabilities 44 CFR 201.6(b)(2) & (3)
Step 4. Assess the hazard	Task 4: 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)

Plans must include narrative in the plan similar to that outlined below. It should include information about what happened at the MPC level during the ten steps and the nine tasks outlined above.

Step 1: Organize the Planning Team ***(Handbook Tasks 1, 2, and 5)***

- The initial “Meeting #1” in Putnam County occurred as follows:
 - 1601 Main Street Unionville Old Soldiers Room: August 18th, 2025, from 3pm-4pm
 - Virtual meeting: August 19th, 2025, from 10am-10:30am.
- The meeting #1 (both in-person and virtual) covered hazard mitigation planning, including introductions, an overview of the planning process, and the requirements for jurisdictions to participate. Attendees were asked to complete and share a public survey, and hazards were identified using a detailed worksheet.
- The agenda included introductions, an explanation of hazard mitigation planning (existing plan, updates every 5 years, and requirements for HMGP Grants), and an outline of the planning process which consists of 3 in-person meetings and/or 3 virtual meetings. To participate, jurisdictions must complete a questionnaire, attend at least one meeting, and provide suggestions for the plan.
- The Data Collection Questionnaire was distributed to each of the attendees at the meeting #1.
- Meeting attendees were encouraged to post flyers about upcoming meetings and the public opinion survey.
- Planning Meeting #2:
 - August 28, 2025, at 1601 Main St. Unionville, MO in the Putnam County Courthouse. 3-4:30pm.
 - August 29, 2025, virtual meeting at 10am-10:30am.
- Both meetings discussed the Putnam County Hazard Mitigation Plan Update, provided a brief overview of what had been discussed at Meeting #1, specifically the purpose of the hazard mitigation plan, requirements for eligibility, and hazards identified in Putnam County.
- Attendees discussed and ranked regional hazards, identified vulnerable assets using a worksheet, and reviewed mitigation strategies including prevention, protection, mitigation, response, and recovery. The meeting included introductions, explanations of asset categories, and concluded with a Q&A before adjourning. Participants were encouraged to comment on the previous meetings and provide additional information if

available.

- Planning Meeting #3
 - September 29, 2025, at 1601 Main St. Unionville, Mo in the Putnam County Courthouse. 3-4:30pm.
 - September 30, 2025, a virtual meeting was held from 10 – 10:30am
- The focus of Meeting #3, both in-person and virtual, was action prioritization and plan maintenance.
- Attendees were given STAPLEE worksheets for each action in their jurisdiction. Once attendees completed STAPLEE worksheets for the actions, they were encouraged to discuss hazards that had not been mitigated and new actions were discussed if desired.
- The following information about the public meetings and the location in the appendix of this plan can be found as follows:
 - The outreach efforts, including envelope scans and address labels; Facebook posts, meeting flyers, survey monkey QR code can be found in Appendix B.
 - Meeting information such as agendas, meeting minutes, and sign-in sheets, and other documentation relating to the planning process can be found in Appendix B.
 - Other products of the public meetings such as hazard identification, risk assessment products, and vulnerable asset identification worksheets can be found in Appendix B.
- The Data Collection Questionnaires, STAPLEE worksheets, Survey, and Survey Results can be found in Appendix C.
- Any public comments made during this period of planning or after plan was published on GHRPC's website on November 20, 2025, and until submission to SEMA on December 20, 2025, can be found in Appendix C.
- During the planning process, in addition to the public meetings, there were also numerous phone calls, emails, and in person conversations with jurisdictions to help with plan requirements, to answer questions, to encourage participation, and to confirm meeting times.
-

Table 1.7. Schedule of MPC Meetings

Meeting	Topic	Date
Kick-off Meeting/ Planning Meeting #1	Outreach and Hazard Identification	August 18, 2025 & August 19, 2025
Planning Meeting #2	Risk Assessment and Mitigation Strategies	August 28, 2025 & August 29, 2025
Planning Meeting #3	Action Prioritization, Adopting the Plan, & Plan Maintenance	September 29, 2025 & September 30, 2025

Step 2: Plan for Public Involvement (Handbook Task 3)

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.

How to involve the public was discussed at each Meeting #1

- Prior to the kick-off meetings scheduled in Putnam County, the GHRPC staff produced social media posts with meeting times and locations, flyers for distribution throughout the county, and this information was sent to all jurisdictions which were encouraged to publish and display the information about the hazard mitigation plan and the meeting times. The meetings were also advertised on the GHRPC website and Facebook pages, and the Facebook post was also forwarded to all jurisdictions within Putnam County. (Copies of the Facebook post, flyer, and QR code for the public opinion survey can be found in Appendix B).
- Prior to the kick-off meeting scheduled in Putnam County invitation letters were sent out to all jurisdictions in the planning area, civic organizations, food pantries, churches, emergency services, and special districts. (Please see Appendix B for a complete list).
- Additionally, the neighboring communities, located outside of the county, but with populations and structures located within Putnam County were also invited to attend. (Please see Appendix B for a complete list of people and organizations invited to attend).
- All meetings, both in person and virtual, were public meetings and information about the meetings was distributed throughout the county. During the planning process, prior to the publication of the plan draft, there was opportunity for any citizen of Putnam County to attend the meetings and/or make comment.
- The initial meetings for the Hazard Mitigation Plan for Putnam County were conducted in person with representatives from the County. At the Kick-off meeting in Gallatin, the FEMA requirements for public participation were mentioned. All people attending were asked to complete the survey and share with others located in the county. Printed flyers were distributed with information about upcoming meetings and a link to the public opinion survey.
- The Hazard Mitigation Committee also agreed to mention the upcoming meetings at their respective churches, civic organizations, meetings, and in passing when speaking with people from the community.
- The draft of the plan was made available to the public and members of the planning committee; there was a draft of the plan on the GHRPC website. The plan was made available for review from August 29, 2025, to September 30, 2025. The availability of this plan for public review was advertised on local social media pages and press releases were sent to news outlets in Putnam County.
- All available information about the public meetings, attendance, press releases, paperwork completed at meetings, public surveys, questionnaires, agendas, power point presentation, and all other available documentation can be found in the Appendices as follows:
 - Planning Documentation & Invitations: Appendix B
 - Press Release regarding public comment on the plan draft: Appendix B
 - Questionnaires & Completed Surveys: Appendix C
 - Action Plans/STAPLEE Worksheets: Appendix C
- Both at the public meetings, virtual and in-person, no public comment was made regarding the plan.
- In the public opinion survey, there was a comment about affordability and availability of emergency services in the planning area.

- During the publication of the plan draft there were no comments made prior to the submission of the plan to SEMA.
- There were 16 responses to the public opinion survey. The data collected is listed below and the full survey results can be found in Appendix C.

Step 3: Coordinate with Other Departments and Agencies and Incorporate Existing Information
(Handbook Task 2)

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.

There are few organizations that are multijurisdictional in nature whose interests' interface with hazard mitigation planning in Putnam County. These groups were included in the emailed invitation to the Meeting #1 in Unionville, Missouri at the Putnam County Courthouse. In small communities, local officials wear multiple hats out of necessity. The agencies and interest groups who were invited to take part in the hazard mitigation plan update are listed below.

- Neighboring Communities:
 - City of Newtown
 - City of Novinger
 - City of Cincinnati
- Local and regional agencies involved in hazard mitigation activities:
 - Elm Township Fire Protection District
 - Grant Township Fire Protection district
 - Lemons Rural Volunteer Fire Department
 - Liberty Township Fire Protection District
 - Unionville Fire Department
 - York Township Volunteer Fire Department
 - Putnam County Ambulance Service
 - Putnam County Sheriff's Office
 - Putnam County Rural Health Clinic
 - Memorial Hospital
- Agencies with the authority to regulate development:
 - Village of Livonia
 - Village of Lucerne
 - City of Unionville
 - Village of Worthington
 - Village of Powersville
 - Putnam County Emergency Manager
 - Unionville Emergency Manager

- Unionville Floodplain Manager
- Businesses & Academia
 - Putnam County R-I
 - Smithfield Hog Production
 - Hy-Vee
 - MFA Propane
 - Shelter Insurance
 - Alamo Inn
 - Circle R Motel
- Other private and non-profit interests, including underserved/vulnerable populations
 - Putnam Senior Center
 - Putnam County Care Center
 - Bristol Manor
 - Putnam County Health Department
 - Putnam County Food Bank
 - Putnam County Ministerial Alliance
 - First Christian Church
 - Midway Baptist Church
 - United Methodist Church
 - First Baptist Church
 - St Mary's Catholic Church
 - Broadlawn Baptist church
 - Martinstown Church of Christ
 - Central Missouri Food Bank
 - North Central Rural Electric Co-op
 - Northeast Missouri Rural Telecom
 - Public Water Supply district

The Data Collection Questionnaires that all participants completed were the basis for data incorporated into the plan. These documents provided a wealth of information on the capabilities of participants, their experience with administering FEMA projects, their critical facilities, and many more items relevant to the plan.

In addition to the invitations sent out to various stakeholders throughout the planning area, meeting notices were provided to all jurisdictions as well as flyers and social media posts that were used to promote the meetings. This information was also made available on GHRPCs website and Facebook page. A copy of the address labels, invitations, flyers, and social media posts can be found in Appendix B of the plan.

A Survey Monkey public survey was created to solicit public comments. The link and the QR code were made available to all jurisdictions, published on social media, and published on the flyers that were sent to all jurisdictions.

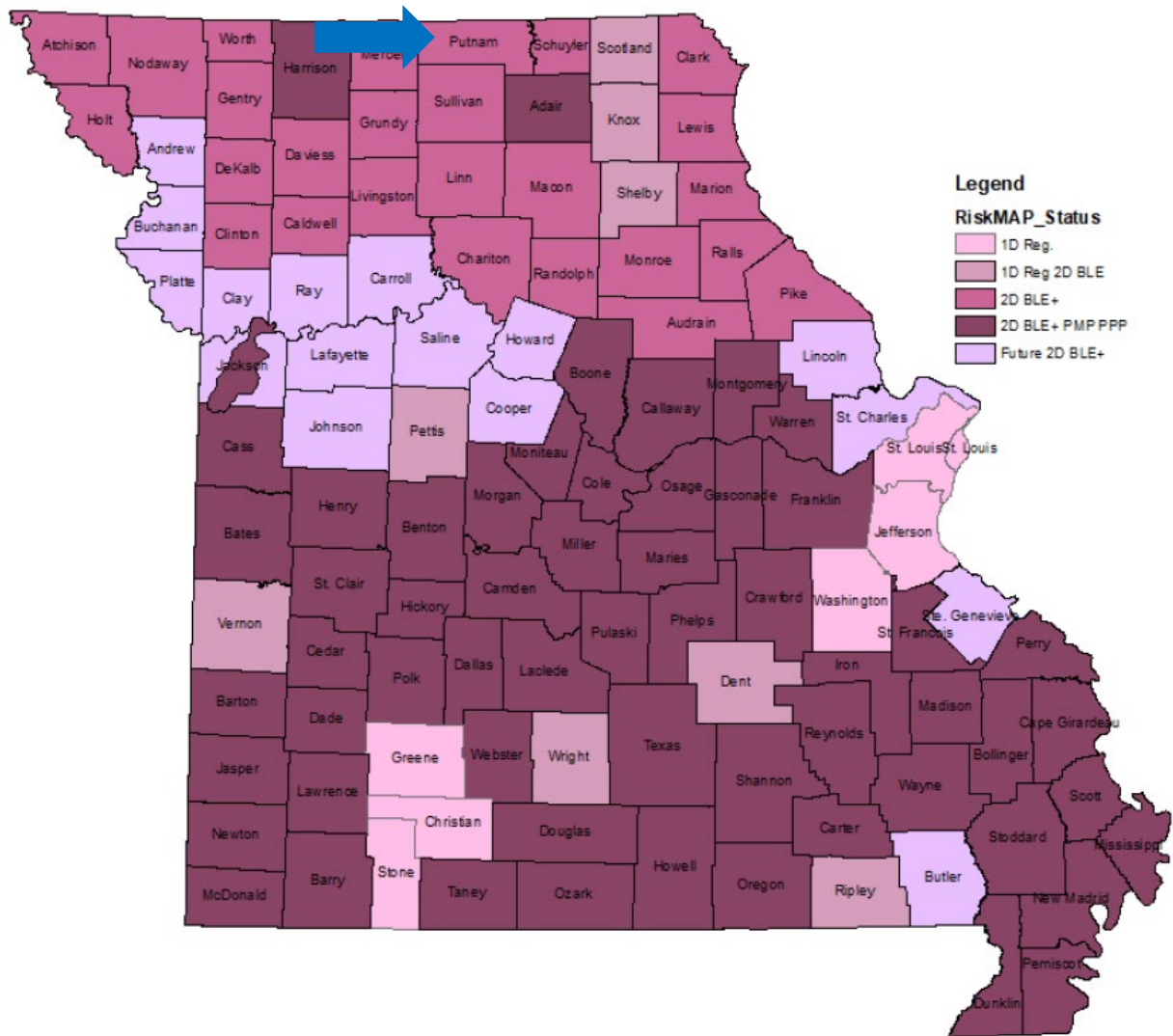
The draft of the Putnam County Hazard Mitigation Plan was published on Green Hills Regional Planning Commission's website on August 29, 2025. Contact information was provided to any individual that wanted to make a comment on the plan and the ability to make a comment was

enabled on the GHRPC website.

Coordination with FEMA Risk MAP Project

- At the beginning of the planning process, check the Risk MAP Study Status Map located at:
<http://fema.maps.arcgis.com/apps/webappviewer/index.html?id=48cfac9a9ffb4003b565aaccf464d0ac> .
- Describe the flood risk products that were used as best available data to inform the flood risk assessment. This may include preliminary or effective regulatory products and/or non-regulatory products.
- Describe efforts to coordinate with any FEMA RiskMap Projects that are underway in the planning area simultaneous with this plan update.
- Talk about discussions with the RiskMAP Projects contractors, including dates for conference calls or meetings, referencing documentation in the appendix.
- Describe any data or mitigation action ideas that were exchanged.
- Insert in the plan the state map (**Figure 1.1**) showing locations of RiskMAP projects including deployed watersheds, outlining the planning area or indicating in text status of planning area relative to any Risk MAP projects

Figure 1.1. **RiskMAP Study Status Map**



Source: 2023 Missouri State Hazard Mitigation Plan

According to the Missouri State Hazard Mitigation Plan, a Statewide Needs Assessment was conducted, and the above figure summarizes the mapping status of each county. Putnam County is classified as a county in the discovery phase with 2D BLE models under development that are planned to move forward with regulatory mapping using 2D results. Shown in the above figure with a blue arrow.

Integration of Other Data, Reports, Studies, and Plans

The most current data, reports, studies, and plans were reviewed in order to input the data that mostly represents the current view of Putnam County and its local jurisdictions. The resources used were:

- Current Missouri State Hazard Mitigation Plan (2023)
- Flood Insurance Rate Maps (FIRMs)
- Missouri Department of Natural Resources (DNR)
- National Inventory of Dams (NID)

- US Department of Agriculture's (USDA) Risk Management Agency Crop Insurance Statistics
- 2020 and 2023 Census
- 2021 Putnam County Hazard Mitigation Plan

Relevant information from the above-listed sources was reviewed by the Mitigation Planning Committee as appropriate and included in the update of the Putnam County Hazard Mitigation Plan. Additional resources are listed in Appendix A and cited in the plan where appropriate.

- (Reference PRT A4-a).

Step 4: Assess the Hazard: Identify and Profile Hazards (Handbook Task 4)

- During Meeting #1 the MPC identified and profiled their hazards. The process of identifying hazards at this meeting included:
 - previous disaster declarations in the county
 - hazards in the most recent State Hazard Mitigation Plan
 - hazards identified in the previously approved hazard mitigation plan.
 - Anecdotal accounts of specific occurrences in the jurisdictions
- The MPC reviewed each jurisdiction's completed Data Collection Questionnaire to incorporate additional risk assessment information.
- The MPC reviewed and incorporated data from existing plans, studies, reports, and technical information as well as information available through internet research and GIS analysis.
- The Risk Assessment chapter of the plan provides additional detail on conclusions drawn from the data reviewed.

Step 5: Assess the Problem: Identify Assets and Estimate Losses (Handbook Task 4)

- In cases where vulnerability estimates were unavailable, data from the 2023 Missouri State Hazard Mitigation Plan was utilized as the best and most recent data available SEMA was also able to share some preliminary data from the 2023 State Plan update.
- The following information was used to determine the assets and estimate losses in Putnam County: census, GIS data, HAZUS, and the Data Collection Questionnaire.
- Losses were estimated using the Missouri State Hazard Mitigation Plan and available HAZUS data for Putnam County.
- At the 2nd meeting, the initial draft of the risk assessment was available, chapter 3 of the plan.
- The MPC performed a risk assessment using data from Chapter 3 of the plan. Jurisdictions attending the meeting were encouraged to identify vulnerabilities that may have been overlooked or that they concluded were important. See appendix B for the vulnerability assessment worksheets.

Step 6: Set Goals (Handbook Task 6)

At the 2nd planning meeting the MPC reviewed the goals of the previously approved plan, they made the determination to update the goals to better address the specific hazards to the region

and make implementation and planning more efficient. The goals can be found in Chapter 4 of the Putnam County Hazard Mitigation Plan. They were listed as follows:

- Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorms/high winds, hail, and lightning.
- Goal 2: Minimize property damage due to flooding, levee failure, and dam failure.
- Goal 3: Minimize the impact to natural and human resources caused by drought, extreme temperatures, and wildfire.
- Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather.
- Goal 5: Minimize injuries and property damage due to seismic and/or geological events.

Step 7: Review Possible Mitigation Actions and Activities ***(Handbook Task 6)***

- The 3rd Planning Meeting was when the MPC reviewed the mitigation strategy from the previously approved plan. Each jurisdiction was aware that they must have at least one action plan for each hazard included in the plan.
- The jurisdictions determined which actions would be retained, modified, or deleted from the previous plan. The individual jurisdictions provided information on any progress made on the actions from the previous plan, and if they were still feasible.
- MPC members were encouraged to continue forward only those actions that substantively addressed long-term risks identified in the risk assessment.
- The FEMA publication *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards* (January 2013) was made available to the planning committee. It was suggested that this would be a valuable resource in guiding the planning activities to mitigate hazards in the planning area.
- Participants were encouraged to focus on long-term mitigation solutions and consideration was given to the potential cost of each project in relation to the anticipated future cost savings.
- The Putnam County Hazard Mitigation Planning Committee utilized the STAPLEE method for evaluating the priority and effectiveness of each action.

Step 8: Draft an Action Plan ***(Handbook Task 6)***

The action worksheets, including the plan for implementation, submitted by each jurisdiction for the updated Mitigation Strategy are included in Chapter 4.

Step 9: Adopt the Plan ***(Handbook Task 8)***

Each jurisdiction is aware that they must adopt the plan prior to submission to SEMA. Each jurisdiction will document the adoption of the plan. This documentation can be found in Appendix E.

Step 10: Implement, Evaluate, and Revise the Plan

(Handbook Tasks 7 & 9)

At the 3rd planning meeting, where actions were scored and decided upon, the MPC along with the GHRPC Planner agreed to meet at least annually to determine if actions were ongoing or completed. It was determined that the Hazard Mitigation Committee would schedule annual meetings to discuss any needed updates, changes, or progress on the plan's actions. It was determined that at these meetings, any amendments that were needed in the plan would be discussed and undertaken if necessary. It was also determined that any jurisdiction would use this annual meeting to develop NOIs for SEMA if desired. There is more detailed information about the strategy for plan maintenance in Chapter 5 of the Putnam County Hazard Mitigation Plan.

2 PLANNING AREA PROFILE AND CAPABILITIES

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2.1 PUTNAM COUNTY PLANNING AREA PROFILE

The first settlers arrived in the area now known as Putnam County in 1836. They settled in the heavily wooded area directly west of the Chariton River, and other areas convenient to water and timber. The timbered ridge tops, where the soil was easier to work, were cleared and planted. These early settlers practiced only subsistence agriculture because they did not have a reasonable means of transporting surpluses to established markets.

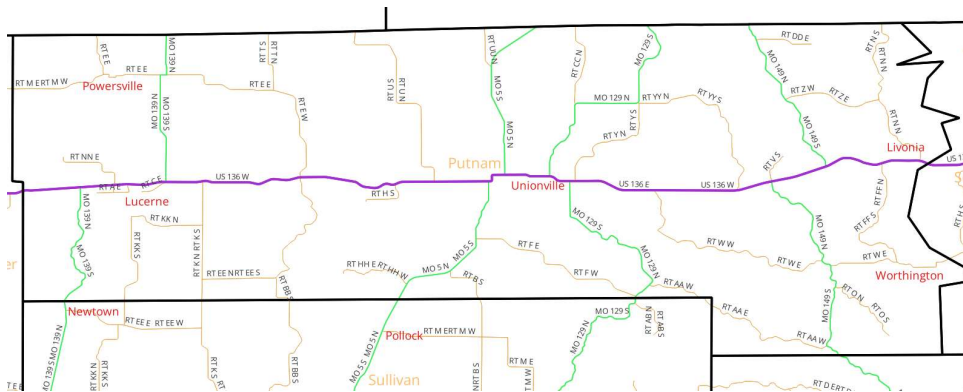
Originally formed in 1845, Putnam County was named for Israel Putnam, a Revolutionary War General famous for telling his men "Don't fire until you see the whites of their eyes" and for killing the last wolf in Connecticut during the winter of 1742-43.

The boundaries of present day Putnam County was created in 1853 by the consolidation of the previously existing counties of Putnam and Dodge; who had lost their 12 northern sections to Iowa in 1851 and were too small to constitute Independent counties.

In the 1870's, the county gained railway service and agriculture became more profitable. In the latter half of the 1800's, timber was exploited in the eastern part of the county as a valuable economic resource. Coal mining also was economically important to the county for a time.

Agriculture has always been a prominent enterprise in Putnam County. In 1988, livestock production accounted for nearly 75% of the gross revenue generated in the county. The production of crops, such as soybeans, corn, and small grain, accounted for about 25%.

Figure 2.1. Map of Putnam County



2.1.1 Geography, Geology and Topography

Putnam County is in the northeastern part of Missouri. It has a total area of 333,101 acres, or about 520 square miles. This acreage includes 1,065 acres of water areas more than 40 acres in size. Putnam County is bordered on the north by Wayne and Appanoose Counties of Iowa and on the south by Adair and Sullivan Counties of Missouri. The western boundary is Mercer County, and the eastern boundary is the old Chariton River Channel. The county generally is about 35 miles east to west and 14 miles north to south, except in the extreme eastern part of the county, where it is as much as 17 miles. Unionville, the county seat, is located in the center of the county.

Relief in Putnam County ranges from 1,100 feet near Powersville, in the northwest, to 779 feet at the point where the Chariton River leaves the county, in the southeast. Most streams in the county flow intermittently. There are, however, three major perennial drainage systems that eventually flow south into the Missouri River. Much of the eastern part of the county has high, narrow ridges and steep-sided ravines. It is drained by Shoal and Blackbird Creeks and their tributaries. These water courses feed the Chariton River. The western part of the county is more gently sloping, and streams in this area have a more winding course. Medicine Creek enters the county directly west of Powersville. The headwaters of the Locust Creek system are in the west-central portion of the county, near the Iowa border.

The two major land resource areas in the county are the Iowa and Missouri Heavy Till Plain and the Iowa and Missouri Deep Loess Hills (3). The major soils of the Iowa and Missouri Heavy Till Plain are Seymour and Pershing soils on ridges and Gara and Shelby on side slopes. Colo and Zook soils are on bottom land. The major soils of the Iowa and Missouri Deep Loess Hills are Gorin soils on narrow ridges and Keswick and Winnegan soils on side slopes. Nodaway soils are dominant on flood plains.

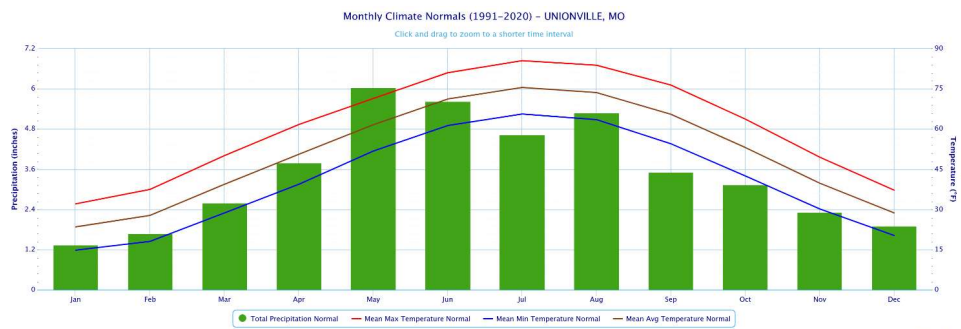
2.1.2 Climate

In winter, the average temperature is 27F and the average daily minimum temperature is 18 F. The lowest temperature on record, which occurred on December 28 1924, was -29 F°. In summer, the average temperature is 74 F° and the average daily maximum temperature is 85 F°. The highest recorded temperature, which occurred on August 8th, 1936, is 114 F°.

The total annual precipitation is 37 inches. Of this, 24 inches, or about 65 percent, usually falls in April through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall on record was 8.92 inches on July 25, 2008. Thunderstorms occur on about 53 days each year, and most occur in May.

The average seasonal snowfall is 25 inches. The greatest snow depth at any one time on record was 24 inches. On the average, 20 days of the year have at least 1 inch of snow on the ground. The heaviest 1-day snowfall on record was 16 inches.

Figure 2.2 NOAA Climate chart for Unionville



Source: <https://xmacis.rcc-acis.org/> -- Unionville NOAA Data

Table 2.1. NOAA Climate data for Unionville

Month	Total Precipitation Normal (inches)	Mean Max Temperature Normal (°F)	Mean Min Temperature Normal (°F)	Mean Avg Temperature Normal (°F)
January	1.35	32.1	14.8	23.5
February	1.69	37.5	18.1	27.8
March	2.60	50.1	28.7	39.4
April	3.80	61.7	39.4	50.6
May	6.04	71.4	51.8	61.6
June	5.62	81.0	61.3	71.2
July	4.64	85.5	65.6	75.5
August	5.29	83.8	63.5	73.6
September	3.52	76.4	54.5	65.5
October	3.15	63.7	42.5	53.1
November	2.32	49.5	30.2	39.8
December	1.91	37.2	20.3	28.7
Annual	41.93	60.8	40.9	50.9

Source : NOAA NCEI 11/2025

2.1.3 Population/Demographics

Table 2.1 provides the populations for each city, village, and the unincorporated county for 2000, 2010, and latest population estimates or American Community Survey with the number and percentage change. The unincorporated area population can be estimated by subtracting the populations of the incorporated areas from the overall county population.

Table 2.2. Putnam County Population 2010-2023 by Jurisdiction

Jurisdiction	2010 Population	2020 Population	2023 Annual Population Estimate or ACS Population	# Change (2010-2023)	% Change (2010-2023)
Putnam County	4,979	4,681	4,675	-304	-6.1%
Unincorporated Putnam	2814	2748	2828	+14	+0.5%
Unionville	1,865	1,735	1,725	-140	-7.5%
Powersville	60	42	66	+6	+10%
Lucerne	85	57	20	-65	-76%
Livonia	74	52	13	-61	-82%
Worthington	81	47	23	-58	71%

Source: U.S. Bureau of the Census, Decennial Census, annual population estimates/ 5-Year American Community Survey 2023; *population includes the portions of these cities in adjacent counties

Table 2.3. Putnam County Population Under Age 5 and Over Age 65, 2010-2019 Census Data

Jurisdiction	Population Under 5	% Population Under 5	Population 65 and over	% Population 65 and over
Putnam County	320	6.8%	1,198	25.6%
Village of Livonia	3	5.8%	11	21.2%
Village of Lucerne	5	8.8%	11	19.3%
Village of Powersville	2	4.8%	15	35.7%
Village of Worthington	7	14.9%	7	14.9%
City of Unionville	131	7.6%	406	23.4%

Source: U.S. Census Bureau, Profile of General Population and Housing Characteristics (DP1)

The University of South Carolina developed an index to evaluate and rank the ability to respond to, cope with, recover from, and adapt to disasters. The index synthesizes 29 socioeconomic variables which research literature suggests contribute to reduction in a community's ability to prepare for, respond to, and recover from hazards. SoVI ® data sources include primarily those from the United States Census Bureau.

To visually compare the SoVI® scores at a state and national level, they are mapped using quantiles. Scores in the top 20% of the United States are more vulnerable counties (red) and scores in the bottom 20% of the United States indicate the least vulnerable counties (blue). A low SoVI score number means that the county is more resilient to hazard events, and a high SoVI score number means the county is less resilient. Putnam County has a medium SoVI score.

Figure 2.3 below shows the SoVI scores for Putnam County from 2010 - 2014 at both the state and national levels. Putnam County has a medium SoVI score of as compared to the other counties in the state and as compared to other counties in the United States. As you can see, the score remained the same regardless of comparison level.

Figure 2.3 Social Vulnerability to Environmental Hazards, State of Missouri

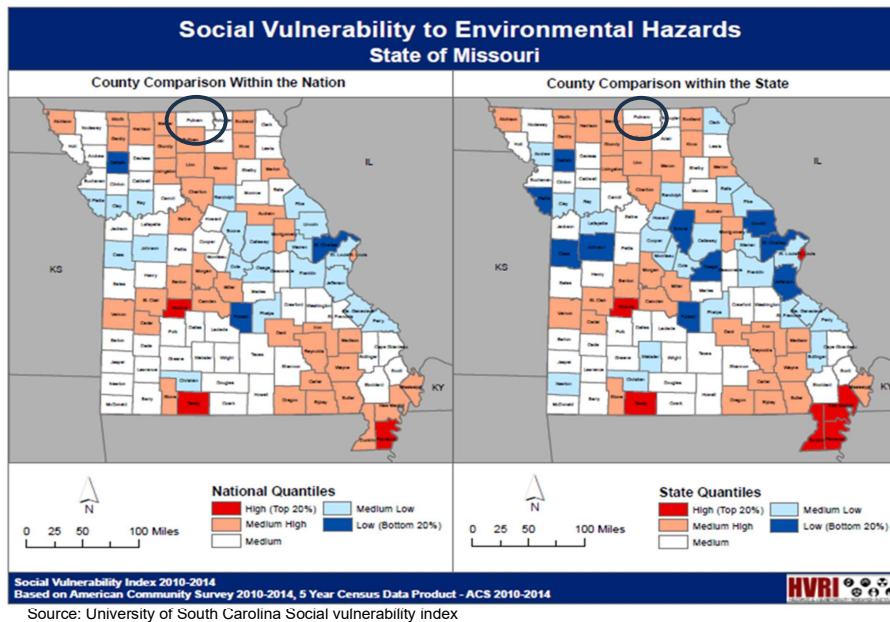


Table 2.4. Unemployment, Poverty, Education, and Language Percentage Demographics, Putnam County, Missouri

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
Putnam County	2,144	2.2%	16%	72%	19%	3.6%
Unionville	783	3.1%	18%	66%	18%	1.0%
Powersville	48	2.1%	25%	90%	24%	3.2%
Lucerne	9	0.0%	10%	87%	6.3%	10%
Livonia	0	-	62%	92%	0.0%	0.0%
Worthington	2	0.0%	61%	92%	0.0%	0.0%
Missouri	3,180,243	3.4%	12.0%	92.0%	33.2%	7.0%
Nationwide	171,742,922	4.3%	12.5%	89.8%	36.2%	22.5%

Source: U.S. Census, 202 American Community Survey, 5-year Estimates.

The University of South Carolina developed an index to evaluate and rank the ability to respond to, cope with, recover from, and adapt to disasters. The index synthesizes 29 socioeconomic variables which research literature suggests contribute to reduction in a community's ability to prepare for, respond to, and recover from hazards. SoVI® data sources include primarily those from the United States Census Bureau.

To visually compare the SoVI® scores at a state and national level, they are mapped using

quantiles. Scores in the top 20% of the United States are more vulnerable counties (red) and scores in the bottom 20% of the United States indicate the least vulnerable counties (blue). A low SoVI score number means that the county is more resilient to hazard events, and a high SoVI score number means the county is less resilient. Carroll County has a medium SoVI score

2.1.4 Occupations

Putnam County, Missouri, has a relatively small and stable workforce, with employment figures hovering around 2,060 to 2,070 employees in recent years. The county's economy is primarily rooted in agriculture, but its occupational landscape is more diverse, with key sectors including manufacturing, healthcare, and public administration.

Major Employment Sectors include manufacturing the largest employment sector in Putnam County, employing approximately 354 people. Health Care & Social Assistance employs around 311 people, indicating a strong presence of medical services and social support within the community. Putnam County Memorial Hospital is a key healthcare provider. Public Administration employs approximately 250 employees, public administration plays a notable role, including government functions and services. The Putnam County R-I School District is also a major employer in the education sector, which falls under public services.

The key employers in Putnam County reflect the dominant industries:

Putnam County R-I School District: A major employer in education.
Putnam County Government: Encompasses various public administration roles.
Putnam County Memorial Hospital: A primary healthcare provider.

Employment in Putnam County has shown a slight Decline in Recent Years: From 2022 to 2023, employment in Putnam County saw a slight decline of about -0.338% despite this, the county's unemployment rate has generally remained relatively low. As of April 2025, the unemployment rate was 3.8%.

Putnam County's economy is largely driven by its agricultural heritage, with additional support from small businesses and manufacturing facilities.

The median household income in Putnam County was around \$56,875 in 2023.

In summary, Putnam County's occupational landscape is characterized by a strong foundation in manufacturing, healthcare, and public administration, supported by a significant agricultural sector. Many residents are employed in administrative, management, and transportation roles, reflecting the diverse needs of the local economy.

Table 2.5. Occupation Statistics, Putnam 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
Putnam County	683	316	390	258	415
Unionville	219	128	166	87	159
Powersville	30	0	0	2	15
Lucerne	1	0	4	1	3
Livonia	0	0	0	0	0
Worthington	0	0	0	2	0

Source: U.S. Census, 2023 American Community Survey, 5-year Estimates.

2.1.5 Agriculture

The Putnam County Profile of the 2022 Census of Agriculture indicated that the county has a total of 574 farms, which is a decrease of 2% from 2017.

A total of 295,526 acres were in farms, which is an increase of 12% since 2017.

The average farm size is 515 acres, which is 224 acres above the State average of 291 acres.

Land use on Putnam County farms breaks out as cropland with 51%, pastureland with 30%, woodland at 13% and all other use types make up the remaining 5% of use. The top crop for Putnam County is soybeans with 46,547 (16%) acres planted. Forage/Hay is the second crop producer with 43,428 (15%) acres planted, followed by 17,454 (6%) planted acres of corn. The average sales per farm is \$222,376 with crop sales making up 33% and livestock, poultry and products making up 67% of the sales.

2.1.6 FEMA Hazard Mitigation Assistance (HMA) Grants in Planning Area

While there have been Disaster Declarations for Putnam County, there is no record of Hazard Mitigation Grants. As of January 9th, 2025, there is no record of FEMA Hazard Mitigation Grants awarded in the Harrison County planning area.

Table 2.6. FEMA HMA Grants in Putnam County from 1993-2024

Disaster Declaration	Project Type	Sub-Grantee	Date Approved	Project Total
		no projects		
Total				\$0

Source: Federal Emergency Management Agency, 2025

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2.1.7 FEMA Public Assistance (PA) Grants in Planning Area

In the last 25 years, 2000-2025, 12 different federally declared disasters have impacted Putnam County resulting in \$5,671,368.21 in impacts to the county.

On average since 2000 Putnam County has had a federally declared disaster every 1.4years.

Roads and Bridges were the commonly damaged items with 268 projects, which lead to \$5,021,171.21 or more than 88% of the total in damages. Emergency Protective Measures was the second highest category with 28 projects totaling \$94,429.09

Table 2.7. FEMA PA Grants in Putnam County from 1993-2024

Disaster Declaration	Incident Type	Project Size	Applicant	Project Total
1631	Severe Storm	Small	PUBLIC UTILITIES	\$500
1631	Severe Storm	Small	RECREATIONAL OR OTHER	\$1,261
1631	Severe Storm	Small	PUBLIC BUILDINGS AND FACILITIES	\$3,815
1631	Severe Storm	Small	PUBLIC BUILDINGS AND FACILITIES	\$2,812
1631	Severe Storm	Small	PUBLIC UTILITIES	\$21,087
1736	Severe Ice Storm	Small	UTILITY LINES & POWER POLE DAMAGES	\$8,863
1736	Severe Ice Storm	Small	DONATED RESOURCES	\$3,226
1736	Severe Ice Storm	Small	PA PILOT - DEBRIS REMOVAL	\$1,166
1736	Severe Ice Storm	Small	EMERGENCY PROTECTIVE MEASURES	\$9,497
1773	Severe Storm	Small	ROAD & CULVERT WASHOUT	\$3,200
1773	Severe Storm	Small	WATER LINE WASHOUT	\$57,152
1773	Severe Storm	Small	ROAD WASHOUTS	\$1,996
1773	Severe Storm	Small	ROADS & CULVERT WASHOUT	\$10,968
1773	Severe Storm	Small	ROAD WASHOUTS	\$4,538
1773	Severe Storm	Small	ROAD WASHOUTS	\$3,855
1773	Severe Storm	Small	CULVERT WASHOUT	\$18,988
1773	Severe Storm	Small	RURAL WATER DISTRIBUTION LINES	\$21,886
1773	Severe Storm	Small	ROAD WASHOUT	\$5,041

1773	Severe Storm	Small	ROAD WASHOUT	\$28,370
1773	Severe Storm	Small	ROAD WASHOUT	\$15,762
1773	Severe Storm	Small	ROOF DAMAGE	\$2,000
1773	Severe Storm	Small	WATER LINE DAMAGE	\$28,377
1773	Severe Storm	Small	ROAD & CULVERT WASHOUT	\$5,474
1773	Severe Storm	Small	ROAD WASHOUT	\$8,190
1773	Severe Storm	Small	ROAD WASHOUTS	\$8,506
1773	Severe Storm	Small	ROAD WASHOUT	\$7,973
1773	Severe Storm	Small	ROAD & CULVERT WASHOUT	\$12,863
1773	Severe Storm	Small	ROAD WASHOUT	\$18,797
1773	Severe Storm	Small	ROAD WASHOUT	\$9,180
1773	Severe Storm	Small	ROAD & CULVERT WASHOUT	\$27,001
1773	Severe Storm	Small	ROAD & CULVERT WASHOUT	\$34,800
1773	Severe Storm	Small	BRIDGE WASHOUT	\$51,603
1773	Severe Storm	Small	ROADS AND BRIDGES	\$3,040
1773	Severe Storm	Small	ROAD WASHOUT	\$1,906
1773	Severe Storm	Small	ROADS AND BRIDGES	\$1,243
1773	Severe Storm	Small	ROAD WASHOUT	\$1,730
1773	Severe Storm	Small	DEBRIS REMOVAL	\$2,098
1773	Severe Storm	Small	ROAD WASHOUT - NORTH	\$7,325
1773	Severe Storm	Small	ROAD WASHOUT - SOUTH	\$13,750
1773	Severe Storm	Small	ROAD WASHOUTS	\$35,254
1773	Severe Storm	Small	MEDICINE TWP GRAVEL ROADS	\$4,359
1773	Severe Storm	Small	WASHED OUT ROADS	\$7,464
1773	Severe Storm	Small	ROAD WASHOUTS	\$15,448
1773	Severe Storm	Small	GRAVEL WASHOFF	\$2,457
1773	Severe Storm	Small	ROAD WASHOUT	\$4,825
1773	Severe Storm	Small	GRAVEL WASHOFF	\$13,075
1773	Severe Storm	Small	ROAD WASHOUT	\$11,650
1773	Severe Storm	Small	ROAD WASHOUT	\$18,139

1773	Severe Storm	Small	GRAVEL ROAD WASHOUTS & SCOURING	\$4,301
1773	Severe Storm	Small	GRAVEL ROAD WASHOUTS	\$8,188
1773	Severe Storm	Small	GRAVEL ROAD WASHOUTS	\$3,990
1773	Severe Storm	Small	GRAVEL ROAD WASHOUTS	\$2,453
1773	Severe Storm	Small	GRAVEL ROAD WASHOUTS	\$3,315
1773	Severe Storm	Small	GRAVEL WASHOFFS	\$1,795
1773	Severe Storm	Small	GRAVEL ROAD WASHOFFS	\$8,369
1773	Severe Storm	Small	GRAVEL ROAD WASHOFF	\$14,000
1934	Severe Storm	Small	1934-Putnam County-RJD-02	\$2,515
1934	Severe Storm	Small	RJD01-1934-Putnam County Water Supply	\$11,431
1934	Severe Storm	Small	RJD11-1934-Elm Township Road & Bridge	\$9,612
1934	Severe Storm	Small	RJD13 - GRAVEL ROADS	\$15,520
1934	Severe Storm	Small	RJD22-Water Distribution Pipe Mains	\$1,928
1934	Severe Storm	Small	RJD14-Water Distribution Pipe Mains	\$13,318
1934	Severe Storm	Small	RJD08- Water Distribution Pipe Mains	\$13,900
1934	Severe Storm	Small	RJD26- Roads	\$35,410
1934	Severe Storm	Small	RJDF27- Roads and Ditches	\$3,449
1934	Severe Storm	Small	RJD24 - Roads and Bridges	\$1,869
1934	Severe Storm	Small	RJD23 - Roads and Bridges	\$4,567
1934	Severe Storm	Small	RJD19 - Roads and Bridges	\$2,915
1934	Severe Storm	Small	DC14RR - Dirt Road	\$4,635
1934	Severe Storm	Small	DC13RR- Roads and Culvert Jurisdiction Wide	\$9,781
1934	Severe Storm	Small	DC12RR - Roads and Culverts Jurisdiction Wide	\$16,874
1934	Severe Storm	Small	RJD32 - Roads and Ditches	\$3,884
1934	Severe Storm	Small	RJD30 - Roads and Ditches	\$4,537
1934	Severe Storm	Small	RJD31 - Roads and Ditches	\$16,346
1934	Severe Storm	Small	RDJ12- Roads and Culverts	\$7,490
1934	Severe Storm	Small	RJD18- Roads and bridges	\$5,785
1934	Severe Storm	Small	RJD21- Roads and Ditches	\$6,907
1934	Severe Storm	Small	DC16RR- Erosion of Roads Jurisdiction Wide	\$8,969

1934	Severe Storm	Small	DC15RR- Dirt Road	\$17,880
1934	Severe Storm	Small	DC17RR- Erosion of Culvert outlet	\$6,289
1934	Severe Storm	Small	RJD28 - Roads and Drainage Tubes	\$8,979
1934	Severe Storm	Small	RJD34- Roads and Ditches	\$29,573
1934	Severe Storm	Small	RJD35- Roads and Ditches	\$11,031
1934	Severe Storm	Small	FC-CO10 - Township Street # 160	\$3,824
1934	Severe Storm	Small	FC-CO09 - Township Street #150	\$4,472
1934	Severe Storm	Small	FC-CO12 - Township Street # 170	\$6,418
1934	Severe Storm	Small	KG027 'Sherman TWP Roads	\$12,562
1934	Severe Storm	Small	KG026 'Sherman TWP Roads	\$11,054
1934	Severe Storm	Small	FC-CO11 - Township Street # 168	\$1,640
1934	Severe Storm	Small	JPRAC01 - Township Roads	\$3,510
1934	Severe Storm	Small	FC-CO02 - Township Street # 100	\$2,511
1934	Severe Storm	Small	FC-CO07 - Township Street # 140	\$13,567
1934	Severe Storm	Small	FC-CO03 - Township Street # 110	\$5,580
1934	Severe Storm	Small	FC-CO04- Township Street # 115	\$3,352
1934	Severe Storm	Small	32JACMS - Roads, Ditches and Intersections	\$30,209
1934	Severe Storm	Small	FC-CO06- Township Street # 133	\$2,264
1934	Severe Storm	Small	PPF-01C - Road gravel, Culvert and Rip Rap	\$4,169
1934	Severe Storm	Small	FC-C015 - Road #117 & #113	\$2,908
1934	Severe Storm	Small	FC-C013 - Township Road 140	\$4,878
1934	Severe Storm	Small	PPF-05C - Bridge Approach: Sheet Pile, Dirt Work, Rip	\$9,537
1934	Severe Storm	Small	FC-C001 - Township Road #130	\$2,019
1934	Severe Storm	Small	FC-CO05 - Township Street # 120	\$9,155
1934	Severe Storm	Small	FCC019 - Road #120	\$3,951
1934	Severe Storm	Small	PPF-07C - Bridge Approach: Sheet Pile, Dirt Work, Rip	\$19,153
1934	Severe Storm	Small	POLC08 - Jackie Buster Bridge	\$7,811
1934	Severe Storm	Small	POLC06 - Bridge	\$13,008
1934	Severe Storm	Small	POLC03 - Gilliam Bridge	\$11,181
1934	Severe Storm	Small	FCC018 - Road #107	\$4,271

1934	Severe Storm	Small	FC-CO08 - Township Street # 147	\$3,912
1934	Severe Storm	Small	PCCC001 - Bridges and Culverts	\$25,984
1934	Severe Storm	Small	FC-0C14 - Road #135	\$5,011
1934	Severe Storm	Small	FC-0C16 - Road #100	\$3,396
1934	Severe Storm	Small	PRMC01 - Roadway Bridge	\$11,144
1934	Severe Storm	Small	PRMC02 - Roadway Culvert	\$1,346
1934	Severe Storm	Small	PRMC04 - Roadway Bridge	\$55,687
1934	Severe Storm	Small	PRMC06 - Roadway Bridge	\$4,601
1934	Severe Storm	Small	RJD37 - Roads and Ditches	\$21,536
1934	Severe Storm	Small	RJD40 - Roads and Ditches	\$5,946
1934	Severe Storm	Small	RJD36 - Roads, Ditches and Culverts	\$10,098
1934	Severe Storm	Small	MDC01C - Osage Trail, Calamint Trail, Drill Trail	\$1,288
1934	Severe Storm	Small	MDC02C - Pine Rd, CR 125, CR120, CR 380	\$2,464
1934	Severe Storm	Small	MDC03C - CR 387	\$2,000
1934	Severe Storm	Small	JSLT01 - Road embankment Loss and CMP Drainage Tube	\$11,421
1934	Severe Storm	Small	DSPC02C - Wing and headwalls	\$12,103
1934	Severe Storm	Small	PCDD01A - Debris	\$9,345
1934	Severe Storm	Small	PRMC03 - Roadway Bridge	\$15,138
1934	Severe Storm	Small	PRMC05 - Roadway Bridge	\$3,016
1934	Severe Storm	Small	PRMC07 - Roadway Bridge	\$10,113
1934	Severe Storm	Small	DSPC01C - Wing and headwalls	\$6,946
1934	Severe Storm	Small	PCDD01C - Wing and Headwalls	\$8,939
1934	Severe Storm	Small	PJLLC01 - Bridge Abutment Repair	\$13,968
1934	Severe Storm	Small	MLA001 - CMPs and Gravel for Roads	\$13,759
1934	Severe Storm	Small	RS-022 - Bridge	\$4,824
1934	Severe Storm	Small	PJLLC04 - Bridge Abutments, Headwall and Wingwalls	\$29,154
1934	Severe Storm	Small	RJD38 - Roads, Culverts	\$11,319
1934	Severe Storm	Small	Improved Project	\$13,920
1934	Severe Storm	Small	RJD39 - Roads, Culverts	\$19,809
1934	Severe Storm	Small	FC-C022 - Road #175	\$10,297

1934	Severe Storm	Small	FC-C020 - Road # 150, 9A and 10A	\$6,028
1934	Severe Storm	Small	FC-0C17 - Road # 143, 145 & 147	\$6,559
1934	Severe Storm	Small	RJD09 - Water Distribution Piping	\$4,584
1934	Severe Storm	Small	FC-C021 - Road # 180, 167 & #190	\$4,768
1934	Severe Storm	Small	RJD10 - Water Distribution Piping	\$22,364
1934	Severe Storm	Small	MCCC001 - Multiple Culverts	\$20,300
1934	Severe Storm	Small	1934-Putnam County-RJD-02	\$2,515
1961	Severe Storm	Small	PNJM003- 48 Hour Snow Assistance	\$4,898
1961	Severe Storm	Small	PNJM004 - 48 Hour Snow Assistance	\$8,983
1961	Severe Storm	Small	PNJM005 - 48 Hour Snow Assistance	\$3,596
1961	Severe Storm	Small	PNJM010-48 Hour Snow Assistant	\$3,218
1961	Severe Storm	Small	PNJM009-48 Hour Snow Assistant	\$2,301
1961	Severe Storm	Small	PNJM007-48 Hour Snow Assistance	\$17,259
1961	Severe Storm	Small	PNJM006-48 Hour Snow Assistance	\$4,267
1961	Severe Storm	Small	PNJM017 - 48 Hour Snow Assistance	\$13,201
1961	Severe Storm	Small	PNJM014 - 48 Hour Snow Assistance	\$2,423
1961	Severe Storm	Small	PNJM016 - 48 Hour Snow Assistance	\$2,366
1961	Severe Storm	Small	PNJM021 - 48 Hour Snow Assistance	\$1,620
1961	Severe Storm	Small	PNJM019 - 48 Hour Snow Assistance	\$11,074
1961	Severe Storm	Small	PNJM020 - Road	\$1,348
1961	Severe Storm	Small	PNJM013 - EPM - 48 Hour Snow Assistance	\$4,302
1961	Severe Storm	Small	PNJM022 - 48 Hour Snow Assistance	\$1,389
4130	Severe Storm	Small	PCUT02C Road Bank and Shoulder 300th Rd - 1site	\$19,197
4130	Severe Storm	Small	PCLT01C - Roads Washout - 4 Sites	\$10,572
4130	Severe Storm	Small	PCLN01C Gravel Roads -6 Sites	\$22,985
4130	Severe Storm	Small	PCGT01C Aggregate Road Washouts - 11 Sites	\$8,513
4130	Severe Storm	Small	PCGT02C - Culvert Replacement (3 Sites)	\$2,925
4130	Severe Storm	Small	PCLD01C - Lake Thunderhead Special Road District	\$26,339
4130	Severe Storm	Small	PCLD01C Roads and Culvert Damages- 12 sites	\$45,975
4130	Severe Storm	Small	PCST02C Culvert Replacement (10 Sites)	\$9,089

4130	Severe Storm	Small	PCPC01A Debris Removal	\$3,549
4130	Severe Storm	Small	PCST01C Aggregate Road Washouts	\$19,890
4130	Severe Storm	Small	PCPC02C- Roads and Bridges	\$17,241
4130	Severe Storm	Large	PCPC01C-Roads and Bridges- 14 Sites	\$85,677
4130	Severe Storm	Small	PCLT02C Road and Ditch Washout	\$8,190
4130	Severe Storm	Small	PCET01C Township Roads & Culverts 24 Sites	\$24,667
4200	Severe Storm	Small	PTSHC08 Gravel Roads	\$33,216
4200	Severe Storm	Small	PTMCC04 - Gravel Road Washouts	\$18,779
4200	Severe Storm	Small	PTMLC03 - bridge abutment wall, wing walls	\$5,531
4200	Severe Storm	Small	PTRL001 Gravel Roads	\$34,328
4200	Severe Storm	Small	PTMLC10 - bridge abutment wall, wing walls	\$4,648
4200	Severe Storm	Small	PTSSC05 Gravel Roads/ Culverts	\$59,093
4200	Severe Storm	Small	PTSSF04 PWSD	\$105,703
4200	Severe Storm	Small	PTMCC03 - Gravel Road Washouts	\$4,142
4200	Severe Storm	Small	PTTSC01- Gravel Washouts Over Culverts	\$10,780
4200	Severe Storm	Small	PTRL002 Gravel Roads	\$39,186
4200	Severe Storm	Small	PTMLC04-Gravel Roads	\$86,187
4200	Severe Storm	Small	PTMLC12 bridge abutment wall, wing walls	\$4,459
4200	Severe Storm	Small	PTMLC13 - bridge abutment wall, wing walls	\$17,212
4200	Severe Storm	Small	PTMLC11 - bridge, culvert, low water crossing	\$20,334
4238	Severe Storm	Small	CDS005C Bridge Abutment Repair	\$28,591
4238	Severe Storm	Small	CDS004C Road & Embankment Repairs	\$76,757
4238	Severe Storm	Small	CDS007B -Emergency Protective Measures - City Wide	\$4,371
4238	Severe Storm	Small	CDS006F - City Wide Electrical System	\$14,202
4238	Severe Storm	Small	CDS021C - ROADWAY DAMAGE	\$10,994
4238	Severe Storm	Small	CDS017C - Roads and Culverts	\$20,179
4238	Severe Storm	Small	CDS018C -Roadway & Culvert Repairs	\$8,010
4238	Severe Storm	Small	CDS019C - ROADWAY & CULVERT REPAIR	\$9,255
4238	Severe Storm	Small	VPF015C - Bridges & Culverts - Putnam (County)	\$38,480
4238	Severe Storm	Small	RII004C - Bridge 4610008 Site 6	\$19,752

4238	Severe Storm	Small	VPF018A - Debris	\$6,955
4238	Severe Storm	Small	MMS124C - UnionTownship - Roads and Culverts	\$68,139
4238	Severe Storm	Small	RII007C - Bridge 0840017 Site 18	\$37,254
4238	Severe Storm	Small	RII008C - Bridge 4590010 Site 7	\$18,703
4238	Severe Storm	Large	CCB001F - Putnam Water Supply District	\$144,736
4238	Severe Storm	Large	VPF014C - Bridges, Box Culverts - Putnam (County)	\$166,628
4238	Severe Storm	Large	VPF013C - Roads - Putnam (County)	\$147,770
4238	Severe Storm	Small	RII005C - Bridge 1320014 Site 23	\$66,894
4238	Severe Storm	Small	RII017C - Bridge #45800021 Repairs - Site 8	\$51,065
4238	Severe Storm	Small	RII015C - Bridge #2930010 Repairs - Site 37	\$22,071
4238	Severe Storm	Small	RII013C - Bridge #0950019 Repairs - Site 22	\$19,115
4238	Severe Storm	Small	RII012C - Bridge #0840023 Repairs - Site 19	\$33,636
4238	Severe Storm	Small	RII014C - Bridge #0950027 Repairs - Site 21	\$21,084
4238	Severe Storm	Small	RII016C - Bridge #22700011 Repairs - Site 30	\$57,154
4238	Severe Storm	Small	RII011C - Bridge #0840011 Repairs - Site 18.5	\$35,667
4238	Severe Storm	Small	RII019C - CR 110th Street Culvert Repair - Site 68	\$11,441
4238	Severe Storm	Small	VPF017C - Drainage Systems - Putnam (County)	\$88,024
4238	Severe Storm	Small	MMS129C - Roads	\$48,957
4238	Severe Storm	Small	RII018C - Box Culvert - Dahlia Trail Repairs - Site 16	\$42,326
4238	Severe Storm	Large	VPF016C - Drainage Systems - Putnam (County)	\$241,094
4238	Severe Storm	Small	MMS122C Gravel Road Washouts - 20 sites	\$40,445
4238	Severe Storm	Small	CDS020C - Roadway & Culvert Damage	\$5,427
4238	Severe Storm	Small	CDS023C Gravel Road Washouts - 9 sites	\$28,906
4238	Severe Storm	Small	MMS125C - Gravel Road Washout 26 Sites	\$44,331
4238	Severe Storm	Small	MMS123C - Gravel Roads	\$8,269
4238	Severe Storm	Small	CDS022C Gravel Road Washouts	\$28,764
4238	Severe Storm	Small	MMS121C - Gravel Road Washouts - 10 sites	\$111,901
4238	Severe Storm	Small	MMS118C - Road & Culvert Wash Out	\$7,472
4451	Severe Storm(s)	Small	York Township - Putnam - Management Cost	\$8,643
4451	Severe Storm(s)	Small	Completed Roads and Culverts	\$124,499

4451	Severe Storm(s)	Small	Three Culverts - Flax, Ivy, Irish Trail	\$5,173
4451	Severe Storm(s)	Small	Three Bridge Roads	\$13,191
4451	Severe Storm(s)	Small	York Township Complete Culverts and Roads	\$61,505
4451	Severe Storm(s)	Small	10th Street Gravel Road	\$19,262
4451	Severe Storm(s)	Large	Lincoln Township Roads	\$147,235
4451	Severe Storm(s)	Small	Union Township Culvert	\$3,625
4451	Severe Storm(s)	Large	Public Water Supply District 1 - Completed Water Lines	\$178,991
4451	Severe Storm(s)	Small	Gravel Road Washouts	\$7,802
4451	Severe Storm(s)	Small	Culvert Reconstruction	\$69,240
4451	Severe Storm(s)	Small	Medicine Township Roads & Culverts	\$64,683
4451	Severe Storm(s)	Small	110th Rd	\$10,220
4451	Severe Storm(s)	Small	Wilson Township Road Culverts	\$5,727
4451	Severe Storm(s)	Small	Six Culvert Replacements	\$56,692
4451	Severe Storm(s)	Small	Grant Township County Wide Roads	\$40,971
4451	Severe Storm(s)	Small	Culvert Outlet	\$3,677
4451	Severe Storm(s)	Small	Culverts at Gold Dust / Old Cross Trail	\$6,956
4451	Severe Storm(s)	Large	Roads WTBC	\$146,447
4451	Severe Storm(s)	Small	Multiple Road Washouts	\$19,182
4451	Severe Storm(s)	Small	Jackson Township - Management Costs	\$2,499
4451	Severe Storm(s)	Small	Completed Bridge Repair	\$14,825
4451	Severe Storm(s)	Small	Union Township Roads	\$13,695
4451	Severe Storm(s)	Small	Culverts WC	\$6,533
4451	Severe Storm(s)	Small	Putnam County Culverts	\$40,480
4451	Severe Storm(s)	Large	Putnam County Bridges	\$214,451
4451	Severe Storm(s)	Small	Public Water Supply District 1 - Water lines	\$22,347
4451	Severe Storm(s)	Small	Public Water Supply District #1 - Putnam County - Management Cost	\$10,419
4451	Severe Storm(s)	Small	Lake Thunderhead Culvert	\$21,041
4451	Severe Storm(s)	Small	Roads WTBC	\$62,297
4451	Severe Storm(s)	Small	Union Township Gravel Roads & Culvert	\$63,038
4451	Severe Storm(s)	Small	Estimated Management Costs	\$9,911

4451	Severe Storm(s)	Small	Culvert at Lake McKinley	\$9,999
4451	Severe Storm(s)	Small	457th Rd Debris Removal	\$7,113
4451	Severe Storm(s)	Small	York Township - Putnam - Management Cost	\$8,643
Total:				\$5,671,368.21

Source: Federal Emergency Management Agency, January 2025

2.2 JURISDICTIONAL PROFILES AND MITIGATION CAPABILITIES

2.2.1 Unincorporated Putnam County

Putnam County was established on February 28, 1845, utilizing parts of Adair and Sullivan counties. The following year, a portion of Putnam was removed to form Dodge County. Both Putnam and Dodge extended nearly nine miles further north until a pivotal 1851 Supreme Court ruling on a border dispute with Iowa assigned the contested land to Iowa. This ruling left both counties with less than the minimum statutory area required for a county by the state legislature, resulting in the dissolution of Dodge County and the addition of its area to Putnam.

In its early years, the location of the county seat frequently changed amidst contentious debate. Putnamville and Bryant Station (neither of which are still in existence) and Hartford all served as the seat until a centrally located place called Harmony, later renamed Unionville, was chosen. By the 1860 U.S. Census, Putnam County's population was 9,240, supporting eighteen sawmills and three flour mills.

Coal had been abundant since the county's earliest settlement, but following the 1873 arrival of the Burlington & Southwestern Railway, coal mining became a major industry, particularly in the eastern part of the county. At one time, three railroads crossed Putnam County: the Chicago, Milwaukee and St. Paul; the Chicago, Burlington and Quincy; and the Iowa and St. Louis. As the United States transitioned from a rural to an urban country, Putnam County experienced a significant demographic shift, losing over two-thirds of its population between 1900 and 2000. A notable and tragic event occurred in May 1962 when Continental Airlines Flight 11, en route from Chicago to Kansas City, crashed into a field north of Unionville after being blown up by a suicide bomber, killing all 45 people onboard.

As of 2023 census estimates, Putnam County had a population of 4,675 people residing in 1,874 households, with a population density of 9 people per square mile. There were 2,835 housing units, averaging 5 per square mile. The county's population is predominantly White (99%), with 1% Black or African American. Additionally, around 3% of the population were reported as Hispanic or Latino of any race.

In terms of household composition, 21% of households included children under the age of 18. 46% were married couples living together, 31% had a female householder with no partner present, and 20% had someone living alone who was 65 years of age or older. The average household size was 2.45, and the average family size was 3.18. The population's age distribution showed 22% under the age of 18 and 25% who were 65 years of age or older, contributing to a median age of 45.6 years. The male-to-female ratio was 104.8 males for every 100 females.

The median income for a household in the county was \$56,875, and the median income for a family was \$74,602. Approximately 16% of the overall population were below the poverty line. This included 18% of those under age 18 and 13% of those age 65 or over. The County is governed by an elected board of Commissioners, which is composed of a Presiding Commissioner and two Associate Commissioners.

Other positions within Putnam County's government include:

Assessor, Associate Circuit Judge, Circuit Clerk, Community, Family & Youth Services, Collector, Coroner, County Clerk, County Library, County Treasurer, Emergency Management, General Services, Health Department, Health Services, Interim Coroner, Presiding Circuit Judge, Prosecuting Attorney, Public Administrator, Recorder, Sheriff, Treasurer, Veteran's Affairs, and Zoning Administrator

Mitigation Initiatives/Capabilities

The County has few ordinances in place.

The County has had limited mitigation activities due to limited capabilities. The County expanding its mitigation capabilities is unlikely, due to limited capabilities, both financially and in terms of staff availability.

Table 2.8. Unincorporated Putnam County Mitigation Capabilities

Capabilities	Status, Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	
Builder's Plan	
Capital Improvement Plan	
City Emergency Operations Plan	
County Emergency Operations Plan	
Local Recovery Plan	
County Recovery Plan	
City Mitigation Plan	
County Mitigation Plan	
Debris Management Plan	
Economic Development Plan	
Transportation Plan	
Land-use Plan	
Flood Mitigation Assistance (FMA) Plan	
Watershed Plan	
Firewise or other fire mitigation plan	
School Mitigation Plan	
Critical Facilities Plan	
Policies/Ordinance	
Zoning Ordinance	
Building Code	
Floodplain Ordinance	
Subdivision Ordinance	
Tree Trimming Ordinance	
Nuisance Ordinance	
Stormwater Ordinance	
Drainage Ordinance	

Site Plan Review Requirements	
Historic Preservation Ordinance	
Landscape Ordinance	
Seismic Construction Ordinance	
Program	
Zoning/Land Use Restrictions	
Codes Building Site/Design	
Hazard Awareness Program	
National Flood Insurance Program (NFIP)	
NFIP Community Rating System (CRS) program	
National Weather Service (NWS) Storm Ready	
Firewise Community Certification	
Building Code Effectiveness Grading (BCEGs)	
ISO Fire Rating	
Economic Development Program	
Land Use Program	
Public Education/Awareness	
Property Acquisition	
Planning/Zoning Boards	
Stream Maintenance Program	
Tree Trimming Program	
Engineering Studies for Streams (Local/County/Regional)	
Mutual Aid Agreements	
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	
Hazard Analysis/Risk Assessment (County)	
Flood Insurance Maps	
FEMA Flood Insurance Study (Detailed)	
Evacuation Route Map	
Critical Facilities Inventory	
Vulnerable Population Inventory	
Land Use Map	
Staff/Department	
Building Code Official	
Building Inspector	
Mapping Specialist (GIS)	
Engineer	
Development Planner	
Public Works Official	
Emergency Management Director	
NFIP Floodplain Administrator	
Emergency Response Team	
Hazardous Materials Expert	
Local Emergency Planning Committee	
County Emergency Management Commission	
Sanitation Department	
Transportation Department	
Economic Development Department	
Housing Department	
Historic Preservation	
Non-Governmental Organizations (NGOs)	
American Red Cross	

Salvation Army	
Veterans Groups	
Local Environmental Organization	
Homeowner Associations	
Neighborhood Associations	
Chamber of Commerce	
Community Organizations (Lions, Kiwanis, etc.)	
Local Funding Availability	
Apply for Community Development Block	
Fund projects through Capital	
Authority to levy taxes for a specific purpose	
Fees for water, sewer, gas, or electric services	
Impact fees for new development	
Ability to incur debt through general obligation bonds	
Ability to incur debt through special tax bonds	
Ability to incur debt through private activities	
Withhold spending in hazard prone areas	

Source: Data Collection Questionnaire, 11/2025

2.2.2 City of Unionville

The City of Unionville was established in 1853 as the county seat for Putnam County. It was initially named Harmony, reflecting the hope that its centralized location would resolve the heated debates that accompanied the frequent relocation of the county seat prior to its selection. Unionville currently straddles the municipal border between Union Township and Wilson Township, a jurisdictional detail noted since the Union Township trustees first convened at the courthouse in Unionville on February 4, 1873. The city is governed by a Mayor and a board of aldermen.

A tragic and historically significant event occurred on May 22, 1962, when Continental Airlines Flight 11 crashed in a clover field north of Unionville, near Lake Thunderhead. The Boeing 707, en route from O'Hare Airport in Chicago, Illinois, to Kansas City, Missouri, resulted in the deaths of all 37 passengers and 8 crew members. Subsequent investigation determined that the crash was caused by the detonation of a bomb onboard by one of the passengers, Thomas G. Doty, as part of a suicide-for-insurance plot.

As of the 2023 census estimates, Unionville was home to 1,725 people residing in 694 households. The city's population density was calculated at 862 people per square mile. The city contained 949 housing units, representing an average density of 474 per square mile. 98% of the population was identified as White, 2% was identified as Alaskan or American Indian and 1.2% of the population was identified as Hispanic or Latino (of any race).

31% of the total households included children under the age of 18, 37% were married couples living together around 42% had a female householder with no partner present and 18% had someone living alone who was 65 years of age or older. The average household size was 2.36, and the average family size was 3.52. The median household income for the city was \$51,771, and the median family income was notably higher at \$101,250.

Among the residents of Unionville, 29% were under the age of 18 and 21% were 65 years of age or older. The median age was 36.4 years. The gender ratio was skewed towards males, with 113.5 males for every 100 females.

There are no past or ongoing projects or programs specifically designed to reduce disaster losses. As of January 2025, no approved projects have been submitted for FEMA mitigation grants.

There has been no residential or industrial development since the last plan update in 2020, any future planned development could potentially increase risk by expanding the population and infrastructure vulnerable to hazards without corresponding mitigation measures.

Mitigation Initiatives/Capabilities

The City of Unionville has few ordinances in place. These include, Planning and zoning, Dangerous and dilapidated buildings, through building code enforcement, flood plain management, and storm water management

The city has had limited mitigation activities due to limited capabilities. The city expanding its mitigation capabilities is unlikely due to limited capabilities, both financially and in terms of staff availability.

Some of the limited actions that the community has been able to undertake include, having outdoor warning sirens and the use of a "text caster" type system to send out weather alerts.

Table 2.9. City of Unionville Mitigation Capabilities

Capabilities	Status, Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	NA
Capital Improvement Plan	No
City Emergency Operations Plan	No
County Emergency Operations Plan	Yes
Local Recovery Plan	Yes
County Recovery Plan	NA
City Mitigation Plan	No
County Mitigation Plan	Yes
Debris Management Plan	No
Economic Development Plan	No
Transportation Plan	No
Land-use Plan	NA
Flood Mitigation Assistance (FMA) Plan	NA
Watershed Plan	No
Firewise or other fire mitigation plan	No
School Mitigation Plan	NA
Critical Facilities Plan	NA
Policies/Ordinance	
Zoning Ordinance	Yes
Building Code	Yes
Floodplain Ordinance	Yes
Subdivision Ordinance	NA
Tree Trimming Ordinance	NA
Nuisance Ordinance	NA

Stormwater Ordinance	Yes
Drainage Ordinance	No
Site Plan Review Requirements	Yes
Historic Preservation Ordinance	Yes
Landscape Ordinance	NA
Seismic Construction Ordinance	NA
Program	
Zoning/Land Use Restrictions	NA
Codes Building Site/Design	Yes
Hazard Awareness Program	NA
National Flood Insurance Program (NFIP)	Yes
NFIP Community Rating System (CRS) program	No
National Weather Service (NWS) Storm Ready	No
Firewise Community Certification	No
Building Code Effectiveness Grading (BCEGs)	NA
ISO Fire Rating	7
Economic Development Program	NA
Land Use Program	NA
Public Education/Awareness	Yes
Property Acquisition	NA
Planning/Zoning Boards	No
Stream Maintenance Program	NA
Tree Trimming Program	NA
Engineering Studies for Streams (Local/County/Regional)	NA
Mutual Aid Agreements	Yes
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	NA
Hazard Analysis/Risk Assessment (County)	NA
Flood Insurance Maps	Yes
FEMA Flood Insurance Study (Detailed)	NA
Evacuation Route Map	NA
Critical Facilities Inventory	No
Vulnerable Population Inventory	No
Land Use Map	NA
Staff/Department	
Building Code Official	Yes, FT
Building Inspector	Yes
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	No
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	Yes
Transportation Department	No
Economic Development Department	Yes, PT
Housing Department	No
Historic Preservation	Yes, PT

Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	Yes
Local Environmental Organization	No
Homeowner Associations	No
Neighborhood 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	No
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	No

Source: Data Collection Questionnaire, 11/2025

2.2.3 City of Powersville

The community of Powersville, located in northwest Putnam County, was platted in 1887 following the extension of the railroad to that location. The town was named after Israel Powers, the original owner of the town site. A post office has been in continuous operation at Powersville since its founding year in 1887.

Powersville is situated on Missouri Route E, three miles west of Missouri Route 139. The community of Lucerne is six miles to the south, and the Missouri-Iowa border is two miles north. Medicine Creek flows approximately one mile to the west, and the Chicago, Milwaukee, St. Paul and Pacific Railroad passes along the west side of the village. According to the United States Census Bureau, the village has a total area of 0.56 square miles, all of which is land.

As of the 2023 census estimates, the village of Powersville had a population of 66 people residing in 44 households. The population density was 117 inhabitants per square mile. There were 41 housing units at an average density of 73 per square mile.

The racial makeup of the village was 100% White. The population profile is notably skewed toward older residents:

The median age in the city was 69.3 years. 62% of residents were 65 years of age or older, only 4.5% of residents were under the age of 18.

The average household size was 1.5, and the average family size was 8. 62% of households had someone living alone who was 65 years of age or older. Around 2.3% of households had children under the age of 18 living with them. The household structures were varied, with 2.3% being married couples living together, 4.5% having a female householder with no partner present, and 93% having a male householder with no partner present.

Mitigation Initiatives/Capabilities

The City of Powersville has few ordinances in place.

The city has had limited mitigation activities due to limited capabilities. The city expanding its mitigation capabilities is unlikely due to limited capabilities, both financially and in terms of staff availability.

Table 2.10. City of Powersville Mitigation Capabilities

Capability	Status, Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	
Builder's Plan	
Capital Improvement Plan	
Local Emergency Plan	
County Emergency Plan	
Local Recovery Plan	
County Recovery Plan	
Local Mitigation Plan	
County Mitigation Plan	
Economic Development Plan	
Transportation Plan	
Land-use Plan	
Flood Mitigation Assistance (FMA) Plan	
Watershed Plan	
Firewise or other fire mitigation plan	
School Mitigation Plan	
Critical Facilities Plan	
Mitigation/Response/Recovery	
Policies/Ordinance	
Zoning Ordinance	
Building Code	
Floodplain Ordinance	
Subdivision Ordinance	
Tree Trimming Ordinance	
Nuisance Ordinance	
Storm Water Ordinance	
Drainage Ordinance	
Seismic Construction Ordinance	
Capability	
Site Plan Review Requirements	
Historic Preservation Ordinance	
Landscape Ordinance	
Wetlands and Riparian Areas Conservation Plan	
Debris Management Plan	
Program	
Zoning/Land Use Restrictions	
Codes Building Site/Design	
National Flood Insurance Program (NFIP) Participant	
NFIP Community Rating System (CRS) Participating Community	
Hazard Awareness Program	
National Weather Service (NWS) Storm Ready	
Building Code Effectiveness Grading (BCEGs)	
ISO Fire Rating	
Economic Development Program	
Land Use Program	
Public Education/Awareness	

Capability	Status, Including Date of Document or Policy
Property Acquisition	
Planning/Zoning Boards	
Stream Maintenance Program	
Tree Trimming Program	
Engineering Studies for Streams (Local/County/Regional)	
Mutual Aid Agreements	
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	
Hazard Analysis/Risk Assessment (County)	
Flood Insurance Maps	
FEMA Flood Insurance Study (Detailed)	
Evacuation Route Map	
Critical Facilities Inventory	
Vulnerable Population Inventory	
Land Use Map	
Staff/Department	
Building Code Official	
Building Inspector	
Mapping Specialist (GIS)	
Engineer	
Development Planner	
Public Works Official	
Emergency Management Coordinator	
NFIP Floodplain Administrator	
Emergency Response Team	
Hazardous Materials Expert	
Local Emergency Planning Committee	
County Emergency Management Commission	
Sanitation Department	
Transportation Department	
Economic Development Department	
Housing Department	
Historic Preservation	
Non-Governmental Organizations (NGOs)	
American Red Cross	
Salvation Army	
Veterans Groups	
Environmental Organization	
Homeowner Associations	
Neighborhood Associations	
Chamber of Commerce	
Community Organizations (Lions, Kiwanis, etc.)	
Local Funding Availability	
Ability to apply for Community Development Block Grants	
Ability to fund projects through Capital Improvements funding	
Authority to levy taxes for a specific purpose	
Fees for water, sewer, gas, or electric services	
Impact fees for new development	
Ability to incur debt through general obligation bonds	
Ability to incur debt through special tax bonds	
Ability to incur debt through private activities	
Ability to withhold spending in hazard prone areas	

Source: Data Collection Questionnaire, Jan 2025

2.2.4 Village of Lucerne

The village of Lucerne was platted in 1887, the same year a post office began operation there. It is most likely that the community took its name from Lucerne, Ohio.

Lucerne is located on US Route 136, approximately 15 miles west of Unionville. The village of Powersville is situated six miles to the north, while Newtown in northwest Sullivan County is six miles to the south. Medicine Creek flows past a half mile to the east, and the Chicago, Milwaukee, St. Paul and Pacific Railroad passes along the east side of the village. According to the United States Census Bureau, the village has a total area of 0.25 square miles, all of which is land.

As of the 2023 census estimates, Lucerne had a population of 20 people residing in 13 households. The population density was 80 people per square mile. There were 41 housing units at an average density of 164 per square mile. The racial makeup of the town was 100% White.

The average household size was 1.54, and the average family size was 2.75. 7.7% of households had children under the age of 18 living with them. 23% were married couples living together, while 62% had a female householder with no partner present and 30% of households had someone living alone who was 65 years of age or older.

The median household income was \$43,125 with approximately 10% of the overall population below the poverty line. Notably, 0% of those under age 18 and 0% of those age 65 or over were reported to be below the poverty line.

The population's age distribution showed 20% under the age of 18 and 30% who were 65 years of age or older. The median age was 60 years. The village has a significant gender imbalance, with only 53.8 males for every 100 females.

The village of Lucerne is governed by a board of aldermen. The village Clerk is designated as the sole Planning Committee Member.

There has been no residential or industrial development since the last plan update in 2020, and there are no development trends or expected areas of growth. Additionally, there are no major employers within the village limits.

The village has not submitted any approved projects for FEMA mitigation grants as of January 2025.

The village does not utilize any warning systems beyond personal citizen subscriptions to the National Weather Service or the use of private social media platforms. There are no designated public tornado shelters or safe rooms in the town. Lucerne does not participate in the National Flood Insurance Program (NFIP), as flooding is not considered a major concern in the village limits, and the surrounding area is mostly agricultural. The village did not identify any high potential loss facilities or concerns regarding transportation and lifelines that would impede its normal functions.

Mitigation Initiatives/Capabilities

The Village of Lucerne has very few ordinances in place.

The village has had limited mitigation activities due to limited capabilities. The village expanding its mitigation capabilities is unlikely due to limited capabilities, both financially and in terms of staff availability.

Table 2.11. Village of Lucerne mitigation capabilities

Capabilities	Status, Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	NA
Builder's Plan	NA
Capital Improvement Plan	NA
City Emergency Operations Plan	NA
County Emergency Operations Plan	Yes
Local Recovery Plan	NA
County Recovery Plan	NA
City Mitigation Plan	NA
County Mitigation Plan	Yes
Debris Management Plan	No
Economic Development Plan	No
Transportation Plan	NA
Land-use Plan	NA
Flood Mitigation Assistance (FMA) Plan	NA
Watershed Plan	No
Firewise or other fire mitigation plan	NA
School Mitigation Plan	NA
Critical Facilities Plan	NA
Policies/Ordinance	
Zoning Ordinance	NA
Building Code	NA
Floodplain Ordinance	NA
Subdivision Ordinance	NA
Tree Trimming Ordinance	NA
Nuisance Ordinance	NA
Stormwater Ordinance	NA
Drainage Ordinance	NA
Site Plan Review Requirements	NA
Historic Preservation Ordinance	NA
Landscape Ordinance	NA
Seismic Construction Ordinance	NA
Program	
Zoning/Land Use Restrictions	NA
Codes Building Site/Design	NA
Hazard Awareness Program	NA
National Flood Insurance Program (NFIP)	NA
NFIP Community Rating System (CRS) program	NA
National Weather Service (NWS) Storm Ready	No
Firewise Community Certification	NA
Building Code Effectiveness Grading (BCEGs)	NA
ISO Fire Rating	NA
Economic Development Program	NA
Land Use Program	NA
Public Education/Awareness	NA

Property Acquisition	NA
Planning/Zoning Boards	NA
Stream Maintenance Program	NA
Tree Trimming Program	NA
Engineering Studies for Streams (Local/County/Regional)	NA
Mutual Aid Agreements	Yes
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	NA
Hazard Analysis/Risk Assessment (County)	NA
Flood Insurance Maps	NA
FEMA Flood Insurance Study (Detailed)	NA
Evacuation Route Map	NA
Critical Facilities Inventory	NA
Vulnerable Population Inventory	NA
Land Use Map	NA
Staff/Department	
Building Code Official	NA
Building Inspector	NA
Mapping Specialist (GIS)	NA
Engineer	NA
Development Planner	NA
Public Works Official	NA
Emergency Management Director	NA
NFIP Floodplain Administrator	NA
Emergency Response Team	NA
Hazardous Materials Expert	NA
Local Emergency Planning Committee	NA
County Emergency Management Commission	NA
Sanitation Department	NA
Transportation Department	NA
Economic Development Department	NA
Housing Department	NA
Historic Preservation	NA
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	No
Local Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, etc.)	No
Local Funding Availability	
Apply for Community Development Block	No
Fund projects through Capital	No
Authority to levy taxes for a specific purpose	No
Fees for water, sewer, gas, or electric services	No
Impact fees for new development	No
Ability to incur debt through general obligation bonds	No
Ability to incur debt through special tax bonds	No
Ability to incur debt through private activities	No
Withhold spending in hazard prone areas	No

Source: Data Collection Questionnaire, 11/2025

2.2.5 Village of Livonia

The plat for the village of Livonia was originally laid out in May 1859 by Absalom Grogan, consisting of four blocks, each containing eight lots. Grogan also served as the town's first postmaster. Following his death, the post office was relocated about three miles north to the farm of Joseph Martin. The town, for all practical purposes, followed this move, and by 1888, the community included the post office, Martin's general store, Dan Kelly's blacksmith shop, and a population of around 15 residents. The United States Postal Service announced plans on July 26, 2011, to permanently close the Livonia post office as part of a nationwide restructuring plan.

Livonia is geographically located on Missouri Route N just north of US Route 136. The Putnam-Schuyler county line runs along the Chariton River just to the east of the town. Unionville is approximately 17 miles to the west via Route 136, and Lancaster is approximately eleven miles east in Schuyler County. According to the United States Census Bureau, the village has a total area of 0.27 square miles, all of which is land.

As of the 2023 census estimates, Livonia had a population of 13 people residing in 13 households. The resulting population density was 48 people per square mile. There were 27 housing units in the village, averaging a density of 100 per square mile. The racial makeup of the city was 100% White.

The average household size was 1, and the average family size was also 1. None of households had children under the age of 18 living with them, and none were married couples living together. 23% of households had a female householder with no partner present. 70% of households had someone living alone who was 65 years of age or older.

The population is entirely composed of adults over the age of 18, with nearly 70% of all persons being over 65 years old. The median age was 67 years. In the community for every 100 females, there were 333 males (meaning men outnumbered women by more than 3 to 1).

Data on the median income for a household in the village was unavailable. However, approximately 62% of the overall population were below the poverty line. Of the residents older than 65, nearly 78% were living below the poverty line. No residents were under the age of 18.

There are currently no major employers within the city limits. Furthermore, there has been no residential, commercial, or industrial development since the last plan update in 2020, with no development trends or new facilities expected in the next 5 years.

In terms of risk reduction, there are currently no past or ongoing projects or programs designed to reduce disaster losses, and no approved projects have been submitted for FEMA mitigation grants as of January 2025

Mitigation Initiatives/Capabilities

The City of Livonia has few ordinances in place due to it's extremely small size

The city has had limited mitigation activities due to limited capabilities. The city expanding its mitigation capabilities is unlikely due to limited capabilities, both financially and in terms of staff availability.

Table 2.12. Village of Livonia Mitigation Capabilities

Capabilities	Status, Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	NA
Capital Improvement Plan	NA
City Emergency Operations Plan	NA
County Emergency Operations Plan	Yes
Local Recovery Plan	NA
County Recovery Plan	Yes
City Mitigation Plan	No
County Mitigation Plan	Yes
Debris Management Plan	NA
Economic Development Plan	No
Transportation Plan	NA
Land-use Plan	NA
Flood Mitigation Assistance (FMA) Plan	NA
Watershed Plan	No
Firewise or other fire mitigation plan	NA
School Mitigation Plan	NA
Critical Facilities Plan	NA
Policies/Ordinance	
Zoning Ordinance	NA
Building Code	NA
Floodplain Ordinance	NA
Subdivision Ordinance	NA
Tree Trimming Ordinance	NA
Nuisance Ordinance	NA
Stormwater Ordinance	NA
Drainage Ordinance	NA
Site Plan Review Requirements	NA
Historic Preservation Ordinance	NA
Landscape Ordinance	NA
Seismic Construction Ordinance	NA
Program	
Zoning/Land Use Restrictions	NA
Codes Building Site/Design	NA
Hazard Awareness Program	NA
National Flood Insurance Program (NFIP)	NA
NFIP Community Rating System (CRS) program	NA
National Weather Service (NWS) Storm Ready	NA
Firewise Community Certification	NA
Building Code Effectiveness Grading (BCEGs)	NA
ISO Fire Rating	9
Economic Development Program	NA
Land Use Program	NA
Public Education/Awareness	NA
Property Acquisition	NA
Planning/Zoning Boards	NA
Stream Maintenance Program	NA
Tree Trimming Program	NA
Engineering Studies for Streams	NA

(Local/County/Regional)	
Mutual Aid Agreements	NA
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	No
Hazard Analysis/Risk Assessment (County)	Yes
Flood Insurance Maps	NA
FEMA Flood Insurance Study (Detailed)	NA
Evacuation Route Map	NA
Critical Facilities Inventory	NA
Vulnerable Population Inventory	NA
Land Use Map	No
Staff/Department	
Building Code Official	NA
Building Inspector	NA
Mapping Specialist (GIS)	NA
Engineer	NA
Development Planner	NA
Public Works Official	NA
Emergency Management Director	County
NFIP Floodplain Administrator	NA
Emergency Response Team	Fire
Hazardous Materials Expert	NA
Local Emergency Planning Committee	Yes
County Emergency Management Commission	No
Sanitation Department	NA
Transportation Department	NA
Economic Development Department	NA
Housing Department	NA
Historic Preservation	NA
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	No
Local Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, etc.)	No
Local Funding Availability	
Apply for Community Development Block	No
Fund projects through Capital	No
Authority to levy taxes for a specific purpose	No
Fees for water, sewer, gas, or electric services	No
Impact fees for new development	No
Ability to incur debt through general obligation bonds	No
Ability to incur debt through special tax bonds	No
Ability to incur debt through private activities	No
Withhold spending in hazard prone areas	No

Source: Data Collection Questionnaire, 11/2025

2.2.6 Village of Worthington

The village of Worthington was named after an early citizen of the community. A post office has been in operation in Worthington since 1902. Worthington is located on Missouri Route W, approximately one-half mile west of the Putnam-Schuyler county line, which is situated on the Chariton River. The community of Queen City, located in Schuyler County, is approximately 6.5 miles to the east, while the community of Martinstown, on Missouri Route 149, is four miles west. According to the United States Census Bureau, the village has a total area of 0.11 square miles, all of which is land.

As of the 2023 census estimates, Worthington had a population of 23 people residing in 8 households. The population density was 209 people per square mile. The village contained 20 housing units at an average density of 181 per square mile.

The racial makeup of the village was 100% White. The median household income was unavailable. However, the current poverty rate for the population is 61%.

The average household size was 2.88, and the average family size was also 2.88. 37% of households had children under the age of 18 living with them. 63% were married couples living together. 37% had a female householder with no partner present.

No households consisted only of one person aged 65 or older. The median age was 59.5 years old. The population was distributed across age groups with 48% under the age of 18 and 35% who were 65 or older. The gender ratio was significantly skewed towards males, with 130 males for every 100 females.

Mitigation Initiatives/Capabilities

The village of Worthington has few ordinances in place.

The city has had limited mitigation activities due to limited capabilities. The city expanding its mitigation capabilities is unlikely due to limited capabilities, both financially and in terms of staff availability.

Table 2.13. Village of Worthington Mitigation Capabilities

Capabilities	Status, Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	
Builder's Plan	
Capital Improvement Plan	
City Emergency Operations Plan	
County Emergency Operations Plan	
Local Recovery Plan	
County Recovery Plan	
City Mitigation Plan	
County Mitigation Plan	
Debris Management Plan	
Economic Development Plan	
Transportation Plan	
Land-use Plan	

Flood Mitigation Assistance (FMA) Plan	
Watershed Plan	
Firewise or other fire mitigation plan	
School Mitigation Plan	
Critical Facilities Plan	
Policies/Ordinance	
Zoning Ordinance	
Building Code	
Floodplain Ordinance	
Subdivision Ordinance	
Tree Trimming Ordinance	
Nuisance Ordinance	
Stormwater Ordinance	
Drainage Ordinance	
Site Plan Review Requirements	
Historic Preservation Ordinance	
Landscape Ordinance	
Seismic Construction Ordinance	
Program	
Zoning/Land Use Restrictions	
Codes Building Site/Design	
Hazard Awareness Program	
National Flood Insurance Program (NFIP)	
NFIP Community Rating System (CRS) program	
National Weather Service (NWS) Storm Ready	
Firewise Community Certification	
Building Code Effectiveness Grading (BCEGs)	
ISO Fire Rating	
Economic Development Program	
Land Use Program	
Public Education/Awareness	
Property Acquisition	
Planning/Zoning Boards	
Stream Maintenance Program	
Tree Trimming Program	
Engineering Studies for Streams (Local/County/Regional)	
Mutual Aid Agreements	
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	
Hazard Analysis/Risk Assessment (County)	
Flood Insurance Maps	
FEMA Flood Insurance Study (Detailed)	
Evacuation Route Map	
Critical Facilities Inventory	
Vulnerable Population Inventory	
Land Use Map	
Staff/Department	
Building Code Official	
Building Inspector	
Mapping Specialist (GIS)	
Engineer	
Development Planner	

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

Source: Data Collection Questionnaire, 11/2025

2.2.7 Summary of Jurisdictional Capabilities

Table 2.14. Mitigation Capabilities Summary Table

CAPABILITIES	Uninc. Putnam County	City of Unionville	City of Powersville	Village of Lucerne	Village of Livonia	Village of Worthington
Planning Capabilities						
Comprehensive Plan		No		NA	No	
Builder's Plan		NA		NA	NA	
Capital Improvement Plan		No		NA	NA	
City Emergency Operations Plan		No		NA	NA	
County Emergency Operations Plan		Yes		Yes	Yes	
Local Recovery Plan		Yes		NA	NA	
County Recovery Plan		NA		NA	Yes	
City Mitigation Plan		No		NA	No	
County Mitigation Plan		Yes		Yes	Yes	
Debris Management Plan		No		No	NA	
Economic Development Plan		No		No	No	
Transportation Plan		No		NA	NA	
Land-use Plan		NA		NA	NA	
Flood Mitigation Assistance (FMA) Plan		NA		NA	NA	
Watershed Plan		No		No	No	
Firewise or other fire mitigation plan		No		NA	NA	
School Mitigation Plan		NA		NA	NA	
Critical Facilities Plan		NA		NA	NA	
Policies/Ordinance						
Zoning Ordinance		Yes		NA	NA	
Building Code		Yes		NA	NA	
Floodplain Ordinance		Yes		NA	NA	
Subdivision Ordinance		NA		NA	NA	
Tree Trimming Ordinance		NA		NA	NA	
Nuisance Ordinance		NA		NA	NA	
Stormwater Ordinance		Yes		NA	NA	
Drainage Ordinance		No		NA	NA	
Site Plan Review Requirements		Yes		NA	NA	
Historic Preservation Ordinance		Yes		NA	NA	
Landscape Ordinance		NA		NA	NA	
Seismic Construction Ordinance		NA		NA	NA	
Program						
Zoning/Land Use Restrictions		NA		NA	NA	

CAPABILITIES	Uninc. Putnam County	City of Unionville	City of Powersville	Village of Lucerne	Village of Livonia	Village of Worthington
Codes Building Site/Design		Yes		NA	NA	
Hazard Awareness Program		NA		NA	NA	
National Flood Insurance Program (NFIP)		Yes		NA	NA	
NFIP Community Rating System (CRS) program		No		NA	NA	
National Weather Service (NWS) Storm Ready		No		No	NA	
Firewise Community Certification		No		NA	NA	
Building Code Effectiveness Grading (BCEGs)		NA		NA	NA	
ISO Fire Rating		7		NA	9	
Economic Development Program		NA		NA	NA	
Land Use Program		NA		NA	NA	
Public Education/Awareness		Yes		NA	NA	
Property Acquisition		NA		NA	NA	
Planning/Zoning Boards		No		NA	NA	
Stream Maintenance Program		NA		NA	NA	
Tree Trimming Program		NA		NA	NA	
Engineering Studies for Streams (Local/County/Regional)		NA		NA	NA	
Mutual Aid Agreements		Yes		Yes	NA	
Studies/Reports/Maps						
Hazard Analysis/Risk Assessment (Local)		NA		NA	No	
Hazard Analysis/Risk Assessment (County)		NA		NA	Yes	
Flood Insurance Maps		Yes		NA	NA	
FEMA Flood Insurance Study (Detailed)		NA		NA	NA	
Evacuation Route Map		NA		NA	NA	
Critical Facilities Inventory		No		NA	NA	
Vulnerable Population Inventory		No		NA	NA	
Land Use Map		NA		NA	No	
Staff/Department						
Building Code Official		Yes, FT		NA	NA	
Building Inspector		Yes		NA	NA	
Mapping Specialist (GIS)		No		NA	NA	
Engineer		No		NA	NA	
Development Planner		No		NA	NA	
Public Works Official		No		NA	NA	
Emergency Management Director		Yes		NA	County	
NFIP Floodplain Administrator		Yes		NA	NA	
Emergency Response Team		No		NA	Fire	
Hazardous Materials Expert		No		NA	NA	
Local Emergency Planning Committee		No		NA	Yes	
County Emergency Management Commission		No		NA	No	

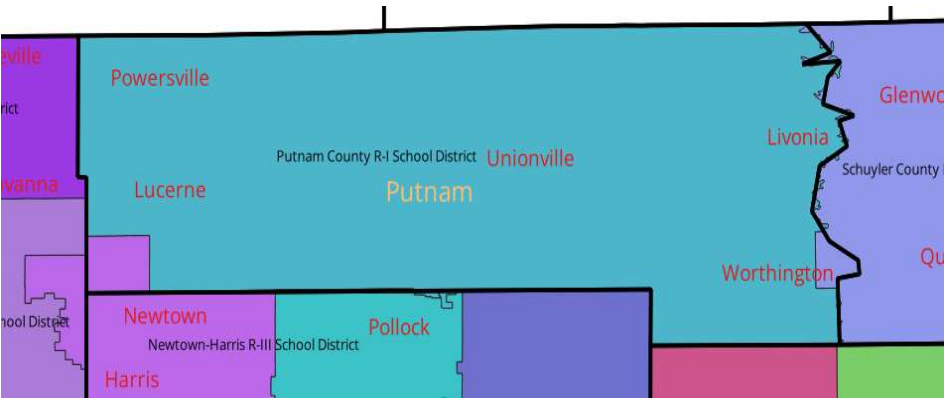
CAPABILITIES	Uninc. Putnam County	City of Unionville	City of Powersville	Village of Lucerne	Village of Livonia	Village of Worthington
Sanitation Department		Yes		NA	NA	
Transportation Department		No		NA	NA	
Economic Development Department		Yes, PT		NA	NA	
Housing Department		No		NA	NA	
Historic Preservation		Yes, PT		NA	NA	
Non-Governmental Organizations (NGOs)						
American Red Cross		No		No	No	
Salvation Army		No		No	No	
Veterans Groups		Yes		No	No	
Local Environmental Organization		No		No	No	
Homeowner Associations		No		No	No	
Neighborhood Associations		No		No	No	
Chamber of Commerce		No		No	No	
Community Organizations (Lions, Kiwanis, etc.)		Yes		No	No	
Financial Resources						
Apply for Community Development Block Grants		Yes		No	No	
Fund projects through Capital Improvements funding		Yes		No	No	
Authority to levy taxes for a specific purpose		Yes		No	No	
Fees for water, sewer, gas, or electric services		Yes		No	No	
Impact fees for new development		No		No	No	
Ability to incur debt through general obligation bonds		Yes		No	No	
Ability to incur debt through special tax bonds		Yes		No	No	
Ability to incur debt through private activities		Yes		No	No	
Withhold spending in hazard prone areas		No		No	No	

Source: Local questionnaires

2.2.8 Special District

2.2.9 School District Profiles and Mitigation Capabilities

Figure 2.3 Putnam County School district map



2.3 PUTNAM COUNTY R-I

803 South 20th, Unionville, MO, 63565

The school conducts severe weather and evacuation drills. Each school building is equipped with a PA system used for emergency announcements and staff also receive alerts through internal radio and phone systems.

Putnam County R-I is governed by a Board of Education consisting of the Board President and seven elected board members.

Putnam County R-I has done little to expand mitigation capabilities since the last plan update due to limited capabilities and has little planned in the way of expanding mitigation capabilities due to limited budget and resources.

Enrollment					
	Schools	Cert. Staff	Resident	Non-Res.	Total
Elementary Schools	1	32	296	0	296
Middle Schools	1	21	134	0	134
High Schools	1	27	175	0	175

Total:		80	605	0	605
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Table 2.15. Summary of Mitigation Capabilities, Putnam County Schools

Capability	Putnam County R-I
Planning Elements	
Master Plan/ Date	
Capital Improvement Plan/Date	
School Emergency Plan / Date	
Weapons Policy/Date	
Personnel Resources	
Full-Time Building Official (Principal)	
Emergency Manager	
Grant Writer	
Public Information Officer	
Financial Resources	
Capital Improvements Funding	
Local Funds	
General Obligation Bonds	
Special Tax Bonds	
Private Activities/Donations	
State and Federal Funds/Grants	
Other	
Public Education Programs	
Privately or Self- Insured?	
Fire Evacuation Training	
Tornado Sheltering Exercises	
Public Address/Emergency Alert System	
NOAA Weather Radios	
Lock-Down Security Training	
Mitigation Programs	
Tornado Shelter/Safe Room	
Campus Police	

2.4

3 RISK ASSESSMENT

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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.

The goal of the risk assessment is to estimate the potential loss in the planning area, including loss of life, personal injury, property damage, and economic loss, from a hazard event. The risk assessment process allows communities and school/special districts in the planning area to better understand their potential risk to the identified hazards. It will provide a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

This chapter is divided into four main parts:

- **Section 3.1 Hazard Identification** identifies the hazards that threaten the planning area and provides a factual basis for elimination of hazards from further consideration;
- **Section 3.2 Assets at Risk** provides the planning area’s total exposure to natural 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. This section also discusses areas of planned future development and any implications on risk/vulnerability;
- **Section 3.4 Hazard Profiles and Vulnerability Analysis** provides more detailed information about the hazards impacting the planning area. For each hazard, there are three sections: 1) Hazard Profile provides a general description and discusses the threat to the planning area, the geographic location at risk, potential Strength/Magnitude/Extent, previous occurrences of hazard events, probability of future occurrence, risk summary by jurisdiction, impact of future development on the risk; 2) Vulnerability Assessment further defines and quantifies populations, buildings, critical facilities, and other community/school or special district assets at risk to natural hazards; and 3) Problem Statement briefly summarizes the problem and develops possible solutions.

3.1 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.

Natural hazards can be complex, occurring with a wide range of intensities. Some events are instantaneous and offer no window of warning, such as earthquakes. Some offer a short warning in which to alert the public to take actions, such as tornadoes or severe thunderstorms. Others occur less frequently and are typically more expensive, with some warning time to allow the public time to prepare, such as flooding.

Each year there are increases in human-caused incidents, which can be just as devastating as natural disasters. For the purpose of this plan “human-caused hazards” are technological hazards and terrorism. These are distinct from natural hazards primarily in that they originate from human activity. In contrast, while the risks presented by natural hazards may be increased or decreased as a result of human activity, they are not inherently human-induced. The term “technological hazards” refers to the origins of incidents that can arise from human activities such as the manufacture, transportation, storage, and use of hazardous materials. For the sake of simplicity, this guide assumes that technological emergencies are accidental and that their consequences are unintended.

3.1.1 Review of Existing Mitigation Plans

The MPC previously developed a multi-jurisdiction Hazard Mitigation Plan dated May 3rd 2021, and Putnam County, along with the towns of Unionville, Powersville, Lucerne, Livonia, Worthington and The Putnam County R-I school district participated in the multi-jurisdictional county wide-plan. The 2021 Hazard mitigation Plan was consulted in development of the risk assessment and information included and updated where appropriate.

The MPC decided to include only natural hazards, as only natural hazards are required by federal regulation to be included. The only human-caused hazard that is included in this plan is Pandemic, due to the COVID-19 Emergency Disaster Declaration. All other human-caused and technological hazards were eliminated from further analysis due to these hazards, which are not necessary for plans to meet the requirements of the Disaster Mitigation Act of 2000.

Levee failure was excluded from the mitigation planning process as there are no mapped levees nor associated levee protected areas within or immediately upstream of Putnam County per the 2018 Missouri State Hazard Mitigation Plan.

Levee failure was excluded from the mitigation planning process as there are no mapped levees nor associated levee protected areas within or immediately upstream of Putnam County.

3.1.2 Review Disaster Declaration History

Disaster Declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government’s capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. If the disaster is so severe that both the local and state governments’ capacities are exceeded; a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

FEMA also issues emergency declarations, which are more limited in scope and do not include the long-term federal recovery programs of major disaster declarations. Determinations for declaration type are based on scale and type of damages and institutions or industrial sectors

affected.

Contact SEMA for list (Reference PRT B1-d). Give background for federal and/or state declarations, i.e. that Missouri State of Emergencies are Executive Orders (E.O.) signed by the Governor. For disasters, a State of Emergency could lead to a Federal Disaster Declaration. Since the last plan update, no non-federally declared events resulted in a significant event impacting the planning area

OR

E.O. XX-XX (list all applicable Executive Orders) resulted in a significant event impacting the planning area. If an Executive Order resulted in a Federal Disaster Declaration, the Federal Declaration will be listed in table XYZ.

Use this past Public Assistance and Disaster Declaration data when considering Mitigation Actions for the Mitigation Strategy.

Table 3.1. FEMA Disaster Declarations that included Putnam County, Missouri, 1965-Present

Disaster Number	Description	Declaration Date Incident Period	Individual Assistance (IA) Public Assistance (PA)
372	HEAVY RAINS, TORNADOES &	4/19/1973	IA PA
407	SEVERE STORMS & FLOODING	11/1/1973	IA PA
995	SEVERE STORMS & FLOODING	6/10/1993 - 7/9/1993	IA PA
1631	Severe Storms, Tornadoes, and Flooding	Mar 8, 2006 - Mar 13, 2006	IA PA
1736	SEVERE WINTER STORMS	12/6/2007 - 12/15/2007	PA
1773	SEVERE STORMS AND FLOODING	6/1/2008 – 8/13/2008	IA PA
1934	Severe Storms, Flooding, and Tornadoes	Jun 12, 2010 - Jul 31, 2010	PA
1961	Severe Winter Storm and Snowstorm	Jan 31, 2011 - Feb 5, 2011	PA
3017	DROUGHT	9/24/1976	PA
3232	HURRICANE KATRINA EVACUATION	8/29/2005 – 10/1/2005	PA
3281	SEVERE WINTER STORMS	12/18/2007 12/15/2007	PA
3303	SEVERE WINTER STORM	1/26/2009 – 1/28/2009	PA
3317	SEVERE WINTER STORM	1/31/2011 – 2/5/2011	PA
4200	SEVERE STORMS, TORNADOES, STRAIGHT-LINE	9/9/2014 – 9/10/2014	PA
4238	SEVERE STORMS, TORNADOES, STRAIGHT-LINE	5/15/2015 – 7/27/2015	PA
4451	Severe Storm(s)	4/29/2019 - 7/05/2019	PA
4490	Biological	1/2020 - 3/2021	IA PA

Source: Federal Emergency Management Agency, <https://www.fema.gov/data-visualization-summary-disaster-declarations-and-grants>

3.1.3 Research Additional Sources

Note that the only centralized source of data for many of the weather-related hazards is the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI). Although it is usually the best and most current source, there are limitations to the data which should be noted. The NCEI documents the occurrence of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce. In addition, it is a partial record of other significant meteorological events, such as record maximum or minimum temperatures or precipitation that occurs in connection with another event. Some information appearing in the NCEI may be provided by or gathered from sources outside the National Weather Service (NWS), such as the media, law enforcement and/or other government agencies, private companies, individuals, etc. An effort is made to use the best available information but because of time and resource constraints, information from these sources may be unverified by the NWS. Those using information from NCEI should be cautious as the NWS does not guarantee the accuracy or validity of the information.

The NCEI damage amounts are estimates received from a variety of sources, including those listed above in the Data Sources section. For damage amounts, the NWS makes a best guess using all available data at the time of the publication. Property and crop damage figures should be considered as a broad estimate. Damages reported are in dollar values as they existed at the time of the storm event. They do not represent current dollar values.

The database currently contains data from January 1950 to March 2024, as entered by the NWS. Due to changes in the data collection and processing procedures over time, there are unique periods of record available depending on the event type. The following timelines show the different time spans for each period of unique data collection and processing procedures.

1. Tornado: From 1950 through 1954, only tornado events were recorded.
2. Tornado, Thunderstorm Wind and Hail: From 1955 through 1992, only tornado, thunderstorm wind and hail events were keyed from the paper publications into digital data. From 1993 to 1995, only tornado, thunderstorm wind and hail events have been extracted from the Unformatted Text Files.
3. All Event Types (48 from Directive 10-1605): From 1996 to present, 48 event types are recorded as defined in NWS Directive 10-1605.

Note that injuries and deaths caused by a storm event are reported on an area-wide basis. When reviewing a table resulting from an NCEI search by county, the death or injury listed in connection with that county search did not necessarily occur in that county.

3.1.4 Hazards Identified

List the hazards that significantly impact the planning area and were chosen for further analysis in alphabetical order. Explain that not all hazards impact every jurisdiction. Insert a table providing a summary of the jurisdictions impacted by each hazard. Explain the symbols used, such as the fact that an “x” indicates the jurisdiction is impacted by the hazard, and a “-” indicates the hazard is not applicable to that jurisdiction. If there are variations in the assessed hazard risk for hazards that usually are area-wide in risk, such as thunderstorms, include the rationale for that variation. Example: a community with a high percentage of housing comprised of mobile homes could be more at risk to damages from a tornado. This information could be conveyed using footnotes to explanations at the bottom of the page. the plan MUST include a rationale for any natural hazards commonly recognized to impact the planning area that have been omitted. If there are hazards which do not impact a specific jurisdiction, this MUST be explicitly stated and rationalized here. If not, actions will need to be created to mitigate against all hazards for all jurisdictions.

Table 3.2. Hazards Identified for Each Jurisdiction

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	
Putnam County												
Unionville												
Powersville												
Lucerne												
Livonia												
Worthington												
Schools and Special Districts												
Putnam County R-I School												

3.1.5 Multi-Jurisdictional Risk Assessment

For this multi-jurisdictional plan, the risks are assessed for each jurisdiction where they deviate from the risks facing the entire planning area. The planning area is uniform, in terms of climate and topography, as well as building construction characteristics. Accordingly, the geographic areas of occurrence for weather-related hazards do not vary greatly across the planning area for most hazards. The city of Unionville is slightly more urbanized within the planning area and they have more assets that are vulnerable to the weather-related hazards and varied development trends impact future vulnerability.

Similarly, more rural areas have more assets (crops/livestock) that are vulnerable to animal/plant/crop disease. These differences are discussed in greater detail in the vulnerability sections of each hazard. The hazards that vary across the planning area in terms of risk include dam failure, flash flood, grass or wildland fire, river flood, flash flood, and sinkholes/land subsidence. Explain that these differences are detailed in each hazard profile under a separate heading.

3.2 ASSETS AT RISK

This section assesses the population, structures, critical facilities and infrastructure, and other important assets in the planning area that may be at risk to natural hazards. **Table 3.3** shows the total population, building count, estimated value of buildings, estimated value of contents and estimated total exposure to parcels by jurisdiction.

3.2.1 Total Exposure of Population and Structures

Unincorporated County and Incorporated Cities In the following three tables, population data is based on 2023 Census Bureau data. Building counts and building exposure values are based on parcel data developed by the State of Missouri Geographic Information Systems (GIS) database. This data, organized by County, is available on Google Drive through the link provided on the previous page.

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 in **Table 3.3**. Land values have been purposely excluded from consideration because land remains following disasters, and subsequent market devaluations are frequently short term and difficult to quantify.

Another reason for excluding land values is that state and federal disaster assistance programs generally do not address loss of land (other than crop insurance). It should be noted that the total valuation of buildings is based on county assessors' data which may not be current. In addition, government-owned properties are usually taxed differently or not at all and so may not be an accurate representation of true value. Note that public school district assets and special districts assets are included in the total exposure tables assets by community and county.

Table 3.3 shows the total population, building count, estimated value of buildings, estimated value of contents and estimated total exposure to parcels for the unincorporated county and each incorporated city. For multi-county communities, the population and building data may include data on assets located outside the planning area. **Table 3.4** that follows provides the building value exposures for the county and each city in the planning area broken down by usage type. Finally, **Table 3.5** provides the building count total for the county and each city in the planning area broken out by building usage types (residential, commercial, industrial, and agricultural).

Unincorporated County and Incorporated Cities

Table 3.3. Maximum Population and Building Exposure by Jurisdiction

Jurisdiction	2023 Annual Population Estimate	Building Count	Building Exposure (\$)	Contents Exposure (\$)	Total Exposure (\$)
Unincorporated Putnam	2828	7,369	\$199,546	\$100,332	\$299,877
Livonia	13	77	\$6,366	\$3,885	\$10,251
Lucerne	20	89	\$6,993	\$4,350	\$11,343
Powersville	66	73	\$6,868	\$3,872	\$10,741
Unionville	1,725	1,082	\$117,889	\$69,595	\$187,484
Worthington	23	24	\$2,635	\$1,314	\$3,948
Totals	4,675	8,714	\$340,672	\$183,536	\$542,208

Source: U.S. Bureau of the Census, Annual population estimates/ 5-Year American Community Survey 2023; Building Count and Building Exposure, Missouri GIS Database from SEMA Mitigation Management; Contents Exposure derived by applying multiplier to Building Exposure based on Hazus 6.0 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 3.4. Building Values/Exposure by Usage Type

Jurisdiction	Residential	Commercial	Industrial	Agricultural	Total
Unincorporated Putnam	\$172,548	\$12,570	\$992	\$13,436	\$199,546
Livonia	\$4,880	\$1,445	\$0	\$42	\$6,366
Lucerne	\$6,006	\$72	\$850	\$65	\$6,993
Powersville	\$5,881	\$72	\$0	\$56	\$6,868
Unionville	\$93,469	\$16,254	\$3,258	\$134	\$117,889
Worthington	\$2,628	\$0	\$0	\$7	\$2,635
Totals:	\$285,787	\$30,414	\$5,100	\$13,739	\$340,672

Source: Missouri GIS Database, SEMA Mitigation Management Section

Table 3.5. Building Counts by Usage Type

Jurisdiction	Residential Counts	Commercial Counts	Industrial Counts	Agricultural Counts	Total
Unincorporated Putnam	1379	174	14	5802	7369
Livonia	39	20	0	18	77
Lucerne	48	1	12	28	89
Powersville	47	1	0	24	73
Unionville	747	225	46	58	1082
Worthington	21	0	0	3	24

Totals:	2284	421	72	5933	8717
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Source: Missouri GIS Database, SEMA Mitigation Management Section; Public School Districts and Special Districts

Even though schools and special districts' total assets are included in the tables above, additional discussion is needed, based on the data that is available from the districts' completion of the Data Collection Questionnaire and district-maintained websites. The number of enrolled students at the participating public-school districts is provided in **Table 3.6** below. Additional information includes the number of buildings, building values (building exposure) and contents value (contents exposure). These numbers will represent the total enrollment and building count for the public school districts regardless of the county in which they are located.

Table 3.6. Population and Building Exposure by Jurisdiction-Public School Districts

Public School District	Enrolment	Building Count	Building Exposure (\$)	Contents Exposure (\$)	Total Exposure (\$)
Putnam County R-I District	621	3			

Source: [MCDS Portal | Missouri Department of Elementary and Secondary Education - MCDS \(mo.gov\)](#), select the file for the most recent year called "2024 Building Enrollment PK-12", filter the spreadsheet by selecting only the public school districts in the planning area. The Building Exposure, Contents Exposure, and Total Exposure amounts come from the completed Data Collection Questionnaires from Public School Districts. In general, the school districts obtain this information from their insurance coverage amounts.

3.2.2 Critical and Essential Facilities and Infrastructure

This section will include information from the Data Collection Questionnaire and other sources concerning the vulnerability of participating jurisdictions' critical, essential, high potential loss, and transportation/lifeline facilities to identified hazards. Definitions of each of these types of facilities are provided below.

- **Critical Facility:** Those facilities essential in providing utility or direction either during the response to an emergency or during the recovery operation.
- **Essential Facility:** Those facilities that if damaged, would have devastating impacts on disaster response and/or recovery.
- **High Potential Loss Facilities:** Those facilities that would have a high loss or impact on the community.
- **Transportation and lifeline facilities:** Those facilities and infrastructure critical to transportation, communications, and necessary utilities.

Table 3.7 includes a summary of the inventory of critical and essential facilities and infrastructure in the planning area. The list was compiled from the Data Collection Questionnaire as well as the following sources:

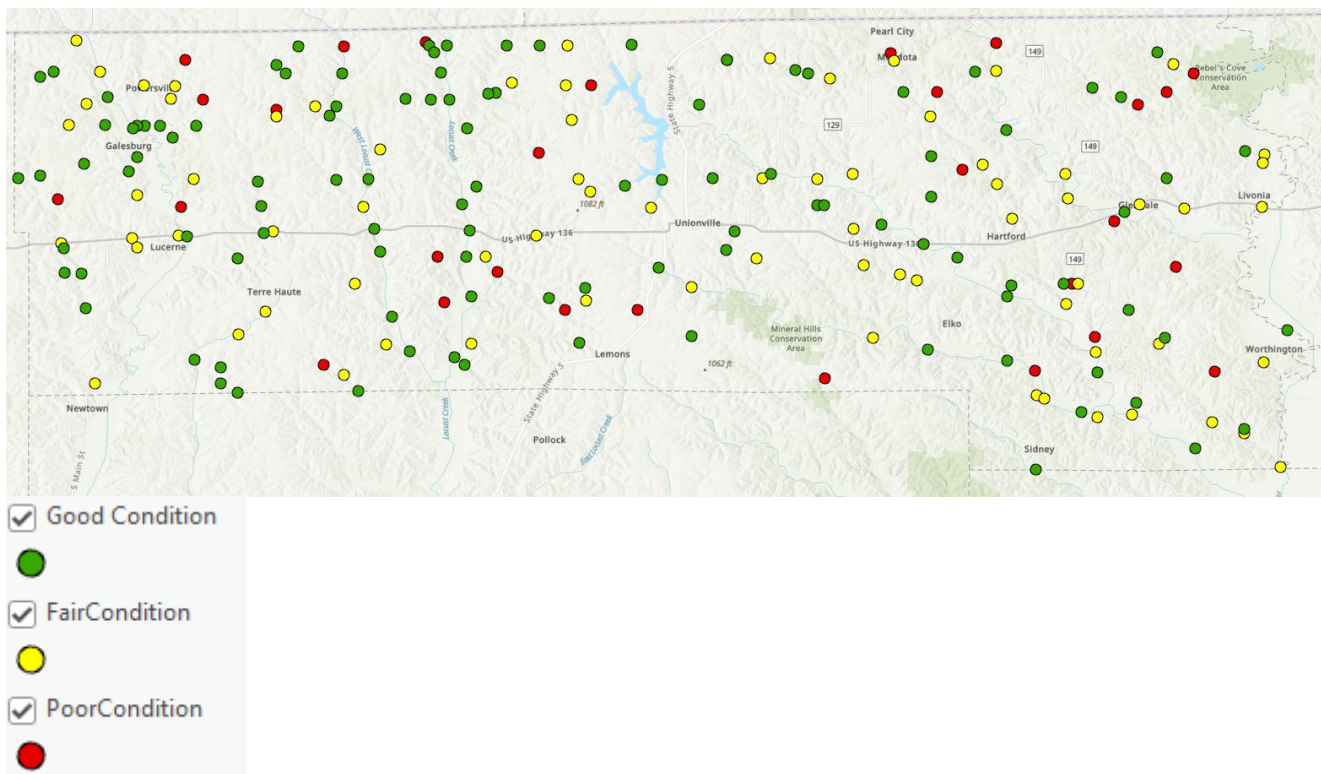
Table 3.7. Inventory of Critical/Essential Facilities and Infrastructure by Jurisdiction

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 Putnam																								
Livonia																								
Lucerne																								
Powersville																								
Unionville																								
Worthington																								
Totals																								

Source: Missouri 2023 State Hazard Mitigation Plan and Hazard Mitigation Viewer; Data Collection Questionnaires; Hazus, etc.

The term “scour critical” refers to one of the database elements in the National Bridge Inventory. This element is quantified using a “scour index”, which is a number indicating the vulnerability of a bridge to scour during a flood. Bridges with a scour index between 1 and 3 are considered “scour critical”, or a bridge with a foundation determined to be unstable for the observed or evaluated scour condition.

Figure 3.1. Putnam County Bridges



There is currently one structurally deficient or “scour critical” bridge located in Putnam County. It is not within city boundaries, rather it lies within the unincorporated area of Putnam County as seen in the following figure. (It is marked by a red circle).

Figure 3.2. Putnam County Scour Critical Bridges

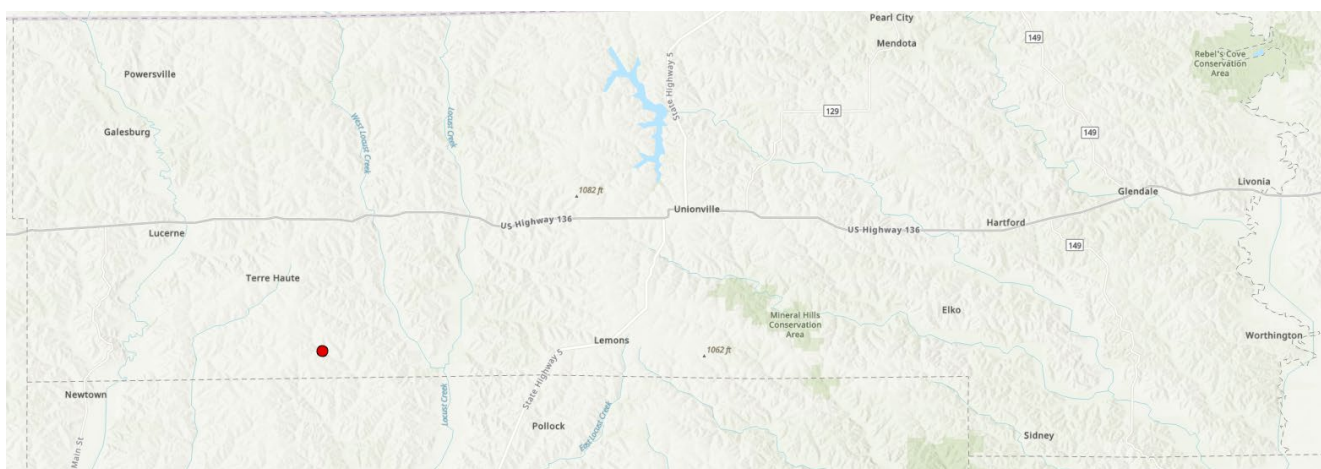


Table 3.8. Putnam County Bridges

County	All	Good	Fair	Poor	Scour Critical
Putnam	213	104	76	33	1

3.2.3 Other Assets

Assessing the vulnerability of the planning area to disaster also requires data on the natural, historic, cultural, and economic assets of the area. This information is important for many reasons.

- These types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- Knowing about these resources in advance allows for consideration immediately following a hazard event, which is when the potential for damages is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- The presence of natural resources can reduce the impacts of future natural hazards, such as wetlands and riparian habitats which help absorb floodwaters.
- Losses to economic assets like these (e.g., major employers or primary economic sectors) could have severe impacts on a community and its ability to recover from disaster.

Table 3.9. Threatened and Endangered Species in Putnam County

Common Name	Scientific Name	Status
Gray Bat	Myotis grisescens	Endangered
Indiana Bat	Myotis sodalis	Endangered
Northern Long-eared Bat	Myotis septentrionalis	Endangered
Tricolored Bat	Perimyotis subflavus	Proposed Endangered
Topeka Shiner	Notropis topeka (=tristis)	Endangered
Monarch Butterfly	Danaus plexippus	Proposed Threatened
Western Regal Fritillary	Argynnis idalia occidentalis	Proposed Threatened
Eastern Prairie Fringed Orchid	Platanthera leucophaea	Threatened
Mead's Milkweed	Asclepias meadii	Threatened
Western Prairie Fringed Orchid	Platanthera praeclara	Threatened

Source: U.S. Fish and Wildlife Service, [Listed Species \(fws.gov\)](https://www.fws.gov/); see also <https://ecos.fws.gov/ipac/> and select 'Get Started' > Step '1 Find Location', choose select by state or county and enter the county name, selecting the appropriate community > follow remaining on-screen instructions.

Missouri Department of Conservation (MDC) provides a database of lands the MDC owns, leases, or manages for public use. Use **Table 3.10** to provide the names and locations of parks and conservation areas in the planning area.

Table 3.10. Parks in Putnam County

Park / Conservation Area	Address	City
--------------------------	---------	------

Unionville City Park	801 S 20 th St.	Unionville
Rebel's Cove Conservation Area	North of Livonia	Coatsville, MO 63535
Union Ridge Conservation Area	2.5 miles north of Green Castle	Green Castle, MO
Mineral Hills Conservation Area	Unionville, Hwy 5 s 3mi, then HWY F, east 2.50 miles.	Unionville, MO
Marris Prairie Conservation Area	South 2.6 miles on HWY 5, east 6.7 miles on Route F, west on 25 th St. for 0.6 miles	Unionville Area
Mullanix Ford Access	6 miles on Route K west of Greentop to Chariton River Bridge	Greentop Area
Unionville (Lake Mohoney)	1 mile north of Unionville on HWY 5 then 1 mile west of Reservoir Trail	Unionville Area

Source: Missouri Department of Conservation; 2021 Putnam County HMP

Historic Resources: The National Register of Historic Places is the official list of registered cultural resources worthy of preservation. It was authorized under the National Historic Preservation Act of 1966 as part of a national program. The purpose of the program is to coordinate and support public and private efforts to identify, evaluate, and protect our historic and archeological resources. The National Register is administered by the National Park Service under the Secretary of the Interior. Properties listed in the National Register include districts, sites, buildings, structures and objects that are significant in American history, architecture, archeology, engineering, and culture. See **Figure 3.11** for historic places located in Putnam County

Table 3.11. Putnam County Properties on the National Register of Historic Places

Property	Address	City	Date Listed
Unionville Square Historic District	Roughly along portions of Main, Grant., 16th and 17th Sts.	Unionville	7/19/2002

Source: National Register of Historic Places – Spreadsheet of NRHP Listed Properties
<https://www.nps.gov/subjects/nationalregister/data-downloads.htm>

See table **3.12** for a list of major employers in Putnam county.

Table 3.12. Major Non-Government Employers in Putnam County

Employer Name	Main Locations	Product or Service	Employees

Source: Data Collection Questionnaires; local Economic Development Commissions

Agriculture is the primary industry in the planning area. **Table 3.13** lists the Agriculture related jobs in Putnam County.

Table 3.13. Agriculture-Related Jobs in Putnam County

Jurisdiction	Hired Farm Labor	Unpaid farm workers	Payroll
Putnam County	468	334	\$80,654
Missouri	40,576	68,022	\$585,141,000

Putnam County has approximately 150,873 acres of cropland and 89,408 acres of pastureland. The top crops by acres in Putnam County are Soybeans, which comprise over 46,000 acres, followed by Hay/Forage and Corn. Hogs and pigs make up the majority of livestock inventory, with over 150,000 animals. Cattle and calves number approximately 44,400 in the county.

Of the farms in Putnam County 96% are family owned and 70% have internet access. Of the total producers in Putnam County 668 are male and 339 are female. The following figures contain images of the 2022 Census of Agriculture for Putnam County.

Figure 3.3. 2022 Census of Agriculture of Putnam County (pg. 1)

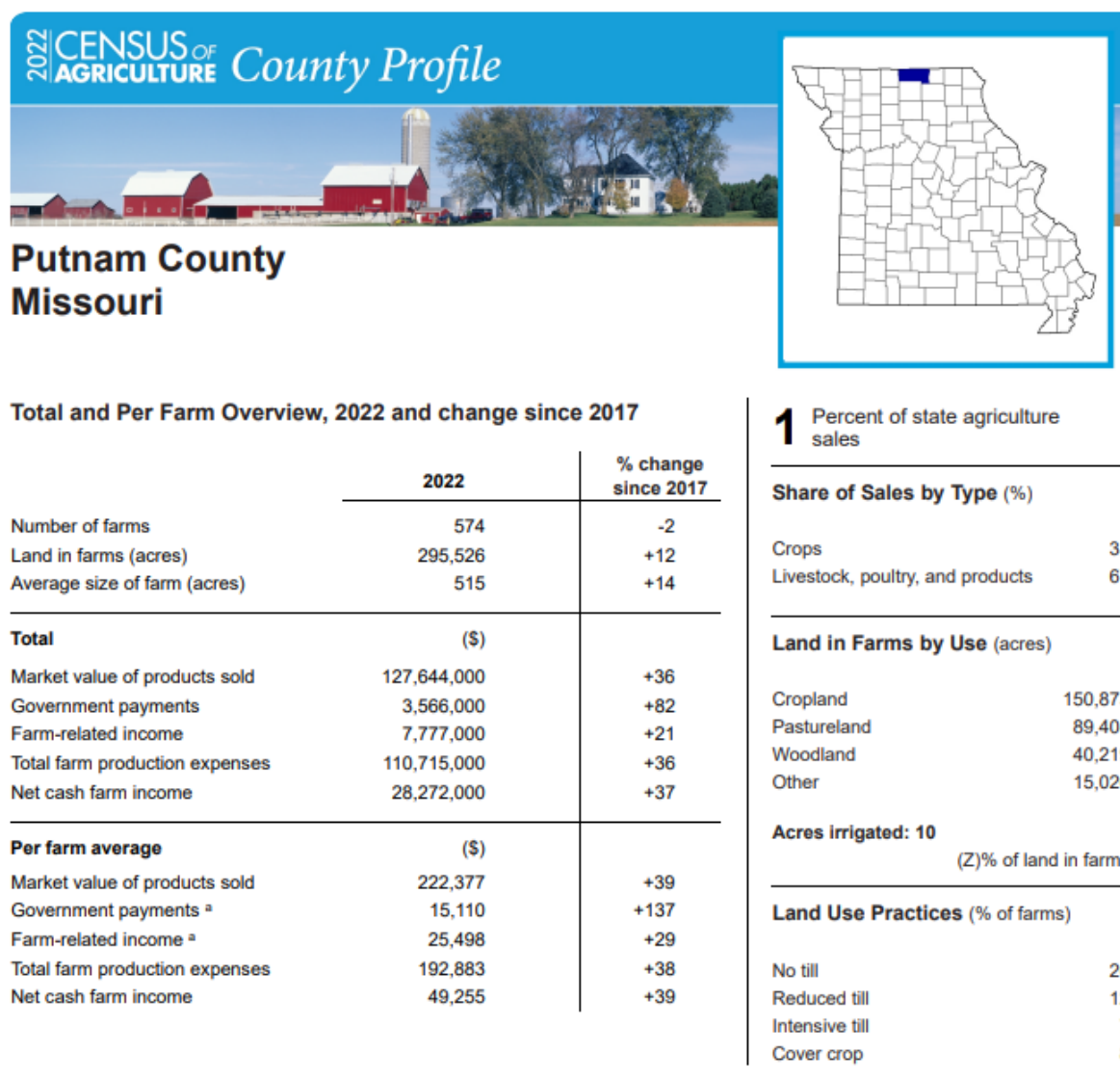


Figure 3.4. 2022 Census of Agriculture of Putnam County (pg. 2)

Market Value of Agricultural Products Sold

	Sales (\$1,000)	Rank in State ^c	Counties Producing Item	Rank in U.S. ^c	Counties Producing Item
Total	127,644	48	114	1,202	3,078
Crops	42,531	59	114	1,404	3,074
Grains, oilseeds, dry beans, dry peas	37,946	60	109	1,051	2,917
Tobacco	-	-	2	-	267
Cotton and cottonseed	-	-	7	-	647
Vegetables, melons, potatoes, sweet potatoes	147	51	112	1,597	2,831
Fruits, tree nuts, berries	(D)	93	112	(D)	2,711
Nursery, greenhouse, floriculture, sod	(D)	68	104	(D)	2,660
Cultivated Christmas trees, short rotation woody crops	-	-	36	-	1,274
Other crops and hay	4,371	11	114	785	3,035
Livestock, poultry, and products	85,113	22	114	760	3,076
Poultry and eggs	(D)	96	113	(D)	3,027
Cattle and calves	32,206	22	114	557	3,047
Milk from cows	(D)	(D)	84	(D)	1,770
Hogs and pigs	52,734	12	111	169	2,814
Sheep, goats, wool, mohair, milk	59	84	111	1,754	2,967
Horses, ponies, mules, burros, donkeys	38	85	113	1,942	2,907
Aquaculture	-	-	36	-	1,190
Other animals and animal products	(D)	84	106	(D)	2,909

Producers ^d	1,007	Percent of farms that:	Top Crops in Acres ^e
Sex			
Male	668	Have internet access	70
Female	339		
Age		Farm organically	(Z)
<35	104		
35 – 64	485	Sell directly to consumers	2
65 and older	418		
Race		Hire farm labor	22
American Indian/Alaska Native	-		
Asian	-	Are family farms	96
Black or African American	-		
Native Hawaiian/Pacific Islander	-		
White	1,005		
More than one race	2		
Other characteristics			
Hispanic, Latino, Spanish origin	3		
With military service	86		
New and beginning farmers	265		

Livestock Inventory (Dec 31, 2022)

Broilers and other meat-type chickens	(D)
Cattle and calves	44,466
Goats	359
Hogs and pigs	150,020
Horses and ponies	209
Layers	637
Pullets	162
Sheep and lambs	326
Turkeys	(D)

^a Average per farm receiving. ^b May not add to 100% due to rounding. ^c Among counties whose rank can be displayed. ^d Data collected for a maximum of four producers per farm. ^e Crop commodity names may be shortened; see full names at www.nass.usda.gov/go/croptypes.pdf. ^f Position below the line does not indicate rank. (D) Withheld to avoid disclosing data for individual operations. (NA) Not available. (Z) Less than half of the unit shown. (-) Represents zero.

USDA is an equal opportunity provider, employer, and lender.

3.3 LAND USE AND DEVELOPMENT

3.3.1 Development Since Previous Plan Update

Putnam County as a whole continues to see a slow and steady decline in population. Since the last

place update Communities have lost between 3 and 25% of their population. **Table 3.14** shows the population trends of Putnam County.

Table 3.14. County Population Growth, 2010-2023

Jurisdiction	Total Population 2010	Total Population 2023	2010-2023 # Change	2010-2023 % Change
Unincorp. Putnam	2817	2715	-102	-3.6%
Livonia	74	55	-19	-25%
Lucerne	85	56	-29	-34%
Powersville	58	43	-15	-26%
Unionville	1859	1709	-150	-8.0%
Worthington	81	60	-21	-26%

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

The population decline is generally accompanied by decreases in the number of housing units. Table (**Table 3.15**) provides the change in the numbers of housing units in the planning area from 2010 to 2020.

Table 3.15. Change in Housing Units, 2010-2020

Jurisdiction	Housing Units 2010	Housing Units 2020	2010-2020 # Change	2010-2020 % Change
Unincorp. Putnam	1770	1763	-7	-3.9%
Livonia	47	21	-26	-55%
Lucerne	51	41	-10	-20%
Powersville	53	41	-12	-23%
Unionville	1009	949	-60	-5.9%
Worthington	52	20	-32	-62%

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

3.3.2 Future Land Use and Development

Putnam County and the participating jurisdictions are in a very rural area of northern Missouri, and it is very difficult to attract new development due to the inability to attract new employers to the area. In fact, the population of Putnam County and participating jurisdictions have been declining steadily for at least the last 10 years. Due to a lack of population growth there has been little in the way of new developments. No new development is expected to occur in known hazard areas, and no new facilities or infrastructure is planned for construction within the next five years.

3.4 HAZARD PROFILES, VULNERABILITY, AND PROBLEM STATEMENTS

Each hazard will be analyzed individually in a hazard profile. The profile will consist of a general hazard description, location, strength/magnitude/extent, previous events, future probability, a discussion of risk variations between jurisdictions, and how anticipated development could impact risk. At the end of each hazard profile will be a vulnerability assessment, followed by a summary problem statement.

Hazard Profiles

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.

The level of information presented in the profiles will vary by hazard based on the information available. With each update of this plan, new information will be incorporated to provide better evaluation and prioritization of the hazards that affect the planning area. Detailed profiles for each of the identified hazards and the impact of Climate Change” to Changing Future Conditions Considerations in all of the hazard profiles. Include information categorized as follows:

Hazard Description: This section consists of a general description of the hazard and the types of impacts it may have on a community or school/special district.

Geographic Location: This section describes the geographic areas in the planning area that are affected by the hazard. Where available, use maps to indicate the specific locations of the planning area that are vulnerable to the subject hazard. For some hazards, the entire planning area is at risk.

Strength/Magnitude/Extent: This includes information about the strength, magnitude, and extent of a hazard. For some hazards, this is accomplished with a description of a value on an established scientific scale or measurement system, such as an EF2 tornado on the Enhanced Fujita Scale. This section should also include information on the typical or expected strength/magnitude/extent of the hazard in the planning area. Strength, magnitude, and extent can also include the speed of onset and the duration of hazard events. Describing the strength/magnitude/extent of a hazard is not the same as describing its potential impacts on a community. Strength/magnitude/extent defines the characteristics of the hazard regardless of the people and property it affects.

Previous Occurrences: This section includes available information on historic incidents and their impacts. Historic event records form a solid basis for probability calculations.

Probability of Future Occurrence: The frequency of recorded past events is used to estimate the likelihood of future occurrences. Probability can be determined by dividing the number of recorded events by the number of years of available data and multiplying by 100. This gives the percent chance of the event happening in any given year. For events occurring more than once annually, the probability should be reported as 100% in any given year, with a statement of the average number of events annually. For hazards such as drought that may have gradual onset and extended duration, probability can be based on the number of months in drought in a given time-period and expressed as the probability for any given month to be in drought.

- **Changing Future Conditions Considerations:**

In addition to the probability of future occurrence, changing future conditions should also be considered, including the effects of long-term changes in weather patterns and climate on the identified hazards. NOAA has a new tool that can provide useful information for this purpose.

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.

Requirement §201.6(c)(2)(ii): (As of October 1, 2008) [The risk assessment] must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged in floods.

Following the hazard profile for each hazard will be the vulnerability assessment. The vulnerability assessment further defines and quantifies populations, buildings, critical facilities, and other community assets at risk to damages from natural hazards. The vulnerability assessments should be based on the best available data. The vulnerability assessments can also be based on data that was collected for the 2023 State Hazard Mitigation Plan Update. With the 2023 Hazard Mitigation Plan Update, SEMA is pleased to provide online access to the risk assessment data and associated mapping for the 114 counties in the State, including the independent City of St. Louis. Through the web-based Missouri Hazard Mitigation Viewer, local planners or other interested parties can obtain all State Plan datasets. This effort removes from local mitigation planners a barrier to performing all the needed local risk assessments by providing the data developed during the 2023 State Plan Update.

The vulnerability assessments in the County plan will also be based on:

- Written descriptions of assets and risks provided by participating jurisdictions;
- Existing plans and reports;
- Personal interviews with planning committee members and other stakeholders; and
- Other sources as cited.

- **Vulnerability Overview:**

The plan provides an overall summary of each jurisdiction's vulnerability to the identified hazards. The overall summary of vulnerability identifies structures, systems, populations or other community assets as defined by the community that are susceptible to damage and loss for hazard events.

(Reference PR TB1-e, B2-a)

- **Potential Losses to Existing Development:**

The plan describes the potential impacts of the hazard. Impact means the consequences of effect of the hazard on the jurisdiction and its assets. Assets are determined by the community and include, for example, people, structures, facilities, systems, capabilities, and/or activities that have

value to the community. For example, impacts could be described by referencing historical disaster impacts and/or an estimate of potential future losses.

- **Previous and Future Development:**

This section will include information on how changes in development have impacted the community's vulnerability to this hazard. Describe how any changes in development that occurred in known hazard prone areas since the previous plan have increased or decreased the community's vulnerability. Describe any anticipated future development in the county, and how that would impact hazard risk in the planning area.

- **Hazard Summary by Jurisdiction:**

For hazard risks that vary by jurisdiction, this section will provide an overview of the variation and the factual basis for that variation.

Problem Statements

Each hazard analysis concludes with a brief summary of the problems created by the hazard in the planning area, and possible ways to resolve those problems. Including jurisdiction-specific information in those cases where the risk varies across the planning area. The focus of the problem statements sub-section is to synthesize the "problems" revealed through the risk assessment and then through the process of updating the mitigation strategy, develop mitigation actions that are aimed at "solving" the identified problems.

3.4.1 Flooding (Riverine and Flash)

Hazard Profile

Hazard Description

A flood is partial or complete inundation of normally dry land areas. Riverine flooding is defined as the overflow of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt, or ice. There are several types of riverine floods, including headwater, backwater, interior drainage, and flash flooding. Riverine flooding is defined as the overflow of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt or ice melt. The areas adjacent to rivers and stream banks that carry excess floodwater during rapid runoff are called floodplains. A floodplain is defined as the lowland and relatively flat area adjoining a river or stream. The terms “base flood” and “100- year flood” refer to the area in the floodplain that is subject to a one percent or greater chance of flooding in any given year. Floodplains are part of a larger entity called a basin, which is defined as all the land drained by a river and its branches.

Flooding caused by dam failure is discussed in Section 3.4.2. It will not be addressed in this section.

A flash flood occurs when water levels rise at an extremely fast rate as a result of intense rainfall over a brief period, sometimes combined with rapid snowmelt, ice jam release, frozen ground, saturated soil, or impermeable surfaces. Flash flooding can happen in Special Flood Hazard Areas (SFHAs) as delineated by the National Flood Insurance Program (NFIP) and can also happen in areas not associated with floodplains.

Ice jam flooding is a form of flash flooding that occurs when ice breaks up in moving waterways and then stacks on itself where channels narrow. This creates a natural dam, often causing flooding within minutes of dam formation.

In some cases, flooding may not be directly attributable to a river, stream, or lake overflowing its banks. Rather, it may simply be the combination of excessive rainfall or snowmelt, saturated ground, and inadequate drainage. With no place to go, the 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.

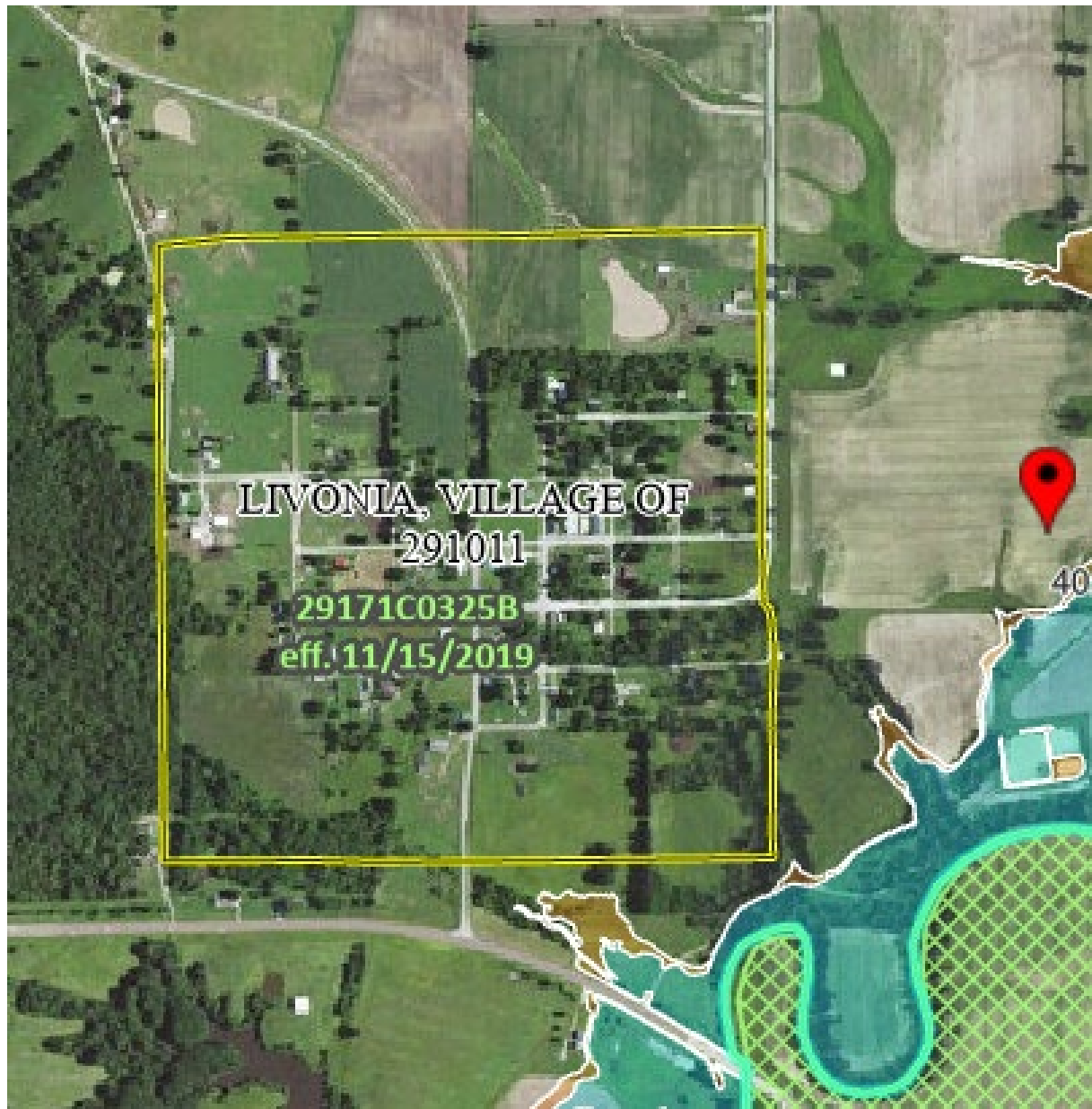
Most flash flooding is caused by slow-moving thunderstorms or thunderstorms repeatedly moving over the same area. Flash flooding is a dangerous form of flooding which can reach full peak in only a few minutes. Rapid onset allows little or no time for protective measures. Flash flood water moves at very fast speeds and can move boulders, tear out trees, scour channels, destroy buildings, and obliterate bridges. Flash flooding can result in higher loss of life, both human and animal, than slower developing river and stream flooding.

In certain areas, aging storm sewer systems are not designed to carry the capacity currently needed to handle the increased storm runoff. Typically, the result is water backing into basements, which damages mechanical systems and can create serious public health and safety concerns. This combined with rainfall trends and rainfall extremes all demonstrate the high probability, yet generally unpredictable nature of flash flooding in the planning area.

Although flash floods are somewhat unpredictable, there are factors that can point to the likelihood of flash floods occurring. Weather surveillance radar is being used to improve monitoring capabilities of intense rainfall. This, along with knowledge of the watershed characteristics, modeling techniques, monitoring, and advanced warning systems has increased the warning time for flash floods.

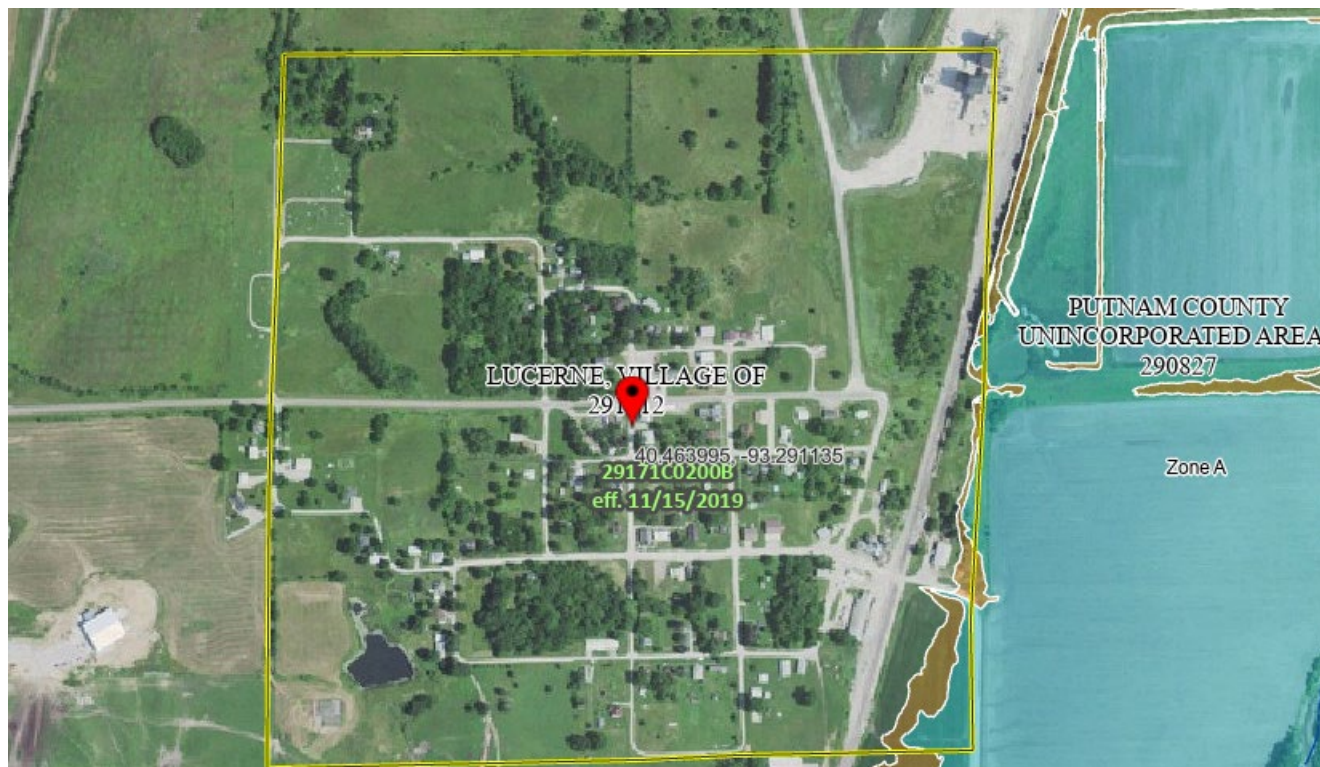
Geographic Location

Figure 3.5. Livonia FIRM



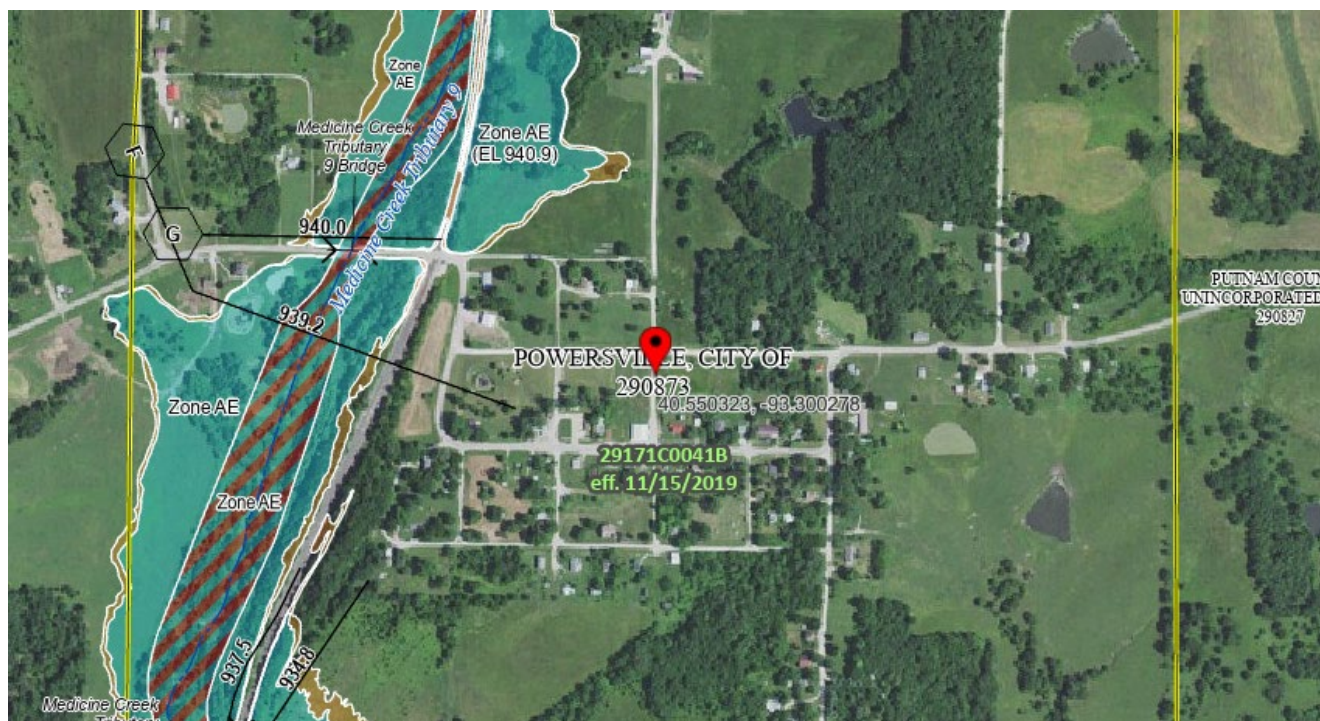
Source : <http://msc.fema.gov>

Figure 3.6. Lucerne FIRM



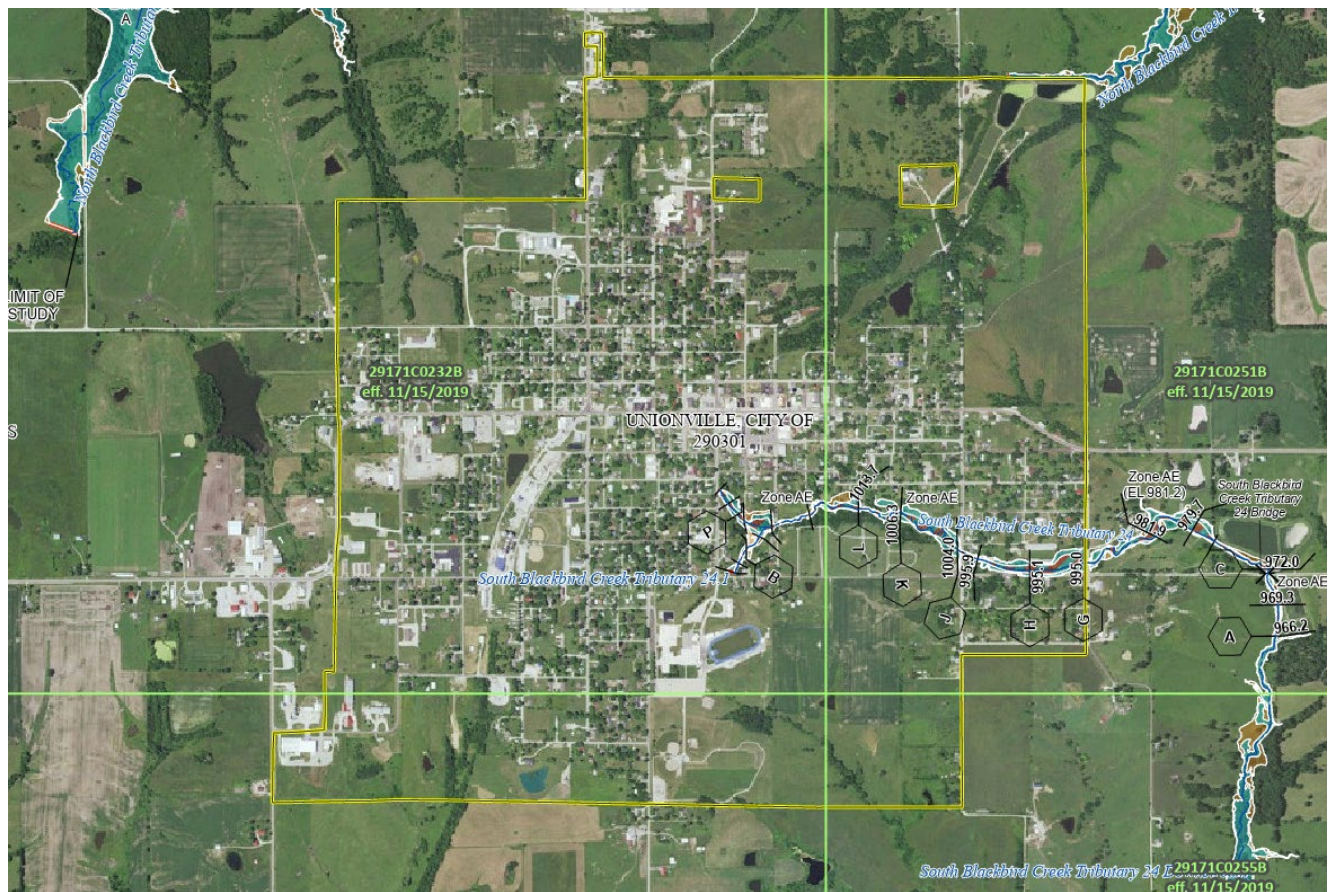
Source : <http://msc.fema.gov>

Figure 3.7. Powersville FIRM



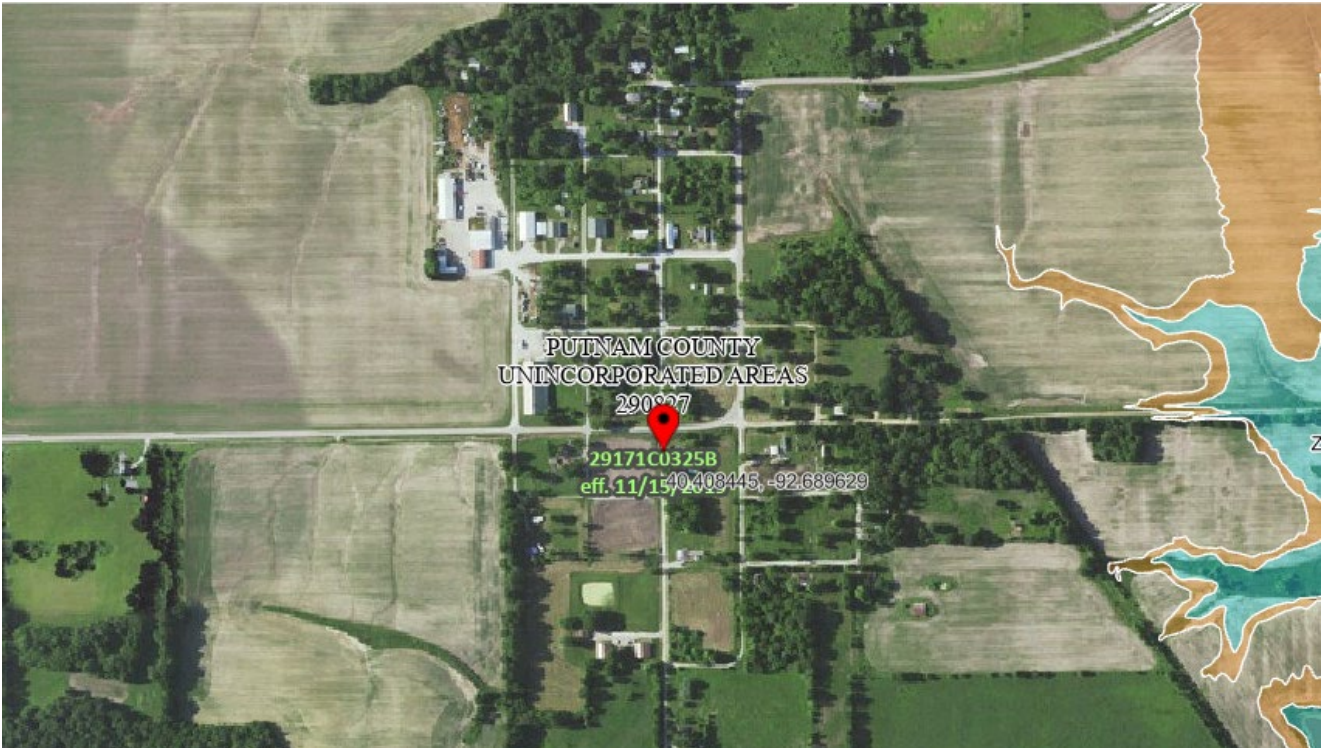
Source : <http://msc.fema.gov>

Figure 3.8. Unionville FIRM



Source : 1 <http://msc.fema.gov>

Figure 3.9. Worthington FIRM



Source: <http://msc.fema.gov>

Ravine flooding is most likely to occur along main streams and creeks in Putnam Couty, **Table 3.16** shows 1 reported event of ravine flooding in Putnam County since 2000.

Table 3.16. Putnam County NCEI Flood Events by Location, 2000-2025

Location	# of Events
Unincorporated Putnam County	1
-Unincorporated Putnam County (Mendota)-1 flood event	

Source: National Centers for Environmental Information, 8-2025

Flash flooding is much more likely in Putnam Couty and may occur over virtually any portion of the county. Table 3.17 shows 21 different flash flood events since 2000. The Mendota area of Putnam County has experienced the most flash flooding events with 4 since 2000.

Table 3.17. Putnam County NCEI Flash Flood Events by Location, 2000-2025

Location	# of Events
Unincorporated Putnam County	16
-Unincorporated Putnam County (Lemons)- 3 flood events	
-Unincorporated Putnam County (Mendota)-5 flood events	
-Unincorporated Putnam County (Howland)-2 flood events	
-Unincorporated Putnam County (Glendale)- 1 flood event	
-Unincorporated Putnam County (Esper)- 1 flood event	
-Unincorporated Putnam County (West Liberty)-2 flood events	
-Unincorporated Putnam County (Quinn)-1 flood event	
-Unincorporated Putnam County (Chapel)-1 flood event	
City of Powersville	

-City of Powersville (unspecified)- 2 flood events	2
City of Unionville	4
-City of Unionville (unspecified)-4 flood events	
Total	17

Source : National Centers for Environmental Information, 8-2025

Strength/Magnitude/Extent

Missouri has a long and active history of flooding over the past century, according to the 2023 State Hazard Mitigation Plan. Flooding along Missouri's major rivers generally results in slow-moving disasters. River crest levels are forecast several days in advance, allowing communities downstream sufficient time to take protective measures, such as sandbagging and evacuations. Nevertheless, floods exact a heavy toll in terms of human suffering and losses to public and private property. By contrast, flash flood events in recent years have caused a higher number of deaths and major property damage in many areas of Missouri.

According to the U.S. Geological Survey, two critical factors affect flooding due to rainfall: rainfall duration and rainfall intensity – the rate at which it rains. These factors contribute to a flood's height, water velocity and other properties that reveal its magnitude.

National Flood Insurance Program (NFIP) Participation

The following table illustrates the participants in the NFIP. Participation in the NFIP has the goal of reducing the impact of flooding on private and public structures. The NFIP does so by providing affordable insurance to property owners and by encouraging communities to adopt and enforce floodplain management regulations. These efforts help mitigate the effects of flooding on new and improved structures. The jurisdictions that participate in the NFIP in Chariton County are listed below, the floodplain ordinance that each jurisdiction has currently can be found in Appendix E, if they were provided for the plan.

Table 3.18. NFIP Participation in Putnam County – Ordinance and Enforcement Information

Community ID #	Community Name	NFIP Participant (Y/N/Sanctioned)	Adoption Date of Current Flood Damage Prevention Ordinance	Floodplain Administrator and/or Agency
290301A	UNIONVILLE	Yes		
291012A	LUCERNE	No		
290873A	POWERSVILLE	No		
290827A	PUTNAM COUNTY	No		
291011A	Village of Livonia	No		

Source: NFIP Community Status Book, 1-2025; PIVOT (information from STATE) [Community Status Book | FEMA.gov](#); M= No elevation determined – all Zone A, C, and X: NSFHA = No Special Flood Hazard Area; E=Emergency Program

Table 3.19. NFIP Participation in Putnam County- Mapping Information

Community ID #	Community Name	Current Effective Map Date	Regular- Emergency Program Entry Date
290301A	UNIONVILLE	11/15/19	
291012A	LUCERNE	11/15/19	

290873A	POWERSVILLE	11/15/19	
290827A	PUTNAM COUNTY	11/15/19	

Source: NFIP Community Status Book, 2-2025; PIVOT (information from STATE) [Community Status Book | FEMA.gov](#); M= No elevation determined – all Zone A, C, and X: NSFHA = No Special Flood Hazard Area; E=Emergency Program

According to the information obtained from SEMA, there was one closed loss in the City of Unionville in Putnam County. The total paid was \$3,122.06. The jurisdictions that participate in the NFIP have adopted Floodplain Ordinances that establish regulations for construction, development, and substantial improvements within floodplain areas.

These regulations mandate the acquisition of floodplain development permits and elevation certificates to ensure that all projects comply with these standards. Records and documentation for all floodplain development is kept in adherence to FEMA regulations and the designated floodplain administrator of each jurisdiction maintains these records.

Substantial improvements/ substantial damage provisions are implemented after an event through the Floodplain Ordinance of participating jurisdictions. Each jurisdiction that participates in the NFIP has addressed the specific requirements of FEMA regarding substantial damage/substantial improvement provisions and development in SFHA. The Floodplain Ordinances that were made available for inclusion in this plan can be found in **Appendix E**.

Table 3.20. NFIP Policy and Claim Statistics as of Date

Community Name	Policies in Force	Insurance in Force	Closed Losses	Total Payments
Putnam County				
UNIONVILLE				
LUCERNE				
POWERSVILLE				

Source: NFIP Community Status Book, [insert date]; PIVOT (information from STATE), [Community Status Book | FEMA.gov](#)

*Closed Losses are those flood insurance claims that resulted in payment. Loss statistics are for the period from [date] to [date].

The City of Unionville is the only jurisdiction with a record of paid losses. There has been 1 paid loss in the amount of \$3,122.06.

Repetitive Loss/Severe Repetitive Loss Properties

Repetitive Loss Properties are those properties with at least two flood insurance payments of \$1,000 or more in a 10-year period. According to the Flood Insurance Administration, jurisdictions included in the planning area have a combined total of 0 repetitive loss properties.

A SRL property is defined it as a single family property (consisting of one-to-four residences) 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 such claims 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. There are no severe repetitive loss properties in the planning area.

Previous Occurrences

Flood events, as reported in the NOAA (National Oceanic and Atmospheric Administration) storm events database were reviewed. There were 22 flood events in the planning area between 2000 and

2024. Of these 21 were reported as flash flood events and 1 was reported as riverine events. In addition, Putnam County has been included in 6 Presidential disaster declarations that included flooding between 1973 and 2025. Historical accounts of flooding events are recorded below. Sources include the NOAA database, FEMA, local news, and planning committee member accounts.

Table 3.21. NCEI Putnam County Flash Flood Events Summary, 2000 to 2024

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Crop Damages
2004	4	0	0	0	0
2008	4	0	0	0	0
2009	3	0	0	0	0
2010	3	0	0	0	0
2014	1	0	0	0	0
2015	1	0	0	0	0
2019	6	0	0	0	0

Source: NCEI, 1-2025

Table 3.22. Putnam County Flash Flood Event Narratives, 2000-2025

Begin Date	Event Narrative
5/30/2004	Route 129 closed 9 miles north of Highway 136.
8/27/2004	Water covering road at intersection of State Route HH and 5.
8/27/2004	Southbound Highway 5 closed due to high water.
8/27/2004	State Route UU and Highway 136 flooded.
6/3/2008	Highway 129 was closed in Mendota due to high water.
7/8/2008	Route 129 near the Iowa border was closed due to high water.
7/25/2008	State Route 129 was closed at Shoal Creek, due to high water.
7/25/2008	State Route Y was closed due to high water at Blackbird Creek.
5/15/2009	State Route 129 was closed near Mendota.
5/15/2009	State Route 129 was closed due to flooding.
5/15/2009	State Route M was closed due to flooding.
7/20/2010	State Highway Y was closed due to flooding along Blackbird Creek.
7/20/2010	State Highway M was closed due to flooding along Medicine Creek.
7/20/2010	State Highway 129 along Shoal Creek was closed due to flooding.
6/3/2014	Roads flooded in town. Water was up to the back door of some homes.
6/24/2015	High water shut down numerous roads in Worthington and Livonia.
5/28/2019	After several hours of heavy rain several roads were washed out in and around Unionville. Some vehicles were washed into a creek in Unionville. Damage estimates are unknown.
5/28/2019	After several hours of rain several roads and bridges were washed out. One such bridge was along HWY 192 north of HWY 136. Damage estimates are unknown.
5/28/2019	After several hours of heavy rain, significant flooding occurred in Putnam County, including a bridge being washed out on Road YY, just north of HWY 136. Damage estimates are unknown.
5/28/2019	After several hours of heavy rain several roads were washed out in Putnam County. One such road was HWY HH where a bridge was damaged or washed out. Damage estimates are unknown.
5/28/2019	After several hours of heavy rain several roads were washed out including HWY H near 190th Street. Damage estimates are unknown.
5/28/2019	After several hours of heavy rain Redwood Trail north of Livonia was washed out. Damage estimates are unknown.

Putnam County has been granted more than 5.5 million dollars in public assistance funds since 1973 due to flooding or heavy rain events. A review of the data does not indicate that any area suffers from greater losses than another.

Table 3.23. NCEI Putnam County Riverine Flood Events Summary, 2000 to 2024

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Crop Damages
2017	1	0	0	0	0

Source: NCEI, 1-2025

Table 3.24. Putnam County Flood Event Narratives, 2000 to 2025

Begin Date	Event Narrative
4/5/2017	State Route 129 was closed due to flooding by nearby creeks.

The following figure, taken from the Missouri State Hazard Mitigation Plan of 2023, contains information about previously declared presidential disaster declarations for flooding since 1973. According to information obtained from FEMA, Putnam County has had 6 such declared disasters related to flooding.

Figure 3.10. Missouri presidential disaster declarations for flooding since 1973

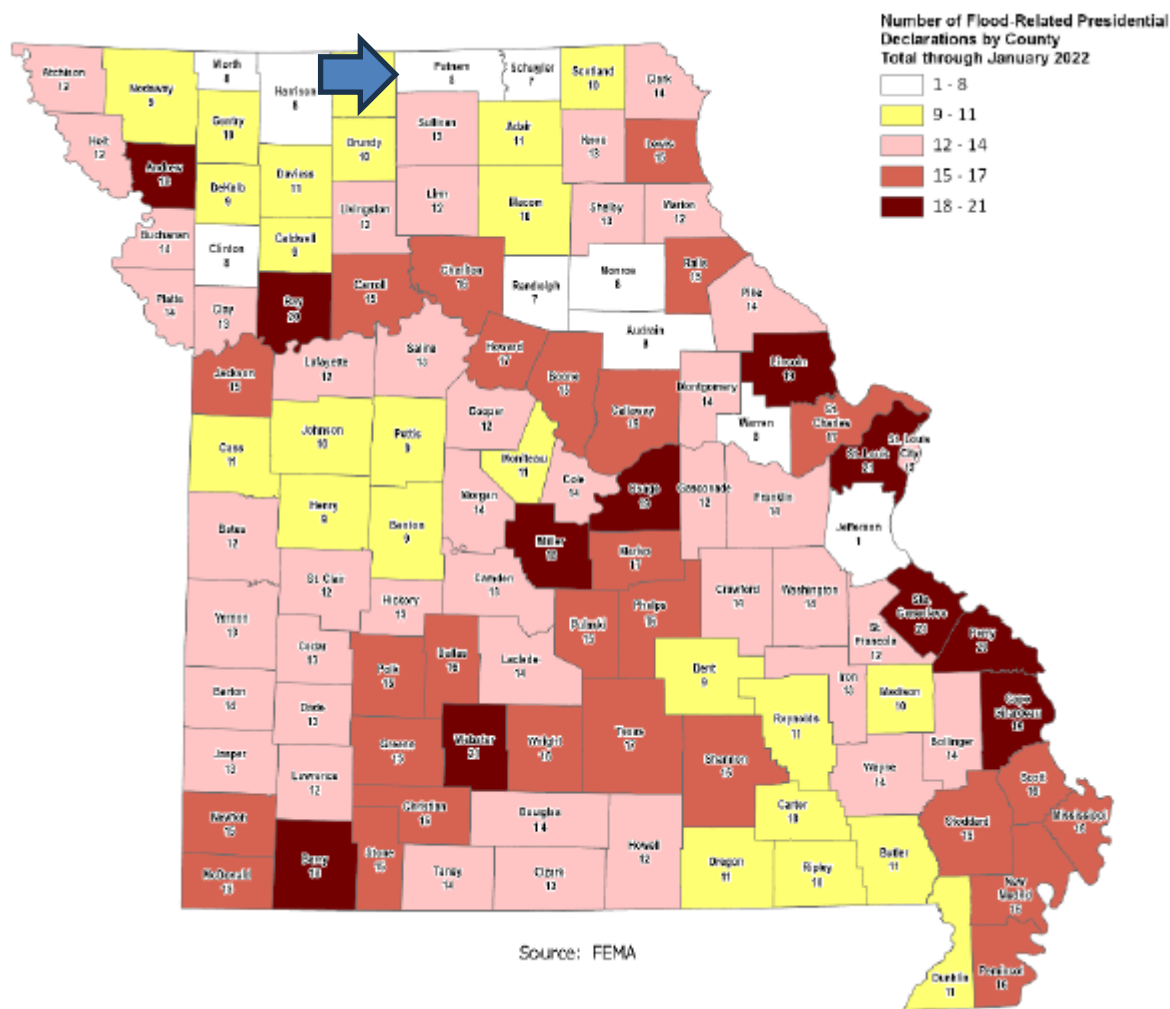


Table 3.25. Flooding Disaster Declarations in Chariton County (1973-2024)

Disaster Number	Declaration Date	Incident Subcategory	Information
372	4/19/1973	Heavy Rains, Tornadoes, Flooding	Heavy Rains, Tornadoes, Flooding
407	11/1/1973	Severe storms	Severe storms and flooding
995	7/9/1993	Flood	Flooding and severe storms
1631	3/6/2006	Flooding	Severe storms
1773	6/25/2008	Flooding	Severe storms and Flooding
1934	8/17/2010	Flooding	Tornadoes, severe storms and flooding

The following table provides historic information of crop insurance claims paid between 2014 and 2024 in Putnam County.

Table 3.26. Crop Loss Payments for Flood in Putnam County 2014 – 2024

CROP YEAR	CROP LOSS	CAUSE OF LOSS	INSURANCE PAID (\$)
2014	Corn	Flood	\$20,026.00
	Soybeans		\$105,136.00
2015	Soybeans	Flood	\$7,765.00
2016	- No Claims -		\$0

2017	- No Claims -		\$0
2018	Soybeans	Flood	\$4,572.00
2019	Corn	Flood	\$272,081.00
	Soybeans		\$54,177.00
2020	- No Claims -		\$0
2021	Corn	Flood	\$13,195.00
2022	- No Claims -		\$0
2023	- No Claims -		\$0
2024	- No Claims -		\$0
Total			\$476,952.00

Source: USDA Risk Management Agency <http://www.rma.usda.gov/data/cause>

According to the USDA Risk Management Agency, there have been a total of \$476,952.00 in crop losses due to flood between the years 2014 and 2025.

Probability of Future Occurrence

The probability of future flood events was calculated by the following formulas:

$$\text{Probability of Flood} = \frac{1 \text{ flood event}}{25 \text{ years}} = 0.004 = 4\% \text{ probability of flood}$$

The probability of a flash flood occurring in the planning area is calculated as follows:

$$\text{Probability of Flash Flood} = \frac{21 \text{ flood events}}{25 \text{ years}} = 0.84 = 84\% \text{ probability of flash flood}$$

Changing Future Conditions Considerations

According to the 2023 Missouri State Hazard Mitigation Plan, “frequency of floods in Missouri is likely to increase,” and “over the last half century, average annual precipitation in most of the Midwest has increased by 5 to 10 percent.” Missouri has experienced above average precipitation since 1990. It is likely that the frequency and intensity of rainfall events will increase. As the number of these heavy rain events increases, more flooding and pooling water is to be expected.

The expected increases in rainfall frequency and intensity are also likely to put additional stress on natural hydrological systems and community stormwater systems. Heavier snowfalls in the winter will lead to intensified spring flooding, and groundwater levels will remain high.

These changes in climate patterns could potentially lead to the development of compounding events that could interact and cause extreme conditions. Other environmental impacts of flooding could include erosion, surface and groundwater contamination, and reduced water quality.

Vulnerability

Vulnerability Overview

Flooding presents a danger to life and property, often resulting in injuries, and in some cases, fatalities. Floodwaters themselves can interact with hazardous materials. Hazardous materials stored in large containers could break loose or puncture as a result of flood activity. Examples are bulk propane tanks. When this happens, evacuation of citizens is necessary.

Public health concerns may result from flooding, requiring disease and injury surveillance. Community sanitation to evaluate flood-affected food supplies may also be necessary. Private water and sewage sanitation could be impacted, and vector control (for mosquitoes and other entomology concerns) may be necessary.

When roads and bridges are inundated by water, damage can occur as the water scours materials around bridge abutments and gravel roads. Floodwaters can also cause erosion undermining road beds. In some instances, steep slopes that are saturated with water may cause mud or rock slides onto roadways. These damages can cause costly repairs for state, county, and city road and bridge maintenance departments. When sewer back-up occurs, this can result in costly clean-up for home and business owners as well as present a health hazard.

Scour critical bridges were discussed in **Section 3.2.2 Critical and Essential Facilities and Infrastructure**, maps of the bridge conditions can be found in **Figures 3.1 & 3.2** of **Section 3.2.2**.

Potential Losses to Existing Development

The 2023 Missouri Hazard Mitigation Plan used HAZUS data to analyze the county's vulnerability to flooding. A summary of the information is shown in the following table.

Table 3.27. HAZUS Estimated of Potential Losses for Putnam County

Table 3.28. Data from State Plan	Putnam County
Countywide Building Exposure	\$646,819,289
Structural Damage	\$4,472,855
Loss Ratio	0.69%
Contents Loss	\$2,593,259
Inventory Loss	\$103,341
Total Direct Loss	\$7,169,455
Total Income Loss	\$3,647
Total Direct and Income Loss	\$7,173,102
# HAZUS UDF Damaged Structures	5
# Substantially Damaged	0
# Displaced People	169
# Shelter Needs	7

Source: 2023 Missouri Hazard Mitigation Plan

The 2023 Missouri State Hazard Mitigation Plan also provides a further breakdown of potential losses categorized by type of structure. That information is summarized in the following table.

Table 3.29. Potential Losses in Putnam County by Type of Structure

Table 3.30. Type of Structure	Data from State Plan
Residential	2
	\$363,320
Agriculture	18
	\$16,703,601
Commercial	0
	\$0
Education	0
	\$0
Government	0
	\$0
Industrial	10
	\$8,611,100
Total # Population Affected	5

Source: 2023 Missouri Hazard Mitigation Plan

Impact of Previous and Future Development

Future development could impact flash and riverine flooding in Putnam County. Development in low-lying areas near rivers and streams or where interior drainage systems are not adequate to provide drainage during heavy rainfall events will be at risk to flash flooding. Future development would also increase impervious surfaces causing additional water run-off and drainage problems during heavy rainfall events.

In planning future development, jurisdictions in the planning area should avoid development in low-lying areas near rivers and streams or where interior drainage systems are not adequate to provide drainage during heavy rainfall events. Future development should also take into consideration the impact of additional impervious surfaces to water run-off and drainage capabilities during heavy rainfall events.

Hazard Summary by Jurisdiction

Vulnerability to flooding varies by jurisdiction as each community has a different layout, as described above. The floodplain maps in the Geographic Location section depict the flood area in each jurisdiction.

Putnam County

Putnam County has a few flood areas along smaller creeks. While there are areas of the county that are especially vulnerable to flood events, the majority of the vulnerable areas are farmland. The most vulnerable areas of the county are in Eastern Putnam County along the Chariton River

City of Unionville

The city of Unionville is within central Putnam County on Highway 136. There is a small creek with a mapped flood plain along the community's South and Southeast sides that could lead to flooding impacts to homes and businesses in the event of a flood. Putnam County schools set just off the Southwest edge of the flood plain.

City of Lucerne

The city of Lucerne is in Western Putnam County just south of highway 136. The Medicine creek sits East of the community and the town's eastern border is adjacent to flood plain. A railroad track

running along the east edge of the community may serve to act as an unintended levee, this could reduce the risk of flooding, while also increasing the risk of drainage issues.

City of Powersville

The city of Powersville is in Northwestern Putnam County along state route E. The Medicine creek sits west of the community. An additional smaller creek runs east of the community. Flooding from either creek would lead to possible issues related to transportation as Route E and Route M could be impacted by flooding.

Village of Livonia

The Village of Livonia is located north of HWY 136 and is bisected by State Highway N; none of the incorporated areas are located within a flood hazard area. The village is not particularly vulnerable to flooding. Flash flooding could cause drainage issues within the village, but historically the village has not been impacted by flash flooding, according to the NCEI database.

ADD other communities and districts if they participate

Problem Statement

Local governments should make a strong effort to improve emergency warning systems to ensure future deaths and injuries do not occur. Local governments should consider making improvements to roads, road tubes, and low water crossings that consistently flood by placing them on a hazard mitigation projects list and actively seek funding to successfully complete the projects.

3.4.2 Dam Failure

Hazard Profile

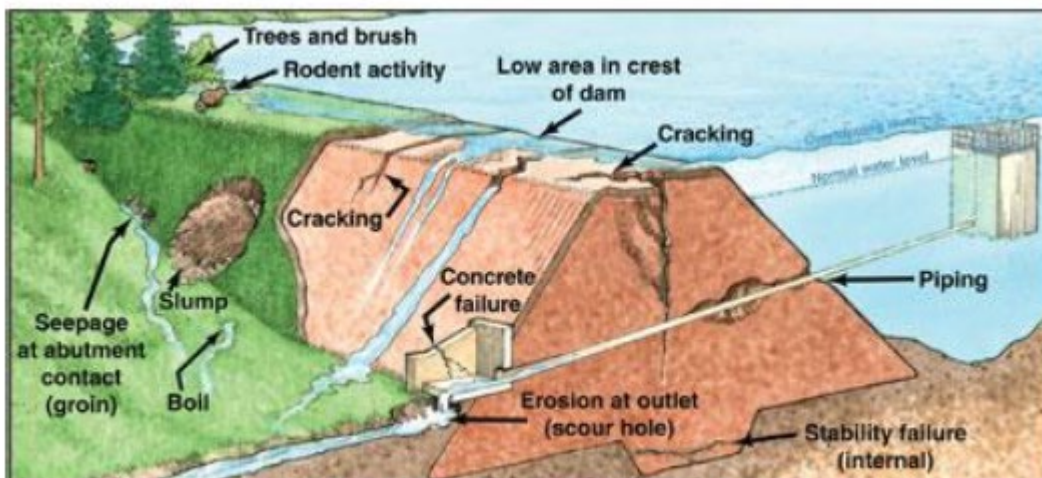
Hazard Description

A dam is defined as a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water. Dams are typically constructed of earth, rock, concrete, or mine tailings. Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, affecting both life and property. Dam failure can be caused by any of the following:

1. Overtopping: Inadequate spillway design, debris blockage of spillways or settlement of the dam crest.
2. Piping: Internal erosion caused by embankment leakage, foundation leakage and deterioration of pertinent structures appended to the dam.
3. Erosion: Inadequate spillway capacity causing overtopping of the dam, flow erosion, and inadequate slope protection.
4. Structural Failure: Caused by an earthquake, slope instability or faulty construction.

The four types of failures are often interrelated. For example, erosion, either on the surface or internal, may weaken the dam, which could lead to structural failure. Similarly, a structural failure could shorten the seepage path and lead to a piping failure. Observable defects that provide good evidence of potential dam failures are illustrated in the following figure.

Figure 3.11. Causes of Dam Failure



Source: United States Forest Service: <https://www.fs.fed.us/eng/pubs/htmlpubs/htm12732805/page02.htm>

Table 3.31. MoDNR Dam Hazard Classification Definitions

Hazard Class	Definition
Class I	The area downstream from the dam that would be affected by inundation contains ten (10) or more permanent dwellings or any public building. Inspection of these dams must every two years.
Class II	The area downstream from the dam that would be affected by inundation contains one (1) to nine (9) permanent dwellings, or one (1) or more campgrounds with permanent water, sewer, and electrical services or one (1) or more industrial buildings. Inspection of these dams must occur once every three years.

Class III	The area downstream from the dam that would be affected by inundation does not contain any of the structures identified for Class 1 or Class 2 dams. Inspection of these dams must occur once every five years.
-----------	---

Source: Missouri Department of Natural Resources, http://dnr.mo.gov/env/wrc/docs/rules_reg_94.pdf

Table 3.32. NID Dam Hazard Classification Definitions

Hazard Class	Definition
High Hazard	Loss of at least one human life is likely if the dam fails.
Significant Hazard	Possible loss of human life and likely significant property or environmental destruction.
Low Hazard	Equal or exceed 25 feet in height and exceed 15 acre-feet storage; Equal or exceed 50-acre feet storage and exceed 6 feet in height; Do not meet the criteria for high or significant hazard.

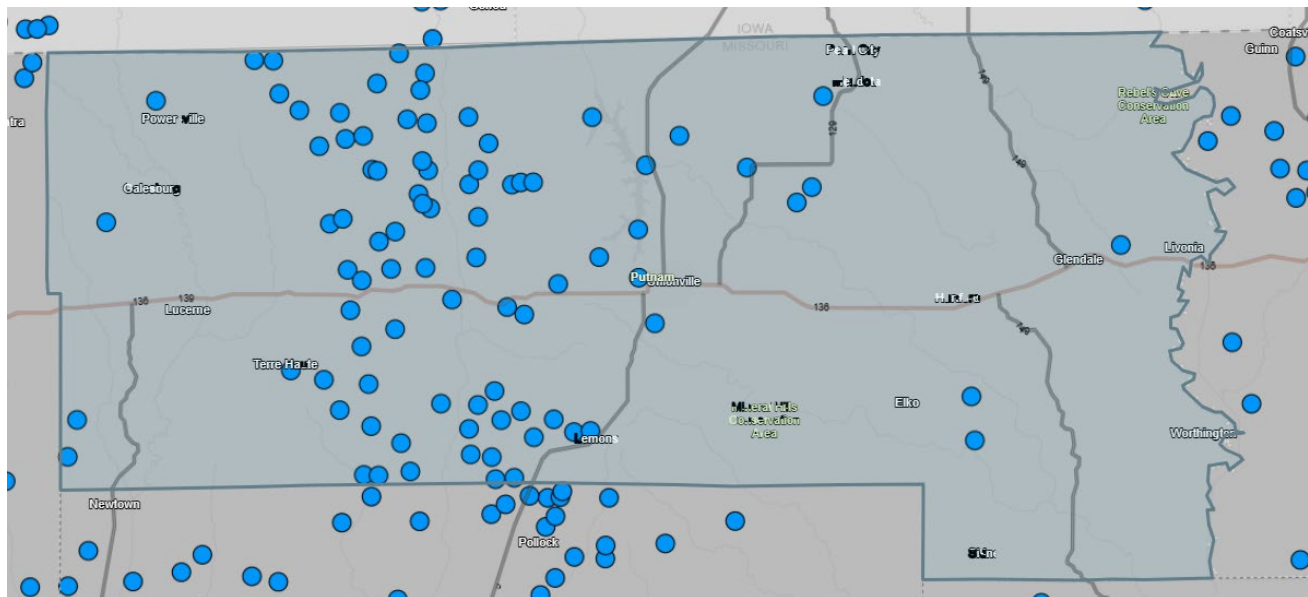
Source: National Inventory of Dams

Geographic Location

Dams Located Within the Planning Area

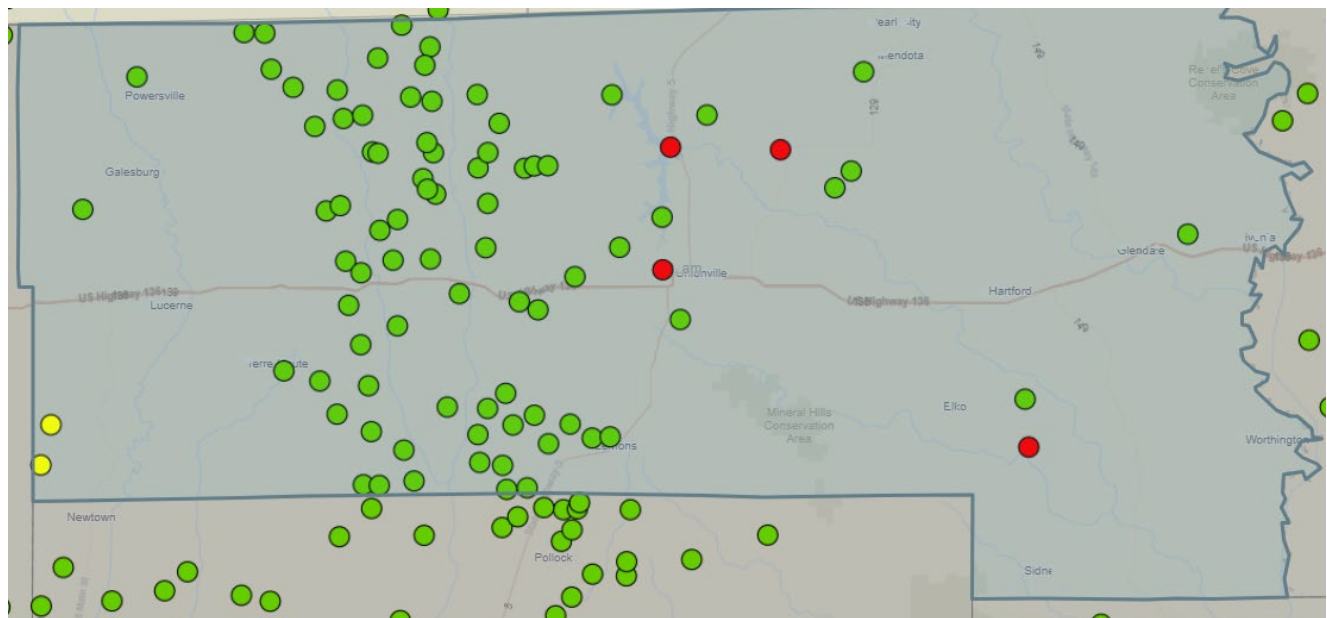
The following figure (Figure 3.12) shows the location of dams located within the planning area. Putnam County has a total of 86 dams. There are 0 Federally Regulated and 4 High Hazard Dams and 2 Significant Hazard Dams(See figure 3.13).

Figure 3.12. Dams Located in Putnam County



Source: Missouri Department of Natural Resources

Figure 3.13.



LEGEND

- High
- Significant
- Low
- Undetermined

The High Hazard Dams are listed in the following table.

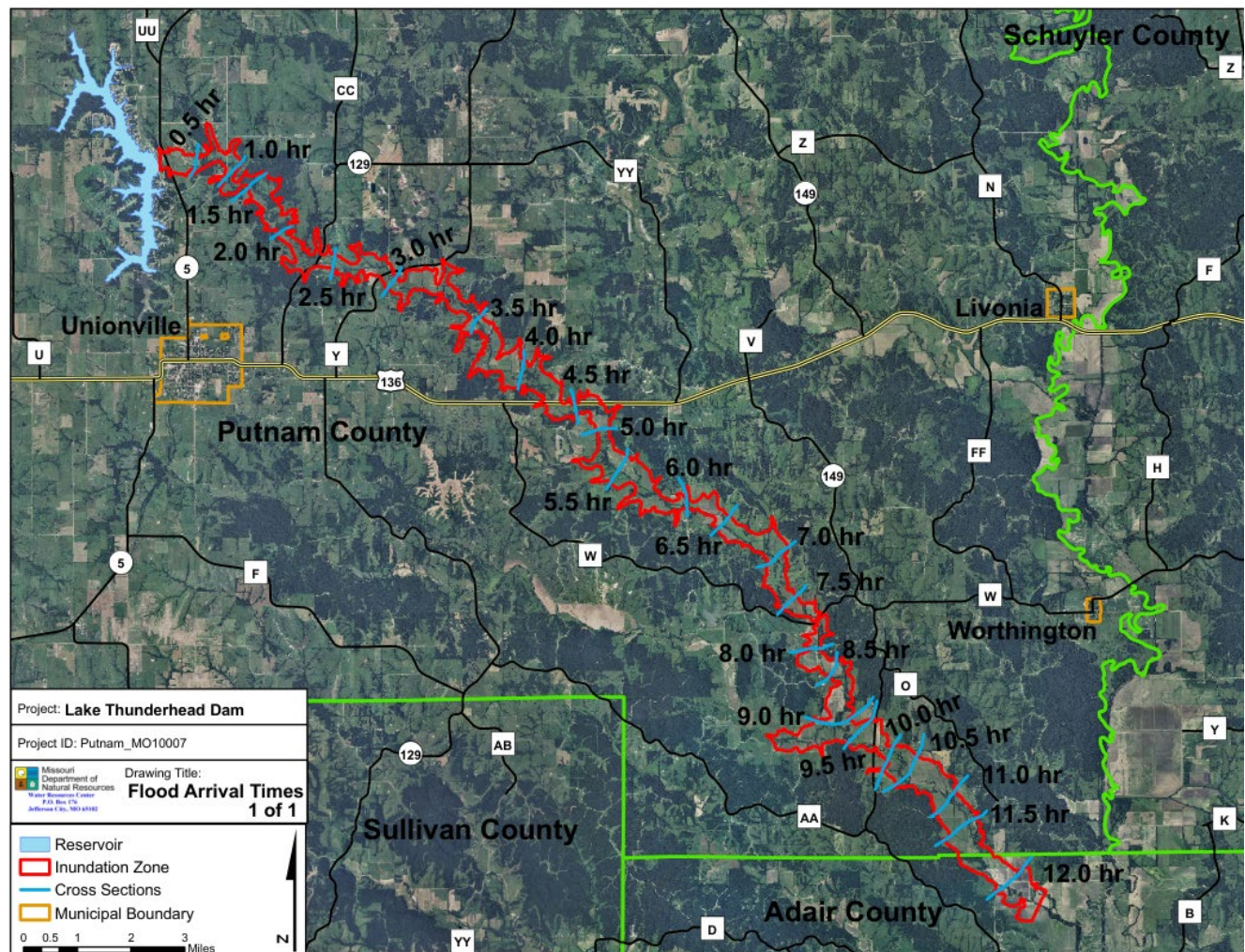
Table 3.33. High Hazard Dams in Putnam County

Dam Name	Emergency Action Plan (EAP)AP	Dam Height (Ft)	Maximum Storage (Acre-Ft)	Last Inspection Date	River	Nearest Downstream City	Distance To Nearest City	Dam Owner
Unionville Old City Lake Dam	Not Required	28	180	Not reported	TR-BLACKBIRD CREEK	UNIONVILLE	1	UNIONVILL, MO
Phantom Lake Dam	Not Required	25	80	Not reported	TR-SHOAL CREEK	WORTHINGTON	22	ROBERT A HIBBERD
Elko/Bidwell Farm	No	45	unknown	Not reported	Not reported	Not reported	N/A	ELKO Farms LLC
Lake Thunderhead Dam	Yes	54	28690	7/15/2021	NORTH BLACKBIRD	MARTINSTOWN	18	WILDFLOWER POA

Source National Inventory of Dams; High Hazard Potential Classification

Of the 4 High Hazard Dams located in Putnam County, Lake Thunderhead is the only one with an available inundation map, see figure below.

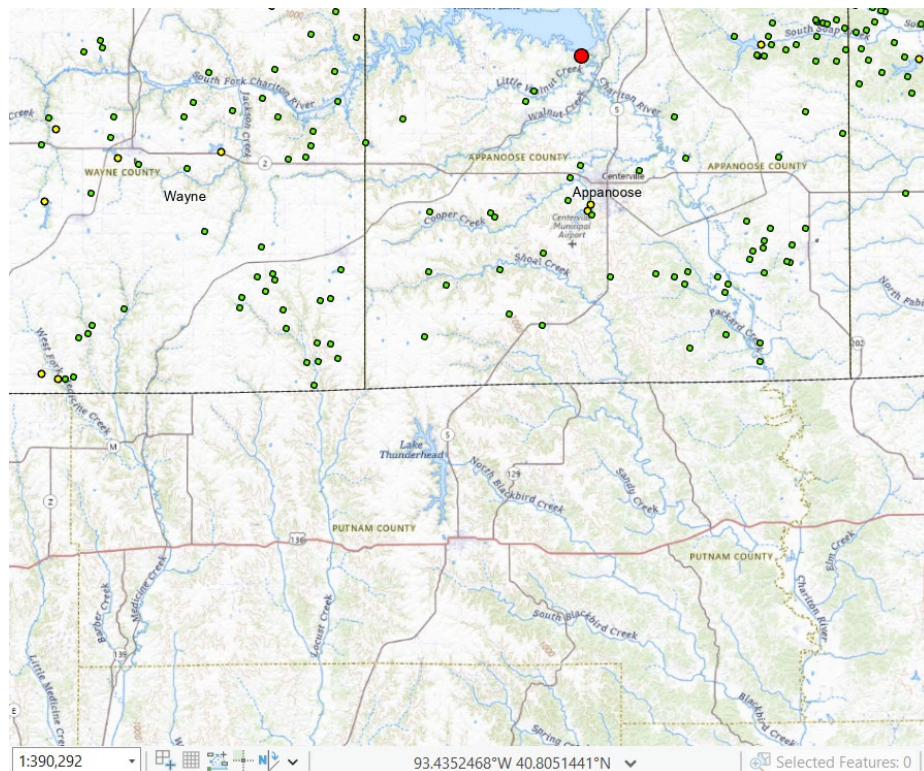
Figure 3.14. Lake Thunderhead Dam Inundation Map



Upstream Dams Outside the Planning Area

The Rathbun Reservoir Dam located near Centerville, IA is the only upstream dam that could potentially cause flooding in Putnam County. While this upstream dam could potentially cause flooding in Putnam County, there is no available inundation map. This dam is inspected every five years, and the last inspection was on March 15, 2021.

Figure 3.15. Upstream Dams Outside Putnam County – Lake Rathbun Dam



Source: Iowa dams - May 2025 from Iowa Dam safety

Figure 3.16. Numbers and Types of Dams in Putnam County

Count of NID Dams				Count of State Regulated Dams				Count of Federally Regulated Dams				Count of Un-Regulated Dams			
H	S	L	Total	1	2	3	Total	H	S	L	Total	H	S	L	Total
3	2	80	85	0	1	1	2	0	0	0	0	2	1	80	83

Source: Missouri State Hazard Mitigation Plan 2023

Strength/Magnitude/Extent

The strength/magnitude of dam failure would be similar in some cases to flood events (see the flood hazard vulnerability analysis and discussion). The strength/magnitude/extent of dam failure is related to the volume of water behind the dam as well as the potential speed of onset, depth, and velocity. Note that for this reason, dam failures could flood areas outside of mapped flood hazards.

Previous Occurrences

Information shows no known dam incidents in Putnam County as reported by the Sanford dam incident database.

Probability of Future Occurrence

There are currently 4 regulated dams in Putnam County. They are state regulated and are inspected once every five years. There are no USACE-regulated dams in the planning area. According to the information from the 2023 Missouri State Hazard Mitigation Plan, there have been no dam incidents in the last 20 years, which resulted in a failure of the dams.

It should be considered that within Missouri historical dam failures and incidents include events from all hazard classes and all dams; regulated or not. Failures and incidents for regulated dams that have higher inspection frequencies should be less probable. The non-regulated dams do not have a regular inspection schedule nor requirement.

If we base the probability upon past events:

$$\text{Probability of Dam Failure} = \frac{0}{20}$$

With no previous occurrences of dam failure, the probability of such an event occurring is unlikely in the planning area.

However, if we consider the instances of dam incidents:

$$\text{Probability of Dam Incident} = \frac{0}{20} = 0.00$$

The probability of the planning area experiencing any type of dam incident, if based on past occurrences, would be 0% in any given year. Since this hazard cannot be ruled out, it could be stated that the probability of dam failure is low, or less than 5% probability of dam failure. Regular inspection of the State Regulated Dams does lessen the probability of a future occurrence.

Changing Future Conditions Considerations

The safety of dams for the future climate can be based on an evaluation of changes in design floods and the freeboard available to accommodate an increase in flood levels. The results from the studies indicate that the design floods with the corresponding outflow floods and flood water levels will increase in the future, and this increase will affect the safety of the dams in the future. Studies concluded that the total hydrological failure probability of a dam will increase in the future climate and that the extent and depth of flood waters will increase by the future dam break scenario.

Vulnerability

Vulnerability Overview

According to the US Army Corps of Engineers (USACE) National Inventory of Dams (NID) there are a total of 85 dams located in the planning area. There are 3 high hazard dams, 2 significant hazard dams, and 80 low hazard dams in Putnam County.

There are currently some structures of both agricultural and residential varieties. The 2023 Missouri State Hazard Mitigation Plan contains the following information about the vulnerability of Putnam County to dam failure.

Potential Losses to Existing Development: (including types and numbers, of buildings, critical facilities, etc.)

The following information was obtained from the 2023 Missouri State Hazard Mitigation Plan. The information is based on current HAZUS data, and calculates estimated values of buildings at risk, building values from HAZUS were used to determine an average value for each property type. This average value per property type was then applied to the number of structures in dam inundation

areas by type to calculate an overall estimated value of buildings at risk by type. In addition to counts and values of structures at risk, an estimated population impacted for each county was calculated based on the number of residential properties in inundation areas multiplied by the average household size.

Table 3.34. Estimated Number and Values of Structures & Population Vulnerable to Failure of State-Regulated Dams with Available Inundation Areas

Type of Structure	Value of Structures	Number of Structures	Population
Agriculture	\$13,919,668	15	0
Residential	\$181,659	1	0
Total	\$2,373,671	16	0

Source: 2023 Missouri State Hazard Mitigation Plan

Table 3.35. State Estimates of Potential Loss as a Result of Dam Failure, Both State Regulated and USACE Dams

Location	Potential Damage (in \$)
Putnam County	\$16,341,247

Source: 2023 Missouri State Hazard Mitigation Plan

Table 3.36. Estimated Number and Values of Structures & Population Vulnerable to Failure of USACE Dams with Available Inundation Areas

Type of Structure	Value of Structures	Number of Structures	Population
No USACE dam impacts within the planning area			
Total	0	0	0

Source: 2023 Missouri State Hazard Mitigation Plan

Impact of Previous and Future Development

While growth in the planning area would lead to an increased risk due to dam failure, Putnam County is largely rural with little evidence of growth within the inundation area of a dam.

Hazard Summary by Jurisdiction

The vast majority of Putnam County is not in danger of being inundated due to a breach in a dam. No further analysis of dam failure hazards will be conducted for this plan update. It will be helpful for residents near the high hazard dams to get familiarized with the dam's Emergency Action Plan (EAP) and work closely with County EOP & participate in dam emergency exercises. See Figure 3.31 and Figure 3.32 for known inundation zones due to dam failure in Putnam County.

The inundation zones are located almost exclusively in the unincorporated areas of Putnam County. The rural areas in the inundation zones are at greatest risk of dam failure and could be negatively affected by dam failure because dam failure could damage agricultural assets and could potentially close or damage roadways.

Problem Statement

Some entities in Putnam County that own and control dams do not properly inspect and maintain them to ensure the safety of people and property that lie within the inundation area of a dam breach.

3.4.3 Earthquakes

Hazard Profile

Hazard Description

An earthquake is a sudden motion or trembling that is caused by a release of energy accumulated within or along the edge of the earth's tectonic plates. Earthquakes occur primarily along fault zones and tears in the earth's crust. Along these faults and tears in the crust, stresses can build until one side of the fault slips, generating compressive and shear energy that produces the shaking and damage to the built environment. Heaviest damage generally occurs nearest the earthquake epicenter, which is that point on the earth's surface directly above the point of fault movement. The composition of geologic materials between these points is a major factor in transmitting the energy to buildings and other structures on the earth's surface.

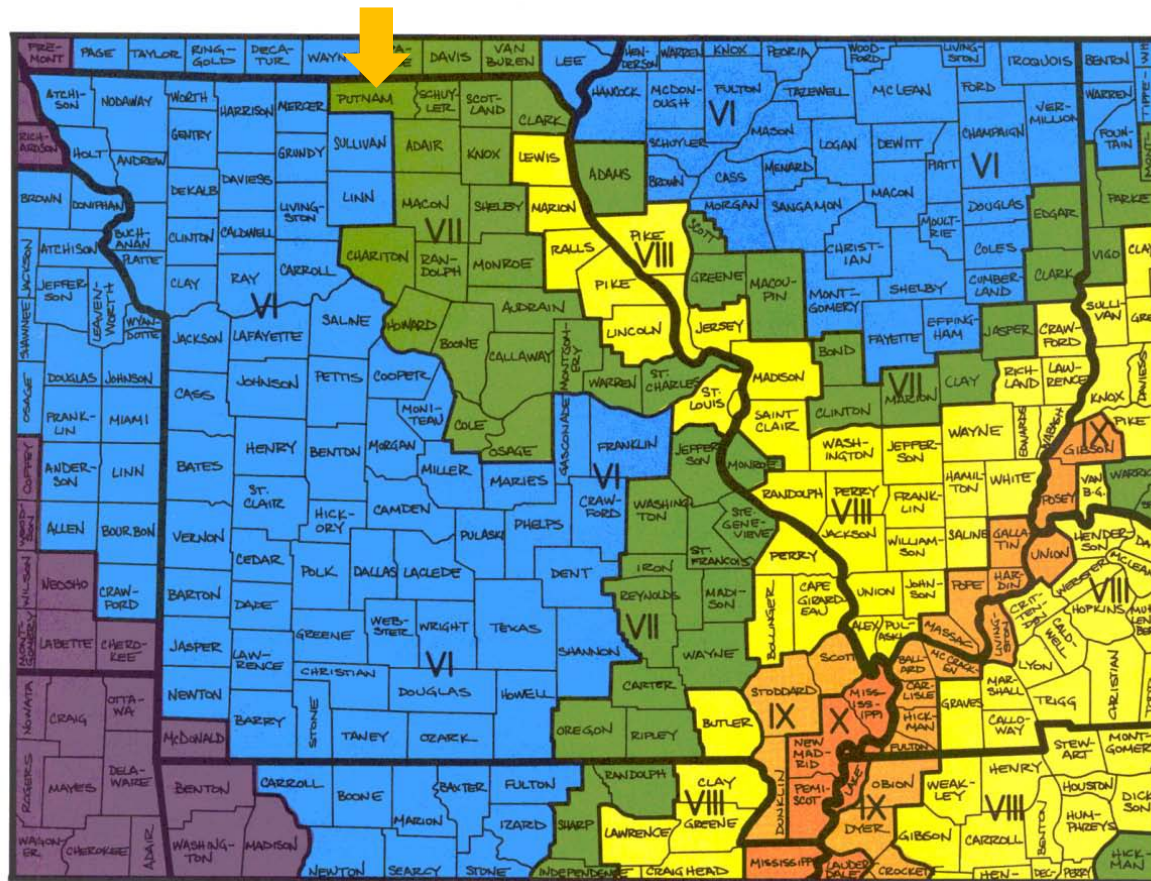
Missouri holds the record for the most devastating earthquake in the history of post-settlement North America. The New Madrid 1811-1812 earthquake series included five earthquakes of magnitude 8.0 (Modified Mercalli Intensity Scale) or higher occurring in the period of December 16, 1811, through February 7, 1812. These earthquakes affected an estimated 600,000 square kilometers. Movement was felt as far away as Quebec, and damage was reported in Charleston, South Carolina, and Washington D.C.

Geographic Location

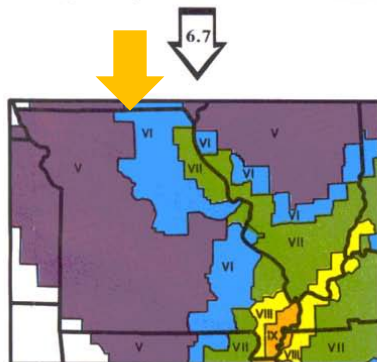
While the history of the New Madrid fault line and its potential for another major earthquake is well known and much studied, that threat lies far enough away from Putnam County that the effects of such an event would be negligible and would not vary much throughout the planning area. The most likely outcome for Putnam County would be as follows: everyone would feel movement, poorly built buildings would be damaged slightly, considerable quantities of dishes, glassware, and some windows would be broken, people would have trouble walking, pictures would fall off walls, plaster in walls might crack, and furniture could be overturned.

Seismic activity on the New Madrid Seismic Zone of Southeastern Missouri is very significant both historically and at present. On December 16, 1811, and January 23 and February 7 of 1812, three earthquakes struck the central U.S. with magnitudes estimated to be 7.5-8.0. These earthquakes caused violent ground cracking and volcano-like eruptions of sediment (sand blows) over an area of >10,500 km², and uplift of a 50 km by 23 km zone (the Lake County uplift). The shaking was felt over a total area of over 10 million km² (the largest felt area of any historical earthquake). Of all the historical earthquakes that have the U.S., an 1811- style event would do the most damage if it recurred today. If an 1811 earthquake occurred in Putnam County the earthquake intensity would not vary within the county. Damage would be to buildings of poor design and construction, slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures and some chimneys broken. The following Figure shows the impact zones for earthquakes along the New Madrid Fault.

Figure 3.17. Impact Zones for Earthquake Along the New Madrid Fault

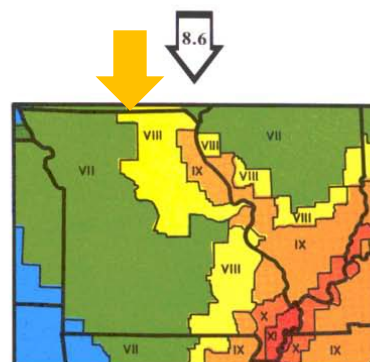


This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.



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 3.18. Projected Earthquake Intensities

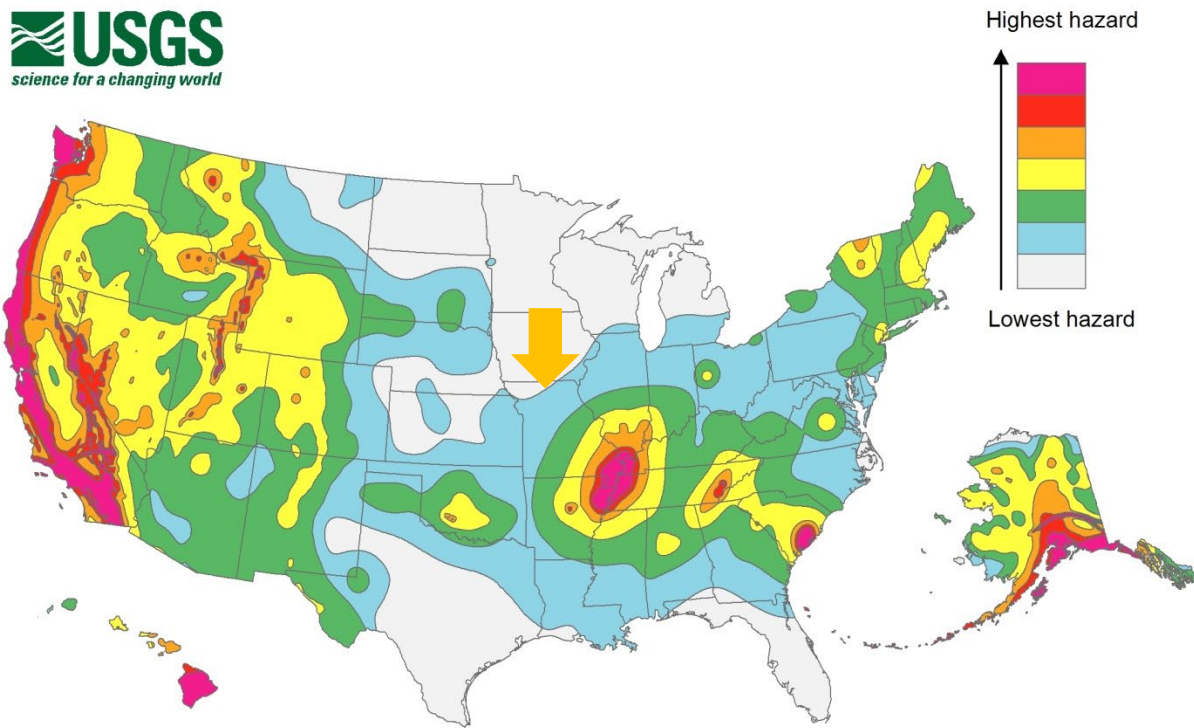
MODIFIED MERCALLI INTENSITY SCALE

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

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

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EMERGENCY MANAGEMENT AGENCY
P.O. BOX 116
JEFFERSON CITY, MO 65102
Telephone: 573-526-9100

Figure 3.19. United States Seismic Hazard Map



Source: United States Geological Survey at <https://www.usgs.gov/programs/earthquake-hazards/hazards>

Strength/Magnitude/Extent

The extent or severity of earthquakes is generally measured in two ways: 1) the Richter Magnitude Scale is a measure of earthquake magnitude; and 2) the Modified Mercalli Intensity Scale is a measure of earthquake severity. The two scales are defined as follows.

Richter Magnitude Scale

The Richter Magnitude Scale was developed in 1935 as a device to compare the size of earthquakes. The magnitude of an earthquake is measured using a logarithm of the maximum extent of waves recorded by seismographs. Adjustments are made to reflect the variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, comparing a 5.3 and a 6.3 earthquake shows that the 6.3 quake is ten times bigger in magnitude. Each whole number increase in magnitude represents a tenfold increase in measured amplitude because of the logarithm. Each whole number step in the magnitude scale represents a release of approximately 31 times more energy.

Modified Mercalli Intensity Scale

The intensity of an earthquake is measured by the effect of the earthquake on the earth's surface. The intensity scale is based on the responses to the quake, such as people awakening, movement of furniture, damage to chimneys, etc. The intensity scale currently used in the United States is the

Modified Mercalli (MM) Intensity Scale. It was developed in 1931 and is composed of 12 increasing levels of intensity. They range from imperceptible shaking to catastrophic destruction, and each of the twelve levels is denoted by a Roman numeral. The scale does not have a mathematical basis, but is based on observed effects. Its use gives the laymen a more meaningful idea of the severity.

Previous Occurrences

There have been no earthquakes within 30 miles of Putnam County since 1931. The closest earthquake recorded to Putnam County since 2000 was a M2.6 which happened in 2024 near Old Monroe, Missouri, which is on the northwest edge of the St. Louis metro area.

Probability of Future Occurrence

Putnam County has a very low earthquake risk, with a total of 0 earthquakes since 1931, as shown in the figure below. The USGS database shows that there is a 0.14% chance of a major earthquake within 50km of Putnam County within the next 50 years.

Figure 3.20. HAZUS-MH Earthquake 2% Probability of Exceedance in 50 Years – Ground Shaking and Liquefaction Potential

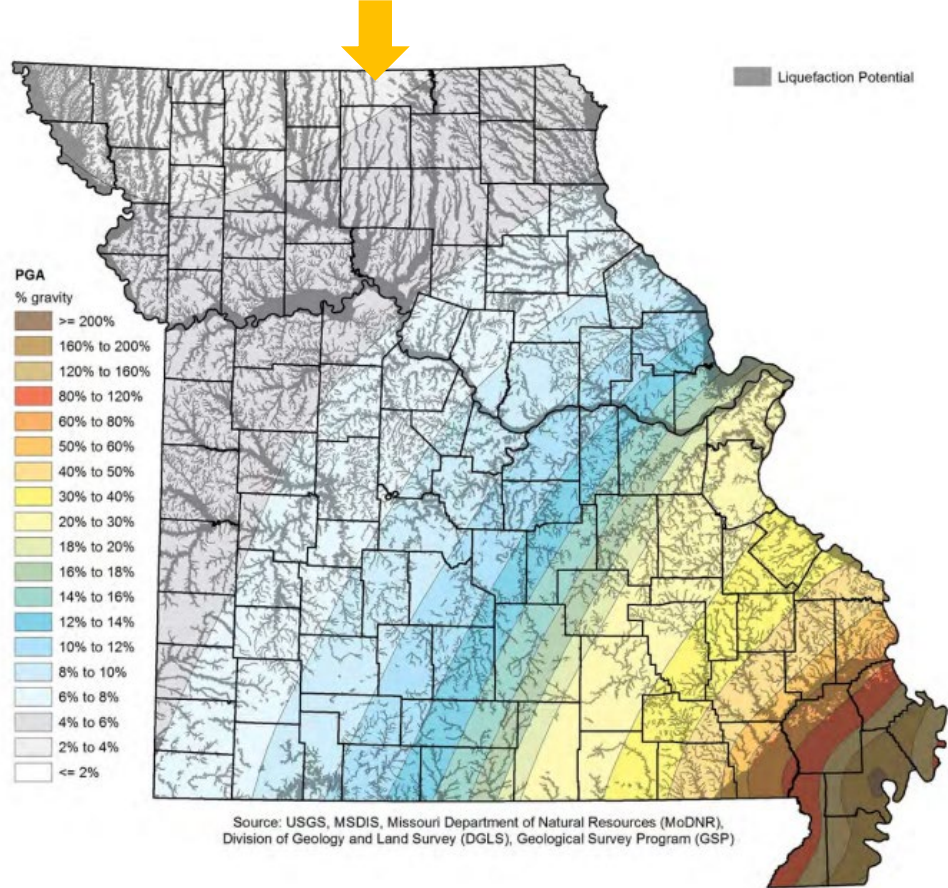


Table 3.37. HAZUS-MH Earthquake Loss Estimation 2% Probability of Exceedance in 50-Years Scenario Direct Economic Losses Results for Putnam County (All Values in

Thousands)

County	Cost Structural Damage	Cost Non-structural Damage	Cost Contents Damage	Inventory Loss	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Putnam	\$445	\$793	\$190	\$5	0.23	\$289	\$74	\$104	\$1,953

Source: 2023 Missouri State Hazard Mitigation Plan

Changing Future Conditions Considerations

Scientists are beginning to believe there may be a connection between changing climate conditions and earthquakes. Changing ice caps and sea-level redistribute weight over fault lines, which could potentially have an influence on earthquake occurrences. However, currently no studies quantify the relationship to a high level of detail, so recent earthquakes should not be linked with climate change. While not conclusive, early research suggests that more intense earthquakes and tsunamis may eventually be added to the adverse consequences which are caused by changing future conditions.

Vulnerability

Vulnerability Overview

The 2023 Missouri State Hazard Mitigation Plan provided an earthquake loss estimation for each county. The annualized loss scenario from the 2023 State Hazard Mitigation Plan for Putnam County is provided in the following table.

Table 3.38. HAZUS-MH Earthquake Loss Estimation: Annualized Loss Scenario for Putnam County

County	Total Losses, in \$ Thousands	Loss Per Capita, in \$ Thousands	Loss Ratio, in \$ per Million
Putnam	\$3	\$0.0005	\$5

Source: Missouri Hazard Mitigation Plan 2023

The State of Earthquake Coverage Report states that the average premium for earthquake coverage in Putnam County during 2023 was \$143. The following table provides information about earthquake coverage in Putnam County in the 2023 report.

Table 3.39. Earthquake Coverage in Putnam County, Missouri in 2023

Earthquake Exposures	Homeowners, Farm, Mobile Home Exposures	% With Earthquake Endorsement	Average Premium, All Earthquake	Average Premium, \$110k-\$140k Coverage
63	1,355	4.6%	\$143	\$60

Source: Missouri Department of Commerce & Insurance "overview of Residential Earthquake Insurance 2023"

Potential Losses to Existing Development

Potential losses to existing development were estimated using FEMA's loss estimation software, HAZUS 6.0. The HAZUS building inventory counts are based on the 2020 census data and primarily 2022 economic values. Population counts are 2019 estimates from the US Census Bureau.

Table 3.40. HAZUS Earthquake Loss Estimation with a 2% Probability of Exceedance in 50

Years Scenario – Total Building Loss

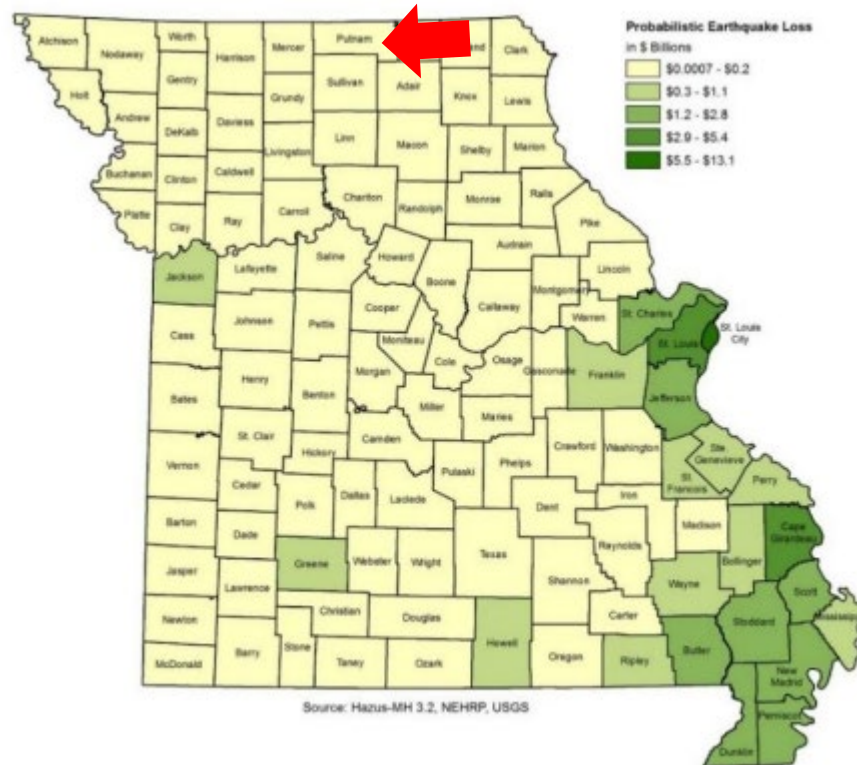


Table 3.41. FEMA National Risk Index Loss Estimation: Annualized Loss Scenario for Putnam County

Annualized Frequency	Expected Annual Loss (In Buildings (In \$ Thousands)	Expected Annual Loss- Fatalities	Expected Annual Loss – Population Equivalence	Expected Annual Loss – Total	Expected Annual Loss Rating
0.00022	\$3	0.00002	\$119	\$2,807	Very Low

Source: Missouri Hazard Mitigation Plan 2023

Impact of Previous and Future Development

Any future development to the planning area while unexpected, would not increase the risk to an earthquake other than contributing to the overall exposure of what could become damaged because of an earthquake event.

Hazard Summary by Jurisdiction

Since earthquake intensity is not likely to vary greatly throughout the planning area, the risk will be the same throughout. Putnam County is not near the New Madrid Shock Zone, but it will likely endure mild effects from the earthquake such as structure damage environmental impacts and economic disruption/losses. However, damage could vary due to structural variations in the planning area's built environment. Putnam County would likely be impacted by the number of refugees traveling through the area seeking safety and assistance.

However, damages could differ if there are structural variations in the planning area-built environment. The impact of an earthquake is likely to be higher on homes built before 1939 and on mobile homes. The following table lists the number and percentage of homes built prior to 1939 in the planning area as well as number and percentage of mobile homes.

Table 3.42. Mobile Homes and Homes Built Prior to 1939 in Putnam County.

Putnam County	Mobile Home	% Mobile Home	Homes Built Before 1939	% Homes Built Before 1939
Putnam County	232	12.4%	218	11.6%
Village of Livonia	0	0.0%	3	23.1%
Village of Lucerne	4	30.8%	6	46.2%
Village of Powersville	32	72.7%	10	22.7%
Village of Worthington	0	0.0%	5	62.5%
City of Unionville	19	2.7%	83	12.0%

Source: U.S. Census Bureau, Physical Housing Characteristics for Occupied Housing Units (S2501)

Problem Statement

Although Putnam County is not located in an area that will likely see catastrophic damage from an earthquake, the County could be impacted by breaks in underground infrastructure such as water, gas, and communication lines.

3.4.4 Drought

Hazard Profile

Hazard Description

Drought is generally defined as a condition of moisture levels significantly below normal for an extended period of time over a large area that adversely affects plants, animal life, and humans. A drought period can last for months, years, or even decades. There are four types of drought conditions relevant to Missouri, according to the State Plan, which are as follows.

- Meteorological drought is defined in terms of the basis of the degree of dryness (in comparison to some “normal” or average amount) and the duration of the dry period. A meteorological drought must be considered as region-specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region.
- Hydrological drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply (e.g., streamflow, reservoir and lake levels, ground water). The frequency and severity of hydrological drought is often defined on a watershed or river basin scale. Although all droughts originate with a deficiency of precipitation, hydrologists are more concerned with how this deficiency plays out through the hydrologic system. Hydrological droughts are usually out of phase with or lag the occurrence of meteorological and agricultural droughts. It takes longer for precipitation deficiencies to show up in components of the hydrological system such as soil moisture, streamflow, and ground water and reservoir levels. As a result, these impacts also are out of phase with impacts in other economic sectors.
- Agricultural drought focus is on soil moisture deficiencies, differences between actual and potential evaporation, reduced ground water or reservoir levels, etc. Plant demand for water depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil.
- Socioeconomic drought refers to when physical water shortage begins to affect people.

Geographic Location

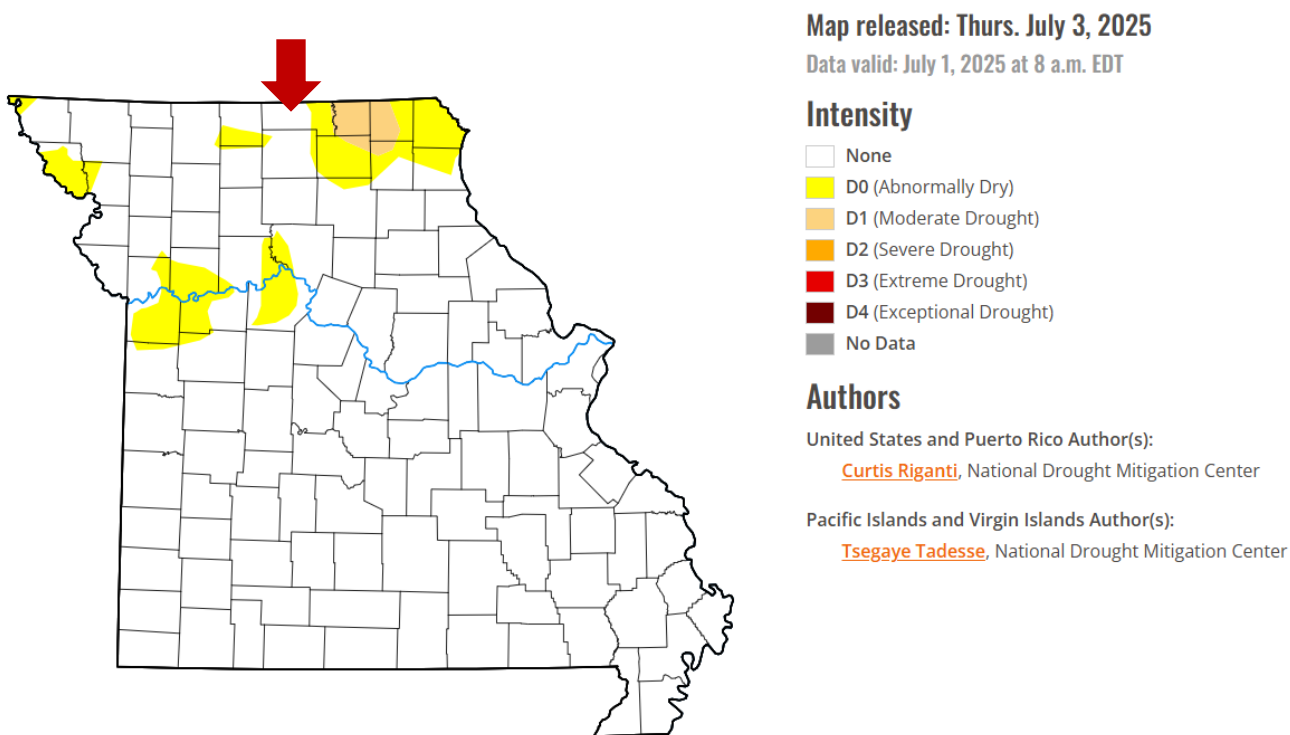
Because of the broad scope of drought, all of Putnam County, with the exception of the school district, is susceptible to this hazard. Agricultural land is extremely vulnerable to drought impacts. According to the most recent census of agriculture, 264,311 acres in Putnam County is made up of farmland, making the impacts of drought one that is acutely felt by residents of Putnam County. A drought would directly impact livestock production and the agriculture economy in Putnam County.

Droughts are regional in nature. All areas of the United States are vulnerable to the risk of drought and extreme heat. Droughts can be widespread or localized events. The extent of the droughts varies both in terms of the extent of the heat and range of precipitation. The severity of a drought depends on location, duration, and geographical extent. Additionally, drought severity depends on the water supply, usage demands made by human activities, vegetation and agricultural operations.

Drought brings several different problems that must be addressed. The quality and quantity of crops, livestock and other agricultural assets will be affected during drought. Drought can adversely

impact forested areas leading to an increased potential for extremely destructive forest and woodland fires that could threaten residential, commercial, and recreational structures. Putnam County is seated in the northwestern portion of Missouri. Most of the northern and west-central portions of Missouri are underlain by rocks that are not conducive to water-bearing formations. They yield only small amounts of water, even during periods of normal and above-normal rainfall. Under drought conditions, adequate amounts of water cannot be pumped from the rock formations of northern Missouri to supply even domestic needs. Most streams in northern Missouri do not receive appreciable groundwater recharge. During periods of drought, these streams are generally reduced to a series of pools, or may become completely dry. Streams and water impoundments are the only localized sources of water during droughts, and even these limited resources are at risk when the drought is prolonged. Agriculture in west-central and northern Missouri is usually the first to feel the effects of drought. Although row-cropping is more extensive in this part of the State, irrigation is generally not feasible except on the floodplains of major rivers.

Figure 3.21. U.S. Drought Monitor Map of Missouri on July 3, 2025



Source: U.S. Drought Monitor, <https://droughtmonitor.unl.edu/Maps/MapArchive.aspx>

Strength/Magnitude/Extent

The Palmer Drought Indices measure dryness based on recent precipitation and temperature. The indices are based on a “supply-and-demand model” of soil moisture. Calculation of supply is relatively straightforward, using temperature and the amount of moisture in the soil. However, demand is more complicated as it depends on a variety of factors, such as evapotranspiration and recharge rates. These rates are harder to calculate. Palmer tried to overcome these difficulties by developing an algorithm that approximated these rates and based the algorithm on the most readily available data — precipitation and temperature.

The Palmer Index has proven most effective in identifying long-term drought of more than several months. However, the Palmer Index has been less effective in determining conditions over a matter of weeks. It uses a “0” as normal, and drought is shown in terms of negative numbers; for example, negative 2 is moderate drought, negative 3 is severe drought, and negative 4 is extreme drought. Palmer’s algorithm also is used to describe wet spells, using corresponding positive numbers.

Palmer also developed a formula for standardizing drought calculations for each individual location based on the variability of precipitation and temperature at that location. The Palmer index can therefore be applied to any site for which sufficient precipitation and temperature data is available.

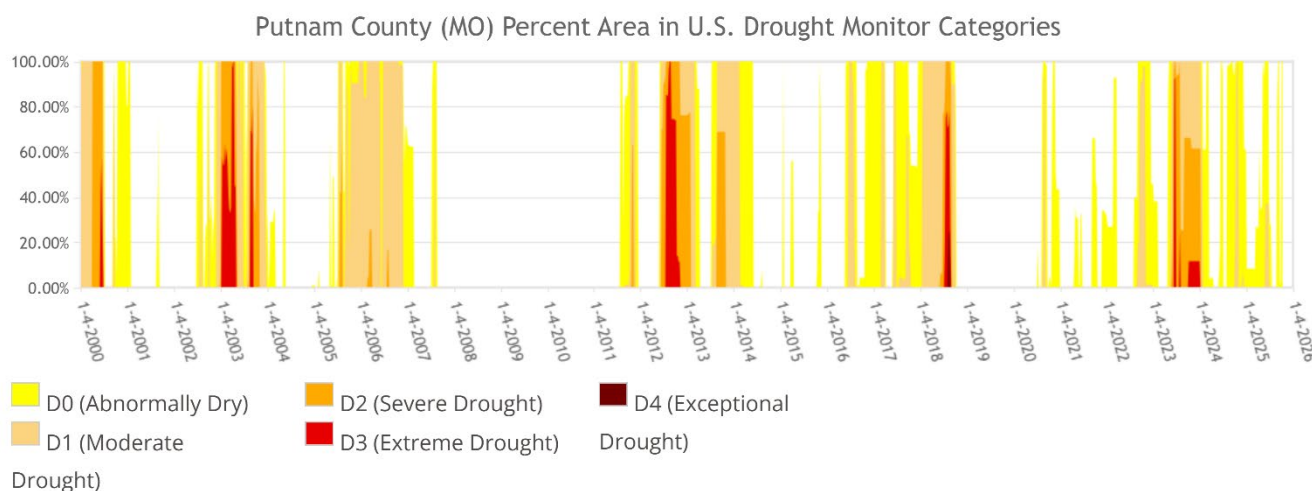
Figure 3.22. Drought Severity Classification

Category	Description	Possible Impacts	Palmer Drought Index
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
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
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed	-3.0 to -3.9
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions	-4.0 to -4.9
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less

Previous Occurrences

The following figure, obtained from the US Drought Monitor (2015-2025) depicts the previous occurrence of drought in Putnam County by severity and total percentage of land area that was affected by the drought.

Figure 3.23. Percentage of Putnam County in Drought 2000-2025



From the U.S. Drought Monitor website, <https://droughtmonitor.unl.edu/DmData/TimeSeries.aspx>, 10-22-2025



According to the NCEI database, Putnam County has experienced drought conditions on numerous occasions. The following information provides the date the individual drought conditions were declared or continued, and a narrative about the event.

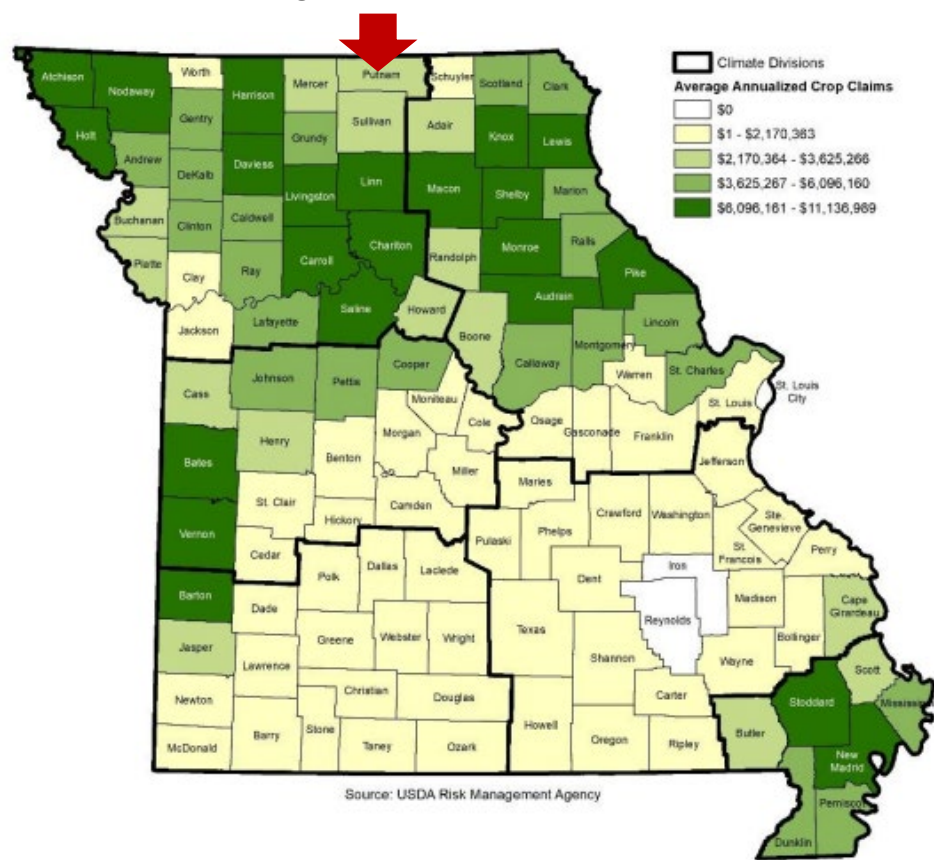
Table 3.43. Previous Occurrences of Drought in Putnam County 2004-2025

Begin Date	End Date	Episode Narrative
7/1/2012	7/31/2012	Dry conditions, which started in the spring, intensified during the month of July. Drought conditions expanded across Missouri, with D2 conditions at the beginning of the month, increasing to D3 conditions by the end of the month. Most locations by the end of the month had yearly rainfall deficits of 10 to 15 inches.
8/1/2012	8/31/2012	Dry conditions, which started in the spring, intensified during the month of August. Drought D2 and D3 conditions at the beginning of the month increased to D3 and D4 conditions by the end of the month. Most locations by the end month continued yearly rainfall deficits in the 10-to-15-inch range.
9/1/2012	9/30/2012	The remnants of Hurricane Isaac brought some much-needed relief to drought conditions across the area, on the 1st of September. This helped improve drought conditions from D4 and D3 to D3 and D2. Rainfall totals with the remnants of Isaac, ranged from around one inch near the Iowa border, to around 7 inches in the Kansas City Metropolitan area.
10/1/2012	10/31/2012	The drought continued across west central and northwest Missouri through the month of October, with slight improvement noted, especially across north central and central portions of the state. Rainfall deficits for the year were in the 10-to-15-inch range.
11/1/2012	11/30/2012	The drought continued across the area during the month of November. Slight improvement was noted, with D1 to D2 conditions prevailing. Rainfall deficits were generally in the 10-to-16-inch range for the year.
12/1/2012	12/31/2012	Slight improvements in the drought conditions were observed across northwest and west central Missouri. However, D1 to D2 conditions, moderate to severe drought conditions, still prevailed across the area.

1/1/2013	1/31/2013	There have been several storm systems that have impacted the region in the last half of January. Most of the precipitation from these systems has fallen along and southeast of a Kansas City to Kirksville line. This has resulted in some improvement to the drought across portions of central to northern and northeastern Missouri. However, western and far northwestern Missouri remain in a severe drought (D2).
8/27/2013	8/31/2013	A persistent upper-level ridge of high pressure centered over the lower Missouri Valley, in late August, caused D2 drought conditions to redevelop across portions of north central Missouri. Several locations, including Kirksville, reported only a trace of rainfall for the month of August.
9/1/2013	9/30/2013	Severe drought D2 conditions persisted across most of northern Missouri during the month of September.
10/1/2013	10/31/2013	Severe D2 drought conditions continued in the month of October across north central Missouri.
6/1/2018	6/30/2018	Starting at the very end of May and going into June, the US Drought Monitor at the University of Nebraska declared portions of Missouri in a D2 or worse drought. While impacts from this drought would be felt through the summer, it's unclear if any drought impacts were felt through the month of June.
7/1/2018	7/31/2018	The anomalously dry period that plagued the region during the summer of 2018 continued into and through July. Most areas were about 2 inches short of normal precipitation for the month of July. Most of northern Missouri, north of the Missouri River, came up between 4 and 5 inches short of normal. This combined with the dry June has caused the drought across the region to worsen.
8/1/2018	8/31/2018	Precipitation picked up during August, especially in some of the hardest hit drought areas, but in a lot of cases the damage had already been done, and while the rain did pick back up the ground soil was so parched that it made hardly a dent in the drought across northern Missouri.
9/1/2018	9/30/2018	While much of the area saw some relief from the drought, many counties remained in D2-D4 status through the month of September. While the full scope of drought impacts is unknown, many farmers took losses on their hay and corn, opting to bale it for livestock or knock it down.
6/1/2023	6/30/2023	After 2 months of relatively dry conditions portions of Missouri were brought into severe drought conditions. According to the Advanced Hydrologic Precipitation Service page there was a deficit of 2-5 inches across May and June which led to the declaration of severe drought, and eventual upgrade to extreme drought later in the month.
7/1/2023	7/31/2023	After another month of below normal precipitation the severe drought across eastern Kansas persisted through the month of July.
8/1/2023	8/31/2023	Severe (D2) to extreme (D3) drought due to precipitation deficits over the previous several months continued through August in several Missouri counties.
9/1/2023	9/30/2023	Precipitation deficits over the previous several months created severe extreme droughts across many counties in Missouri for September 2023.
10/1/2023	10/31/2023	Numerous counties over central and western Missouri were plagued by severe to extreme drought through the entire month of October.
11/1/2023	11/30/2023	Severe drought continued through the entire month of November for 9 counties in the Pleasant Hill/Kansas City CWA.
12/1/2023	12/31/2023	Severe drought continued through the entire month of December for 3 counties of northeastern MO and 3 counties of central MO.
1/1/2024	1/16/2024	Precipitation deficits over the previous several months had several counties across central MO and northeastern MO in severe to extreme drought at the start of January 2024. Widespread snowfall helped these counties improve to only moderate drought (D1) or better by the January 16th issuance of the US Drought Monitor.

The following table contains the data for crop loss claims due to drought that have been paid in Putnam County from 2013 to 2024. The following graphic indicates that Putnam County is at moderate risk due to drought.

Figure 3.24. Annualized Drought Crop Insurance Claims Paid 2013-2021



Source 2023 Missouri State Hazard Mitigation Plan

Table 3.44. Crop Loss Payments for Drought in Putnam County 2014 – 2024

CROP YEAR	CROP LOSS	CAUSE OF LOSS	INSURANCE PAID (\$)
2014	Corn	Drought	\$1,444.00
2015	- No Claims -		\$0
2016	Corn	Drought	\$16,903.50
	Soybeans		\$42,535.00
2017	Corn	Drought	\$96,602.00
	Soybeans		\$534,803.50
2018	Corn	Drought	\$974,851.71
	Soybeans		\$1,161,451.70
2019	Corn	Drought	\$6,677.00
2020	Corn	Drought	\$160,594.00
	Soybeans		\$293,036.00
2021	Wheat	Drought	\$3,751.00
	Corn		\$116,115.52

	Soybeans		\$406,490.44
2022	Corn	Drought	\$107,329.00
	Grain Sorghum		\$43,449.00
	Soybeans		\$1,421,057.60
2023	Corn	Drought	\$8,881.00
	Soybeans		\$50,199.90
2024	Corn	Drought	\$48,965.02
	Soybeans		\$338,771.80
Total			\$5,833,908.69

Source: USDA.gov/data/cause.html

Probability of Future Occurrence

To determine the frequency of previous droughts in Putnam County the data was taken from droughtmonitor.unl.edu. A search was conducted on the frequency and drought classifications that Putnam County has had for the time frame of January 2000 through July 2025. This time frame encompasses 332.75 months in total, and this figure was used in the probability calculations. The following table provides a breakdown of the information that was gathered regarding Putnam County.

Table 3.45. Putnam County and Weeks Spent by Drought Classification 2000-2025

Putnam County	D0	D1	D2	D3	D4
Weeks at this Designation	654	376	145	62	2
Months at this Designation	163.5	94	36.25	15.5	.5

Source: US Drought Monitor; Statistics by Threshold; Chariton County, Missouri 7/8/2025

The following calculations provide the probability of drought occurring based on drought classification.

$$\text{Probability of D0 Drought} = \frac{163.5}{332.75} = 49\%$$

$$\text{Probability of D1 Drought} = \frac{94}{332.75} = 28\%$$

$$\text{Probability of D2 Drought} = \frac{36.25}{332.75} = 11\%$$

$$\text{Probability of D3 Drought} = \frac{15.5}{332.75} = 4.7\%$$

$$\text{Probability of D4 Drought} = \frac{.5}{332.75} = 0.2\%$$

The probability of Putnam County experiencing a drought, regardless of severity, is calculated by combining all instances of drought and dividing by the number of months within the time frame in question.

$$\text{Probability of Drought} = \frac{309.75}{332.75} = 93\%$$

Putnam County has 93.1% chance of experiencing drought annually, so drought is likely each year,

but the severity will vary. Due to the likelihood of some type of drought, Putnam County should plan for the occurrence of drought and take steps to alleviate the severity with measures intended to conserve water usage.

Changing Future Conditions Considerations

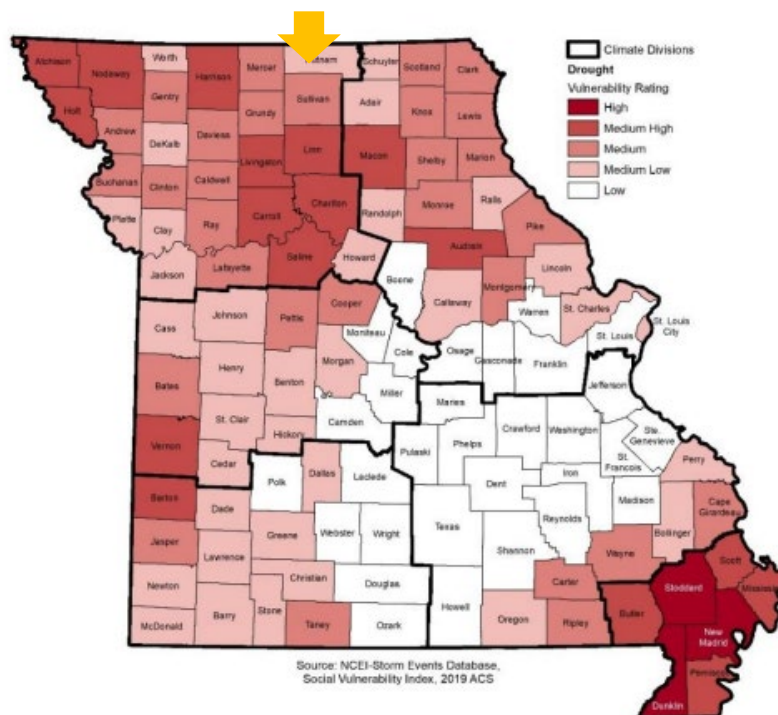
Although drought is not predictable, long-range outlooks and predicted impacts of changing future conditions could indicate an increased chance of drought. With an increase in annual temperatures due to a changing climate, droughts are more likely to occur through higher evaporation rates. With the likelihood of wetter springs there is an increased chance of dryer summers. The dryness is likely to reduce the river flow and may lead to a shortage of agricultural water availability. This has a large effect on the farm-dependent community.

A new analysis, performed for the Natural Resources Defense Council, examined the effects of climate change on water supply and demand in the contiguous United States. The study found that more than 1,100 counties will face higher risks of water shortages by mid-century as a result of climate change. Two of the principal reasons for the projected water constraints are shifts in precipitation and potential evapotranspiration (PET). Climate models project decreases in precipitation in many regions of the US, including areas that may currently be described as experiencing water shortages of some degree. This study shows a low risk of water shortages in 2050 for Putnam County with the effects of changing future conditions.

Vulnerability

Vulnerability Overview

Figure 3.25. Drought Vulnerability in Missouri by County



Source: 2023 Missouri State Hazard Mitigation Plan

As per the previous Figure, Putnam County in Missouri has a Medium-Low Drought Vulnerability Rating per the 2023 State Hazard Mitigation Plan. The method used to determine vulnerability to drought across Missouri was a statistical analysis of data from several sources: USDA Risk Management Agency's insured crop losses as a result of drought (2021-2022), USDA crop exposure by county, the calculated Social Vulnerability Index for Missouri Counties from the Hazards and Vulnerability Research Institute in the Department of Geography at the University of South Carolina, and storm events data (1996-December 31, 2021) and probability of severe drought based on historic Palmer Drought Severity Index. The USDA crop exposure by county is from the 2017 Agricultural Census and assumes that the larger the exposure, the greater potential for loss and impact on the local economy.

From the statistical data collected, four factors were considered in determining overall vulnerability to drought as follows: social vulnerability, crop exposure ratio, annualized crop claims paid, and likelihood of occurrence. Based on natural breaks in the statistical data, a rating value of 1 through 5 was assigned to each factor. Once the ranges were determined and applied to all factors considered in the analysis, the ratings were combined to determine an overall vulnerability rating for drought. These rating values correspond to the following descriptive terms:

1. Low
2. Medium-low
3. Medium
4. Medium-High
5. High

The following table utilizes these factors in determining the vulnerability rating of Putnam County to drought, according to the 2023 Missouri Hazard Mitigation Plan.

Table 3.46. Vulnerability of Putnam County to Drought

SOVI Index Rating	USDA RMA Total Drought Crop Claims	Average Annualized Crop Claims	USDA Claims Rating	2017 Crop Exposure	Crop Exposure Rating	Likelihood of Severe Drought	Drought Occurrence	Total Rating	Total Rating (text) Drought
3	\$30,721,736	\$3,072,174	3	\$22,460,000	1	0.58	3	10	Medium Low

Source: 2023 Missouri State Hazard Mitigation Plan

Potential Losses to Existing Development

The National Drought Monitor Center at the University of Nebraska at Lincoln summarized the potential impacts of drought as follows: Drought can create economic impacts on agriculture and related sectors, including forestry and fisheries, because of the reliance of these sectors on surface and subsurface water supplies. In addition to losses in yields in crop and livestock production, drought is associated with increases in insect infestations, plant disease, and wind erosion. Droughts also bring increased problems with insects and disease to forests and reduce growth. The incidence of forest and range fires increases substantially during extended droughts, which in turn place both human and wildlife populations at higher levels of risk. Income loss is another indicator used in assessing the impacts of drought because so many sectors are affected. Finally, while drought is rarely a direct cause of death, the associated heat, dust and stress can all contribute to increased mortality.

Although it is difficult to quantify many of the potential losses that may occur due to drought, agriculture losses are direct economic costs that can be easily quantified by examining previous insurance claims in the county. Putnam County's crop exposure is high, with approximately 89% of the county's total land area in use for agriculture. Over the past 11 years Putnam County has experienced an average of \$530,355.34 in crop losses annually due to drought conditions.

Impact of Previous and Future Development

Increases in acreage planted with crops would increase the exposure to drought-related agricultural losses. In addition, increases in population impose additional strains on water supply systems to meet the growing demand for treated water, and these strains could prove impactful during times of drought.

Hazard Summary by Jurisdiction

The entire planning area, with the exception of the school district, will be affected by drought to some degree. However, the ways in which the impacts will be experienced vary. The unincorporated agricultural areas of Putnam County are the most vulnerable to drought. Therefore, the magnitude of the impacts of drought may be greater in rural parts of the county, which have large areas of crops and wildlife. In areas with greater building density, there is more exposure to potential shrinking and expanding soil problems around foundations because of drought. If drought conditions are severe and prolonged, water supplies could also be affected.

Problem Statement

- Drought could lead to issues with water supply and fire suppression.
- Prolonged drought could lead to an economic downturn, as the county is predominantly rural.
- Drought could also lead to breaks in underground infrastructure as the dry ground shifts.

3.4.5 Extreme Temperatures

Hazard Profile

Hazard Description

Extreme temperature events, both hot and cold, can impact human health and mortality, natural ecosystems, agriculture and other economic sectors. According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Ambient air temperature is one component of heat conditions, with relative humidity being the other. The relationship of these factors creates what is known as the apparent temperature. The Heat Index chart shown in **Figure 3.26** uses both of these factors to produce a guide for the apparent temperature or relative intensity of heat conditions.

Extreme cold often accompanies severe winter storms and can lead to hypothermia and frostbite in people without adequate clothing protection. Cold can cause fuel to congeal in storage tanks and supply lines, stopping electric generators. Cold temperatures can also overpower a building's heating system and cause water and sewer pipes to freeze and rupture. Extreme cold also increases the likelihood of ice jams on flat rivers or streams. When combined with high winds from winter storms, extreme cold becomes extreme wind chill, which is hazardous to health and safety. The National Institute on Aging estimates that more than 2.5 million Americans are elderly and especially vulnerable to hypothermia, with the isolated elders being most at risk. About 10 percent of people over the age of 65 have some kind of bodily temperature-regulating defect, and 3-4 percent of all hospital patients over 65 are hypothermic.

Also at risk are those without shelter, those who are stranded, or who live in a home that is poorly insulated or without heat. Other impacts of extreme cold include asphyxiation (unconsciousness or death from a lack of oxygen) from toxic fumes from emergency heaters; household fires, which can be caused by fireplaces and emergency heaters; and frozen/burst pipes.

Geographic Location

Since extreme temperatures are an area-wide event the entire planning area of Putnam County is subject to extreme heat and cold, and all participating jurisdictions within the county are affected.

However, there are additional factors to consider when there is an extreme heat event. Specific climatic factors, such as temperature and humidity, along with wind and sun/shade determine the effects of this hazard. An individual's physical condition has a profound effect on their ability to deal with the effects of excessive heat. Illness or heavy exercise adds to the metabolic heat that the body must dissipate. Age is also a contributing factor. The accessibility of air-conditioned shelters is important to those falling into at-risk groups.

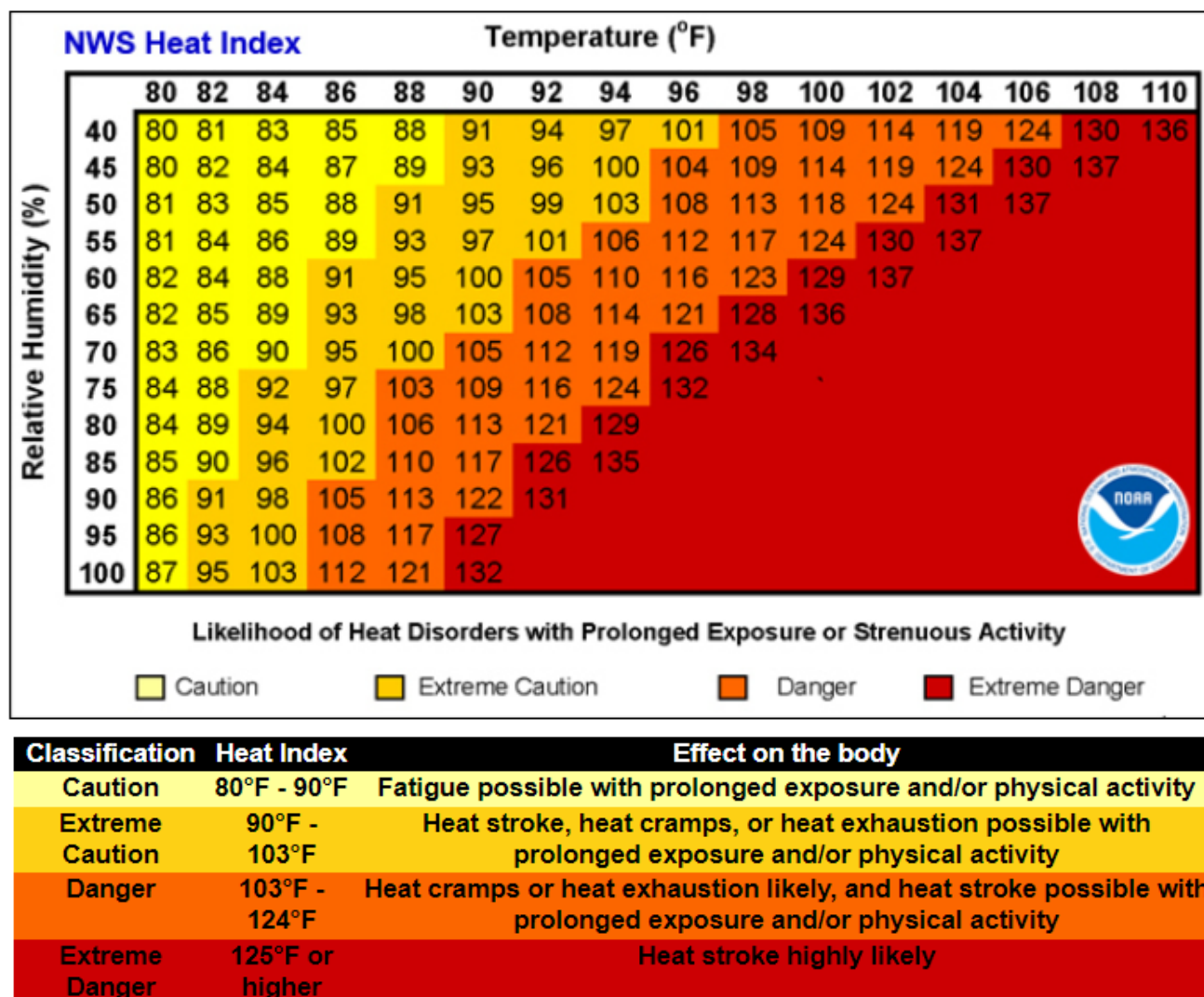
Strength/Magnitude/Extent

The National Weather Service (NWS) has an alert system in place (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. A common guideline for issuing excessive heat alerts is when for two or more consecutive days: (1) when the maximum daytime Heat Index is expected to equal or exceed 105 degrees Fahrenheit (°F); and the nighttime minimum Heat Index is 80°F or above. A heat advisory is issued when temperatures reach 105

degrees, and a warning is issued at 115 degrees.

Figure 3.46 below shows the Heat Index Chart from the National Weather Service that indicates the Heat Index calculation of temperature and relative humidity. A Heat Index is used to determine heat exposure, dangerous conditions and possible loss as a result of a high heat index

Figure 3.26. Heat Index (HI) Chart



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.

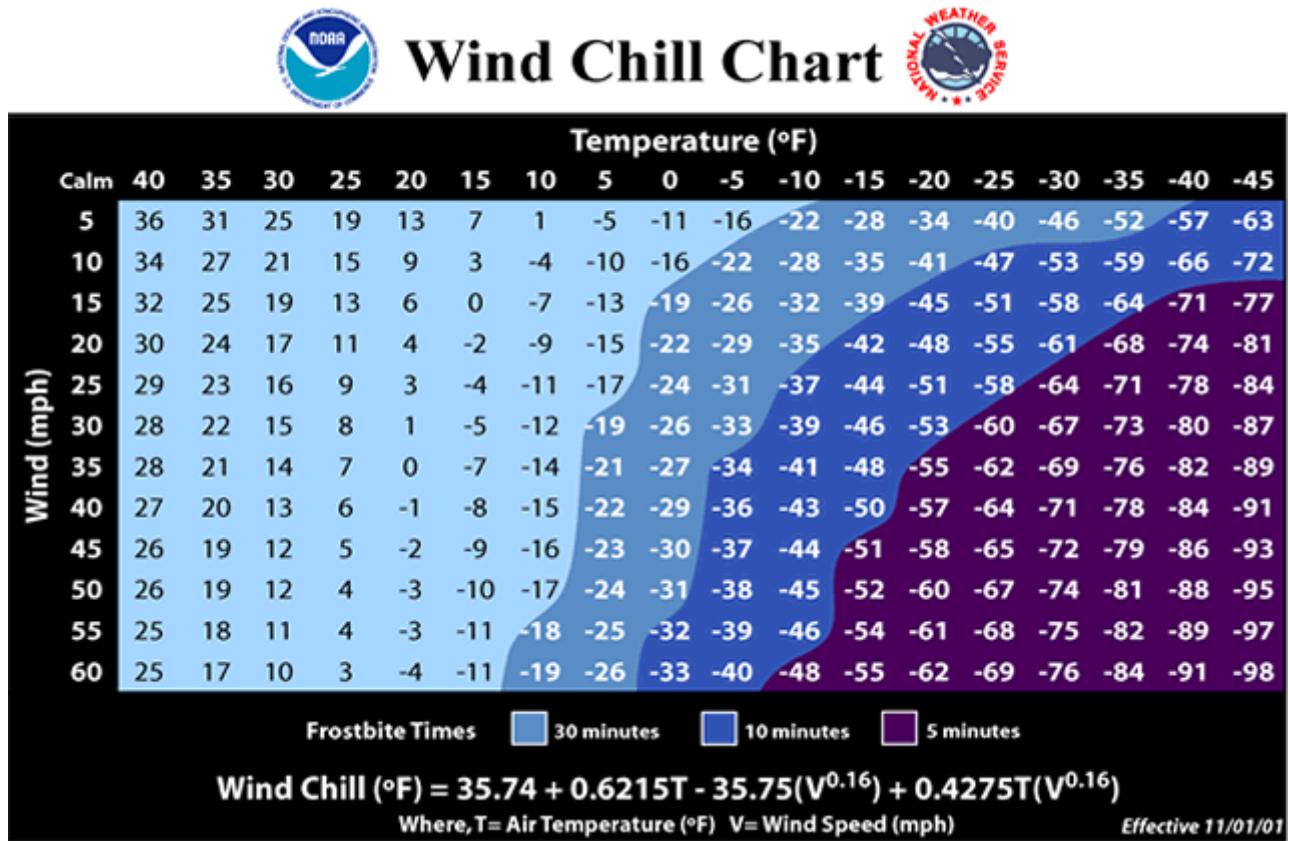
The NWS Wind Chill Temperature (WCT) index uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from winter winds and freezing temperatures. The figure below presents wind chill temperatures which are based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

The National Weather Service issues the following wind chill products as conditions warrant across the State of Missouri. NWS local offices in Missouri may collaborate with local partners to determine

when an alert should be issued for a local area. The planning area is vulnerable to all of these warnings if the temperature drops low enough.

- Wind Chill Warning: NWS issues a wind chill warning when dangerously cold wind chill values are expected or occurring. If you are in an area with a wind chill warning, avoid going outside during the coldest parts of the day. If you do go outside, dress in layers, cover exposed skin, and make sure at least one other person knows your whereabouts. Update them when you arrive safely at your destination.
- Wind Chill Watch: NWS issues a wind chill watch when dangerously cold wind chill values are possible. As with a warning, adjust your plans to avoid being outside during the coldest parts of the day. Make sure your car has at least a half a tank of gas and update your winter survival kit.
- Wind Chill Advisory: NWS issues a wind chill advisory when seasonably cold wind chill values, but not extremely cold values are expected or occurring. Be sure you and your loved ones dress appropriately and cover exposed skin when venturing outdoors.
- Hard Freeze Warning: NWS issues a hard freeze warning when temperatures are expected to drop below 28°F for an extended period of time, killing most types of commercial crops and residential plants.
- Freeze Warning: When temperatures are forecasted to go below 32°F for a long period of time, NWS issues a freeze warning. This temperature threshold kills some types of commercial crops and residential plants.
- Freeze Watch: NWS issues a freeze watch when there is a potential for significant, widespread freezing temperatures within the next 24-36 hours. A freeze watch is issued in the autumn until the end of the growing season and in the spring at the start of the growing season.
- Frost Advisory: A frost advisory means areas of frost are expected or occurring, posing a threat to sensitive vegetation.

Figure 3.27. Wind Chill Chart



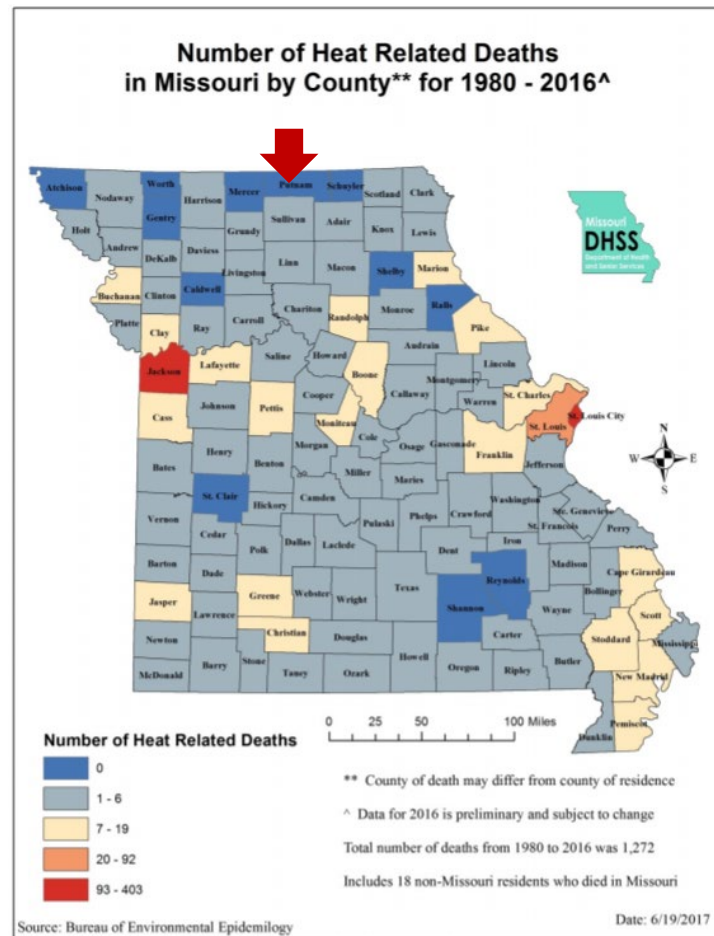
Source: <https://www.weather.gov/safety/cold-wind-chill-chart>

Previous Occurrences

The recorded events in the National Centers for Environmental Information (NCEI) database indicates there have been 15 recorded events of excessive heat in Putnam County for the period of 1950 – 2024. There were no deaths or injuries associated with these events.

The NCEI database indicates 8 recorded events of extreme cold/wind chill in the same period, with no deaths or injuries associated with these events. The figure below shows between zero heat related deaths in Putnam County from 1980 – 2016, per DHSS records. It should be noted that these records are not a complete record of all the cold spells, only those reported into the database.

Figure 3.28. Heat Related Deaths in Missouri 2000 - 2016



Source: <https://health.mo.gov/living/healthcondiseases/hyperthermia/pdf/stat-report.pdf>

Extreme heat can cause stress to crops and animals. According to USDA Risk Management Agency, losses to insurable crops during the 10-year time period from 2014 to 2024 were \$54,857 in Putnam County. Extreme heat can also strain electricity delivery infrastructure overloaded during peak use of air conditioning during extreme heat events. Another type of infrastructure damage from extreme heat is road damage. When asphalt is exposed to prolonged extreme heat, it can cause buckling of asphalt-paved roads, driveways, and parking lots.

From 1988-2011, there were 3,496 fatalities in the U.S. attributed to summer heat. This translates to an annual national average of 146 deaths. During the same period, 0 deaths were recorded in the planning area, according to NCEI data. The National Weather Service stated that among natural hazards, no other natural disaster—not lightning, hurricanes, tornadoes, floods, or earthquakes—causes more deaths.

The table below shows insurance payments for agriculture due to cold temperatures from the year 2014 through 2024.

Table 3.47. Crop Loss Due to Cold Winter in Putnam County (2014-2024)

Year	Crop	Cause of Loss	Insurance Paid (\$)
2014	Wheat	Cold Winter	\$11,052.00
2015	No Claims		\$0

2016	No Claims	\$0
2017	No Claims	\$0
2018	No Claims	\$0
2019	No Claims	\$0
2020	No Claims	\$0
2021	No Claims	\$0
2022	No Claims	\$0
2023	No Claims	\$0
2024	No Claims	\$0
Total		\$11,052.00

Source: USDA Cause of Loss Data

The table below shows the crop insurance payments in Putnam County due to heat or excessive heat from 2014-2024.

Table 3.48. Crop Loss Due to Heat/Excessive Heat in Putnam County (2014-2025)

Year	Crop	Cause of Loss	Insurance Paid (\$)
2014	No Claims		0
2015	No Claims		0
2016	No Claims		0
2017	Corn	Heat	\$538
	Soybeans		\$14,842
	Soybeans	Hot Wind	\$2,091
2018	No Claims		0
2019	No Claims		0
2020	No Claims		0
2021	Soybeans	Heat	\$4,107
2022	Soybeans	Heat	\$10,717
2023	No Claims		0
2024	Soybeans	Heat	\$22,562
Total			\$54,857

Source: USDA Cause of Loss Data

From 1988-2011, there were 3,496 fatalities in the U.S. attributed to summer heat. This translates to an annual national average of 146 deaths. During the same period, no deaths were recorded in the planning area, according to NCEI data. The National Weather Service stated that among natural hazards, no other natural disaster—not lightning, hurricanes, tornadoes, floods, or earthquakes— causes more deaths.

According to the National Centers for Environmental Information (NCEI) Storm Events database, from 2005-2025, there have been 8 recorded events related to cold/wind chill and extreme cold and 7 recorded events related to heat/extreme heat. The event narratives indicating significant impacts in Putnam County are Summarized below.

Table 3.49. Extreme Cold Events in Putnam County (2005-2025)

Date	Event Narrative
1/5/2014	A polar plunge of arctic air slammed into Kansas, bringing wind chill values to around 40 degrees below zero for the morning of January 6.
2/6/2014	Cold temperatures and north winds combined to bring wind chill values down to around 30 below zero.
2/14/2021	In the first night of bitter cold across the area, temperatures dropped well below zero and with winds around 10-20 mph wind chills overnight going into Sunday morning dropped to around 20 to 30 below.

2/15/2021	In the second night of bitter cold across the area, temperatures dropped well below zero and with winds around 10-20 mph wind chills overnight going into Monday morning dropped to around 20 to 30 below.
2/16/2021	In the third night of bitter cold across the area, temperatures dropped well below zero and with winds around 10-20 mph wind chills overnight going into Sunday morning dropped to around 20 to 30 below.
12/22/2022	An arctic air mass sent temperatures below zero along with strong winds. Minimum wind chills across the region generally range from -30 to -40 degrees between roughly 10 am on 12/22 to noon on 12/23.
1/12/2024	The nearest AWOS or ASOS site to Putnam County was Kirksville Airport. The high and low temperatures at Kirksville airport were as follows: Jan 12: High: 29 Low: 10 Jan 13: High: 10 Low: -13 Jan 14: High: -6 Low: -17 Jan 15: High: 0 Low: -17 Jan 16: High: 6 Low: -9 Jan 19: High: 9 Low: -5 Jan 20: High: 11 Low: -13 Jan 21: High: 30 Low: -6 The coldest wind chill recorded during this cold air outbreak was -40 degrees at 4 AM on January 14th. This was the coldest wind chill recorded at Kirksville since the morning of December 22, 1989 (-43 degrees). The 4-day period of Jan 13-16 was the coldest 4-day period on record in Kirksville, with an average temperature of -5.7 degrees. (Period of record begins Jan 1, 1948).
2/18/2025	The ASOS at Kirksville Airport reported wind chills ranging between -20 and -24 degrees between midnight and 10 am on Feb 18th with subzero temperatures. Wind chills dropped to -20 degrees or colder again between 3 am and 8 am on Feb 20th, with temperatures between -5 and -7 degrees. Wind chills were below zero the entire time between midnight at Feb 18th around noon on Feb 20th.

Source: NCEI Weather Database, 8,2025

Table 3.50. Extreme Heat Events in Putnam County (2005-2025)

Date	Event Narrative
7/21/2005	Oppressive heat and humidity prevailed across the area from July 21st to July 25th. Afternoon heat indices reached from 105 to 110 degrees. Kansas City International heat index reached 114 degrees on July 22nd, and St. Joseph topped out at 113 degrees on July 22nd.
7/16/2006	Oppressive heat and humidity combined to produce afternoon and early evening heat indices from 105 to 115 degrees, from July 16th through July 20th. The highest computed heat index reached 121 degrees at Amity Missouri. Three males and one female died of heat related causes in Jackson County.
7/29/2006	Oppressive heat and humidity combined to produce heat indices from 105 to 115 degrees, from July 29th through July 31st.
8/1/2006	Oppressive heat and humidity continued from July...with heat indices from 105 to 115 degrees before ending on August 2nd. Two males aged 58 and 62 died due to the heat.
8/6/2007	An upper-level ridge of high pressure persisted across the area from August 6th through August 17th. The combination of heat and humidity produced heat index readings in the 105-to-115-degree range.
7/18/2012	An unusually strong upper-level ridge of high pressure dominated the central United States with very hot and dry conditions, from July 18th through 25th 2012. Temperatures topped out from 100 to 110 degrees.
8/19/2023	Starting on August 19, 2023, well-above normal temperatures impacted the central part of the United States, kicking off a heatwave that has not been experienced in the region in recent history. Kansas City International Airport reached high temperatures not recorded in the area since August of 2012. In contrast to the 2012 heatwave, this stretch of hot weather was accompanied by extremely high dewpoints, with frequently reached the upper 70s to middle 80s across the entire area. The combination of the extreme heat and the excessively high dewpoints led to heat indices from August 19 through August 25 to rise to 120-130 degrees. The hottest heat index in the area occurred in Lawrence, Kansas on the 20th and 21st, when it rose to 134 degrees.

Source: NCEI Weather Database, 8,2025

Probability of Future Occurrence

NCEI, dating from 2004 to August of 2025, indicates a total of 7 events related to extreme heat and 8 events related to extreme cold in Putnam County. Based on this historical data, the calculated probability of an event is as follows:

Probability of an Extreme Cold Event:

$$Probability = \frac{\# \text{ of events}}{Years} = \frac{8}{20} = 40\%$$

Putnam County has a 40% chance of experiencing an extreme cold event in any given year.

Probability of an Extreme Heat Event:

$$Probability = \frac{\# \text{ of events}}{Years} = \frac{7}{20} = 35\%$$

Putnam County has a 35% chance of experiencing an extreme heat event in any given year.

Changing Future Conditions Considerations

By the end of the century, the temperatures are projected to continue to increase. The best scenario, with lower greenhouse gas emissions, temperatures are expected to exceed historic levels by the middle of the 21st century. If greenhouse gas emissions are not curbed, historically unprecedented warming is projected by the end of the century. Due to the change in climate, it is projected that by the middle of the 21st century, record breaking heat is likely to occur on a regular basis. This will lead to a higher frequency of heat waves.

The impacts of extreme temperatures are experienced more acutely by the elderly and other vulnerable populations. High temperatures are often higher in urban areas, of which Putnam County has none. There is a higher demand for electricity as people try and keep cool. This increased demand adds a strain to electricity providers and could potentially lead to an increase in the number of power outages.

Additionally, air quality and water quality can be adversely affected by an increase in temperatures. Putnam County is mostly agricultural, and the strain placed on crops and livestock could increase along with the temperature.

Vulnerability

Vulnerability Overview

Those at greatest risk for heat-related illness include infants and children up to five years of age, people 65 years of age and older, people who are overweight, and people who are ill or on certain medications. However, even young and healthy individuals are susceptible if they participate in strenuous physical activities during hot weather. In agricultural areas, the exposure of farm workers, as well as livestock, to extreme temperatures is a major concern.

The following table lists typical symptoms and health impacts due to exposure to extreme heat.

Table 3.51. 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

The National Institute on Aging estimates that more than 49 million Americans over the age of 65 are particularly vulnerable to hypothermia, with isolated elders being most at risk. For an older person, a body temperature of 95° or lower can cause many health problems, such as heart attack, kidney problems, liver damage or worse.

Also at risk are those without shelter, those who are stranded, and those who live in a home that is poorly insulated or without heat. Other impacts of extreme cold include asphyxiation (unconsciousness or death from a lack of oxygen) from toxic fumes from emergency heaters; household fires, which can be caused by fireplaces and emergency heaters; and frozen/burst pipes.

Extreme heat and extreme cold events are common occurrences in Missouri. The method used to determine vulnerability to extreme temperatures across Missouri was statistical analysis of data from several sources: National Centers for Environmental Information (NCEI) storm events data (1996 to December 31, 2021), total population and percentage of population over 65 data from the U.S. Census (2019), and the calculated Social Vulnerability Index for Missouri counties from the Hazards and Vulnerability Research Institute in the Department of Geography at the University of South Carolina.

From the statistical data collected, four factors were considered in determining overall vulnerability to extreme temperatures as follows: total population, percentage of population over 65, likelihood of occurrence, and social vulnerability. Based on natural breaks in the statistical data, a rating value of 1 through 5 was assigned to each factor. Once the individual ratings were determined for the above factors, a combined vulnerability rating was computed for extreme heat and extreme cold. These rating values correspond to the following descriptive terms:

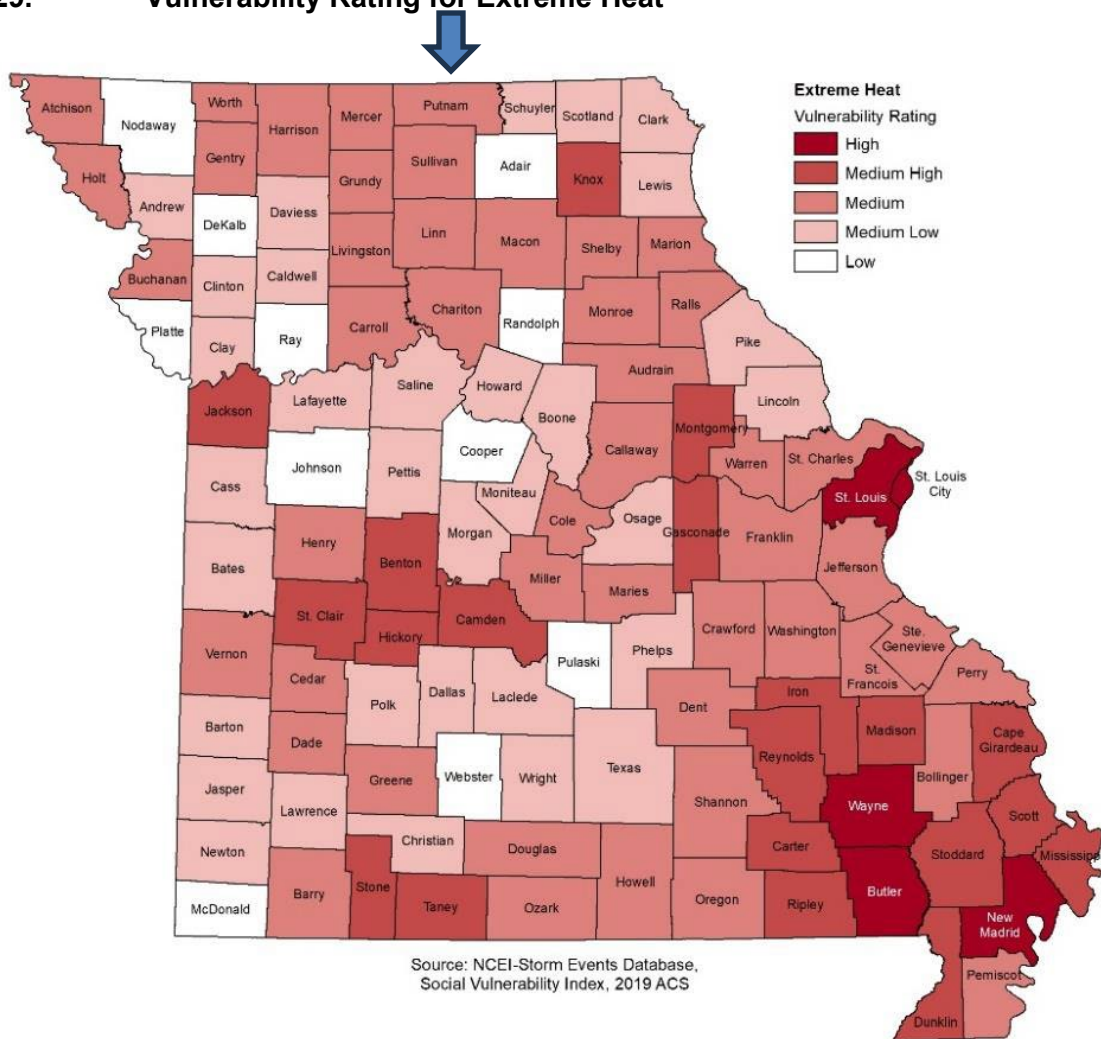
- 1) Low
- 2) Medium-Low
- 3) Medium
- 4) Medium-High
- 5) High

Table 3.52. Likelihood of Occurrence and Overall Vulnerability Rating for Extreme Temperatures

Heat					Cold				
Total Events	Likelihood of Occurrence	Likelihood Rating	Total Vulnerability	Total Vulnerability Description	Total Events	Likelihood of Occurrence	Likelihood Rating	Total Vulnerability	Total Vulnerability Description
16	0.62	1	9	Medium	7	0.28	2	10	Medium High

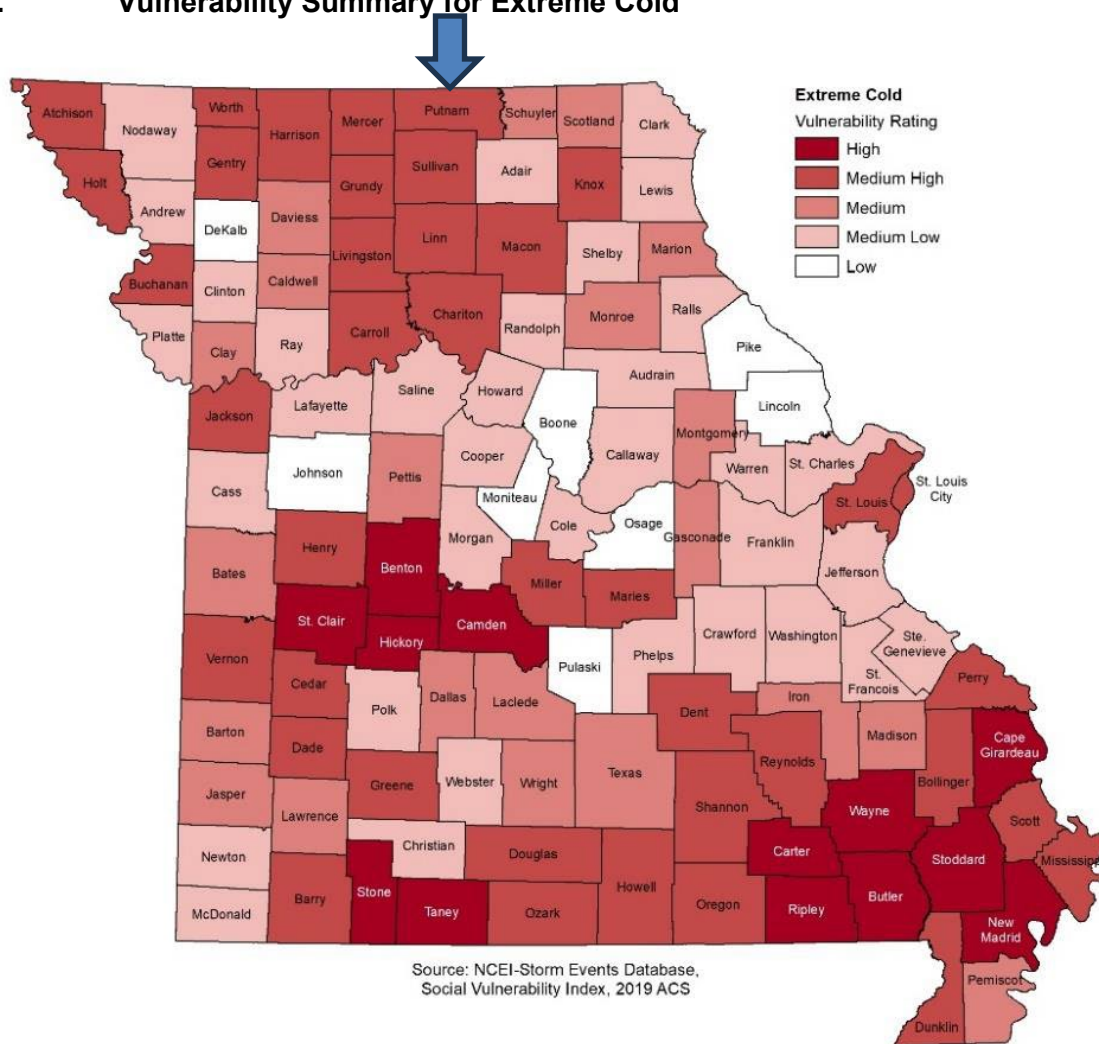
Source: 2023 Missouri State Hazard Mitigation Plan

Figure 3.29. Vulnerability Rating for Extreme Heat



Source 2023 Missouri State Hazard Mitigation Plan

Figure 3.30. Vulnerability Summary for Extreme Cold



Source: 2023 Missouri State Hazard Mitigation Plan

Potential Losses to Existing Development

During extreme heat events structural, road, and electrical infrastructure are vulnerable to damages. Depending upon temperatures and the duration of extreme temperature losses will vary.

In the years from 2014 to 2024 Putnam County suffered a total of \$65,909 in crop losses due to extreme temperatures. This would equal approximately \$6,590.90 in claims for crop loss each year in Putnam County.

Impact of Previous and Future Development

Population growth can result in increases in the age groups that are most vulnerable to extreme heat. Population growth also increases the strain on electricity infrastructure, as more electricity is needed to accommodate the growing population. Putnam County's population has been declining for the last 10 years and there is no planned future development that would increase vulnerability to extreme temperatures.

Hazard Summary by Jurisdiction

There is no variation in vulnerability due to location or jurisdiction within the planning area. Rather those at greatest risk for heat-related illnesses and deaths include children up to five years of age, people 65 years of age and older, people who are overweight, and people who are ill or on certain medications. To determine jurisdictions within the planning area with populations more vulnerable to extreme heat, demographic data was obtained from the 2010 census on population percentages in each jurisdiction comprised of those under age 5 and over age 65. Data was not available for overweight individuals and those on medications vulnerable to extreme heat. The table below summarizes vulnerable populations in the participating jurisdictions. Note that school and special districts are not included in the table because students and those working for the special districts are not customarily in these age groups.

Table 3.53. Putnam County Population Under Age 5 and Over Age 65, 2023 Census Data

Table 3.54. Jurisdiction	Population Under 5	% Population Under 5	Population 65 and over	% Population 65 and over
Putnam County	320	6.8%	1,198	25.6%
Village of Livonia	3	5.8%	11	21.2%
Village of Lucerne	5	8.8%	11	19.3%
Village of Powersville	2	4.8%	15	35.7%
Village of Worthington	7	14.9%	7	14.9%
City of Unionville	131	7.6%	406	23.4%

Source: U.S. Census Bureau, Profile of General Population and Housing Characteristics (DP1)

Problem Statement

Extreme heat could lead to increased use of water increasing stress on the public water supply systems, as well as increasing the risk to the health of residents who lack proper cooling systems. Heat will also increase demand for electricity and could lead to possible power outages. Extreme cold will cause schools to alter class times and, in some cases, suspend classes all together, cold temperatures may also lead to frozen pipes and increases in electric demand.

3.4.6 Severe Thunderstorms Including High Winds, Hail, and Lightning

Hazard Profile

Hazard Description

Thunderstorms

A thunderstorm is defined as a storm that contains lightning and thunder which is caused by unstable atmospheric conditions. When cold upper air sinks and warm moist air rises, storm clouds or 'thunderheads' develop resulting in thunderstorms. This can occur singularly, as well as in clusters or lines. The National Weather Service defines a thunderstorm as "severe" if it includes hail that is one inch or more, or wind gusts that are at 58 miles per hour or higher. At any given moment across the world, there are about 1,800 thunderstorms occurring. Severe thunderstorms most often occur in Missouri in the spring and summer, during the afternoon and evenings, but can occur at any time. Other hazards associated with thunderstorms are heavy rains resulting in flooding (discussed separately in **Section 3.____**) and tornadoes (discussed separately in **Section 3.____**).

High Winds

A severe thunderstorm can produce winds causing as much damage as a weak tornado. The damaging winds of thunderstorms include downbursts, microbursts, and straight-line winds. Downbursts are localized currents of air blasting down from a thunderstorm, which induce an outward burst of damaging wind on or near the ground. Microbursts are minimized downbursts covering an area of less than 2.5 miles across. They include a strong wind shear (a rapid change in the direction of wind over a short distance) near the surface. Microbursts may or may not include precipitation and can produce winds at speeds of more than 150 miles per hour. Damaging straight-line winds are high winds across a wide area that can reach speeds of 140 miles per hour.

Lightning

All thunderstorms produce lightning which can strike outside of the area where it is raining and is has been known to fall more than 10 miles away from the rainfall area. Thunder is simply the sound that lightning makes. Lightning is a huge discharge of electricity that shoots through the air causing vibrations and creating the sound of thunder.

Hail

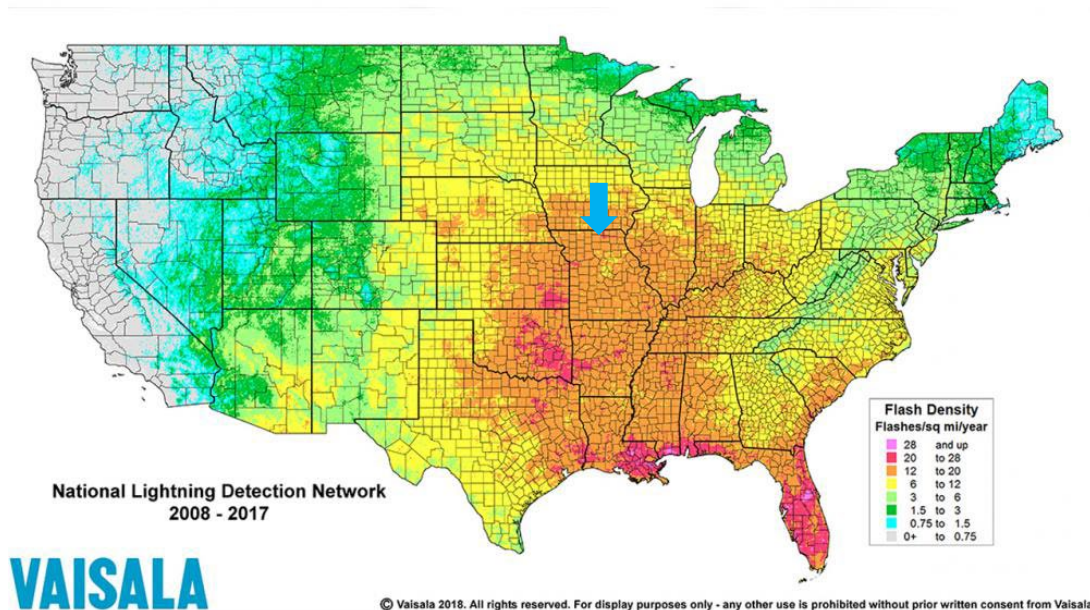
According to the National Oceanic and Atmospheric Administration (NOAA), hail is precipitation that is formed when thunderstorm updrafts carry raindrops upward into extremely cold atmosphere causing them to freeze. The raindrops form into small frozen droplets. They continue to grow as they come into contact with super-cooled water which will freeze on contact with the frozen rain droplet. This frozen droplet can continue to grow and form hail. As long as the updraft forces can support or suspend the weight of the hailstone, hail can continue to grow before it hits the earth.

At the time when the updraft can no longer support the hailstone, it will fall down to the earth. For example, a ¼" diameter or pea sized hail requires updrafts of 24 miles per hour, while a 2 ¾" diameter or baseball sized hail requires an updraft of 81 miles per hour. According to the NOAA, the largest hailstone in diameter recorded in the United States was found in Vivian, South Dakota on July 23, 2010. It was eight inches in diameter, almost the size of a soccer ball. Soccer-ball-sized hail is the exception, but even small pea-sized hail can do damage.

Geographic Location

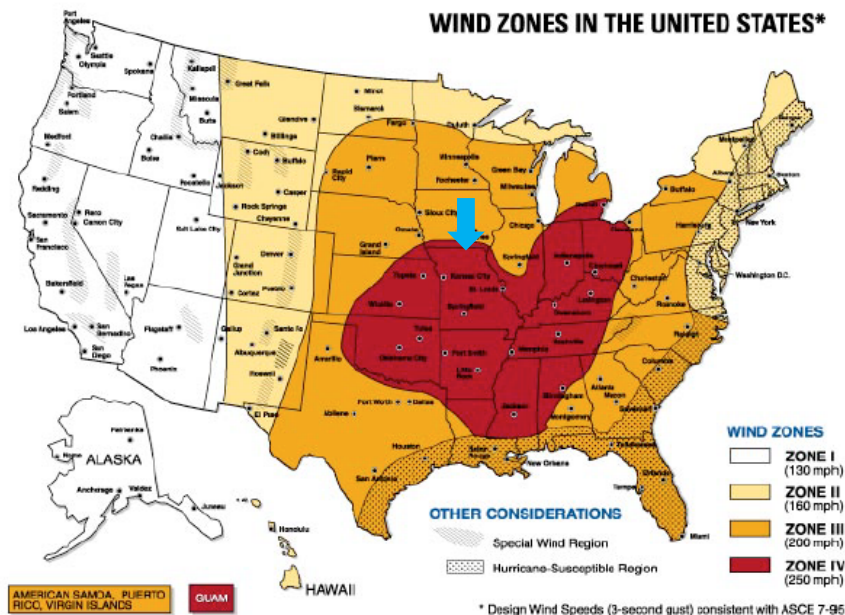
Thunderstorms/high winds/hail/lightning events are an area-wide hazard that can happen anywhere in the county. Although these events occur similarly throughout the planning area, they are more frequently reported in more urbanized areas. In addition, damages are more likely to occur in more densely developed urban areas. The majority of Putnam County is rural. According to the following table, the flash density of lightning in Putnam County is categorized as 12 to 20 flashes/square mile/year.

Figure 3.31. Location and Frequency of Lightning in Putnam County, Missouri



The following figure is a map that depicts the different wind zones in the United States. Putnam County, indicated with a blue arrow, is located entirely within Zone IV. This provides the information that Putnam County could sustain wind speeds of up to 250 miles per hour.

Figure 3.32. 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

Based on information provided by the Tornado and Storm Research Organization (TORRO), the following table describes typical damage impacts of the various sizes of hail.

Table 3.55. Tornado and Storm Research Organization Hailstorm Intensity Scale

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 Hailstorms	91-100	3.6-3.9	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
Super Hailstorms	>100	4.0+	Melon	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

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/hyscale.php>

Straight-line winds are defined as any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 miles per hour, which represent the most

common type of severe weather. They are responsible for most wind damage related to thunderstorms. Since thunderstorms do not have narrow tracks like tornadoes, the associated wind damage can be extensive and affect entire (and multiple) counties. Objects like trees, barns, outbuildings, high-profile vehicles, and power lines/poles can be toppled or destroyed, and roofs, windows, and homes can be damaged as wind speeds increase.

The onset of thunderstorms with lightning, high wind, and hail is generally rapid. Duration is less than six hours and warning time is generally six to twelve hours. Nationwide, lightning kills 75 to 100 people each year. Lightning strikes can also start structural and wildland fires, as well as damage electrical systems and equipment.

Previous Occurrences

Limitations to the use of NCEI reported lightning events include the fact that only lightning events that result in fatality, injury and/or property and crop damage are in the NCEI.

The tables below summarize past crop damages as indicated by crop insurance claims. The tables illustrate the magnitude of the impact on the planning area's agricultural economy.

The economy in Putnam County is largely agricultural in nature. The following crop insurance claims paid due to the hazards associated with severe storms, specifically hail, have had a significant impact on the planning area between 2014 and 2024.

Table 3.56. Crop Insurance Claims Paid in Putnam County from Thunderstorms, 2014-2024.

Crop Year	Crop Name	Cause of Loss Description	Insurance Paid
Total			\$0

Source: USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/tools-reports/summary-business/cause-loss>

Crop loss data showed no claims labeled as thunderstorm during any year from 2000 to 2024.

Table 3.57. Crop Insurance Claims Paid in Putnam County from High Winds, 2014-2024

Year	Crop	Cause of Loss	Insurance Paid (\$)
2014		No Claim	\$0
2015	Corn	Wind / Excess Wind	\$15,384.00
	Soybeans		\$73,752.00
2016	Corn	Wind / Excess Wind	\$8,655.00
2017		No Claim	\$0
2018		No Claim	\$0
2019	Grain Sorghum	Wind / Excess Wind	\$7,508.00
2020		No Claim	\$0
2021	Corn	Wind / Excess Wind	\$60,192.00
2022		No Claim	\$0
2023		No Claim	\$0
2024		No Claim	\$0
Total			\$165,491.00

Source: USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/tools-reports/summary-business/cause-loss>

Table 3.58. Crop Insurance Claims Paid in Putnam County from Lightning, 2014-2024

Year	Crop	Cause of Loss	Insurance Paid (\$)
2014		No Claim	\$0
2015		No Claim	\$0
2016	Soybeans	Other – Lightning	\$19,414.00
2017		No Claim	\$0
2018		No Claim	\$0

2019	No Claim	\$0
2020	No Claim	\$0
2021	Corn Other – Lightning	\$17,071.00
2022	No Claim	\$0
2023	No Claim	\$0
2024	No Claim	\$0
Total		\$36,485.00

USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/tools-reports/summary-business/cause-loss>

Table 3.59. Crop Insurance Claims Paid in Putnam County from Hail, 2014-2024

Year	Crop	Cause of Loss	Insurance Paid (\$)
2014	Corn	Hail	\$42,817.90
	Soybeans		\$1,620.00
2015	No Claim		\$0
2016	No Claim		\$0
2017	No Claim		\$0
2018	Soybeans	Hail	\$14,127.00
2019	Soybeans	Hail	\$6,983.00
2020	No Claim		\$0
2021	Corn	Hail	\$14,086.00
2022	No Claim		\$0
2023	Soybeans	Hail	\$4,294.00
2024	Soybeans	Hail	\$3,498.00
Total			\$87,425.90

USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/tools-reports/summary-business/cause-loss>

The following table includes NCEI reported events and damages for the past 20 years for all four included hazards when information is available (2004-August 2025)

Table 3.60. NCEI Reported Thunderstorm Events and Damages in Putnam County (2004-2025)

Date	Event Type	Magnitude	Deaths/Injuries	Property Damage	Crop Damage
5/24/2004	Thunderstorm Wind	57	0	\$10,000	0
6/12/2004	Hail	0.88	0	0	0
8/27/2004	Thunderstorm Wind	52	0	0	0
8/27/2004	Hail	0.88	0	0	0
8/27/2004	Thunderstorm Wind	52	0	0	0
10/29/2004	Hail	0.88	0	0	0
9/13/2005	Thunderstorm Wind	52	0	\$5,000	0
9/13/2005	Hail	1	0	0	0
9/13/2005	Thunderstorm Wind	52	0	0	0
3/12/2006	Thunderstorm Wind	52	0	\$200,000	0
4/2/2006	Hail	1	0	0	0
4/15/2006	Thunderstorm Wind	52	0	0	0
4/18/2006	Hail	1	0	0	0
4/18/2006	Hail	0.75	0	0	0

5/27/2006	Hail	0.75	0	0	0
8/13/2006	Thunderstorm Wind	52	0	0	0
4/3/2007	Hail	0.75	0	0	0
8/12/2007	Thunderstorm Wind	52	0	0	0
4/10/2008	Hail	0.88	0	0	0
6/12/2008	Hail	1.75	0	0	0
6/12/2008	Hail	1.75	0	0	0
6/19/2008	Hail	0.88	0	0	0
6/26/2008	Hail	0.75	0	0	0
6/26/2008	Hail	1	0	0	0
7/21/2008	Hail	0.88	0	0	0
7/25/2008	Heavy Rain		0	0	0
7/27/2008	Hail	4	0	0	0
2/26/2009	Hail	0.75	0	0	0
4/5/2010	Hail	0.75	0	0	0
6/1/2010	Thunderstorm Wind	61	0	\$3,000	0
6/21/2010	Hail	0.75	0	0	0
6/21/2010	Hail	0.75	0	0	0
6/21/2010	Hail	0.88	0	0	0
6/21/2010	Thunderstorm Wind	52	0	0	0
3/22/2011	Hail	1	0	0	0
4/3/2011	Hail	1	0	0	0
4/3/2011	Hail	1.5	0	0	0
6/14/2011	Hail	0.88	0	0	0
6/26/2011	Hail	0.88	0	0	0
6/26/2011	Thunderstorm Wind	52	0	0	0
7/23/2011	Thunderstorm Wind	52	0	0	0
5/25/2012	Hail	1.25	0	0	0
5/25/2012	Hail	1	0	0	0
5/25/2012	Hail	1	0	0	0
6/16/2012	Hail	1.5	0	0	0
6/16/2012	Hail	1.75	0	0	0
6/16/2012	Hail	1.75	0	0	0
4/27/2014	Thunderstorm Wind	61	0	0	0
5/12/2014	Hail	0.75	0	0	0
6/3/2014	Hail	2.75	0	0	0
6/3/2014	Hail	1.75	0	0	0
6/7/2015	Thunderstorm Wind	52	0	0	0
6/7/2015	Hail	0.75	0	0	0

6/20/2015	Hail	0.75	0	0	0
6/20/2015	Thunderstorm Wind	56	0	0	0
6/20/2015	Hail	1.25	0	0	0
6/20/2015	Hail	0.75	0	0	0
7/13/2015	Thunderstorm Wind	52	0	0	0
11/11/2015	Thunderstorm Wind	61	0	0	0
3/23/2016	Thunderstorm Wind	52	0	0	0
9/19/2016	Thunderstorm Wind	52	0	\$5,000	0
9/19/2016	Hail	0.88	0	0	0
3/6/2017	Thunderstorm Wind	61	0	0	0
6/14/2017	Hail	0.88	0	0	0
6/28/2017	Thunderstorm Wind	69	0	0	0
6/28/2018	Hail	1.5	0	0	0
6/25/2019	Hail	1	0	0	0
6/28/2019	Thunderstorm Wind	61	0	0	0
8/20/2019	Hail	1	0	0	0
5/24/2020	Hail	1	0	0	0
12/15/2021	High Wind	56	0	0	0
12/15/2021	Thunderstorm Wind	74	0	0	0
12/15/2021	Thunderstorm Wind	70	0	0	0
3/5/2022	Thunderstorm Wind	52	0	0	0
5/17/2022	Thunderstorm Wind	61	0	0	0
3/31/2023	Hail	1.5	0	0	0
3/31/2023	Hail	1	0	0	0
3/31/2023	Thunderstorm Wind	56	0	0	0
6/29/2023	Thunderstorm Wind	52	0	0	0
6/30/2023	Thunderstorm Wind	52	0	0	0
5/24/2024	Hail	1	0	0	0
6/13/2024	Hail	2.75	0	0	0
6/13/2024	Hail	2.5	0	0	0
6/13/2024	Hail	2.5	0	0	0
6/13/2024	Hail	2.5	0	0	0
6/13/2024	Hail	1.75	0	0	0
7/2/2024	Thunderstorm Wind	52	0	0	0
8/27/2024	Hail	1.25	0	0	0

Total	88		0	\$223,000	0
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Source: NCEI Storm Database (Magnitude if Thunderstorm; Wind in MPH; Hail in inches diameter)

Table 3.61. NCEI Thunderstorm Event Narratives for Putnam (When Available)

Date	Event Narrative
5/24/2004	Damaged reported to some buildings.
6/12/2004	
8/27/2004	
8/27/2004	
8/27/2004	Large trees down along County Road FF.
10/29/2004	
9/13/2005	Roof blown off small building.
9/13/2005	
9/13/2005	
3/12/2006	\$200,000 in wind damage reported by FEMA from the North Central Missouri Electric Cooperative.
4/2/2006	
4/15/2006	
4/18/2006	
4/18/2006	
5/27/2006	
8/13/2006	Trees reported down.
4/3/2007	Near the intersection of HWY 136 and County Road EE.
8/12/2007	
4/10/2008	
6/12/2008	
6/12/2008	
6/19/2008	
6/26/2008	
6/26/2008	
7/21/2008	
7/25/2008	Storm total rainfall was measured at 8.92 inches.
7/27/2008	
2/26/2009	
4/5/2010	
6/1/2010	Trees and power lines were reported down. Portion of a roof was blown onto 17th and Main Streets. Winds were estimated to 70 mph.
6/21/2010	
6/21/2010	
6/21/2010	
6/21/2010	Large trees were reported down in Livonia. Thunderstorm wind gusts were estimated to 60 mph.
3/22/2011	
4/3/2011	
4/3/2011	
6/14/2011	

6/26/2011	
6/26/2011	Six-to-ten-inch tree limbs were reported down, at the intersection of Highway 129 and Highway CC.
7/23/2011	Patio furniture was blown off a deck, with thunderstorm wind gusts estimated up to 60 mph.
5/25/2012	
5/25/2012	
5/25/2012	
6/16/2012	
6/16/2012	
6/16/2012	
4/27/2014	A large hog barn was blown apart and 6-to-12-inch diameter trees down.
5/12/2014	
6/3/2014	
6/3/2014	Relayed by emergency management.
6/7/2015	A 60-mph wind gust was reported by the public.
6/7/2015	
6/20/2015	
6/20/2015	There was a 10-inch tree limb down in the city of Unionville. Power was out in the town.
6/20/2015	
6/20/2015	
7/13/2015	A tree was uprooted.
11/11/2015	A tree was down on a house, and multiple car ports were destroyed in Unionville from severe thunderstorm winds.
3/23/2016	A 60-mph wind was estimated by Fire Department in Lucerne.
9/19/2016	There were a few tree limbs of unknown size and conditions and a few powerlines down in Powersville.
9/19/2016	
3/6/2017	Unionville dispatch relayed reports of 70 mph winds near Unionville.
6/14/2017	
6/28/2017	A Missouri Mesonet station near Unionville recorded a 79-mph wind gust with thunderstorms moving through the area.
6/28/2018	
6/25/2019	
6/28/2019	Several trees and power lines were down in Unionville.
8/20/2019	
5/24/2020	
12/15/2021	Through the afternoon on December 15th strong wind caused sustained winds in the 40 to 50 mph range, with frequent gusts well over 60 mph. While most ASOS and AWOS stations recorded gusts around 65 mph, there were several reports of higher winds and damage representative of around 70 mph, such as tree damage and powerlines down. This preceded strong thunderstorms that also caused strong winds and scattered damage across the area.
12/15/2021	Widespread 70 to 80 mph winds were reported across Putnam County. Near Lucerne a state trooper vehicle was pushed off the road.
12/15/2021	Four hog barns were destroyed, killing all of the hogs inside. There were reports of 75 to 80 mph wind in Unionville at about the same time as the report of the destroyed buildings.
3/5/2022	Emergency management reported powerlines down, along with other debris along Highway 5 near Lake Thunderhead.
5/17/2022	Several powerlines were down. There was roof damage, and a roof was taken off a machine shed at HWY 129 and 190th Street in Unionville.
3/31/2023	A supercell produced 1.5 hail northeast of Lucerne in western Putnam County.

3/31/2023	
3/31/2023	A tree of unknown size and condition was knocked over.
6/29/2023	Large tree branches downed across Unionville.
6/30/2023	Estimated wind gusts up to 60 mph in Powersville. A few large tree branches were downed.
5/24/2024	Quarter sized hail reported in Lemons.
6/13/2024	Report of baseball sized hail northwest of Livonia near Agave Trail and County Road N.
6/13/2024	Missouri Department of Conservation reports tennis ball sized hail at Rebel's Cove Conservation Area. Hail smashed the windshield of a vehicle.
6/13/2024	Tennis ball sized hail was reported northwest of Glenwood.
6/13/2024	Tennis ball sized hail was reported northwest of Glenwood.
6/13/2024	Golf ball sized hail was reported just south of the Iowa border.
7/2/2024	Estimated 60 mph wind gusts in Unionville with tree limbs downed and damage to a house.
8/27/2024	Half dollar size hail was reported near Livonia.

Probability of Future Occurrence

The probability of future occurrence is calculated based on the number of events in previous years divided by the number of years, this provides an average probability, the following calculations are based on the previous 20 years.

Probability of Thunderstorm

$$Probability = \frac{\# \text{ of Events}}{Years} = \frac{88}{20} = 4.4$$

According to the above calculation, the planning area of Putnam County should experience an average of 4.4 thunderstorms annually.

Probability of Thunderstorm with Hail

$$Probability = \frac{\# \text{ of Events}}{Years} = \frac{55}{20} = 2.75$$

According to this calculation, the planning area of Putnam County should experience an average of 2.75 thunderstorms accompanied by hail annually.

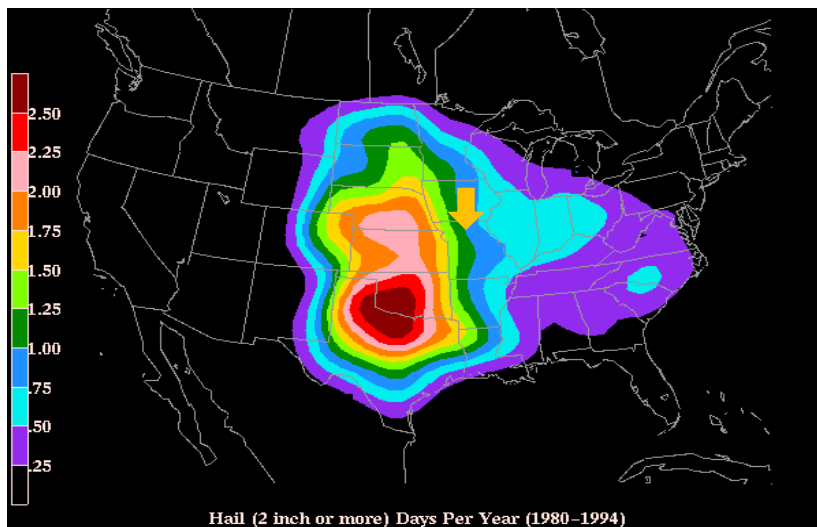
Probability of Thunderstorm with High or Excessive Winds

$$Probability = \frac{\# \text{ of Events}}{Years} = \frac{33}{20} = 1.65$$

According to this calculation, the planning area of Putnam County should expect an average of 1.65 thunderstorms accompanied by high or excessive winds annually.

The figure below shows the annual hailstorm probability in Putnam County for hail stones larger than 2 inches in diameter from 1980 through 1994. Putnam County, indicated by an arrow, shows a probability of .75 to 1.00. Putnam County is likely to experience a hailstorm with hailstones 2" or larger on an annual basis.

Figure 3.33. Annual Hailstorm Probability (2" Diameter or Larger), U 1980- 1994



Source: NSSL, http://www.nssl.noaa.gov/users/brooks/public_html/bighail.gif Note:

Changing Future Conditions Considerations

As temperatures increase with changing conditions, the severity of storms is likely to increase, as warm air is the key component of thunderstorms. Due to higher levels of convection, there could be a higher frequency and severity of storm events.

Vulnerability

Vulnerability Overview

Severe thunderstorm losses are usually attributed to the associated hazards of hail, downburst winds, lightning and heavy rains. Losses due to hail and high wind are typically insured losses that are localized and do not result in presidential disaster declarations. However, in some cases, impacts are severe and widespread and assistance outside state capabilities is necessary. Hail and wind also can have devastating impacts on crops. Severe thunderstorms/heavy rains that lead to flooding are discussed in the flooding hazard profile. Hailstorms cause damage to property, crops, and the environment, and can injure and even kill livestock. In the United States, hail causes more than \$1 billion in damage to property and crops each year. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are also commonly damaged by hail. Hail has been known to cause injury to humans, occasionally fatal injury.

In general, assets in the County vulnerable to thunderstorms with lightning, high winds, and hail include people, crops, vehicles, and built structures. Although this hazard results in high annual losses, private property insurance and crop insurance usually cover the majority of losses. Considering insurance coverage as a recovery capability, the overall impact on jurisdictions is reduced.

Most lightning damages occur to electronic equipment located inside buildings. But structural damage can also occur when a lightning strike causes a building fire. In addition, lightning strikes can cause damages to crops, if fields or forested lands are set on fire. Communications equipment and warning transmitters and receivers can also be knocked out by lightning strikes.

<http://www.vaisala.com/en/products/thunderstormandlightningdetectionsystems/Pages/NLDN.aspx> and <http://www.lightningsafety.noaa.gov/>

The method used to determine vulnerability to severe thunderstorms across Missouri was statistical analysis of data from several sources: National Centers for Environmental Information (NCEI) storm events data (1996 to December 31, 2021), HAZUS Building Exposure Value data, housing density and mobile home data from the U.S. Census (2019), and the calculated Social Vulnerability Index for Missouri Counties from the Hazards and Vulnerability Research Institute in the Department of Geography at the University of South Carolina.

From the statistical data collected, six factors were considered in determining overall vulnerability to lightning as follows: housing density, building exposure, percentage of mobile homes, social vulnerability, likelihood of occurrence, and average annual property loss. Based on natural breaks in the statistical data, a rating value of 1 through 5 was assigned to each factor. Once the ranges were determined and applied to all factors considered in the analysis for wind, hail, and lightning, they were rated individually and factored together to determine an overall vulnerability rating for thunderstorms. This vulnerability rating was taken from the 2023 Missouri State Hazard Mitigation Plan.

These rating values correspond to the following descriptive terms:

- 1) Low
- 2) Medium-Low
- 3) Medium
- 4) Medium-High
- 5) High

Table 3.62. Housing Density, Building Exposure, SOVI, and Mobile Home Data for Putnam County

Total Building Exposure (HAZUS)	Building Exposure Rating	Housing Density	Housing Density Rating	SOVI Rating	SOVI Ranking Rating	Percent Mobile Homes	Percent Mobile Homes Rating
\$554,649,000	1	5.75	1	Medium	3	8.7%	2

Source: 2023 Missouri State Hazard Mitigation Plan

Table 3.63. High Wind, Hail, and Lightning Events, Likelihood of Occurrence, and Associated Ratings for Putnam County

High Wind			Hail			Lightning		
Total Number of Events	Likelihood of Occurrence	Likelihood of Occurrence Rating	Total Number of Events	Likelihood of Occurrence	Likelihood of Occurrence Rating	Total Number of Events	Likelihood of Occurrence	Likelihood of Occurrence Rating
37	1.42	1	54	2.08	1	0	0.00	1

Table 3.64. Annualized Property Loss and Associated Ratings for Putnam County

High Wind		Hail		Lightning	
Total Annualized Property Loss	Total Annualized Property Loss Rating	Total Annualized Property Loss	Total Annualized Property Loss Rating	Total Annualized Property Loss	Total Annualized Property Loss Rating
\$11,038	1	\$0	1	\$0	1

Source: 2023 Missouri State Hazard Mitigation Plan

Potential Losses to Existing Development

According to historical data reported for thunderstorm wind, high wind, hail, and lightning by NCEI from 2014 to 2025, 88 severe weather events impacted Putnam County and caused an estimated \$223,000 in property damage with no reported crop damage. Based on this estimate Putnam County experiences an average annual property loss of approximately \$20,272.

The USDA reported crop losses due to high winds, lightning, and hail. According to the USDA there were \$289,901.90 in crop insurance claims recorded from 2014 to 2024. Based on these figures, Putnam County can expect to experience an average annual crop loss of \$28,990.

Previous and Future Development

Any additional development that occurs in Putnam County will result in increased exposure and thus increased vulnerability to severe thunderstorms and their associated wind, hail, and lightning. There are currently no plans for development in Putnam County.

Hazard Summary by Jurisdiction

Thunderstorms, high winds, lightning, and hail events are area-wide and expected to occur uniformly across the planning area. However, the magnitude of impacts may vary by jurisdiction based on the physical vulnerability of structures.

Heavily populated areas of the counties are more likely to experience higher losses due to these events because of these areas being more densely populated. The unincorporated areas and communities are more likely to experience crop losses because the population and structure numbers are less than incorporated areas.

The following table details the percentage of housing built before 1939 and the percentage of manufactured housing units in each jurisdiction, as both characteristics may indicate increased vulnerability to severe thunderstorms. The Village of Powersville has a significant number of mobile homes. The Village of Lucerne and the Village of Worthington have a significant number of homes built prior to 1939.

Table 3.65. Housing Vulnerability Indicators for Putnam County

Jurisdiction	Mobile Home	% Mobile Home	Homes Built Before 1939	% Homes Built Before 1939
Putnam County	232	12.4%	218	11.6%
Village of Livonia	0	0.0%	3	23.1%

Village of Lucerne	4	30.8%	6	46.2%
Village of Powersville	32	72.7%	10	22.7%
Village of Worthington	0	0.0%	5	62.5%
City of Unionville	19	2.7%	83	12.0%

Source: U.S. Census Bureau, Physical Housing Characteristics for Occupied Housing Units (S2501)

Problem Statement

Severe thunderstorms can damage power lines with the high winds or fallen debris such as tree limbs. Not everyone in the county utilizes social media, texting or has access to a weather radio, communities would benefit from updated sirens. Possible solutions include review of local ordinance and building codes to address high winds and/or construction techniques to include structural bracing, straps and clips, or anchor bolts.

3.4.7 Severe Winter Weather

Hazard Profile

Hazard Description

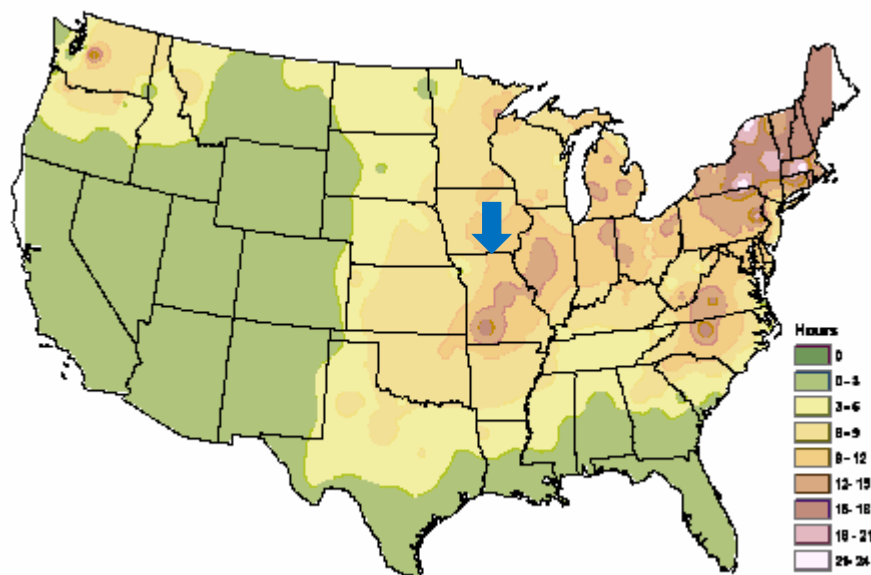
A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall, and cold temperatures. The National Weather Service describes different types of winter storm events as follows.

- **Blizzard**—Winds of 35 miles per hour or more with snow and blowing snow reducing visibility to less than $\frac{1}{4}$ 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 vulnerable to heavy snow, ice, extreme cold temperatures, and freezing rain. According to the following figure, the average amount of hours of freezing rain in Putnam County can expect annually is between 8 and 12 hours per year.

Figure 3.34. NWS Statewide Average Number of Hours per Year with Freezing Rain



Source: American Meteorological Society. "Freezing Rain Events in the United States." <http://ams.confex.com/ams/pdfpapers/71872.pdf>

Strength/Magnitude/Extent

Severe winter storms include heavy snowfall, ice, and strong winds which can push the wind chill well below zero degrees in the planning area.

For severe weather conditions, the National Weather Service issues some or all of the following products as conditions warrant across the State of Missouri. NWS local offices in Missouri may collaborate with local partners to determine when an alert should be issued for a local area.

- 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. Often the greatest hazard is 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.
- Blizzard Warning — Snow and strong winds will combine to produce a blinding snow (near zero visibility), deep drifts, and life-threatening wind chill.
- 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.
- Cold weather Advisory -- Combination of low temperatures and strong winds will result in wind

chill readings of -20 degrees F or lower.

- Extreme cold Warning -- Wind chill temperatures of -35 degrees F or lower are expected. This is a life-threatening situation.

Previous Occurrences

The table below includes NCEI reported events and damages for at least the past 10 years. Events include blizzard, cold wet weather cold/wind chill, extreme cold/wind chill, frost, freezing fog, heavy Harrison County snow, ice storm, sleet, winter storm, and winter weather. The lines highlighted in blue are events that lasted for more than one day but can be attributed to one storm system.

Table 3.66. NCEI Harrison Winter Weather Events Summary, 2010-2024

Type of Event	Date	# of Injuries	Property Damages	Crop Damages
Winter Storm	2/21/2010	0	0	0
Winter Weather	1/10/2011	0	0	0
Blizzard	2/1/2011	0	0	0
Winter Storm	2/24/2011	0	0	0
Winter Weather	2/13/2012	0	0	0
Winter Weather	2/23/2012	0	0	0
Blizzard	12/20/2012	0	0	0
Winter Weather	1/30/2013	0	0	0
Winter Storm	2/21/2013	0	0	0
Heavy Snow	12/21/2013	0	0	0
Cold/Wind Chill	1/5/2014	0	0	0
Heavy Snow	2/4/2014	0	0	0
Extreme Cold/Wind Chill	2/6/2014	0	0	0
Heavy Snow	1/31/2015	0	0	0
Heavy Snow	2/1/2015	0	0	0
Winter Storm	12/27/2015	0	0	0
Ice Storm	1/15/2017	0	0	0
Blizzard	11/25/2018	0	0	0
Winter Storm	1/11/2019	0	0	0
Winter Storm	01/10/2020	0	0	0
Winter Storm	04/16/2020	0	0	0
Winter Storm	12/29/2020	0	0	0
Winter Storm	01/25/2021	0	0	0
Extreme Cold/wind Chill	02/14/2021	0	0	0
Extreme Cold/wind Chill	02/15/2021	0	0	0
Extreme Cold/wind Chill	02/16/2021	0	0	0
Winter Storm	01/01/2022	0	0	0
Winter Storm	01/14/2022	0	0	0
Extreme Cold/wind Chill	12/22/2022	0	0	0
Extreme Cold/wind Chill	01/12/2024	0	0	0

Source: NCEI, data accessed 2-2025 Note: Injury and property damage data may not include traffic accidents or other indirect injuries.

The following table contains the dates and event narratives, where available, for 2005-2025 winter storm events in Putnam County.

Date	Event Narrative (When Available)
1/5/2005	
1/20/2006	
11/29/2006	One quarter to one half inch of ice reported across the county.
12/1/2007	One quarter to four tenths of an inch of ice was reported across the county.

12/10/2007	Ice accumulations of around a half inch were reported across the county. Some tree branches and power lines were down.
12/22/2007	Six to nine inches of snow was reported across the county. Travel was extremely hazardous with the blowing and drifting of the snow.
2/16/2008	Up to four inches of snow was reported in the county. There was also blowing and drifting snow.
12/18/2008	Three quarters of an inch of ice was reported.
12/7/2009	Blizzard conditions were observed across the county. Snowfall amounts up to around 6 inches were observed in the county.
1/6/2010	Up to 5 inches of snow was reported across the county. Strong gusty northwest winds caused blowing and drifting of the snow.
2/7/2010	Unionville had 5.8 inches of snow.
2/21/2010	The observer in Unionville measured 10.4 inches of snow. Blowing and drifting snow caused hazardous driving conditions.
1/10/2011	Five to six inches of snow was reported across the county.
2/1/2011	Blizzard conditions were observed across the county, with frequent wind gusts up to 45 mph, visibilities less than 1/4 of a mile, and heavy snow of up to 14.1 inches, measured in Unionville. Travel was nearly impossible, with the blowing and drifting snow, and the very low visibilities.
2/24/2011	The combination of up to 6.7 inches of snow, and blowing and drifting snow, led to hazardous driving conditions across the county.
1/11/2012	The observer in Unionville reported 2.5 inches of snow.
1/27/2012	The observer in Unionville measured 1.9 inches of snow.
2/13/2012	The observer in Unionville measured 2.1 inches of snow.
2/24/2012	The observer in Unionville measured 1.3 inches of snow.
12/20/2012	The combination of high winds and snowfall of one to three inches, caused near blizzard conditions across the county.
1/30/2013	Snowfall was measured at 1.9 inches in Unionville.
2/21/2013	Four to six inches of snow was reported across the county.
5/2/2013	Unionville measured 6.8 inches of snow.
12/27/2015	Several areas across northeast Kansas and northwest Missouri saw ice accumulation approaching a quarter inch as well as sleet ranging from a quarter to a half inch in most locations, with some locations reporting over an inch of sleet. Once the sleet ended another 3 to 4 inches of snow fell before the system moved out.
1/15/2017	To finish off a prolonged freezing rain event across northeast Kansas and northwest Missouri light rain lifted north into far northern Missouri causing ice to accumulate through the day on Sunday and overnight into Monday morning. Several trained weather spotters from across northern Missouri reported a quarter inch of ice on all surfaces. Several area roads were ice covered through the day on Sunday and into Monday morning before temperatures warmed above freezing Monday morning.
11/25/2018	Blizzard conditions started after a few hours of light to moderately falling snow. Once the heavy snow arrived winds gusted up to 40 mph for nearly 4 hours, creating whiteout conditions, officially measured by the ASOS at nearby KTVK as sub-quarter mile for that duration. Despite the heavy impacts from this system affecting Thanksgiving weekend return traffic, no serious injuries occurred from this event.
1/11/2019	Between 8 and 12 inches of snow fell across Putnam County, with most of it falling over the course of the first 12 hours. Light snow continued into the next day (January 12), but it was fairly light and only accounted for 1 to 2 inches.
1/10/2020	Freezing rain occurred through much of the night going into January 11 and caused around a quarter to one-third inch accumulation. This occurred prior to about 2 to 3 inches of snow falling. This resulted in several auto accidents.
4/16/2020	Light snow fell off and on through the day on Thursday, accumulating about an inch; however, by mid-to-late afternoon the snow picked up intensity. One to two inches per hour snow rates were reported across the area for periods. Numerous reports of very low visibility due to very heavy snow were also received. The heavier snow came to an end on the evening of April 16

	and gradually tapered to a stop by early morning on April 17. When all was said and done there was about 8 to 12 inches of snow reported across portions of the county.
12/29/2020	During the day on December 29, a potent winter storm moved into the area. The precipitation started primarily as snow during the morning hours producing a couple inches of accumulation but switched to freezing rain just before 10 am as warm air aloft moved over the area. Moderate, to at times heavy rain ensued through the rest of the morning and early to middle afternoon hours, before eventually moving out by the evening hours. The main impact from this storm was several power outages around the area. Due to the rain rates, not all of the nearly 1 inch of liquid precipitation accreted on surfaces, but a quarter to half inch did accrete, causing a significant disruption to the power, and closing numerous roads.
1/25/2021	Light to moderate snow moved into far northwest Missouri on the morning of January 25, by mid-day roughly 6 inches of snow fell, and by the end of the event roughly 6 to 7 inches of snow fell across the county.
1/1/2022	Trained spotters and COOP Observers in the area reported 5-6 inches of snow.
1/14/2022	Several reports from across the area indicated around 6-8 inches of snow Putnam County.
1/4/2025	A major winter storm impacted the region Saturday Jan 4th through late night Sunday Jan 5th/early morning Monday Jan 6th. For Putnam County, major impacts occurred during the morning and afternoon hours of Sunday Jan 5th, when moderate to heavy snow fell.

Source: NCEI Storm Data Weather Data (Accessed on 8/2025)

The following table includes the crop losses for Putnam County over the last 10 years due to freeze or cold winter. Winter storms, cold, frost, and freeze take a toll on crop production in the planning area. The following table shows the USDA's Risk Management Agency payments for insured crop losses in the planning area because of cold conditions and snow for the last 10 years.

Table 3.67. Crop Insurance Claims Paid in Putnam County as a Result of Cold Conditions and Snow 2014-2024

CROP YEAR	CROP LOSS	CAUSE OF LOSS	INSURANCE PAID (\$)
2014	Wheat	Cold Winter	\$11,052.00
2015	- No Claims -		\$0
2016	- No Claims -		\$0
2017	- No Claims -		\$0
2018	- No Claims -		\$0
2019	- No Claims -		\$0
2020	- No Claims -		\$0
2021	- No Claims -		\$0
2022	- No Claims -		\$0
2023	- No Claims -		\$0
2024	- No Claims -		\$0
Total			\$11,052.00

Source: USDA Risk Management Agency, <https://www.rma.usda.gov/tools-reports/summary-business/cause-loss>

Probability of Future Occurrence

Over the last 20 years, Putnam County has experienced 34 winter weather events. Since one storm would generally include more than one type of event the probability of future occurrence was calculated as follows:

$$Probability = \frac{\# \text{ of Events}}{\text{Years}} = \frac{34}{20} = 1.7$$

This calculation would indicate that Putnam County could expect to experience on average, 1.7 winter weather events annually.

In a 10-year period from 2010 – 2024, 78 insurance claims paid a total of \$6,461,174.62 in crop loss

due to winter weather. This is an average of 5.6 insurance claims paying \$461,512.47 annually due to the effects of winter storms/blizzards, ice storms, winter weather, cold weather, wind chill, frost and snow. An average of \$82,835.57 was paid per insurance claim for crop loss.

Changing Future Conditions Considerations

With higher average temperatures occurring across the globe due to climate change, one might assume that winters would be milder. However, with the increase in the atmosphere's water-holding capacity, there is an increased likelihood of heavy snow events. Changes in the jet stream patterns can also result in allowing pools of very cold air to sink further south than usual. In summation, the changing climate could result in more severe storms, both in duration and amount of precipitation.

Vulnerability

Vulnerability Overview

Heavy snow can bring a community to a standstill by inhibiting transportation (in whiteout conditions), weighing down utility lines, and by causing structural collapse in buildings not designed to withstand the weight of the snow. Repair and snow removal costs can be significant. Ice buildup can collapse utility lines and communication towers, as well as make transportation difficult and hazardous. Ice can also become a problem on roadways if the air temperature is high enough that precipitation falls as freezing rain rather than snow.

Buildings with overhanging tree limbs are more vulnerable to damage during winter storms when limbs fall. Businesses experience loss of income as a result of closure during power outages. In general heavy winter storms increase wear and tear on roadways though the cost of such damages is difficult to determine. Businesses can experience loss of income as a result of closure during winter storms.

Overhead power lines and infrastructure are also vulnerable to damages from winter storms. In particular ice accumulation during winter storm events damage to power lines due to the ice weight on the lines and equipment. Damages also occur to lines and equipment from falling trees and tree limbs weighted down by ice. Potential losses could include cost of repair or replacement of damaged facilities, and lost economic opportunities for businesses.

Secondary effects from loss of power could include burst water pipes in homes without electricity during winter storms. Public safety hazards include risk of electrocution from downed power lines. Specific amounts of estimated losses are not available due to the complexity and multiple variables associated with this hazard. Standard values for loss of service for utilities reported in FEMA's BCA Toolkit 6.0 Release Notes, the economic impact as a result of loss of power is \$174 per person per day of lost service.

From the 2023 Missouri Hazard Mitigation Plan, the method used to determine vulnerability to severe winter weather across Missouri was statistical analysis of data from several sources: National Centers for Environmental Information (NCEI) storm events data (1996 to December 31, 2021), HAZUS Building Exposure Value Data, housing density data from the US Census, and the calculated Social Vulnerability Index for Missouri Counties from the Hazard and Vulnerability Research Institute in the Department of Geography at the University of South Carolina.

From the statistical data collected, five factors were considered in determining overall vulnerability to severe winter weather as follows: housing density, building exposure, social vulnerability, likelihood of occurrence, and average annual property loss. Based on natural breaks in the statistical data, a rating value of 1 through 5 was assigned to each factor. These rating values correspond to the following descriptive terms:

1. Low

2. Low-medium
3. Medium
4. Medium-high
5. High

Once the individual ratings were determined for the above factors, a combined vulnerability rating was computed for severe winter weather events. The following table provides the calculated ranges applied to determine overall vulnerability of Missouri counties to severe winter weather.

Table 3.68. Ranges for Severe Winter Weather Combined Vulnerability Rating

	Low (1)	Low-Medium (2)	Medium (3)	Medium-High (4)	High (5)
Severe Winter Weather Combined Vulnerability	7-8	8-10	10-12	12-15	15-22

Source: 2023 Missouri State Hazard Mitigation Plan

Table 3.69. Housing Density, Building Exposure, and SOVI Data for Putnam County

	Total Building Exposure (HAZUS)	Building Exposure Rating	Housing Density	Housing Density Rating	SOVI Ranking	SOVI Rating
Putnam	\$554,649,000	1	5.75	1	Medium	3

Source: 2023 Missouri State Hazard Mitigation Plan

Table 3.70. Annualized Severe Winter Weather Damages in Putnam County

Annualized Blizzard Property Loss (\$)	Annualized Heavy Snow Property Loss (\$)	Annualized Ice Storm Property Loss (\$)	Annualized Winter Storm Property Loss (\$)	Annualized Winter Weather Property Loss (\$)	Total Annualized Winter Weather Property Loss (\$)
\$0	\$19,231	\$192	\$0	\$0	\$19,423

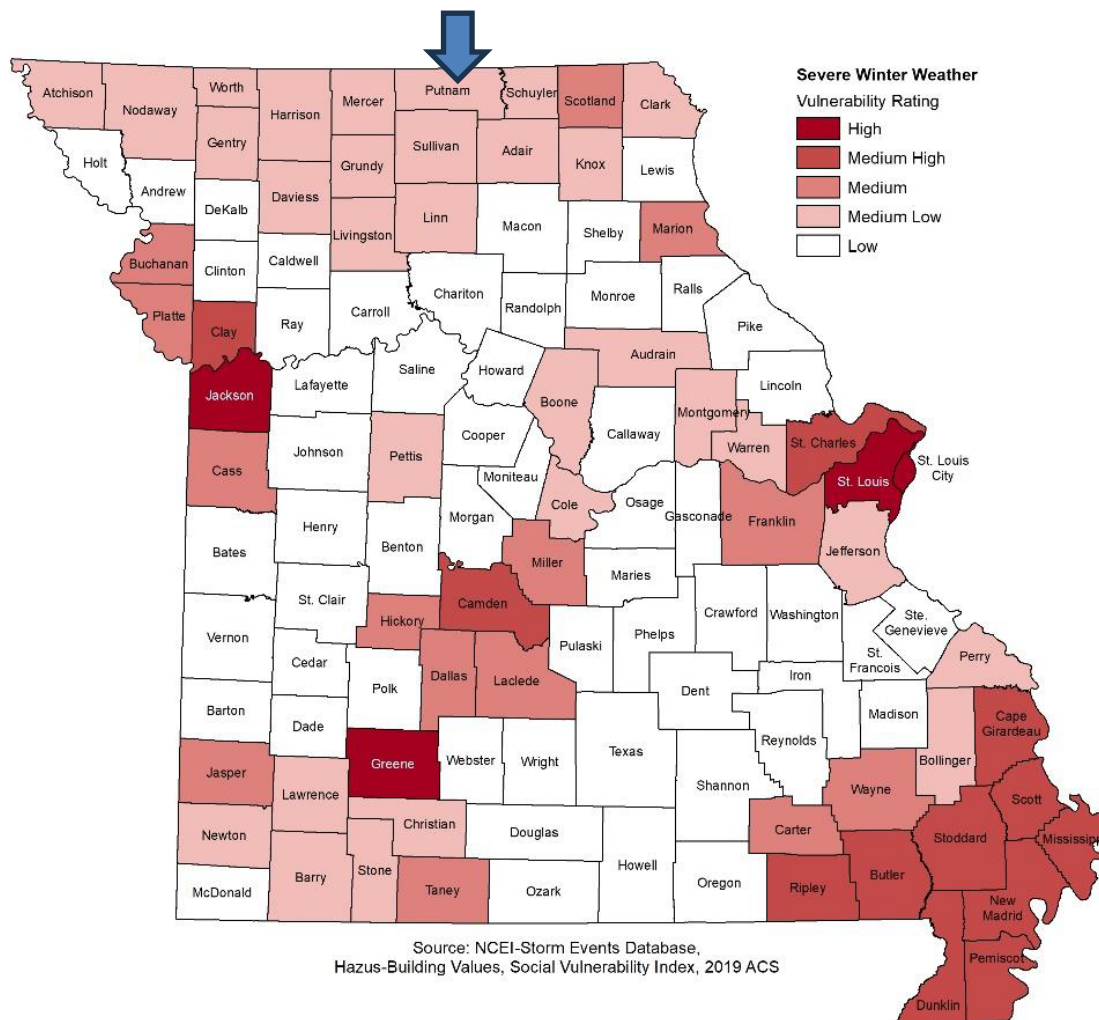
Source: 2023 Missouri State Hazard Mitigation Plan

Table 3.71. Additional Statistical Data for Severe Winter Weather Vulnerability in Putnam County

Table 3.72. Type of Data	Amount
Total # of Winter Weather Events	50
Likelihood of Occurrence	1.92
Likelihood of Occurrence Rating	3
Total Annualized Property Loss	\$19,423
Total Annualized Property Loss Rating	1
Overall Vulnerability Rating	9
Overall Vulnerability Rating Description	Medium Low

Source: 2023 Missouri State Hazard Mitigation Plan

Figure 3.35. Vulnerability Summary for Winter Weather



Potential Losses to Existing Development

The next severe winter storm will most likely close schools and businesses for multiple days and make roadways hazardous for travel. Heavy ice accumulation may damage electrical infrastructures causing prolonged power outages for large portions of the region. In addition, freezing temperatures make water lines vulnerable to freezing. Fallen tree limbs also pose a threat to various structures/infrastructures across the county.

Previous and Future Development

Future development could potentially increase vulnerability to this hazard by increasing demand on the utilities and increasing the exposure of infrastructure networks. At this time, there is little expected in the way of new development that would lead to an increased risk to the planning area.

Hazard Summary by Jurisdiction

Although crop loss as a result of severe winter weather occurs more in the unincorporated portions of the planning area, the density of vulnerable populations is higher in the urban areas of the planning areas. It is considered that the magnitude of this hazard is relatively equal. The factors of

probability, warning time, and duration are also equal across the planning area. Therefore, the conclusion is that the hazard does not substantially vary by jurisdiction.

Problem Statement

Putnam County is expected to experience at least one severe winter weather event annually. The county has a low-medium vulnerability rating. Jurisdictions should enhance their weather monitoring to be better prepared for severe weather hazards. If jurisdictions monitor winter weather, they can dispatch road crews to prepare for the hazard.

County and city crews can also trim trees along power lines to minimize the potential for outages due to snow and ice. Citizens should also be educated about the benefits of being proactive to alleviate property damage as well as preparing for power outages. Education needs to occur to ensure all residents are aware of the shelters in the County, residents are educated on emergency supplies to have and the utilization of social media and texting increases.

Extreme temperatures can lead to a disruption in services to the county, such as schools and private commerce. Additional strains on the electric grid could potentially cause interruptions to power. During extreme-cold events water lines could freeze or burst.

3.4.8 Tornado

Hazard Profile

Hazard Description

Essentially, tornadoes are a vortex storm with two components of winds. The first is the rotational winds that can measure up to 500 miles per hour, and the second is an uplifting current of great strength. The dynamic strength of both these currents can cause vacuums that can overpressure structures from the inside.

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

Tornadoes spawn from the largest thunderstorms. The associated cumulonimbus clouds can reach heights of up to 55,000 feet above ground level and are commonly formed when Gulf air is warmed by solar heating. The moist, warm air is overridden by the dry cool air provided by the jet stream. This cold air presses down on the warm air, preventing it from rising, but only temporarily. Soon, the warm air forces its way through the cool air and the cool air moves downward past the rising warm air. This air movement, along with the deflection of the earth’s surface, can cause the air masses to start rotating. This rotational movement around the location of the breakthrough forms a vortex, or funnel. If the newly created funnel stays in the sky, it is referred to as a funnel cloud. However, if it touches the ground, the funnel officially becomes a tornado.

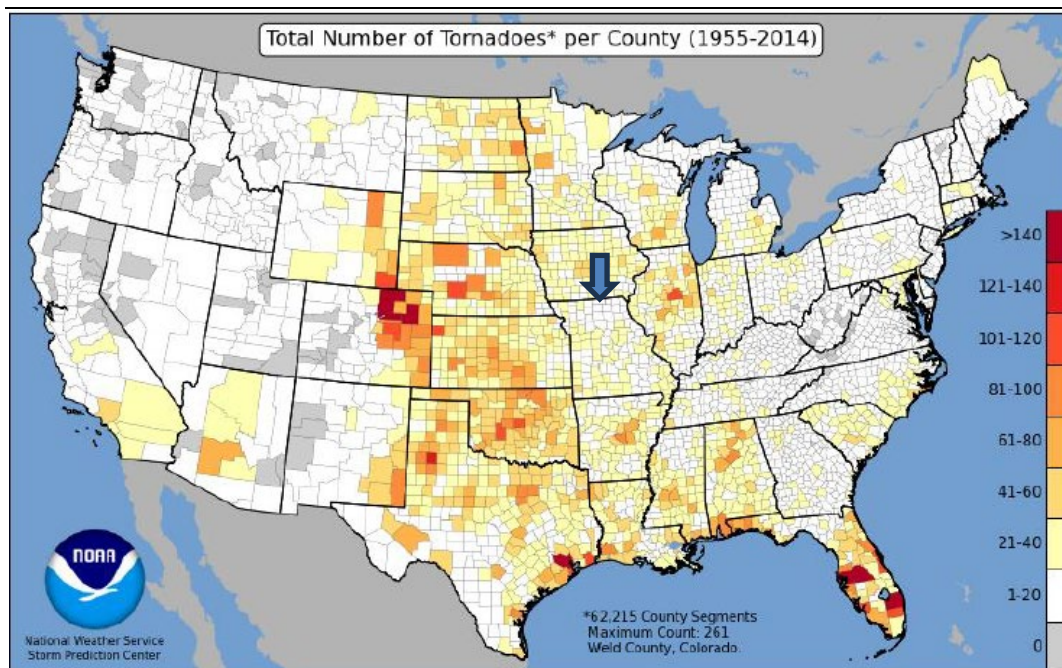
A typical tornado can be described as a funnel-shaped cloud that is “anchored” to a cloud, usually a cumulonimbus that is also in contact with the earth’s surface. This contact on average lasts 30 minutes and covers an average distance of 15 miles. The width of the tornado (and its path of destruction)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

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

Geographic Location

Tornadoes can occur anywhere in the planning area. The following map was obtained from the 2023 Missouri State Hazard Mitigation Plan and shows the total number of tornadoes per county. Putnam County is indicated with a red arrow, and according to this map, had between 1-20 tornadoes between 1955 and 2014.

Figure 3.36. Tornado Activity in the United States 1955-2014



Source: NOAA Tornado Activity in the United States

Strength/Magnitude/Extent

Tornadoes are the most violent of all atmospheric storms and are capable of tremendous destruction. Wind speeds can exceed 250 miles per hour and damage paths can be more than one mile wide and 50 miles long. Tornadoes have been known to lift and move objects weighing more than 300 tons a distance of 30 feet, toss homes more than 300 feet from their foundations, and siphon millions of tons of water from water bodies. Tornadoes also can generate a tremendous amount of flying debris or “missiles,” which often become airborne shrapnel that causes additional damage. If wind speeds are high enough, missiles can be thrown at a building with enough force to penetrate windows, roofs, and walls. However, the less spectacular damage is much more common.

Tornado magnitude is classified according to the EF- Scale (or the Enhance Fujita Scale, based on the original Fujita Scale developed by Dr. Theodore Fujita, a renowned severe storm researcher). The EF- Scale (see the following table) attempts to rank tornadoes according to wind speed based on the damage caused. This update to the original F Scale was implemented in the U.S. on February 1, 2007.

Table 3.73. 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 (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

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

The wind speeds for the EF scale and damage descriptions are based on information on the NOAA Storm Prediction Center as listed in the following table. The damage descriptions are

summaries. For the actual EF scale it is necessary to look up the damage indicator (type of structure damaged) and refer to the degrees of damage associated with that indicator. Information on the Enhanced Fujita Scale's damage indicators and degrees of damage is located online at www.spc.noaa.gov/efscale/ef-scale.html.

Table 3.74. 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
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>

Enhanced weather forecasting has provided the ability to predict severe weather likely to produce tornadoes days in advance. Tornado watches can be delivered to those in the path of these storms several hours in advance. Lead time for actual tornado warnings is about 30 minutes. Tornadoes have been known to change paths very rapidly, thus limiting the time in which to take shelter. Tornadoes may not be visible on the ground if they occur after sundown or due to blowing dust or driving rain and hail.

Previous Occurrences

There are limitations to the use of NCEI tornado data that must be noted. For example, one tornado may contain multiple segments as it moves geographically. A tornado that crosses a county line or state line is considered a separate segment for the purposes of reporting to the NCEI. Also, a tornado that lifts off the ground for less than 5 minutes or 2.5 miles is considered a separate segment. If the tornado lifts off the ground for greater than 5 minutes or 2.5 miles, it is considered a separate tornado. Tornadoes reported in Storm Data and the Storm Events Database are in segments.

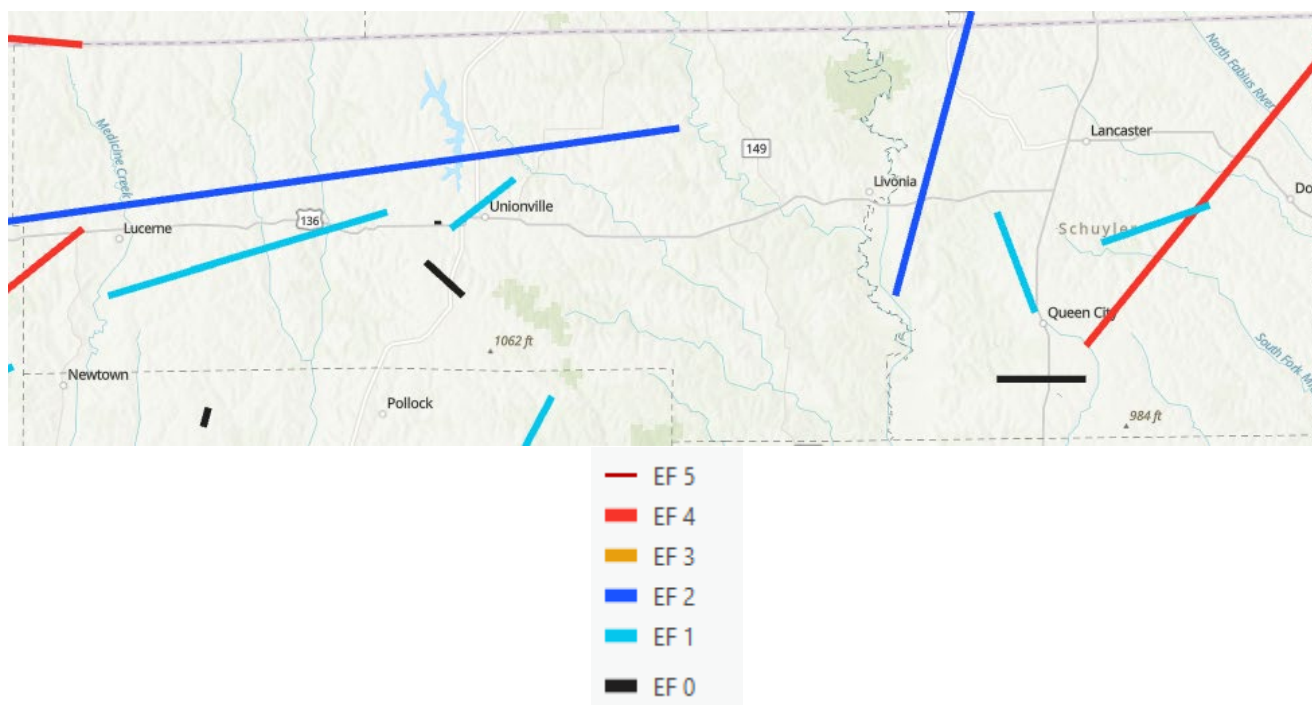
Table 3.75. Recorded Tornadoes in Putnam County, 1950 – Present

Date	Begin Location	F/EF Rating	Death/Injury	Property Damage	Crop Damage
11/17/1958		F1	0	\$25,000	0
1/24/1967		F1	0	\$2,500	0
4/21/1973		F4	0	\$250,000	0

4/30/2003	LEMONS	F0	0	0	0
5/10/2003	LUCERNE	F1	0	\$20,000	0
5/10/2003	UNIONVILLE	F0	0	\$1,000	0
6/12/2008	UNIONVILLE	EF0	0	0	0
5/31/2016	MIDWAY	EF0	0	0	0
Total			0	\$298,500	\$0

Source: National Centers for Environmental Information, <http://www.NCEI.noaa.gov/stormevents/>

Figure 3.37. Putnam County Map of Historic Tornado Events



Source : ArcGIS PRO

There were 8 tornado events listed in the NCEI storm database for Putnam County. The events listed as wind events were included in the plan under severe storms. The narratives obtained from the NCEI storm database are listed below.

Table 3.76. Tornado Event Narratives for Putnam County (1950-2025)

Date	Event Narrative (If available)
11/17/1958	No narrative
1/24/1967	No narrative
4/21/1973	No narrative
4/30/2003	Tornado reported by spotter in open country.
5/10/2003	Two separate residences reported damage in Putnam County. First home along EE Highway just south of US-136 lost a garage and had cars overturned. Second residence was damaged along 220th Road at US-136 on the crest of a hill, lost a garage, with minor damage to the house and trees.
5/10/2003	Brief tornado touchdown with minor damage to a barn.
6/12/2008	Brief EF0 tornado touchdown in open country at 15:13 CST.
5/31/2016	Video of a brief but very tall landspout was sent to the NWS via social media. The landspout caused no damage and only lasted a minute.

Source: NCEI Storm Database

There have been no crop losses due to tornado in Putnam County in the last 10 years.

Probability of Future Occurrence

The National Center for Environmental Information reported 11 tornadoes in Harrison County in a 31-year time period, 6 years during this period had a tornado which calculates to a 19% chance of a tornado occurring in any given year. Therefore, it is a reasonably low probability that some portion of Harrison County will experience tornado activity in any given year.

Changing Future Conditions Considerations

According to the Missouri State Hazard Mitigation Plan, scientists do not know how the frequency and severity of tornadoes will change. Research published in 2015 suggests that changes in heat and moisture content in the atmosphere, brought on by a warming world, could be playing a role in making tornado outbreaks more common and severe in the US. The research concluded that the number of days with large outbreaks has been increasing since the 1950's and that densely concentrated tornado outbreaks are on the rise. It is notable that the research shows that the area of tornado activity is not expanding, but rather the areas already subject to tornado activity are seeing more densely packed tornadoes. Because Putnam County experiences approximately one tornado every four years, and based on the research, the frequency of such events could increase in the future.

Vulnerability

Vulnerability Overview

The 2023 Missouri State Hazard Mitigation Plan provided the following vulnerability analysis of Putnam County to tornadoes.

The method used to determine vulnerability to tornadoes across Missouri was statistical analysis of data from several sources: HAZUS building exposure value data, population density and mobile home data from the U.S. Census (2019), the calculated Social Vulnerability Index for Missouri Counties from the Hazards and Vulnerability Research Institute in the Department of Geography at the University of South Carolina, and storm events data (1950 to December 31, 2021) from the National Centers for Environmental Information (NCEI). It is important to realize that one limitation to the NCEI data is that many tornadoes that might have occurred in uninhabited areas, as well as some in inhabited areas, may not have been reported. The incompleteness of the data suggests that it is not appropriate for use in parametric modeling. In addition, NOAA data cannot show a realistic frequency distribution of different Fujita scale tornado events, except for recent years. Thus, a parametric model based on a combination of many physical aspects of the tornado to predict future expected losses was not used. The statistical model used for this analysis was probabilistic based purely on tornado frequency and historic losses. It is based on past experience and forecasts the expected results for the immediate or extended future.

From the statistical data collected, six factors were considered in determining overall vulnerability to tornadoes as follows: building exposure, population density, social vulnerability, percentage of mobile homes, likelihood of occurrence, and annual property loss. Based on natural breaks in the statistical data, a rating value of 1 through 5 was assigned to each factor. Once the ranges were determined and applied to all factors considered in the analysis, the ratings were combed to determine an overall vulnerability rating for tornadoes. These rating values correspond to the following descriptive terms:

- 1) Low
- 2) Medium-Low

- 3) Medium
- 4) Medium-High
- 5) High

Table 3.77. Likelihood of Occurrence, Annual Property Loss, and Overall Vulnerability Rating for Putnam County by Tornadoes

Total Number of Tornadoes	8
Likelihood of Occurrence	.0111
Likelihood of Occurrence Rating	1
Total Annualized Property Loss	\$4,146
Total Annualized Property Loss Rating	1
Overall Vulnerability Rating	9
Overall Vulnerability Rating Description	Low

Source: 2023 Missouri State Hazard Mitigation Plan

Table 3.78. Tornado Vulnerability Rating for Putnam County

Vulnerability	Data for Putnam County
Total Building Exposure	\$554,649,000
Exposure Rating	1
Population Density	9.08
Population Density Rating	1
SOVI Index Ranking	Medium
SOVI Rating	3
Percent of Mobile Homes	8.7
Mobile Home Rating	2

Source: 2023 Missouri State Hazard Mitigation Plan

Putnam County is a region of the U.S. with high frequency of dangerous and destructive tornadoes referred to as “Tornado Alley”, illustrated below. (Indicated by red arrow).

Figure 3.38. Tornado Alley in the U.S.

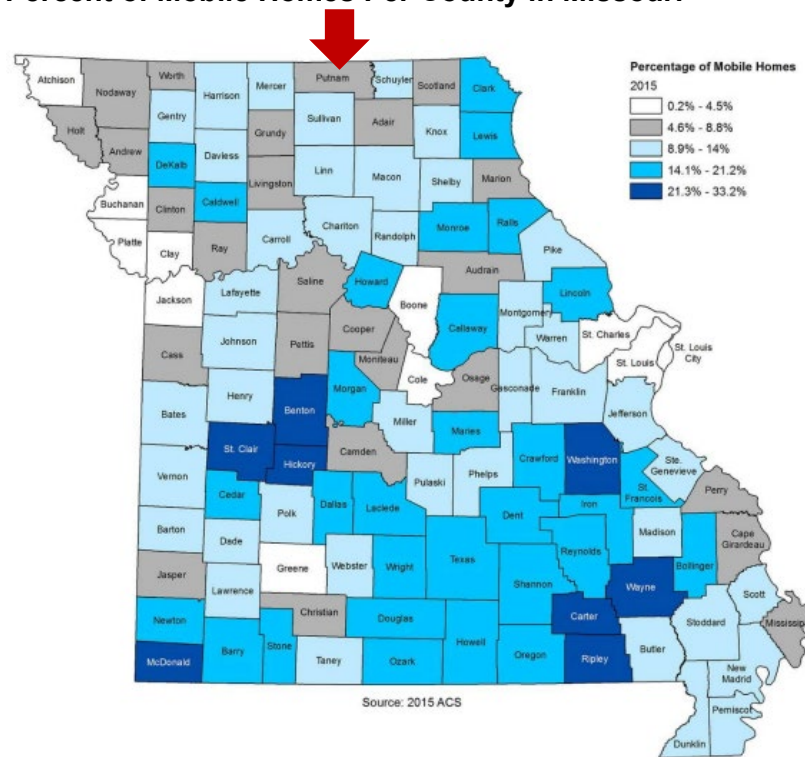


Source: <http://www.tornadochaser.net/tornalley.html>

Another factor to consider when determining vulnerability to tornadoes is the number of mobile homes in a county. Mobile homes are especially vulnerable to this hazard, as they are not built to provide adequate shelter from tornadoes, rather citizens that dwell in mobile homes must typically seek shelter elsewhere. Per the following figure, Putnam County has between 4.4% and 8.8% of

residences that are mobile homes.

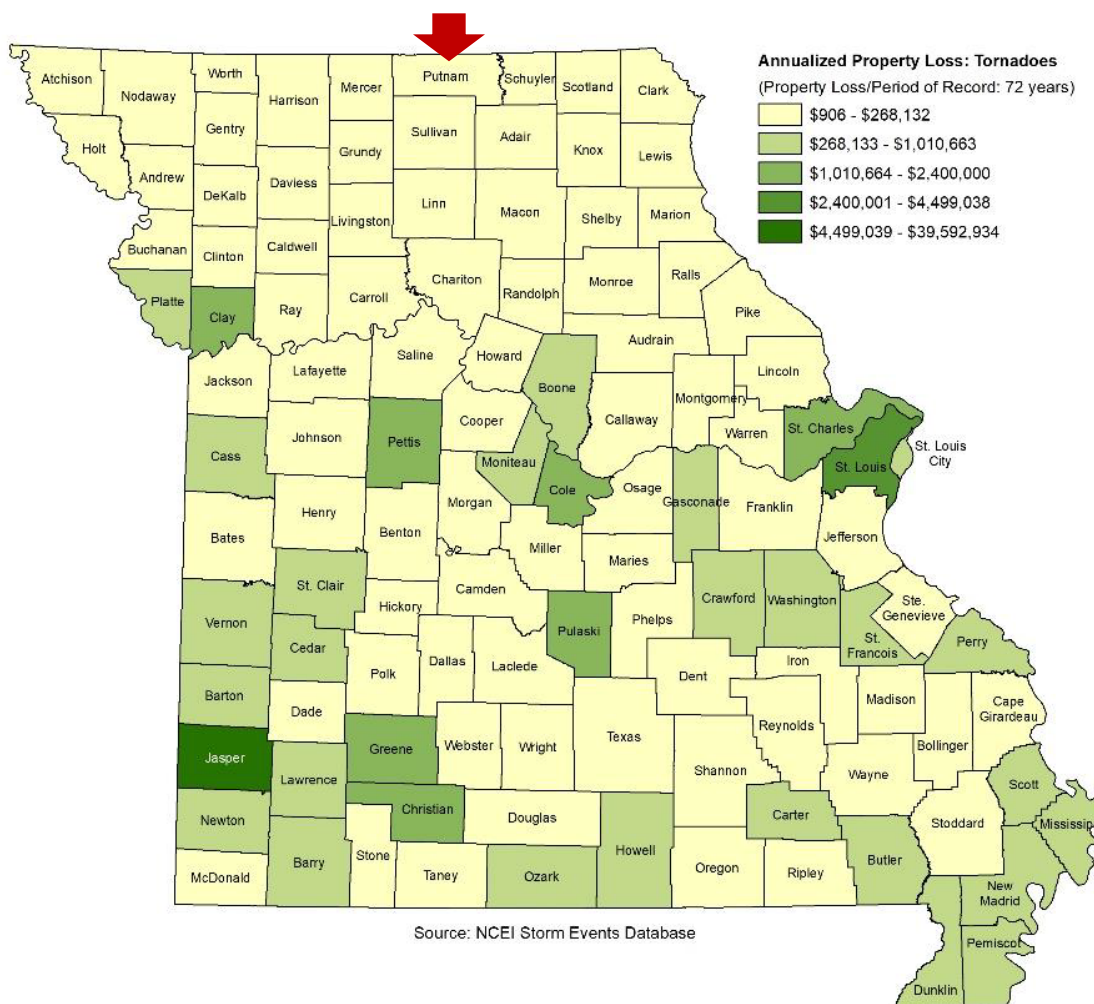
Figure 3.39. Percent of Mobile Homes Per County in Missouri



Potential Losses to Existing Development

While there are no losses reported in the USDA Risk Management database as being from tornadoes, there were damages to property between 1950 and 2025 of \$298,500. This would produce an annual estimated loss of \$3,980 in Putnam County.

Figure 3.40. Annualized Property Loss for Tornadoes



Source: Missouri State Hazard Mitigation Plan – 2023

Previous and Future Development

There is currently no planned development within the planning area that would increase vulnerability to tornadoes.

Vulnerability to tornadoes is anticipated to remain the same. Future development for public buildings such as schools, government offices, as well as buildings with high occupancy and campgrounds should consider including a tornado safe room to protect occupants in the event of a tornado.

Hazard Summary by Jurisdiction

A tornado event could occur anywhere in the planning area, but some jurisdictions would suffer heavier damages because of the age of the housing unit, the increased density of buildings and infrastructure, or the high concentration of mobile homes.

It is generally accepted that mobile homes are highly vulnerable to damage or devastation by tornadoes. The following table illustrates the number of mobile homes and homes built prior to

1939.

Table 3.79. Housing Vulnerability Indicators for Putnam County, 2023

Jurisdiction	Mobile Home	% Mobile Home	Homes Built Before 1939	% Homes Built Before 1939
Putnam County	232	12.4%	218	11.6%
Village of Livonia	0	0.0%	3	23.1%
Village of Lucerne	4	30.8%	6	46.2%
Village of Powersville	32	72.7%	10	22.7%
Village of Worthington	0	0.0%	5	62.5%
City of Unionville	19	2.7%	83	12.0%

Source: U.S. Census Bureau, Physical Housing Characteristics for Occupied Housing Units (S2501)

Problem Statement

A tornado could lead to damage to critical facilities or disrupt the utility systems to critical facilities.
A significant tornado would lead to a loss of life and may overwhelm resources.

Lack of tornado shelters in the county could present problems for residents that lack shelter at their residences.

3.4.9 Wildfire

Hazard Profile

Hazard Description

The fire incident types for wildfires include:

- 1) natural vegetation fire,
- 2) outside rubbish fire,
- 3) special outside fire, and
- 4) cultivated vegetation, crop fire.

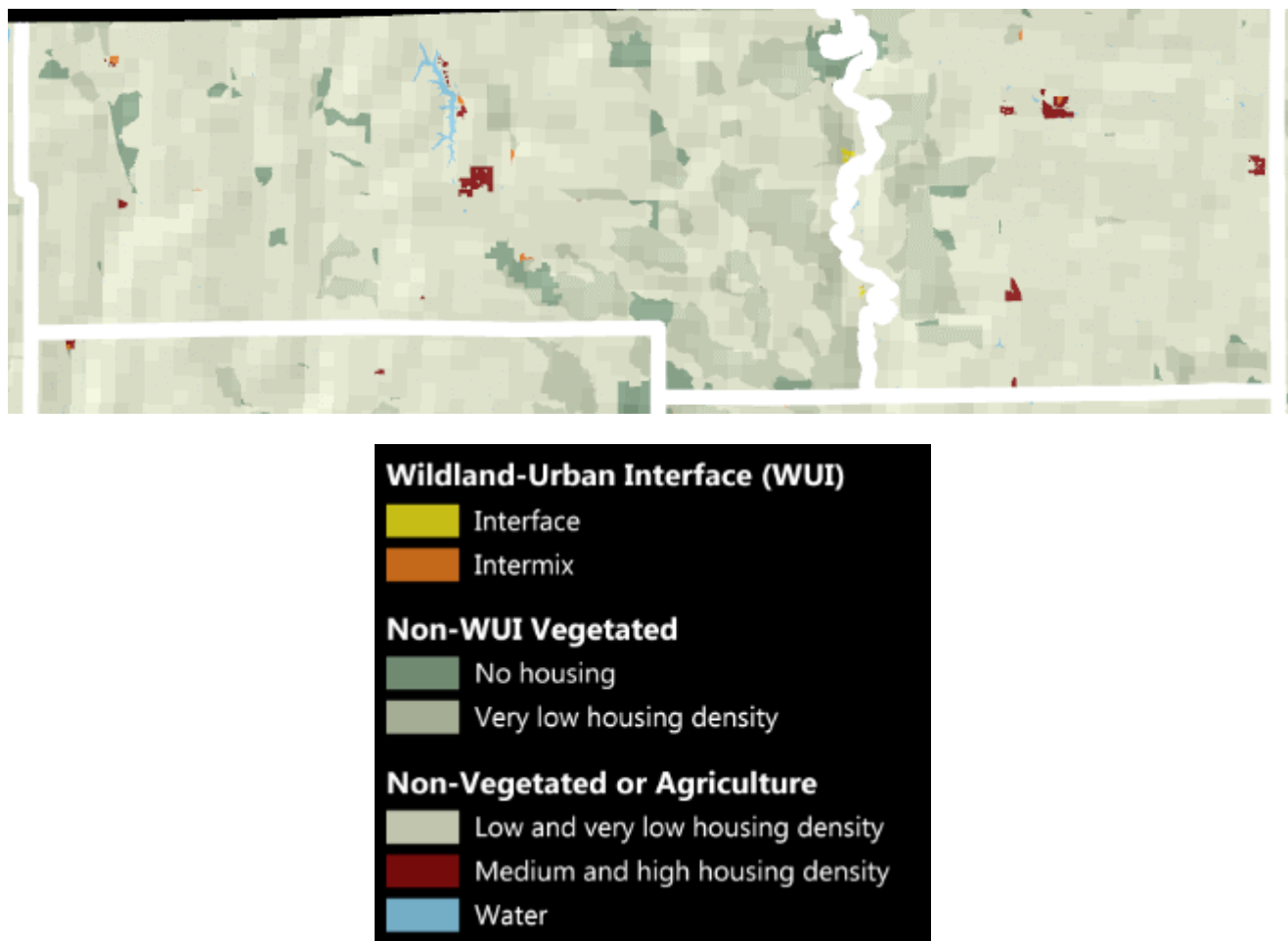
The Forestry Division of the Missouri Department of Conservation (MDC) is responsible for protecting privately owned and state-owned forests and grasslands from wildfires. To accomplish this task, eight forestry regions have been established in Missouri for fire suppression. The Forestry Division works closely with volunteer fire departments and federal partners to assist with fire suppression activities. Currently, more than 900 rural fire departments in Missouri have mutual aid agreements with the Forestry Division to obtain assistance in wildfire protection if needed.

Most Missouri fires occur during the spring season between February and May. The length and severity of wildland fires depend largely on weather conditions. Spring in Missouri is usually characterized by low humidity and high winds. These conditions result in higher fire danger. In addition, due to the recent lack of moisture throughout many areas of the state, conditions are likely to increase the risk of wildfires. Drought conditions can also hamper firefighting efforts, as decreasing water supplies may not prove adequate for firefighting. It is common for rural residents to burn their garden spots, brush piles, and other areas in the spring. Some landowners also believe it is necessary to burn their forests in the spring to promote grass growth, kill ticks, and reduce brush. Therefore, spring months are the most dangerous for wildfires. The second most critical period of the year is fall. Depending on the weather conditions, a sizeable number of fires may occur between mid-October and late November.

Geographic Location

While all of Putnam County is at risk for the possibility of wildfires, areas with a higher Wildland Urban interface (WUI) are more susceptible to losses from a wildfire situation. The term refers to the zone of transition between unoccupied land and human development and needs to be defined in the plan. Within the WUI, there are two specific areas identified: 1) Interface and 2) Intermix. The interface areas are those areas that abut wildland vegetation and the Intermix areas are those areas that intermingle with wildland areas.

Figure 3.41. University of Wisconsin Wildland Urban Map showing Putnam County

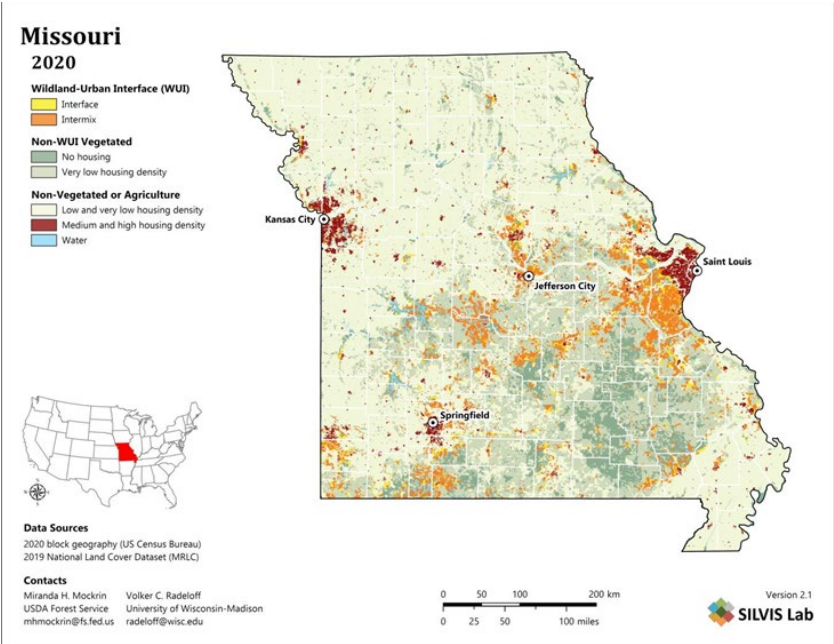


Source: University of Wisconsin Global Wildland-Urban Interface (WUI) – 2020 accessed June 2025

As the previous figure illustrates, Putnam County is largely rural with very little density in housing. The most at-risk areas to wildfire are those areas that have a high wildland-urban Interface. In the planning area there are relatively few areas of concern, however there are intermittent areas of medium and high housing density and small areas of intermix.

The following figure is a map of the State of Missouri that shows the Wildland-Urban Interface (WUI) areas statewide. Putnam County is indicated with an arrow.

Figure 3.42. Wildfire Urban Interface (WUI) Areas, 2020



Strength/Magnitude/Extent

Wildfires damage the environment, killing some plants and occasionally animals. Firefighters have been injured or killed, and structures can be damaged or destroyed. The loss of plants can heighten the risk of soil erosion and landslides. Although Missouri wildfires are not the size and intensity of those in the Western United States, they could impact recreation and tourism in and near the fires.

Wildland fires in Missouri have been mostly a result of human activity rather than lightning or some other natural event. Wildfires in Missouri are usually surface fires, burning the dead leaves on the ground or dried grasses. They do sometimes “torch” or “crown” out in certain dense evergreen stands like eastern red cedar and shortleaf pine. However, Missouri does not have the extensive stands of evergreens found in the western US that fuel the large fire storms seen on television news stories.

While very unusual, crown fires can and do occur in Missouri native hardwood forests during prolonged periods of drought combined with extreme heat, low relative humidity, and high wind. Tornadoes, high winds, wet snow and ice storms in recent years have placed a large amount of woody material on the forest floor that causes wildfires to burn hotter and longer. These conditions also make it more difficult for fire fighters suppress fires safely.

Often wildfires in Missouri go unnoticed by the general public because the sensational fire behavior that captures the attention of television viewers is rare in the state. Yet, from the standpoint of destroying homes and other property, Missouri wildfires can be quite destructive.

There have been no notable structural fires that resulted from wildfires in the planning area since the previous plan update.

Previous Occurrences

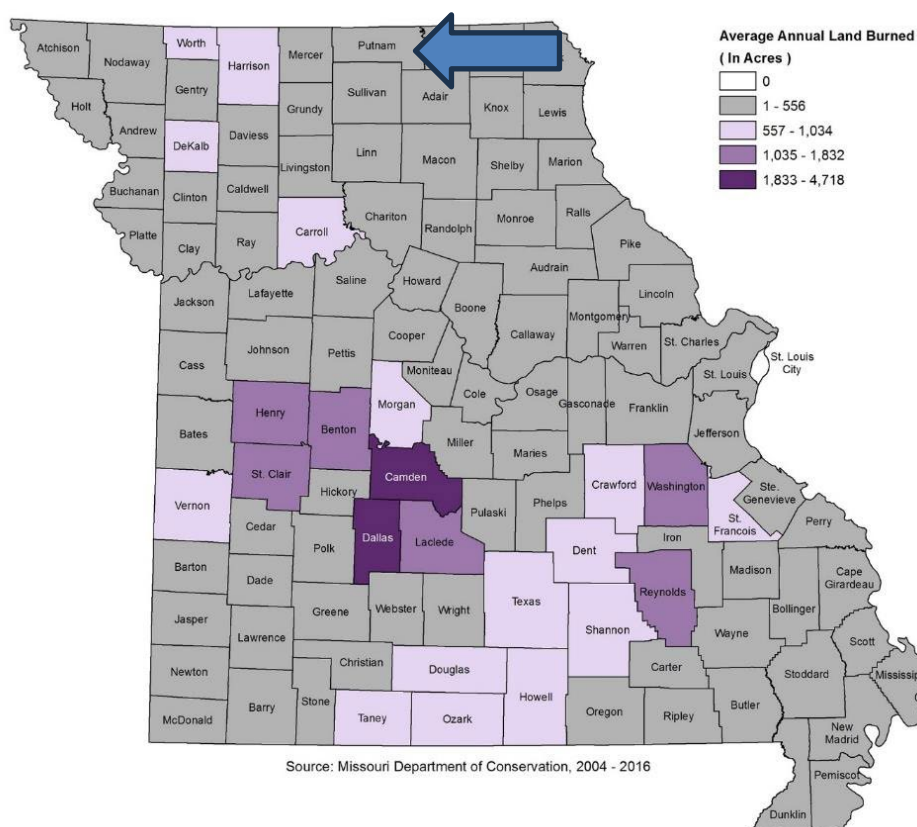
Table 3.80. Counts of fires reported by year

Year	Number of fires reported	Acres burned
------	--------------------------	--------------

2015	15	67.36
2016	13	206.1
2017	28	528
2018	0	0
2019	2	60.91
2020	1	8.366
2021	0	0
2022	8	769.947
2023	9	141.994
2024	0	0
Total	76	178
Average	8	1782.677

Source: Missouri department of conservation wildfire reporting system

Figure 3.43. Average Annual Acreage Burned



Source: Missouri Department of Conservation, 2004 - 2016

Causes of Fire by
type and count

Cause	Number of fires
Debris	34
Unknown	27
Miscellaneous	14
Equipment	8
Smoking	2
Campfire	1
Arson	1
Structure	1

Source: Missouri department of conservation wildfire reporting system.

Probability of Future Occurrence

There is a very high likelihood of wildfire in Putnam County in a given year. Over the last 10 years, 8 years have featured at least 1 reported fire. As the formula below indicates there is an 880% chance of a wildfire event each year, which suggests that in any given year, there will most likely be approximately 8.8 wildfires annually.

$$\text{Probability of wildland fire Incident} = \frac{88}{10} = 8.80$$

Changing Future Conditions Considerations

The predicted higher temperatures and changes in rainfall are not likely to substantially reduce forest cover in Putnam County, although the composition of trees in the forests may change. An increase in droughts would reduce forest productivity. Additionally, the changing future conditions are likely to increase the amount of damage from insects and diseases. But longer growing seasons and increased carbon dioxide concentrations could quite possibly offset the losses from these factors.

As the climate changes, the abundance of pines in Putnam County is likely to increase, while the population of hickory trees is likely to decrease. Higher temperatures will also reduce the number of days prescribed burning can be performed. Reduction of prescribed burning will allow for growth of understory vegetation – providing fuel for destructive wildfires.

Drought is also anticipated to increase in frequency and intensity during summer months under projected future scenarios. Drought can lead to dead or dying vegetation and landscaping material close to structures, which increases the possibility of structural fires in both urban and rural areas.

Vulnerability

Vulnerability Overview

Higher temperatures and changes in rainfall are unlikely to substantially reduce forest cover in Missouri, although the composition of trees in the forests may change. More droughts would reduce forest productivity, and changing future conditions are also likely to increase the damage from insects and diseases. But longer growing seasons and increased carbon dioxide concentrations could more than offset the losses from those factors. Forests cover about one-third of the state, dominated by oak and hickory trees. As the climate changes, the abundance of pines in Missouri’s forests is likely to increase, while the population of hickory trees is likely to decrease. Higher temperatures will also reduce the number of days prescribed burning can be performed. Reduction of prescribed burning will allow for growth of understory vegetation – providing fuel for destructive wildfires. Drought is also anticipated to increase in frequency and intensity during summer months under projected future scenarios. Drought can lead to dead or dying vegetation and landscaping material close to structures which creates fodder for wildfires within both the urban and rural settings.

Potential Losses to Existing Development

Table 3.81. Estimated numbers and Values of Structures and Population Vulnerable to Wildfire in Putnam County

Type of Property	Number of Structures	Value of Structures	Population
------------------	----------------------	---------------------	------------

Residential	190	\$37,039,347	509
Agriculture	61	\$159,260	0
Commercial	28	\$4,188,561	0
Total	279	\$41,387,168.00	509

Source: 2023 Missouri state hazard mitigation plan

Table 3.82. Statistical Data for Wildfire Hazard in Putnam County

Number of Wildfires 2015-2025	Likelihood of Occurrence (#/year)	Total Acres Burned	Average Annual Acreage Burned
76	8	1,782.677	178

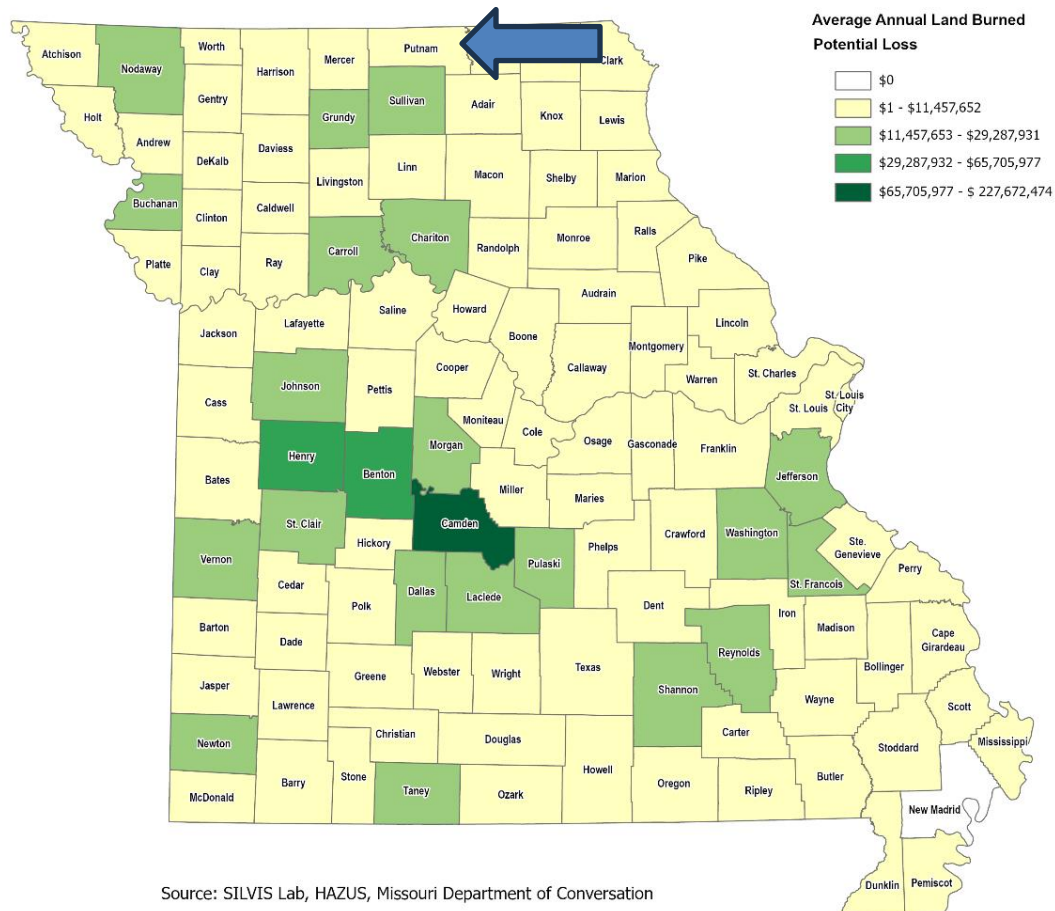
Source: 2023 Missouri State Hazard Mitigation Plan

Table 3.83. Wildfire Potential Loss Estimates in Putnam County

Total WUI Acreage	Total Structure Value Within WUI	Average Value/Acre within WUI	Average Annual Acreage Burned	Potential Loss
996.52	\$41,387,168	\$41,532	178	\$5,183,687

Source: 2023 Missouri State Hazard Mitigation Plan

Figure 3.44. Wildfire Potential Loss Estimate



Source: SILVIS Lab, HAZUS, Missouri Department of Conservation

Impact of Previous and Future Development

Future and previous development in the wildland-urban interface would increase vulnerability to the hazard. There are no known developments within the county that would increase the vulnerability.

Hazard Summary by Jurisdiction

The rural jurisdictions in the planning area are all surrounded by undeveloped agricultural land and face the possibility of a wildfire event. The school districts are located in such a way that they are not particularly vulnerable to wildfire as there are barriers in place that would lessen the impacts of a wildfire. Future wildfires in Daviess County should have a negligible adverse impact on the community, as it would affect a small percentage of the population. Nonetheless, homes and businesses located in unincorporated areas are at higher risk from wildfires due to proximity to wood and distance from fire services. Variations in both structural/urban and wildfires cannot be determined at this time due to lack of data. However, both fire types are expected to occur on an annual basis across the county.

Problem Statement

Residents do not comply with burn bans, education is not readily available for the levels of burn bans, many residents lack education in fire safety, and not all residents utilize social media and texting. Education should occur on the dangers of not complying with burn bans, more education for fire safety, and utilization of social media and texting for early warning.

Due to the region's high drought risk, they may be more susceptible to fires. The plan could address this potential for high crop losses during drought and lessen the risk of wildfires during drought.

Wildfire would lead to the loss of agricultural products, residential and commercial properties and possible loss of life. A large size, or number of wildfires could overload available resources.

4 MITIGATION STRATEGY

4	MITIGATION STRATEGY	4.1
4.1	Goals.....	4.1
4.2	Identification and Analysis of Mitigation Actions.....	4.1
4.3	Implementation of Mitigation Actions	4.4

This section presents the mitigation strategy updated by the Mitigation Planning Committee (MPC) based on the [updated] risk assessment. The mitigation strategy was developed through a collaborative group process. The process included review of [updated] general goal statements to guide the jurisdictions in lessening disaster impacts as well as specific mitigation actions to directly reduce vulnerability to hazards and losses. The following definitions are taken from FEMA's *Local Mitigation Planning Policy Guide (2023)*

- **Goals** are broad, long-term policy and vision statements that explain what is to be achieved by implementing the mitigation strategy.
- A **mitigation action** is a measure, project, plan or activity proposed to reduce current and future vulnerabilities described in the risk assessment.

4.1 Goals

This planning effort is an update to Putnam County's existing hazard mitigation plan approved by FEMA on May 14th, 2021. Therefore, the goals from the 2020 Putnam County Hazard Mitigation Plan were reviewed to see if they were still valid, feasible, practical, and applicable to the defined hazard impacts. The MPC conducted a discussion session during their second meeting to review and update the plan goals. To ensure that the goals developed for this update were comprehensive and supported State goals, the 2023 State Hazard Mitigation Plan goals were reviewed. The MPC also reviewed the goals from current surrounding county plans.

4.2 Identification and Analysis of Mitigation Actions

Some specific sources for mitigation action ideas include the following:

- FEMA's Mitigation Ideas Publication, https://www.fema.gov/sites/default/files/2020-06/fema-mitigation-ideas_02-13-2013.pdf
- FEMA's Climate Resilient Activities for Hazard Mitigation Assistance, <https://www.fema.gov/emergency-managers/risk-management/climate-resilience>
- FEMA Resources for Climate Resilience, https://www.fema.gov/sites/default/files/documents/fema_resources-climate-resilience.pdf
- EPA's Hazard Mitigation for Natural Disasters Publication, <https://www.epa.gov/waterutilityresponse/hazard-mitigation-natural-disasters>

- EPAs Planning for an Emergency Drinking Water Supply Publication, <https://www.epa.gov/waterutilityresponse/water-utility-planning-emergency-drinking-water-supply>

During the second MPC meeting, the results of the risk assessment update were provided to the MPC members for review, and the key issues were identified for specific hazards. Changes in risk since adoption of the previously approved plan were discussed. Actions from the previous plan included completed actions, on-going actions, and actions upon which progress had not been made. The MPC discussed SEMA's identified funding priorities and the types of mitigation actions generally recognized by FEMA.

The MPC included problem statements in the plan update at the end of each hazard profile. The problem statements summarize the risk to the planning area presented by each hazard and include possible methods to reduce that risk. Use of the problem statements allowed the MPC to recognize new and innovative strategies for mitigating risks in the planning area.

The focus of Meeting #3 was update of the mitigation strategy. For a comprehensive range of mitigation actions to consider^{7(a)}, the MPC reviewed the following information during Meeting #3:

- A list of actions proposed in the previous mitigation plan, the current 2023 State Plan, and approved plans in surrounding counties,
- Key issues from the risk assessments, including the problem statements concluding each hazard profile and vulnerability analysis,
- State priorities established for HMA grants, and
- Public input during meetings, responses to data collection questionnaires, and other efforts to involve the public in the plan development process.

For Meeting #3, individual jurisdictions, including school and special districts, developed final mitigation strategy for submission to the MPC. They were encouraged to review the details of the risk assessment vulnerability analysis specific to their jurisdiction. They were also provided a link to the FEMA's publication, *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (January 2013)*. This document was developed by FEMA as a resource for identification of a range of potential mitigation actions for reducing risk to natural hazards and disasters.

The MPC reviewed the actions from the previously approved plan for progress made since the plan had been adopted, using worksheets included in Appendix C of this plan. Prior to Meeting #3, the list of actions for each jurisdiction was emailed to that jurisdiction's MPC representative along with the worksheets. Each jurisdiction was instructed to provide information regarding the "Action Status" with one of the following status choices:

- Completed, with a description of the progress;
- Ongoing, with a description of the progress made to date; or
- Not Yet Started, with a discussion of the reasons for lack of progress.

Additionally, the future inclusion of each mitigation action in the plan update was identified as either keep, delete, or modify. Based on the status updates, there were 0 completed actions, 24 continuing actions (either ongoing or modified), and 2 deleted actions.

Table 4.1 provides a summary of the action statuses for each jurisdiction:

Table 4.1. Action Status Summary

Jurisdiction	Completed Actions	Continuing Actions (ongoing or modify)	Deleted Actions
Putnam County	0	5	1
Village of Livonia	0	4	0
Village of Lucerne	0	4	0
City of Unionville	0	5	0
Village of Worthington	0	4	0
Putnam County R-I	0	2	1
Total:	0	24	2

Table 4.2 provides a summary of the completed and deleted actions from the previous plan.

Table 4.2. Summary of Completed and Deleted Actions from the Previous Plan

Completed Actions	Completion Details (date, amount, funding source)
No actions from previous plan were completed	
Deleted Actions	Reason for Deletion
County 2020.5	Deemed not a natural hazard, no longer covered in plan.
PCSD 2020.1	Deemed not a natural hazard, no longer covered in plan.

Source: Previously approved County Hazard Mitigation Plan; Data Collection Questionnaires.

Table 4.3. Summary of actions from 2021 plan update

Status	Action from Previous Plan
Continued	COUNTY - 2020.1 MAINTAIN TRANSPORTATION INFRASTRUCTURE
Continued	COUNTY - 2020.2 GENERATOR FOR SHELTERS/CRITICAL FACILITIES
Continued	COUNTY - 2020.3 DEBRIS REMOVAL
Continued	COUNTY - 2020.4 INSTALLATION/UPGRADE SIREN
Removed	COUNTY - 2020.5 RESPONSE TO PANDEMIC
Continued	COUNTY - 2020.6 NOAA WEATHER RADIOS
Continued	LIVIONIA - 2020.1 MAINTAIN TRANSPORTATION INFRASTRUCTURE
Continued	LIVIONIA - 2020.2 GENERATOR FOR SHELTERS/CRITICAL FACILITIES
Continued	LIVIONIA - 2020.3 INSTALLATION/UPGRADE SIREN
Continued	LIVIONIA - 2020.4 SAFE ROOM/STORM SHELTER
Continued	LUCERNE - 2020.1 MAINTAIN TRANSPORTATION INFRASTRUCTURE
Continued	LUCERNE - 2020.2 GENERATOR FOR SHELTERS/CRITICAL FACILITIES
Continued	LUCERNE - 2020.3 INSTALLATION/UPGRADE SIREN
Continued	LUCERNE - 2020.4 SAFE ROOM/STORM SHELTER
Continued	UNIONVILLE 2020.1 - GENERATOR FOR SHELTERS/CRITICAL FACILITIES
Continued	UNIONVILLE 2020.2 - MAINTAIN TRANSPORTATION INFRASTRUCTURE
Continued	UNIONVILLE 2020.3 - SAFE ROOM/STORM SHELTER
Continued	UNIONVILLE 2020.4 - INSTALLATION/UPGRADE SIREN
Continued	UNIONVILLE 2020.5 - NFIP PARTICIPATION
Continued	WORTHINGTON - 2020.1 MAINTAIN TRANSPORTATION INFRASTRUCTURE
Continued	WORTHINGTON - 2020.2 GENERATOR FOR SHELTERS/CRITICAL FACILITIES
Continued	WORTHINGTON - 2020.3 INSTALLATION/UPGRADE SIREN
Continued	WORTHINGTON - 2020.4 SAFE ROOM/STORM SHELTER
Removed	PCSD 2020.1 - PANDEMIC PERSONAL PROTECTIVE EQUIPMENT (PPE)
Continued	PCSD 2020.2 - SAFE ROOM/STORM SHELTER
Continued	PCSD 2020.3 - GENERATOR FOR SHELTERS/CRITICAL FACILITIES

4.3 Implementation of Mitigation Actions

Jurisdictional MPC members were encouraged to meet with others in their community to finalize the actions to be submitted for the updated mitigation strategy. Throughout the MPC consideration and discussion, emphasis was placed on the importance of a benefit-cost analysis in determining project priority. The Disaster Mitigation Act requires benefit-cost review as the primary method by which mitigation projects should be prioritized. The MPC decided to pursue implementation according to when and where damage occurs, available funding, political will, jurisdictional priority, and priorities identified in the 2023 Missouri State Hazard Mitigation Plan. The benefit/cost review at the planning stage primarily consisted of a qualitative analysis and was not the detailed process required grant funding application. For each action, the plan sets forth a narrative describing the types of benefits that could be realized from action implementation. The cost was estimated as closely as possible, with further refinement to be supplied as project development occurs.

FEMA's STAPLEE methodology was used to assess the costs and benefits, overall feasibility of mitigation actions, and other issues impacting project^{7(a)}. During the prioritization process, the jurisdictions used worksheets to assign scores. The worksheets posed questions based on the STAPLEE elements as well as the potential mitigation effectiveness of each action. Scores were based on the responses to the questions as follows:

Definitely YES = 3 points

Maybe YES = 2 points

Probably NO = 1 points

Definitely NO = 0 points

The following questions were asked for each proposed action.

S: Is the action socially acceptable?

T: Is the action technically feasible and potentially successful?

A: Does the jurisdiction have the administrative capability to successfully implement this action?

P: Is the action politically acceptable?

L: Does the jurisdiction have the legal authority to implement the action?

E: Is the action economically beneficial?

E: Will the project have an environmental impact that is either beneficial or neutral? (score "3" if positive and "2" if neutral)

Will the implemented action result in lives saved?

Will the implanted action result in a reduction of disaster damage?

The final scores are listed below in the analysis of each action. The worksheets are attached to this plan as Appendix _____. The STAPLEE final score for each action, absent other considerations, such as a localized need for a project, determined the priority. Low priority action items were those that had a total score of between 0 and 24. Moderate priority actions were those scoring between 25 and 29. High priority actions scored 30 or above. A blank STAPLEE worksheet is shown in Figure 4.1

Figure 4.1. Blank STAPLEE Worksheet

STAPLEE Worksheet		
Name of Jurisdiction:		
Action or Project		
Action/Project Number:	Insert a unique action number for this action for future tracking purposes. This can be a combination of the jurisdiction name, followed by the goal number and action number (i.e. Joplin1.1)	
Name of Action or Project:		
Mitigation Category:		Prevention; Structure and Infrastructure Projects; Natural Systems Protection; Education and Outreach; Emergency Services
STAPLEE Criteria Evaluation Rating Definitely YES = 3 Maybe YES = 2 Probably NO = 1 Definitely NO = 0		Score
S: Is it Socially Acceptable		
T: Is it Technically feasible and potentially successful?		
A: Does the jurisdiction have the Administrative capacity to execute this action?		
P: Is it Politically acceptable?		
L: Is there Legal authority to implement?		
E: Is it Economically beneficial?		
E: Will the project have either a neutral or positive impact on the natural Environment ?		
Will historic structures be saved or protected?		
Could it be implemented quickly?		
STAPLEE SCORE		
Mitigation Effectiveness Criteria	Evaluation Rating	Score
Will the implemented action result in lives saved?	Assign from 5-10 points based on the likelihood that lives will be saved.	
Will the implemented action result in a reduction of disaster damages?	Assign from 5-10 points based on the relative reduction of disaster damages.	
MITIGATION EFFECTIVENESS SCORE		
TOTAL SCORE (STAPLEE + Mitigation Effectiveness)		
☐ High Priority (30+ points)	☐ Medium Priority (25 - 29 points)	☐ Low Priority (<25 points)

Completed by
(Name, Title, Phone Number)

ACTION WORKSHEET

Action Worksheet	
Name of Jurisdiction:	
Risk / Vulnerability	
Hazard(s) Addressed:	List the hazard or hazards that will be addressed by this action
Problem being Mitigated:	Provide a brief description of the problem that the action will address. Utilize the problem statement developed in the risk assessment.
Action or Project	
Applicable Goal Statement:	Choose the goal statement that applies to this action
Action/Project Number:	Insert a unique action number for this action for future tracking purposes. This can be a combination of the jurisdiction name, followed by the goal number and action number (i.e. Joplin1.1)
Name of Action or Project:	
Mitigation Category:	Prevention; Structure and Infrastructure Projects; Natural Systems Protection; Education and Outreach; Emergency Services
Action or Project Description:	Describe the action or project.
Estimated Cost:	Provide an estimate of the cost to implement this action. This can be accomplished with a range of estimated costs.
Benefits:	Provide a narrative describing the losses that will be avoided by implementing this action. If dollar amounts of avoided losses are known, include them as well.
Plan for Implementation	
Responsible Organization/Department:	Which organization will be responsible for tracking this action? Be specific to include the specific department or position within a department.
Supporting Organization/Department:	Which organization/department will assist in implementation of this action?
Action/Project Priority:	Include the STAPLEE score and Priority (H, M, L)
Timeline for Completion:	How many months/years to complete.
Potential Fund Sources:	List specific funding sources that may be used to pay for the implementation of the action.
Local Planning Mechanisms to be Used in Implementation, if any:	
Progress Report	
Action Status:	Indicate status as New, Continuing Not Started, or Continuing in Progress)
Report of Progress:	For Continuing actions only, indicate the report on progress. If the action is not started, indicate any barriers encountered to initiate the action. If the action is in progress, indicate the activity that has occurred to date.

Action Worksheet	
Name of Jurisdiction:	Putnam County
Risk / Vulnerability	
Hazard(s) Addressed:	Flooding, Dam Failure, Earthquakes, Drought, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado, Wildfire
Problem being Mitigated:	Lack of public knowledge about natural disasters.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning. Goal 2: Minimize property damage due to flooding, levee failure or dam incidents. Goal 3: Minimize the impact to natural and human resources caused by drought, extreme temperatures and wildfire Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather Goal 5: Minimize injuries and property damage due to seismic and/or geological events.
Action/Project Number:	County 2025.1
Name of Action or Project:	Public mitigation education
Mitigation Category:	Education and Outreach
Action or Project Description:	Provide emergency preparedness information and resources related to all natural disasters to the public through active education and outreach programs.
Estimated Cost:	\$500
Benefits:	The general population will increase understanding of natural disasters and how to prepare for natural disasters potentially affecting the County.
Plan for Implementation	
Responsible Organization/Department:	County Emergency Management
Supporting Organization/Department:	FEMA, SEMA, NWS, USGS
Action/Project Priority:	Medium
Timeline for Completion:	1-5 years
Potential Fund Sources:	NA
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	New
Report of Progress:	New Project

Action Worksheet	
Name of Jurisdiction:	Putnam County
Risk / Vulnerability	
Hazard(s) Addressed:	Flooding, Earthquakes, Severe thunderstorms, Severe winter weather, Tornado
Problem being Mitigated:	Transportation routes can be disrupted by debris caused by natural disasters.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning. Goal 2: Minimize property damage due to flooding, levee failure or dam incidents. Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather Goal 5: Minimize injuries and property damage due to seismic and/or geological events.
Action/Project Number:	County 2025.2
Name of Action or Project:	Maintain transportation infrastructure
Mitigation Category:	Structure and Infrastructure Projects
Action or Project Description:	Mitigate the risk to life and property and promote continued operation of government and emergency functions by regularly maintaining and improving infrastructure.
Estimated Cost:	\$500,000
Benefits:	Reduce long term costs by improving infrastructure and addressing on-going issues long
Plan for Implementation	
Responsible Organization/Department:	Road and Bridge Department
Supporting Organization/Department:	n/a
Action/Project Priority:	High
Timeline for Completion:	1-5 years
Potential Fund Sources:	Transportation budget, FEMA Recovery funds, Emergency budget
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued
Report of Progress:	On going as needed

Action Worksheet	
Name of Jurisdiction:	Putnam County
Risk / Vulnerability	
Hazard(s) Addressed:	Earthquakes, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado
Problem being Mitigated:	Loss of power threatening student safety and property during an extreme event.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning. Goal 3: Minimize the impact to natural and human resources caused by drought, extreme temperatures and wildfire Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather Goal 5: Minimize injuries and property damage due to seismic and/or geological events.
Action/Project Number:	County 2025.3
Name of Action or Project:	Generators
Mitigation Category:	Structure and Infrastructure
Action or Project Description:	Install backup generators or transfer switch to allow for the safe use of backup power ensuring public safety and property during power outages due to extreme events
Estimated Cost:	\$1,000,000
Benefits:	Critical facilities, such as schools, can continue to operate in the event of a disaster.
Plan for Implementation	
Responsible Organization/Department:	County Commission
Supporting Organization/Department:	
Action/Project Priority:	HIGH
Timeline for Completion:	1 to 5 years
Potential Fund Sources:	General Revenue, Capital projects, HMGP
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued/Modified
Report of Progress:	Awaiting funding

Action Worksheet	
Name of Jurisdiction:	Putnam County
Risk / Vulnerability	
Hazard(s) Addressed:	Flooding, Earthquake, Severe thunderstorm, Sever winter storm, tornado
Problem being Mitigated:	Transportation routes can be disrupted by debris caused by natural disasters.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning. Goal 2: Minimize property damage due to flooding, levee failure or dam incidents. Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather Goal 5: Minimize injuries and property damage due to seismic and/or geological events.
Action/Project Number:	County 2025.4
Name of Action or Project:	Debris removal
Mitigation Category:	Structure and Infrastructure, Natural systems protection
Action or Project Description:	Mitigate the risk to life and property and promote continued operation of government and emergency functions by regularly removing debris as needed along transportation routes and drainage systems.
Estimated Cost:	\$500,000
Benefits:	Frequent removal of debris will help clear roadways and drainage systems. Emergency services can respond quicker to emergencies. Stormwater can drain effectively and reduce the risk of flooding with regular removal of debris.
Plan for Implementation	
Responsible Organization/Department:	County Road and Bridge Department
Supporting Organization/Department:	
Action/Project Priority:	High
Timeline for Completion:	1-5 years
Potential Fund Sources:	HMGP, FEMA Recovery, Transportation budget
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued
Report of Progress:	On-going

Action Worksheet	
Name of Jurisdiction:	Putnam County
Risk / Vulnerability	
Hazard(s) Addressed:	Severe thunderstorm, Tornado
Problem being Mitigated:	Early Warning Sirens
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning.
Action/Project Number:	County 2025.5
Name of Action or Project:	Installation of warning siren
Mitigation Category:	Structure and Infrastructure Projects, Emergency Services
Action or Project Description:	Installation of early warning sirens
Estimated Cost:	\$100,000
Benefits:	With adequate time for warning of storms, residents are able to seek cover to help minimize the loss of life.
Plan for Implementation	
Responsible Organization/Department:	County Commission
Supporting Organization/Department:	
Action/Project Priority:	Medium
Timeline for Completion:	1-5 years
Potential Fund Sources:	Hazard Mitigation Grant Funds, Capital projects
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued
Report of Progress:	Awaiting funding

Action Worksheet	
Name of Jurisdiction:	Putnam County
Risk / Vulnerability	
Hazard(s) Addressed:	Flooding, Dam Failure, Earthquakes, Drought, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado, Wildfire
Problem being Mitigated:	Lack of robust early warning systems
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning. Goal 2: Minimize property damage due to flooding, levee failure or dam incidents. Goal 3: Minimize the impact to natural and human resources caused by drought, extreme temperatures and wildfire Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather Goal 5: Minimize injuries and property damage due to seismic and/or geological events.
Action/Project Number:	County 2025.6
Name of Action or Project:	N.O.A.A. Weather Radio
Mitigation Category:	Education and Outreach
Action or Project Description:	Provide emergency preparedness information and resources related to all natural disasters to the public through active education and outreach programs.
Estimated Cost:	\$5,000
Benefits:	The general population will increase understanding of natural disasters and how to prepare for natural disasters potentially affecting the County.
Plan for Implementation	
Responsible Organization/Department:	County Emergency Management
Supporting Organization/Department:	FEMA, SEMA, NWS, USGS
Action/Project Priority:	Medium
Timeline for Completion:	1-5 years
Potential Fund Sources:	NA
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued
Report of Progress:	Awaiting funding

Action Worksheet	
Name of Jurisdiction:	Village of Livonia
Risk / Vulnerability	
Hazard(s) Addressed:	Flooding, Dam Failure, Earthquakes, Drought, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado, Wildfire
Problem being Mitigated:	Lack of public knowledge about natural disasters.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning. Goal 2: Minimize property damage due to flooding, levee failure or dam incidents. Goal 3: Minimize the impact to natural and human resources caused by drought, extreme temperatures and wildfire Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather Goal 5: Minimize injuries and property damage due to seismic and/or geological events.
Action/Project Number:	VL 2025.1
Name of Action or Project:	Public mitigation education
Mitigation Category:	Education and Outreach
Action or Project Description:	Provide emergency preparedness information and resources related to all natural disasters to the public through active education and outreach programs.
Estimated Cost:	\$500
Benefits:	The general population will increase understanding of natural disasters and how to prepare for natural disasters potentially affecting the County.
Plan for Implementation	
Responsible Organization/Department:	Village board
Supporting Organization/Department:	FEMA, SEMA, NWS, USGS
Action/Project Priority:	Medium
Timeline for Completion:	1-5 years
Potential Fund Sources:	NA
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	New
Report of Progress:	New Project

Action Worksheet	
Name of Jurisdiction:	Village of Livonia
Risk / Vulnerability	
Hazard(s) Addressed:	Earthquakes, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado
Problem being Mitigated:	Loss of power threatening student safety and property during an extreme event.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning. Goal 3: Minimize the impact to natural and human resources caused by drought, extreme temperatures and wildfire Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather Goal 5: Minimize injuries and property damage due to seismic and/or geological events.
Action/Project Number:	VL 2025.2
Name of Action or Project:	Generators
Mitigation Category:	Structure and Infrastructure
Action or Project Description:	Install backup generators or transfer switch to allow for the safe use of backup power ensuring public safety and property during power outages due to extreme events
Estimated Cost:	\$1,000,000
Benefits:	Critical facilities, such as schools, can continue to operate in the event of a disaster.
Plan for Implementation	
Responsible Organization/Department:	Village board
Supporting Organization/Department:	
Action/Project Priority:	HIGH
Timeline for Completion:	1 to 5 years
Potential Fund Sources:	General Revenue, Capital projects, HMGP
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued/Modified
Report of Progress:	Awaiting funding

Action Worksheet	
Name of Jurisdiction:	Village of Livonia
Risk / Vulnerability	
Hazard(s) Addressed:	Severe thunderstorm, Tornado
Problem being Mitigated:	Early Warning Sirens
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning.
Action/Project Number:	VL 2025.3
Name of Action or Project:	Installation of warning siren
Mitigation Category:	Structure and Infrastructure Projects, Emergency Services
Action or Project Description:	Installation of early warning sirens
Estimated Cost:	\$100,000
Benefits:	With adequate time for warning of storms, residents are able to seek cover to help minimize the loss of life.
Plan for Implementation	
Responsible Organization/Department:	Village board
Supporting Organization/Department:	
Action/Project Priority:	Medium
Timeline for Completion:	1-5 years
Potential Fund Sources:	Hazard Mitigation Grant Funds, Capital projects
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued
Report of Progress:	Awaiting funding

Action Worksheet	
Name of Jurisdiction:	Village of Livonia
Risk / Vulnerability	
Hazard(s) Addressed:	Severe Thunderstorms, Tornado
Problem being Mitigated:	FEMA-approved storm shelters have proven effective in mitigating the loss of property and life during tornados. A community-wide shelter program should be adopted for residents who may not have adequate shelter in their homes to minimize the potential for loss of life. School safe rooms can protect students from injury during a thunderstorm, tornado or natural wind event/disaster.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning.
Action/Project Number:	VL 2025.4
Name of Action or Project:	Storm shelter/safe room
Mitigation Category:	Structure and Infrastructure
Action or Project Description:	Utilize grant funds and local resources to construct or install storm shelters in locations with insufficient protection including, but not limited to, schools, local recreation areas, and public facilities.
Estimated Cost:	\$2M
Benefits:	Storm shelters can protect the lives of individuals in a thunderstorm, tornado or hazardous wind event who may not have other options for sufficient shelter.
Plan for Implementation	
Responsible Organization/Department:	Village Board
Supporting Organization/Department:	County Commissioners, GHRPC, County EMD
Action/Project Priority:	High
Timeline for Completion:	5 years
Potential Fund Sources:	Capital projects budget, HMGP
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued
Report of Progress:	Awaiting funding

Action Worksheet	
Name of Jurisdiction:	Village of Lucerne
Risk / Vulnerability	
Hazard(s) Addressed:	Flooding, Dam Failure, Earthquakes, Drought, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado, Wildfire
Problem being Mitigated:	Lack of public knowledge about natural disasters.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning. Goal 2: Minimize property damage due to flooding, levee failure or dam incidents. Goal 3: Minimize the impact to natural and human resources caused by drought, extreme temperatures and wildfire Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather Goal 5: Minimize injuries and property damage due to seismic and/or geological events.
Action/Project Number:	VLU 2025.1
Name of Action or Project:	Public mitigation education
Mitigation Category:	Education and Outreach
Action or Project Description:	Provide emergency preparedness information and resources related to all natural disasters to the public through active education and outreach programs.
Estimated Cost:	\$500
Benefits:	The general population will increase understanding of natural disasters and how to prepare for natural disasters potentially affecting the County.
Plan for Implementation	
Responsible Organization/Department:	Village board
Supporting Organization/Department:	FEMA, SEMA, NWS, USGS
Action/Project Priority:	Medium
Timeline for Completion:	1-5 years
Potential Fund Sources:	NA
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	New
Report of Progress:	New Project

Action Worksheet	
Name of Jurisdiction:	Village of Lucerne
Risk / Vulnerability	
Hazard(s) Addressed:	Earthquakes, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado
Problem being Mitigated:	Loss of power threatening student safety and property during an extreme event.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning. Goal 3: Minimize the impact to natural and human resources caused by drought, extreme temperatures and wildfire Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather Goal 5: Minimize injuries and property damage due to seismic and/or geological events.
Action/Project Number:	VLU 2025.2
Name of Action or Project:	Generators
Mitigation Category:	Structure and Infrastructure
Action or Project Description:	Install backup generators or transfer switch to allow for the safe use of backup power ensuring public safety and property during power outages due to extreme events
Estimated Cost:	\$1,000,000
Benefits:	Critical facilities, such as schools, can continue to operate in the event of a disaster.
Plan for Implementation	
Responsible Organization/Department:	Village board
Supporting Organization/Department:	
Action/Project Priority:	HIGH
Timeline for Completion:	1 to 5 years
Potential Fund Sources:	General Revenue, Capital projects, HMGP
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued/Modified
Report of Progress:	Awaiting funding

Action Worksheet	
Name of Jurisdiction:	Village of Lucerne
Risk / Vulnerability	
Hazard(s) Addressed:	Severe thunderstorm, Tornado
Problem being Mitigated:	Early Warning Sirens
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning.
Action/Project Number:	VLU 2025.3
Name of Action or Project:	Installation of warning siren
Mitigation Category:	Structure and Infrastructure Projects, Emergency Services
Action or Project Description:	Installation of early warning sirens
Estimated Cost:	\$100,000
Benefits:	With adequate time for warning of storms, residents are able to seek cover to help minimize the loss of life.
Plan for Implementation	
Responsible Organization/Department:	Village board
Supporting Organization/Department:	
Action/Project Priority:	Medium
Timeline for Completion:	1-5 years
Potential Fund Sources:	Hazard Mitigation Grant Funds, Capital projects
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued
Report of Progress:	Awaiting funding

Action Worksheet	
Name of Jurisdiction:	City of Unionville
Risk / Vulnerability	
Hazard(s) Addressed:	Flooding, Dam Failure, Earthquakes, Drought, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado, Wildfire
Problem being Mitigated:	Lack of public knowledge about natural disasters.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning. Goal 2: Minimize property damage due to flooding, levee failure or dam incidents. Goal 3: Minimize the impact to natural and human resources caused by drought, extreme temperatures and wildfire Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather Goal 5: Minimize injuries and property damage due to seismic and/or geological events.
Action/Project Number:	CU 2025.1
Name of Action or Project:	Public mitigation education
Mitigation Category:	Education and Outreach
Action or Project Description:	Provide emergency preparedness information and resources related to all natural disasters to the public through active education and outreach programs.
Estimated Cost:	\$500
Benefits:	The general population will increase understanding of natural disasters and how to prepare for natural disasters potentially affecting the County.
Plan for Implementation	
Responsible Organization/Department:	City Council
Supporting Organization/Department:	FEMA, SEMA, NWS, USGS
Action/Project Priority:	Medium
Timeline for Completion:	1-5 years
Potential Fund Sources:	NA
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	New
Report of Progress:	New Project

Action Worksheet	
Name of Jurisdiction:	City of Unionville
Risk / Vulnerability	
Hazard(s) Addressed:	Earthquakes, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado
Problem being Mitigated:	Loss of power threatening student safety and property during an extreme event.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning. Goal 3: Minimize the impact to natural and human resources caused by drought, extreme temperatures and wildfire Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather Goal 5: Minimize injuries and property damage due to seismic and/or geological events.
Action/Project Number:	CU 2025.2
Name of Action or Project:	Generators
Mitigation Category:	Structure and Infrastructure
Action or Project Description:	Install backup generators or transfer switch to allow for the safe use of backup power ensuring public safety and property during power outages due to extreme events
Estimated Cost:	\$1,000,000
Benefits:	Critical facilities, such as schools, can continue to operate in the event of a disaster.
Plan for Implementation	
Responsible Organization/Department:	City Council
Supporting Organization/Department:	
Action/Project Priority:	HIGH
Timeline for Completion:	1 to 5 years
Potential Fund Sources:	General Revenue, Capital projects, HMGP
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued/Modified
Report of Progress:	Awaiting funding

Action Worksheet	
Name of Jurisdiction:	City of Unionville
Risk / Vulnerability	
Hazard(s) Addressed:	Flooding, Earthquakes, Severe thunderstorms, Severe winter weather, Tornado
Problem being Mitigated:	Transportation routes can be disrupted by debris caused by natural disasters.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning. Goal 2: Minimize property damage due to flooding, levee failure or dam incidents. Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather Goal 5: Minimize injuries and property damage due to seismic and/or geological events.
Action/Project Number:	CU 2025.3
Name of Action or Project:	Maintain transportation infrastructure
Mitigation Category:	Structure and Infrastructure Projects
Action or Project Description:	Mitigate the risk to life and property and promote continued operation of government and emergency functions by regularly maintaining and improving infrastructure.
Estimated Cost:	\$500,000
Benefits:	Reduce long term costs by improving infrastructure and addressing on-going issues long
Plan for Implementation	
Responsible Organization/Department:	Road and Bridge Department
Supporting Organization/Department:	n/a
Action/Project Priority:	High
Timeline for Completion:	1-5 years
Potential Fund Sources:	Transportation budget, FEMA Recovery funds, Emergency budget
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued
Report of Progress:	On going as needed

Action Worksheet	
Name of Jurisdiction:	City of Unionville
Risk / Vulnerability	
Hazard(s) Addressed:	Severe Thunderstorms, Tornado
Problem being Mitigated:	FEMA-approved storm shelters have proven effective in mitigating the loss of property and life during tornados. A community-wide shelter program should be adopted for residents who may not have adequate shelter in their homes to minimize the potential for loss of life. School safe rooms can protect students from injury during a thunderstorm, tornado or natural wind event/disaster.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning.
Action/Project Number:	CU 2025.4
Name of Action or Project:	Storm shelter/safe room
Mitigation Category:	Structure and Infrastructure
Action or Project Description:	Utilize grant funds and local resources to construct or install storm shelters in locations with insufficient protection including, but not limited to, schools, local recreation areas, and public facilities.
Estimated Cost:	\$2M
Benefits:	Storm shelters can protect the lives of individuals in a thunderstorm, tornado or hazardous wind event who may not have other options for sufficient shelter.
Plan for Implementation	
Responsible Organization/Department:	City Council
Supporting Organization/Department:	County Commissioners, GHRPC, County EMD
Action/Project Priority:	High
Timeline for Completion:	5 years
Potential Fund Sources:	Capital projects budget, HMGP
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued
Report of Progress:	Awaiting funding

Action Worksheet	
Name of Jurisdiction:	City of Unionville
Risk / Vulnerability	
Hazard(s) Addressed:	Severe thunderstorm, Tornado
Problem being Mitigated:	Early Warning Sirens
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning.
Action/Project Number:	CU 2025.5
Name of Action or Project:	Installation of warning siren
Mitigation Category:	Structure and Infrastructure Projects, Emergency Services
Action or Project Description:	Installation of early warning sirens
Estimated Cost:	\$100,000
Benefits:	With adequate time for warning of storms, residents are able to seek cover to help minimize the loss of life.
Plan for Implementation	
Responsible Organization/Department:	City council
Supporting Organization/Department:	
Action/Project Priority:	Medium
Timeline for Completion:	1-5 years
Potential Fund Sources:	Hazard Mitigation Grant Funds, Capital projects
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued
Report of Progress:	Awaiting funding

Action Worksheet	
Name of Jurisdiction:	City of Unionville
Risk / Vulnerability	
Hazard(s) Addressed:	Flooding
Problem being Mitigated:	Unregulated development in the floodplains
Action or Project	
Applicable Goal Statement:	Goal 2: Minimize property damage due to flooding, levee failure or dam incidents.
Action/Project Number:	CU 2025.6
Name of Action or Project:	PARTICIPATION IN NFIP (National Floodplain Insurance Program)
Mitigation Category:	Planning and Regulation
Action or Project Description:	County will continue participation in NFIP, re-evaluate and continue enforcement of ordinances and regulations, and continue to work with the floodplain manager.
Estimated Cost:	\$100/Yearly
Benefits:	Protection of structures insured through NFIP.
Plan for Implementation	
Responsible Organization/Department:	Floodplain Administrator
Supporting Organization/Department:	
Action/Project Priority:	Medium
Timeline for Completion:	1-5 years
Potential Fund Sources:	General revenue
Local Planning Mechanisms to be Used in Implementation, if any:	Floodplain Ordinance
Progress Report	
Action Status:	Continued
Report of Progress:	Continue, in progress

Action Worksheet	
Name of Jurisdiction:	Village of Worthington
Risk / Vulnerability	
Hazard(s) Addressed:	Flooding, Dam Failure, Earthquakes, Drought, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado, Wildfire
Problem being Mitigated:	Lack of public knowledge about natural disasters.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning. Goal 2: Minimize property damage due to flooding, levee failure or dam incidents. Goal 3: Minimize the impact to natural and human resources caused by drought, extreme temperatures and wildfire Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather Goal 5: Minimize injuries and property damage due to seismic and/or geological events.
Action/Project Number:	VW 2025.1
Name of Action or Project:	Public mitigation education
Mitigation Category:	Education and Outreach
Action or Project Description:	Provide emergency preparedness information and resources related to all natural disasters to the public through active education and outreach programs.
Estimated Cost:	\$500
Benefits:	The general population will increase understanding of natural disasters and how to prepare for natural disasters potentially affecting the County.
Plan for Implementation	
Responsible Organization/Department:	Village board
Supporting Organization/Department:	FEMA, SEMA, NWS, USGS
Action/Project Priority:	Medium
Timeline for Completion:	1-5 years
Potential Fund Sources:	NA
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	New
Report of Progress:	New Project

Action Worksheet	
Name of Jurisdiction:	Village of Worthington
Risk / Vulnerability	
Hazard(s) Addressed:	Earthquakes, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado
Problem being Mitigated:	Loss of power threatening student safety and property during an extreme event.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning. Goal 3: Minimize the impact to natural and human resources caused by drought, extreme temperatures and wildfire Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather Goal 5: Minimize injuries and property damage due to seismic and/or geological events.
Action/Project Number:	VW 2025.2
Name of Action or Project:	Generators
Mitigation Category:	Structure and Infrastructure
Action or Project Description:	Install backup generators or transfer switch to allow for the safe use of backup power ensuring public safety and property during power outages due to extreme events
Estimated Cost:	\$1,000,000
Benefits:	Critical facilities, such as schools, can continue to operate in the event of a disaster.
Plan for Implementation	
Responsible Organization/Department:	Village board
Supporting Organization/Department:	
Action/Project Priority:	HIGH
Timeline for Completion:	1 to 5 years
Potential Fund Sources:	General Revenue, Capital projects, HMGP
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued/Modified
Report of Progress:	Awaiting funding

Action Worksheet	
Name of Jurisdiction:	Village of Worthington
Risk / Vulnerability	
Hazard(s) Addressed:	Severe thunderstorm, Tornado
Problem being Mitigated:	Early Warning Sirens
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning.
Action/Project Number:	VW 2025.3
Name of Action or Project:	Installation of warning siren
Mitigation Category:	Structure and Infrastructure Projects, Emergency Services
Action or Project Description:	Installation of early warning sirens
Estimated Cost:	\$100,000
Benefits:	With adequate time for warning of storms, residents are able to seek cover to help minimize the loss of life.
Plan for Implementation	
Responsible Organization/Department:	Village board
Supporting Organization/Department:	
Action/Project Priority:	Medium
Timeline for Completion:	1-5 years
Potential Fund Sources:	Hazard Mitigation Grant Funds, Capital projects
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued
Report of Progress:	Awaiting funding

Action Worksheet	
Name of Jurisdiction:	Village of Worthington
Risk / Vulnerability	
Hazard(s) Addressed:	Severe Thunderstorms, Tornado
Problem being Mitigated:	FEMA-approved storm shelters have proven effective in mitigating the loss of property and life during tornados. A community-wide shelter program should be adopted for residents who may not have adequate shelter in their homes to minimize the potential for loss of life. School safe rooms can protect students from injury during a thunderstorm, tornado or natural wind event/disaster.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning.
Action/Project Number:	VW 2025.4
Name of Action or Project:	Storm shelter/safe room
Mitigation Category:	Structure and Infrastructure
Action or Project Description:	Utilize grant funds and local resources to construct or install storm shelters in locations with insufficient protection including, but not limited to, schools, local recreation areas, and public facilities.
Estimated Cost:	\$2M
Benefits:	Storm shelters can protect the lives of individuals in a thunderstorm, tornado or hazardous wind event who may not have other options for sufficient shelter.
Plan for Implementation	
Responsible Organization/Department:	Village board
Supporting Organization/Department:	County Commissioners, GHRPC, County EMD
Action/Project Priority:	High
Timeline for Completion:	5 years
Potential Fund Sources:	Capital projects budget, HMGP
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued
Report of Progress:	Awaiting funding

Action Worksheet	
Name of Jurisdiction:	Village of Worthington
Risk / Vulnerability	
Hazard(s) Addressed:	Flooding, Earthquakes, Severe thunderstorms, Severe winter weather, Tornado
Problem being Mitigated:	Transportation routes can be disrupted by debris caused by natural disasters.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning. Goal 2: Minimize property damage due to flooding, levee failure or dam incidents. Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather Goal 5: Minimize injuries and property damage due to seismic and/or geological events.
Action/Project Number:	VW 2025.5
Name of Action or Project:	Maintain transportation infrastructure
Mitigation Category:	Structure and Infrastructure Projects
Action or Project Description:	Mitigate the risk to life and property and promote continued operation of government and emergency functions by regularly maintaining and improving infrastructure.
Estimated Cost:	\$500,000
Benefits:	Reduce long term costs by improving infrastructure and addressing on-going issues long
Plan for Implementation	
Responsible Organization/Department:	Road and Bridge Department
Supporting Organization/Department:	n/a
Action/Project Priority:	High
Timeline for Completion:	1-5 years
Potential Fund Sources:	Transportation budget, FEMA Recovery funds, Emergency budget
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued
Report of Progress:	On going as needed

Action Worksheet	
Name of Jurisdiction:	Putnam County R-I
Risk / Vulnerability	
Hazard(s) Addressed:	Severe Thunderstorms, Tornado
Problem being Mitigated:	FEMA-approved storm shelters have proven effective in mitigating the loss of property and life during tornados. A community-wide shelter program should be adopted for residents who may not have adequate shelter in their homes to minimize the potential for loss of life. School safe rooms can protect students from injury during a thunderstorm, tornado or natural wind event/disaster.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning.
Action/Project Number:	PCSD 2025.1
Name of Action or Project:	Storm shelter/safe room
Mitigation Category:	Structure and Infrastructure
Action or Project Description:	Utilize grant funds and local resources to construct or install storm shelters in locations with insufficient protection including, but not limited to, schools, local recreation areas, and public facilities.
Estimated Cost:	\$2M
Benefits:	Storm shelters can protect the lives of individuals in a thunderstorm, tornado or hazardous wind event who may not have other options for sufficient shelter.
Plan for Implementation	
Responsible Organization/Department:	School board
Supporting Organization/Department:	County Commissioners, GHRPC, County EMD
Action/Project Priority:	High
Timeline for Completion:	5 years
Potential Fund Sources:	Capital projects budget, HMGP
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued
Report of Progress:	Awaiting funding

Action Worksheet	
Name of Jurisdiction:	Putnam County R-I
Risk / Vulnerability	
Hazard(s) Addressed:	Earthquakes, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado
Problem being Mitigated:	Loss of power threatening student safety and property during an extreme event.
Action or Project	
Applicable Goal Statement:	Goal 1: Eliminate loss of life, minimize injuries, and reduce property damage caused by tornadoes, severe thunderstorm high winds, hail and lightning. Goal 3: Minimize the impact to natural and human resources caused by drought, extreme temperatures and wildfire Goal 4: Maintain public services, protect life, and minimize the risk of property damage caused by severe winter weather Goal 5: Minimize injuries and property damage due to seismic and/or geological events.
Action/Project Number:	PCSD 2025.2
Name of Action or Project:	Generators
Mitigation Category:	Structure and Infrastructure
Action or Project Description:	Install backup generators or transfer switch to allow for the safe use of backup power ensuring public safety and property during power outages due to extreme events
Estimated Cost:	\$1,000,000
Benefits:	Critical facilities, such as schools, can continue to operate in the event of a disaster.
Plan for Implementation	
Responsible Organization/Department:	School board
Supporting Organization/Department:	
Action/Project Priority:	HIGH
Timeline for Completion:	1 to 5 years
Potential Fund Sources:	General Revenue, Capital projects, HMGP
Local Planning Mechanisms to be Used in Implementation, if any:	NA
Progress Report	
Action Status:	Continued/Modified
Report of Progress:	Awaiting funding

Table 4.4. Mitigation Action Matrix

#	Action	Jurisdiction	Priority	Goals Addressed	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
Structure and Infrastructure Projects								
County 2025.2	Maintain transportation infrastructure	Putnam Co.	Low	1,4,5	Flooding, Earthquakes, Severe thunderstorms, Severe winter weather, Tornado	x	x	
County 2025.3	Generators	Putnam Co.	High	1,3,4,5	Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado	x	x	
County 2025.4	Debris removal	Putnam Co.	Low	1,4,5	Flooding, Earthquakes, Severe thunderstorms, Severe winter weather, Tornado	x	x	
County 2025.5	Weather Sirens	Putnam Co.	High	1,2,3,4	Severe thunderstorms, Tornado	x	x	
VL 2025.2	Generators	Livonia	High	1,3,4,5	Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado	x	x	
VL 2025.3	Weather Sirens	Livonia	High	1,2,3,4	Severe thunderstorms, Tornado	x	x	
VL 2025.4	Storm shelters and safe rooms	Livonia	High	1,3,4,5	Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado,	x	X	
VLU 2025.2	Generators	Lucerne	High	1,3,4,5	Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado	x	x	

Note: Remove these footer instructional notes for final document.

4.33

Black Text – Instructional information for the mitigation planner

Blue Text – Sample language to assist the mitigation planner

Green Text – Reference Information for the Community Rating System

#	Action	Jurisdiction	Priority	Goals Addressed	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
VLU 2025.3	Weather Sirens	Lucerne	High	1,2,3,4	Severe thunderstorms, Tornado	x	x	
CU 2025.2	Generators	Unionville	High	1,3,4,5	Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado	x	x	
CU 2025.3	Maintain transportation infrastructure	Unionville	Low	1,4,5	Flooding, Earthquakes, Severe thunderstorms, Severe winter weather, Tornado	x	x	
CU 2025.4	Storm shelters and safe rooms	Unionville	High	1,3,4,5	Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado,	x	X	
CU 2025.5	Weather Sirens	Unionville	High	1,2,3,4	Severe thunderstorms, Tornado	x	x	
VW 2025.2	Generators	Worthington	High	1,3,4,5	Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado	x	x	
VW 2025.3	Weather Sirens	Worthington	High	1,2,3,4	Severe thunderstorms, Tornado	x	x	
VW 2025.4	Storm shelters and safe rooms	Worthington	High	1,3,4,5	Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado,	x	X	
VW 2025.5	Maintain transportation infrastructure	Worthington	Low	1,4,5	Flooding, Earthquakes, Severe thunderstorms, Severe winter weather, Tornado	x	x	

#	Action	Jurisdiction	Priority	Goals Addressed	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
PCSD 2025.1	Storm shelters and safe rooms	Putnam Co. R-I	High	1,3,4,5	Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado,	x	X	
PCSD 2025.2	Generators	Putnam Co R-I	High	1,3,4,5	Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado	x	x	
Natural Systems Protection								
County 2025.4	Debris removal	Putnam Co.	Low	1,4,5	Flooding, Earthquakes, Severe thunderstorms, Severe winter weather, Tornado	x	x	
CU 2025.6	Participation in the NFIP	Unionville	High	2	Flooding	x	x	x
Planning and Regulation								
CU 2025.6	Participation in the NFIP	Unionville	High	2	Flooding	x	x	x
Education and Outreach								
County 2025.2	Mitigation education	Putnam Co.	High	1,2,3,4,5	Flooding, Dam failure, Drought, Earthquakes, Levee Failure, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado, Wildfire	x	x	x
County 2025.6	N.O.A.A. Weather Radio	Putnam Co.	High	1,2,3,4,5	Flooding, Dam failure, Drought, Earthquakes, Levee Failure, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado, Wildfire	x	x	

#	Action	Jurisdiction	Priority	Goals Addressed	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
VL 2025.1	Mitigation education	Livonia	High	1,2,3,4,5	Flooding, Dam failure, Drought, Earthquakes, Levee Failure, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado, Wildfire	x	x	x
VLU 2025.1	Mitigation education	Lucerne	High	1,2,3,4,5	Flooding, Dam failure, Drought, Earthquakes, Levee Failure, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado, Wildfire	x	x	x
CU 2025.1	Mitigation education	Unionville	High	1,2,3,4,5	Flooding, Dam failure, Drought, Earthquakes, Levee Failure, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado, Wildfire	x	x	X
VW 2025.1	Mitigation education	Worthington	High	1,2,3,4,5	Flooding, Dam failure, Drought, Earthquakes, Levee Failure, Extreme Temperatures, Severe thunderstorms, Severe winter weather, Tornado, Wildfire	x	x	x

5 PLAN MAINTENANCE PROCESS

5 PLAN MAINTENANCE PROCESS	5.1
5.1 Monitoring, Evaluating, and Updating the Plan.....	5.1
5.1.1 Responsibility for Plan Maintenance	5.1
5.1.2 Plan Maintenance Schedule	5.2
5.1.3 Plan Maintenance Process.....	5.2
5.2 Incorporation into Existing Planning Mechanisms.....	5.3
5.3 Continued Public Involvement.....	5.5

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.

5.1 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.

5.1.1 Responsibility for Plan Maintenance

The State Emergency Management Agency (SEMA) requires that Hazard Mitigation Plans be reviewed periodically, at least annually, to ensure that goals and objectives are being considered. Revisions to the actions or strategies may be required, as well as acknowledging completed successful mitigations. This section of the Putnam County Multi-jurisdictional Hazard Mitigation Plan provides the process to review, revise, and update the plan.

The maintenance of the plan shall be delegated to the County Emergency Management Committee. They meet quarterly and following any disaster declarations, and will invite members of the MPC to attend these meetings to discuss the plan progress and determine if any updates or amendments need to be considered.

Maintenance shall 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 Commissioners and governing bodies of participating jurisdictions; and
- Inform and solicit input from the public.

The Putnam County Emergency Management Committee is an advisory body and can only make recommendations to county, city, town, or district elected officials. Its primary duty is to coordinate emergency departments within the county. It will attempt 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. 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.

5.1.2 Plan Maintenance Schedule

The MPC agrees to meet annually and after a state or federally declared hazard event as appropriate to monitor progress and update the mitigation strategy. The Putnam County Emergency Management Director will be responsible for initiating the plan reviews and will invite members of the MPC and other interested parties 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.

5.1.3 Plan Maintenance Process

There were no changes made in the plan due to changes in priorities of any jurisdiction that participated in the development of the plan. The plan **MUST** describe the process for evaluating the plan for effectiveness, including evaluation criteria, when it will be evaluated for effectiveness, and who will be responsible for this evaluation.

The plan must identify how, when and by whom the plan will be assessed for effectiveness at achieving its stated purpose and goals (evaluating). Progress on the proposed actions can be monitored by evaluating changes in vulnerabilities identified in the plan. The MPC (and the Putnam County Emergency Committee) 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.
- If new actions are identified to implement mitigation activities, the jurisdictional MPC member will take necessary actions to amend the plan. GHRPC staff currently handles such requests.

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 in cooperation with the Putnam County Emergency Committee deems appropriate and necessary. Changes will be approved by the Putnam County Commissioners and the governing boards of the other participating jurisdictions.

5.2 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. Based on the capability assessments of the participating jurisdictions, communities in Putnam 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;
- Putnam 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 (or designated responsible entity) 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 (or designated responsible entity) 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 Putnam County Emergency Management Director will provide the updated Mitigation Strategy with current status of each mitigation action to the County Commissioners as well as all Mayors, City Clerks, and School District Superintendents. The Emergency Management 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.

Table 5.1. Planning Mechanisms Identified for Integration of Hazard Mitigation Plan

Jurisdiction	Planning Mechanisms	Integration Process for Previous Plan	Integration Process for Current Plan
Putnam County	Transportation Advisory Committee (TAC)	Member of TAC attended all planning meetings and identified actions relating to transportation infrastructure were included in annual update to Unfunded Needs List and the State Transportation Improvement Plan, and the Regional Transportation Plan	Member of TAC attended all planning meetings and identified actions relating to transportation infrastructure were included in annual update to unfunded needs list, the State Transportation Improvement Plan, and the Regional Transportation Plan
	Putnam County Emergency Plan	The Commissioners attended all planning meetings and identified actions relating to infrastructure were included in annual update to Comprehensive Plan	The Commissioners and EMD attended all planning meetings. Identified new actions or ongoing actions relating to infrastructure will be included in annual update to Comprehensive Plan
	CEDS, LEPC, Council Budgeting Session	Annual review, county emergency plan review	Annual CEDS review, County Emergency Plan Review
	Local Budget, CEDS, Emergency Plan, City Ordinances	Annual review	Annual CEDS review, Emergency Plan Review, Regional Transportation Plan
	Local Budget, CEDS, Emergency Plan, City Ordinances, Floodplain Ordinance	Annual Review	Annual CEDS review, Emergency Plan Review, Regional Transportation Plan
	Local Budget, CEDS, Emergency Plan, City Ordinances	Annual Review	Annual CEDS review, Emergency Plan Review, Regional Transportation Plan
	Local Budget, CEDS, Emergency Plan, City Ordinances	Annual Review	Annual CEDS review, Emergency Plan Review, Regional Transportation Plan
	Local Budget, CEDS,	Annual Review	Annual CEDS review,

	Emergency Plan, City Ordinances		Emergency Plan Review, Regional Transportation Plan
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5.3 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 in the local newspaper, as well as on the Putnam County website following each annual review of the mitigation plan and will solicit comments from the public based on the annual review.

The Putnam County emergency management director and the MPC will be responsible for publicizing success stories if mitigation activities are completed by issuing press releases and publicizing information on the Putnam County and/or Jurisdiction's website.

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.