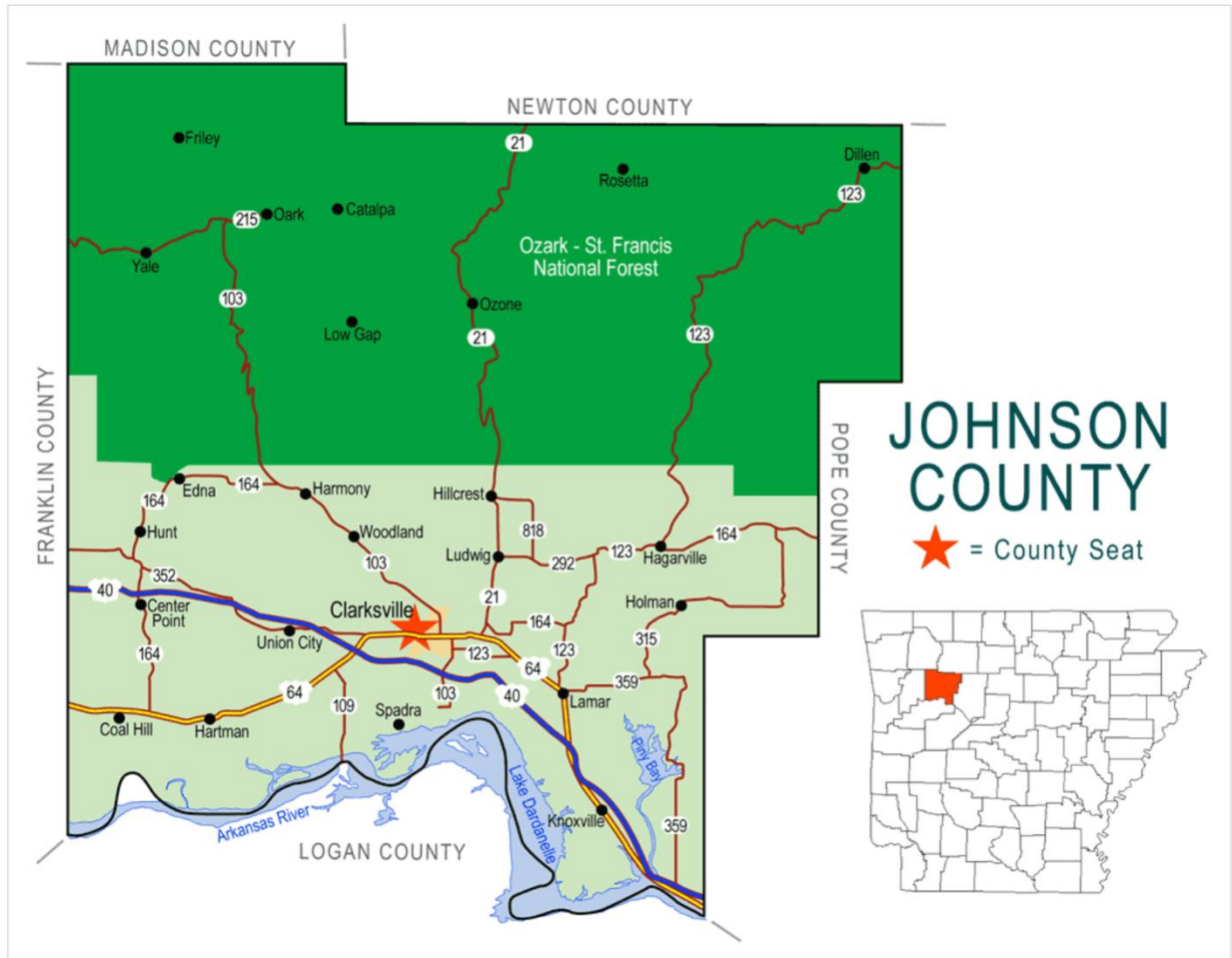


# 2024 Johnson County Hazard Mitigation Plan EMT-2021-BR-133-0011 Awarded September 6, 2022



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# SAMPLE ADOPTION RESOLUTION

## SAMPLE RESOLUTION

RESOLUTION NO. \_\_\_\_\_

A RESOLUTION OF (LOCAL GOVERNMENT) ADOPTING THE (TITLE AND DATE OF MITIGATION PLAN)

WHEREAS the (local governing body) recognizes the threat that natural hazards pose to people and property within its jurisdiction; and

WHEREAS the (local government) has prepared a multi-hazard mitigation plan, hereby known as (title and date of mitigation plan) in accordance with federal laws, including the [Robert T. Stafford Disaster Relief and Emergency Assistance Act](#), as amended; the [National Flood Insurance Act of 1968](#), as amended; and the [National Dam Safety Program Act](#), as amended; and

WHEREAS (title and date of mitigation plan) identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in its jurisdiction from the impacts of future hazards and disasters; and

WHEREAS adoption by the (local governing body) demonstrates its commitment to hazard mitigation and achieving the goals outlined in the (title and date of mitigation plan).

NOW THEREFORE, BE IT RESOLVED BY THE (LOCAL GOVERNMENT), (STATE), THAT:

In accordance with (local rule for adopting resolutions), the (local governing body) adopts the (title and date of mitigation plan). While content related to (local government) may require revisions to meet the plan approval requirements, changes occurring after adoption will not require (local government) to re-adopt any further iterations of the plan. Subsequent plan updates following the approval period for this plan will require separate adoption resolutions.

ADOPTED by a vote of (local governing body) this \_\_\_\_\_ day of \_\_,\_\_\_\_\_.

Mayor: \_\_\_\_\_

Clerk: \_\_\_\_\_

## **Section 1 Introduction**

### **1.1 General Description**

Hazards are part of the world around us. The occurrence of floods, hurricanes, tornadoes, winter storms, earthquakes, wildfires, and other hazardous events are inevitable. These hazards are natural phenomena we cannot control. These events damage the ecological environment. Despite their destructiveness, these occurrences are part of the natural system.

The natural environment is recuperative and can regenerate with resiliency. It is when manmade environments intersect with these natural phenomena that disasters result. Disasters occur when human activity, such as buildings, infrastructure, agriculture, and other land uses take place in the path of the forces of nature. The man-made environment is not as recuperative as the natural one. The consequences could mean damage and hardship for entire communities for years to come.

While we cannot prevent natural hazards, we can take some measures to reduce some of their adverse consequences. We have tools and techniques which, when put into effect in a timely fashion, allow us to avoid the worst-case scenario when a hazard does occur. By managing a community's capabilities and infrastructure before a hazardous event occurs, we can mitigate many of the negative impacts of a disaster. This reduces the magnitude of an event.

Hazard mitigation is the cornerstone of emergency management. It is defined as any sustained action to reduce or eliminate long-term risk to life and property from a hazard event. Mitigation encourages long-term reduction of hazard vulnerability. The goal of mitigation is to save lives and reduce property damage.

In the past, federal legislation has provided funding for disaster relief, recovery, and some hazard mitigation planning. The Disaster Mitigation Act of 2000 (DMA 2000) is the latest legislation to improve this planning process. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act by repealing the previous Mitigation Planning section (409) and replacing it with a new Mitigation Planning section (322). This new section emphasizes the need for State, Tribal, and local entities to closely coordinate mitigation planning and implementation efforts. The new legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur. As such, this Act establishes a pre-disaster hazard mitigation program (PDM) and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP). It also requires communities to have an approved hazard mitigation plan to receive Stafford Act assistance, excluding assistance provided pursuant to emergency provisions.

The goals of this Johnson County Hazard Mitigation plan are:

1. Reduce the potential for loss of life, injury and economic damage created by exposure to natural hazard for residents of the planning area due to natural disasters.
2. Provide a framework and coordination to encourage all levels of government, public/private organizations, and other participants to undertake mitigation to minimize potential disasters and to employ mitigation in the recovery following disasters.
3. Seek grants for mitigation projects through State and Federal funding.
4. Protect existing properties from natural disasters.

Whole community approach to mitigation has specific planning objectives to minimize damage due to disasters. These five specific objectives are:

1. Identify, describe, and characterize the natural hazards to which Johnson County is susceptible,
2. Assess the risk of each hazard including probability and frequency, exposure, and consequences,
3. Examine feasible mitigation opportunities appropriate for the identified hazards and prioritize those opportunities,
4. Implement mitigation actions to reduce loss of lives and property, and
5. Identify mitigation opportunities for long-range planning consideration.

The Johnson County Hazard Mitigation Plan has been developed to assess the ongoing natural hazard mitigation activities in Johnson County. It evaluates additional mitigation measures that should be undertaken and outlines a strategy for implementation of mitigation projects. This Hazard Mitigation Plan is multi-jurisdictional with a planning area that unincorporated Johnson County and the municipalities within the County including the Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, Oark-Jasper School District, Westside School District along with University of the Ozarks are included in the Planning Area.

Formal adoption and implementation of a hazard mitigation plan presents many benefits to Johnson County and its residents. By identifying problems and possible solutions in advance of a disaster, the Planning Area will be in a better position to obtain pre- and post-disaster funding.

Specifically, the Disaster Mitigation Act of 2000 establishes a pre-disaster hazard mitigation program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP). It requires states and communities to have a FEMA approved hazard mitigation plan in place prior to receiving post-disaster HMGP funds. Adoption of this hazard mitigation strategy will also increase Johnson County's eligibility for assistance from FEMA's Flood Mitigation Assistance (FMA) program. The Planning Area will also gain additional credit points under FEMA's Community Rating System (CRS) program. This program provides discounts on National Flood Insurance Program (NFIP) flood insurance premiums for residents of communities who voluntarily participate in this program. Most importantly, Johnson County will be able to recover faster and more wisely from a disaster. Through planning and acting on local mitigation strategies, Johnson County communities will reduce vulnerability to disasters and identify opportunities for mitigation. In addition, the communities may meet comprehensive planning requirements and achieve community goals.

This update includes information pertaining to disasters that have impacted the Planning Area since the last revision. This document helps in obtaining information to better mitigate hazards in areas within the county that are prone to certain disasters. This plan is an update of the 2018 FEMA approved Johnson County Hazard Mitigation Plan. The priorities of the 2024 Johnson County Hazard Mitigation Plan remain consistent with the 2018 FEMA approved Johnson County Hazard Mitigation Plan. The priorities of the county have not changed.

## **1.2 Parts of the Plan**

The Johnson County Hazard Mitigation Plan is divided into sections. These sections are created to address FEMA requirements that became effective April 19, 2023.

1. Element A: Planning Process
2. Element B: Hazard Identification and Risk Assessment
3. Element C: Mitigation Strategy
4. Element D: Plan Maintenance
5. Element E: Plan Update
6. Element F: Plan Adoption
7. Element G: High Hazard Potential Dams
8. Element H: Additional State Requirements/Supporting Documentation

This Hazard Mitigation Plan is multi-jurisdictional with a planning area that includes all unincorporated Johnson County and the municipalities within the County including the Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, Oark-Jasper School District, Westside School District along with University of the Ozarks are also included in the Planning Area.

All jurisdictions and school districts listed above actively participated in the planning process from its inception. Each jurisdiction provided a representative to participate on the planning team or if a representative was unable to attend, they chose to be represented by the Johnson County Office of Emergency Management. Planning team members actively participated in meetings, solicited input from members of their communities, and ensured that all jurisdiction information was reflected in the plan.

## **1.3 Involvement of Local Government**

Johnson County's mitigation update planning process was initiated September 6, 2022, when the County, through the efforts of the Johnson County Office of Emergency Management (OEM), was awarded a Hazard Mitigation Grant Program (HMGP) grant by FEMA through ADEM, under Johnson County Judge Herman Houston. Johnson County negotiated a subcontract with West Central Arkansas Planning and Development District to facilitate their mitigation planning efforts. West Central Arkansas Planning and Development District served as facilitator. Klay Rowbotham, Director of the Johnson County OEM, led the planning effort.

Once all participants in the Planning Area under the responsibility of the Johnson County OEM formally agreed to participate, an initial planning team comprised of representatives from the Planning Area was organized.

This initial team was instructed to solicit interested people from their communities to participate on the planning team. This solicitation led to the addition of several planning team members. The planning team members include representatives from County government, local governments, city governments, public works officials, emergency management officials, fire districts, school districts and nonprofits.

All participating jurisdictions actively participated in the planning process. This participation was performed by soliciting input from communities in the Planning Area and participation in meetings. Due to Covid-19 pandemic meetings were primarily by Zoom. If a city or school district could not attend a meeting, Johnson County OEM Klay Rowbotham represented them. Also, all minutes and materials were mailed/mailed out to the jurisdiction representatives that could not attend. Communication was followed up by phone and email by Klay Rowbotham, Johnson County OEM and Kristen Lancaster or Kristin Cawyer at West Central Arkansas Planning and Development District. Courtney Decker at West Central Arkansas Planning and Development District completed communications, finished the plan writing, and followed through with Public Review upload and revisions, ADEM, and FEMA.

The Planning Teams main discussion topics with WCAPDD were:

- Discussion on what mitigation is and how it benefits the Planning Area
- Risk for the Planning Area
- Past hazard occurrences
- Mitigation actions/plans
- Ongoing/future mitigation projects

Three planning events were scheduled throughout the planning process. A kick-off meeting was held December 7, 2022, at the Johnson County Courthouse to discuss and distribute the Natural Hazard Questionnaire.

In April 2023 there was a staff change at WCAPDD. Due to staff changes, and the amount of time that passed, it was important to conduct a public meeting where the community could attend. April 16, 2024, a planning meeting was held. Invites were sent out via email and phone calls. The meeting date, time, place, and reason were advertised in the newspaper, social media and on the West Central Arkansas Planning and Development District website. This meeting allowed us to:

- Define mitigation and establish its purpose for the Planning Area
- Organize a consistent Planning Team
- Assess capabilities.
- Engage the community.

April 30, 2024, a planning meeting was held. Invites were sent out via email and phone calls. The meeting date, time, place, and reason were advertised in the newspaper, social media and on the West Central Arkansas Planning and Development District website. This meeting was lengthy and allowed the Planning Team to:

- Assess the risks for the Planning Area using the results from the Natural Hazards Questionnaire and the National Risk Index
- Identify specific vulnerable populations.
- Discuss mitigation actions from the 2018 Hazard Mitigation Plan and identify what had been completed.
- Develop new mitigation actions.
- Develop new mitigation plans/future projects.



- Determine how the Planning Team will maintain the Hazard Mitigation Plan once it is adopted.

Technical assistance and training were provided to WCAPDD by the Arkansas Department of Emergency Management and FEMA. Both entities discussed the importance of incorporating whole community into the process. Guidelines for the mitigation plan were outlined in FEMA Local Mitigation Planning Policy Guide FP 206-21-0002.

A whole community approach to mitigation planning was encouraged. According to FEMA a whole community approach is one that attempts to engage the full capacity of residents, emergency management, government (local, tribal, state, territorial and federal), private and nonprofit sectors. This includes businesses, faith-based organizations, and disability organizations. A whole community approach to mitigation provides people of the planning area a more informed and shared understanding of the community's risk, needs and capabilities. This approach empowers the whole community and allows for resources to be effectively used. Using a whole community approach to mitigation planning paves a path to the planning areas stability and resilience.

For Johnson County to achieve a whole community approach, special consideration was taken to enable and target underserved communities by providing the Natural Hazard Risk Questionnaire in an online format for accessibility ease. Other vulnerable populations found the online Questionnaire difficult to navigate, so a paper copy of the Natural Hazard Risk Questionnaire was made available upon request.

## **1.4 Neighboring Community Involvement**

During the Mitigation Planning Process neighboring communities, State and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development were informed of planning meetings. They received a personal invite by the Johnson County OEM to attend these meetings. Representatives from Arkansas Department of Emergency Management (Layce Blake, Jennifer Oakley), attended in person. These mutual aid agreements were reviewed and discussed during the planning process.

## Section 2 Planning Process

### 2.1 Planning Process

The Planning Process consisted of the following items:

- Once the initial planning meeting was held, Planning Committees were formed. These committees were divided by county/city/municipality. Everyone was encouraged to participate in their committee and invite others to join often. Johnson County OEM oversaw organizing and overseeing these committees. Johnson County OEM was responsible for collecting data and documentation from committees and sharing them with West Central Arkansas Planning and Development District (WCAPDD).
- Johnson County Judge engaged West Central Arkansas Planning and Development District (WCAPDD), the regional planning organization, to provide staff support in conducting the planning process and preparing the plan.
- Meetings were held with committee members to understand and agree on the planning process. The steps required for the planning process include organizing resources, assessing hazards, developing a mitigation plan, implementing the plan, and monitoring progress.
- WCAPDD staff attended workshops presented by FEMA and ADEM on the preparation of the mitigation plan.
- WCAPDD staff had numerous subsequent discussions about the planning process with ADEM staff.
- The WCAPDD staff discussed planning process issues with others in the state that were involved in the preparation of other hazard mitigation plans such as neighboring Counties and other Planning and Development Districts.
- Natural Hazard Mitigation Questionnaires were distributed and a total of 2 were returned. The natural hazards that the public seemed most concerned about were wildfire, flood, dam failure, earthquake, and mudslide. A copy of the Natural Hazards Questionnaire and the results collected are in the Supporting Documents section of this plan. The Natural Hazards Questionnaire will be available year-round at the public library, County Website, and WCAPDD website. The questionnaire is a google form. The google form provides easy access to anyone with a cellphone or computer. The information will be collected/documentated in the next update.
- Mitigation actions were created using the data from the Natural Hazards Questionnaire by the planning team.

The Planning Committee utilized these technical documents:

- Arkansas Hazard Mitigation Plan was used as a guidance tool for past occurrences and risk assessments.
- WCAPDD Comprehensive Economic Development Strategy was used to review Disaster and Resiliency procedures from natural disasters that helped during the mitigation actions process.
- Esri with ArcGIS was utilized to create maps.
- National Inventory of Dams

- Google Earth was used when looking at dams as well as geological information of the area.
- NOAA Storm Events Database was used to research previous natural hazard events.

<b>Timeline of Events</b>		
<b>Date</b>	<b>Meeting Information</b>	<b>Attendees</b>
<b>December 7, 2022</b>	Johnson County HMGP Kick Off Meeting	<ul style="list-style-type: none"> <li>• <i>Johnson County Judge Chief Deputy Erin Rowbotham</i></li> <li>• <i>Kristen Lancaster, WCAPDD</i></li> <li>• <i>Klay Rowbotham, Johnson OEM</i></li> <li>• <i>Jeff Cole, Hartman Fire Chief</i></li> <li>• <i>Jeshua Reeder, Clarksville Fire Deputy Chief</i></li> <li>• <i>Coal Hill Mayor, Ronnie Garner</i></li> <li>• <i>Steven Wyatt, Asst. Superintendent Clarksville School District</i></li> <li>• <i>Roy Hall, Lamar Fire Chief</i></li> </ul>
<b>April 16, 2024</b>	Discuss and Distribute the Natural Hazard Questionnaire	<ul style="list-style-type: none"> <li>• <i>Klay Rowbotham, Johnson OEM</i></li> <li>• <i>Rickey Casey, Johnson County DEM</i></li> <li>• <i>Honorable Herman Houston</i></li> <li>• <i>Karen Nordin, Coal Hill Housing</i></li> <li>• <i>David Graves, RFD #3</i></li> <li>• <i>Steve Owens, JCSO/Mapping</i></li> <li>• <i>Kristin Cawyer, WCAPDD</i></li> <li>• <i>Courtney Decker, WCAPDD</i></li> <li>• <i>Jeff Mizo, CCU</i></li> <li>• <i>Jason Weaves, Clarksville Fire</i></li> </ul>

		<ul style="list-style-type: none"> <li>• Jonathan Smith, <i>Johnson Regional EMS</i></li> <li>• Robbin Roble, <i>Clarksville Housing Authority</i></li> <li>• Kurt Schrock, <i>Johnson Regional Medical Center</i></li> </ul>
<b>January 30, 2024</b>	Discuss mitigation actions and develop new Mitigation Strategy. Review details for plan maintenance.	<ul style="list-style-type: none"> <li>• Klay Rowbotham, <i>Johnson OEM</i></li> <li>• Courtney Decker, <i>WCAPDD</i></li> <li>• Kristin Cawyer, <i>WCAPDD</i></li> <li>• David Graves, <i>RFD #3</i></li> <li>• <i>Johnson County Judge</i> Herman Houston</li> <li>• Jeff Mizo, <i>CCU</i></li> <li>• Robbin Roble, <i>Clarksville Housing Authority</i></li> <li>• Jeff Ross, <i>Clarksville Police Department</i></li> <li>• Rickey Casey, <i>Johnson County DEM</i></li> <li>• Tommy Hobbs, <i>JRMC</i></li> <li>• Jonathan Smith, <i>JRMC EMS</i></li> <li>• Tracy Eichenberger, <i>Ozark Ridge Campground</i></li> <li>• Tom Hughes, <i>Johnson County Sherriff's Department</i></li> </ul>
<p><b>Those not in attendance for public meetings were represented by the Johnson County OEM Klay Rowbotham. Information from the meeting was followed up by email/phone conversation.</b></p>		

Follow up meetings were held throughout 2022 and into 2024 with the Planning Team to address questions regarding capabilities assessments, mitigation actions, and future mitigation plans to address concerns in the Planning Area.

**Prevention actions** were updated:

- Zoning codes limiting development in a floodplain, open space preservation, and development of parks and recreation areas in hazard prone areas.
- Land development regulations such as requiring large lot sizes to ensure a minimum amount of impervious surface area.
- Storm water management regulations requiring retention/detention basins and clearing of ditches.
- Capital improvements planning preventing extension of public infrastructure into hazard areas.

- Building or fire codes requiring certain types of roofing or sprinkler systems

**Property Protection actions** addressing individual buildings were addressed and updated such as:

- Acquisition
- Relocation
- Retrofitting
- Flood-proofing
- installing structures such as piles and retaining walls
- grouting rock joints and fissures

**Public Education and Awareness actions:**

- Provide hazard maps with specific hazard information.
- Develop websites making hazard information publicly available.
- Implement outreach programs providing hazard and mitigation information to the public.
- Asking business owners to provide mitigation information to employees.
- Mailouts about hazards
- Newspaper articles
- Designing education programs for school age children and adults

**Natural Resource Protection actions:**

- erosion and sediment control programs
- wetland protection programs
- expanding public open space
- environmental restoration, and freshwater/sediment diversion programs)

**Emergency Services Protection actions:**

- emergency services before, during and immediately after an occurrence such as protection of warning system capability
- protection or hardening of critical facilities (fire stations and hospitals)
- protection of infrastructure (roads needed for emergency response)

**Structural Projects actions** to control the hazard including:

- reservoirs
- levees
- floodwalls
- other stormwater diversions.

## 2.2 Public Review

After the completion of planning meetings, the draft plan was provided for the public viewing. Copies of the draft were placed in the public library and the Johnson County Courthouse. The draft can be found online on Johnson County social media page, WCAPDD social media page, and on the WCAPDD website. The goal was to reach as many community members as possible for public comment before submission to the Arkansas Department of Emergency Management.

## 2.3 Plan Developers

Points of Contact		
Judge Herman Houston Johnson County Courthouse 215 W Main St. Clarksville, AR 72830	Johnson County OEM Director-Klay Rowbotham 215 W Main St. Clarksville, AR 72830	City of Clarksville Mayoral Office David Rieder 205 Walnut St. Clarksville, AR 72830
City of Coal Hill Mayoral Office Ronnie Garner 101 US-64 Coal Hill, AR 72832	City of Hartman Mayoral Office Jackie Weathers 235 Main St. Hartman, AR 72840	City of Knoxville Mayoral Office John Tyson 153 Old Hwy 64 Knoxville, AR 72845
City of Lamar Mayoral Office Jerry Boen 437 W Main St. Lamar, AR 72846	Clarksville School District Superintendent David Hopkins 1701 Clark Rd. Clarksville, AR 72830	Lamar School District Superintendent Shane Gordon 301 Elberta St. Lamar, AR 72846
Westside School District Superintendent Brad Kent 122 Thompson St. Hartman, AR 72840	Oark Campus of Jasper School District Principal Jeremy Pitts 370 Hwy 215 Oark, AR 72852	University of the Ozarks PR Director Larry Ische 415 N. College Ave. Clarksville, AR 72830

The following individuals participated in the plan development for their jurisdictions.

Developers and Planning Activities	
Jurisdiction	Name of Participation and Activity
Unincorporated Areas of Johnson County & State Agencies	<p>County Judge Herman Houston – Represented Johnson County. Received hazard mitigation workbook, attended planning meetings, received questionnaires, and provided information on disasters. Participated in phone calls, emails, and other correspondence.</p> <p>Johnson County Office of Emergency Management Director: Klay Rowbotham, received hazard mitigation workbooks, attended planning meetings, and distributed hazard questionnaires, participated in collection of historical natural disasters information. Participated in phone calls, emails, and other correspondence with facilitator and school districts, cities, and fire departments.</p> <p>West Central Arkansas Planning and Development District: Kristin Lancaster, Kristin Cawyer and Courtney Decker planned the meetings, received hazard mitigation workbook, attended planning meetings, participated in open discussion, received natural hazard questionnaire and distributed capabilities assessments.</p>

	<p>Johnson County Mapping/GIS: Steve Owens received hazard mitigation workbook, attended planning meetings, participated in open discussion, received natural hazard questionnaire.</p> <p>Johnson County Sherriff's Department: Tom Hughes received hazard mitigation workbook, attended planning meetings, participated in open discussion, received natural hazard questionnaire.</p> <p>Ozark Ridge Campground: Tracy Eichenberger received hazard mitigation workbook, attended planning meetings, participated in open discussion, received natural hazard questionnaire.</p>
City of Clarksville	<p>Johnson Regional Medical Center: Kurt Schrock, Tommy Hobbs and EMS Jonathan Smith received hazard mitigation workbook, attended planning meetings, participated in open discussion, received natural hazard questionnaire.</p> <p>Clarksville Housing Authority: Robbin Roble received hazard mitigation workbook, attended planning meetings, participated in open discussion, received natural hazard questionnaire.</p> <p>Clarksville Fire Department: Deputy Chief Jeshua Reeder and Jason Weaves received hazard mitigation workbook and natural hazard questionnaire.</p> <p>Clarksville Police Department: Jeff Ross received hazard mitigation workbook, attended planning meetings, participated in open discussion, received natural hazard questionnaire.</p>
City of Coal Hill	<p>Mayor of Coal Hill: Ronnie Garner received hazard mitigation workbook, attended planning meetings, participated in open discussion, received natural hazard questionnaire.</p> <p>Coal Hill Housing Authority: Karen Nordin received hazard mitigation workbook, attended planning meetings, participated in open discussion, received natural hazard questionnaire.</p>
City of Hartman	<p>Hartman Fire Department: Chief Jeff Cole received hazard mitigation workbook, attended planning meetings, participated in open discussion, received natural hazard questionnaire.</p>
City of Knoxville	
City of Lamar	<p>Lamar Fire Department: Chief Roy Hall received hazard mitigation workbook, attended planning meetings, participated in open discussion, received natural hazard questionnaire.</p>
Clarksville School District	<p>Asst. Superintendent Clarksville School District: Steven Wyatt received hazard mitigation workbook, attended planning meetings,</p>

	participated in open discussion, received natural hazard questionnaire.
Lamar School District	Lamar Schools Superintendent: Shane Gordon received hazard mitigation workbook, received natural hazard questionnaire and completed capabilities assessment.
Westside School District	
Oark-Jasper School District	
University of the Ozarks	

## 2.4 Plan Maintenance

This plan is a blueprint for reducing risk and protecting the planning area’s investments. Below is the process for maintaining the plan reflecting change. The purpose is threefold:

1. To track progress on implementing the mitigation strategy.
2. To update the plan as new information becomes available.
3. To record when disasters occur.

The plan needs to be revisited at regular intervals to keep it relevant. FEMA regulations require this to be done every five years. It should also be done after major disaster events or if new conditions significantly change risk.

**Monitoring, Evaluating and Updating** the Johnson County Hazard Mitigation Plan is required by FEMA every five years. A review of the Johnson County Hazard Mitigation Plan is required yearly. The planning team developed a method to ensure monitoring, evaluation, and updating of the Johnson County Hazard Mitigation Plan occurs annually or as needed. The plan will be submitted to FEMA within five years for review. The County will form a Hazard Mitigation Plan Evaluation Sub-Committee of the existing Johnson County Local Emergency Planning Committee (LEPC). The LEPC consists of members from fire service, health officials, emergency management, law enforcement, community groups, transportation, hospital personnel, school administration, emergency medical personnel, elected officials, and owners/operators of covered facilities. The Director of the Johnson County Office of Emergency Management will be the initial Chair of the sub-committee or Planning Team Leader. The Planning Team Leader will contact the planning team committee, set up meeting dates quarterly, and ensure each community will maintain a representative on the team.

During the update period, representatives of the Planning Team will verify point of contact information is still correct. Also, as events occur within the jurisdictions covered by this plan, they will be recorded in the appropriate sections throughout. If the planning team feels a new hazard is faced by the County and its jurisdictions, then this hazard should be added and addressed in the plan. When Johnson County receives a new presidential declaration, this will be noted in the appropriate sections of the plan. Mitigation actions are completed, the appropriate section of the plan is updated. The responsible party for overseeing and assuring plan updates is



the Johnson County Office of Emergency Management. At this time, the maintenance procedures for the Mitigation Plan will be conducted at the quarterly LEPC meeting. Each community's representative will be responsible for monitoring and evaluating the progress of the mitigation strategies in the plan. The team members will monitor the plan by providing a mitigation planning update at each quarterly meeting. During the last LEPC meeting of each year, the sub-committee will meet to review and evaluate each goal and objective to determine their relevance to changing situations in Johnson County. Changes in State or Federal policy will be evaluated. The Sub-committee will also review and evaluate the risk assessment portion of the plan to determine if this information should be updated or modified. The parties or agencies responsible for the various implementation actions will report on the status of their projects and will evaluate which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which strategies should be revised.

The Johnson County Office of Emergency Management will update the plan within three months before submitting it to the Sub-Committee members and the State Hazard Mitigation Officer, undergoing 12 to 18 months of update review. If no changes are necessary, the State Hazard Mitigation Officer will be given a justification for this determination. Comments and recommendations offered by Sub-Committee members and the State Hazard Mitigation Officer will be incorporated into the plan update. In addition, the Johnson County Hazard Mitigation Plan will be integrated into other plans. Integrating hazard mitigation into the local comprehensive plan establishes resilience as an overarching value of the community and provides opportunity to continuously manage development in a way that does not increase hazard vulnerability.

**Land Use and Development Plans** will guide future growth and development away from areas with known hazards. Plans will ensure design standards for new or improved construction taking potential hazards into account. Land use policies can build community resilience by taking information on location, frequency, and severity of hazards into consideration and setting forth recommendations that influence development in a way that does not increase risk to life and property.

**Transportation Plans** can build community resilience by adopting policies directing growth away from known hazard areas. Transportation systems and other critical infrastructure are designed to withstand the effect of known hazards, so they still function in the event of an emergency or disaster.

**Housing Plans** help strengthen community resilience by ensuring new or improved housing complies with existing building codes. They are a tool for identifying when building code improvements are needed. Opportunities to strengthen or replace structures identified as vulnerable to hazards can be promoted using existing maintenance or rehabilitation programs, or policies regarding non-conforming, substantially damaged, or improved properties.

**Economic Development Plans** can promote commercial or industrial expansion in areas that are not vulnerable to damage or disruption from hazards. They make community resilience a key feature in attracting, expanding, and retaining businesses and industry. Public Facilities and Infrastructure Plans can be adopted to ensure critical facilities (police and fire stations) and key

infrastructure (water and wastewater treatment plants) are protected from the effects of hazards. They provide established goals and policies for mitigation projects such as storm water drainage improvements or the public acquisition of hazard areas for open space.

**Natural Resource Protection Plans** have policies designed to preserve or enhance environmental areas of concern, such as wetlands, riparian corridors, and floodplains. They often include the added benefit of avoiding or minimizing development in hazard areas. These types of policies build community resilience by protecting lives and property and maintaining natural and beneficial functions of system acting as buffers against hazardous events.

**Historic Properties and Cultural Resources Plans** are designed to protect and preserve historic and cultural sites, buildings, and other resources. They can be linked with mitigation strategies to prevent damage and losses from hazardous events.

The Hazard Mitigation Plan will account for any changes in these plans and incorporate the information accordingly in its next update.

The Planning Committee will make every attempt to ensure the public will be able to directly comment on and provide feedback about the Plan. This will be done by posting the agenda and submitting meeting notice to the local media through newspaper articles, county websites and postings in public locations. This process will inform the citizens of the planning area on any changes or revisions of the Johnson County Hazard Mitigation Plan.

Since future plans and government regulations may need to be adopted into the Hazard Mitigation Plan, Johnson County Quorum Court will be informed of any necessary changes to the plan by the Team Leader, to be adopted into the Plan by county resolution. The Arkansas Department of Emergency Management will be contacted as necessary for professional and technical advice as needed.

## **2.5 Continuous Public Involvement**

Johnson County is dedicated to involving the public directly in the continual reshaping and updating of the Johnson County Hazard Mitigation Plan. The Hazard Mitigation Plan Evaluation Sub-Committee members are responsible for the annual monitoring, evaluation, and update of the plan. Although they represent the public to some extent, the public will be able to directly comment on and provide feedback about the plan.

Copies of the FEMA approved Johnson County Hazard Mitigation Plan will be available at [www.wcapdd.org](http://www.wcapdd.org). Contained in the plan are the address, phone number, and e-mail of the Director of the Johnson County Office of Emergency Management, the primary point of contact for the plan.

A public announcement inviting all interested parties will be made prior to each quarterly LEPC meeting, including the December LEPC meeting during which the Hazard Mitigation Planning Sub-Committee reviews and evaluates the plan in its entirety. This meeting will provide the public a forum for which the public can express concerns, opinions, or ideas about the plan. The Johnson County Office of Emergency Management and the Johnson County LEPC will publicize

and host this meeting. Following the meeting, the evaluation committee will review the comments and make changes to the plan, as appropriate.

## **2.6 Incorporation into Existing Planning Mechanisms**

Johnson County and all plan participants currently use state laws pertaining to compliance with the National Flood Insurance Program and state fire codes, to keep compliance with its hazard mitigation programs. These existing mechanisms have hazard mitigation strategies integrated into them. Johnson County has a current Emergency Operations Plan. The Hazard Mitigation Plan will become an annex of the EOP for future submissions.

The Johnson County Hazard Mitigation Plan will be available for public view on the West Central Arkansas Planning and Development District's website [www.wcapdd.org](http://www.wcapdd.org) and the Counties website for any entity or citizen who wishes to view or make a copy of it. Copies will also be made available at public libraries, the Johnson County Courthouse and the municipalities within the County including the Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, Oark-Jasper School District, Westside School District along with University of the Ozarks.

Any participant without previous plans in place will be encouraged to develop zoning plans and other land ordinances to incorporate mitigation strategies. Participants will incorporate the Johnson County Hazard Mitigation Plan as it pertains to them. After these discussions, each incorporating mechanism will follow their local laws or guidelines necessary for implementation through open forum public meetings. Each incorporating party will monitor the progress of any incorporated mitigation strategy and report the success or failure to the Emergency Operations Council for inclusion in its annual report. After each update of the Johnson County Hazard Mitigation Plan, each incorporating participant will be informed of the changes so they can reflect these changes in their plans also.

All participating jurisdictions will use the risk assessment that was conducted in this mitigation plan for creating strategies when dealing with hazards. The data and maps will be used as supporting documentation to encourage participating jurisdictions to address hazards affecting the planning area and organizations. This supporting data may be used in grant applications. Johnson County will incorporate the Johnson County Hazard Mitigation Plan into the Johnson County Continuity of Operations Plan and in county land use ordinances and/or plans by following the laws set forth by the county government.

Incorporating the plan into other plans will be done by vote at the regular quorum court meetings and passed by resolution.

All participating schools will incorporate the Johnson County Hazard Mitigation Plan into their Continuity of Operations Plan by following the rules set forth by each school board.

Incorporating the plan into continuity of operation plans will be done at regular school board meetings.

The previous plan was incorporated into the listed planning mechanisms to request grant funding for: **NEEDING POTENTIAL PROJECT IDEAS TO GO HERE!**

No additional incorporation of the Johnson County Hazard Mitigation Plan could be documented at this time.

## Section 3 Planning Area and Resources

### 3.1 General Geography

35.6026° N, 93.5003° W



Nestled in the picturesque heart of the Ozark Mountains, Johnson County, Arkansas, is a land of enchanting beauty and rugged charm. This slice of the Natural State boasts a diverse landscape, where rolling hills, verdant forests, and sparkling streams create a tapestry of natural wonders.

At the center of Johnson County lies the Arkansas River Valley, a fertile plain flanked by towering bluffs that rise majestically on either side. Here, the Arkansas River winds its way through the landscape, carving a path through ancient rock formations and providing a lifeline for the communities that call this region home.

To the north, the landscape transitions into the rugged terrain of the Ozark Mountains, where dense forests carpet the hillsides and hidden valleys harbor secrets known only to the wildlife that inhabit them. This rugged wilderness offers endless opportunities for outdoor adventure, from hiking and camping to fishing and hunting.

In the southern part of the county, the landscape becomes gentler, giving way to rolling farmland and pastureland. Here, quaint towns and hamlets dot the countryside, their historic buildings and charming main streets offering a glimpse into the region's rich past.

Throughout Johnson County, nature reigns supreme, with sprawling state parks and wildlife management areas providing havens for outdoor enthusiasts and nature lovers alike. Whether exploring the towering bluffs of Mount Magazine State Park, casting a line into the clear waters of Lake Dardanelle, or simply taking a leisurely drive along the scenic byways that crisscross the county, there's no shortage of natural beauty to behold.

But beyond its stunning landscapes, Johnson County is also home to a vibrant community of people who take pride in their heritage and way of life. From the hardworking farmers and ranchers who tend the land to the artists and artisans who draw inspiration from its beauty, the spirit of Johnson County is as resilient and enduring as the landscape itself.

In Johnson County, Arkansas, the past and present converge in a harmonious blend of natural beauty, cultural heritage, and small-town charm, making it a place like no other. Whether you're exploring its rugged wilderness, savoring its down-home cooking, or simply taking in the breathtaking scenery, one thing is certain: Johnson County will capture your heart and leave you longing to return again and again.

### **3.2 General Land Use/Analyzing Development Trends**

From 2010 to 2022, Johnson County experienced a population increase of 0.8%. The 2010 Census reported a population of 25,749. This increase is projected to continue in 2024. In 2020 census there were approximately 11,475 housing units in Johnson County.

The planning area has not seen a substantial increase or decrease in population, land use and development that would impact the community's infrastructure, people, and economy. However, this information will continue to be documented by the planning team over the next five years.

### 3.3 NFIP Participation

The National Flood Insurance Program (NFIP) enables property owners to purchase flood insurance. To qualify, communities must agree to adopt and implement local floodplain management regulations. These regulations are intended to protect lives and reduce the risk of new construction or substantial improvements from flooding.

#### Johnson County ID# 050441B



[Johnson County - Google Maps](#)

Johnson County is a member of the National Flood Insurance Program. Their community Identification number is 050441B. Their initial Flood Hazard Boundary Map (FHBM) was identified 08/02/1977, their current effective map date 05/16/2019 and Reg-Emergency Date 08/01/2008.

Johnson County participates in the NFIP by assisting residents with filling out documents for the NFIP and educating citizens about the NFIP program. Building permits are not issued by Johnson County. In Johnson County the city of Clarksville is the only city to issue building permits. However, Johnson County does have a Certified Floodplain Manager (CFM) who oversees the Counties floodplain management. The CFM monitors land use. This includes new construction, substantial alterations to a structure, and changes in the use of a structure or land. If floodplain resources are needed that the County cannot provide, the Counties CFM requests assistance from Arkansas Natural Resource Conservation Service and FEMA. The ANRC provides technical assistance to the community assuring that the community is adequately enforcing its floodplain management regulations.

The county plans to continue participating in the NFIP through continuing floodplain education and continually evaluating structures:

- In need of improvements
- Substantially damaged.
- Located within the floodplain.

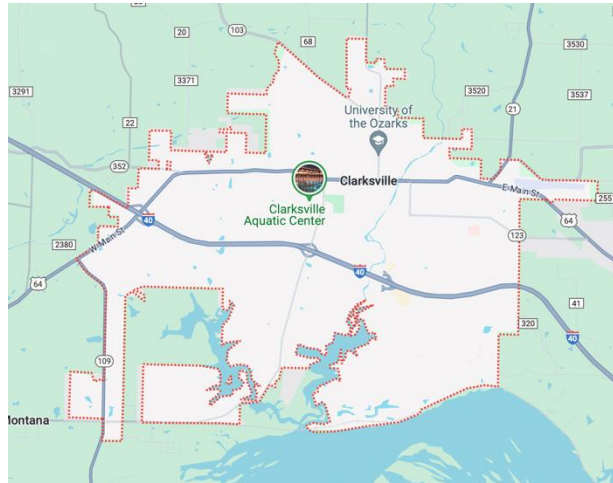
The County will work with owners who have structures that are substantially damaged or need improvements/repairs. The County will work with the owner to bring the structure into

compliance with State and Federal NFIP compliance codes by providing the owner with the necessary codes and monitoring to ensure compliance.

Johnson County does not have a Community Rating System (CRS) Classification. Johnson County currently lacks the necessary resources to take part in the CRS.



## Clarksville ID# 050112B



[Clarksville - Google Maps](#)

The City of Clarksville is a member of the National Flood Insurance Program, Community Identification Number 050112B. Their initial Flood Hazard Boundary Map was identified 11/30/1973, the Initial Flood Insurance Rate Map identified 09/30/1982, current effective map date 05/16/2019, and Reg-Emergency Date 09/30/1982.

The City of Clarksville participates in the NFIP by assisting the residents with filling out documents for the NFIP and educating citizens about the NFIP program.

The Mayor of Clarksville is the designated Floodplain Manager. The Floodplain Manager oversees the city's floodplain management program. The Floodplain Manager monitors land use within the city. This includes new construction, substantial alterations to a structure, and changes in the use of a structure or land. If floodplain resources are needed that the city of Clarksville cannot provide, the Floodplain Manager requests assistance from County. If the County cannot provide the needed assistance they will rely on State/Federal guidelines and resources such as Arkansas Natural Resource Conservation Service (AMRC) and FEMA. ANRC provides technical assistance to the community assuring that the community is adequately enforcing its floodplain management regulations. The city plans to continue to participate through continuing floodplain education and staying in compliance with NFIP.

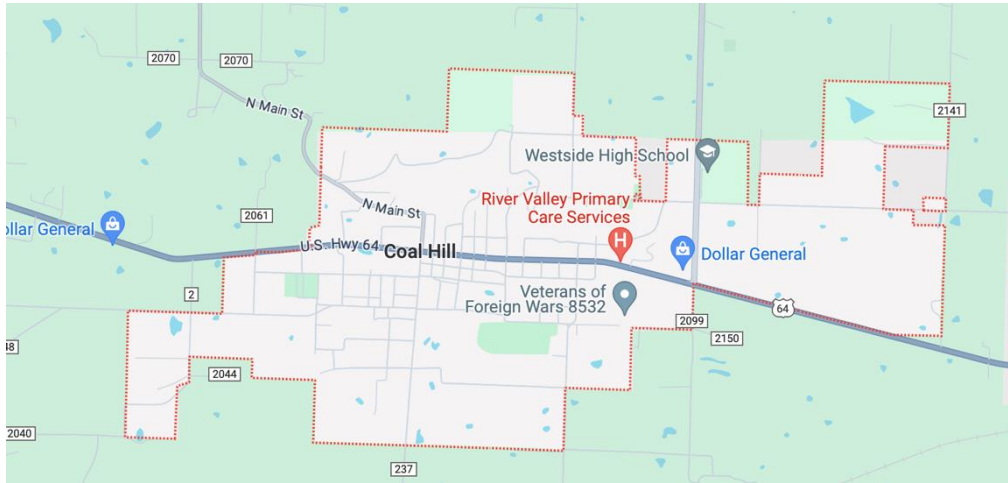
The City of Clarksville and Johnson County continues to evaluate structures that are:

- In need of improvements
- Substantially damaged.
- Located within the floodplain.

The city will work with owners who have structures that are substantially damaged or need improvements/repairs. The city will work with the owner to bring the structure into compliance with State and Federal NFIP compliance codes by providing the owner with the necessary codes and monitoring to ensure compliance.

The city of Clarksville does not have a Community Rating System (CRS) Classification. Currently, the city lacks the necessary resources to take part in the CRS.

## Coal Hill ID# 050315B



[Coal Hill - Google Maps](#)

The City of Coal Hill is a member of the National Flood Insurance Program, Community Identification Number 050315B. Their initial Flood Hazard Boundary Map was identified 01/10/1975, the Initial Flood Insurance Rate Map identified 05/04/1982, current effective map date 05/16/2019, and Reg-Emergency Date 05/04/1982.

The City of Coal Hill participates in the NFIP by assisting the residents with filling out documents for the NFIP, issuing permits, and educating citizens about the NFIP program.

The City of Coal Hill has a Certified Floodplain Manager. The Floodplain Manager oversees the city's floodplain management program. The Floodplain Manager monitors land use within the city. This includes new construction, substantial alterations to a structure, and changes in the use of a structure or land. If floodplain resources are needed that the city of Coal Hill cannot provide, the Floodplain Manager requests assistance from the County. If the County cannot provide the needed assistance they will rely on State/Federal guidelines and resources such as Arkansas Natural Resource Conservation Service (AMRC) and FEMA. ANRC provides technical assistance to the community assuring that the community is adequately enforcing its floodplain management regulations.

The city plans to continue to participate through continuing floodplain education, overseeing, issuing permits and staying in compliance with NFIP.

The City of Coal Hill and Johnson County continues to evaluate structures that are:

- In need of improvements
- Substantially damaged.
- Located within the floodplain.

The County will work with owners who have structures that are substantially damaged or need improvements/repairs. The County will work with the owner to bring the structure into compliance with State and Federal NFIP compliance codes by providing the owner with the necessary codes, permits and monitoring to ensure compliance.

The city of Coal Hill does not have a Community Rating System (CRS) Classification. Currently, the city lacks the necessary resources to take part in the CRS.

## Hartman ID# 050251B



[Hartman - Google Maps](#)

The City of Hartman is a member of the National Flood Insurance Program, Community Identification Number 050251B. Their initial Flood Hazard Boundary Map was identified 10/29/1976, the Initial Flood Insurance Rate Map identified 11/26/2010, current effective map date 05/16/2019, and Reg-Emergency Date 11/26/2010.

The City of Hartman participates in the NFIP by assisting the residents with filling out documents for the NFIP, issuing permits, and educating citizens about the NFIP program.

The City of Hartman has a Certified Floodplain Manager. The Floodplain Manager oversees the city's floodplain management program. The Floodplain Manager monitors land use within the city. This includes new construction, substantial alterations to a structure, and changes in the use of a structure or land. If floodplain resources are needed that the city of Hartman cannot provide, the Floodplain Manager requests assistance from County. If the County cannot provide the needed assistance they will rely on State/Federal guidelines and resources such as Arkansas Natural Resource Conservation Service (AMRC) and FEMA. ANRC provides technical assistance to the community assuring that the community is adequately enforcing its floodplain management regulations.

The city plans to continue to participate through continuing floodplain education, overseeing, issuing permits and staying in compliance with NFIP.

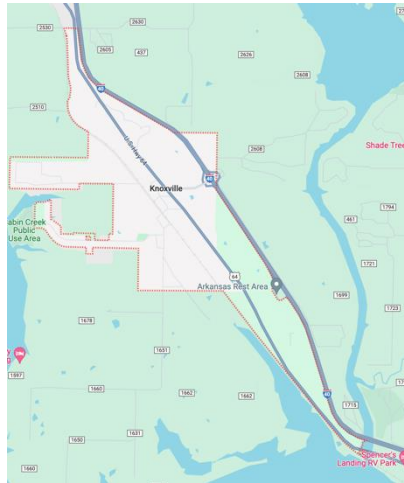
The City of Hartman and Johnson County continues to evaluate structures that are:

- In need of improvements
- Substantially damaged
- Located within the floodplain

The County will work with owners who have structures that are substantially damaged or need improvements/repairs. The County will work with the owner to bring the structure into compliance with State and Federal NFIP compliance codes by providing the owner with the necessary codes, permits and monitoring to ensure compliance.

The City of Hartman does not have a Community Rating System (CRS) Classification. Currently the city lacks the necessary resources to take part in the CRS.

## Knoxville ID# 050260



[Knoxville - Google Maps](#)

The City of Knoxville is a member of the National Flood Insurance Program, Community Identification Number 050260. Their initial Flood Hazard Boundary Map was identified 02/21/1975, the Initial Flood Insurance Rate Map identified 08/01/2008, current effective map date 11/26/2010, and Reg-Emergency Date 08/01/2008.

The City of Knoxville participates in the NFIP by assisting the residents with filling out documents for the NFIP, issuing permits, and educating citizens about the NFIP program.

The City of Knoxville has a Certified Floodplain Manager. The Floodplain Manager oversees the city's floodplain management program. The Floodplain Manager monitors land use within the city. This includes new construction, substantial alterations to a structure, and changes in the use of a structure or land. If floodplain resources are needed that the city of Knoxville cannot provide, the Floodplain Manager requests assistance from County. If the County cannot provide the needed assistance they will rely on State/Federal guidelines and resources such as Arkansas Natural Resource Conservation Service (AMRC) and FEMA. ANRC provides technical assistance to the community assuring that the community is adequately enforcing its floodplain management regulations.

The city plans to continue to participate through continuing floodplain education, overseeing, issuing permits and staying in compliance with NFIP.

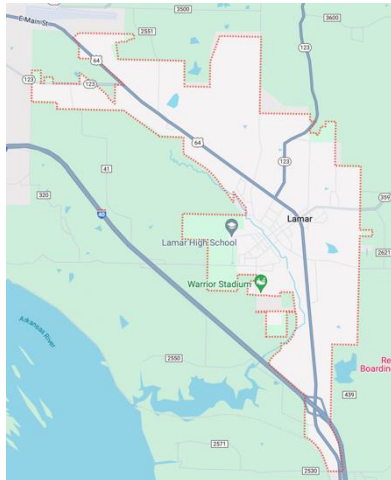
The City of Knoxville and Johnson County continues to evaluate structures that are:

- In need of improvements
- Substantially damaged
- Located within the floodplain

The County will work with owners who have structures that are substantially damaged or need improvements/repairs. The County will work with the owner to bring the structure into compliance with State and Federal NFIP compliance codes by providing the owner with the necessary codes, permits and monitoring to ensure compliance.

The City of Knoxville does not have a Community Rating System (CRS) Classification. At this time the city lacks the necessary resources to take part in the CRS.

### **Lamar ID# 050113**



[Lamar - Google Maps](#)

The City of Lamar is a member of the National Flood Insurance Program, Community Identification Number 050113. Their initial Flood Hazard Boundary Map was identified 04/05/1974, the Initial Flood Insurance Rate Map identified 07/01/1987, current effective map date 11/26/2010, and Reg-Emergency Date 07/01/1987.

The City of Lamar participates in the NFIP by assisting the residents with filling out documents for the NFIP, issuing permits, and educating citizens about the NFIP program.

The City of Lamar has a Certified Floodplain Manager. The Floodplain Manager oversees the city's floodplain management program. The Floodplain Manager monitors land use within the city. This includes new construction, substantial alterations to a structure, and changes in the use of a structure or land. If floodplain resources are needed that the city of Lamar cannot provide, the Floodplain Manager requests assistance from County. If the County cannot provide the needed assistance they will rely on State/Federal guidelines and resources such as Arkansas Natural Resource Conservation Service (ANRCS) and FEMA. ANRCS provides technical assistance to the community assuring that the community is adequately enforcing its floodplain management regulations.

The city plans to continue to participate through continuing floodplain education, overseeing, issuing permits and staying in compliance with NFIP.

The City of Lamar and Johnson County continues to evaluate structures that are:

- In need of improvements
- Substantially damaged.
- Located within the floodplain.



The County will work with owners who have structures that are substantially damaged or need improvements/repairs. The County will work with the owner to bring the structure into compliance with State and Federal NFIP compliance codes by providing the owner with the necessary codes, permits and monitoring to ensure compliance.

The City of Lamar does not have a Community Rating System (CRS) Classification. At this time the city lacks the necessary resources to take part in the CRS.

### 3.4 Capabilities Assessment

Jurisdiction	Planning and Regulatory Capabilities													
	Comprehensive Master Plan	Capital Improvements	Economic Development	Local Emergency Operations Plan	Continuity of Operations Plan	Transportation Plan	Stormwater Management	Community Wildfire	Zoning Ordinance	Subdivision Ordinance	Floodplain Ordinance	Building Codes	Acquisition of land for Open Space	BCEGS Score
Johnson County			X	X	X						X			
Clarksville	X		X	X	X	X			X	X	X	X	X	
Coal Hill				X										
Hartman				X				X						
Knoxville				X										
Lamar		X							X		X	X		
Clarksville School District	X	X		X	X	X								
Lamar School District	X			X	X	X								
Oark-Jasper School District														
Westside School District														
University of the Ozarks														

Jurisdiction	Administrative and Technical Capabilities									
	Johnson County Local Emergency Planning Committee	Planning Commission	Mutual Aid Agreements	Maintenance Programs to Reduce Risk	Floodplain Administrator	Emergency Manager	Community Planner/Grant Writer	GIS/HAZUS	Warning Systems	Civil Engineer
Johnson County	X		X	X	X	X		X	X	X
Clarksville	X	X	X	X	X	X	X	X	X	X
Coal Hill	X				X					X
Hartman	X			X	X				X	X
Knoxville	X				X				X	X
Lamar		X	X		X		X		X	X
Clarksville School District			X	X		X			X	X
Lamar School District	X	X								
Oark-Jasper School District										
Westside School District										
University of the Ozarks										

Jurisdiction	Financial Capabilities						
	Fees for water, sewer, gas, or electric services	Capital Improvements project funding	Community Development Block Grant	Federal Funding Programs	State Funding Programs	Impact fees for New Development	Authority to levy taxes for specific purposes
Johnson County	X		X	X	X	X	X
Clarksville	X		X	X	X	X	X
Coal Hill							
Hartman	X			X	X	X	X
Knoxville							
Lamar							
Clarksville School District		X		X		X	
Lamar School District							
Oark-Jasper School District							
Westside School District							
University of the Ozarks							

Jurisdiction	Education and Outreach Capabilities			
	Non-Profit Organizations for Environment Protects, Emergency Preparedness, or Access to Asset Functional needs populations	Ongoing Public Education Program or Information Program	Natural Disaster or Safety-related School Programs	Firewise Community Certification
	Public/Private partnership initiatives addressing disaster related issues			Storm-Ready Certification
Johnson County	X	X	X	X
Clarksville	X	X	X	X
Coal Hill	X			
Hartman	X	X		
Knoxville	X			
Lamar			X	
Clarksville School District	X	X	X	
Lamar School District		X	X	X
Oark-Jasper School District				
Westside School District				
University of the Ozarks				

### **3.5 Improving Capabilities**

Leadership and representatives in all participating jurisdictions are very receptive to mitigation. The Johnson County Judge, Johnson County OEM, and leadership make mitigation a top priority. Representatives are actively seeking additional funding to improve the readiness and preparedness of their communities. Ways the communities are improving capabilities are:

- Expand upon education and outreach about mitigation activities with an emphasis on underserved populations.
- Work with schools and local jurisdictions to construct saferooms.
- Exploring funding options for flood mitigation.
- Improving roadways and bridges against flooding
- Constructing a County/Community Wildfire Plan

## **Section 4 Hazard Identification and Risk Assessment**

### **4.1 Risk Assessment Overview**

This chapter focuses on how the hazards identified in the Planning Area directly and uniquely impact people, the economy, the built environment, and the natural environment.

The risk assessment helps communicate vulnerabilities, develop priorities, and inform decision-making for the hazard mitigation plan and for other emergency management efforts. This plan was completed with hours of input from stakeholders and community members in the Planning Area. The 2024 risk assessment provides the factual basis for developing a mitigation strategy for the Planning Area.

This assessment integrates an assets-based approach with an analysis of individual hazards to provide a deeper understanding of specific hazards and their impact on the Planning Area. An assets-based approach aligns with the most current FEMA guidance, allows communities to identify assets that are critical to their stability and that are most exposed to hazards. For hazard mitigation planning, this approach allows communities to drive mitigation actions more effectively. Beyond the scope of this mitigation plan, results from the risk assessment should be integrated into future emergency management planning, recovery planning, and development efforts.

### **4.2 Structure of the Risk Assessment**

This introductory section includes a brief discussion of previous FEMA disaster declarations, an overview of the hazard assessment process, and a summary risk profile for the Planning Area. The risk profile is driven by an assessment of the hazard's overall significance, combined with a hazard's probability and extent, along with community vulnerabilities to the hazard. The individual risk assessment for each hazard aligns with the same format. They outline a hazard's overall significance from a determination of its specific probabilities, risks, and communities' specific vulnerabilities to them.

### **4.3 Developing the 2024 Risk Assessment**

The 2024 risk assessment updates the risk assessment found in the 2018 Johnson County Hazard Mitigation Plan. The update process included reviews of the 2018 Plan, previous events, and the specific vulnerabilities of the planning communities. Outreach to subject-matter experts, stakeholders, the public and information from the National Risk Index ensured the appropriate elements of each hazard were included and that the best-available data was used for the risk assessment.

### **4.4 Hazard Risk Profile Overview**

The hazard risk profile summarized each hazard's probability, location, extent, vulnerability, and overall significance. FEMA's Local Mitigation Planning Handbook Worksheet 5.1 provided the basis for these classifications, but they were adjusted to better meet the needs of the Planning Area. An overview of these four classifications is provided below.

## 4.5 Vulnerability and Risk Assessment by Hazard

Vulnerability examines what assets are susceptible to damage from each hazard. Vulnerability is a qualitative estimate based on the Planning Teams desktop research and local expertise from the officials and stakeholders in the Planning Area.

The Planning Team did not use a quantitative metric to describe the vulnerability for each hazard since the vulnerability was not uniform across the Planning Area for all hazards. Instead, the Planning Team used a narrative to describe vulnerability.

The Johnson County Hazard Mitigation Plan includes a description or profile, location, and extent of all-natural hazards affecting each jurisdiction. (44 CFR 201.6(c)(2)(i) and 44 CFR 201.6(c)(2)(iii).

**Description:** the natural hazard affecting the jurisdictions in the planning area.

**Location:** (Geographic Area Affected) the geographic areas in the planning area affected by the hazard, and when possible, maps to illustrate the location. But for some hazards, such as tornados, the plan states the entire planning area is equally at risk to that hazard.

**Extent:** (Magnitude/Strength based on historic events or future probability)

**Previous Occurrences:** hazard events for each jurisdiction (44 CFR 201.6 (c)(2)(i) that have been addressed.

**Probability of Future Events:** means the likelihood of the hazard occurring in the future and may be defined in terms of general descriptors, historical frequencies, and statistical probabilities. Statistical probabilities often refer to events of a specific size or strength. Hazard likelihood can also be compared using general descriptions or rankings. For the purpose of this plan, we will use the general descriptors to describe the likelihood of hazard events based on historical frequency.

The equation used to estimate probability of future events:

$$\frac{\# \text{ of events}}{\# \text{ of days}} \times 100 = \underline{\hspace{2cm}}$$

**Impact:** the consequence or effect of the hazard on the community and its assets. Impacts will be described by referencing historical disaster impacts and/or an estimate of potential future losses, such as percent damage of total exposure.

**Vulnerability of Estimating Potential Loss:** identifies structures, systems, populations, or other community assets as defined by the community susceptible to damage and loss from hazard events. It is a list of key issues or problem statements that clearly describe the community's greatest vulnerabilities and will be addressed in the mitigation strategy.

**Repetitive Loss Properties and Severe Repetitive Loss Properties:** addresses NFIP insured structures describing the types (residential, commercial, institutional, etc.) and estimates the number of repetitive loss properties located in the identified flood hazard areas. (44 CFR 201.6(c)(2)(ii))

**Methodology used in Estimating Potential Loss**

The methodology used in this plan for the potential loss estimate was developed by using past hazard events data from The National Climatic Data Center (NCDC) Storm Events Database. If we were unable to obtain information of a certain type of past hazard event, we did not estimate a potential loss due to the lack of information.

**Natural Hazards Affecting the Planning Area**

This mitigation plan addresses the natural hazards affecting the planning area. The hazards of concern are dam failure, drought, earthquake, extreme heat, flooding, landslides, thunderstorms, tornadoes, wildfire, and winter storms. Expansive soils are not addressed in this plan since they are not an issue/threat to the planning area.

**4.6 Disaster Declaration History**

The Planning Area has been a recipient to 20 disaster declarations from 2000-2023. Since the adoption of the Johnson County Hazard Mitigation Plan in 2018, there have been 5 disaster declarations in the Planning Area. The table below is a list of disaster declarations from 2000-2023. For more information on the data in the table below please go to [Disaster Declarations for States and Counties | FEMA.gov](https://www.fema.gov/disaster-declarations-states-counties).

Disaster Declaration History		
Declaration #	Date	Incident Description
3159	12/28/00	Severe Ice Storm
1354	12/29/00	Severe Ice Storm
1516	5/7/04	Severe Storm
3215	9/2/05	Hurricane
1751	3/26/08	Severe Storm
3301	1/28/09	Severe Ice Storm
1819	2/6/09	Severe Storm
1861	12/3/09	Severe Storm
1975	5/2/11	Severe Storm
4000	7/8/11	Severe Storm
4160	1/6/14	Severe Ice Storm
4226	6/26/15	Severe Storm
3414	5/30/19	Flood
4441	6/8/19	Flood
3461	3/13/20	Biological
4518	4/3/20	Biological
3541	8/27/20	Hurricane



## **4.7 Hazard Classification and Identification**

### **Classification**

The planning team considered a full range of hazards that could affect the area for the 2023 Johnson County Hazard Mitigation Plan. FEMA and the Department of Homeland Security generally organize threats and hazards into three categories:

- Natural
- Technological/accidental (dam incident)
- Human-induced/intentional

This plan will address hazards that can be categorized as natural or technological/accidental. Although this plan recognizes the potential threat caused by human-induced/intentional threats, these considerations are outside the scope of this mitigation plan. Natural or technological hazards that have posed a historical threat or a probable future threat were addressed because they FEMA’s hazard mitigation requirements. These assessed hazards were derived from the State Hazard Mitigation Plan and from the 2018 Johnson County Hazard Mitigation Plan. The planning team, stakeholders, and the public participated in meetings and hazard questionnaires that were designed to discuss each hazard as it relates to the Planning Area.

### **Identification**

Hazard identification is the process of identifying hazards threatening a given area. It is the first step in the risk assessment process. The planning team identified several natural hazards posing a threat to the Planning Area warranting a complete profile in this hazard mitigation plan. The following hazards were identified from historical information provided by planning team members, newspapers, review of plans, reports, internet research, the State Mitigation Plan, FEMA publication “Multi-Hazard Identification and Risk Assessment”, and information provided by FEMA and ADEM.

Hazards	Hazard Events
Dam/Levee Failure	There have been no dam/levee failure events in Johnson County.
Drought	13 events reported from 1/1/2000-1/1/2024
Earthquake	1 event reported from 1/1/2000-1/1/2024
Extreme Heat	1 event reported from 1/1/2000-1/1/2024
Flood/Flash Flood	3 flood events and 37 flash flood events were reported from 2000-2024.
Hailstorm	105 hailstorm events were reported from 2000-2024.
Landslide	There have been no landslide events in Johnson County.
Lightning	2 events reported from 2000-2024
Strong Winds	6 strong wind events were reported from 2000-2024.
Thunderstorm Winds	163 events were reported from 2000-2024.
Tornado	13 tornado events were reported from 2000-2024.
Wildfire	4 wildfire events were reported from 2000-2024.
Winter/Ice Storm	5 ice storm and 15 winter storm events were reported from 2000-2024.

[NOAA Storm Event Database - Johnson County](#)

## 4.8 Natural Hazards affecting Johnson County

This mitigation plan addresses the natural hazards affecting the planning area. The hazards of concern are dam failure, drought, extreme heat, earthquake, flooding, landslides, thunderstorms, tornadoes, wildfire, and winter storms. Expansive soils are not addressed in this plan since they are not an issue/threat to the planning area.

## 4.8.1 Dam Failure

**Dam failure:** A dam failure is the collapse, breach or other failure resulting in downstream flooding. A dam impounds water in the upstream area, referred to as the reservoir. The amount of water impounded is measured in acre-feet. An acre-foot is the volume of water that covers an acre of land to a depth of one foot. As a function of upstream topography, even a very small dam may impound or detain many acre-feet of water. Two factors influence the potential severity of a full or partial dam failure:

1. Amount of water impounded.
2. Density, type, and value of development and infrastructure located downstream.

The Arkansas Natural Resource Commission (ANRC) provides comprehensive regulation and supervision of dams. The link may be used to reference the ANRC Rules Governing Design and Operation of Dams Title 7. [TITLE VII \(arkansas.gov\)](https://www.arkansas.gov)

Low Risk Dams that are private, county, or state-owned dams not presenting a danger to individuals, structures, residential housing, county roads or state highways will not be addressed in this plan.

**Extent, Magnitude or Severity of Dam Failure:** Currently, no studies are available for the dams to determine the extent of dam failure in the Planning Area. The need to conduct flood inundation studies for high and significant risk hazard dams will be addressed in this plan as a mitigation action.

**Possible Impact of Climate Change:** The challenges posed by climate change, such as more intense storms, frequent heavy precipitation, heat waves, drought, and extreme flooding would have minimal impact on dam failure but will be noted for continued research on nature-based solutions to mitigate all possibilities of potential increased impact.

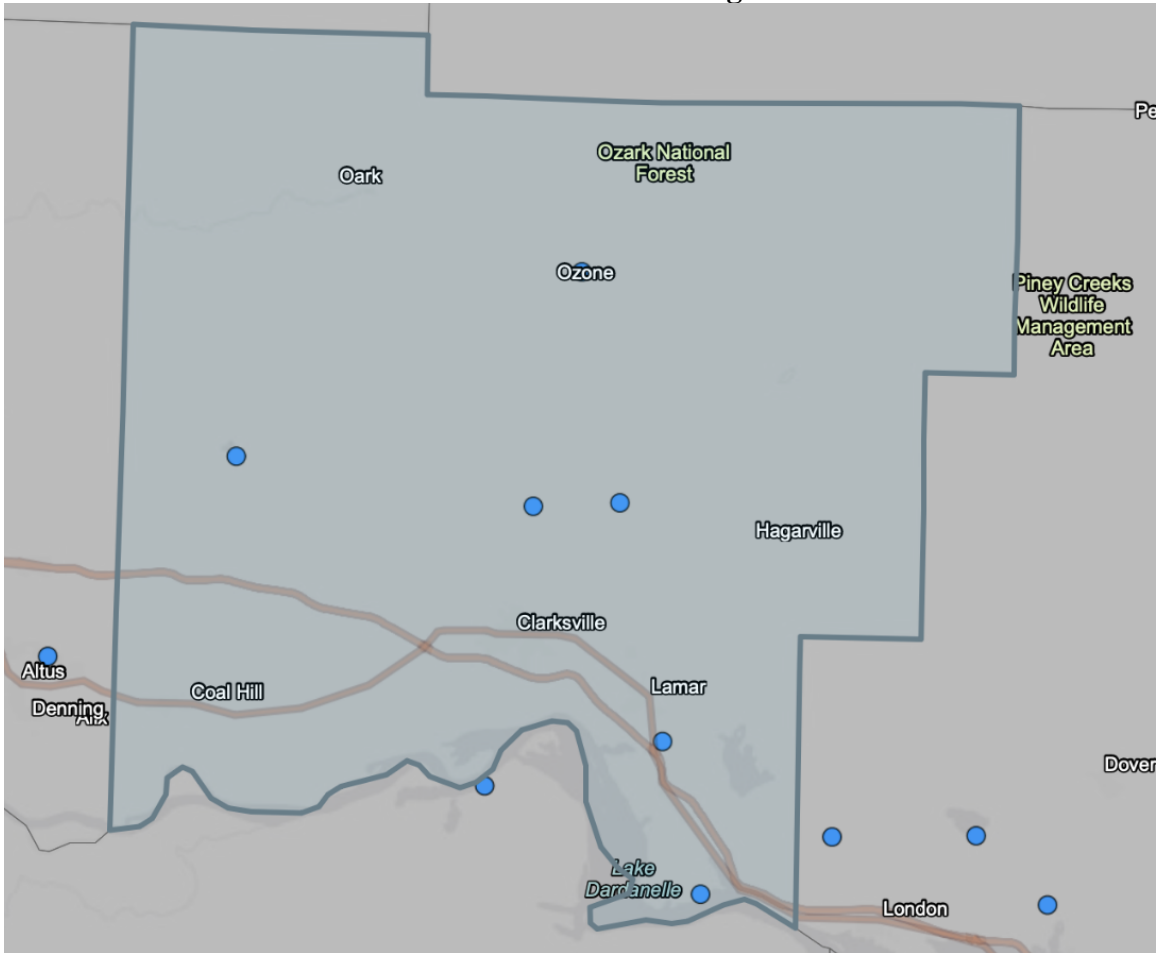
**Possible Impact of Population Change:** Changes in population pose a threat to dams and dam failure. Population growth and urbanization change the landscape of the area. This results in loss/addition of natural landscaping such as trees, grass, and rock. Building structure influence climate and the natural path of water flow. Population growth will have an impact on the number of resources used. Adjustments for population growth impacts wildlife. Population growth increases the chances of loss of life if dam failure were to occur.

**Previous Occurrences:** There have been no previous occurrences of dam failure in the Planning Area.

**Probability of Occurrences:** There have been zero occurrences of dam failure in the past. However, there is always a possibility that a dam failure could occur. There is less than 1 percent chance that a dam failure will occur in any given year.

Each dam will be described separately with their corresponding location, impact, and overall summary of vulnerability due to the uniqueness of each dam and location.

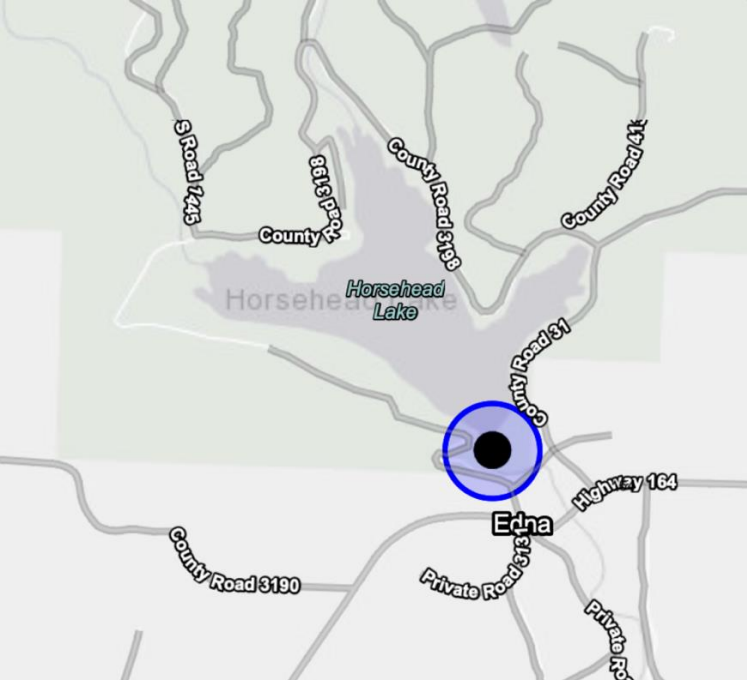
### Dams located in the Planning Area



[National Inventory of Dams \(army.mil\)](http://www.army.mil)

According to the Arkansas State Hazard Mitigation Plan, there are a total of 6 dams throughout the entire county of Johnson. There are 3 dams rated as a low hazard in the State plan, therefore they will not be profiled in the Johnson County Hazard Mitigation Plan update. There is 1 that is ranked significant and 2 ranked high in Johnson County according to the state hazard mitigation plan.

**HORSEHEAD LAKE DAM:** Lat: 35.578 Long: -93.634, NPDP ID: AR00441 'High' Risk Hazard.



<https://nid.sec.usace.army.mil/#/dams/system/AR00441/structure>

Horsehead Lake Dam is owned by Arkansas State Game and Fish Commission. The dam was constructed in 1950 and is used for recreational purposes; it has a dam height of 67 feet tall and 350 feet long. It has a normal surface area of 111 acres and is of earth construction.

Maximum discharge is 9,000 cubic feet per second. Its maximum capacity is 4,913 acres per foot. Normal storage area is 3,663 acres per foot. The drain area is 16.9 square miles.

**Impact/Vulnerability:** There are currently no inundation studies available for Ludwig Lake Dam. In the event of a dam failure, the approximate inundation area would estimate the area impacted. Dam failure can range from spillover up to a catastrophic breach. Spillover could cause damage or destruction of property: A complete breach would threaten loss of life to people and animals, as well as destruction of property and the environment.

There are no spillways for water overflow to run from this dam. If the dam were to fail, there are no inundation studies conducted to estimate what could be lost.

Hunt, Arkansas lies downstream approximately 3.1 miles. Hartman, Arkansas and Interstate 40 are located downstream approximately 12.0 miles.

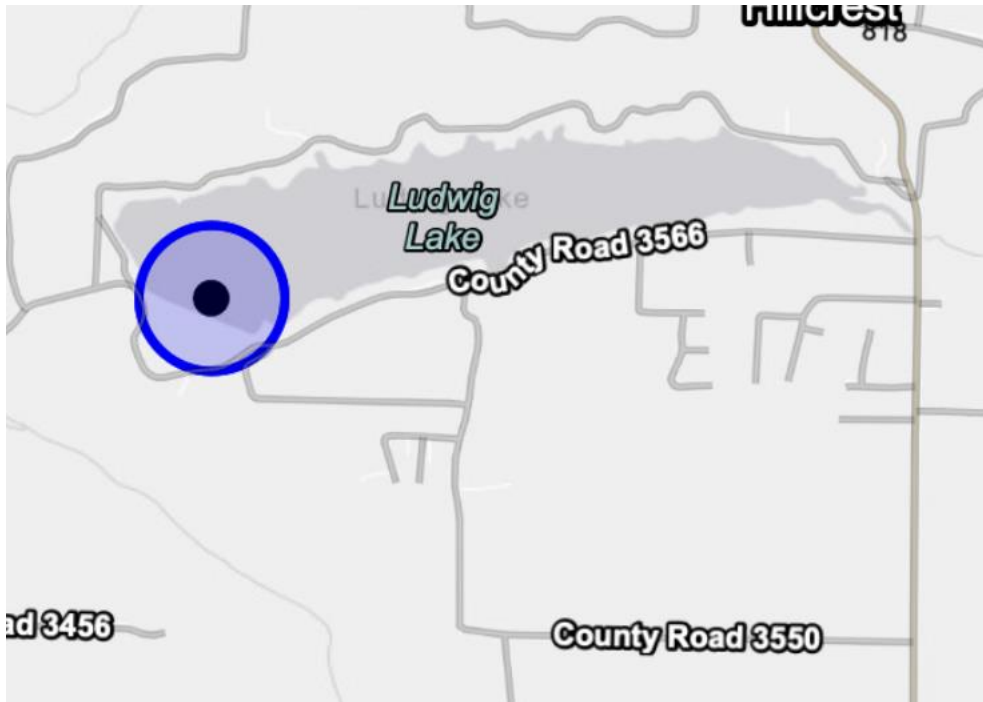
Horsehead Lake Dam is in the Ozark National Forest in west central Johnson County. The area is inhabited with vegetation. There is no housing in the surrounding area, 50% of the area has vegetation.

**Extent:** An Emergency Action plan (EAP) is available to further outline the risk to the city of Clarksville, Hunt, and Hartman. Due to lack of inundation studies being conducted, the inundation descriptions of the areas that would flood downstream are unavailable to the planning team.

According to Association of Dam Safety Dams Incident Database there have been no breaches (<https://damsafety.org/incidents>).

Over the next five years the Planning Team should research and document natural based mitigation projects for dam failure.

**LUDWIG LAKE DAM:** Lat: 35.533 Long: -93.456, NPDP ID: AR00442 ‘High’ Risk Hazard.



<https://nid.sec.usace.army.mil/#/dams/system/AR00442/summary>

Ludwig Lake Dam is locally owned by Clarksville Light and Water Company. The dam was constructed in 1950 and is used for recreation and water supply purposes; it has a dam height of 70 feet tall and 1,882 feet long. It has a normal surface area of 260 acres and is of earth construction.

Maximum discharge is 6,421 cubic feet per second. Its maximum capacity is 5,000 acres per foot. Normal storage area is 3,886 acres per foot. The drain area is 4.8 square miles.

**Impact/Vulnerability:** There are currently no inundation studies available for Ludwig Lake Dam. In the event of a dam failure, the approximate inundation area would estimate the area impacted. Dam failure can range from spillover up to a catastrophic breach. Spillover could cause damage or destruction of property: A complete breach would threaten loss of life to people and animals, as well as destruction of property and the environment.

Clarksville, Arkansas lies downstream approximately 5.8 miles. Lamar, Arkansas is located downstream approximately 9.8 miles.

If there were a breach or spillover from the Ludwig Lake Dam, the pool elevation would have to exceed 5,000 cubic feet per second. Ludwig Lake Dam is in a low-density housing area with 50% vegetation. Surrounded by picnic areas and cemeteries, it is located north of Ludwig community which has 49% to 74% housing density. Additionally, County Road 3550 and Arkansas State Highway 21 may become unstable.

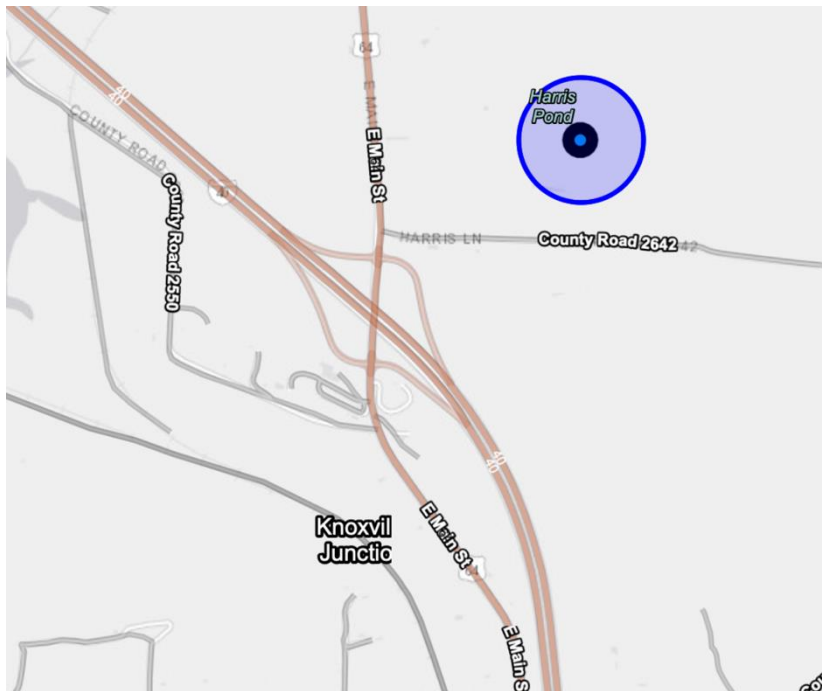
**Extent:** An Emergency Action plan (EAP) is available to further outline the risk to the city of Clarksville, Lamar, and Knoxville. Due to lack of inundation studies being conducted, the inundation descriptions of the areas that would flood downstream are unavailable to the planning team.

According to Association of Dam Safety Dams Incident Database there have been no breaches (<https://damsafety.org/incidents>).

Over the next five years the Planning Team should research and document natural based mitigation projects for dam failure.



**HARRIS POND DAM:** Lat: 35.418 Long: -93.378, NPDP ID: AR00444 ‘Significant’ Risk Hazard.



<https://nid.sec.usace.army.mil/#/dams/system/AR00444/structure>

Harris Pond Dam is privately owned by Bruce Harris. The dam was constructed in 1956 and is used for recreational purposes; it has a dam height of 18 feet tall and 300 feet long. It has an unknown normal surface area and elevation levels. It is made of earthen construction.

Maximum discharge is unknown. Its maximum capacity is 325 acres per foot. Normal storage area is 215 acres per foot. The drain area is unknown.

**Impact/Vulnerability:** In the event of a dam failure the approximate inundation area is outlined in yellow to estimate the area impacted. Dam failure can range from spillover up to a catastrophic breach. Spillover could cause damage or destruction of property: A complete breach would threaten loss of life to people and animals, as well as destruction of property and the environment.

Spillover from this Dam would be redirected to State Highway 64 down to Interstate 40, as there are no spillways in the event of a dam failure.

Knoxville Junction, Arkansas lies downstream approximately 0.5 miles. Knoxville, Arkansas is located downstream approximately 3.0 miles.

**Extent:** An Emergency Action plan (EAP) is available to further outline the risk to the city of Clarksville, Lamar, and Knoxville. Due to lack of inundation studies being conducted, the inundation descriptions of the areas that would flood downstream are unavailable to the planning team.

According to Association of Dam Safety Dams Incident Database there have been no breaches (<https://damsafety.org/incidents>).

Over the next five years the Planning Team should research and document natural based mitigation projects for dam failure.

## 4.8.2 Drought

A drought is a period of unusually dry weather that persists long enough to cause serious deficiencies in water supply (surface or underground). Drought conditions can mean different things in different regions. Normally, drought conditions are defined depending on the average amount of precipitation that an area is accustomed to receiving.

Determining the start of a drought can be tricky as there is no sudden and dramatic onset of this natural hazard unlike tornadoes, earthquakes, and hurricanes. Droughts are more of a slow onset hazard. It can take weeks or years for the full effects of long-term inadequate rainfall to become apparent. However, over time they can severely affect crops, municipal water supplies, recreation resources and wildlife. If drought conditions extend over several years, the direct and indirect economic, social, vegetative, wildlife and climate impacts can be significant. In addition, human actions and demands for water resources can accelerate drought-related impacts. There can be a cascading effect as high temperatures, high winds, and low humidity levels that occur in drought conditions may make areas more susceptible to wildfire.

The end of a drought is also difficult to determine. A single rainstorm will provide short term relief from a drought, but it may take weeks or months before levels of precipitation return to normal.

The United States Drought Monitor (USDM) differentiates between short-term and long-term drought. Short-term drought can have impacts on agriculture and grasslands, and the drought classification can rapidly change. Long-term drought, in contrast, has deeper impacts on hydrology and ecology and can persist even with short-term gains in precipitation ([Drought Classification | U.S. Drought Monitor \(unl.edu\)](#)).

- S = Short-term, typically less than 6 months (agriculture, grasslands)
- L = Long-term, typically more than 6 months (hydrology, ecology)
- SL = Area contains both short- and long-term impacts

### **Locations Affected by Drought**

The entire Planning Area is equally susceptible to experiencing a drought. There is no defined geographic hazard boundary.

### **Extent, Magnitude or Severity of Drought**

The entire Planning Area could experience a drought that is rated between a D0 and D2 in any given year.

Drought Severity Classification								
RANGES								
Category	Description	Possible Impacts	Palmer Drought Index	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Percent of Normal Precipitation	Standardized Precipitation Index (SPI)	Satellite Vegetation Health Index
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures; fire risk above average. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.	-1.0 to -1.9	21-30	21-30	<75% for 3 months	-0.5 to -0.7	36-45
D1	Moderate Drought	Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing, or imminent, voluntary water use restrictions	-2.0 to -2.9	11-20	11-20	<70% for 3 months	-0.8 to -1.2	26-35
D2	Severe Drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed	-3.0 to -3.9	6-10	6-10	<65% for 6 months	-1.3 to -1.5	16-25
D3	Extreme Drought	Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions	-4.0 to -4.9	3-5	3-5	<60% for 6 months	-1.6 to -1.9	6-15
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies	-5.0 or less	0-2	0-2	<65% for 12 months	-2.0 or less	1-5

[Drought Classifications \(weather.gov\)](http://www.weather.gov)

**Previous Occurrences**

There have been 13 past occurrences of drought in the Planning area in the years of 2000-2023.

**NOAA Storms Database for Drought**

Number of County/Zone areas affected:	1
Number of Days with Event:	13
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	0
Number of Days with Event and Crop Damage:	0
Number of Event Types reported:	1

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	0.00K	0.00K
JOHNSON (ZONE)	JOHNSON (ZONE)	AR	09/08/2000	18:00	CST	Drought		0	0	0.00K	0.00K
JOHNSON (ZONE)	JOHNSON (ZONE)	AR	08/02/2011	06:00	CST-6	Drought		0	0	0.00K	0.00K
JOHNSON (ZONE)	JOHNSON (ZONE)	AR	06/19/2012	06:00	CST-6	Drought		0	0	0.00K	0.00K
JOHNSON (ZONE)	JOHNSON (ZONE)	AR	07/01/2012	00:00	CST-6	Drought		0	0	0.00K	0.00K
JOHNSON (ZONE)	JOHNSON (ZONE)	AR	08/01/2012	00:00	CST-6	Drought		0	0	0.00K	0.00K
JOHNSON (ZONE)	JOHNSON (ZONE)	AR	09/01/2012	00:00	CST-6	Drought		0	0	0.00K	0.00K
JOHNSON (ZONE)	JOHNSON (ZONE)	AR	10/01/2012	00:00	CST-6	Drought		0	0	0.00K	0.00K
JOHNSON (ZONE)	JOHNSON (ZONE)	AR	11/01/2012	00:00	CST-6	Drought		0	0	0.00K	0.00K
JOHNSON (ZONE)	JOHNSON (ZONE)	AR	12/01/2012	00:00	CST-6	Drought		0	0	0.00K	0.00K
JOHNSON (ZONE)	JOHNSON (ZONE)	AR	01/01/2013	00:00	CST-6	Drought		0	0	0.00K	0.00K

JOHNSON (ZONE)	JOHNSON (ZONE)	AR	02/01/2013	00:00	CST-6	Drought		0	0	0.00K	0.00K
JOHNSON (ZONE)	JOHNSON (ZONE)	AR	03/01/2013	00:00	CST-6	Drought		0	0	0.00K	0.00K
JOHNSON (ZONE)	JOHNSON (ZONE)	AR	11/28/2017	00:00	CST-6	Drought		0	0	0.00K	0.00K
Totals:								0	0	0.00K	0.00K

[Storm Events Database - Search Results | National Centers for Environmental Information \(noaa.gov\)](#)

September 8, 2000, the Governor of Arkansas asked that all 75 counties in Arkansas be declared agricultural disasters areas. Dry foliage and dead grass led to numerous grass fires. 1200 acres burned in Petit Jean State Park, leaving several forested areas completely burned.

June 2012 in Johnson County was a hot, dry weather month. Several counties across the state declared emergencies so that volunteer fire departments could haul water to stock ponds on private property. Some instituted mandatory water restrictions. Other counties were placed under a burn ban, which were upheld throughout the 2012 summer months.

July 2012 offered no relief to the Planning Area which suffered from June's hot, dry weather. By the end of the month, extreme drought conditions covered the western portion of the Planning Area.

In 2012 the Planning Area experienced unusually dry weather. The entire State of Arkansas was placed under a burn ban. Daily wildfires broke out across the State, burning up to 100 acres each time. Drought conditions in the Planning Area continued to exist thru the end of October.

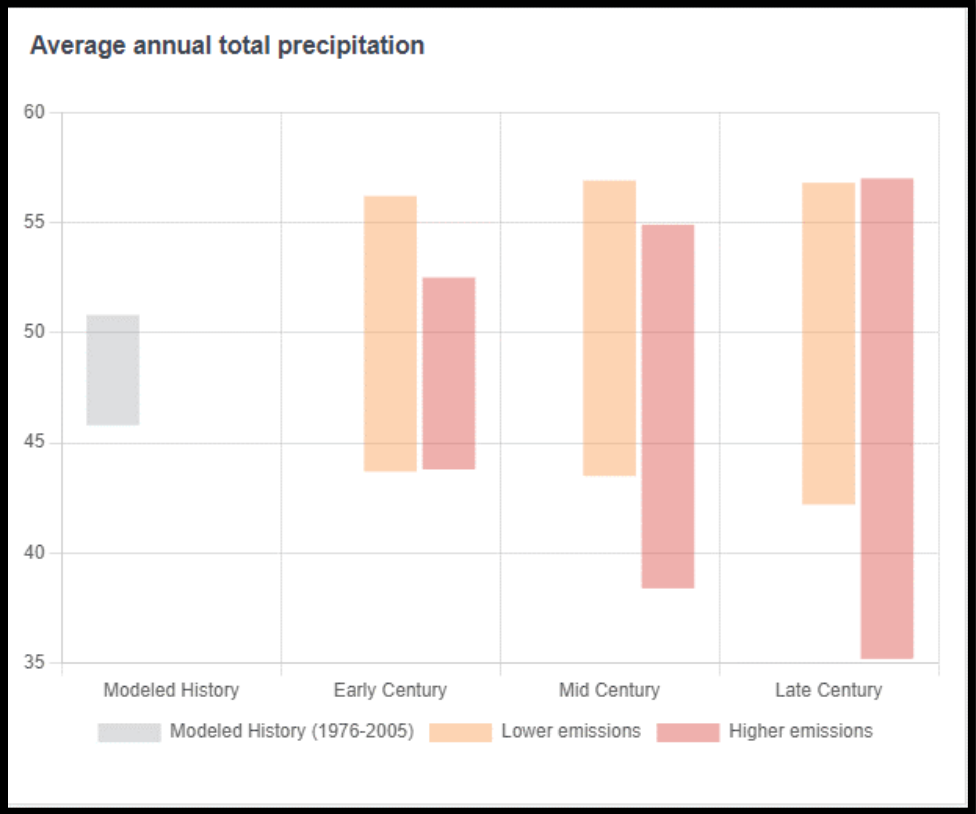
For mapping of past drought conditions, please go to [Johnson County Conditions: Drought.gov](#). Mapping goes back to 1979 and is updated every five days.

### Probability of Future Events

Future Climate Indicators							
Indicator	Modeled History (1976 - 2005)	Early Century (2015 - 2044)		Mid Century (2035 - 2064)		Late Century (2070 - 2099)	
		Lower Emissions Min - Max	Higher Emissions Min - Max	Lower Emissions Min - Max	Higher Emissions Min - Max	Lower Emissions Min - Max	Higher Emissions Min - Max
<b>Precipitation:</b>							
Average annual total precipitation	48" 46 - 51	49" 44 - 56	49" 44 - 52	49" 44 - 57	49" 38 - 55	49" 42 - 57	49" 35 - 57
Days per year with precipitation (wet days)	163 days 156 - 170	159 days 146 - 170	158 days 132 - 168	158 days 142 - 170	156 days 122 - 174	157 days 140 - 171	152 days 110 - 175
Days per year with no precipitation (dry days)	203 days 195 - 209	206 days 195 - 220	207 days 197 - 233	207 days 196 - 223	209 days 192 - 243	208 days 194 - 226	213 days 190 - 255
Maximum number of consecutive dry days	16 days 14 - 20	17 days 14 - 21	17 days 14 - 20	18 days 15 - 21	17 days 14 - 22	18 days 15 - 25	18 days 15 - 26
<b>Temperature thresholds:</b>							
Annual days with maximum temperature > 90 °F	63 days 63 - 75	92 days 74 - 113	95 days 73 - 116	103 days 75 - 127	111 days 88 - 130	114 days 87 - 144	142 days 112 - 168
Annual days with maximum temperature > 100 °F	7 days 6 - 9	19 days 5 - 37	21 days 7 - 54	27 days 6 - 57	35 days 15 - 84	36 days 12 - 57	68 days 30 - 117

N/A = Data Not Available for the selected area

Climate Projections for	Early Century (2015–2044) ↕	Lower emissions	Higher emissions
Average annual total precipitation	48.8 Inches + 0.5 since 1976-2005	49.0 Inches + 0.7 since 1976-2005	
Days per year with precipitation (wet days)	159.0 Days - 3.6 since 1976-2005	158.1 Days - 4.5 since 1976-2005	
Days per year with no precipitation (dry days)	206.2 Days + 3.6 since 1976-2005	207.1 Days + 4.5 since 1976-2005	
Maximum number of consecutive dry days	17.1 Days + 0.8 since 1976-2005	17.2 Days + 0.8 since 1976-2005	
Annual days with maximum temperature > 90°F	92.1 Days + 25.1 since 1976-2005	94.6 Days + 27.6 since 1976-2005	
Annual days with maximum temperature > 100°F	18.7 Days + 11.8 since 1976-2005	21.0 Days + 14.0 since 1976-2005	



[CMRA - Climate Mapping For Resilience and Adaptation \(arcgis.com\)](http://arcgis.com)

Climate mapping trends indicate a slight increase in annual precipitation with a decrease in the number of wet days. This combined with an increase in the number of dry days, an increase in the number of consecutive dry days, and rising temperature thresholds could mean that future drought conditions could exist.

The probability that the Planning Area will experience a drought event every year is less than one percent.

The probability of a drought was estimated using the following formula:

$$\frac{\# \text{ of events}}{\# \text{ of days}} \times 100 = \underline{\hspace{2cm}}$$

Data collected from 2000-2023 was equal to 8,395 days.

### **Vulnerability and Impact of Drought**

Lack of water could be devastating to the Planning Area. As a dry period progresses and water supplies dwindle, existing water supplies will be overtaxed and dry up. If the drought persists long term the impact of the drought could be permanent. Specific impacts may be:

- Economy: loss of revenue/income, higher rates of unemployment, loss of land value/prices
- Population density: there may be forced migration
- Health: dehydration, poor nutrition, famine
- Natural wildlife: wildlife will be competing for the same resources as people
- Land use: not all plant life will be able to survive in drought conditions changing availability of food for both people and wildlife. Erosion from flash floods, high winds, and possible wildfire from consistent dry conditions may change the landscape and natural habitats permanently.
- Damage or loss of infrastructure
- Social: conflict over resources

The populations vulnerable to a drought event are the unincorporated Johnson County and the municipalities within the County including the Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, Oark-Jasper School District, Westside School District along with University of the Ozarks. Populations included in the Planning Area which are vulnerable to these conditions are children under five years, the elderly over 65 years, disabled, those living below the poverty level, and farmers raising livestock, crops, hay, and timber. Buildings and infrastructure are not vulnerable to drought events. The primary and most devastating effect for the Planning Area is the lack of water. As a dry period progresses and water supplies dwindle, existing water supplies are overtaxed and may dry up. If the drought is long term, it may result in permanent changes in settlement, social, and living patterns in these jurisdictions. Cascading effects also include major ecological changes such as increased flash flooding and desertification.

Drought produces impacts that affect the social, environmental, and economical standard of living. Some direct impacts of drought are reduced crop, rangeland, and forest productivity; reduced water levees; increased fire hazard; increased livestock and wildlife death rates; and

damage to wildlife and fish habitat. A reduction in crop productivity usually results in less income for farmers, retailers, and increased prices for food.

Environmental losses are caused by damages to plant and animal species. Wildlife habitat and air and water quality are usually damaged due to a lack of water and an increase in forest and range fires, insect infestations, plant disease and wind erosion. Most of the effects of drought are short-term, and as the drought comes to an end many problems are solved.

Damages from drought are generally economic. Assets at risk would include open land that could become vulnerable to the wildfire hazard due to extended periods of low rain and high heat. Water supply resources would be affected and the vulnerable populations such as the farmers. Farmers, ranchers, and private individuals own about 90% of the timberland in the Planning Area. Drought can have serious impact on farmland and agriculture. Failed crops, inability to maintain healthy livestock, and decreased land value/prices will cause economic strain. The landscape may be unable to adapt and could be permanently changed. Those who depend on the land for their livelihood may be forced to sell their herds, migrate in search of better grazing lands/fertile fields, or move to urban areas in search of employment.

Public Health would be affected through lack of water supply, unsafe water in ponds and creeks, and airborne dust. Those affected most would be the homeless, children, those with health conditions and elderly.

Severe droughts also elevate the potential for wildfires. Burned areas that were once forested or used as stock ponds may dry up permanently. The increased dry fuel load created by drought could ignite. The wildfire could ravage the Planning Area as well as surrounding Counties.

### **Population**

Population changes would impact drought. As populations grow there is an increased strain on water supplies. The Planning Area has seen an increase in population and industry that relies on the current water supply. Increased population and increased industry would stress the current water supply, without a drought. Drought conditions would expedite the impact. Over the next ten years, the Planning Area should anticipate the need to expand its water supply to meet the need of increased industry.

### **Land Use**

Changes in land use could impact the Planning Area. The Planning Area has both agricultural and industrial areas. Both agriculture and industry are dependent on sustainable sources of water. Unsustainable land use by either agriculture or industry can lead to a breakdown of the ecosystem and environmental degradation. Over the next ten years the Planning Area will be working to increase water supply to meet the increased demand that is projected.

The Planning Area has not conducted a study to determine an increase or decrease in agriculture. Over the next five years the Planning Team will need to research and document changes in land use and its effects on the Planning Area.



## **Climate**

Climate change is expected to correlate with land use. Lack of green space, increased land use for agriculture, and waste from industry impact climate. The Planning Area contains large amounts of rural agricultural areas and is expected to see a growth in industry.

### **4.8.3 Earthquake**

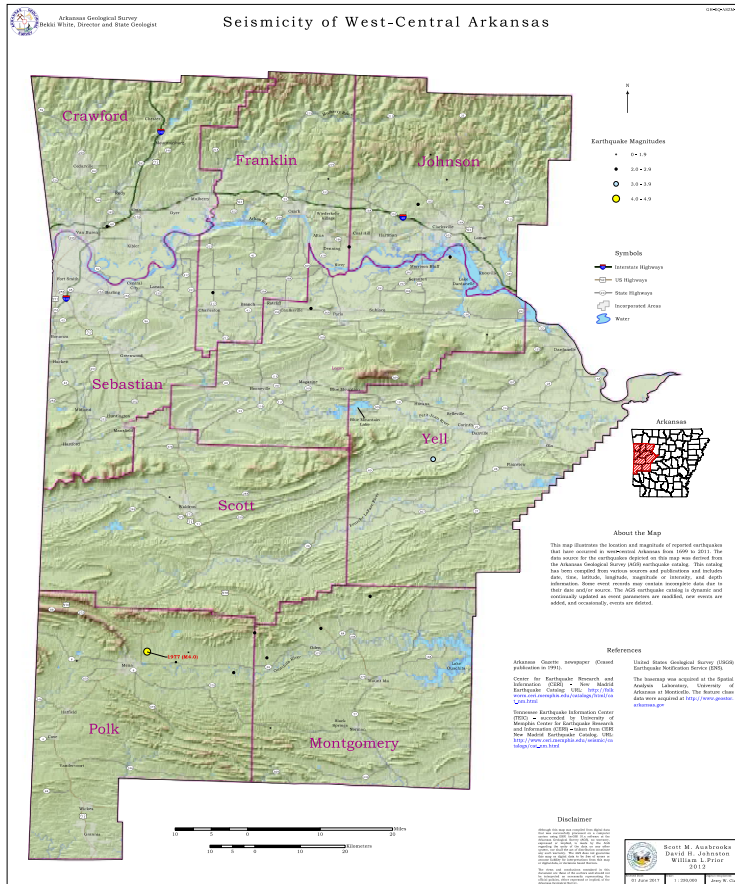
An earthquake is a sudden motion or trembling caused by an abrupt release of accumulated strain on the tectonic plates comprising the Earth's crust.

An earthquake is what happens when two blocks of the earth suddenly slip past one another. The surface where they slip is called the fault or fault plane. The location below the earth's surface where the earthquake starts is called the hypocenter, and the location directly above it on the surface of the earth is called the epicenter.

Sometimes an earthquake has foreshocks. These are smaller earthquakes that happen in the same place as the larger earthquake that follows. Scientists can't tell that an earthquake is a foreshock until the larger earthquake happens. The largest, main earthquake is called the mainshock. Mainshocks always have aftershocks that follow. These are smaller earthquakes that occur afterwards in the same place as the mainshock. Depending on the size of the mainshock, aftershocks can continue for weeks, months, and even years after the mainshock. The Encyclopedia of Arkansas defines an earthquake swarm as numerous, smaller earthquakes that occur in a localized area over a short period of time.

#### **Locations Affected by Earthquakes**

The map below shows the location and magnitude of reported earthquakes that have occurred in and around the Planning Area from 1938-2007.



[West-Central Arkansas Seismic Zone PDF](#)

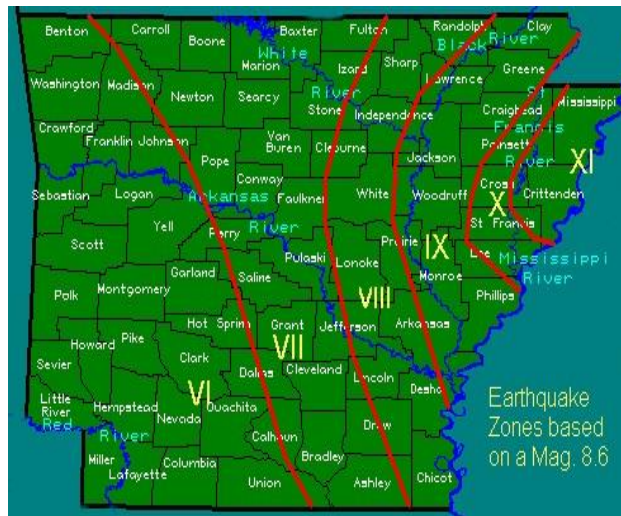
**Extent, Magnitude or Severity of Earthquake Events**

The Planning Area can expect to see earthquakes up to a magnitude of 5.0 on the Richter Scale. The area with the highest probability due to past recorded occurrences would be the city of Clarksville. Other nearby towns could experience earthquake activity within the Planning Area. It is possible that any surroundings of the Planning Area could experience an earthquake ([Historic Earthquake Web Map in Arkansas](#)).

County	Location	Date	Time	Magnitude	Depth (km)
Johnson	Clarksville	4/19/20	1:48 AM	2.1	14.7

Category	Effects	Richter Scale (approximate)
I. Instrumental	Not felt	1-2
II. Just perceptible	Felt by only a few people, especially on upper floors of tall buildings	3
III. Slight	Felt by people lying down, seated on a hard surface, or in the upper stories of tall buildings	3.5
IV. Perceptible	Felt indoors by many, by few outside; dishes and windows rattle	4
V. Rather strong	Generally felt by everyone; sleeping people may be awakened	4.5
VI. Strong	Trees sway, chandeliers swing, bells ring, some damage from falling objects	5
VII. Very strong	General alarm; walls and plaster crack	5.5
VIII. Destructive	Felt in moving vehicles; chimneys collapse; poorly constructed buildings seriously damaged	6
IX. Ruinous	Some houses collapse; pipes break	6.5
X. Disastrous	Obvious ground cracks; railroad tracks bent; some landslides on steep hillsides	7
XI. Very disastrous	Few buildings survive; bridges damaged or destroyed; all services interrupted (electrical, water, sewage, railroad); severe landslides	7.5
XII. Catastrophic	Total destruction; objects thrown into the air; river courses and topography altered	8

The Arkansas Geological Survey confirms that damage is not a concern unless a quake has a magnitude of at least 4.0. As shown below, the Planning Area could experience up to a 5.0 magnitude earthquake on the Richter Scale.



### Previous Occurrences

The New Madrid Seismic Zone is a very active geologic fault located closely to the State of Arkansas. Within the Planning Area, there have been zero earthquakes.

Location	Date	Magnitude
Clarksville	4/19/20	2.1

### Probability of Future Events

The probability of an earthquake taking place in any given year is less than one percent. The probability of an earthquake was estimated using the following formula:

$$\frac{\# \text{ of events}}{\# \text{ of days}} \times 100 = \underline{\hspace{2cm}}$$

Data collected from 1974-2024 is equal to 18,250 days.

## **Vulnerability and Impact of Earthquakes**

According to the Arkansas State Mitigation Plan the regions with the highest probability of impact and vulnerability are those located along the New Madrid Fault. The portions of Arkansas that are most likely to experience damage are in the northeast part of the state. This does not include the Planning Area.

The Arkansas Geological Survey confirms that damage is not a concern unless a quake has a magnitude of at least a 4.0. Most of the Planning Area is in Earthquake Zone VI. This means the planning area could see an earthquake up to a 5.0 on the Richter Scale. Damage at this magnitude could result in cracked walls.

All buildings and infrastructure in the Planning Area are vulnerable to earthquakes. As businesses and residential areas grow so will the impact and vulnerability of the Planning Area. Growth in the number and size of both businesses and residential areas will require more mitigation efforts to address both new and existing structures.

Damage from an earthquake can be widespread and varied. Buildings can be structurally damaged or collapse depending on the magnitude of the earthquake. Furniture and equipment may be overturned or displaced. Windows could be broken or become unanchored from the structure. Mobile homes could be knocked off their foundations. Infrastructure and lifesaving services could be delayed, damaged, or destroyed by an earthquake. Depending on the magnitude of the earthquake, pipes carrying water and other utilities may become damaged. Hazardous material may be released. Services such as cell service and landlines may become unavailable due to damage or capacity limits.

The planning Area includes populations under the age of 5, over the age of 65, special needs, and those living below the poverty level. These population are at risk of injury, death, or inability to recover from an earthquake.

The city of Clarksville would be most affected by an earthquake (stronger than 4.0) due to the building density in the area. There are vulnerable commercial structures located in downtown Clarksville that are constructed with unreinforced masonry. During a 5.5 magnitude earthquake, the walls of the buildings would crack, or collapse and windows would break. All furniture, equipment, and material inside the buildings could be overturned, broken. Cars parked downtown could be rocked and displaced by the shaking and damaged or destroyed by falling debris. Sidewalks could be cracked. Pedestrians located in downtown Clarksville would be especially vulnerable. They could be knocked off their feet, and falling debris from buildings could strike a bystander.

The cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar are in rural areas. In these areas most housing is constructed with unreinforced masonry. The walls of the buildings could crack or collapse. The windows could be broken and or destroyed. Mobile homes that are mounted on piers could be knocked off their foundations and dropped 24 to 36 inches before striking the ground. Any residents in mobile homes are vulnerable and would be knocked from their current position to the floor and injured or killed.

Clarksville School District and University of the Ozarks are in Clarksville. Some of the buildings are older and constructed with unreinforced masonry. The walls of the buildings could crack or collapse. Furniture and equipment inside the buildings would be overturned and displaced. Heavy furniture and equipment could strike students, faculty, or staff located in the buildings during an earthquake event. Due to the amount of people that could be in one area during an earthquake event, widespread panic could pose additional risk to those located on campus trying to exit the building and injuring others in their path.

Lamar School District in Lamar, Westside School District in Hartman, and Oark-Jasper Schools in Oark contain buildings that are older and constructed with unreinforced masonry. The walls of the buildings could crack or collapse. Furniture and equipment inside the buildings would be overturned and displaced. Heavy furniture and equipment could strike students, faculty, or staff located in the buildings during an earthquake event. Due to the amount of people that could be in one area during an earthquake event, widespread panic could pose additional risk to those located on campus trying to exit the building and injuring others in their path.

### **Population**

Population increase/decrease will not alter the probability of an earthquake event; however, changes in demographic, socioeconomic characteristics, and distribution of population can affect the vulnerability and impact of earthquakes. Higher population density and lower economic characteristics will result in increased vulnerability and impact. Over the next five years, the planning team should monitor increase/decrease of population and its impact. The mitigation plan should be updated for any significant changes.

### **Land Use**

Sustainable urban resilience to natural disasters is a constant challenge. Lack of green space makes urban areas more vulnerable. Land use planning is an essential tool in promoting earthquake resilience. There have been no land use studies conducted for the Planning Area.

Over the next five years the planning team should consider a land use study and update the mitigation plan with any significant changes.

### **Climate**

Climate change does not have a direct impact on earthquake vulnerability, impact, or frequency.

### 4.8.4 Extreme Heat

There is no strict definition of extreme heat. The term is used to describe a hotter than normal period for the time and place of the extreme heat event.

Extreme heat is a dangerous weather condition. According to MIT it is the leading cause of weather-related deaths in the United States (<https://climate.mit.edu/explainers/extreme-heat>). Extreme heat effects:

- Health
- Roads
- Infrastructure
- Crops
- Livestock
- Escalates natural disasters like drought and wildfire

#### Locations Affected by Extreme Heat

There is no geographic hazard boundary for extreme heat. The entire Planning Area is a risk for extreme heat.

#### Extent, Magnitude, or Severity of Extreme Heat

The entire Planning Area can experience extreme heat seasonally. Temperatures in the summer months average between 80° and 115°.

The magnitude or intensity of an extreme heat event is measured in relation to the percentage of humidity. According to the National Oceanic Atmosphere Administration (NOAA) this relationship is referred to as the “Heat Index”. The Heat Index measures how hot it feels outside when humidity is combined with high temperatures. The Planning Area has seen heat indices near 120° ([Storm Events Database - Event Details | National Centers for Environmental Information \(noaa.gov\)](#)).

		RELATIVE HUMIDITY (%)																	
		100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15
AIR TEMPERATURE (CELSIUS)	20	21	21	20	20	20	20	20	20	20	20	19	19	19	19	19	19	19	18
	22	23	23	23	22	22	22	22	22	22	22	22	21	21	21	21	21	21	21
	24	25	25	25	25	25	24	24	24	24	24	24	24	24	23	23	23	23	23
	26	28	28	28	28	28	28	27	27	27	26	26	26	26	26	25	25	25	25
	28	36	35	34	33	32	31	31	30	29	29	28	28	28	27	27	27	27	27
	30	44	43	41	39	38	36	35	34	33	32	31	30	30	29	29	28	28	28
	32	54	52	49	47	44	42	40	39	37	36	34	33	32	31	31	30	30	30
	34	66	62	58	55	52	49	47	44	42	40	38	37	35	34	33	33	32	32
	36	78	74	69	65	61	58	54	51	48	46	43	41	39	38	36	35	34	34
	38	92	87	81	76	71	67	63	59	55	52	49	46	43	41	39	38	37	36
	40	108	101	95	88	83	77	72	67	63	59	55	51	48	46	43	41	39	38
	42	125	117	109	102	95	88	82	77	71	66	62	58	54	50	47	45	42	41
	44	143	134	125	116	108	101	94	87	81	75	69	64	60	56	52	48	46	43
	46	163	152	142	132	123	114	106	98	91	84	78	72	66	61	57	53	49	46
	48	184	172	160	149	139	129	119	111	102	94	87	80	73	67	62	57	53	49
	50	206	193	180	168	156	145	134	124	114	105	96	88	81	74	68	62	57	52

Less than 29	No discomfort	Note: The above chart is based on shady conditions, light winds and no physical activity. In direct sunlight the index can go up by almost 10 degrees Celsius, even more with added factors like physical activity, air speed, etc.
30 - 39	Some discomfort	
40 - 45	Great discomfort	
45 - 54	Dangerous	
Above 54	Heat stroke imminent	

The heat index does not account for variables such as direct sunlight and wind speed. Many individuals in the Planning Area must perform activities outside, therefore these variables must be considered. A Wet Bulb Globe Temperature (WBGT) would be utilized to identify and notify when protective measures should be taken for outdoor work ([Heat Forecast Tools \(weather.gov\)](#)). The chart below is an example of the differences between heat index and WBGT.

	WBGT	HEAT INDEX
Measured in the sun	●	●
Measured in the shade	●	●
Uses temperature	●	●
Uses relative humidity	●	●
Uses wind	●	●
Uses cloud cover	●	●
Uses sun angle	●	●

**HOW DOES WBGT differ from HEAT INDEX**

**WET BULB GLOBE TEMPERATURE**  
The Wet Bulb Globe Temperature (WBGT) is a parameter that estimates the effect of temperature, relative humidity, wind, and solar radiation on humans.

**HEAT INDEX**  
The traditional measure of what the temperature feels like to the human body when relative humidity is combined with the air temperature, also known as apparent temperature.

### Previous Occurrences

There has been one previous occurrence of extreme heat between January 2000 and December 2023.

On August 2, 2010, most reporting satellite stations around the state of Arkansas saw temperatures at 100+ degrees Fahrenheit. Heat indices soared for the next few days, seeing 105 to 110 degrees Fahrenheit across Northern Arkansas. Central and Southern areas across the State recorded indices hovering around 115 degrees F. Relief was only brought by a low-pressure system causing severe thunderstorms across the State.

Storm Events Database Excessive Heat 2000-2023:

Number of County/Zone areas affected:	1
Number of Days with Event:	1
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	0
Number of Days with Event and Crop Damage:	0
Number of Event Types reported:	1

[Storm Events Database - Search Results | National Centers for Environmental Information \(noaa.gov\)](#)

## Probability of Future Events

The probability of an extreme heat event occurring in the Planning Area in any given year is less than one percent. The probability of an extreme heat event was estimated using the following formula:

$$\frac{\# \text{ of events}}{\# \text{ of days}} \times 100 = \underline{\hspace{2cm}}$$

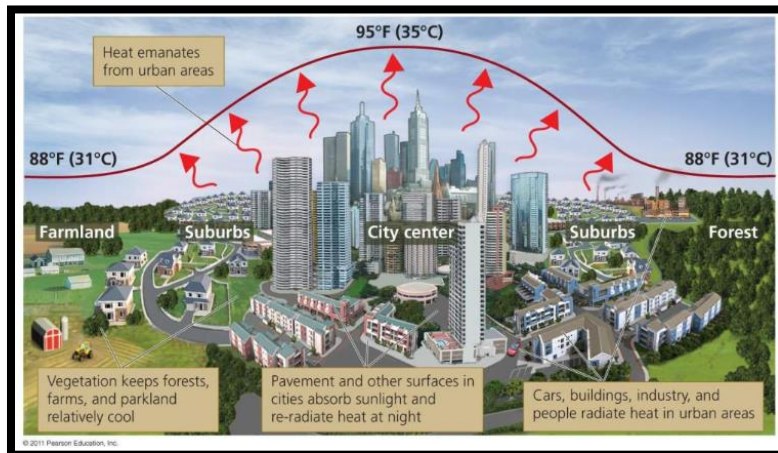
Data collected from 2000-2023 was equal to 8,395 days.

## Vulnerability and Impact of Extreme Heat

The entire Planning Area could be impacted by extreme heat.

The populations vulnerable to an extreme heat event of the unincorporated Johnson County and the municipalities within the County including the Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, Oark-Jasper School District, Westside School District along with University of the Ozarks are children under 5 years, the elderly over 65 years, tourists, and those living below the poverty level. For children and elderly, prolonged exposure to temperatures above 100 degrees Fahrenheit can cause significant health-related ailments that include heat stroke and even death. Building structures are not affected by extreme heat. It primarily affects elderly, children, homeless, agriculture, livestock, wildlife, water supply and timber plantations; however, it is important to note that urban areas are typically hotter than the surrounding rural areas. Construction materials such as asphalt absorb and re-emit more heat. This creates an urban heat island effect. Changing the natural landscape of an area destroys its ability to moderate air temperatures. Trees, plants, soil, and water can naturally lower air temperatures thru evaporative cooling ( [Urban Heat Islands | MIT Climate Portal](#) ).

### Urban Heat Island Effect



[urban heat island - Search Images \(bing.com\)](#)



It affects people of all ages, primarily the elderly, children and homeless. All agriculture crops, livestock, water supply and timber plantations are vulnerable to extreme heat. Heat exhaustion usually affects people who are working or exercising in a hot environment. No area can be said to be immune from, or any more or less vulnerable to extreme heat. Socioeconomic issues increase the risk of heat exhaustion if access to air conditioning is limited. During heat waves, large cities often open cooling centers to help minimize the risk of large numbers of people succumbing to heat-related illness. Tips for preventing heat-related illness can be found at [Tips for Preventing Heat-Related Illness | Natural Disasters and Severe Weather | CDC](#).

The rural, natural landscape within the Planning Area is less altered than more urbanized areas.

However, rural areas may be vulnerable to extreme heat. The rising temperatures may impact people, the natural environment, wildlife, livestock, and farmland. Extreme heat may result in people, the natural environment, wildlife, livestock, and farmland to increase water usage.

Extreme heat may cause water sources to run short or dry up.

Extreme heat may impact the growth cycle production of many crops. In extreme heat crops may become stressed causing crop production to be altered or fail. Rate of plant growth and development is dependent on the surrounding temperatures. Root development may be altered depending on the amount of moisture in the soil. Pollinators such as bees may be harmed by extreme heat. Dry soil and crops may become prone to drought and wildfire. The economic loss may be felt by the farmer, community or global economy creating a food shortage.

Extreme heat may impact livestock. As temperatures rise livestock will require more water.

During extreme heat water sources may become low or dry up. Heat stress can increase vulnerability to disease, reduce fertility, and reduce milk production. Heat stress is one of the major climate change impacts on domesticated livestock. Livestock is responsible for revenue that exceeds \$140 million in the Planning Area.

During extreme heat the natural environment such as trees and wildlife also compete for water resources. Tree growth may be altered due to the availability of water. Wildlife is at a higher risk of disease. Extreme heat may result in drought and an increase in wildfire. The natural environment may be permanently altered or destroyed.

## **Population**

Population changes in size and spatial distribution may have an impact on extreme heat. The Planning Area has seen a decrease in population. There have been no specific studies performed in the Planning Area to document the impact and extent of population changes. Over the next five years the Planning Team will need to research how population changes and distribution are affecting the Planning Area.

## **Land Use**

Land cover plays a vital role in controlling the amount of heat absorbed/radiated by the environment. Temperatures rise in urban areas due to the concentration of asphalt and other materials while rural areas with larger portions of green space remain cooler. There have been no studies in the Planning Area for land use and its effect on extreme heat. Over the next five years the Planning Team will need to research and document heat mitigation. Heat mitigation involves changing land use to reduce the heat island effect.

## **Climate**

The Planning Area has already experienced rising temperatures and extreme highs. With the expected growth in industry, it will be important for the Planning Team to research, document and mitigate against rising temperatures.

### **4.8.5 Flood**

Flood is defined as an overflowing of a large amount of water beyond its normal confines, especially over what is normally dry land. It can be a partial or complete inundation. The various types of flooding in the Planning Area include riverine flooding, urban flooding, shallow flooding and flash flooding.

Riverine flooding occurs from excessive rainfall in upstream areas that gradually cause rivers and streams to overflow their banks inundating the adjacent floodplains. However, it can also be caused by runoff, snowmelt, or dam release. This type of flooding typically lasts longer than flash flooding or shallow flooding. This type of flooding often causes more damage due to the length of time structures are inundated, the velocity and depth of water and size/force of floating debris.

Urban flooding occurs when heavy rainfall runs off structures, parking lots and streets. It converges in culverts and drainage ways that are often clogged with debris, causing streets to flood and storm sewers to back up.

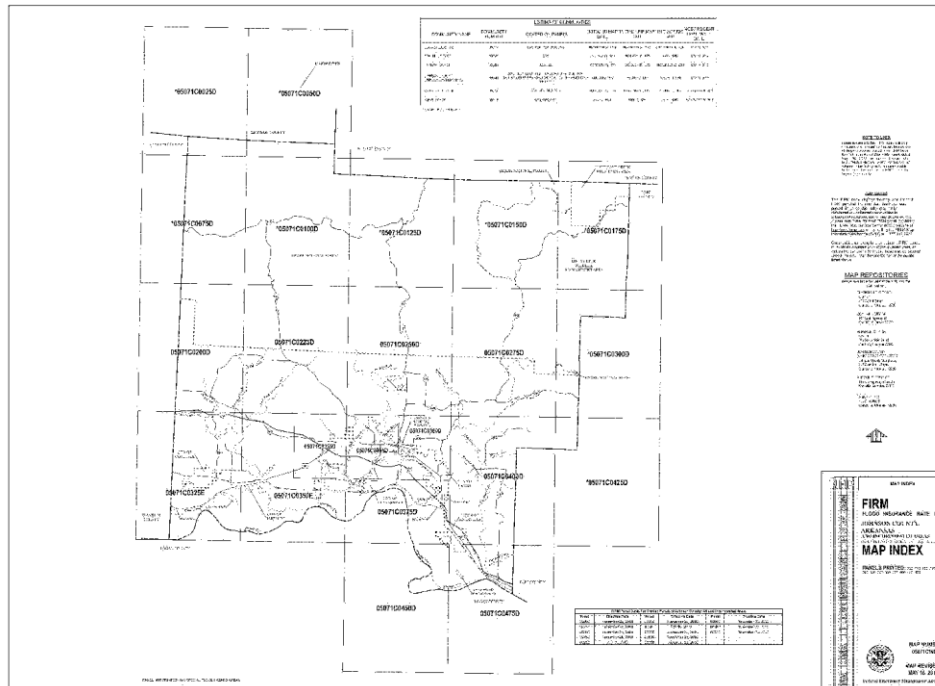
Shallow flooding is defined as flooding with an average depth limited to 3 feet or less where no defined channel exists.

A flash flood is caused by heavy or excessive rainfall in a short period of time, usually less than 6 hours. Flash floods can reach peak flow within a few minutes. They are usually characterized by raging torrents and move with great force and velocity. They can sweep through riverbeds, urban streets, or mountain canyons sweeping everything in their path, rolling boulders, tearing out trees and destroying structures.

Flooding can result in damage to personal property, buildings and infrastructure. In addition to property destruction, flooding can lead to injuries or even fatalities.

## Locations Affected by Flooding

### FIRM Panel Index

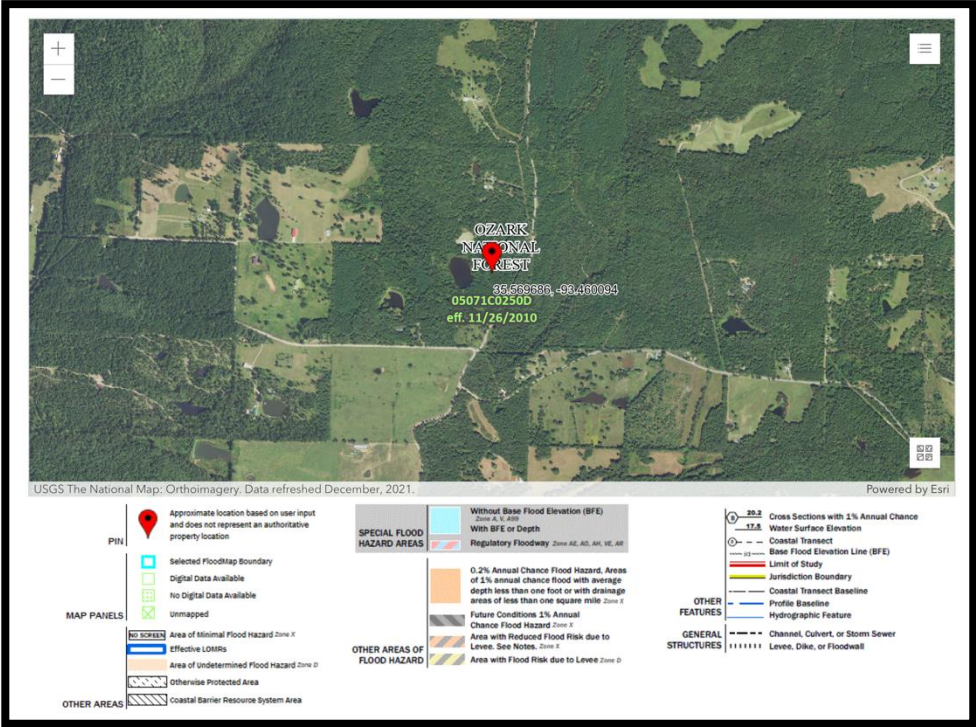


The FIRM Panel index for the planning area and can be found at the following link:  
<https://map1.msc.fema.gov/firm?id=05071CIND0B>.

There are a total of 14 panels that make up the planning area. These panels are located in the appendix of this Hazard Mitigation Plan. Each map contains a quick link below the map.

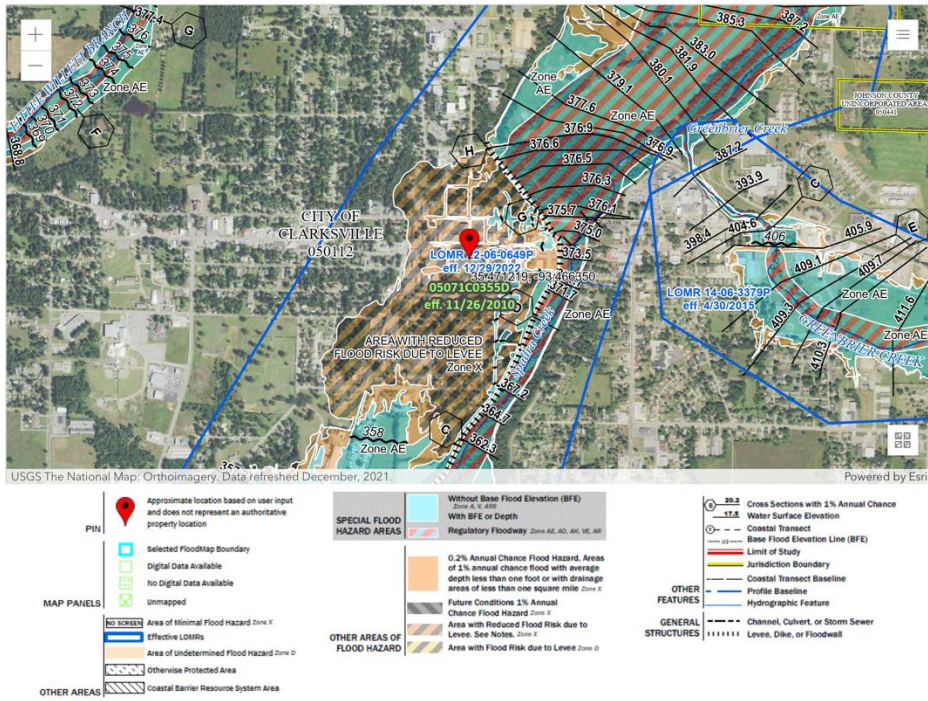
The Flood Insurance Rate Maps (FIRM) inserted below depict the locations of flood zones within each jurisdiction. The entire planning area has potential to be affected by one or more of the flood events described above, even if they are not directly located in a designated flood zone.

# Johnson County Flood Map 05071C0250D Effective 11/26/2010



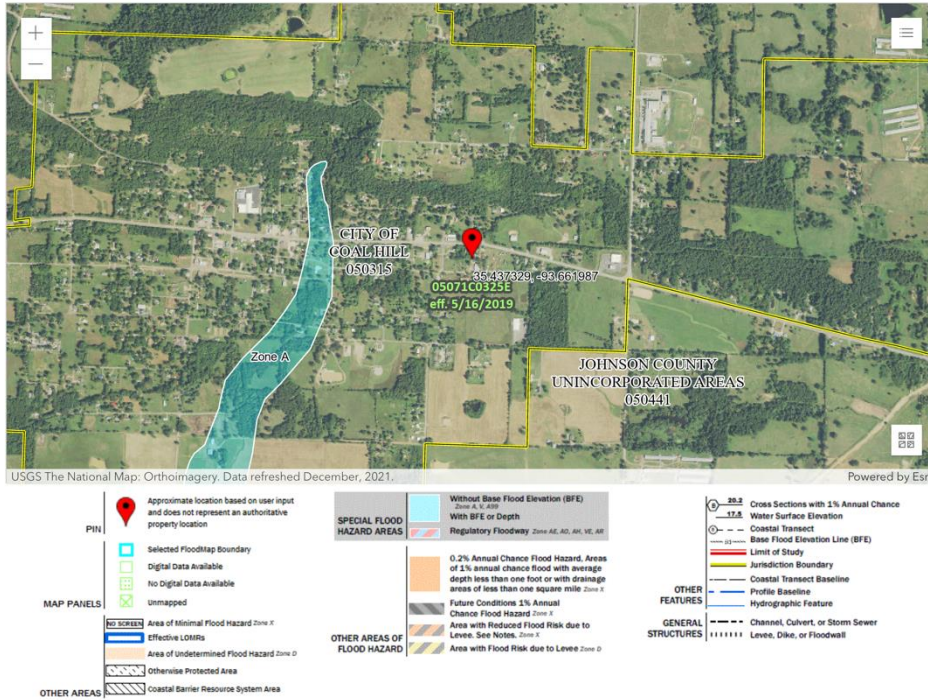
<https://msc.fema.gov/portal/search?AddressQuery=Johnson%20County%20arkansas>

**City of Clarksville Flood Map 05071C0355D Effective 11/26/2010**  
<https://msc.fema.gov/portal/search?AddressQuery=conway county arkansa>



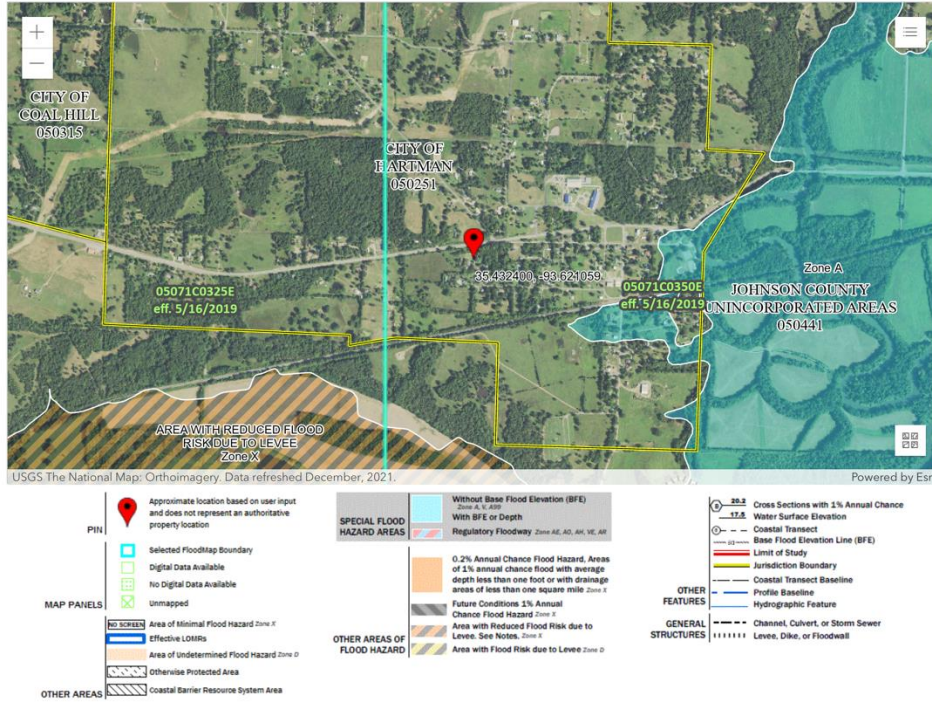
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**City of Coal Hill Flood Map 05071C0325E Effective 5/16/2019**



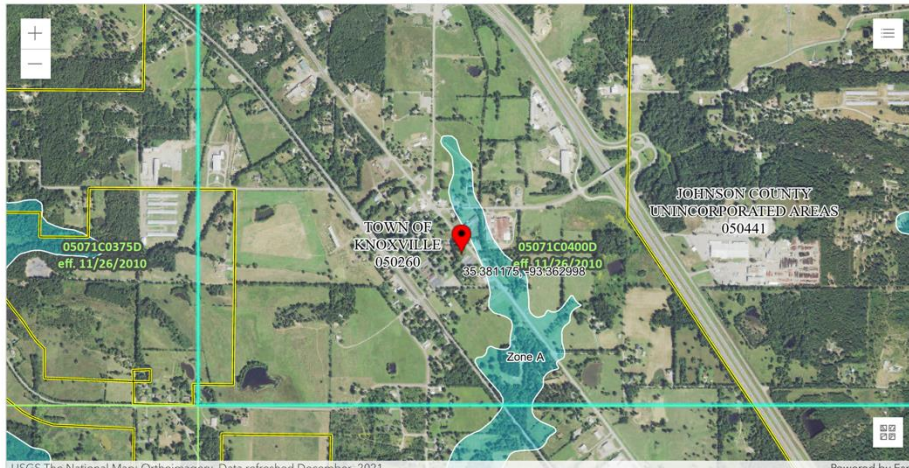
<https://msc.fema.gov/portal/search?AddressQuery=Johnson%20County%20arkansas>

# City of Hartman Flood Map 05071C0350E Effective 5/16/2019



<https://msc.fema.gov/portal/search?AddressQuery=Johnson%20County%20arkansas>

# Town of Knoxville Flood Map 05071C0400D Effective 11/26/2010

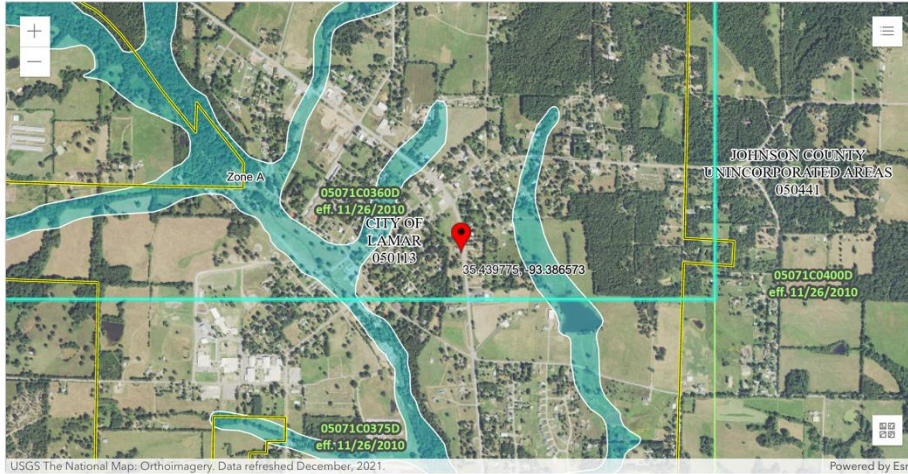


USGS The National Map: Orthoimagery, Data refreshed December, 2021. Powered by Esri

<p><b>PIN</b></p> <ul style="list-style-type: none"> <li> Approximate location based on user input and does not represent an authoritative property location</li> </ul> <p><b>MAP PANELS</b></p> <ul style="list-style-type: none"> <li> Selected Floodmap Boundary</li> <li> Digital Data Available</li> <li> No Digital Data Available</li> <li> Unmapped</li> </ul> <p><b>OTHER AREAS</b></p> <ul style="list-style-type: none"> <li> Area of Minimal Flood Hazard Zone X</li> <li> Effective LOMs</li> <li> Area of Undetermined Flood Hazard Zone D</li> <li> Otherwise Protected Area</li> <li> Coastal Barrier Resource System Area</li> </ul>	<p><b>SPECIAL FLOOD HAZARD AREAS</b></p> <ul style="list-style-type: none"> <li> Without Base Flood Elevation (BFE) Zone A, X, APF</li> <li> With BFE or Depth</li> <li> Regulatory Floodway Zone AE, AE2, AE3, VE, VE2</li> <li> 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X</li> <li> Future Conditions 1% Annual Chance Flood Hazard Zone X</li> <li> Area with Reduced Flood Risk due to Levee. See Notes. Zone X</li> <li> Area with Flood Risk due to Levee Zone D</li> </ul> <p><b>OTHER AREAS OF FLOOD HAZARD</b></p>	<p><b>OTHER</b></p> <ul style="list-style-type: none"> <li> Cross Sections with 1% Annual Chance</li> <li> Water Surface Elevation</li> <li> Coastal Tract</li> <li> Base Flood Elevation Line (BFE)</li> <li> Limit of Study</li> <li> Jurisdiction Boundary</li> <li> Coastal Tract Baseline</li> <li> Profile Baseline</li> <li> Hydrographic Feature</li> </ul> <p><b>GENERAL</b></p> <ul style="list-style-type: none"> <li> Channel, Culvert, or Storm Sewer</li> </ul> <p><b>STRUCTURES</b></p> <ul style="list-style-type: none"> <li> Levee, Dike, or Floodwall</li> </ul>
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<https://msc.fema.gov/portal/search?AddressQuery=Johnson%20County%20arkansas>

# City of Lamar Flood Map 05071C0360D Effective 11/26/2010



USGS The National Map: Orthoimagery, Data refreshed December, 2021.

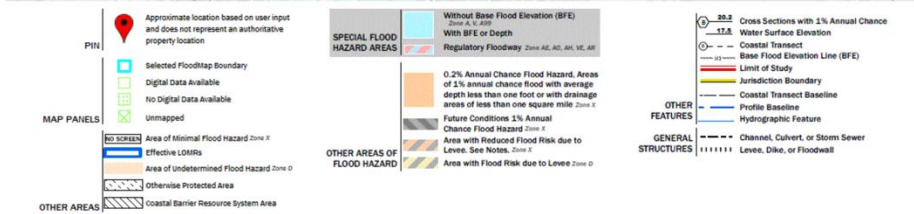
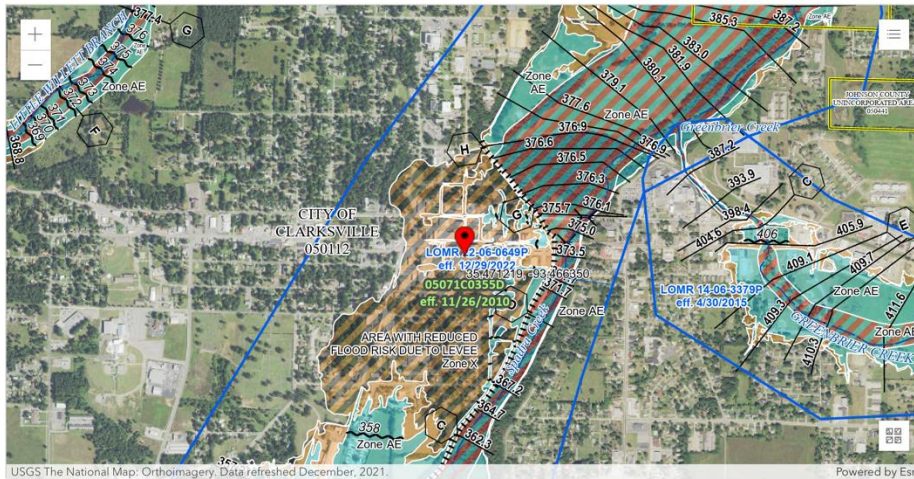
Powered by Esri

<p><b>PHI</b></p> <ul style="list-style-type: none"> <li> Approximate location based on user input and does not represent an authoritative property location</li> </ul> <p><b>MAP PANELS</b></p> <ul style="list-style-type: none"> <li> Selected Floodmap Boundary</li> <li> Digital Data Available</li> <li> No Digital Data Available</li> <li> Unmapped</li> </ul> <p><b>OTHER AREAS</b></p> <ul style="list-style-type: none"> <li> Area of Minimal Flood Hazard Zone X</li> <li> Effective LOMRs</li> <li> Area of Undetermined Flood Hazard Zone D</li> <li> Otherwise Protected Area</li> <li> Coastal Barrier Resource System Area</li> </ul>	<p><b>SPECIAL FLOOD HAZARD AREAS</b></p> <ul style="list-style-type: none"> <li> Without Base Flood Elevation (BFE) Zone A, C, ADP</li> <li> With BFE or Depth</li> <li> Regulatory Floodway Zone AE, AC, AH, VE, AP</li> </ul> <p><b>OTHER AREAS OF FLOOD HAZARD</b></p> <ul style="list-style-type: none"> <li> 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X</li> <li> Future Conditions 1% Annual Chance Flood Hazard Zone X</li> <li> Area with Reduced Flood Risk due to Levee: See Notes, Zone X</li> <li> Area with Flood Risk due to Levee Zone D</li> </ul>	<p><b>OTHER</b></p> <ul style="list-style-type: none"> <li> Cross Sections with 1% Annual Chance</li> <li> Water Surface Elevation</li> <li> Coastal Tract</li> <li> Base Flood Elevation Line (BFE)</li> <li> Limit of Study</li> <li> Jurisdiction Boundary</li> <li> Coastal Tract Baseline</li> <li> Profile Baseline</li> <li> Hydrographic Feature</li> </ul> <p><b>GENERAL STRUCTURES</b></p> <ul style="list-style-type: none"> <li> Channel, Culvert, or Storm Sewer</li> <li> Levee, Dike, or Floodwall</li> </ul>
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<https://msc.fema.gov/portal/search?AddressQuery=Johnson%20County%20arkansas>

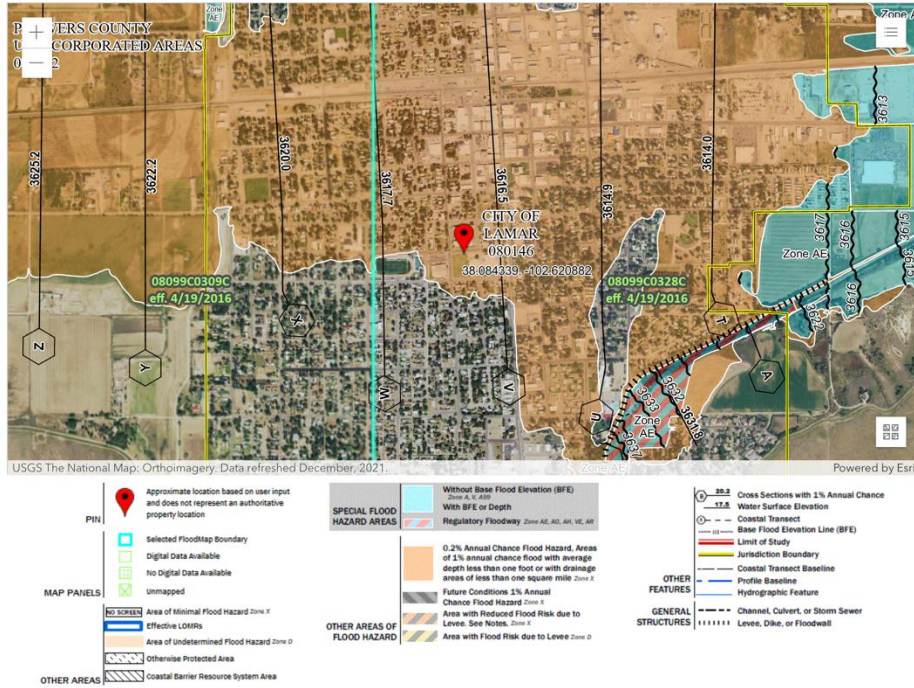


# Clarksville School District Flood Map 05071C0355D Effective 11/26/2010



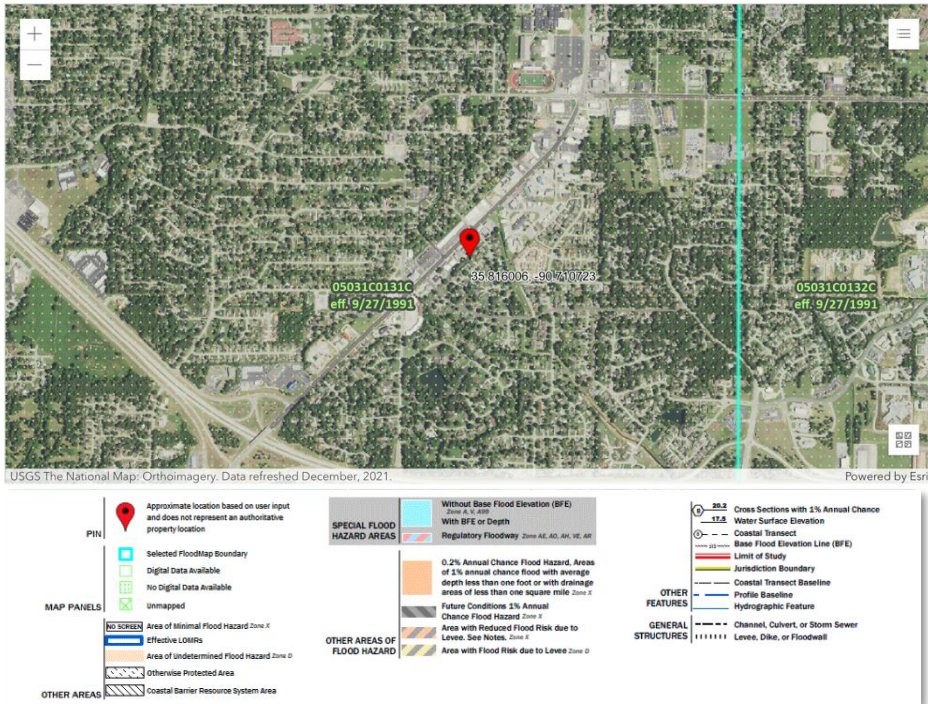
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# Lamar School District Flood Map 08099C0309C Effective 4/19/2016



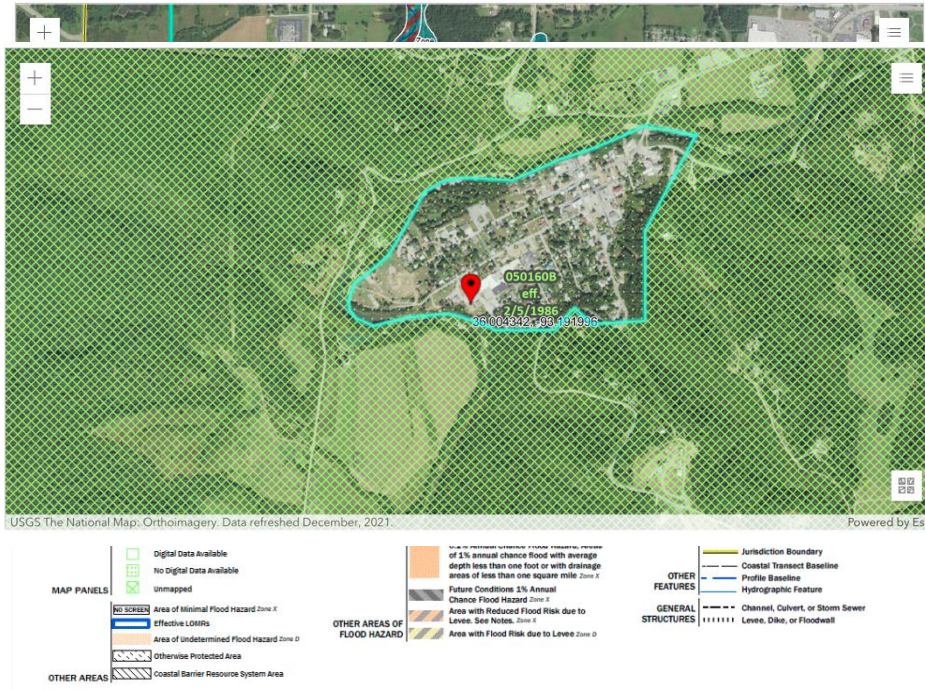
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# Westside School District Flood Map 05031C0131C Effective 9/27/1991



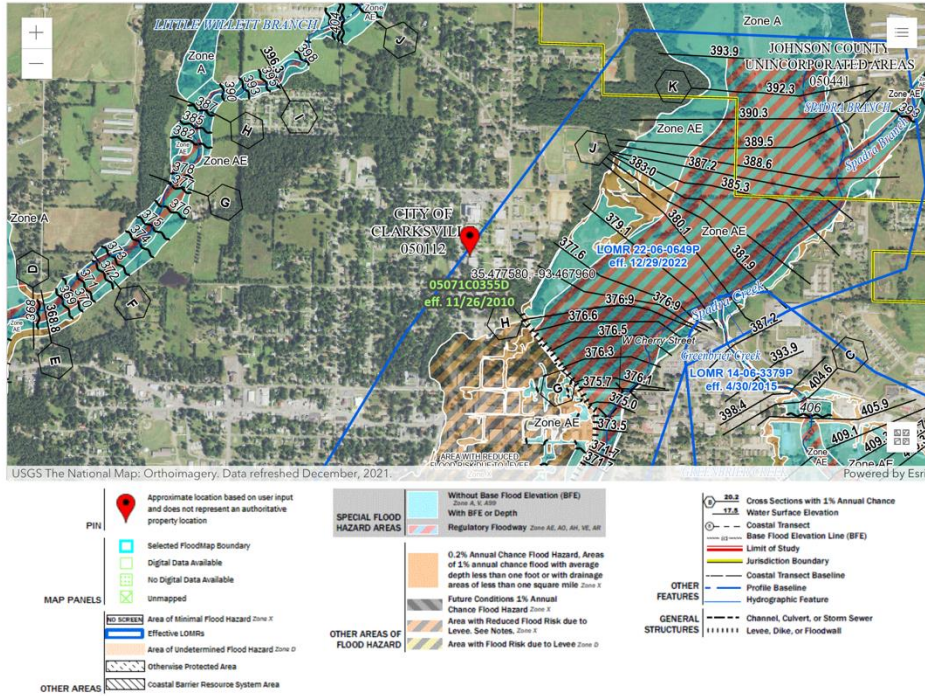
<https://msc.fema.gov/portal/search?AddressQuery=Johnson%20County%20arkansas>

# Oark-Jasper School District Flood Map 050160B Effective 2/5/1986



<https://msc.fema.gov/portal/search?AddressQuery=Johnson%20County%20arkansas>

# University of the Ozarks Flood Map 05029C275D Effective 3/21/2019



<https://msc.fema.gov/portal/search?AddressQuery=Johnson%20County%20arkansas>

## Extent, Magnitude, or Severity of Flood

For flooding, location refers to areas of the planning area that are at the highest risk of flooding frequently. Location is based on FIRM mapping and data from communities in the planning area.

The unincorporated jurisdictions of Johnson County may expect flash flooding events when receiving 3” or more rainfall. Other locations may experience minor to moderate flood events:

The city of Clarksville may expect flash flooding events when receiving 3” or more rainfall. Areas that may expect flooding to occur would be Arkansas State Highways 352 and 103. Johnson County road flooding could affect:

- 3149
- 3151
- 3355
- 3521
- 3341
- 3315
- 3390
- 3329

The city of Coal Hill may expect flash flooding events when receiving 3” or more rainfall.

The city of Hartman can expect flash flooding events when receiving 3” or more of rainfall.

The city of Knoxville may expect flash flooding events when receiving 3” or more rainfall.

The city of Lamar may expect flash flooding events when receiving 3” or more rainfall.

All portions of the Planning Area are expected to receive the same amount of rainfall.

Flood severity categories used by the National Weather Service (NWS) include minor flooding, moderate flooding, and major flooding. Each category has a definition based on property damage and public threat.

Severity	Impact
Minor Flooding	Minimal or no property damage, but possibly some public threat or inconvenience
Moderate Flooding	Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
Major Flooding	Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.

## Previous Occurrences

The planning area suffered 3 flood events between January 1, 2000, and January 31, 2023, resulting in \$525,000 in property losses and \$250,000 in crop losses.

Number of County/Zone areas affected:	1
Number of Days with Event:	3
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	3
Number of Days with Event and Crop Damage:	1
Number of Event Types reported:	1

<u>Location</u>	<u>County/Zone</u>	<u>St.</u>	<u>Date</u>	<u>Time</u>	<u>T.Z.</u>	<u>Type</u>	<u>Mag</u>	<u>Dth</u>	<u>Inj</u>	<u>PrD</u>	<u>CrD</u>
<b>Totals:</b>								0	0	525.00K	250.00K
<a href="#">EDNA</a>	JOHNSON CO.	AR	10/30/2009	06:00	CST-6	Flood		0	0	25.00K	0.00K
<a href="#">OARK</a>	JOHNSON CO.	AR	04/26/2011	02:00	CST-6	Flood		0	0	250.00K	0.00K
<a href="#">OARK</a>	JOHNSON CO.	AR	05/01/2011	00:00	CST-6	Flood		0	0	250.00K	250.00K
<b>Totals:</b>								0	0	525.00K	250.00K

### [NOAA Storm Event Database](#)

On April 26, 2011, flooding damaged property and crops across the State of Arkansas. Water reached aerial flood levels, which remained constant for the next several days from the eastern counties, backed up to the Planning Area. The Mississippi River experiences heavy water flow, backing up the Arkansas and White rivers. This led to farmlands across the State and Counties being underwater for days, ruining crops and property. The total damage from the flood is estimated at \$250,000.

There were 37 flash flood events reported between 01/01/2000 and 12/31/2023.

Number of County/Zone areas affected:	1
Number of Days with Event:	34
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	7
Number of Days with Event and Crop Damage:	0
Number of Event Types reported:	1

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<b>Totals:</b>								0	0	2.337M	0.00K
<a href="#">SALUS</a>	JOHNSON CO.	AR	05/27/2000	03:00	CST	Flash Flood		0	0	0.00K	0.00K
<a href="#">COUNTYWIDE</a>	JOHNSON CO.	AR	06/17/2000	10:00	CST	Flash Flood		0	0	0.00K	0.00K
<a href="#">OARK</a>	JOHNSON CO.	AR	06/17/2000	12:15	CST	Flash Flood		0	0	0.00K	0.00K
<a href="#">COAL HILL</a>	JOHNSON CO.	AR	06/21/2000	07:05	CST	Flash Flood		0	0	0.00K	0.00K
<a href="#">COUNTYWIDE</a>	JOHNSON CO.	AR	12/16/2001	13:30	CST	Flash Flood		0	0	0.00K	0.00K
<a href="#">COUNTYWIDE</a>	JOHNSON CO.	AR	01/31/2002	10:15	CST	Flash Flood		0	0	0.00K	0.00K
<a href="#">COUNTYWIDE</a>	JOHNSON CO.	AR	03/19/2002	07:00	CST	Flash Flood		0	0	0.00K	0.00K
<a href="#">WEST PORTION</a>	JOHNSON CO.	AR	04/23/2004	04:45	CST	Flash Flood		0	0	0.00K	0.00K
<a href="#">COUNTYWIDE</a>	JOHNSON CO.	AR	04/24/2004	05:00	CST	Flash Flood		0	0	0.00K	0.00K
<a href="#">HARTMAN</a>	JOHNSON CO.	AR	06/15/2004	13:00	CST	Flash Flood		0	0	0.00K	0.00K
<a href="#">CLARKSVILLE</a>	JOHNSON CO.	AR	07/01/2004	18:15	CST	Flash Flood		0	0	0.00K	0.00K
<a href="#">COUNTYWIDE</a>	JOHNSON CO.	AR	07/03/2004	04:00	CST	Flash Flood		0	0	0.00K	0.00K
<a href="#">LUDWIG</a>	JOHNSON CO.	AR	09/24/2004	15:30	CST	Flash Flood		0	0	0.00K	0.00K
<a href="#">COUNTYWIDE</a>	JOHNSON CO.	AR	01/12/2005	22:45	CST	Flash Flood		0	0	0.00K	0.00K
<a href="#">CLARKSVILLE</a>	JOHNSON CO.	AR	08/20/2006	16:00	CST	Flash Flood		0	0	0.00K	0.00K
<a href="#">EDNA</a>	JOHNSON CO.	AR	10/16/2006	06:30	CST-6	Flash Flood		0	0	0.00K	0.00K
<a href="#">KNOXVILLE</a>	JOHNSON CO.	AR	05/15/2007	13:30	CST-6	Flash Flood		0	0	0.00K	0.00K
<a href="#">COAL HILL</a>	JOHNSON CO.	AR	03/18/2008	13:30	CST-6	Flash Flood		0	0	100.00K	0.00K
<a href="#">YALE</a>	JOHNSON CO.	AR	04/10/2008	07:30	CST-6	Flash Flood		0	0	0.00K	0.00K
<a href="#">JAMESTOWN</a>	JOHNSON CO.	AR	06/13/2008	22:15	CST-6	Flash Flood		0	0	0.00K	0.00K
<a href="#">OARK</a>	JOHNSON CO.	AR	10/29/2009	17:44	CST-6	Flash Flood		0	0	2.000M	0.00K
<a href="#">WHITE OAK</a>	JOHNSON CO.	AR	09/07/2010	11:23	CST-6	Flash Flood		0	0	15.00K	0.00K
<a href="#">CLARKSVILLE</a>	JOHNSON CO.	AR	09/09/2010	14:25	CST-6	Flash Flood		0	0	100.00K	0.00K
<a href="#">KNOXVILLE</a>	JOHNSON CO.	AR	07/23/2014	14:52	CST-6	Flash Flood		0	0	20.00K	0.00K
<a href="#">CLARKSVILLE MUNI ARP</a>	JOHNSON CO.	AR	05/10/2015	01:00	CST-6	Flash Flood		0	0	0.00K	0.00K
<a href="#">HUNT</a>	JOHNSON CO.	AR	05/10/2015	01:00	CST-6	Flash Flood		0	0	100.00K	0.00K
<a href="#">ZADOCK</a>	JOHNSON CO.	AR	12/27/2015	17:27	CST-6	Flash Flood		0	0	0.00K	0.00K
<a href="#">CLARKSVILLE</a>	JOHNSON CO.	AR	08/15/2017	05:20	CST-6	Flash Flood		0	0	0.00K	0.00K
<a href="#">LAMAR</a>	JOHNSON CO.	AR	08/19/2018	18:52	CST-6	Flash Flood		0	0	0.00K	0.00K
<a href="#">CLARKSVILLE</a>	JOHNSON CO.	AR	05/03/2019	18:15	CST-6	Flash Flood		0	0	0.00K	0.00K
<a href="#">KNOXVILLE</a>	JOHNSON CO.	AR	06/05/2019	15:05	CST-6	Flash Flood		0	0	0.00K	0.00K



<a href="#">OZONE</a>	JOHNSON CO.	AR	06/23/2019	06:40	CST-6	Flash Flood		0	0	0.00K	0.00K
<a href="#">CLARKSVILLE</a>	JOHNSON CO.	AR	09/24/2019	07:30	CST-6	Flash Flood		0	0	0.00K	0.00K
<a href="#">CLARKSVILLE</a>	JOHNSON CO.	AR	04/29/2021	05:00	CST-6	Flash Flood		0	0	0.00K	0.00K
<a href="#">HICKEYTOWN</a>	JOHNSON CO.	AR	04/29/2021	11:11	CST-6	Flash Flood		0	0	0.00K	0.00K
<a href="#">CLARKSVILLE MUNI ARP</a>	JOHNSON CO.	AR	11/04/2022	21:08	CST-6	Flash Flood		0	0	2.00K	0.00K
<a href="#">CLARKSVILLE</a>	JOHNSON CO.	AR	03/24/2023	15:44	CST-6	Flash Flood		0	0	0.00K	0.00K
<b>Totals:</b>								0	0	2.337M	0.00K

### [NOAA Storm Event Database](#)

September 9, 2010, there was widespread flooding in Arkansas. The flooding was caused by large amounts of rain from days prior due to Tropical Storm Hermine. This caused high water to flow downstream and led to backwater flooding from rivers and large creeks/bayous. Many county roads in Clarksville were flooding, halting traffic due to moving water speeds. Water damage to one house occurred along Arkansas Highway 352 near Horsehead Creek. All of the Planning Area experienced heavy rainfall and damage caused from this storm is approximated at \$100,000.

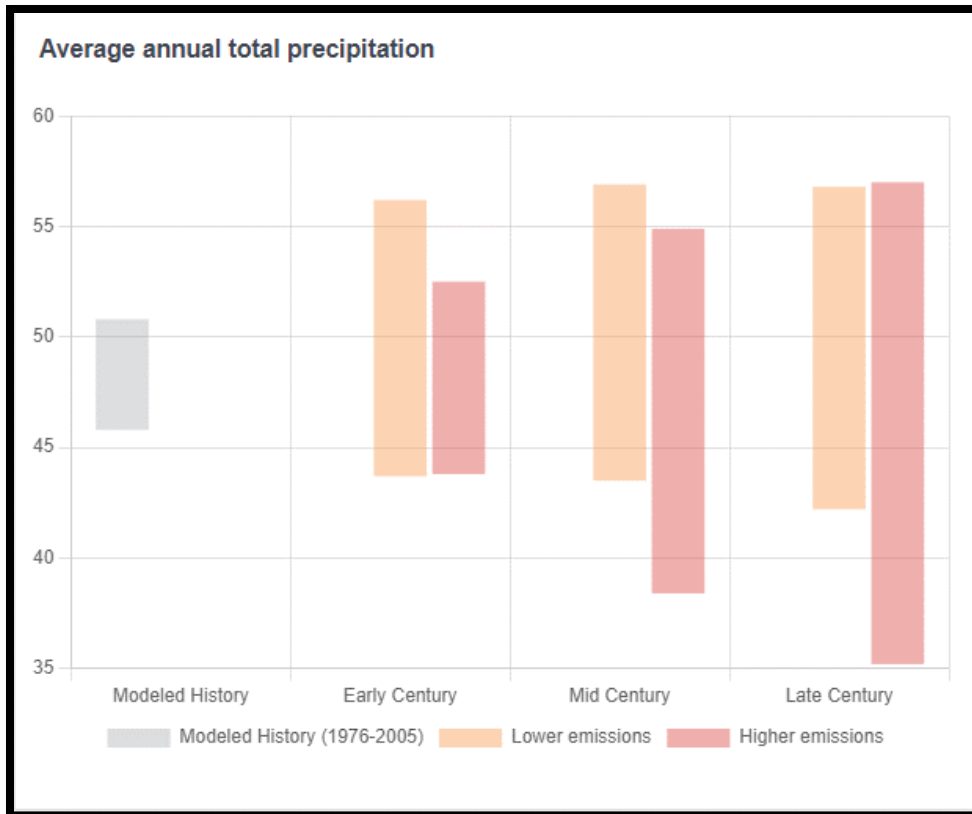
May 10, 2015, the Planning Area experienced several rounds of rainfall, showers, and thunderstorms. The large amounts of moisture and humidity kept the roads wet, and many instances of flash flooding occurred. Within the county, several roads were washed out due to flooding, creating difficult escape routes. In Hunt, Arkansas, two water rescues were performed overnight at homes that had been isolated due to flash flooding. Estimated damage from the storm: \$100,000.

### Probability of Future Flood Events

Future Climate Indicators							
Indicator	Modeled History (1976 - 2005)	Early Century (2015 - 2044)		Mid Century (2035 - 2064)		Late Century (2070 - 2099)	
		Lower Emissions Min - Max	Higher Emissions Min - Max	Lower Emissions Min - Max	Higher Emissions Min - Max	Lower Emissions Min - Max	Higher Emissions Min - Max
<b>Precipitation:</b>							
Annual average total precipitation	48" 46 - 51	49" 44 - 56	49" 44 - 52	49" 44 - 57	49" 38 - 55	49" 42 - 57	49" 35 - 57
Days per year with precipitation (wet days)	163 days 156 - 170	159 days 146 - 170	158 days 132 - 168	158 days 142 - 170	156 days 122 - 174	157 days 140 - 171	152 days 110 - 175
Maximum period of consecutive wet days	12 days 10 - 13	12 days 10 - 15	12 days 9 - 15	12 days 9 - 16	12 days 9 - 15	12 days 9 - 15	12 days 9 - 14
<b>Annual days with:</b>							
Annual days with total precipitation > 1 inch	9 days 8 - 10	9 days 8 - 11	10 days 8 - 12	10 days 8 - 12	10 days 7 - 12	10 days 8 - 12	10 days 7 - 14
Annual days with total precipitation > 2 inches	1 days 1 - 1	1 days 1 - 2	1 days 1 - 2	1 days 1 - 2	1 days 1 - 2	1 days 1 - 2	2 days 1 - 3
Annual days with total precipitation > 3 inches	0 days 0 - 0	0 days 0 - 0	0 days 0 - 0	0 days 0 - 1	0 days 0 - 1	0 days 0 - 1	0 days 0 - 1
Annual days that exceed 99th percentile precipitation	7 days 7 - 7	7 days 7 - 8	8 days 8 - 9	8 days 8 - 8	9 days 8 - 9	8 days 8 - 9	9 days 9 - 10
Days with maximum temperature below 32 °F	4 days 3 - 5	2 days 1 - 4	2 days 1 - 3	2 days 0 - 4	1 days 0 - 3	1 days 0 - 3	0 days 0 - 2

N/A = Data Not Available for the selected area

Climate Projections for	Early Century (2015–2044) ↕	Lower emissions	Higher emissions
Average annual total precipitation	48.8 Inches + 0.5 since 1976-2005	49.0 Inches + 0.7 since 1976-2005	
Days per year with precipitation (wet days)	159.0 Days - 3.6 since 1976-2005	158.1 Days - 4.5 since 1976-2005	
Maximum number of consecutive wet days	12.0 Days + 0.3 since 1976-2005	11.8 Days + 0.1 since 1976-2005	
Annual days with total precipitation > 1 inch	9.5 Days + 0.4 since 1976-2005	9.8 Days + 0.8 since 1976-2005	
Annual days with total precipitation > 2 inches	1.1 Days + 0.2 since 1976-2005	1.2 Days + 0.2 since 1976-2005	
Annual days with total precipitation > 3 inches	0.2 Days No change since 1976-2005	0.3 Days + 0.1 since 1976-2005	
Annual days that exceed 99th percentile precipitation	7.4 Days + 0.6 since 1976-2005	8.1 Days + 1.2 since 1976-2005	



[CMRA - Climate Mapping For Resilience and Adaptation \(arcgis.com\)](http://arcgis.com)

Climate mapping trends do not show a significant change in precipitation and how it relates to flooding. There is a slight increase in annual average total precipitation with a slight decrease in wet days per year. Data for the annual days with total precipitation for less than 1 inch, less than 2 inches, and less than 3 inches remains consistent with no trending changes.

The probability for a flood event occurring in the Planning Area in any given year is less than one percent. The probability for a flood event was estimated using the following formula:

$$\frac{\# \text{ of events}}{\# \text{ of days}} \times 100 = \underline{\hspace{2cm}}$$

Data collected from 2000-2023 was equal to 8,395 days.

### **Vulnerability and Impact of Flood**

Unincorporated areas of Johnson County such as Interstate-40, Ridgewood Dr, Harmony Road, Cherry Street, Taylor Road and others may be closed during flood events. Many roads in Johnson County are unpaved. These unpaved roads are susceptible to a great deal of damage during flooding events that may go unnoticed until the water recedes. Residents may experience a much longer drive time to avoid the closed roads.

In regard to the Clarksville School District, Lamar School District, and Westside School District according to the FIRM maps that are located in this plan and available through the FEMA mapping services, none of the schools physically sit within a flood zone. However, disruptions can still occur because road may be blocked, or the homes of student and staff could be affected in the event flooding or flash flooding was to occur.

A major concern in most areas of the county is the impact of flooding on crops, livestock, and timber plantations. During flood events, fields may wash out and crops lost. Farmers will suffer economically from the loss of crops and livestock forage. Timber plantations may become stressed or die out after being submerged during extended flood events. Flood water may drown livestock or cut off their access to feed and forage.

### **City of Clarksville**

Flooding may disrupt roadways resulting in transportation problems. This can cause economic losses for citizens but also companies located in this area. When goods or services are unable to be performed revenue will be lost. Transportation delays can also cause other issues especially during an emergency. According to the firm maps there are many streets that could be impacted by flood waters.

### **Unincorporated areas of Johnson County, Cities of Coal Hill, Hartman, Knoxville and Lamar**

All populations located in these areas could be at risk of death or injury due to flooding. There have been a few instances in the past where rescue operations for residents trapped in homes have been carried out. Many county roads and culverts were out resulting in repair expenses but

also leaving people stranded in their homes or away from their homes depending on where they are in the flooding occurs.

### **Clarksville School District, Lamar School District, and Westside School District**

According to the FIRM maps there does not appear to be a direct threat of flooding to the school campuses and property however this does not mean that disruption may not occur to the services that the school depends on but also perform for the areas that they service. Roads being inundated and or washed out could possibly disrupt school but also what staff and students are able to make it to the campus depending on where they reside.

In all the above jurisdictions, flood waters could interrupt gas, electricity and water services and contaminate the water supply, making drinkable water unavailable. Homes, personal belongings and businesses could be damaged or lost entirely as a result of ravages of flooding. Residents and homeowners who do not have flood insurance are vulnerable. They could suffer a great financial hardship from the expenses of clean up and rebuilding in the event of a flood.

### **Economic**

Residential loss or damage. Businesses also suffer, not only from the loss of property, but the lack of customers during the flood and recovery. Farmers suffer from the loss of their crops.

### **Financial**

Residents who do not carry flood insurance suffer a great financial hardship. Those who do have insurance get help with the clean-up, but some costs may still come out of pocket. Towns and cities impacted by a flood carry the financial burden of fixing the public buildings, roads and other structures damaged by the flood waters. People who are impacted by the flood may also lose wages because the business they work for suffered damages or they are unable to get to work.

### **Health**

Flood waters can also damage the health of those living and working in the area. Because flood waters can wash dangerous waste into water supplies, tap water may become unsafe to use if the local authorities do not issue a boil advisory warning everyone to boil water before ingesting it. Mold is also likely to grow in homes and other buildings engulfed by the flood waters. It is important to search all homes for mold and remove it completely before moving back in. Breathing the mold spores is dangerous for your health. A flood can also contribute to other health problems from human waste contaminating the ground.

### **Safety**

Once flooding begins, strong currents can pull a grown man beneath the water to drown. Once the flood waters have settled, it is still unsafe to wander through the water by car or on

foot. Deep spots may be undetectable and there may be electric currents running through the water.

## **Rural Impact**

Floods damage farmland by burying crops in silt, uprooting crops by the force of the water or drowning crops. Flood waters can drown livestock as well. Flooding devastates wetlands and other wildlife habitats by depositing massive amounts of silt or leaving behind toxic substances such as petroleum products, fertilizers and pesticides and other man-made chemicals. This can kill animals and lead to water and land pollution.

## **Disease**

Flooding increases human exposure to dysentery and other diseases. Flooded sewage treatment plants contaminate drinking water supply.

## **Population**

Population may have an impact on flood events when there is a shift in population size and composition. Population growth and urbanization alter the natural landscape. This results in loss/addition of natural landscaping such as trees, grass, and rock. Building structures to accommodate growth influences climate and the natural path of water flow. Population growth/density will place a larger number of people at risk for injury or death. The shift could create limited escape routes. Rising populations could mean that more people are vulnerable to a flood event. Population growth will increase the need for mitigation measures to protect people, property, resources, and the natural environment.

The Planning Area is currently trending a slight increase in population. There have been no research studies on population and flood risk for the Planning Area. Over the next five years the Planning Team will need to research and document the shift in population and its effect if any on flood events.

## **Land Use**

Changes in land cover such as urbanization, deforestation and cultivation may result in increased flood frequency and severity. Urbanization may result in a lack of the natural environments capacity to absorb water. Loss of vegetation and forest clearing disrupts the natural environments process of evaporating water from both the soil and leaves of plants.

Flooding results in poor soil aeration, leading to poor plant growth. Soil becomes more acidic following a flood. In addition, flooding can lead to soil erosion or soil contamination from such man-made pollutants as oils (on roadways), fertilizers (in yards and farms) and paints.

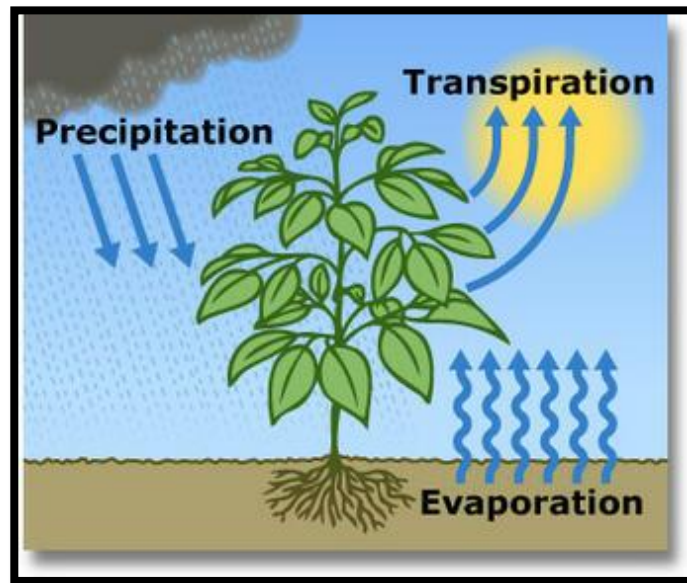
Flooding can severely stress or even kill trees, depending on how deeply or how long they remain submerged. Floods kill trees that are completely covered by water and seedlings pushed

over by the force of the water or buried under silt. Prolonged flooding can cause root rot, leading to tree death. Prior tree health plays a role in whether the trees survive after flooding.

Currently there is no documented research for the Planning Area on land use and its effect on flood events. Over the next five years the Planning Team will need to conduct and document research on the effects of land use and flood events in the Planning Area.

## Climate

Climate change may have an impact on flooding. Changes in temperatures impact the frequency and severity of flood events. Warmer temperatures could cause increased amounts of precipitation. The Planning Area is currently trending both higher temperatures and more days each year of extreme heat. These warmer temperatures, in addition to population distribution and land use, affect the amounts of water evaporating from the land. This process called evapotranspiration, impacts atmospheric temperature changes. Higher rates of evapotranspiration can have a cooling effect on the lands surface and aid the natural environment's ability to filter water.



<https://www.usgs.gov/special-topics/water-science-school/science/evapotranspiration-and-water-cycle>

The Planning Area does not have any documented research on climate change and its effects on flooding. Over the next five years the Planning Team will need to research and document climate changes and its effect on frequency and size of flood events.

## Repetitive Loss

Repetitive loss information was provided by Whit Montague, Arkansas Natural Resources. No personal identifiable information will be presented. Information is as of 5/31/2024. There are no repetitive loss properties in the Planning Area.

## Vulnerability of Estimating Potential Loss

The entire Planning Area is vulnerable to one or more types of flood events. Loss of life and injuries are possible. Expect damage to residential and business structures, transportation systems, disruption of utility services, and major environmental damage.

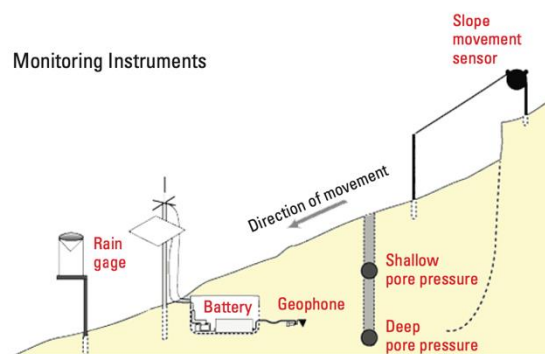
### 4.8.6 Landslide

“Landslide” is used to describe the downward and outward movement of slope-forming materials reacting under the force of gravity. Landslides are classified by type of movement and type of materials. The types of movement are:

- Slides of soil or rock involve downward displacement along one or more failure surfaces. The material from the slide may be broken into several pieces or remain a single, intact mass.
- Flows are characterized by shear distributed throughout the mass of material.
- Lateral Spreads are large elements of distributed, lateral displacement of materials characterize lateral spreads.
- Falls and topples occur when masses of rock or other material detach from a steep slope or cliff, and descend by free fall, rolling, or bouncing.

### Extent, Magnitude or Severity of Landslide

Landslide movement is measuring using an extensometer. This is an instrument that can detect movement of the ground surface between stable ground and sliding ground. Mapping and observations are other ways of detecting landslide activity.

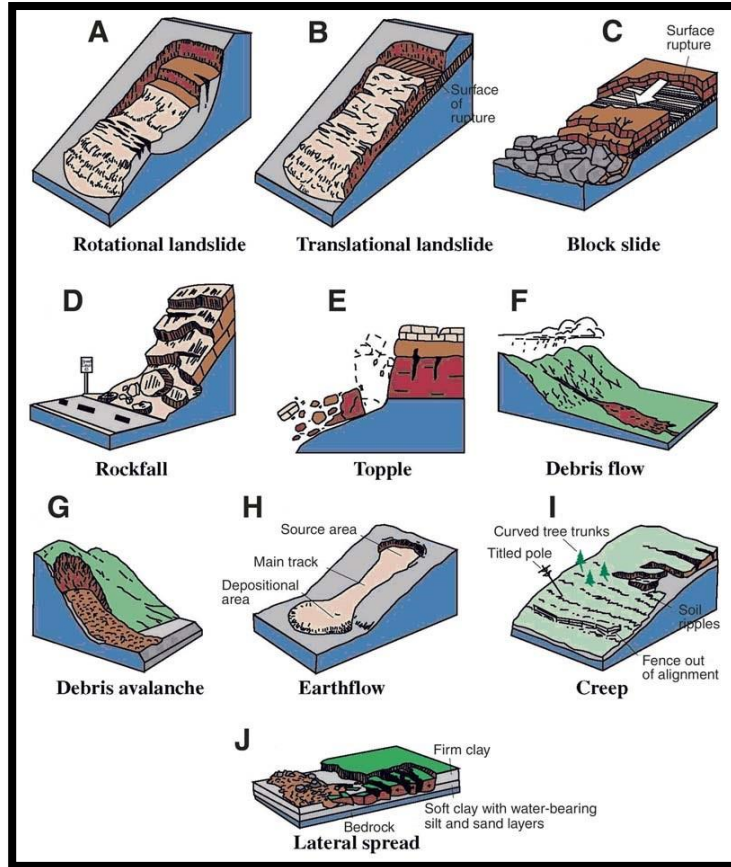


**Figure B10.** Example of a network for measurement and transmission of real-time landslide data. (Schematic from U.S. Geological Survey.)

As can be seen in the figure below, slope movement can occur in multiple ways. They typically start on steep hillsides. Landslides may occur with or without warning and travel up to 35 mph. Historically, landslides have been responsible for moving up to 1,000 tons of rock, dirt, and debris.

If a landslide were to occur, it is expected that a rock fall, topple, or slide would occur unexpectedly in a matter of seconds with no warning time.

### Examples of different types of landslide movement



(modified from Cruden and Varnes, 1996)



## Previous Occurrences

Zero (0) landslide events were reported between 1/01/2000 and 1/30/2024.

Number of County/Zone areas affected:	0
Number of Days with Event:	0
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	0
Number of Days with Event and Crop Damage:	0
Number of Event Types reported:	0

<u>Location</u>	<u>County/Zone</u>	<u>St.</u>	<u>Date</u>	<u>Time</u>	<u>T.Z.</u>	<u>Type</u>	<u>Mag</u>	<u>Dth</u>	<u>Inj</u>	<u>PrD</u>	<u>CrD</u>
<b>Totals:</b>								0	0	0.00K	0.00K

[NCDC NOAA Storm Events](#)

## Probability of Future Landslides

The probability for a landslide event occurring in the Planning Area in any given year is less than one percent. The probability for a landslide event was estimated using the following formula:

$$\frac{\# \text{ of events}}{\# \text{ of days}} \times 100 = \underline{\hspace{2cm}}$$

Data collected from 2000-2023 was equal to 8,395 days.

## Vulnerability and Impact of Landslides

Based on historical records, the Planning Area has not seen a landslide within the years of 2000-2023. There is little information regarding any landslide information within the Planning Area; however, this does not mean landslides would be impossible to occur in Johnson County. If a landslide event occurred on a State Highway, truckloads of mud, topsoil, and fallen trees would impede travel. Individuals caught on a highway would be exposed to the possibility of vehicular accidents resulting in fatalities or injuries. Damages to property and crops are both possible effects from landslide events.

The following districts are vulnerable to landslides: unincorporated Johnson County and the municipalities within the County including the Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, Oark-Jasper School District, Westside School District along with University of the Ozarks.

The most vulnerable populations will be those who are unable to move out of harm's way due to disability, age, or poverty levels. Since landslides typically happen suddenly and without notice, these are the populations most likely to have inadequate abilities and resources.

### **Population, Land Use, and Climate**

Population density influences both the natural landscape and climate.

As people build, they remove rock, dirt, trees, and grass. They build structures for homes, businesses, and infrastructure. Areas that were once full of trees become prime real estate or farmland to meet increased food demands. These changes in structure, weight and landscape alter the vulnerability and impact of a landslide. The human-made changes in topography and vegetation impact the earth's natural balance. Cutting roads, building retaining walls, adding concrete, or clearing vegetation for farmland may weaken slopes. According to research by the American Geophysical Union in 2021, urban areas are at a greater risk for precipitation-triggered landslides than rural areas.

As population dynamics and climate patterns undergo transformation, their combined impact and associated vulnerabilities also evolve. A growing population necessitates the construction of additional infrastructure, thereby heightening the likelihood of resource depletion, property damage, and loss of life in the face of adverse events. The shifting demographic and climatic landscape highlight the need for comprehensive analysis by the planning team.

Currently, the Planning Area lacks documented research concerning the effects of population, land use, and climate change, on landslide events. These impacts will be monitored by the planning team over the next 5 years to continue research for nature-based solutions to mitigate all possibilities of potential increased impact.

#### **4.8.7 Thunderstorm**

**Thunderstorms** are formed from a combination of moisture, rapidly rising warm air and a force capable of lifting air such as a warm or cold fronts.

Thunderstorms can bring heavy rains, strong winds, hail, lightning, and tornadoes.

**Lightning** is an electrical discharge resulting from the buildup of positive and negative charges within a thunderstorm.

**Hail** - Hail is a form of precipitation occurring when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into balls of ice. Hail can damage aircraft, homes and cars, and can be deadly to livestock and people.

**Strong Winds** - also referred to as straight-line wind, is any wind that is not associated with rotation. This term is used mainly to differentiate thunderstorm winds from tornado winds. High winds originate as a downdraft of rain-cooled air, which reaches the ground and spreads out rapidly. This can produce a potentially damaging gust of wind up to and sometimes over 100 mph. In recent years, there have been several occasions in Arkansas where winds greater than 100 mph have been measured. Winds of 58 mph (50 knots) or more are considered severe. The horizontal component of near-surface wind phenomena is the most significant aspect of the hazard.






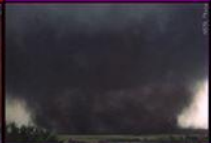


#### **Extent, Magnitude, or Severity**

All plan participants experience thunderstorms, lightning, strong winds and hail events. All parts of the planning area are equally subject to thunderstorms ranging from marginal to high risk.

#### **Location of Thunderstorm, Lightning, Strong Winds, and Hail Events**

Thunderstorm, lightning, strong winds and hail events do not have any geographical boundaries in the Planning Area. The entire planning area is capable of experiencing thunderstorm, lightning, strong winds and hail events.

# Understanding Severe Thunderstorm Risk Categories

THUNDERSTORMS (no label)	1 - MARGINAL (MRGL)	2 - SLIGHT (SLGT)	3 - ENHANCED (ENH)	4 - MODERATE (MDT)	5 - HIGH (HIGH)
No severe* thunderstorms expected	Isolated severe thunderstorms possible	Scattered severe storms possible	Numerous severe storms possible	Widespread severe storms likely	Widespread severe storms expected
Lightning/flooding threats exist with <u>all</u> thunderstorms	Limited in duration and/or coverage and/or intensity	Short-lived and/or not widespread, isolated intense storms possible	More persistent and/or widespread, a few intense	Long-lived, widespread and intense	Long-lived, very widespread and particularly intense
					
<ul style="list-style-type: none"> <li>• Winds to 40 mph</li> <li>• Small hail</li> </ul>	<ul style="list-style-type: none"> <li>• Winds 40-60 mph</li> <li>• Hail up to 1"</li> <li>• Low tornado risk</li> </ul>	<ul style="list-style-type: none"> <li>• One or two tornadoes</li> <li>• Reports of strong winds/wind damage</li> <li>• Hail ~1", isolated 2"</li> </ul>	<ul style="list-style-type: none"> <li>• A few tornadoes</li> <li>• Several reports of wind damage</li> <li>• Damaging hail, 1 - 2"</li> </ul>	<ul style="list-style-type: none"> <li>• Strong tornadoes</li> <li>• Widespread wind damage</li> <li>• Destructive hail, 2" +</li> </ul>	<ul style="list-style-type: none"> <li>• Tornado outbreak</li> <li>• Derecho</li> </ul>
<small>* NWS defines a severe thunderstorm as measured wind gusts to at least 58 mph, and/or hail to at least one inch in diameter, and/or a tornado. All thunderstorm categories imply lightning and the potential for flooding. Categories are also tied to the probability of a severe weather event within 25 miles of your location.</small>					
		<b>National Weather Service</b> <a href="http://www.spc.noaa.gov">www.spc.noaa.gov</a>			

Damage from severe thunderstorm winds account for half of all severe reports in the lower 48 states and is more common than damage from tornadoes. Wind speeds can reach up to 100 mph and can produce a damage path extending for hundreds of miles.

## Previous Occurrences

Event	Events	Fatalities	Injuries	Property Damage/Crop Damage	Total Loss
Thunderstorm winds	163	0	0	37	\$1,597,000.00
Strong Winds	6	0	0	6	\$107,000.00
Lightning	2	0	0	5	\$125,000.00
Hail Events	105	0	0	N/A	N/A

### [NCDC NOAA Storm Events](#)

There has been a total of 276 events over the last 24 years. There have been no reported injuries for thunderstorm, strong winds, lightning and hail events.

The largest amount of property damage has been the result of thunderstorm winds.

March 1, 2017, the Planning Area experienced strong straight line wind damage. The damage began near the intersection of Strawberry Loop Road and Minnow Creek Road. Strong foundation outbuildings suffered major damage due to this storm. At the Adventure Farm, just north of Hagarville, a wallaby and her baby were killed when a nursery barn was destroyed from these winds. Many trees were uprooted and scattered between the storm's starting and ending points. Damage upwards of \$100,000 resulted for this storm.

On April 17, 2019, the State of Arkansas experienced severe thunderstorms. Damage ranged from a few missing shingles to homes being destroyed by fallen trees. Many citizens in the Planning Area were on flood/flash flood watch. Gusty cold winds mixed with Arkansas' hot and humid climate. Quarter sized hail stones were recorded in Clarksville. State Highways had trees impeding the way of travel and emergency services personnel.

May 2, 2022, very heavy rainfall from strong thunderstorms developed in Oklahoma and moved through Arkansas. The Planning Area experienced widespread rain that led to area river levels rising, causing flooding/flash flooding. Damaging winds and hail were witnessed during this storm. A mobile home was destroyed, walls had been pushed inward on one direction. Trees were blown over, falling upon a resident home. Property damage was approximated around \$90,000.

February 16, 2023, in the community of Ozone, Johnson County, a large storm system moved across the Planning Area. Thunderstorm winds created golf ball sized hail. The hail caused minor property damage, but the storm brought strong wind gusts. This wind caused debris to be thrown around the Planning Area. Trees had snapped or been uprooted. No monetary value had been assigned to this storm, but thousands of residents had been affected by it.

### **Probability of Future Occurrences**

The probability for a thunderstorm, strong wind, lightening, or hail event occurring in the Planning Area in any given year is less than one percent. The probability for a thunderstorm event was estimated using the following formula:

$$\frac{\# \text{ of events}}{\# \text{ of days}} \times 100 = \underline{\hspace{2cm}}$$

Data collected from 2000-2023 was equal to 8,395 days.

Climate change may increase the probability and strength of thunderstorms and associated hazards. These impacts will be monitored by the planning team over the next 5 years to continue to research nature-based solutions to mitigate all possibilities of potential increased impact.

### **Vulnerability and Impact for Thunderstorm Events**

The threat of thunderstorms, strong winds, lightning and hailstorms effect all the participating jurisdictions including the unincorporated areas of Johnson County and cities of Clarksville,

Coal Hill, Hartman, Knoxville, Lamar, and the school districts of Clarksville, Lamar, Oark-Jasper, Johnson County Westside and University of the Ozarks can experience thunderstorms.

Across the Planning Area, structures and their contents are vulnerable to damage by thunderstorms winds. Strong winds can down trees onto power lines, damage mobile homes that are not anchored, and rip off roofing. Winds can cause death and injuries by lifting unanchored objects. Lightning strikes can cause structural, timberland, and grass fires. It can cause damage to the communication towers throughout the jurisdictions and disrupt service. Hailstorms could cause damage to all structures, mainly roof shingles which can lead to roof leaks and further damage to the structure interiors. All types of real estate and personal property are vulnerable to hail: such as cars, trailers, boats, and crops. Hailstorms can cause bodily injury if caught outside without protection.

### **Unincorporated areas of Johnson County:**

Many homes may be damaged or destroyed during severe storm events due to the materials used in their construction. Those living in structures built of unreinforced masonry or homes without a safe room are at higher risk of injury or death during thunderstorms, this is especially true for the elderly and the young. Travelers and those camping, without a substantial shelter or safe room nearby, are extremely vulnerable to injury or death. Many rural farm's infrastructure and livestock may be vulnerable to damage or loss during severe weather events. Crops and timberland are at risk from lightning strikes. These strikes may cause injuries or start fires that can destroy infrastructure and/or crops or other field grown products.

The unincorporated areas of Johnson County are concerned about the communication system, and electric grid during thunderstorms. During thunderstorms, the community can lose power and communication capabilities. This threatens safety of the community and hinders response operations.

### **The City of Clarksville:**

In the city of Clarksville, commercial and residential structures throughout the city may be susceptible to destruction or damage during a severe weather event due to the materials used in their construction. These would include the Clarksville City Hall, Clarksville Police Department as just a few. There are several major health facilities located in the City of Clarksville: Clarksville Community Health Center, Clarksville Family Medical Center, Johnson Regional Medical Center and additional, smaller clinics. Damages to the power grid feeding this facility may cause a loss of services during a severe weather event. Patient care may be delayed until power systems are restored. There are other critical facilities in the city of Clarksville that could receive major damage that would impede their abilities to respond and provide support during a thunderstorm event. These would include the 911 Dispatch Center, Johnson County Office of Emergency Management, and the Clarksville Fire Department.

### **The City of Coal Hill:**

In the city of Coal Hill, commercial and residential structures throughout the city may be susceptible to destruction or damage during a severe weather event due to the materials used in their construction. There is no major health facility located in the City of Coal Hill. There are other critical facilities in the city of Coal Hill that could receive major damage that would impede their abilities to respond and provide support during a thunderstorm event. These would include the Coal Hill Fire Department and Coal Hill Water Department. There are no public saferooms or shelters located in the City of Coal Hill.

### **The City of Hartman:**

In the city of Hartman, commercial and residential structures throughout the city may be susceptible to destruction or damage during a severe weather event due to the materials used in their construction. There is no major health facility located in the City of Hartman. There are other critical facilities in the city of Hartman that could receive major damage that would impede their abilities to respond and provide support during a thunderstorm event. These would include the Hartman City Hall and Hartman Water Department. There are no public saferooms or shelters located in the City of Hartman.

### **The City of Knoxville:**

In the city of Knoxville, commercial and residential structures throughout the city may be susceptible to destruction or damage during a severe weather event due to the materials used in their construction. There are no major health facilities located in the City of Knoxville. There are other critical facilities in the city of Knoxville that could receive major damage that would impede their abilities to respond and provide support during a thunderstorm event. These would include the Knoxville City Hall, Johnson County Fire Department: Knoxville District and Knoxville Water. There are no public saferooms or shelters located in the City of Knoxville.

### **The City of Lamar:**

In the city of Lamar, commercial and residential structures throughout the city may be susceptible to destruction or damage during a severe weather event due to the materials used in their construction. There are no major health facilities located in the City of Lamar. There are other critical facilities in the city of Lamar that could receive major damage that would impede their abilities to respond and provide support during a thunderstorm event. These would include the Lamar City Hall, Lamar Police Department, Johnson County Fire Department: Lamar District, and Lamar Water. There are no public saferooms or shelters located in the City of Lamar.

**Clarksville School District:**

The buildings on campus may be susceptible to the effects of a thunderstorm. Buildings could be damaged or destroyed during a severe storm event. Losses could also include the contents such as computers, gym equipment, desks, chairs, and records. There is no saferoom located on campus to provide safety to the students and staff during school hours. This may increase the risk to those on or near campus during a severe weather event.

**Lamar School District:**

The buildings on campus may be susceptible to the effects of a thunderstorm. Buildings could be damaged or destroyed during a severe storm event. Losses could also include the contents such as computers, gym equipment, desks, chairs, and records. There is no saferoom located on campus to provide safety to the students and staff during school hours. This may increase the risk to those on or near campus during a severe weather event.

**Oark-Jasper School District:**

The buildings on campus may be susceptible to the effects of a thunderstorm. Buildings could be damaged or destroyed during a severe storm event. Losses could also include the contents such as computers, gym equipment, desks, chairs, and records. There is no saferoom located on campus to provide safety to the students and staff during school hours. This may increase the risk to those on or near campus during a severe weather event.

**Johnson County Westside School District:**

The buildings on campus may be susceptible to the effects of a thunderstorm. Buildings could be damaged or destroyed during a severe storm event. Losses could also include the contents such as computers, gym equipment, desks, chairs, and records. There is no saferoom located on campus to provide safety to the students and staff during school hours. This may increase the risk to those on or near campus during a severe weather event.

**University of the Ozarks:**

The buildings on campus may be susceptible to the effects of a thunderstorm. Buildings could be damaged or destroyed during a severe storm event. Losses could also include the contents such as computers, gym equipment, desks, chairs, and records. There is no saferoom located on campus to provide safety to the students and staff during school hours. This may increase the risk to those on or near campus during a severe weather event.

**Population** changes in the Planning Area and its effect on thunderstorm events are unknown. However, changes in population demographics could potentially increase the need for mitigation in the Planning Area due to thunderstorm events. Over the next five years the Planning Team



will need to monitor and document an increase/decrease in population as well as track demographics to see if there is a rise or decline in vulnerable populations.

**Land use** changes can have an impact on atmospheric temperatures. Urbanization creates higher air temperatures compared to the surrounding rural areas. The Planning Area is expecting an increase in industry over the next five years. The Planning Team will need to monitor and document land use changes to see if they correlate with an increase/decrease in thunderstorm events over the next five years.

**Climate** change may increase the probability and strength of thunderstorms and associated hazards. These impacts will be monitored by the planning team over the next 5 years to continue to research nature-based solutions to mitigate all possibilities of potential increased impact.

## 4.8.8 Tornado

A tornado is a rapidly rotating vortex or funnel of air extending groundward from a cumulonimbus cloud.

Tornado damage severity is measured by the Enhanced Fujita Scale. The Enhanced Fujita Scale assigns numerical values based on wind speeds and categorizes tornadoes from EF-0 to EF-5. Scale values above EF-5 are not used because wind speeds above 318 mph (513km/h) are unlikely.

### Locations of Tornado Events

There are no defined geographic hazard boundaries. All people and property in the planning area are exposed to the risk of a tornado event.

### Extent, Magnitude, or Severity of Tornado

The entire Planning Area is exposed to the risk of a tornado event any time of the year. The Planning Area could have a tornado ranging from EF-0 to an EF-5 causing minor to massive damage.

### Enhanced Fujita Scale

EF RATING	WIND SPEEDS	EXPECTATIONS
EF-0	65-85 mph	<b>MINOR DAMAGE:</b> Shingles blown off of parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.
EF-1	86-110 mph	<b>MODERATE DAMAGE:</b> More significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.
EF-2	111-135 mph	<b>CONSIDERABLE DAMAGE:</b> Roofs torn off well constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.
EF-3	136-165 mph	<b>SEVERE DAMAGE:</b> Entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark.
EF-4	166-200 mph	<b>EXTREME DAMAGE:</b> Well constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.
EF-5	> 200 mph	<b>MASSIVE/INCREDIBLE DAMAGE:</b> Well constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.

[Weather.gov](http://Weather.gov) - EF Scale

## Previous Occurrences

There have been 13 tornado events reported between 01/01/2000 and 12/31/2023. There are 3 recorded deaths, 19 recorded injuries, \$18,571,000 in property damage and \$20,000 in lost crops.

Number of County/Zone areas affected:	1
Number of Days with Event:	10
Number of Days with Event and Death:	2
Number of Days with Event and Death or Injury:	2
Number of Days with Event and Property Damage:	4
Number of Days with Event and Crop Damage:	1
Number of Event Types reported:	1

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<b>Totals:</b>								3	19	18.571M	20.00K
<a href="#">HUNT</a>	JOHNSON CO.	AR	11/23/2001	19:46	CST	Tornado	F1	0	0	0.00K	0.00K
<a href="#">HUNT</a>	JOHNSON CO.	AR	11/23/2001	19:47	CST	Tornado	F2	1	4	0.00K	0.00K
<a href="#">HUNT</a>	JOHNSON CO.	AR	04/22/2004	21:26	CST	Tornado	F0	0	0	0.00K	0.00K
<a href="#">HAGARVILLE</a>	JOHNSON CO.	AR	11/01/2004	06:58	CST	Tornado	F0	0	0	0.00K	0.00K
<a href="#">HAGARVILLE</a>	JOHNSON CO.	AR	11/11/2004	01:05	CST	Tornado	F0	0	0	0.00K	0.00K
<a href="#">CLARKSVILLE</a>	JOHNSON CO.	AR	04/27/2009	17:11	CST-6	Tornado	EF1	0	0	50.00K	0.00K
<a href="#">COAL HILL</a>	JOHNSON CO.	AR	05/24/2011	23:15	CST-6	Tornado	EF2	1	11	5.500M	0.00K
<a href="#">NEW SPADRA</a>	JOHNSON CO.	AR	05/24/2011	23:25	CST-6	Tornado	EF3	1	4	13.000M	0.00K
<a href="#">LAMAR</a>	JOHNSON CO.	AR	03/01/2017	01:29	CST-6	Tornado	EF1	0	0	20.00K	0.00K
<a href="#">OZONE</a>	JOHNSON CO.	AR	04/13/2018	17:48	CST-6	Tornado	EF1	0	0	0.00K	20.00K
<a href="#">CENTER PT</a>	JOHNSON CO.	AR	10/09/2018	14:35	CST-6	Tornado	EF1	0	0	1.00K	0.00K
<a href="#">CENTER PT</a>	JOHNSON CO.	AR	10/09/2018	14:37	CST-6	Tornado	EF1	0	0	0.00K	0.00K
<a href="#">HARMONY</a>	JOHNSON CO.	AR	03/30/2022	06:47	CST-6	Tornado	EF1	0	0	0.00K	0.00K
<b>Totals:</b>								3	19	18.571M	20.00K

[NOAA Stormevents - Johnson County](#)

On November 23, 2001, an EF2 tornado traveled from Franklin County to Johnson County hitting the community of Hunt, near Horsehead Lake. The tornado killed a woman in her mobile home. Two others within the mobile home were injured. In total, four people were injured. Several chicken houses were destroyed and approximately 120,000 chickens were killed. Numerous trees, power lines, and power poles were blown down. More than a dozen barns were destroyed. Residential homes also sustained major damage. Many vehicles were also damaged.

On May 24, 2011, a F2 tornado went thru the Planning Area. The tornado followed Interstate 40 and overturned several vehicles and moved through the Centerpoint Community Cemetery. This

caused the death of one female in her mobile home and injured eleven (11) others. Homes and businesses were heavily damaged or destroyed near Coal Hill. As the storm raged on, the community of Harmony suffered damage on residential property, barns, chicken houses and other livestock. Outbuildings around the Planning Area were also damaged. The community of Ozone was also hit and suffered damage before the storm lifted farther northeast. At least 65 residences were damaged or destroyed in Johnson County. Damage from this storm cost approximately \$5,500,000.

From the same storm system mentioned above, the sixth and final segment of this tornado event moved through the city of Clarksville. Extensive damage was caused to the county club and surrounding businesses. Initially, this storm system took out the power grid for all of Clarksville. The hardest hit spots were without electricity for upwards of a week. Once through the city, the tornado moved northeast towards the communities of Strawberry and Chronister. The area of Strawberry mourned the loss of 65-year-old man who owned a small house and goat farm. His residence had been destroyed, much like many others within the Planning Area. Trees were blown down and across roadways, into the Ozark National Forest area. This storm segment caused at least \$13,000,000 in damage along with 4 other injuries that were reported.

### **Probability of Future Occurrences**

There is less than one percent chance of a tornado occurring in any given year. Probability is estimated using the following equation:

$$\frac{\# \text{ of events}}{\# \text{ of days}} \times 100 = \underline{\hspace{2cm}}$$

Data collected from 2000-2023 was equal to 8,395 days.

### **Vulnerability and Impact of Tornado**

The Planning Area is located in “Tornado Alley”, the most tornado prone area of the nation. Because there is no defined geographic hazard boundary, all areas, residents, structures, and critical facilities in Planning Area are at high risk from tornado events.

Humans, wildlife, and livestock in the Planning Area, are all vulnerable to tornados and airborne objects. Fatalities can occur with a tornado event. Those that are most vulnerable are children under the age of 5, older adults over the age of 65, those with disabilities, those suffering from economic hardship and the unhoused. Even with advances in meteorology, tornado warning times may be issued in a short period of time.

All infrastructure in the Planning Area is vulnerable to a tornado event. This includes energy, gas, communication, and transportation. Electrical wires and communication towers are the most vulnerable to tornados. Downed power lines combined with other debris from the tornado can cause delay in travel, injury or death. Power and water outages would cause food spoilage and

sanitation problems for communities, increasing the chance of disease. Power outages and water outages during seasonal heat or cold could contribute to fatalities.

All critical facilities in the Planning Area are vulnerable to a tornado event. This includes nursing homes, clinics, hospitals, day care centers, and schools. At least one of these facilities is located in every part of the Planning Area. These facilities house a large portion of the Planning Areas most vulnerable populations. Infrastructure and utility outages caused by a tornado event could prevent staff and emergency workers from working. Supply shipments may be interrupted leaving people without basic necessities and medications. Schools may be forced to close for a short term or longer.

All businesses in the Planning Area are vulnerable to a tornado event. Businesses could receive minor to major damage or be completely destroyed. Damage or destruction of a business could lead to economic hardship for individual business owners, economic damage to the Planning Area, or hazardous waste/contamination.

All residences in the Planning area are vulnerable to a tornado event. Residential structures may receive mild damage or be completely destroyed. Damage to residential structures could cause a significant amount of people to be without shelter or living in unsafe conditions.

The natural environment is vulnerable to a tornado event. Trees may be ripped out of the ground clearing large areas of forest. Change to the natural landscape could have a cascading effect on the Planning Area.

The structures most vulnerable to tornadoes are wood frame structures and manufactured homes. Damage to residential structures could cause hundreds to be without shelter leaving them with no place to live.

Jurisdiction	Total Housing Structures	Wood/Frame Structures	Unreinforced Masonry/Frame Structures	Manufactured Homes
Entire County	11,475	8,033	2,180	1,262

[Census.gov Data](https://www.census.gov)

## Population

As population rises and cities become denser the impact of tornados change. It is not the frequency of tornadoes that changes due to population changes. It is the level of damage that can result due to higher populations, structures, automobiles, and other objects that can be thrown around damaging property and injuring/killing people. The most vulnerable population in the planning area will be those who are unable to take adequate shelter due to disability, age, or poverty levels. These impacts will be monitored by the planning team over the next 5 years to continue research for nature-based solutions to mitigate all possibilities of potential increased impact.

## **Land Use**

The Planning Area does not currently have any documented research on how land use in the Planning Area would affect tornado events. The Planning Area is currently experiencing a continued trend in decrease of population while expecting an increase in industry. These factors will change the natural environment and land use patterns. These impacts will be monitored by the planning team over the next 5 years to continue research for nature-based solutions to mitigate all possibilities of potential increased impact.

## **Climate**

Climate change caused by population growth, burning of fossil fuels, release of carbon dioxide in larger amounts has an impact on global warming. Global warming is attributed to drought in some places and higher levels of rainfall in others. However, [nationalgeographic.org](http://nationalgeographic.org) states that weather events such as tornadoes are much harder for climatologists to attribute to climate change. As of right now the data does not support any long-term increase in tornado frequency.

## 4.8.9 Wildfires

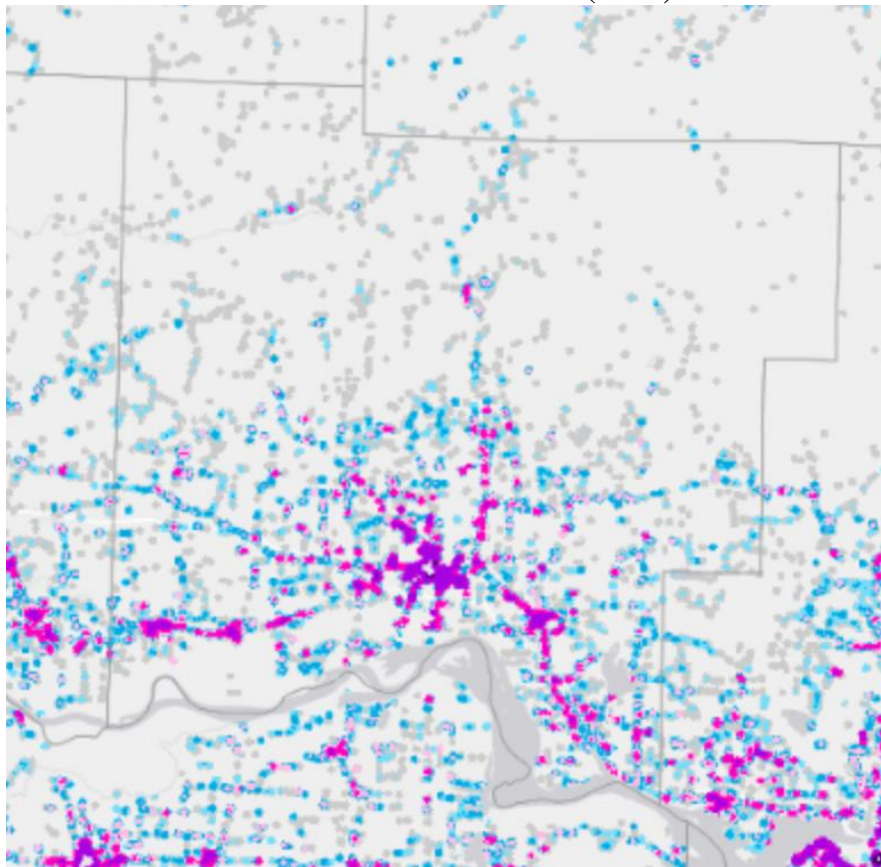
### Description

A wildfire is an unplanned, unwanted fire burning in a natural area, such as a forest, grassland, or prairie. Wildfires can start from natural causes, such as lightning, but most are caused by humans, either accidentally or intentionally. Wildfires can damage natural resources, destroy homes, and threaten human lives and safety. ([FEMA](#))

### Locations Affected by Wildfires

According to the Southern Group of State Foresters, the Wildland Urban Interface (WUI) provides the best assessment of wildfire risk to humans. WUI reflects housing density depicting where humans and their structures meet or intermix with wildland fuels. The darker purple indicates a higher population in proximity to burnable areas.

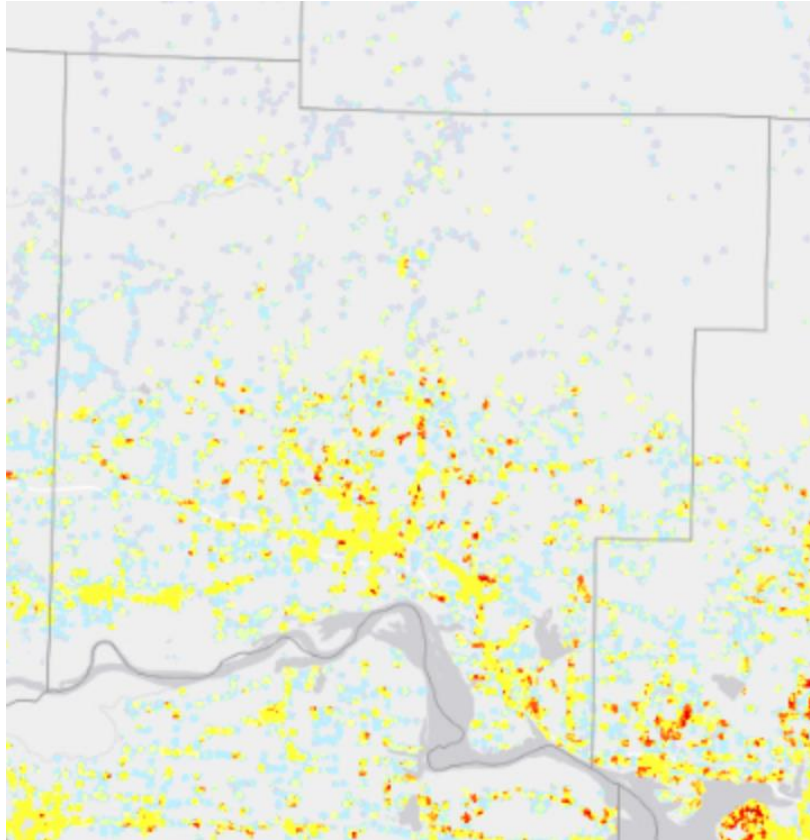
#### Wildland Urban Interface (WUI)



[SGSF Wildfire Risk Assessment Portal](#)

The WUI Risk Index visualizes the potential impact of a wildfire on people and their homes. The Risk Index is based on WUI (housing density) and the susceptibility to fire at different intensity levels, such as flame length. Areas with a high housing density and high flame length have a higher risk than areas with low housing density and low flame lengths. Locations in red determine where the greatest potential impact to homes and people is likely to occur.

## WUI Risk Index



[SGSF Wildfire Risk Assessment Portal](#)

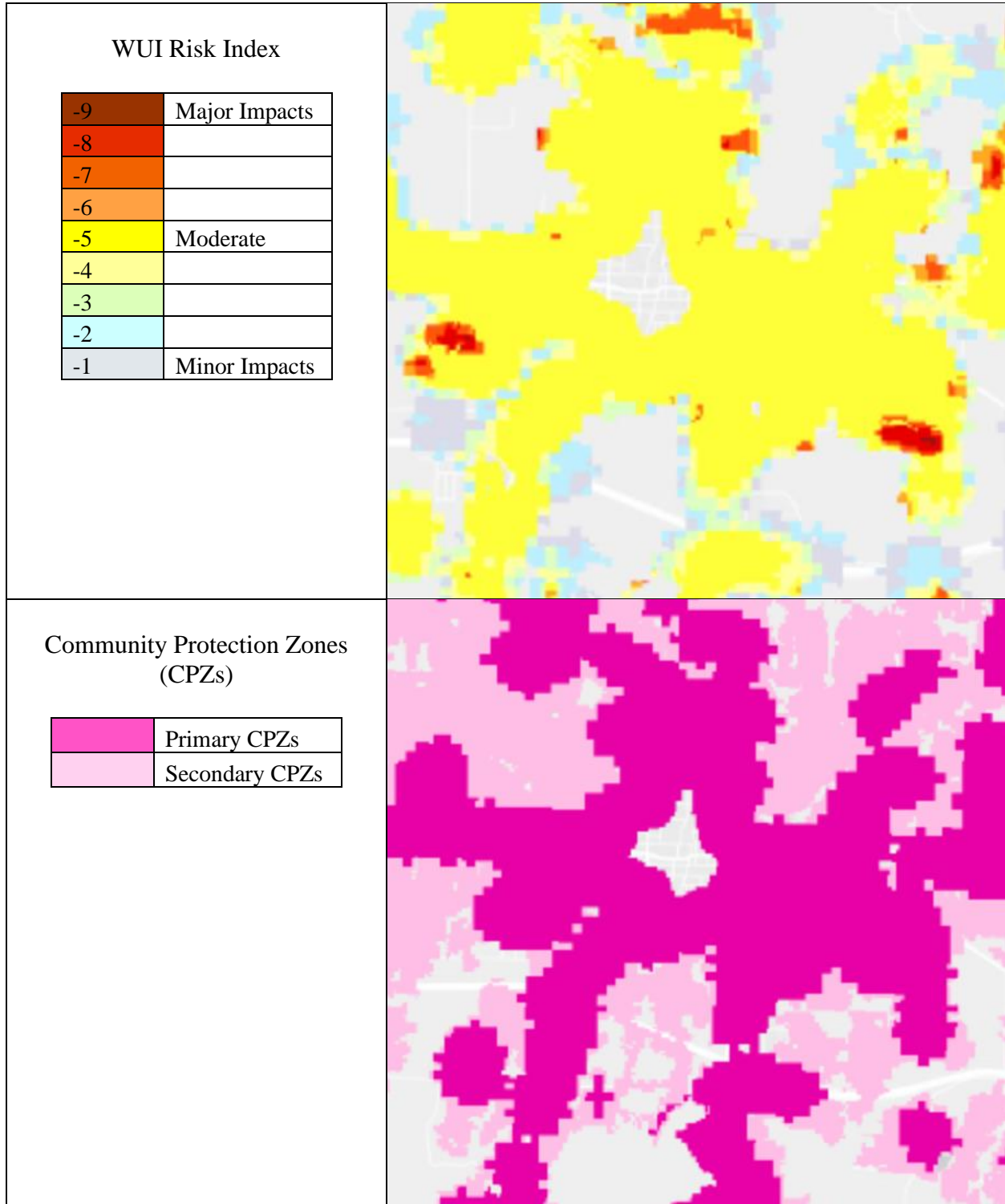
### Extent, Magnitude and Severity of Wildfires

Two methods were used to analyze wildfires risk and mitigation for each plan participant. First, the WUI Risk Index was reviewed to determine the areas with the highest potential impact of a wildfire on people and their homes.

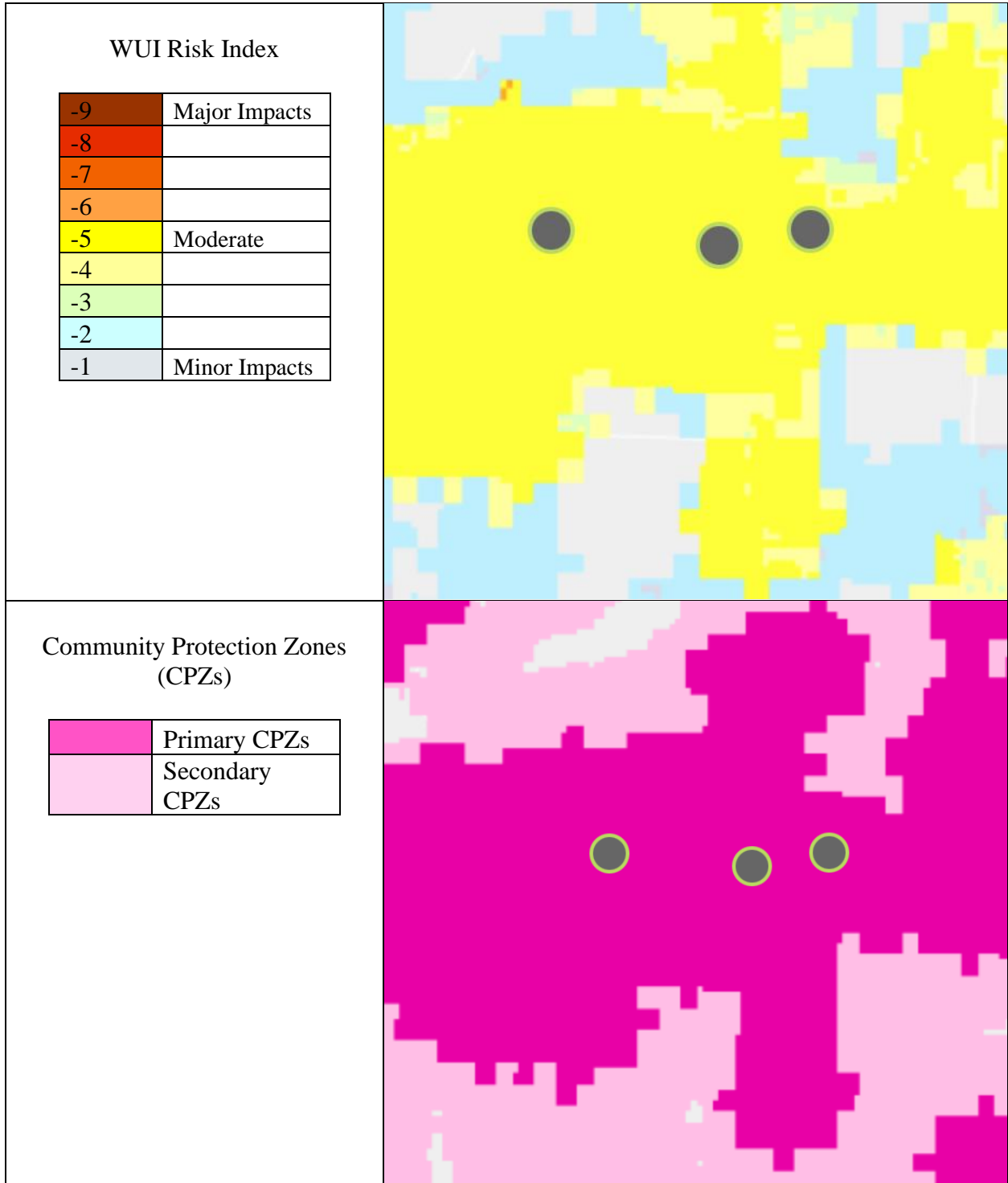
Second, Community Protection Zones (CPZs) were evaluated. CPZs are based on an analysis of the housing density data and surrounding fire behavior potential. Primary CPZs represent those areas considered highest priority for mitigation planning activities. Secondary CPZs are determined using the rate of spread data to determine buffer areas around populated areas within a 2-hour fire spread distance.



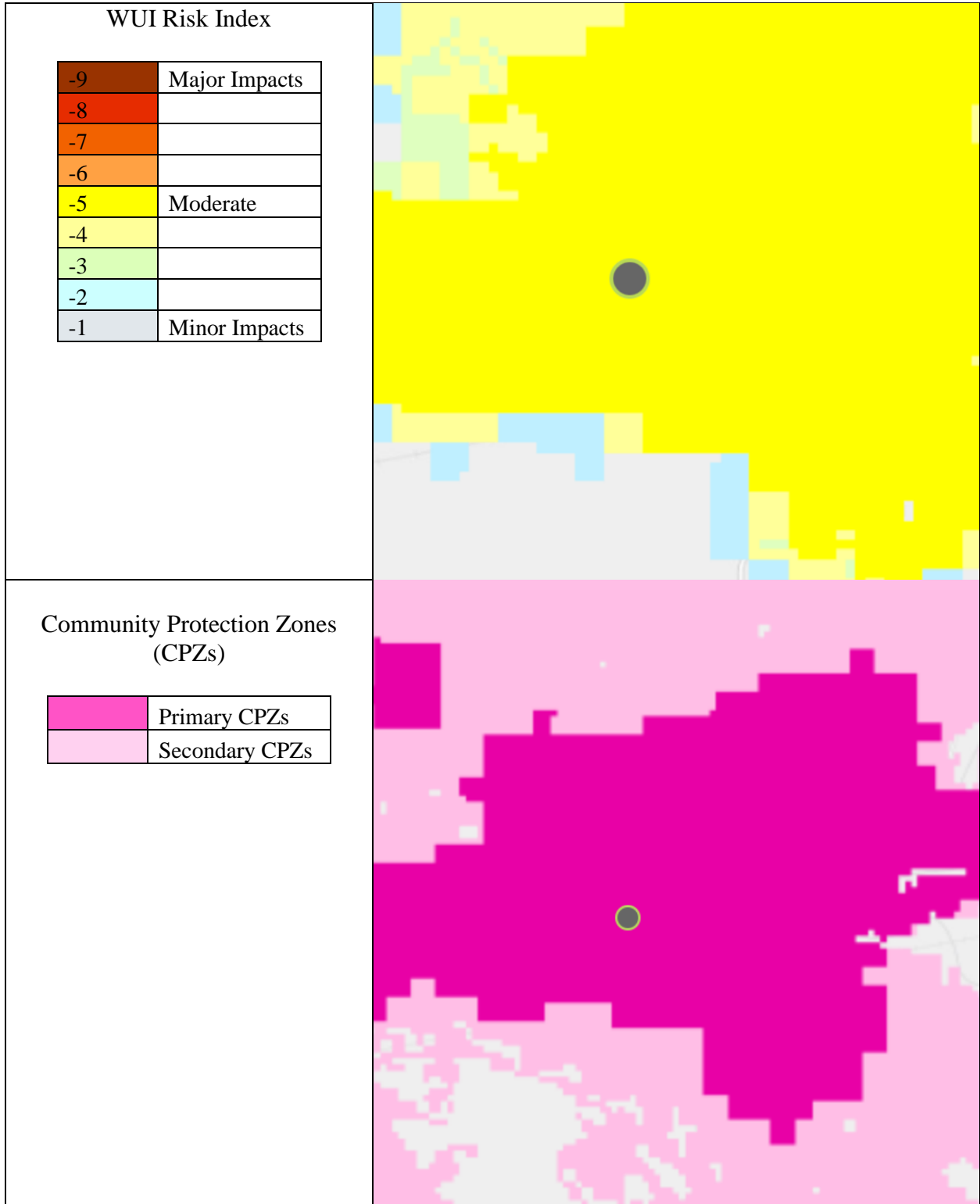
## City of Clarksville



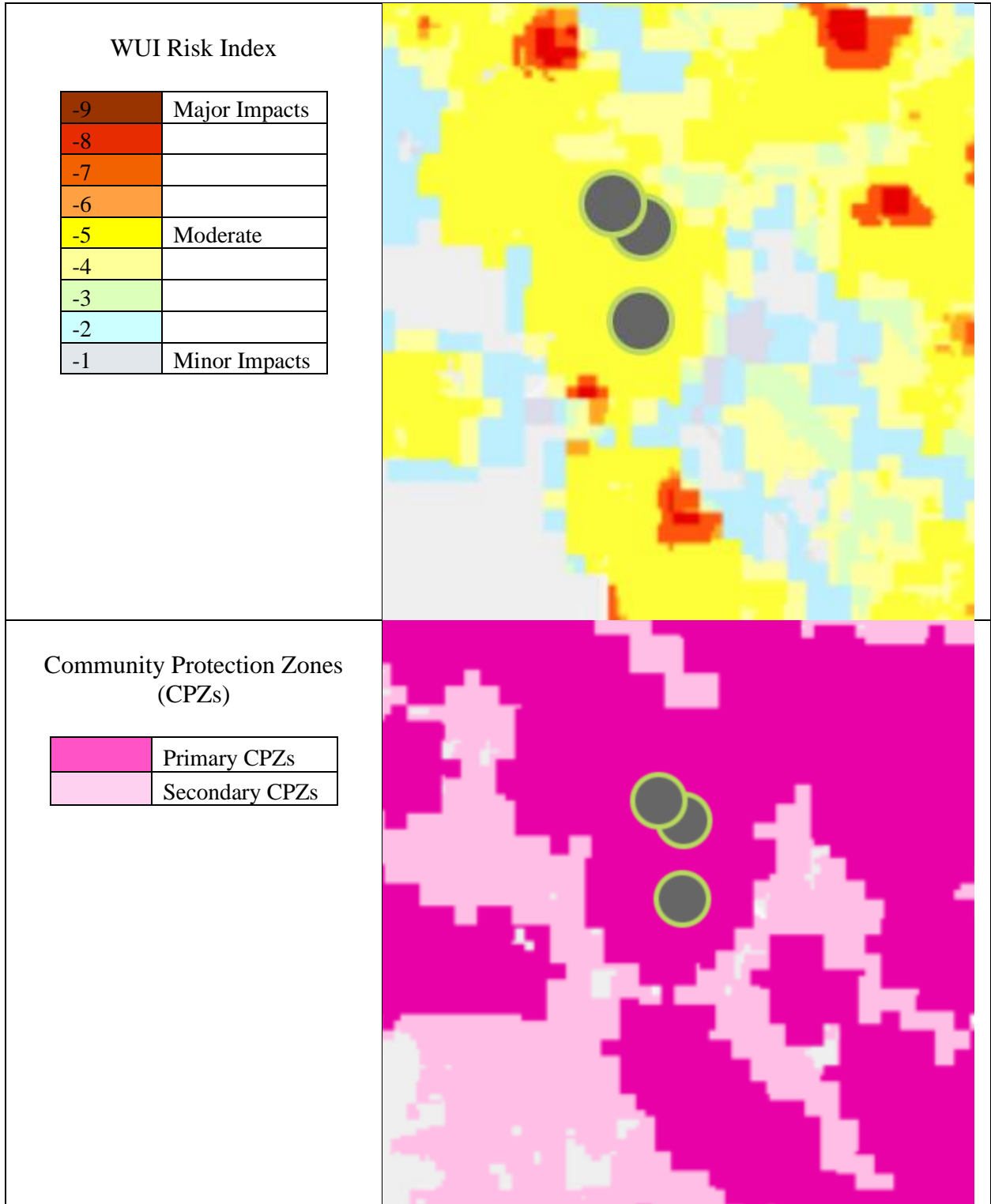
## City of Coal Hill



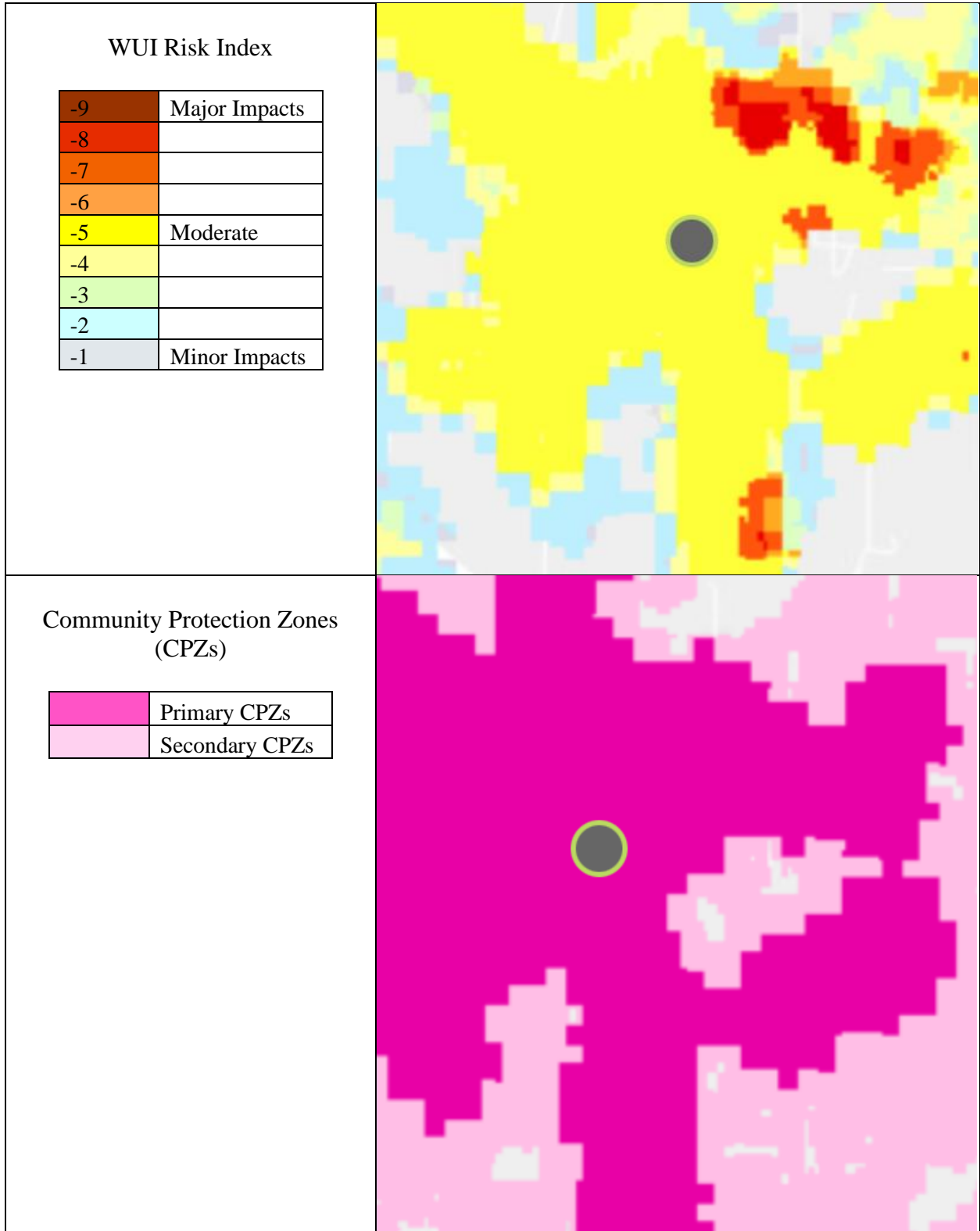
## City of Hartman



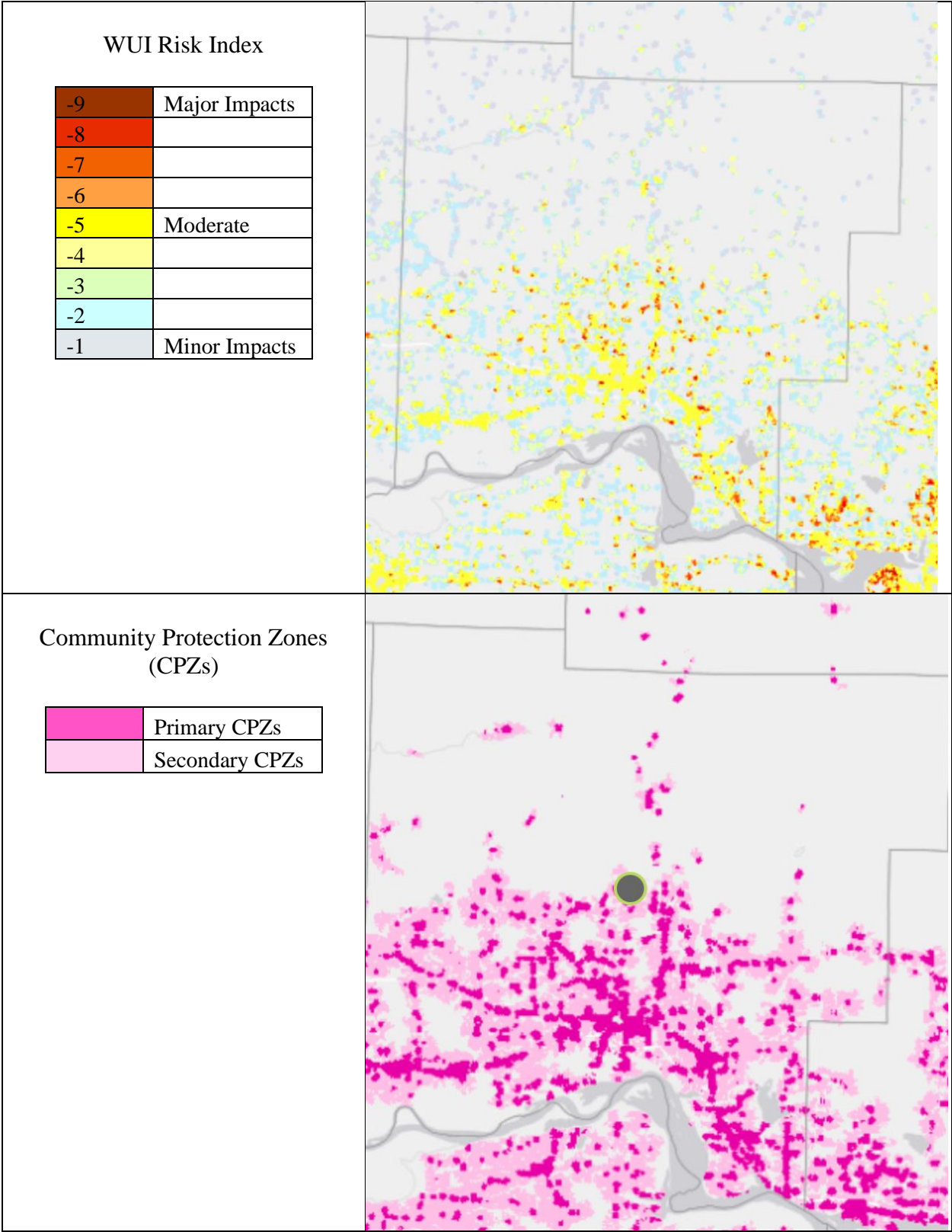
# City of Knoxville



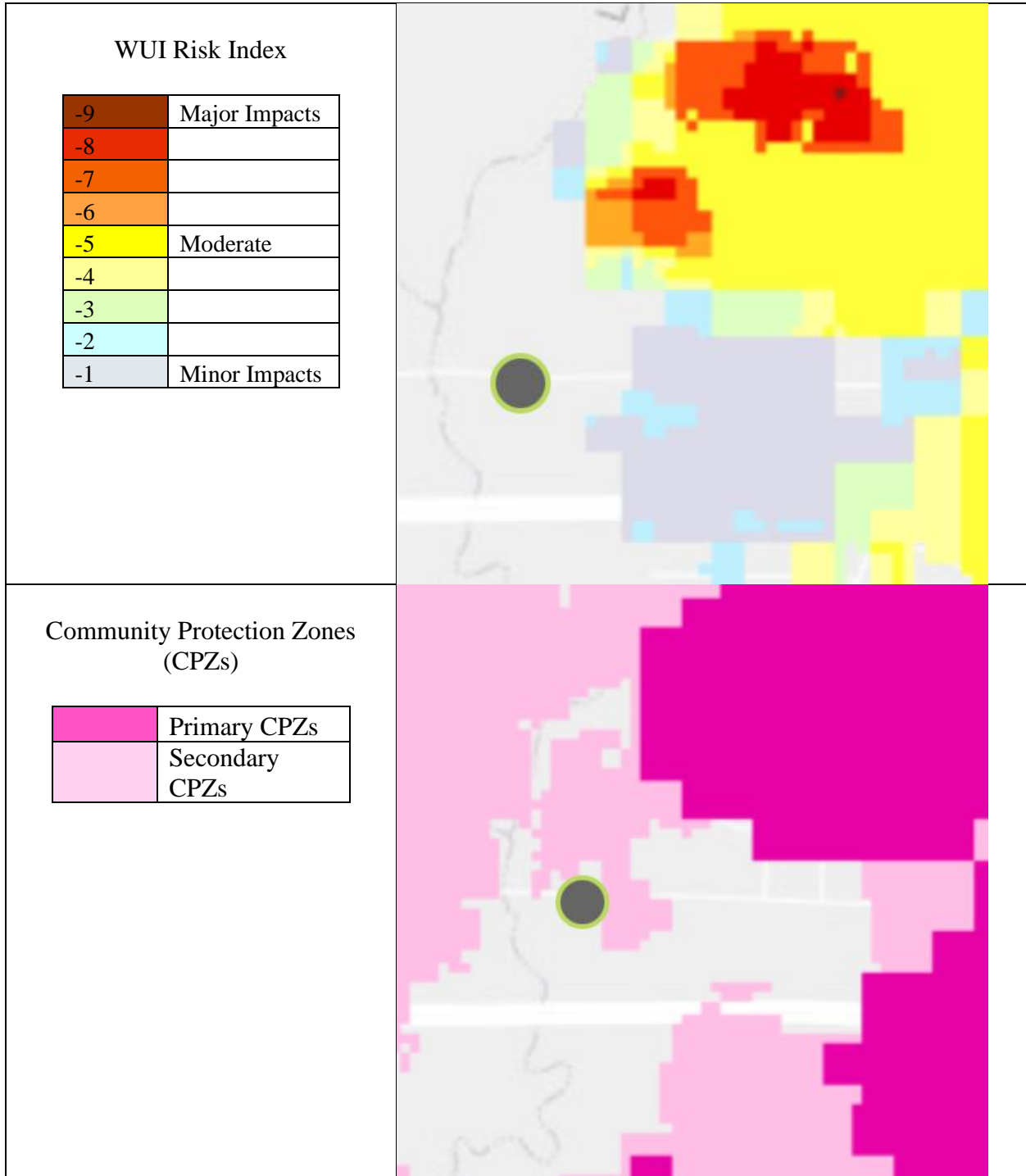
# City of Lamar



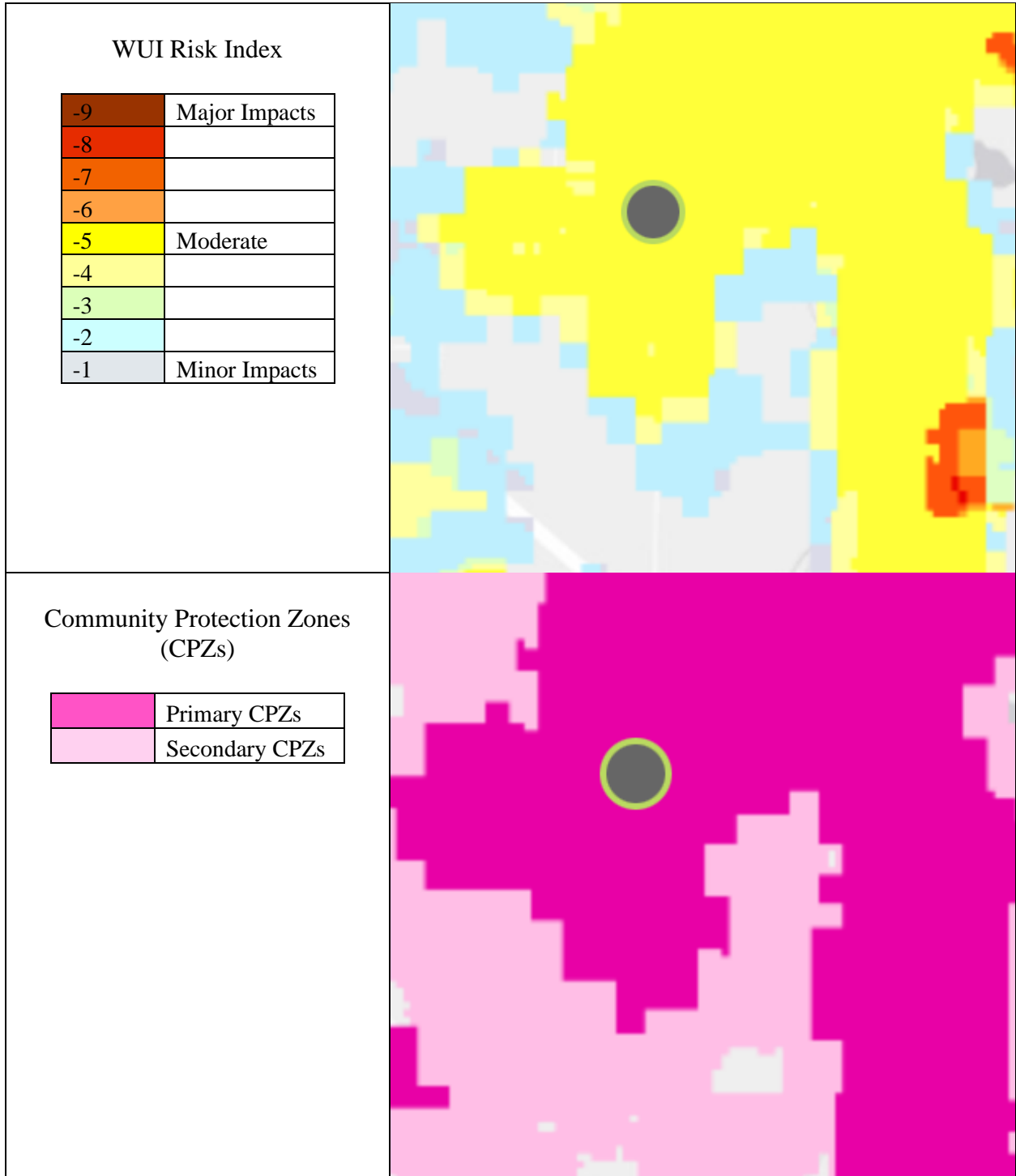
### Unincorporated Areas of Johnson County



## Clarksville School Campus

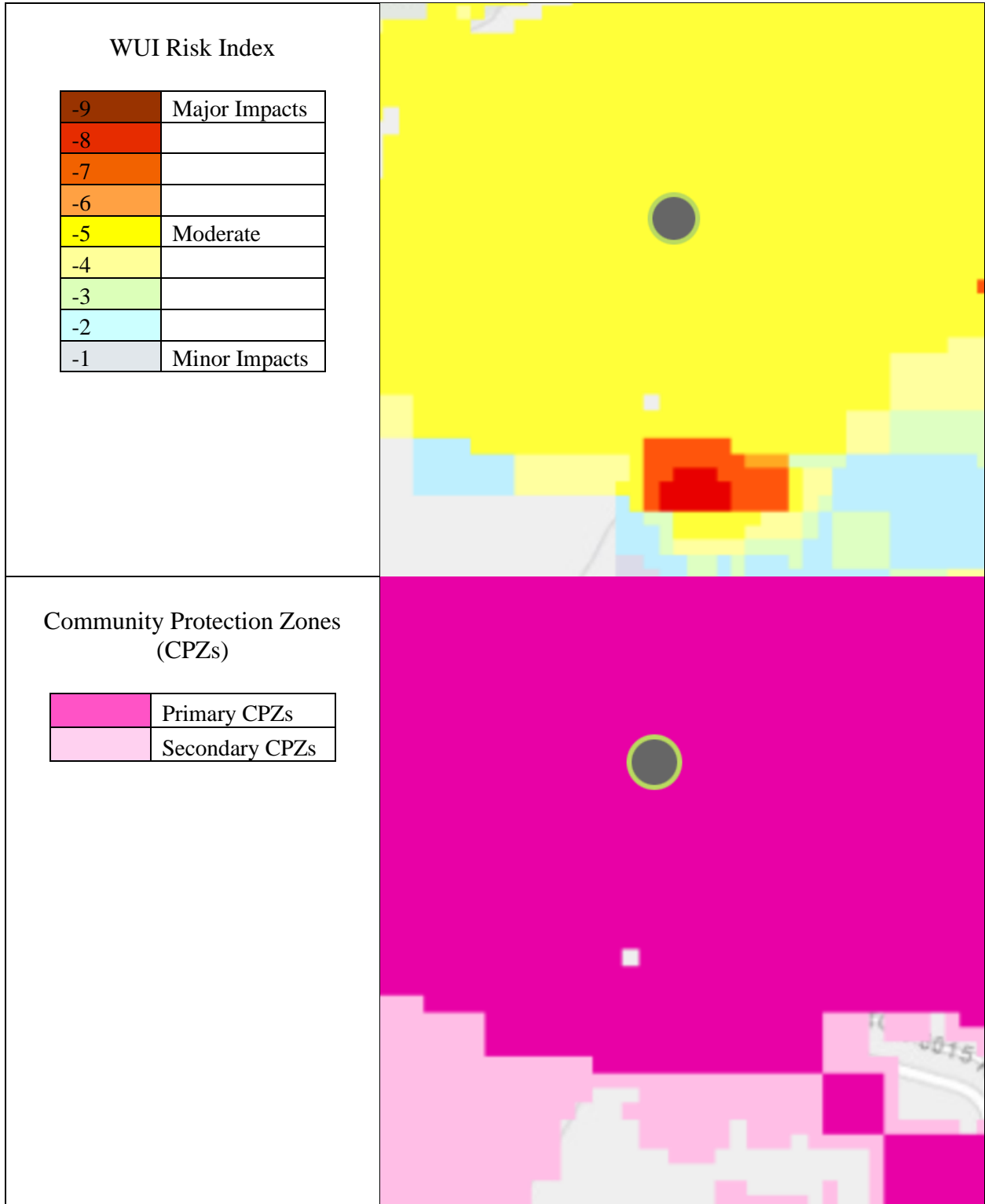


# Lamar School Campus

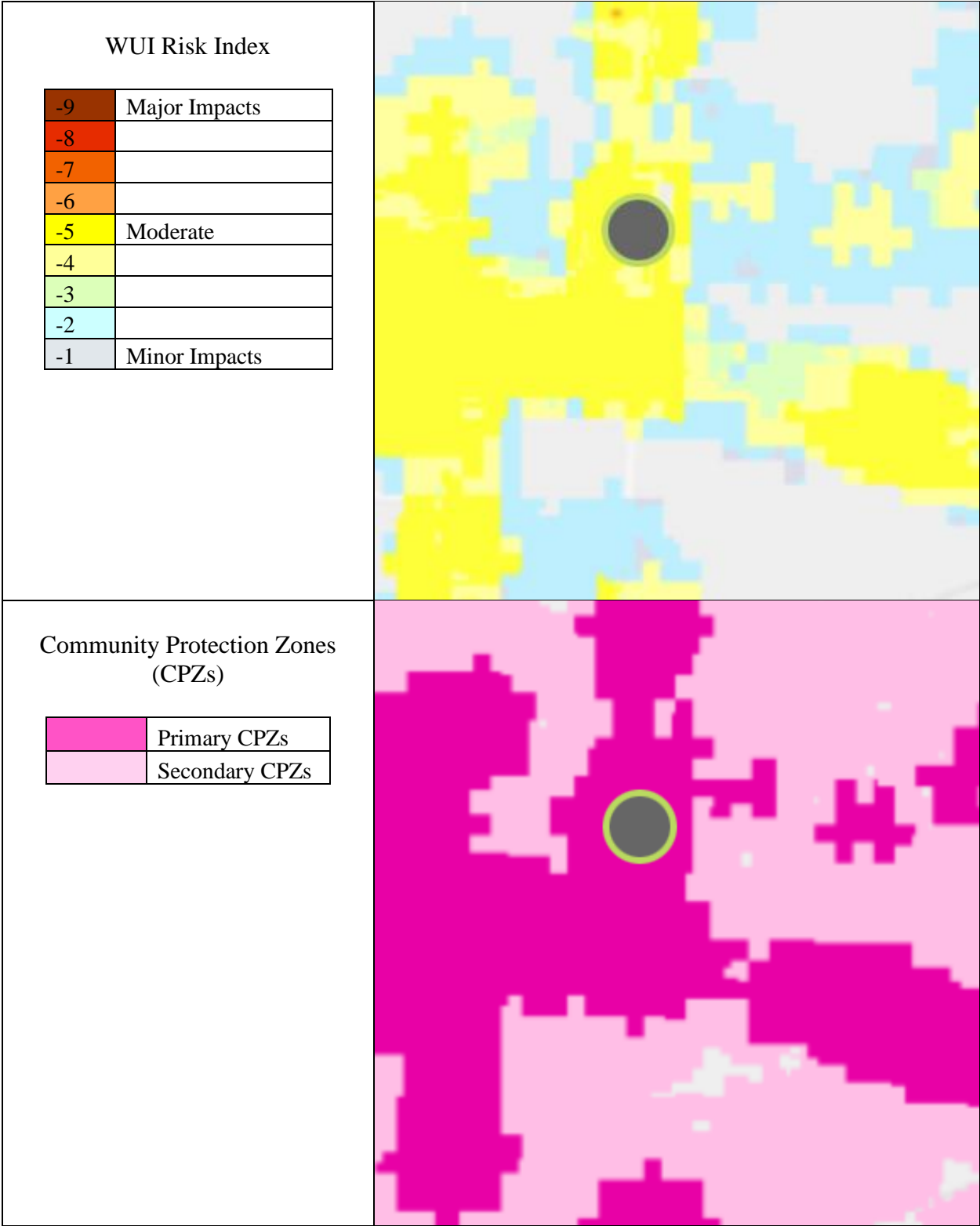




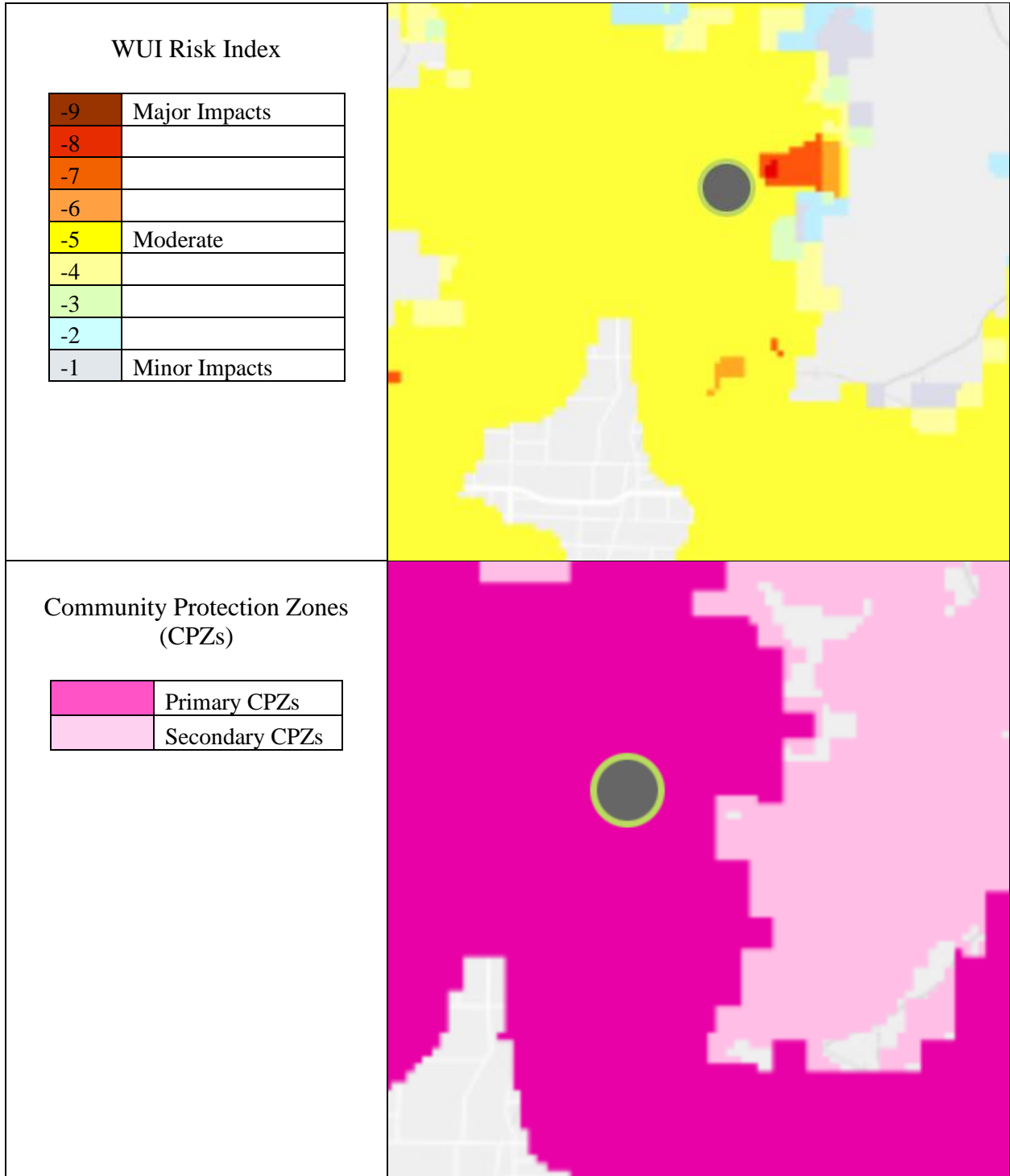
## Oark-Jasper School Campus



### Westside School Campus



# University of the Ozarks



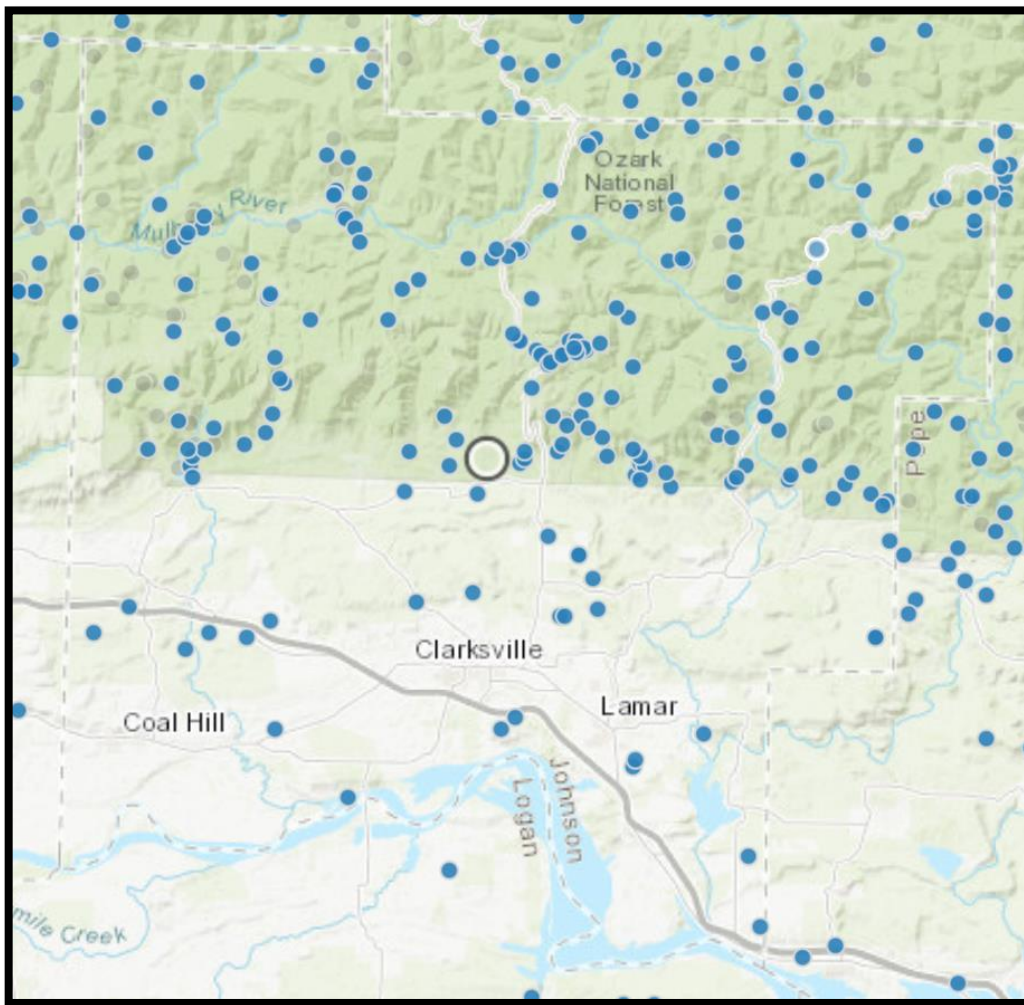
## Previous Occurrences

Between 2013 and 2019, the [Arkansas Department of Agriculture Forestry](#) division reported 92 fires in the Planning area, which burned 582 acres.

FEMA has not declared any wildfire disasters in the Planning Area.

Year	Fires	Acres
2013	10	51
2014	11	49
2015	16	153
2016	21	140
2017	17	58
2018	12	105
2019	5	26
<b>TOTAL</b>	<b>92</b>	<b>582</b>

NIFC Wildland Fire Data (2020 to 2023)



[National Interagency Fire Center \(NIFC\)](#)

The NOAA Storms Events Database reported four wildfires from 2000-2024. Zero people were injured from wildfire during this time period.

Number of County/Zone areas affected:	1
Number of Days with Event:	4
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	0
Number of Days with Event and Crop Damage:	0
Number of Event Types reported:	1

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<b>Totals:</b>								0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	07/05/2012	02:00	CST-6	Wildfire		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	07/06/2012	12:00	CST-6	Wildfire		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	08/01/2012	20:00	CST-6	Wildfire		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	12/13/2012	23:00	CST-6	Wildfire		0	0	0.00K	0.00K
<b>Totals:</b>								0	0	0.00K	0.00K

[Storm Events Database - Search Results | National Centers for Environmental Information \(noaa.gov\)](#)

Johnson County experienced a lightning strike which started a wildfire 5 miles northeast of Hagarville on August 1, 2012. The fire raged for the next 5 days, with zero containment until August 6, 2012. The ‘Hess Knob Fire’ burned 1,438 acres altogether.

The Planning Area experiences many grass fires that end up burning several hundred acres, but the reporting system used had not been updated to centrally report these fires until February 2024.

## Probability of Future Events

There are potentially many more wildfires in the Planning Area than documented. However, due to the multiple ways of documenting or classifying fires at the time of reporting those numbers may not be captured in this document. The Planning Area has experienced several wildfires between 2000-2023. The probability is based upon previous occurrences.

Probability is estimated using the following formula:

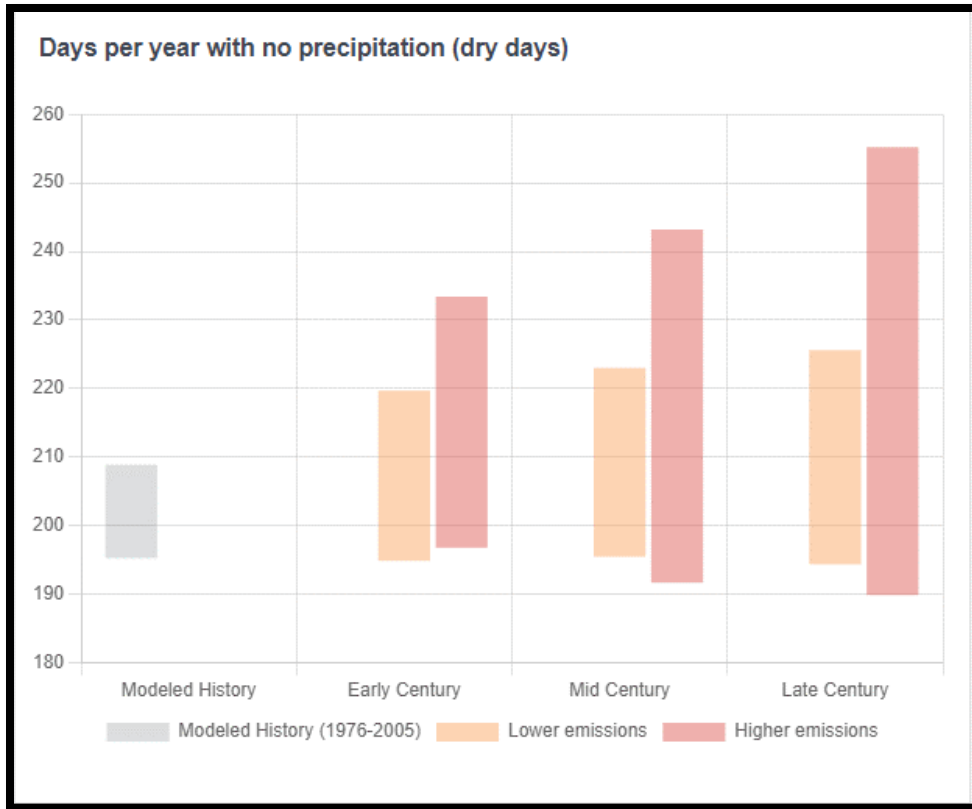
$$\frac{\text{\# of events}}{\text{\# of days}} \times 100 = \underline{\hspace{2cm}}$$

Data collected from 2000-2023 was equal to 8,395 days.

Future Climate Indicators							
Indicator	Modeled History (1976 - 2005)	Early Century (2015 - 2044)		Mid Century (2035 - 2064)		Late Century (2070 - 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
		Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max
<b>Precipitation:</b>							
Days per year with no precipitation (dry days)	203 days 195 - 209	206 days 195 - 220	207 days 197 - 233	207 days 196 - 223	209 days 192 - 243	208 days 194 - 226	213 days 190 - 255
Maximum number of consecutive dry days	16 days 14 - 20	17 days 14 - 21	17 days 14 - 20	18 days 15 - 21	17 days 14 - 22	18 days 15 - 25	18 days 15 - 26
Days per year with precipitation (wet days)	163 days 156 - 170	159 days 146 - 170	158 days 132 - 168	158 days 142 - 170	156 days 122 - 174	157 days 140 - 171	152 days 110 - 175
<b>Temperature thresholds:</b>							
Annual days with maximum temperature > 90°F	63 days 63 - 75	92 days 74 - 113	95 days 73 - 116	103 days 75 - 127	111 days 88 - 130	114 days 87 - 144	142 days 112 - 168
Annual days with maximum temperature > 100°F	7 days 6 - 9	19 days 5 - 37	21 days 7 - 54	27 days 6 - 57	35 days 15 - 84	36 days 12 - 57	68 days 30 - 117

N/A = Data Not Available for the selected area

Climate Projections for	Early Century (2015-2044) ⌵	Lower emissions	Higher emissions
Days per year with no precipitation (dry days)		206.2 Days + 3.6 since 1976-2005	207.1 Days + 4.5 since 1976-2005
Maximum number of consecutive dry days		17.1 Days + 0.8 since 1976-2005	17.2 Days + 0.8 since 1976-2005
Days per year with precipitation (wet days)		159.0 Days - 3.6 since 1976-2005	158.1 Days - 4.5 since 1976-2005
Annual days with maximum temperature > 90°F		92.1 Days + 25.1 since 1976-2005	94.6 Days + 27.6 since 1976-2005
Annual days with maximum temperature > 100°F		18.7 Days + 11.8 since 1976-2005	21.0 Days + 14.0 since 1976-2005



[CMRA - Climate Mapping For Resilience and Adaptation \(arcgis.com\)](http://arcgis.com)

Climate mapping trends indicate a rise in the number of dry days, maximum number of consecutive dry days, and a decrease in the number of wet days. This combined with rising temperatures, and a sharp increase in annual days with maximum temperatures greater than 100°F could lead to an increase in wildfire for the Planning Area.

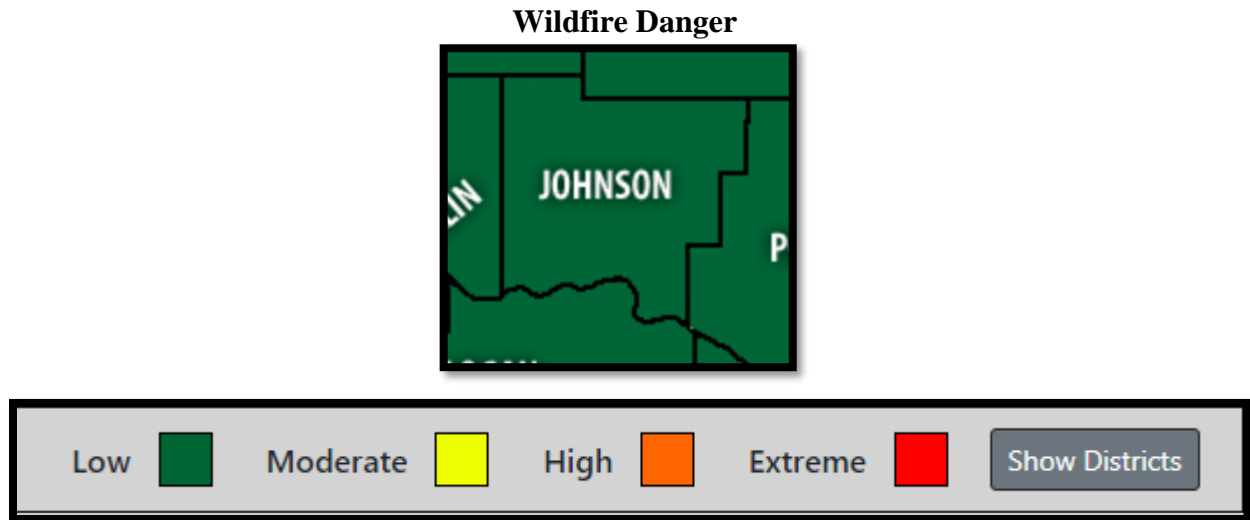
According to FEMA’s National Risk Index, the Planning Area’s risk index is relatively low (69.3) compared to the rest of the U.S.:

Hazard Type	Expected Annual Loss Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
Wildfire	\$80,706	Very High	Very Low	1.46	\$111,805	64.7

**FEMA’s Expected Annual Loss Values:**

Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Wildfire	\$80,706	\$52,808	\$26,775	0.00	\$136

See [Section 8.4](#) for the full FEMA National Risk Index report.



To find out the most recent wildfire danger and current burn bans please click the link:

[Wildfire Map: Arkansas Forestry Division](#)

The Forestry Division is asking you to report fires by calling 1-800-468-8834



## **Vulnerability and Impact of Wildfires**

Wildfires can result in significant damage to the Planning Area including risk to human life, property damage, agricultural impacts, as well as cutting off access to utilities, emergency services, and evacuation routes.

In Johnson County, most rural residents depend on their local volunteer fire departments to protect their property from loss. When wildfires move into residential areas or along roadways, they place the population at risk due to smoke inhalation and burn wounds. Firefighters responding to wildfires are also at risk of injury or death. Area evacuations due to fires also put individuals at risk.

Wildfires can also impact the economy by destroying crops and farm animals. Business may close or be damaged by the fire. Business can also be indirectly impacted by wildfires due to power or other utility outages. Participation in the Firewise program will help the county quantify the number of structures in the county that are vulnerable to wildfire.

### **Climate**

Changes in the climate are anticipated to increase warming and the likelihood of drought. Both of these changes may heighten the frequency and severity of wildfires across the planning area. These impacts will be monitored by the planning team over the next 5 years. Research will be documented for nature-based solutions to mitigate potential increased impact.

### **Population**

Changes in population will affect the impact of wildfires. As populations grow, more individuals and infrastructure will be impacted by wildfires. These impacts will be monitored by the planning team over the next 5 years. Research will be documented for nature-based solutions to mitigate potential increased impact.

### **Land Use**

As land is developed, the risk of wildfires can become greater if precautions are not taken. Constructing residential buildings in close proximity to flammable vegetation or other materials can degrade the Wildland Urban Interface Risk. However, ensuring defense zones are included during new construction can minimize the risk of fire damage. Land use impacts will be monitored by the planning team over the next 5 years. Research will be documented for nature-based solutions to mitigate potential increased impact.

## 4.8.10 Winter Storm

### Description

A winter storm is a combination of severe winter weather types occurring over a wide area. Winter storm formation requires below freezing temperatures, moisture, and precipitation. Severe winter storms include heavy snowfall, ice storms, strong winds, extreme cold, and/or freezing fog.

The National Weather Service defines a winter weather event as a winter weather phenomenon (such as snow, sleet, ice, wind chill) that impacts public safety, transportation, and/or commerce. It typically occurs during the climatological winter season between October 15 and April 15.

### Types of winter warnings include:

Warning Type	Description
Blizzard Warning	Blizzard event is imminent or expected in the next 12 to 36 hours. Sustained wind or frequent gusts greater than or equal to 35 mph will accompany falling and/or blowing snow to frequently reduce visibility to less than 1/4 mile for three or more hours.
Ice Storm Warning	An ice storm event is expected to meet or exceed local ice storm warning criteria in the next 12 to 36 hours. Criteria for ice is 1/2 inch or more over at least 50 percent of the zone or encompassing most of the population.
Winter Storm Warning	A winter storm event (heavy sleet, heavy snow, ice storm, heavy snow and blowing snow or a combination of events) is expected to meet or exceed local winter storm warning criteria in the next 12 to 36 hours. Criteria for snow is 7 inches or more in 12 hours or less; or 9 inches or more in 24 hours covering at least 50 percent of the zone or encompassing most of the population. Use "mid-point" of snowfall range to trigger warning (i.e 5 to 8 inches of snow = warning). Criteria for ice is 1/2 inch or more over at least 50 percent of the zone or encompassing most of the population.
Wind Chill Warning	Wind chill temperatures are expected to meet or exceed local wind chill warning criteria in the next 12 to 36 hours. Wind chill temperatures may reach or exceed -25°F.

[National Weather Service \(weather.gov\)](http://www.weather.gov)

Severe winter storms produce heavy snowfall, sleet, ice, and/or freezing rain. They can also include extreme cold temperatures and high winds, intensifying the impact of the storm. Severe winter weather impacts travel, which causes widespread power outages, damages property and may result in fatalities and injuries.

### Locations Affected by Winter Storms

There is no defined geographical hazard boundary. Winter storms are typically widespread. The entire Planning Area is susceptible to severe winter storm events. Higher elevations typically experience lower temperatures and higher probability of frozen precipitation. Geographical features influence wind chill. The more rural areas of Hartman, Knoxville, Lamar, and the unincorporated areas of Johnson County are more vulnerable to the effects of a winter storm.

## Extent, Magnitude and Severity of Winter Storms

The magnitude and severity of winter storms are affected by the duration of the storm. Factors such as the precipitation type (snow compared to ice), rate, and amount affect the storm's impact. According to National Climatic Data Center (NCDC) and National Weather Service Data, typical snow accumulations in the Planning Area during heavy snow and winter storm events range from 1 inch to 8 inches of snow. Typical ice storm accumulations range from 1/10 of one inch to 1/2 of an inch of ice. Historically the Planning Area can expect 1-12.5 inches of snow/ice.

When severe winter storm events do occur (the worse typically associated with ice), they are usually widespread over the area and impede the movement of vehicles. They limit regular movement of traffic, cause accidents, and limit responsiveness of emergency services. Power lines and communication networks can also be downed. Structures may sustain serious damage creating potentially critical conditions for the entire area.

School Districts located in the Planning Area monitor weather updates via television, radio and internet. If weather becomes hazardous as determined by the Superintendent, then appropriate actions are taken. There is not an actual policy on inclement weather response. Instead, the school administrators use their judgement based on weather forecast, time of day, and location of students to implement actions.

Extreme low temperatures and wind chill can also significantly affect the impact of winter storms. The lowest temperature ever recorded within the Planning Area was 17.4 °F, which occurred in February 1899. The average low temperature for the winter months is approximately 30 °F, according to the [Climate at a Glance Time Series graph](#).

When temperatures below 32-40 degrees, students may be kept inside by the determination of school principals to protect against extreme cold temperatures. Wind chill would be the determining factor in keeping students inside.

## Previous Occurrences

From 2000 to 2023, the National Weather Service recorded 70 severe weather events in the Planning Area. Injuries and deaths were not numerically reported accurately; however, it is mentioned within the event narratives. These events were classified as heavy snow, ice storm, winter storm and winter weather. At least two ice storms (Dec 2000 and Jan 2009) resulted in declared disasters per FEMA.

Event Type	# of Events
Heavy Snow	6
Ice Storm	5
Winter Storm	15
Winter Weather	44
<b>Total:</b>	<b>70</b>

### Heavy Snow

Number of County/Zone areas affected:	1
Number of Days with Event:	6
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	0
Number of Days with Event and Crop Damage:	0
Number of Event Types reported:	1

<u>Location</u>	<u>County/Zone</u>	<u>St.</u>	<u>Date</u>	<u>Time</u>	<u>T.Z.</u>	<u>Type</u>	<u>Mag</u>	<u>Dth</u>	<u>Inj</u>	<u>PrD</u>	<u>CrD</u>
<b>Totals:</b>								0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/06/2003	09:55	CST	Heavy Snow		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/08/2010	04:00	CST-6	Heavy Snow		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/09/2011	04:00	CST-6	Heavy Snow		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/14/2021	13:08	CST-6	Heavy Snow		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/17/2021	06:00	CST-6	Heavy Snow		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	01/15/2022	08:45	CST-6	Heavy Snow		0	0	0.00K	0.00K
<b>Totals:</b>								0	0	0.00K	0.00K

[NOAA Storm Event Database](#)

February 9, 2011, the Planning Area experienced heavy snowfall. Across the state, snow accumulations ranged from four to twelve inches. Schools across the state closed due to blocked or unsafe roadways. Several traffic accidents occurred as well. Within the Planning Area, approximately six inches of snow fell eight miles north of the city of Hartman.

### Ice Storm

Number of County/Zone areas affected:	1
Number of Days with Event:	4
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	2
Number of Days with Event and Crop Damage:	0
Number of Event Types reported:	1

<u>Location</u>	<u>County/Zone</u>	<u>St.</u>	<u>Date</u>	<u>Time</u>	<u>T.Z.</u>	<u>Type</u>	<u>Mag</u>	<u>Dth</u>	<u>Inj</u>	<u>PrD</u>	<u>CrD</u>
<b>Totals:</b>								0	0	25.025M	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	12/26/2000	00:00	CST	Ice Storm		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	01/26/2009	15:00	CST-6	Ice Storm		0	0	25.000M	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/20/2013	12:00	CST-6	Ice Storm		0	0	25.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	01/22/2020	05:00	CST-6	Ice Storm		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	01/22/2020	05:00	CST-6	Ice Storm		0	0	0.00K	0.00K
<b>Totals:</b>								0	0	25.025M	0.00K

### [NOAA Storm Event Database](#)

January 26-27, 2009, the Johnson County Sheriff's office reported one inch of ice across the Planning Area by the early morning hours of the twenty-seventh. The result of the storm was historic and devastating across the state. The ice knocked out electricity for more than 300,000 residents, leaving people without heat in their homes, telephone communication, potable water and/or sewer service. More than 10,000 power poles were broken: hundreds of miles in power lines lay on the cold ground. Transformers everywhere had to be replaced.

#### Winter Storm

Number of County/Zone areas affected:	3
Number of Days with Event:	14
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	2
Number of Days with Event and Crop Damage:	0
Number of Event Types reported:	1

<u>Location</u>	<u>County/Zone</u>	<u>St.</u>	<u>Date</u>	<u>Time</u>	<u>T.Z.</u>	<u>Type</u>	<u>Mag</u>	<u>Dth</u>	<u>Inj</u>	<u>PrD</u>	<u>CrD</u>
<b>Totals:</b>								0	0	1.350M	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	12/13/2000	01:00	CST	Winter Storm		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/05/2002	15:00	CST	Winter Storm		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	03/02/2002	08:00	CST	Winter Storm		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	12/22/2004	17:00	CST	Winter Storm		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	03/06/2008	11:00	CST-6	Winter Storm		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	01/28/2010	20:00	CST-6	Winter Storm		0	0	0.00K	0.00K

<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/13/2012	04:00	CST-6	Winter Storm		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	12/05/2013	13:00	CST-6	Winter Storm		0	0	1.300M	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	03/02/2014	14:00	CST-6	Winter Storm		0	0	50.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/15/2015	21:00	CST-6	Winter Storm		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/02/2022	19:15	CST-6	Winter Storm		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/23/2022	08:50	CST-6	Winter Storm		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/23/2022	08:50	CST-6	Winter Storm		0	0	0.00K	0.00K
<a href="#">JOHNSON COUNTY HIGHER EL...</a>	JOHNSON COUNTY HIGHER EL...	AR	01/24/2023	12:45	CST-6	Winter Storm		0	0	0.00K	0.00K
<a href="#">SOUTHERN JOHNSON COUNTY ...</a>	SOUTHERN JOHNSON COUNTY ...	AR	01/14/2024	12:30	CST-6	Winter Storm		0	0	0.00K	0.00K
<b>Totals:</b>								0	0	1.350M	0.00K

[NOAA Storm Event Database](#)

On December 5, 2013, freezing rain and sleet began fall across the Planning Area. As the storm progressed, sleet turned to snow. The precipitation weighed heavy on the resident’s homes and businesses. One elder man was killed after a limb fell on his mobile trailer home. President Barack Obama declared federal disasters in multiple counties across Arkansas, including Johnson County. Snow and sleet covered the city of Clarksville and surrounding areas. Ice in the northern part of the Planning Area knocked down trees and power lines alike.

**Winter Weather**

Number of County/Zone areas affected:	3
Number of Days with Event:	41
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	2
Number of Days with Event and Crop Damage:	0
Number of Event Types reported:	1

<u>Location</u>	<u>County/Zone</u>	<u>St.</u>	<u>Date</u>	<u>Time</u>	<u>T.Z.</u>	<u>Type</u>	<u>Mag</u>	<u>Dth</u>	<u>Inj</u>	<u>PrD</u>	<u>CrD</u>
<b>Totals:</b>								0	0	150.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	01/21/2008	20:30	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	01/25/2008	09:00	CST-6	Winter Weather		0	0	0.00K	0.00K

<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	01/31/2008	14:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	12/15/2008	04:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	12/23/2008	07:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	01/05/2009	10:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/28/2009	14:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	12/24/2009	22:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	01/03/2010	03:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	01/09/2011	17:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	01/20/2011	08:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/01/2011	05:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/04/2011	10:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	12/05/2011	08:30	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	12/25/2012	13:00	CST-6	Winter Weather		0	0	100.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	01/15/2013	10:30	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	03/21/2013	16:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	11/25/2013	06:30	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	01/08/2014	11:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/04/2014	07:00	CST-6	Winter Weather		0	0	50.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/07/2014	18:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	11/16/2014	17:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/23/2015	10:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/27/2015	15:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	03/04/2015	14:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/23/2016	18:00	CST-6	Winter Weather		0	0	0.00K	0.00K

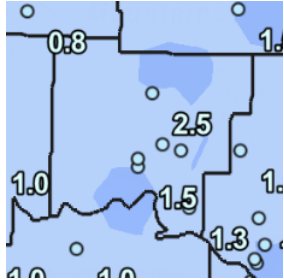
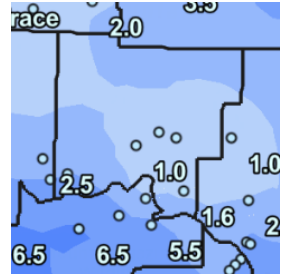
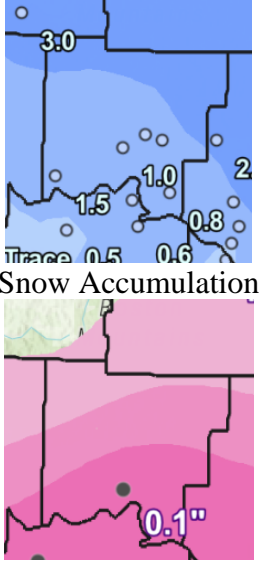
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<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	02/20/2020	02:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	12/13/2020	14:00	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON (ZONE)</a>	JOHNSON (ZONE)	AR	01/06/2021	16:47	CST-6	Winter Weather		0	0	0.00K	0.00K
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<a href="#">JOHNSON COUNTY HIGHER EL...</a>	JOHNSON COUNTY HIGHER EL...	AR	12/22/2022	12:15	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">SOUTHERN JOHNSON COUNTY ...</a>	SOUTHERN JOHNSON COUNTY ...	AR	01/24/2023	14:30	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON COUNTY HIGHER EL...</a>	JOHNSON COUNTY HIGHER EL...	AR	01/30/2023	16:15	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">SOUTHERN JOHNSON COUNTY ...</a>	SOUTHERN JOHNSON COUNTY ...	AR	01/30/2023	16:15	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">JOHNSON COUNTY HIGHER EL...</a>	JOHNSON COUNTY HIGHER EL...	AR	01/05/2024	07:30	CST-6	Winter Weather		0	0	0.00K	0.00K
<a href="#">SOUTHERN JOHNSON COUNTY ...</a>	SOUTHERN JOHNSON COUNTY ...	AR	01/05/2024	07:30	CST-6	Winter Weather		0	0	0.00K	0.00K
<b>Totals:</b>								0	0	150.00K	0.00K

[NOAA Storm Event Database](#)

March 11, 2022, Clarksville had snow on the ground which measured 2.5 inches. Trees, power lines, and power poles were brought down by the ice. About 45,000 electric customers lost power. In a few instances, it took three and a half days to restore power. Several counties opened warming shelters for those who had no electricity. The Planning Area reported no property damage, but the electrical repairs would have endured additional expenses at this time.



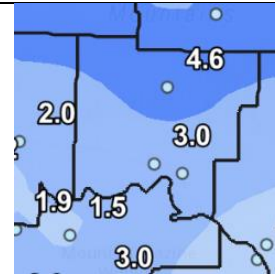
The National Weather Service in Little Rock maintains an [Arkansas Winter Storm Database](#). The database includes severe winter weather events from 2011. From the database, the following significant events impacted the Planning Area:

<p><b>February 9-11, 2011</b>          Heavy snow fell in much of northern and central Arkansas, with as much as two feet of accumulation in parts of the Ozarks. The snow was followed by bitterly cold arctic air, with most places recording the coldest February temperatures since 1996 or 1951. Some locations in northern and central Arkansas recorded their coldest temperatures since the December 1989 Arctic outbreak. Morrilton saw low temperatures of -1 °F.</p>	 <p>Snow Accumulation</p>
<p><b>December 25-26, 2012</b>          Record heavy snow fell on top of some light freezing rain in much of western, central, and northeast Arkansas. Many locations saw the snowiest December on record, just from this one storm. The ice and heavy snow downed trees and caused widespread power outages, especially around Little Rock. Johnson County experienced record-breaking snowfall of 12.5 inches.</p>	 <p>Snow Accumulation</p>
<p><b>March 1-4, 2014</b>          Snow &amp; Sleet (blue) and Freezing Rain (red)          A strong Arctic front stalled in southern Arkansas. Heavy rain fell. Behind the front, freezing rain, sleet and snow accumulated in northern and central Arkansas. Three to five inches of snow fell in northern Arkansas, with one to three inches of sleet and snow in the central on top of a quarter to half inch of freezing rain.</p>	 <p>Snow Accumulation</p> <p>Freezing Rain</p>

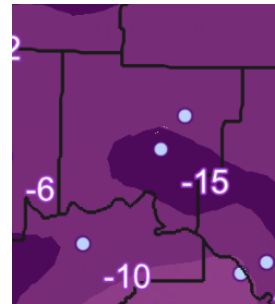
**February 14-18, 2021**

Within the span of five days, beginning on February 14th and lasting through the 18th, two significant winter storms affected Arkansas in back-to-back fashion. The storms produced record snowfall and snow depths across the state. Additionally, record Arctic cold set in, with low temperatures below zero around most of the state.

Very cold Arctic air moved in behind the system, with widespread below zero temperatures in much of the state. The morning of the 16th brought the coldest temperatures of the Arctic Snap, however a prolonged period of high temperatures below freezing also preceded and accompanied the cold snap.



Snow Accumulation

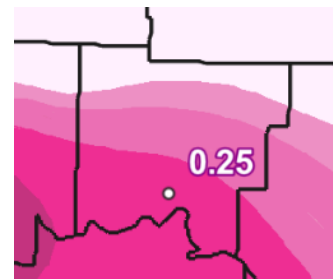


Sub-zero low temperatures

**February 24-25, 2022**

On February 24-25, 2022, the state was impacted with less snow, and greater coverage of primarily sleet and freezing rain, driving widespread travel impacts.

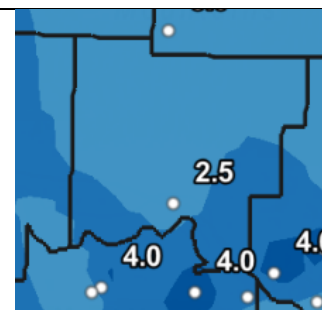
The greatest ice accumulations were observed over central and eastern Arkansas, with ice accruals as thick as one-half inch to three-quarters of an inch common, and over one inch of ice reported near Searcy (White County), and a light glazing of ice more common elsewhere in the state. In addition to travel impacts, over 30,000 power outages were reported over eastern Arkansas where ice accumulations were the most significant.



Sleet / freezing rain

**March 11, 2022**

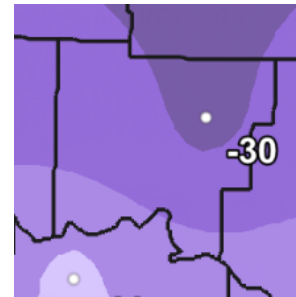
On March 11, 2022, a late-season winter weather event impacted much of the state, with the greatest snow totals observed over much of central Arkansas, and eastern portions of the state near the Mississippi River. Snow totals of 3 to 5 inches were common around the Little Rock and Conway metro areas, with most other locations receiving 2 to 3 inches of snow.



Snow Accumulation

**December 22, 2022**

A strong Arctic cold front swept through the state on the afternoon of December 22, bringing northwesterly winds of 30 to 40 mph to portions of the area. Extremely cold air was ushered into the state overnight, with low temperatures on the morning of December 23, falling to their lowest values the state had seen in the month of December since 1989. Single-digit air temperatures were common over central and southern Arkansas, with much of northern Arkansas and the higher terrain regions falling into the negative single-digits. Strong winds associated with the cold front drove wind chill values into the negative teens and twenties across much of central and northern Arkansas on the morning of December 23.

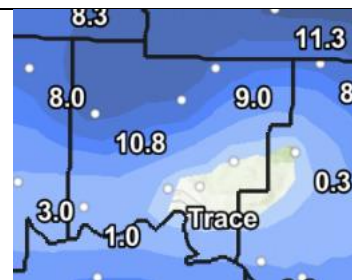


Wind Chill Values

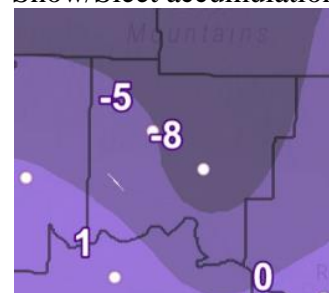
**January 14-16, 2023**

A winter storm impacted mostly northern Arkansas as an Arctic Air Outbreak overspread across the central and southern United States. A band of totals from four to seven (or more) inches of snow was observed across northern Arkansas and the higher terrain of the Boston Mountains/Ozark National Forest. Over the central and southern portions of the state, sleet was much more predominant, and this lowered snow totals to one to three inches, despite bitter cold temps near the surface.

Numerous cold mornings were observed, with progressively colder mornings observed daily through the Arctic Air outbreak, but most areas saw their coldest reading on the mornings of January 16th or the 17th. In addition to record cold lows, several area locations set records for daily "low-high" temperatures on both January 15th and 16th.



Snow/Sleet accumulation



Minimum observed air temperatures

## Probability of Future Events

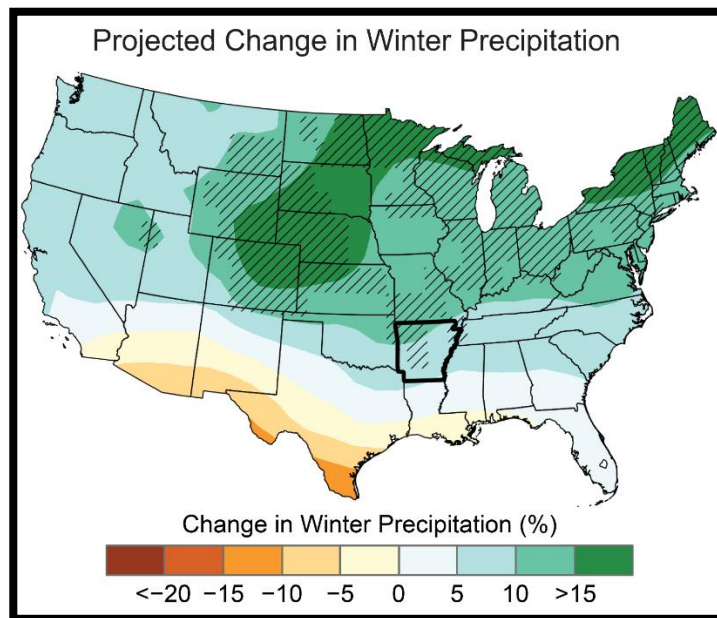
The probability the Planning Area will experience a severe winter storm event is less than 1% per year. Based upon previous occurrences (# of events between 2000 and 2023), the probability is estimated using the following formula:

$$\frac{\# \text{ of events}}{\# \text{ of days}} \times 100 = \underline{\hspace{2cm}}$$

Data collected from 2000-2023 was equal to 8,395 days.

Based on climate research, Arkansas' wintertime precipitation is expected to increase. NOAA National Centers for Environmental Information performed a State Climate Summary in 2022. According to their research,

“Wintertime precipitation is projected to increase in Arkansas by midcentury (see figure below), with the increase being in the form of rain rather than snow. In the other seasons, precipitation changes are uncertain. Increases in evaporation rates due to rising temperatures may increase the rate of soil moisture loss during dry spells. As a result, naturally occurring droughts are projected to be more intense.”



Projected changes in total winter (December–February) precipitation (%) for the middle of the 21st century compared to the late 20th century under a higher emissions pathway. Hatching represents areas where the majority of climate models indicate a statistically significant change. Arkansas is part of a large area of projected increases in winter precipitation across the United States. Sources: CISESS and NEMAC. Data: CMIP5.

Based on historical evidence, the planning team determined the likelihood of future winter storms is HIGH.

### Vulnerability and Impact of Winter Storms

Historical data reports that the Planning Area has had 30 winter weather events in the last 23 years. This means theoretically the Planning Area can expect at least one winter weather event per year. Damage from winter storms is often not reported to public agencies for recording in databases such as SHELDUS.

The overall impact of a severe winter storm is high for the Planning Area. Winter storms can cause dangerous travel conditions and possible structural damage, placing communities and individuals at risk. Utilities including electricity, water, and communications can be lost.

Winter storms can immobilize an entire county. Wet snow quickly turns into ice rendering roads impassable, damaging trees, power lines, cutting off power/communications, and causing death. Winter storms may bring strong winds, freezing rain, snow, ice, and blizzard like conditions that limit visibility. During a winter weather event, roads will likely be impassible. The availability of emergency and essential services will be restricted throughout all participating jurisdictions. Ice accumulation may leave roads, bridges and culverts damaged. The County Road Department has access to equipment for clearing roads and has mutual aid agreements with private services and other counties for support. However, due to the extent of winter weather, there will be limited manpower for clearing roads in the Planning Area. Roads will be cleared on a priority bases. The Planning Area may not have the capabilities to clear rural and unpaved roads. Road conditions as described may leave motorists stranded, interrupt supply chains, and disrupt lifesaving services.

All people and structures in the Planning Area are vulnerable to downed limbs and trees. Ice accumulation on tree branches may cause limbs to fall on people or structures causing minor to extreme impacts.

The entire Planning Area is at risk of extended power outages resulting in exposure to freezing temperatures. Rural areas of the Planning Area are most at risk of losing power and becoming isolated during a winter storm. Children under the age of 5, adults over the age of 65, those with disabilities, economically challenged, and the unhoused are at the greatest risk of hypothermia and other life-threatening health problems.

In addition to hypothermia risks, there is a greater risk of fire, carbon monoxide (CO) poisoning, electrical shock or electrocution during winter weather due to increased use of portable heaters and generators. According to a 2013 Consumer Product Safety Commission report, half of the generator-

Potential Winter Storm Impacts	
	<p><b>No Impacts</b> Impacts not expected.</p>
	<p><b>Limited Impacts</b> Rarely a direct threat to life and property. Typically results in little inconveniences.</p>
	<p><b>Minor Impacts</b> Rarely a direct threat to life and property. Typically results in an inconvenience to daily life.</p>
	<p><b>Moderate Impacts</b> Often threatening to life and property, some damage unavoidable. Typically results in disruptions to daily life.</p>
	<p><b>Major Impacts</b> Extensive property damage likely, life saving actions needed. Will likely result in major disruptions to daily life.</p>
	<p><b>Extreme Impacts</b> Extensive and widespread severe property damage, life saving actions will be needed. Results in extreme disruptions to daily life.</p>

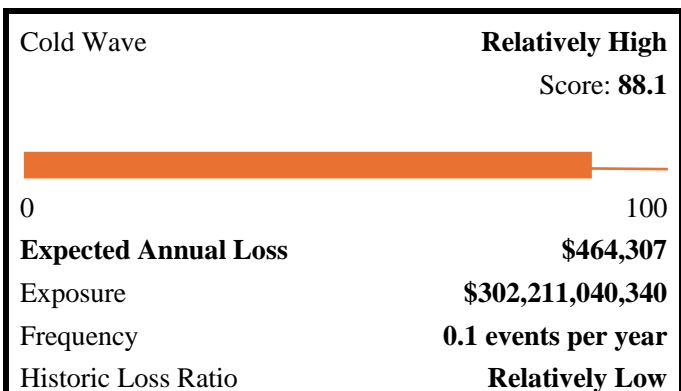
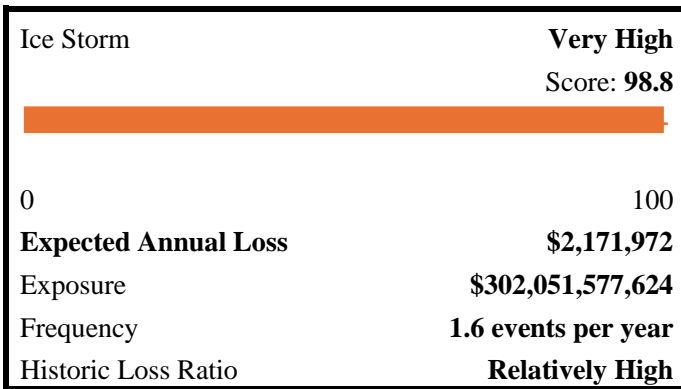
related deaths happened in the four coldest months of the year, November through February, and portable generators were involved in the majority of carbon monoxide deaths involving engine-driven tools. According to the National Fire Protection Association (NFPA), home fires occur more in the winter than in any other season, and heating equipment is involved in one of every six reported home fires, and one in every five home fire deaths (“[Put a Freeze on Winter Fires](#)”, NFPA) (“[Extreme Cold Guide](#)”, CDC). In addition, frozen pipes and impassable roads may impede firefighting efforts.

Severe winter weather also negatively impacts the Planning Area’s economy. Businesses are closed due to snow and ice as well as power outages. Infrastructure can be damaged by a buildup of ice and snow. Extreme cold can rupture pipes. The agricultural sector can be impacted by damaged crops and lost farm animals from winter weather events.

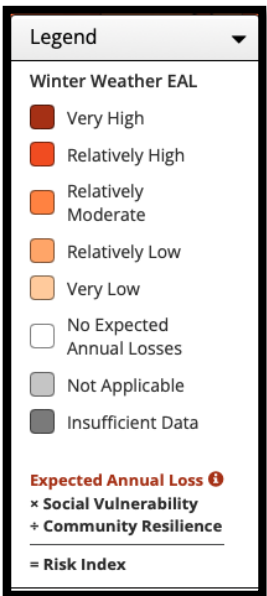
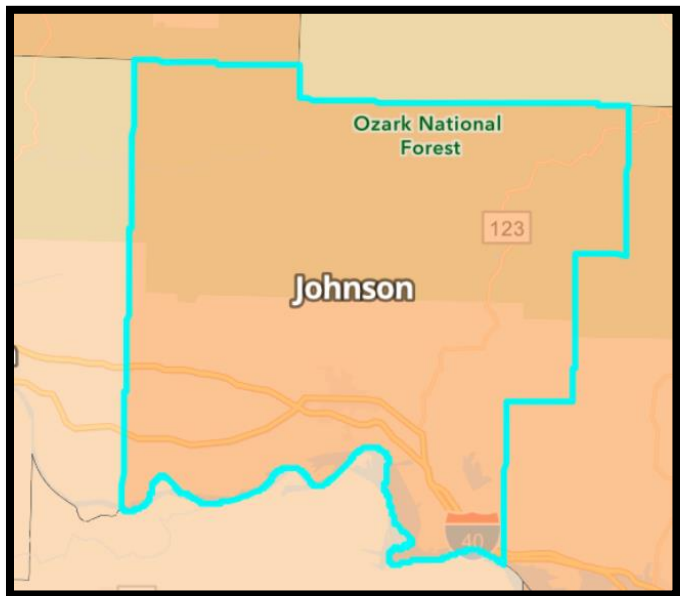
### Estimating Potential Loss

Expected annual loss was calculated for the Planning Area at <https://hazards.fema.gov/nri/map>. Expected annual loss scores are calculated using an equation that combines values for exposure, annualized frequency, and historic loss ratios for the hazard type.

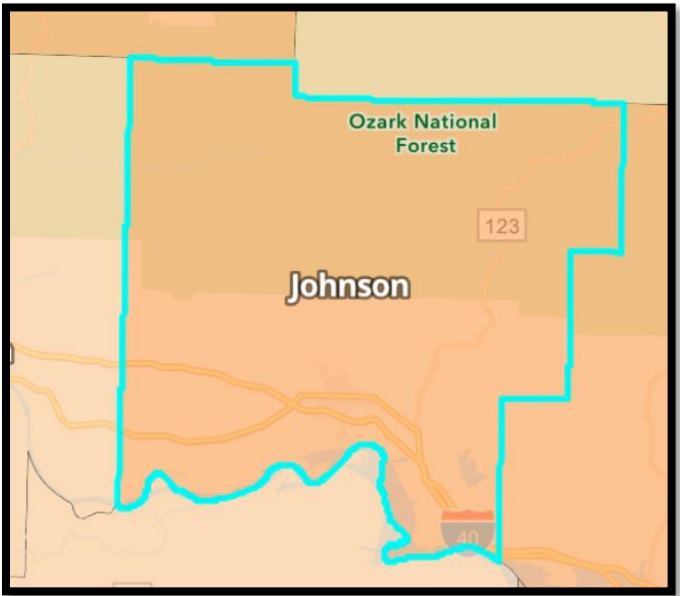
$$\begin{aligned}
 &\text{Exposure} \\
 &\times \text{Annualized Frequency} \\
 &\times \text{Historic Loss Ratio} \\
 \hline
 &= \text{Expected Annual Loss}
 \end{aligned}$$



<b>Composite Expected Annual Loss</b>		<b>\$8,020,558.49</b>	
<b>Composite Expected Annual Loss Rate National Percentile</b>		<b>80.3</b>	
Building EAL	<b>\$3,806,977.66</b>	Population EAL	<b>0.34 fatalities</b>
Building EAL Rate	<b>\$1 per \$1.08K of building value</b>	Population EAL Rate	<b>1 per 75.08K people</b>
Agriculture EAL	<b>\$245,405.64</b>	Population Equivalence EAL	<b>\$3,968,175.19</b>
Agriculture EAL Rate	<b>\$1 per \$649.79 of agriculture value</b>		



<https://hazards.fema.gov/nri/map>



<https://hazards.fema.gov/nri/map>

## **Population**

Changes in population will affect the impact of winter storms. As populations grow, more individuals and infrastructure will be impacted by winter storms. Currently the Planning Area is trending a decrease in population. However, the Planning Area is expecting growth in industry. Over the next five years the Planning Team will need to research and document the effects of population on winter weather.

## **Land Use**

Changes in land use could impact the effects of a winter storm. The Planning Area has both agricultural and industrial areas, which are affected by winter storms. Over the next five years the Planning Team will need to research and document changes in land use and its effects on the Planning Area.

## **Climate**

According to NOAA National Centers for Environmental Information wintertime precipitation is projected to increase. The increase will consist of more rain than snow. The challenges posed by climate change can increase the probability of extreme weather events including winter storms and ice storms. These impacts will be monitored by the planning team over the next 5 years to continue research for nature-based solutions to mitigate all possibilities of potential increased impacts.

## **Multi-Jurisdictional Risk Assessment**

The entire planning area is affected by winter storms. Winter storms are not unique to any portion of the planning area. The occurrence of severe winter storms can have a substantial impact on the planning area's buildings, utility systems, transportation systems, and agriculture.

Heavy accumulations of ice or snow commonly result in damage to buildings. Damage may be caused directly by the excessive weight of the ice/snow or by ice-laden trees or branches falling on structures. Homes, businesses, as well as weaker nonresidential structures are most vulnerable to this type of structural damage. The abundant wood structures and manufactured houses in the planning area are much more vulnerable than steel, concrete, or masonry structures. Past storms indicate poultry houses are particularly vulnerable.

Heavy accumulations of ice or snow as well as high winds can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communication and power can be disrupted for days or weeks while utility companies repair the damage. Power and communication disruptions are common consequences of ice storms and heavy snow. Transportation systems are vulnerable to severe winter storms.

Accumulations of ice and snow can be extremely hazardous to motorists. The planning area lacks the necessary snow removal equipment due to the infrequent occurrence of severe winter storms. Motorists in the planning area are not accustomed to driving on icy roads. These factors result in an increase in traffic accidents. When major roads are blocked, travel flow and the availability of essential services throughout the area is affected.



## **Section 5 Mitigation Strategy**

The Johnson County Hazard Mitigation plan includes a mitigation strategy that provides the Planning Area's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

The County, Cities, and School District have varying capabilities for implementing and maintaining mitigation efforts. These capabilities depend on existing authorities, policies, programs, and resources.

The Cities of Johnsonsville, Coal Hill, Hartman, Knoxville and Lamar each are different in terms of staffing, funding, policies and program capabilities providing the ability to carry out their local hazard mitigation goals. However, each city has the capability to:

- be an active member in the NFIP,
- to pass mitigation ordinances for their local government,
- regulate and limit the development in wildfire hazard areas and flood prone areas through land use planning implement retrofit construction plans,
- brace equipment
- provide emergency preparedness information to area residents through FEMA brochures.

The entire Planning Area is dependent upon grant funding to assist with larger mitigation projects. Examples of projects that may be requested:

- Safe Rooms
- Heavy Duty Generators (back up and maintain electrical power for critical facilities)
- Communication and early warning systems
- Heating/Cooling Centers
- Flood Inundation Study for the Planning Area
- Flash Flood Inundation Studies
- Inspection, Maintenance, and Enforcement Programs for High-Risk Dams

### **5.1 Mitigation Goals and Objectives for Each Hazard**

Based upon the results of the local and State risk assessments, the Johnson County Hazard Mitigation Planning Team, with input from local jurisdictions and officials, developed hazard mitigation goals and objectives and selected those that were determined to be of greatest benefit.

These goals and objectives represent what Johnson County believes is a long-term vision for reduction and enhancement of mitigation capabilities.

**Goal 1: Reduce the potential for loss of life, injury, and economic damage created by exposure to natural hazard for residents of Johnson County due to natural disasters.**

- Identify, describe, and characterize the natural hazards to which Johnson County is susceptible
- Assess the risk of each hazard including probability and frequency, exposure, and consequences
- Examine feasible mitigation opportunities appropriate for the identified hazards and prioritize those opportunities.
- Implement mitigation actions to reduce loss of lives and property
- Identify mitigation opportunities for long-range planning consideration.
- Encourage members of the Johnson County Local Emergency Planning Committee (LEPC) and other stakeholders to include mitigation measures in emergency planning efforts.
- Promote NFIP compliance throughout the County.

**Goal 2: Provide a framework and coordination to encourage all levels of government and public/private organizations to undertake mitigation to minimize potential disasters and to employ mitigation in the recovery following disasters.**

- Hold regular LEPC meetings to discuss mitigation actions with city officials, County emergency office, and private sectors.
- Keep records of all natural hazards and analyze areas that are at risk to prevent future losses.

**Goal 3: Seek grants for mitigation projects through the State and Federal funding.**

- Update Hazard Mitigation plan every 5 years.
- Inquire grant information from Arkansas Department of Emergency Management, and Planning and Development District.

**Goal 4: Protect existing properties from natural disasters.**

- Protect existing structures from natural hazards using cost-effective approaches.

## **5.2 Implementation of Mitigation Actions**

The mitigation actions are prioritized based upon their effect on the overall:

- Risk to life
- Risk to property
- Ease of implementation

- Community
- Agency support
- Ability to obtain funding

The County and participating jurisdictions have used the STAPLEE method to prioritize mitigation actions. This method has the benefit that the Mitigation actions are considered in discrete categories of:

- Social
- Technical
- Administrative
- Political
- Economic
- Environmental

Prioritization can be effectively conducted by meticulously considering each of these categories. By comprehensively analyzing each aspect, potential oversights can be minimized, enabling a thorough evaluation of the most appropriate actions for each jurisdiction to contemplate.

Criteria used for prioritization and review of mitigation actions based on STAPLEE:

Evaluation Category	Sources of Information
Social	Members of Local governments and the County Government were members of the Hazard Mitigation Planning Team and had input throughout the planning process. It must be noted that many small-town political leaders are also business or professional persons. They are also members of the LEPC. Existing community plans were and will be relied on wherever possible. Members of the media were contacted and invited to all attend all HMPT meetings.
Technical	The following persons/agencies were consulted as to the technical feasibility of the various projects: Arkansas Geological Commission, University of Arkansas Extension Service, Arkansas Soil and Water Conservation Commission, Arkansas Health Department, Arkansas Highway and Transportation Department, Arkansas Department of Environmental Quality, Arkansas Governor’s Pre-Disaster Advisory Council, Arkansas Governor’s Earthquake Advisory Council, and Arkansas Forestry Service. Arkansas Department of Emergency Management. All of these had their comments and suggestions incorporated.
Administrative	Staffing for proper implementation of the plan currently will rely largely on existing members of the various agencies involved. Technical assistance is available from various local and state agencies. Some local jurisdictions have incorporated Hazard Mitigation efforts into their Capital Improvement Plans. Operations costs are under discussion by the appropriate agency or department heads.

Political	The County Quorum Court has passed resolutions in support of mitigation activities involving floodplain ordinances, mitigation planning, and fire districts, among others. The Governor of Arkansas issued an Executive Order in August of 2004 (EO 04-02) instructing all state agencies to assist ADEM in mitigation planning and implementation of mitigation goals.
Legal	Members of the HMPT discussed legal issues, and it was their opinion that no significant legal issues were involved in the projects that were selected by the HMPT. However, where legalities may be an issue, this is noted.
Economic	Economic and benefit cost issues were the predominant topics discussed by all concerned. Each entity felt that the projects selected would have positive effects, yet realized that actions often have costs, sometimes hidden, imposed on the community, residents and businesses. Funding for the various activities was a major concern as local budgets are always under pressures with existing and competing projects and activities. Where necessary, particularly for costly capital projects, outside grants would be relied on heavily.
Environmental	The Arkansas Geological Survey, Arkansas Department of Environmental Quality, Arkansas Forestry Commission, and Arkansas Soil and Water Conservation Commission were all consulted as to the environmental impact of the various projects and it was felt that there would be no negative impact. Local environmental issues and concerns were also taken into consideration.

The Johnson County Office of Emergency Management (CCOEM) will be responsible for evaluating actions among competing actions. The Planning Team prioritized the list of mitigation actions by conducting a cost-benefit review. This review was conducted by:

1. Considering the number of people who would be affected by a chosen project.
2. Determining the area the project would cover.
3. Considering how critical the structures were within the project area.
4. Which structures were most critical?
5. How would it benefit the entire community?

The CCOEM shall evaluate actions based on funding availability, comparative value to mitigation objectives, and consideration of economic benefits and environmental concerns of the communities. Actions are prioritized in three different categories:

- **High** need for immediate action
- **Medium** need for action
- **Low** lacking in urgency

All Johnson County actions, and planning mechanisms are the responsibility of the director of the Johnson County Office of Emergency Management. The Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar actions and planning mechanisms are the responsibility of their mayors. The School Districts of Clarksville, Lamar, Oark-Jasper and Johnson County Westside

will be the responsibility of their School Board Administration. The University of the Ozarks will be the responsibility of their Board of Directors and/or University President.

The Responsible Agency for each mitigation action will identify resources. Their responsibility will be to examine resources from all levels of government. The responsible parties will integrate the requirements of the mitigation plan into other plans when appropriate. This will also include funding and support for enacting and enforcing:

- Building codes
- Zoning ordinances
- Developing public education programs
- Alert residents to risks
- Alert residents how they can reduce hazard losses.

Plans will be made to earmark resources for implementing these actions.

Each jurisdiction and school district within the Planning Area that participated in the planning process has at least two actions that will benefit the jurisdiction.

For the purpose of developing the Johnson County Hazard Mitigation Plan, mitigation actions are categorized into six groups:

- **Prevention:** Actions that will keep problems from getting worse.
- **Property Protection:** Actions that address individual buildings
- **Public Education and Awareness:** Actions that will inform the public.
- **Natural Resource Protection:** Actions that will protect natural resources.
- **Emergency Service Protection:** Actions that will protect emergency services before, during, and immediately after an occurrence.
- **Structural Projects:** Actions that will control the hazard.

## 5.3 Mitigation Actions and Projects

### Mitigation Actions

*Conduct inspections, maintenance and enforcement programs on dams to ensure structural integrity. (NFIP consideration; CRS 330 Outreach, CRS 350 Flood Protection Information.*

**Associated Hazard:** Dam Failure

**Type of Action:** Prevention

**Contribution to Mitigation Objective:** Prevent loss of life or property due to future dam and levee failure by correcting structural weakness

**Priority:** Medium

**Rationale for Priority:** Since there are no past dam failures in Johnson County, priority is not high, but failure is a possibility.

**Addresses new or existing buildings:** New and existing

**Cost Benefit:** Highly beneficial, low cost

**TimeLine:** 5 Years

**Projected Resources:** Existing County and Local Resources

**Responsible Party:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville Connect and other utilities.

**Mitigation Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar

**STAPLEE:** Meets all Criteria

*Pass a County ordinance to restrict the use of public water resources for non-essential usage, such as landscaping, washing cars, filling swimming pools, etc.*

**Hazard Associated:** Drought

**Type of Action:** Prevention

**Contribution to Mitigation Objective:** Reduces the risk due to water shortages

**Priority:** High

**Rationale for Priority:** Drought has been an issue several times in the past.

**Addresses New or Existing buildings:** New and existing

**Cost Benefit:** Highly beneficial, at no cost.

**TimeLine:** 1 year

**Projected Resources:** County funds to publish Ordinance

**Responsible Party:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar

**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar

**STAPLEE:** Meets all Criteria

*Mitigate future losses by regulating development in wildfire hazard areas through land use planning and address density and quantity of development, as well as emergency access, landscaping and water supply.*

**Hazard Associated:** Wildfire

**Type of Action:** Prevention

**Mitigation Objective:** Reduces the risk of wildfire due to irresponsible land use.

**Priority:** High

**Rationale for Priority:** Prior wildfire events

**Addresses New or Existing buildings:** Existing.

**Cost Benefit:** Highly beneficial at no cost.

**TimeLine:** 2 Years

**Projected Resources:** Publish notice in paper at minimum expense.

**Responsible Party:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar

**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District

**STAPLEE:** Meets all Criteria

*County and Local Road Departments implement retrofit construction plans to increase drainage or absorption capacities with detention and relief drains, extra culverts and bridge modification where susceptible to flooding.*

**Associated Hazard:** Dam Failure, Flood/Flash Flood, Thunderstorms

**Type of Action:** Prevention and Structural

**Contribution to Mitigation Objective:** Corrects current weaknesses and prevents any future structural damage.

**Priority:** High

**Rationale for Priority:** Protection of life and property

**Addresses New or Existing Buildings:** Existing

**Cost Benefit:** Highly beneficial, outweighs all cost.

**Timeline:** 3 years, will continue maintenance and observation.

**Projected Resources:** Existing State, County, Local resources and possible grant funding when available.

**Responsible Party:** State Highway Department and Johnson County Road Department

**Action adopted by:** Johnson County

**STAPLEE:** Meets all criteria.

*Brace equipment (such as mechanical equipment, chillers, and emergency generators) whose failure may disrupt the operation of a critical facility, such as hospitals and schools.*

**Associated Hazard:** Dam Failure, Earthquake, Flood, Thunderstorm Wind/Strong Wind, Tornado, Winter storms

**Type of Action:** Non-structural

**Contribution to Mitigation Objective:** Prevents damage to necessary operating equipment and injury to citizens

**Priority:** High

**Rationale for Priority:** Protection of critical operations equipment

**Addresses New or Existing buildings:** New and Existing

**Cost Benefit:** Highly Beneficial, minimum cost

**TimeLine:** 5 Year

**Projected Resources:** Existing County, State and Local Resources

**Responsible Party:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District

**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District

**STAPLEE:** Meets all Criteria

*Provide emergency preparedness and mitigation information and resources for extreme weather events through an active educational outreach program with specific plans and procedures for at-risk populations.*

**Associated Hazard:** Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Thunderstorm Wind/Strong Wind, Lightning, Hail, Tornado, Wildfire, Winter storms

**Type of Action:** Public Education and Awareness

**Contribution to Mitigation Objective:** Education public how to be prepared to handle extreme temperatures and to be aware of those of high risk

**Priority:** High

**Rationale for Priority:** Prevent loss of life

**Addresses New or Existing buildings:** N/A

**Cost Benefit:** Highly Beneficial at no cost, free resources at FEMA website.

**TimeLine:** Ongoing

**Projected Resources:** FEMA brochures distributed by Johnson County Department of Emergency Management

**Responsible Party:** Johnson County Department of Emergency Management

**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District

**STAPLEE:** Meets all Criteria

*Conducting NFIP community workshops to provide information for property owners to acquire flood insurance.*

**Associated Hazard:** Flood

**Type of Action:** Public Education and Awareness

**Contribution to Mitigation Objective:** Education residents on the need of flood insurance

**Priority:** High

**Rationale to Priority:** Johnson County is prone to flooding.

**Addresses New or Existing buildings:** New and Existing

**Cost Benefit:** Highly Beneficial at no cost.

**TimeLine:** ongoing

**Projected Resources:** FEMA brochures to be distributed by Johnson County Department of Emergency Management

**Responsible Party:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar

**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar

**STAPLEE:** Meets all Criteria

*Provide education on why and how implementation to a higher standard of road elevation and culvert sizing on all County and city roads would be beneficial.*

**Associated Hazard:** Flood

**Type of Action:** Property Protection

**Contribution to Mitigation Objective:** Prevent flood damage to residents and allow emergency personnel vehicles access to areas otherwise shut off due to flooding.

**Priority:** High

**Rationale for Priority:** Flooding is an issue in parts of Johnson County

**Addresses New or Existing buildings:** New and Existing

**Cost Benefit:** Highly Beneficial

**TimeLine:** 10 year

**Projected Resources:** State, County and Local Resources

**Responsible Party:** County Road/City Street Departments

**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar

**STAPLEE:** Meets all Criteria

*Construct safe rooms within new and existing public buildings, such as schools, libraries, and community centers.*

**Associated Hazard:** Winter storms, Thunderstorm Winds, Tornado

**Type of Action:** Structural Project

**Contribution to Mitigation Objective:** Prevent the loss of life by providing shelter during pre/post disasters.

**Priority:** High

**Rationale of Priority:** Prevents the loss of life during storms and also minimizes the effects post hazard events.

Ranked high due to past storm events

**Addresses New or Existing buildings:** New and Existing

**Cost Benefit:** Benefits outweighs cost. Possible grants for construction.

**TimeLine:** 5 Year

**Projected Resources:** HMGP funding

**Responsible Party:** Emergency Management, School Districts, County and City Governments Offices

**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District

**STAPLEE:** Meets all Criteria



*Protect exceptionally vulnerable populations from the impacts of severe weather events through identifying specific at-risk populations in the event of long-term power outages by establishing accessible heating and cooling centers.*

**Associated Hazard:** Flood, Winter storms, Thunderstorm, Tornado, Wildfire, and Extreme Heat Events.  
**Type of Action:** Structural Project  
**Contribution to Mitigation Objective:** Prevent the loss of life by providing shelter during pre/post disasters.  
**Priority:** High  
**Rationale of Priority:** Prevents the loss of life during storms and also minimizes the effects post hazard events. Ranked high due to past storm events  
**Addresses New or Existing buildings:** Existing  
**Cost Benefit:** Benefits outweighs cost. Possible grants for refurbishment  
**TimeLine:** 2 Years  
**Projected Resources:** HMGP funding  
**Responsible Party:** Emergency Management, School Districts, County and City Governments Offices  
**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District  
**STAPLEE:** Meets all Criteria

*Adopt regulations governing residential construction to prevent wind damage, by requiring tie-downs with anchors and ground anchors appropriate for the soil type for manufactured homes and campground sites.*

**Associated Hazard:** Tornado and Thunderstorm Winds  
**Type of Action:** Public Education and Awareness  
**Contribution to Mitigation Objective:** Prevent loss of life and property by securing mobile homes from becoming missiles during high winds and tornadoes.  
**Priority:** High  
**Rationale of Priority:** Past wind storm events and number of mobile homes in Johnson County.  
**Addresses New or Existing buildings:** New and Existing  
**Cost Benefit:** Highly beneficial, no cost. Free info from fema.gov website  
**TimeLine:** 4 Years  
**Projected Resources:** FEMA brochures  
**Responsible Party:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar  
**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar  
**STAPLEE:** Meets all Criteria

*Install hail resistant roofing and window coverings, shutters laminated glass in windowpanes with a focus on critical infrastructure.*

**Associated Hazard:** Hail  
**Type of Action:** Property Protection  
**Contribution to Mitigation Objective:** Seeks to protect critical facilities from hail damages  
**Priority:** Medium  
**Rationale for Priority:** Past hail events  
**Addresses New or Existing buildings:** New and Existing  
**Cost Benefit:** Highly Beneficial, minimum cost to owner. Possible grant for funding  
**TimeLine:** 5 Years  
**Projected Resources:** Existing County and Local Resources, grant funding when available  
**Responsible Party:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District  
**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District  
**STAPLEE:** Meets all Criteria

*Install surge protection, lightning protection devices on all communications infrastructure and critical facilities.*

**Associated Hazard:** Lightning

**Type of Action:** Property Protection

**Contribution to Mitigation Objective:** Will guard critical communication equipment from lightning strikes.

**Priority:** High

**Rationale of Priority:** Past lightning events, and the need for operable communication equipment before, during and after disasters.

**Addresses New or Existing buildings:** New and Existing

**Cost Benefit:** Highly Beneficial, cost to owners of communications infrastructure and critical facilities.

**TimeLine:** 5 Years

**Projected Resources:** Existing County, Local and School District Resources

**Responsible Party:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District

**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District

**STAPLEE:** Meets all Criteria

*Purchase heavy-duty generators to back up and maintain electrical power for critical facilities, schools, and shelters to maintain power and water supply during disasters.*

**Associated Hazard:** Earthquake, Extreme Heat, Flood, Lightning, Thunderstorm Winds, Tornado, Wildfire, Winter storms

**Type of Action:** Emergency Services Protection

**Contribution to Mitigation Objective:** Continuation of water service, and temperature control

**Priority:** High

**Rationale of Priority:** Past disasters

**Addresses New or Existing buildings:** New and Existing

**Cost Benefit:** Highly Beneficial, cost varies on size and type of generator.

**TimeLine:** 5 Years

**Projected Resources:** Existing County, Local and School Resources and possible grant funds

**Responsible Party:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District

**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District

**STAPLEE:** Meets all Criteria

*Purchase of all-hazard NOAA weather radios in all schools, city halls, churches, assisted living facilities, hospitals, nursing homes, day care facilities, churches, businesses, industries where large numbers of people congregate; provide information to public on importance of having and how to acquire.*

**Associated Hazard:** Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Thunderstorm Wind/Strong Wind, Lightning, Hail, Tornado, Wildfire, Winter storms

**Type of Action:** Prevention

**Contribution to Mitigation Objective:** Protect lives by alerting congregations of people of impending disasters

**Priority:** High

**Rationale of Priority:** Past Disasters

**Addresses New or Existing buildings:** New and Existing

**Cost Benefit:** If action proves effective in influencing other to obtain radios, benefits will greatly outweigh cost. (NFIP consideration: CRS 610 Flood Warning Program)

**TimeLine:** 3 Years

**Projected Resources:** Existing County, Local and School District Resources, possible grant funding when available

**Responsible Party:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District

**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District

**STAPLEE:** Meets all Criteria

*Conduct Dam failure inundation studies with the creation of EAP or obtain EAP's that have already completed for existing dams in Johnson Co. Will provide information for extent and impact it may have on county, cities, and schools.*

**Hazard Associated:** Dam Failure

**Type of Action:** Prevention

**Contribution to Mitigation Objective:** Help planning team and community to understand risk.

**Priority:** Low

**Rationale for Priority:** Dam Failure understanding

**Addresses New or Existing buildings:** New and existing

**Cost Benefit:** NA

**TimeLine:** 5 years

**Projected Resources:** grants

**Responsible Party:** Planning Team

**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District

**STAPLEE:** Meets all Criteria

*Conduct engineering studies on what are the best solutions for dealing with flooding.*

**Hazard Associated:** Flooding

**Type of Action:** Prevention

**Contribution to Mitigation Objective:** Help planning team and community to understand risk.

**Priority:** Low

**Rationale for Priority:** Flooding

**Addresses New or Existing buildings:** New and existing

**Cost Benefit:** Highly Beneficial

**TimeLine:** 3 Years

**Projected Resources:** grants FMA Advanced Assistance

**Responsible Party:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar

**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar

**STAPLEE:** Meets all Criteria

*Acquire properties through grant funding if they flood on a repetitive basis and create green space.*

**Hazard Associated:** Flooding

**Type of Action:** Prevention

**Contribution to Mitigation Objective:** Help planning team and community to understand risk.

**Priority:** Low

**Rationale for Priority:** Flooding

**Addresses New or Existing buildings:** New and existing

**Cost Benefit:** Highly Beneficial

**TimeLine:** 3 Years

**Projected Resources:** available grant funding.

**Responsible Party:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar

**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar

**STAPLEE:** Meets all Criteria

*Pinpoint locations where common outdoor activities take place with no cellphone reception service, where phone alerts would be inactive, so an outdoor siren system may be implemented in the event of severe weather.*

**Hazard Associated:** Dam failure, severe thunderstorms, lightning, hail, tornadoes, flood/flash flooding

**Type of Action:** Preventative

**Contribution to Mitigation Objective:** Protection of life and property.

**Priority:** High

**Rationale for Priority:** previous incidents in cell coverage gap locations

**Addresses New or Existing buildings:** N/A

**Cost Benefit:** Highly beneficial

**Timeline:** 1 year

**Projected Resources:** State and local funds, available grant funding

**Responsible Party:** Johnson County

**Action adopted by:** Johnson County

**STAPLEE:** Meets all criteria.

*Implement ongoing education programs to provide background on the benefits of green spaces within Cities to minimize water waste and future flooding due to lack of land use planning and future development.*

**Hazard Associated:** Flooding/Flash flooding

**Type of Action:** Educational

**Contribution to Mitigation Objective:** Public education on the importance of groundwater absorption to reduce the risk of flooding within heavy traffic areas of the community.

**Priority:** High

**Rationale for Priority:** Reduce the risk of flooding.

**Addresses New or Existing buildings:** N/A

**Cost Benefit:** Highly beneficial, education is the first step in prevention.

**Timeline:** ongoing

**Projected Resources:** State and local funds, grant funding when available.

**Responsible Party:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District

**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar, Clarksville School District, Lamar School District, and Westside School District

**STAPLEE:** Meets all criteria.

*Develop a tabletop experiment to gather common practices in water usage when faced with Drought conditions to assist in minimizing the threat faced when water supplies are short.*

**Hazard Associated:** Drought

**Type of Action:** Exercise and Prevention

**Contribution to Mitigation Objective:** to minimize the impact of water shortage risks during Drought periods.

**Priority:** High

**Rationale for Priority:** Water conservation purposes

**Addresses New or Existing buildings:** New and Existing

**Cost Benefit:** Highly beneficial, reduction of impact when facing Drought risks.

**Timeline:** 3 years

**Projected Resources:** State and local funds

**Responsible Party:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar

**Action adopted by:** Johnson County, Cities of Clarksville, Coal Hill, Hartman, Knoxville and Lamar

**STAPLEE:** Meets all criteria.



Establish and promote accessible cooling center/shelters for vulnerable, special needs, and at-risk populations.	Existing	Extreme Heat							Complete/org anization will continue to seek additional locations which is why it is still relevant action in current plan.
County and communities to encourage utility companies to offer special arrangements for paying of utility bills.	N/A	Extreme Heat, Severe Winter Storm							Completed
Provide emergency preparedness information and resources for extreme heat events through an active educational outreach program with specific plans and procedures for at-risk populations.	N/A	Extreme Heat							Completed- ongoing education
Develop and implement a system to keep track of death/injury caused by extreme heat to ensure accurate data provided at the county level.	N/A	Extreme Heat							Completed- conducted by the Storm Events Database (NOAA)
Develop guidelines for management of development around flood-prone areas and other areas of high flood mitigation values, such as wetlands, floodplain corridors, upland storage, closed depressional bases and areas of high filtration potential.	New	Flood							Ongoing
Prepare and implement standard operating procedures for drainage system maintenance. Ensure storm drains and ditches are not blocked and are able to receive water in flood-prone areas.	New and Existing	Flood							Completed
Initiate public outreach to educate residents on the benefits of purchasing flood insurance.	N/A	Flood							Completed- Ongoing due to changes in residency and additional development.
Implement road elevation and culvert sizing standards for construction upgrade on all county and city roads. Investigate current roadways located in flash-flood prone areas to ensure compliance with current standards for design year floods.	N/A	Flood							Not Completed

Construct safe rooms within new and existing public buildings, such as schools, assisted living facilities, churches, businesses, industries and the general public.	New and Existing	Tornado, High Winds, Severe Thunderstorms							Not Completed
Continue to promote the purchase and usage of NOAA weather radios in all schools, assisted living facilities, hospitals, nursing homes, day care facilities, churches, businesses, industries and the general public.	Existing	Tornado, High Winds, Severe Thunderstorms							Ongoing
Host education programs for installation contractors and mobile homeowners with the help of the Home Builder Association on ways to stabilize existing and future mobile homes against straight-line and tornado force winds.	New and Existing	Tornado, High Winds							Not completed- will be addressed under education and outreach in new plan.
Prepare and adopt an Outdoor Warning Sirens Plan, including consideration of the unique geographical locations, technical requirements, system types and operational procedures of each local jurisdiction. These plans should include a review of existing outdoor warning siren coverage and recommend new locations if and where there are coverage gaps. Install new warning sirens in accordance with plan recommendations.	New and Existing	Tornado, Strong Winds							Not Completed
Install surge protection, lightning protection devices on all communications infrastructure and critical facilities.	Existing	Tornado, Strong Winds, Thunderstorms, Lightning							Not Completed
To minimize damage to public and private buildings through structural bracing, shutters, laminated glass in windowpanes and hail resistant roof shingles.	New and Existing	Thunderstorm, Lightning, Hail							Not Completed
Distribute brochures "Avoiding Wildfire Damage: A Checklist for Homeowners" for early prevention.	New and Existing	Wildfire							Ongoing
Inform residents Broadcast information through community services about fire watches and fire warnings.	New and Existing	Wildfire							Ongoing/Completed
Enact fire safety for prone burning subject to review by quorum court which requires burn permits and restricts campfires and outdoor burning.	N/A	Wildfire							Ongoing/Completed

Educate the community of the benefits of joining the “Firewise” program.	New and Existing	Wildfire							Completed-County is an active member.
Local governments maintain adequate road and debris clearing capabilities.	New and Existing	Winter Storms							Completed
Burying or otherwise protecting electric and other utility lines which can prevent disruptions by protecting lines from ice, wind, snow damage.	New and Existing	Winter Storms							Not Completed
Maintain risk assessment data in GIS, including flood zones, tornado tracks, landslide threat areas, dam inundation areas, disaster events and a comprehensive inventory of critical facilities within the Planning Area.	New and Existing	Flooding, Tornado, Dam Failure, Landslide							Ongoing
Incorporate ‘best practices’ mitigation measures in Johnson County’s current and future capital improvements program.	New and Existing	Tornado, Flood/Flash Flood, Dam Failure, Extreme Heat, Severe Thunderstorms, Severe Winter Storms, Earthquake, Strong Winds, Wildfire							Ongoing/Completed
Work with communities at the County level to improve database of inventory for structure types and vulnerabilities.	New and Existing	Tornado, Flood/Flash Flood, Dam Failure, Extreme Heat, Severe Thunderstorms, Severe Winter Storms, Earthquake, Strong Winds, Wildfire							Ongoing/Completed
Develop a Countywide communication plan and early warning system to facilitate timely communication of relevant information to officials, decision makers, school administration, emergency manager and the general public.									Completed
Countywide ordinances to enforce burn bans during drought periods.									Complete/Ongoing



Conduct flood inundation study for high hazard dams; study will be used to develop mitigation measures such as facilitate acquisition projects, new zoning requirements, or elevation projects. Acquire reliable and current information relating to existing and new buildings and infrastructure, especially critical facilities located in or developed in the path of flooding from dam failure.									Ongoing
Require that all critical facilities to meet requirements and be built 1 foot above the 100-year flood elevation.									Complete
County and Local Road Departments implement retrofit construction plans to increase drainage or absorption capacities with detention and relief drains, extra culverts, and bridge modification where susceptible to flooding.									Complete/Ongoing
Implement a fuels management team using prescribed burning techniques to reduce hazardous vegetative fuels that threaten public safety and property on public lands and working with landowners on private land, and near essential infrastructure.									Complete
Adopt a land use plan with zoning and development restrictions to protect residents from hazardous floodways.									Complete

## Section 6 Acronyms

ADA	Average Daily Attendance
ADEM	Arkansas Department of Emergency Management
BCA	Benefit-Cost Analysis
BMPs	Best Management Practices
CFR	Code of Regulations
CRS	Community Rating System
DMA 2000	Disaster Mitigation Act of 2000
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
GIS	Geographic Information System
HMC	Hazard Mitigation Committee
HMGP	Hazard Mitigation Grant Program
IBC	Internal Building Code
IFR	Interim Final Rule
JCDEM	Johnson County Department of Emergency Management
LEPC	Local Emergency Planning Committee
MOU	Memorandum of Understanding
NFIP	National Flood Insurance Program
PDM	Pre-Disaster Mitigation Program
PGA	Peak Ground Acceleration
SHMO	State Hazard Mitigation Officer
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic
UCC	Uniform Construction Code
WUI	Wildland Urban Interface

## **Section 7 Resolutions and Adoptions**

### **7.1 Resolutions**

Attached are approved resolutions the County, cities and school districts passed after FEMA approved the Johnson County Hazard Mitigation Plan.

**Johnson County –**

**Clarksville –**

**Coal Hill –**

**Hartman –**

**Knoxville –**

**Lamar –**

**Clarksville School District –**

**Lamar School District –**

**Westside School District –**

**Oark-Jasper Schools—**

**University of the Ozarks—**

## 7.2 Adoptions

## Section 8 Supporting Documents

### 8.1 Public Review

*Proof of Public Review will go here.*

### 8.2 Sample Questionnaire

Name: \_\_\_\_\_

Email: \_\_\_\_\_

Please indicate the municipality you reside in: \_\_\_\_\_

Campuses you visit (select all that apply):

Clarksville School District

Lamar School District

Westside School District

Oark-Jasper Schools

University of the Ozarks

Do not visit campuses

Are you responding as:

Citizen

Community Organization

Company

Local Jurisdiction

School Administrator

Have you ever experienced or been impacted by a disaster? (select all that apply)

- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Flood
- Mud/Landslide
- Thunderstorm (Including High Winds/Lightning/Hail)
- Tornado
- Wildfire
- Wind
- Winter storm
- None

How concerned are you about the possibility of your neighborhood being impacted by a disaster?

- Very concerned
- Somewhat concerned
- Not concerned

Please explain your answer:

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Is your home located in a FEMA designated floodplain?

- Yes
- No
- Unknown

Do you have flood insurance on your home?

- Yes
- No
- Unknown

If you do not have flood insurance, why not?

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What is the most effective way for you to receive information about protecting your family and preparing your home from hazard events?

- Email
- Mail
- Public or School Meetings/Workshops
- Radio
- Social Media
- Television

Other (explain):

---

Please rank the following hazards according to the degree of threat faced by your community. One (1) represents the highest/greatest threat and ten (10) represents the lowest/least threat.

<u>Hazards</u>	<u>List Hazards from highest threat to lowest</u>
Tornado	1. _____
Winter Storm	2. _____
Thunderstorm (Including High Winds/Lightning/Hail)	3. _____
Extreme Heat	4. _____
Wildfire	5. _____
Flood	6. _____
Drought	7. _____
Dam Failure	8. _____
Earthquake	9. _____
Mud/Landslide	10. _____

Is there another natural hazard that is a threat that was not listed in the previous question?

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Have you or your community taken any actions to make your home or neighborhood more resistant to hazards?

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If you answered yes to the previous question regarding actions to make your home or neighborhood more resistant to hazards, please explain.

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Are there specific actions you have taken for the following hazards?

Flood: \_\_\_\_\_

Wildfire: \_\_\_\_\_

Drought: \_\_\_\_\_

Earthquake: \_\_\_\_\_

Severe Winter Storm: \_\_\_\_\_

Thunderstorm (including high winds/lightning/hail): \_\_\_\_\_

Tornado: \_\_\_\_\_

Dam Failure: \_\_\_\_\_

Extreme Heat: \_\_\_\_\_

Mud/Landslide: \_\_\_\_\_

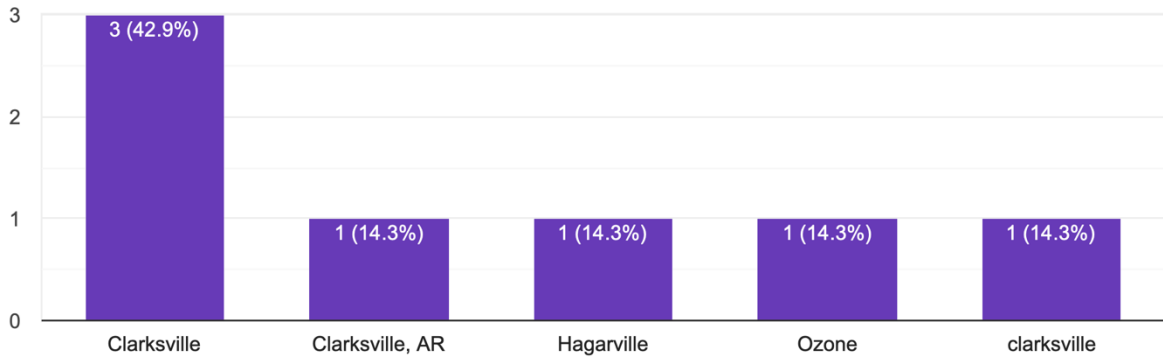
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### 8.3 Questionnaire Responses

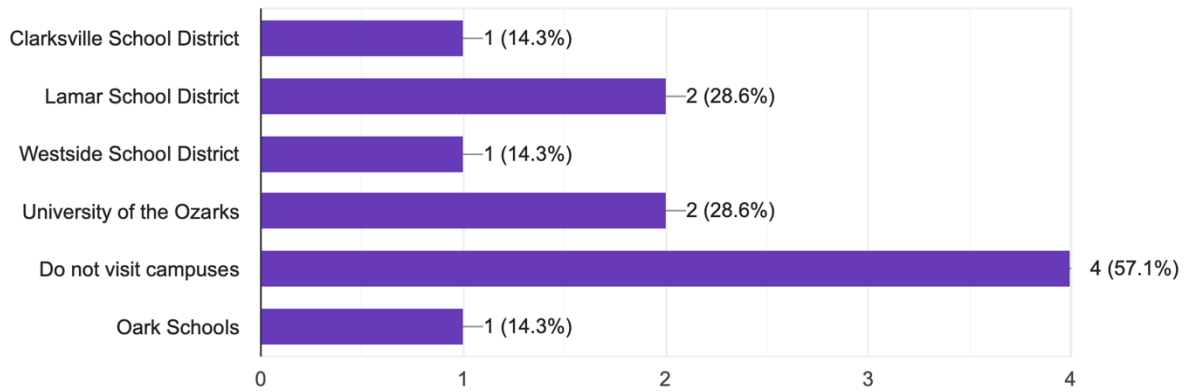
What is the City/Town/Community that you reside in?

7 responses



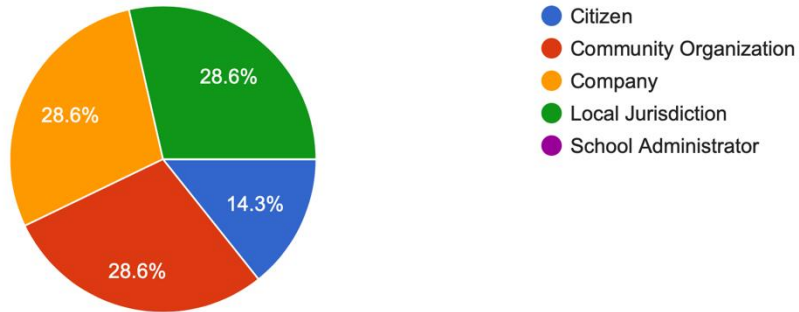
Campuses that you visit (check all that apply)

7 responses



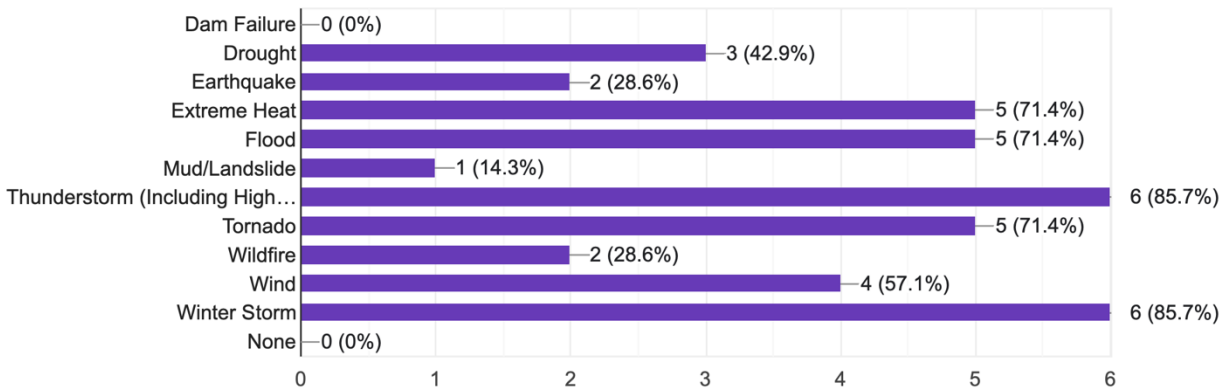
You are responding as :

7 responses



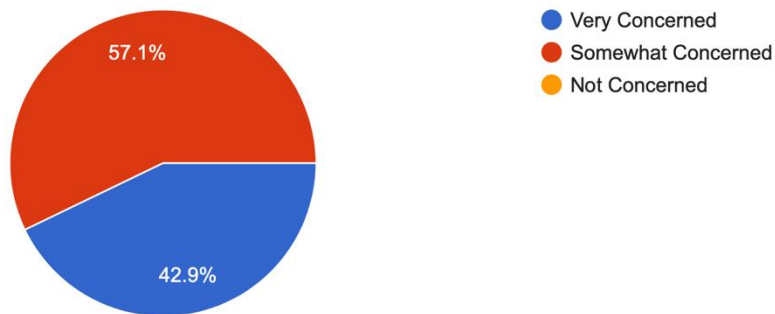
Have you ever experienced a disaster? Please select all that apply

7 responses



How concerned are you about the possibility of your neighborhood being impacted by a disaster?

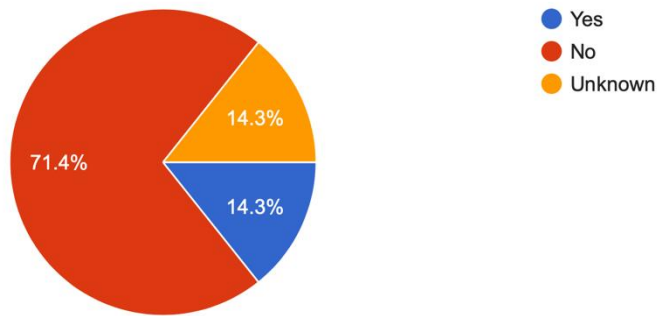
7 responses



Briefly explain your response to the previous question.
Tornadoes and floods are what concern me most
Familiar with how quickly responders can be overwhelmed.
I know at some point a disaster will happen again
We are in Tornado Alley and have a lot of thunderstorms.

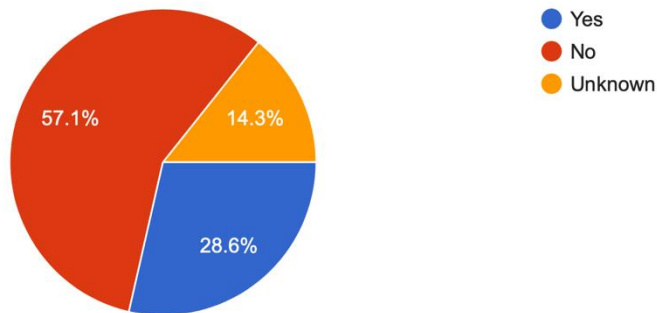
Is your home located in a FEMA designated floodplain?

7 responses



Do you have flood insurance on our home?

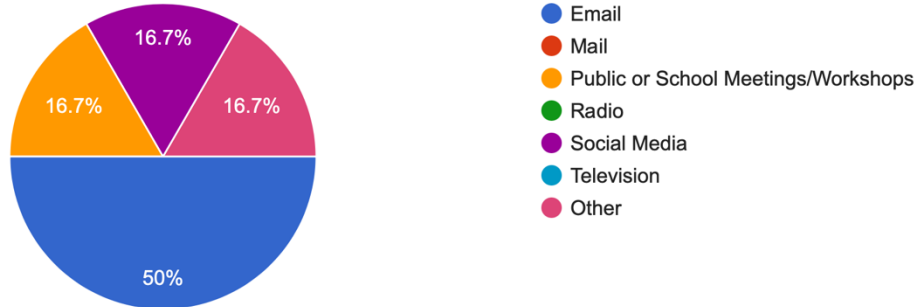
7 responses



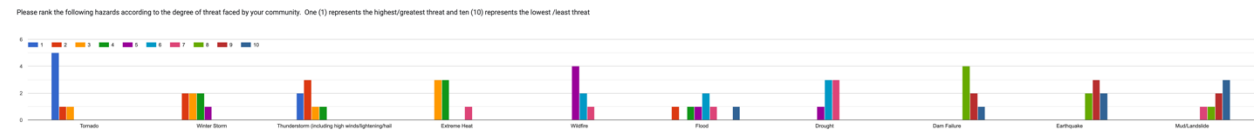
If you do not have flood insurance, why not?
Risk is low
My house is too high up to flood
Not in a flood plain
My home is on a high elevated property. No flood possibility.

What is the most effective way for you to receive information about protecting your family and preparing your home from hazard events?

6 responses



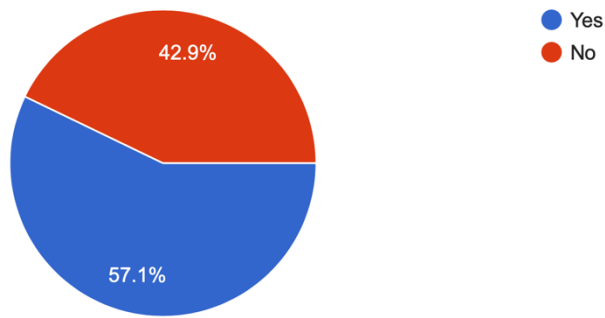
If you chose other on the previous question, please explain.  
**Cell phone**



List any other natural hazard that is a threat you are concerned about that was not listed in the previous question.  
**Nuclear plant reactor meltdown**  
**Solar that can affect communications, including warning systems**  
**None**

Have you or your community taken any actions to make your home or neighborhood more resistant to hazards?

7 responses



If you answered yes to the previous question regarding actions to make your home or neighborhood more resistant to hazards, please explain.
Insurance
Participate in ARES amateur radio weather nets to augment other warning systems.
Working with city to mitigate flooding hazard and buildings have new roofing rated for high winds and hail.
We have a rural fire department..

What are the specific actions you have taken for mitigation against a flood?
N/A
Insurance
N/A
n/a
Talked with city about drainage problem we have on our property.
None

What are the specific actions you have taken for mitigation against a wildfire?
NA
Control burns
Monitor amateur radio and county text alerts
n/a
Added it to our disaster action plan.
Have a water hose ready and a four-wheeler with a tank on it.

What are the specific actions you have taken for mitigation against a drought?
NA
N/A
n/a
Being sure my ponds have water to fill up a fire truck if necessary.

What are the specific actions you have taken for mitigation against an earthquake?
NA
N/A
n/a
NA
None

What are the specific actions you have taken for mitigation against a severe winter storm?
Ensure everything is well insulated
Generator and alternate heat
I have a generator
Response to Ice Storm is included in our Disaster Readiness Plan.
We have policies in place for a significant weather event.
Winterized water lines

Watching the weather service reports
What are the specific actions you have taken for mitigation against a thunderstorm (including high winds/lightning/hail)?
Insurance
ARES weather net, generator
n/a
Response to Severe Storm is included in our Disaster Readiness Plan.
We have policies in place for a significant weather event.
We have a shelter in place
Watching the weather service reports and have a weather alert radio
What are the specific actions you have taken for mitigation against a tornado?
Insurance
ARES weather net, text warnings
I have a storm shelter
Response in Tornado is included in our Disaster Readiness Plan.
We have policies in place for a significant weather event
We have a shelter in place
Watching the weather service reports and have a weather alert radio
What are the specific actions you have taken for mitigation against a dam failure?
Na
N/A
n/a
Response to flooding is included in our Disaster Readiness Plan
NA
NA
None
What are the specific actions you have taken for mitigation against extreme heat?
AC maintenance
N/A
n/a
Heat Wave is mentioned in our Disaster Readiness Plan.
NA
NA
Keeping extra water in all vehicles.
What are the specific actions you have taken for mitigation against a mud/landslide?
NA
Na
n/a
NA
None

## 8.4 National Risk Assessment Report

# National Risk Index

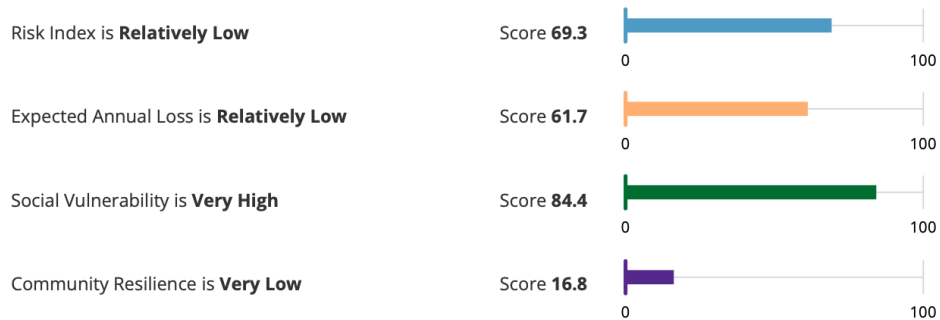


## Johnson County, Arkansas

To access the full report:

<https://hazards.fema.gov/nri/report/viewer?dataLOD=Counties&dataIDs=C05071>

### Summary

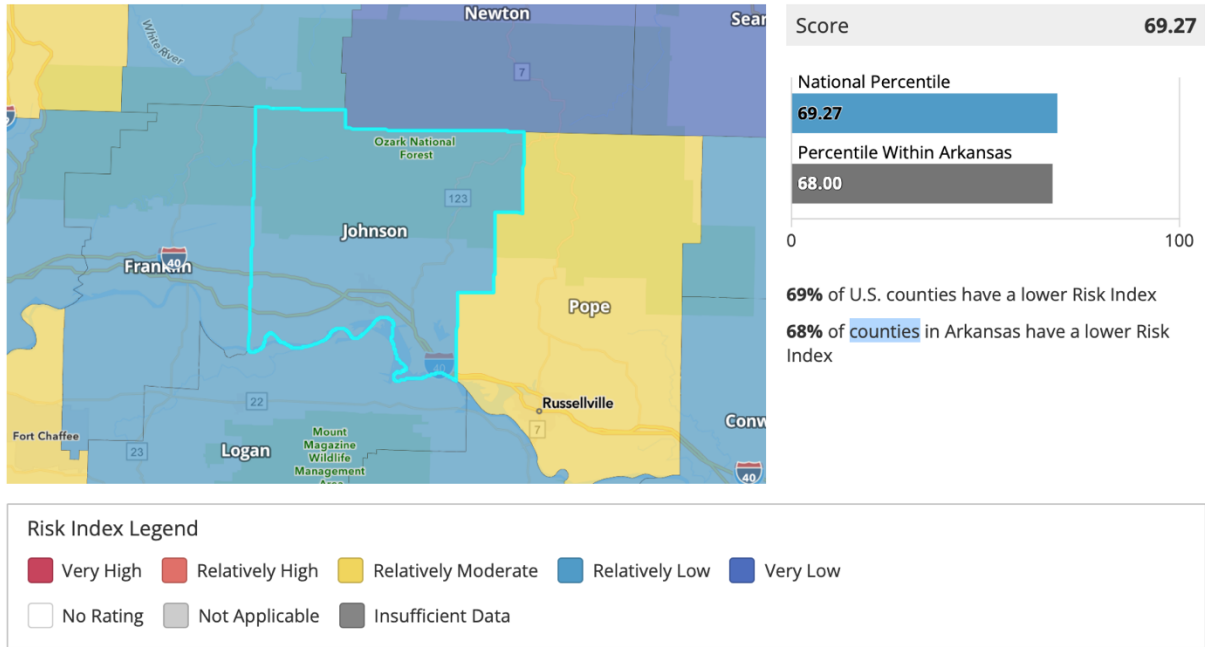


**While reviewing this report, keep in mind that low risk is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.**

For more information about the National Risk Index, its data, and how to interpret the information it provides, please review the **About the National Risk Index** and **How to Take Action** sections at the end of this report. Or, visit the National Risk Index website at [hazards.fema.gov/nri/learn-more](https://hazards.fema.gov/nri/learn-more) to access supporting documentation and links.

# Risk Index





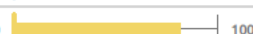









The Risk Index rating is **Relatively Low** for **Johnson County, AR** when compared to the rest of the U.S.





## Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value.

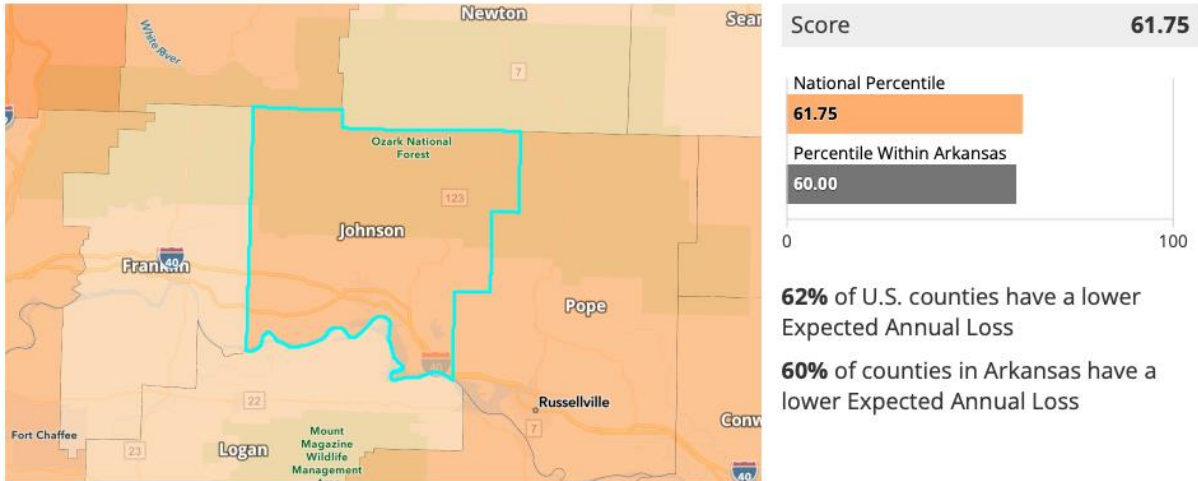
Hazard Type	Risk Index Rating	Risk Index Score	National Percentile
<b>Avalanche</b>	Not Applicable	--	
<b>Coastal Flooding</b>	Not Applicable	--	
<b>Cold Wave</b>	Relatively High	88.1	0  100
<b>Drought</b>	Relatively Low	58.1	0  100
<b>Earthquake</b>	Relatively Low	72	0  100
<b>Hail</b>	Relatively Low	79	0  100
<b>Heat Wave</b>	Relatively Moderate	82.4	0  100
<b>Hurricane</b>	Very Low	24.9	0  100
<b>Ice Storm</b>	Very High	98.8	0  100
<b>Landslide</b>	Relatively Low	76	0  100
<b>Lightning</b>	Relatively Moderate	76.3	0  100
<b>Riverine Flooding</b>	Relatively Low	65.5	0  100
<b>Strong Wind</b>	Relatively Moderate	83.1	0  100
<b>Tornado</b>	Relatively Moderate	77	0  100
<b>Tsunami</b>	Not Applicable	--	
<b>Volcanic Activity</b>	Not Applicable	--	
<b>Wildfire</b>	Relatively Low	64.7	0  100
<b>Winter Weather</b>	Relatively Moderate	82.2	0  100

## Risk Factor Breakdown

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
<b>Tornado</b>	\$2,304,504	Very High	Very Low	1.46	\$3,320,924	77
<b>Ice Storm</b>	\$2,171,972	Very High	Very Low	1.46	\$3,152,067	98.8
<b>Strong Wind</b>	\$806,771	Very High	Very Low	1.46	\$1,166,903	83.1
<b>Riverine Flooding</b>	\$597,506	Very High	Very Low	1.46	\$938,189	65.5
<b>Cold Wave</b>	\$464,307	Very High	Very Low	1.46	\$664,002	88.1
<b>Heat Wave</b>	\$440,770	Very High	Very Low	1.46	\$634,037	82.4
<b>Earthquake</b>	\$360,183	Very High	Very Low	1.46	\$550,566	72
<b>Hail</b>	\$330,811	Very High	Very Low	1.46	\$472,631	79
<b>Lightning</b>	\$190,640	Very High	Very Low	1.46	\$273,037	76.3
<b>Winter Weather</b>	\$164,643	Very High	Very Low	1.46	\$238,265	82.2
<b>Wildfire</b>	\$80,706	Very High	Very Low	1.46	\$111,805	64.7
<b>Landslide</b>	\$47,512	Very High	Very Low	1.46	\$66,392	76
<b>Drought</b>	\$37,791	Very High	Very Low	1.46	\$53,974	58.1
<b>Hurricane</b>	\$22,441	Very High	Very Low	1.46	\$32,263	24.9
<b>Avalanche</b>	--	Very High	Very Low	1.46	--	--
<b>Coastal Flooding</b>	--	Very High	Very Low	1.46	--	--
<b>Tsunami</b>	--	Very High	Very Low	1.46	--	--
<b>Volcanic Activity</b>	--	Very High	Very Low	1.46	--	--

## Expected Annual Loss

In **Johnson County, AR**, expected loss each year due to natural hazards is **Relatively Low** when compared to the rest of the U.S.



### Expected Annual Loss Legend

- Very High
- Relatively High
- Relatively Moderate
- Relatively Low
- Very Low
- No Expected Annual Losses
- Not Applicable
- Insufficient Data

**Composite Expected Annual Loss** **\$8,020,558.49**

**Composite Expected Annual Loss Rate National Percentile** **80.3**

Building EAL <b>\$3,806,977.66</b>	Population EAL <b>0.34 fatalities</b>
------------------------------------	---------------------------------------

Building EAL Rate <b>\$1 per \$1.08K of building value</b>	Population EAL Rate <b>1 per 75.08K people</b>
--	--

Agriculture EAL <b>\$245,405.64</b>	Population Equivalence EAL <b>\$3,968,175.19</b>
-------------------------------------	--

Agriculture EAL Rate **\$1 per \$649.79 of agriculture value**

## Expected Annual Loss for Hazard Types

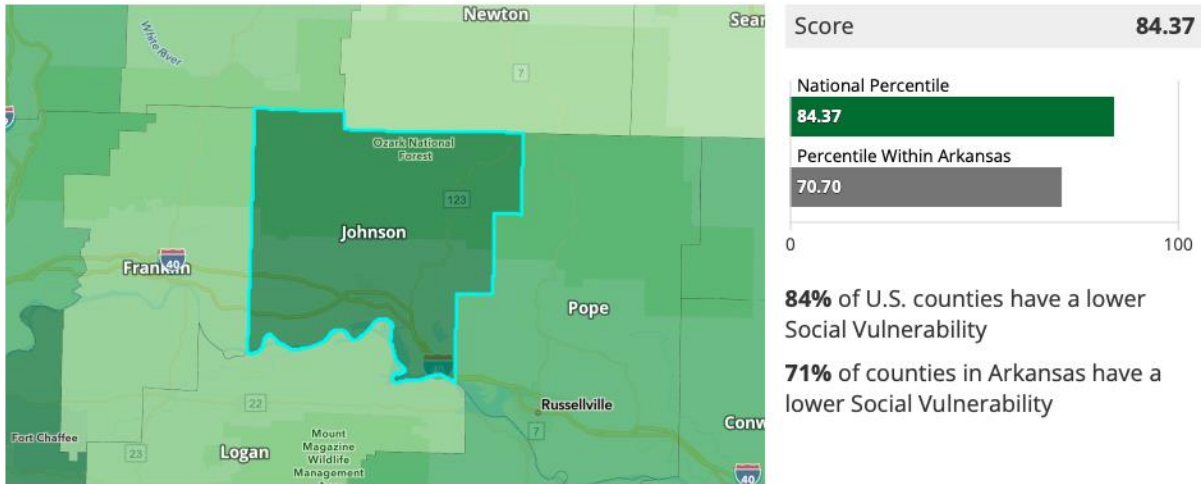
Expected Annual Loss scores for hazard types are calculated using data for only a single hazard type, and reflect a community's relative expected annual loss for only that hazard type.

**14 of 18** hazard types contribute to the expected annual loss for **Johnson County, AR**.

Hazard Type	Expected Annual Loss Rating	EAL Value	Score
<b>Tornado</b>	Relatively Moderate	\$2,304,504	73.7
<b>Ice Storm</b>	Very High	\$2,171,972	98.0
<b>Strong Wind</b>	Relatively Moderate	\$806,771	78.4
<b>Riverine Flooding</b>	Relatively Low	\$597,506	59.2
<b>Cold Wave</b>	Relatively High	\$464,307	85.7
<b>Heat Wave</b>	Relatively Moderate	\$440,770	79.9
<b>Earthquake</b>	Relatively Low	\$360,183	66.3
<b>Hail</b>	Relatively Low	\$330,811	76.6
<b>Lightning</b>	Relatively Moderate	\$190,641	72.6
<b>Winter Weather</b>	Relatively Moderate	\$164,643	78.5
<b>Wildfire</b>	Very Low	\$80,706	61.7
<b>Landslide</b>	Relatively Low	\$47,512	75.4
<b>Drought</b>	Relatively Low	\$37,792	56.8
<b>Hurricane</b>	Very Low	\$22,442	21.2
<b>Avalanche</b>	Not Applicable	--	--
<b>Coastal Flooding</b>	Not Applicable	--	--
<b>Tsunami</b>	Not Applicable	--	--
<b>Volcanic Activity</b>	Not Applicable	--	--

## Social Vulnerability

Social groups in **Johnson County, AR** have a **Very High** susceptibility to the adverse impacts of natural hazards when compared to the rest of the U.S.

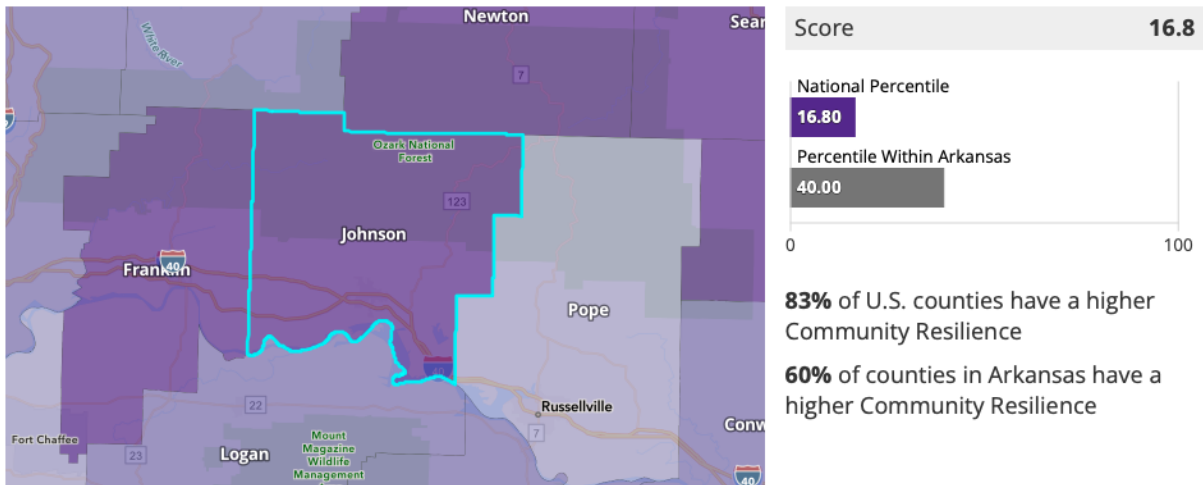


### Social Vulnerability Legend

- Very High
- Relatively High
- Relatively Moderate
- Relatively Low
- Very Low
- Data Unavailable

## Community Resilience

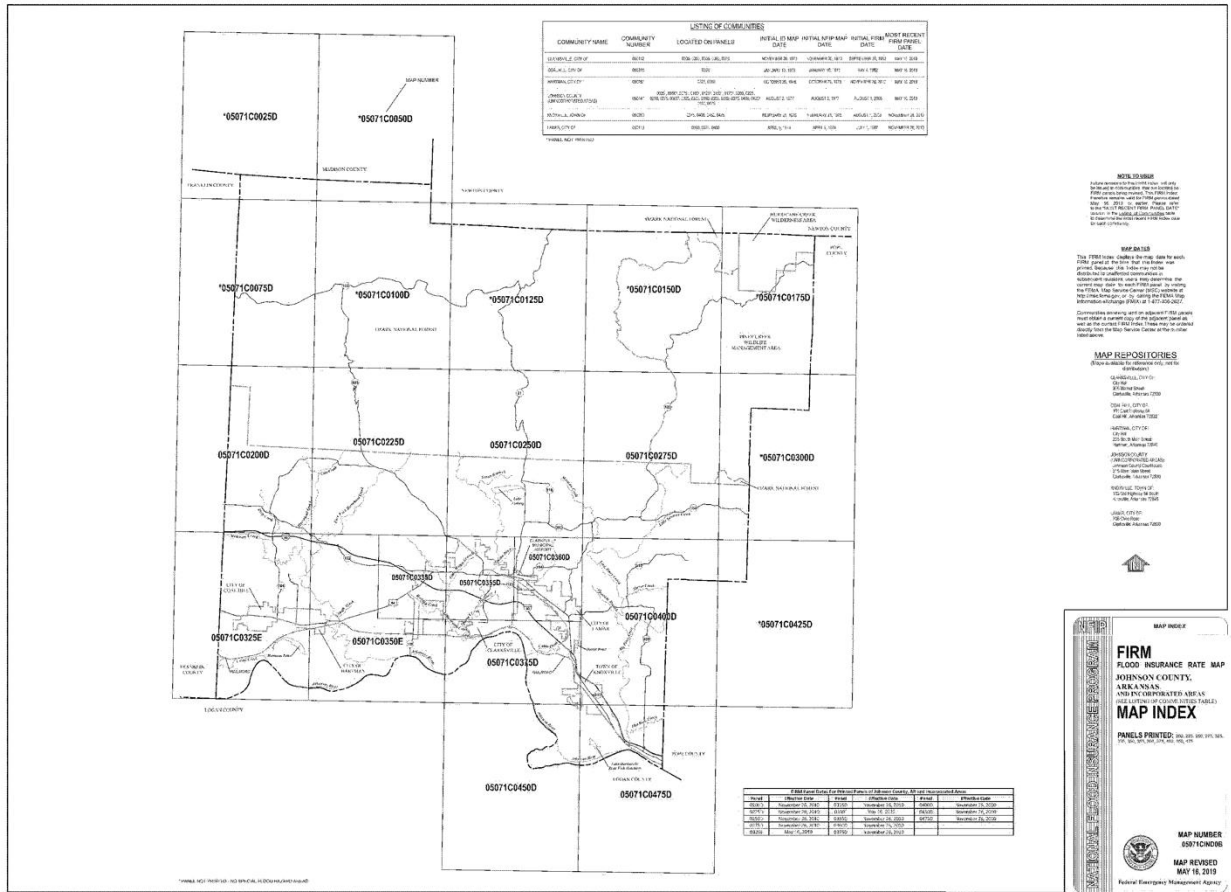
Communities in **Johnson County, AR** have a **Very Low** ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the U.S.

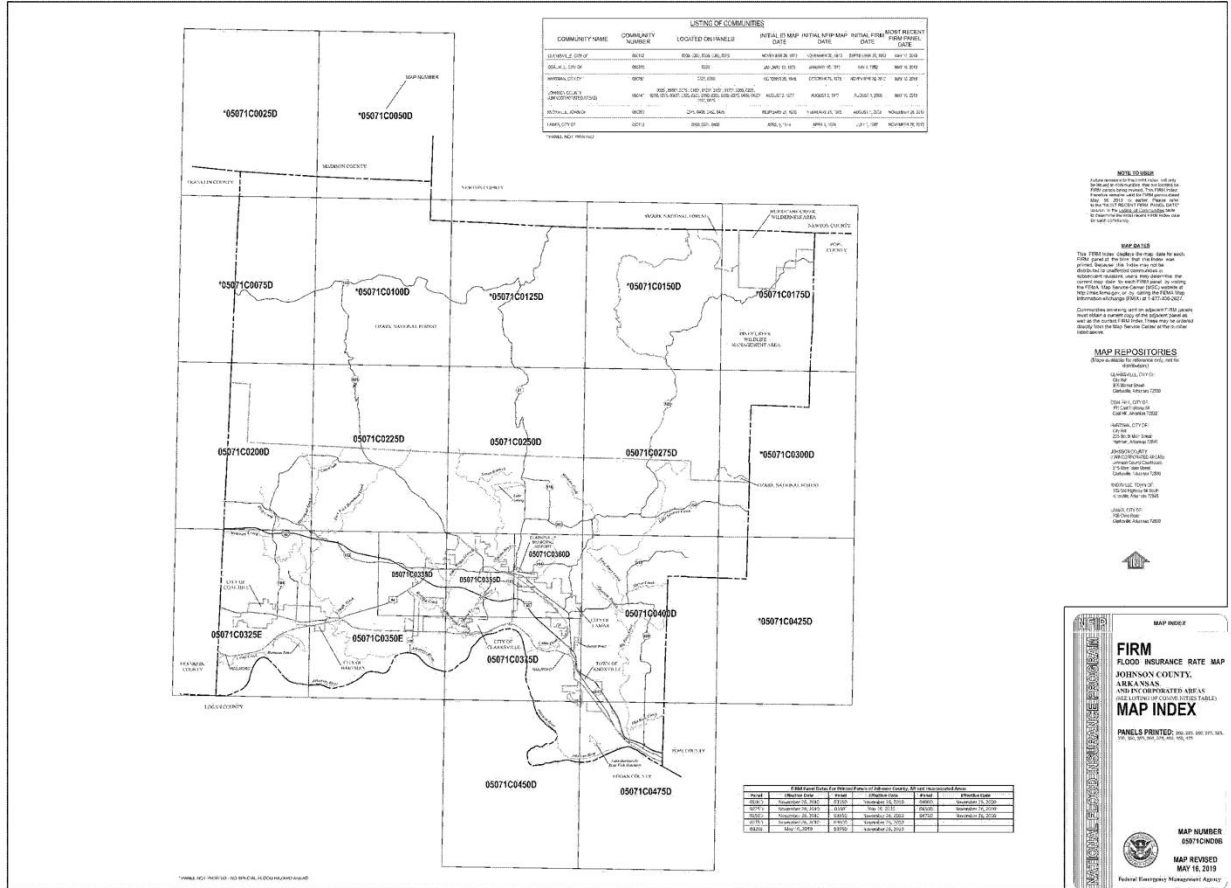


### Community Resilience Legend

- Very High
- Relatively High
- Relatively Moderate
- Relatively Low
- Very Low
- Data Unavailable

# 8.5 FIRMette Panels





<https://map1.msc.fema.gov/firm/?id=05071CIND0B>









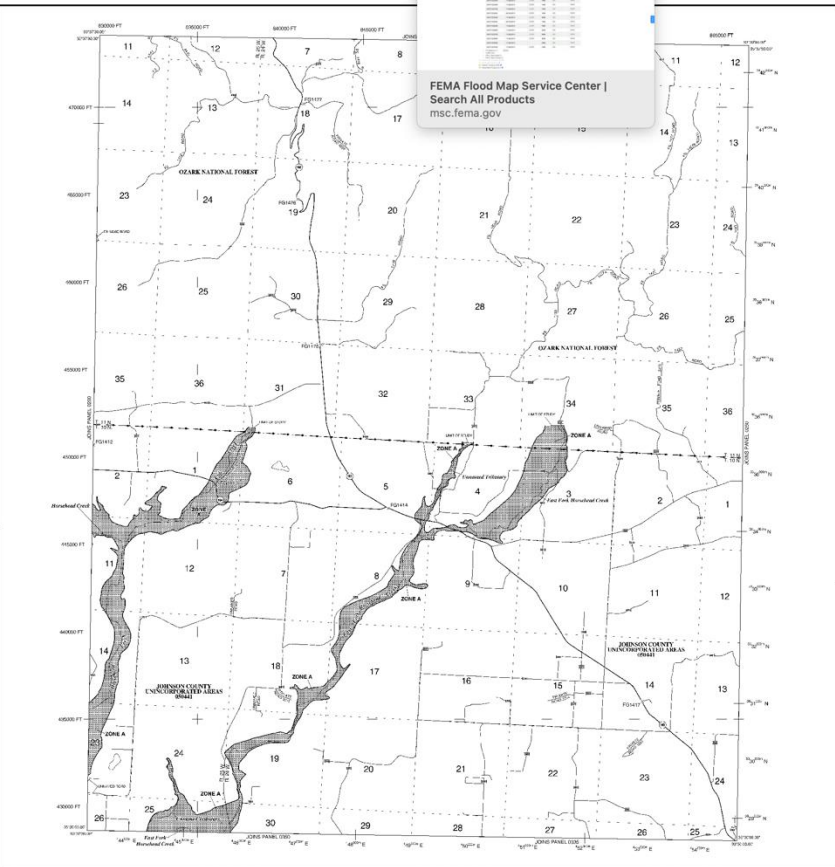
**NOTES TO USERS**

This map is for use in determining the flood insurance rate for the insured property. It is not to be used for any other purpose. The flood insurance rate is determined by the Flood Insurance Rate Manual (FIRM) published by the Federal Emergency Management Agency (FEMA). The FIRM is available at [www.fema.gov](http://www.fema.gov).

To obtain more detailed information on rates, visit [www.fema.gov](http://www.fema.gov). For more information on the FIRM, visit [www.fema.gov/firm](http://www.fema.gov/firm). For more information on the Flood Insurance Rate Manual, visit [www.fema.gov/firm/firm-manual](http://www.fema.gov/firm/firm-manual).

**Legend:**

- Zone A:** Flood Insurance Rate Zone A (FIRM Panel 0225D)
- Zone B:** Flood Insurance Rate Zone B (FIRM Panel 0225D)
- Zone C:** Flood Insurance Rate Zone C (FIRM Panel 0225D)
- Zone D:** Flood Insurance Rate Zone D (FIRM Panel 0225D)
- Zone E:** Flood Insurance Rate Zone E (FIRM Panel 0225D)
- Zone F:** Flood Insurance Rate Zone F (FIRM Panel 0225D)
- Zone G:** Flood Insurance Rate Zone G (FIRM Panel 0225D)
- Zone H:** Flood Insurance Rate Zone H (FIRM Panel 0225D)
- Zone I:** Flood Insurance Rate Zone I (FIRM Panel 0225D)
- Zone J:** Flood Insurance Rate Zone J (FIRM Panel 0225D)
- Zone K:** Flood Insurance Rate Zone K (FIRM Panel 0225D)
- Zone L:** Flood Insurance Rate Zone L (FIRM Panel 0225D)
- Zone M:** Flood Insurance Rate Zone M (FIRM Panel 0225D)
- Zone N:** Flood Insurance Rate Zone N (FIRM Panel 0225D)
- Zone O:** Flood Insurance Rate Zone O (FIRM Panel 0225D)
- Zone P:** Flood Insurance Rate Zone P (FIRM Panel 0225D)
- Zone Q:** Flood Insurance Rate Zone Q (FIRM Panel 0225D)
- Zone R:** Flood Insurance Rate Zone R (FIRM Panel 0225D)
- Zone S:** Flood Insurance Rate Zone S (FIRM Panel 0225D)
- Zone T:** Flood Insurance Rate Zone T (FIRM Panel 0225D)
- Zone U:** Flood Insurance Rate Zone U (FIRM Panel 0225D)
- Zone V:** Flood Insurance Rate Zone V (FIRM Panel 0225D)
- Zone W:** Flood Insurance Rate Zone W (FIRM Panel 0225D)
- Zone X:** Flood Insurance Rate Zone X (FIRM Panel 0225D)
- Zone Y:** Flood Insurance Rate Zone Y (FIRM Panel 0225D)
- Zone Z:** Flood Insurance Rate Zone Z (FIRM Panel 0225D)



**LEGEND**

**Zone A:** Flood Insurance Rate Zone A (FIRM Panel 0225D)

**Zone B:** Flood Insurance Rate Zone B (FIRM Panel 0225D)

**Zone C:** Flood Insurance Rate Zone C (FIRM Panel 0225D)

**Zone D:** Flood Insurance Rate Zone D (FIRM Panel 0225D)

**Zone E:** Flood Insurance Rate Zone E (FIRM Panel 0225D)

**Zone F:** Flood Insurance Rate Zone F (FIRM Panel 0225D)

**Zone G:** Flood Insurance Rate Zone G (FIRM Panel 0225D)

**Zone H:** Flood Insurance Rate Zone H (FIRM Panel 0225D)

**Zone I:** Flood Insurance Rate Zone I (FIRM Panel 0225D)

**Zone J:** Flood Insurance Rate Zone J (FIRM Panel 0225D)

**Zone K:** Flood Insurance Rate Zone K (FIRM Panel 0225D)

**Zone L:** Flood Insurance Rate Zone L (FIRM Panel 0225D)

**Zone M:** Flood Insurance Rate Zone M (FIRM Panel 0225D)

**Zone N:** Flood Insurance Rate Zone N (FIRM Panel 0225D)

**Zone O:** Flood Insurance Rate Zone O (FIRM Panel 0225D)

**Zone P:** Flood Insurance Rate Zone P (FIRM Panel 0225D)

**Zone Q:** Flood Insurance Rate Zone Q (FIRM Panel 0225D)

**Zone R:** Flood Insurance Rate Zone R (FIRM Panel 0225D)

**Zone S:** Flood Insurance Rate Zone S (FIRM Panel 0225D)

**Zone T:** Flood Insurance Rate Zone T (FIRM Panel 0225D)

**Zone U:** Flood Insurance Rate Zone U (FIRM Panel 0225D)

**Zone V:** Flood Insurance Rate Zone V (FIRM Panel 0225D)

**Zone W:** Flood Insurance Rate Zone W (FIRM Panel 0225D)

**Zone X:** Flood Insurance Rate Zone X (FIRM Panel 0225D)

**Zone Y:** Flood Insurance Rate Zone Y (FIRM Panel 0225D)

**Zone Z:** Flood Insurance Rate Zone Z (FIRM Panel 0225D)

**Scale:** 1" = 1 Mile

**Map Number:** 0225D

**FIRM:** Flood Insurance Rate Map

**JOHNSON COUNTY, ARKANSAS**

**AND UNINCORPORATED AREAS**

**PANEL 0225D OF FIRM**

**DATE:** 11/26/2019

**MAP NUMBER:** 0225D

**EFFECTIVE DATE:** NOVEMBER 26, 2019

<https://map1.msc.fema.gov/firm?id=05071C0225D>



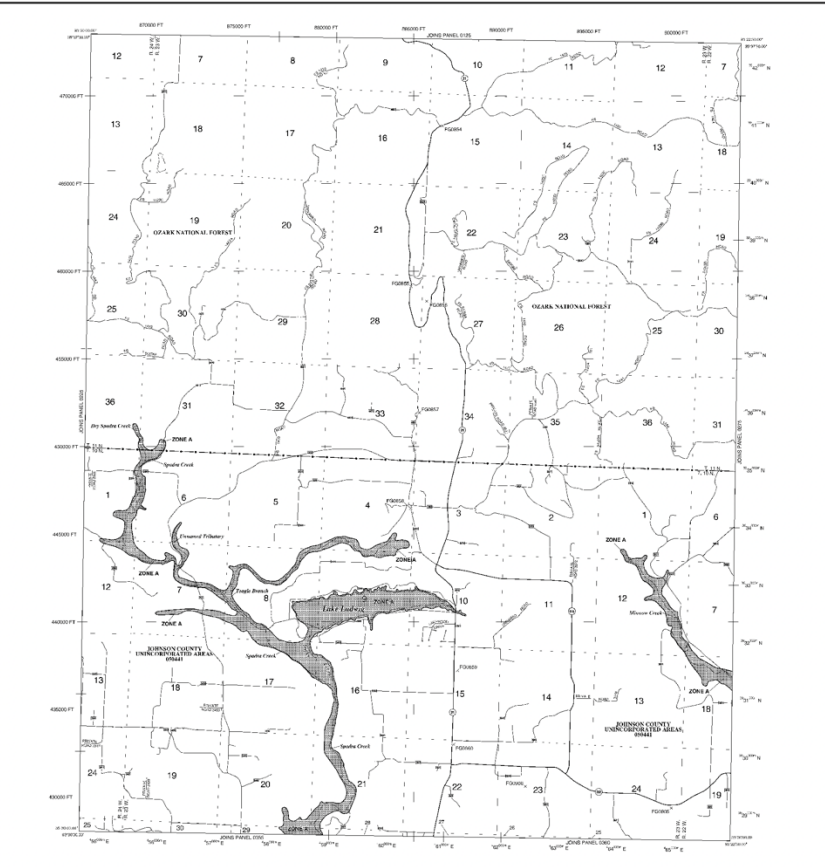
**NOTES TO USERS**

This map is for use in the Flood Insurance Rate Program (FIRP) under the National Flood Insurance Act (NFIA) of 1968, as amended. The FIRP is a Federal program authorized by Congress to provide flood insurance coverage to property owners in the United States.

To obtain more detailed information on areas shown on this Flood Insurance Rate Map (FIRM), please refer to the Flood Insurance Manual (FIM) and the Flood Insurance Study (FIS). The FIS is a detailed study of the flood hazard in the community. It includes a description of the flood hazard, a map of the flood hazard, and a list of the flood-prone areas. The FIS is available from the Federal Emergency Management Agency (FEMA) at 1215 Jefferson Davis Highway, Alexandria, Virginia 22304-6145. For more information, call 1-800-358-6145.

The FIRM is a map of the flood hazard in the community. It is based on the FIS and is used to determine the flood insurance rate for property owners in the community. The FIRM is a map of the flood hazard in the community. It is based on the FIS and is used to determine the flood insurance rate for property owners in the community.

The FIRM is a map of the flood hazard in the community. It is based on the FIS and is used to determine the flood insurance rate for property owners in the community. The FIRM is a map of the flood hazard in the community. It is based on the FIS and is used to determine the flood insurance rate for property owners in the community.



**LEGEND**

**FLOOD HAZARD ZONE**

**Zone A**

Zone A areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone A areas are shown on this map with a wavy line pattern.

**Zone B**

Zone B areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone B areas are shown on this map with a dashed line pattern.

**Zone C**

Zone C areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone C areas are shown on this map with a solid line pattern.

**Zone D**

Zone D areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone D areas are shown on this map with a dotted line pattern.

**Zone E**

Zone E areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone E areas are shown on this map with a cross-hatch pattern.

**Zone F**

Zone F areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone F areas are shown on this map with a diagonal line pattern.

**Zone G**

Zone G areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone G areas are shown on this map with a horizontal line pattern.

**Zone H**

Zone H areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone H areas are shown on this map with a vertical line pattern.

**Zone I**

Zone I areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone I areas are shown on this map with a diagonal line pattern.

**Zone J**

Zone J areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone J areas are shown on this map with a horizontal line pattern.

**Zone K**

Zone K areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone K areas are shown on this map with a vertical line pattern.

**Zone L**

Zone L areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone L areas are shown on this map with a diagonal line pattern.

**Zone M**

Zone M areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone M areas are shown on this map with a horizontal line pattern.

**Zone N**

Zone N areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone N areas are shown on this map with a vertical line pattern.

**Zone O**

Zone O areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone O areas are shown on this map with a diagonal line pattern.

**Zone P**

Zone P areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone P areas are shown on this map with a horizontal line pattern.

**Zone Q**

Zone Q areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone Q areas are shown on this map with a vertical line pattern.

**Zone R**

Zone R areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone R areas are shown on this map with a diagonal line pattern.

**Zone S**

Zone S areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone S areas are shown on this map with a horizontal line pattern.

**Zone T**

Zone T areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone T areas are shown on this map with a vertical line pattern.

**Zone U**

Zone U areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone U areas are shown on this map with a diagonal line pattern.

**Zone V**

Zone V areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone V areas are shown on this map with a horizontal line pattern.

**Zone W**

Zone W areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone W areas are shown on this map with a vertical line pattern.

**Zone X**

Zone X areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone X areas are shown on this map with a diagonal line pattern.

**Zone Y**

Zone Y areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone Y areas are shown on this map with a horizontal line pattern.

**Zone Z**

Zone Z areas are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Zone Z areas are shown on this map with a vertical line pattern.

**UNINCORPORATED AREAS**

Unincorporated areas are areas that are not subject to flood insurance under the FIRP. Unincorporated areas are shown on this map with a dashed line pattern.

**WATER BODIES**

Water bodies are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Water bodies are shown on this map with a solid line pattern.

**ROADS**

Roads are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Roads are shown on this map with a solid line pattern.

**RAILROADS**

Railroads are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Railroads are shown on this map with a solid line pattern.

**UTILITY LINES**

Utility lines are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Utility lines are shown on this map with a solid line pattern.

**BOUNDARIES**

Boundaries are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Boundaries are shown on this map with a solid line pattern.

**PROPERTY LINES**

Property lines are areas that are subject to flooding from the overflow of a stream or other natural water body that is not a tidal water body. Property lines are shown on this map with a solid line pattern.

**ADDITIONAL INFORMATION**

Additional information is provided for each flood hazard zone. This information includes a description of the flood hazard, a map of the flood hazard, and a list of the flood-prone areas. This information is available from the Federal Emergency Management Agency (FEMA) at 1215 Jefferson Davis Highway, Alexandria, Virginia 22304-6145. For more information, call 1-800-358-6145.

**FIRM PANEL G250**

**FIRM FLOOD INSURANCE RATE MAP**

**JOHNSON COUNTY, ARKANSAS**

**UNINCORPORATED AREAS**

**PANEL 250 OF 475**

**DATE: 05/11/2010**

**CONTRACT: 15982**

**COMMENTS: 05/11/2010**

**MAP NUMBER: 05071C0250D**

**EFFECTIVE DATE: NOVEMBER 26, 2010**

**Federal Emergency Management Agency**

<https://map1.msc.fema.gov/firm?id=05071C0250D>

**NOTES TO USERS**

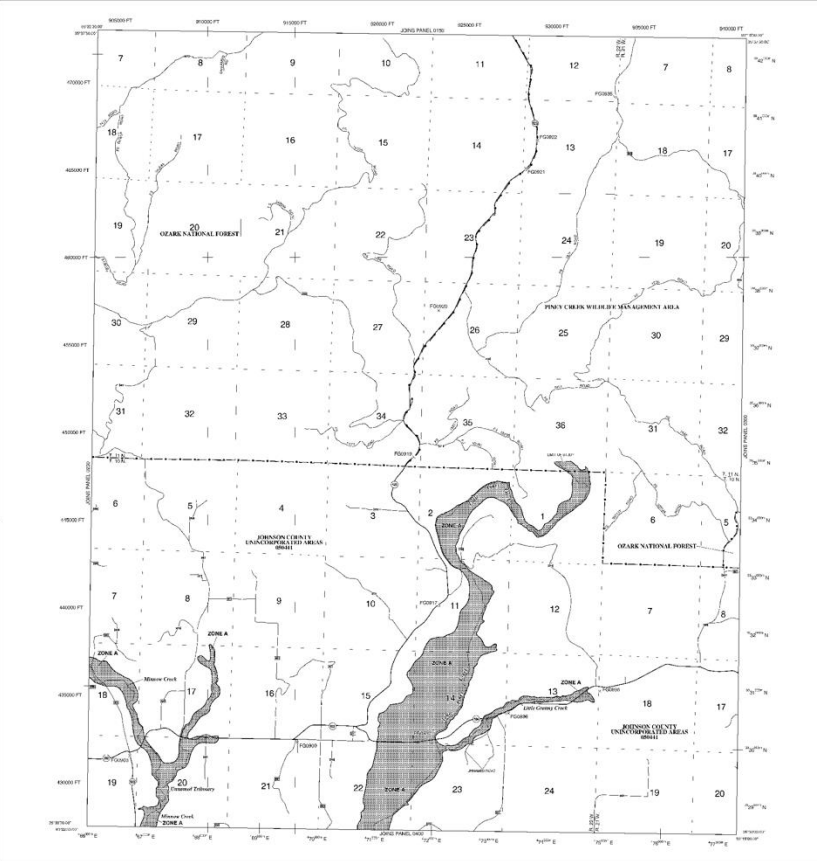
The map is for use only in determining Flood Insurance Rate Zones. It is not to be used for any other purpose. The Flood Insurance Rate Zones are shown on this map and are subject to change. The Flood Insurance Rate Zones are shown on this map and are subject to change. The Flood Insurance Rate Zones are shown on this map and are subject to change.

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**LEGEND**

**GENERAL NOTES:**

The Flood Insurance Rate Zones are shown on this map and are subject to change. The Flood Insurance Rate Zones are shown on this map and are subject to change.

**LEGEND:**

**ZONE A:** Flood Insurance Rate Zone

**ZONE B:** Flood Insurance Rate Zone

**GENERAL NOTES:**

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**LEGEND:**

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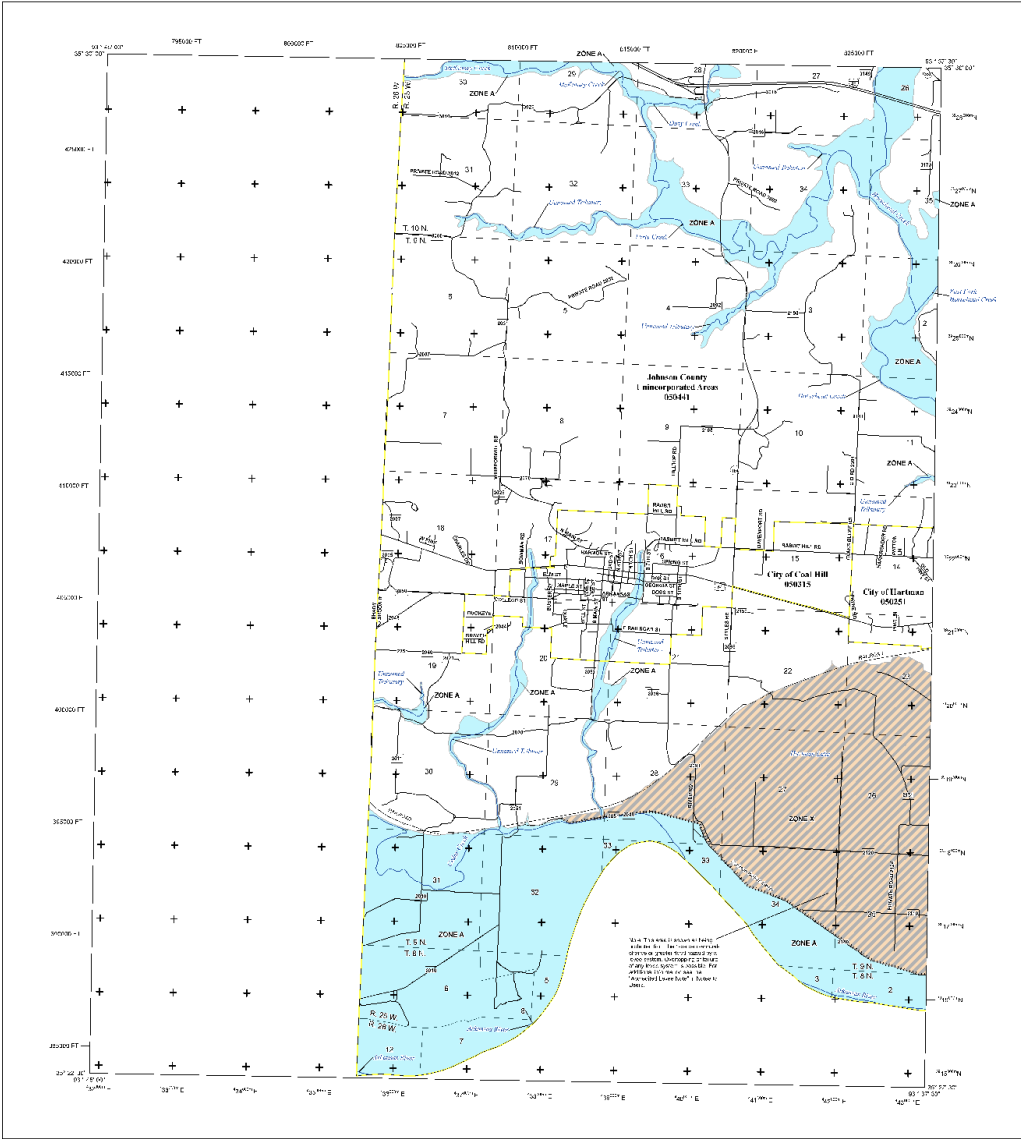
**LEGEND:**

**GENERAL NOTES:**

The Flood Insurance Rate Zones are shown on this map and are subject to change. The Flood Insurance Rate Zones are shown on this map and are subject to change.







**FLOOD HAZARD INFORMATION**

SEE REPORT FOR DETAILED USES AND NOTICES FOR THIS PANEL WITH THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT [HTTPS://MSC.FEMA.GOV](https://msc.fema.gov)

**SPECIAL FLOOD HAZARD AREAS**

- Without Base Flood Elevation (BFE)
- With BFE or Depth Zone A, X, Y, or D
- Regulatory Floodway
- 0.2% Annual Chance Flood Hazard: Areas of 0.2% Annual Chance Flood with average depths less than one foot or with drainage areas less than one square mile (Zone X Flood Conditions 1% Annual Chance Flood Hazard Zone X)
- Area with Reduced Flood Risk due to Levee
- Area with Flood Risk due to Levee Zone D
- Area of Minimal Flood Hazard Zone Y
- Area of Undetermined Flood Hazard Zone D

**OTHER AREAS OF FLOOD HAZARD**

- Channel, Culvert, or Storm Sewer Level, Ditch, or Floodway
- Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transact
- Coastal Transact Baseline
- Pavement
- Hydrographic Features
- Base Flood Elevation Limit (BFE)
- Line of Study
- Jurisdiction Boundary

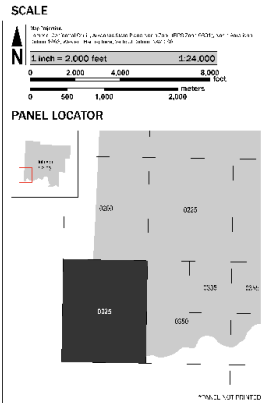
**OTHER FEATURES**

**NOTES TO USERS**

For reference and information, the Flood Insurance Rate Map (FIRM) panels are produced in a digital format. The information depicted on this map and supporting documentation are also available in digital format at <https://msc.fema.gov>.

This map is a digital format of the Flood Insurance Rate Map (FIRM) panels. The information depicted on this map and supporting documentation are also available in digital format at <https://msc.fema.gov>.

The information depicted on this map and supporting documentation are also available in digital format at <https://msc.fema.gov>.



**NATIONAL FLOOD INSURANCE PROGRAM**

FLOOD INSURANCE RATE MAP

**JOHNSON COUNTY, ARKANSAS**

FIRM PANEL 325 of 475

Panel Coordinates: COUNTY: JOHNSON COUNTY; FIRM PANEL: 325 of 475

**FEDERAL EMERGENCY MANAGEMENT AGENCY**

**FEMA**

National Flood Insurance Program

Version Number: 2.8.1.0  
 Map Number: 08071C0328E  
 Map Date: MAY 16, 2018



**NOTES TO USERS**

This map is to be used in conjunction with the Johnson County Insurance Program, a flood insurance program for the purchase of flood insurance. The program is a joint effort of the State of Arkansas, the National Flood Insurance Program, and the Federal Emergency Management Agency. This map is intended to provide flood hazard information to aid in the purchase of flood insurance. The program is subject to the terms and conditions of the policy. The program is not intended to provide a guarantee of the accuracy of the information shown on this map.

**General Notes:**  
 1. Flood Hazard Information shown on this map was derived from the National Flood Hazard Review (NFHR) conducted by the Federal Emergency Management Agency (FEMA) in 1999. The NFHR is based on a 100-year flood return period. The NFHR is subject to the terms and conditions of the policy. The program is not intended to provide a guarantee of the accuracy of the information shown on this map.

**Control Points:**  
 The map was prepared using the following control points:  
 1. National Flood Hazard Review (NFHR) data  
 2. State of Arkansas Flood Insurance Program data  
 3. Federal Emergency Management Agency (FEMA) data

**Scale:**  
 The map is shown at a scale of 1 inch = 2,000 feet.

**Projection:**  
 The map is shown in the North American Datum of 1983 (NAD 83) projection.

**Disclaimer:**  
 The information shown on this map is intended to provide general information only. It is not intended to be used as a basis for engineering or other professional services. The user should consult the National Flood Hazard Review (NFHR) data for more information.



**LEGEND**

- FLOOD HAZARD INFORMATION**
- Zone A**: Unincorporated Areas
- Zone B**: Unincorporated Areas
- Zone C**: Unincorporated Areas
- Zone D**: Unincorporated Areas
- Zone E**: Unincorporated Areas
- Zone F**: Unincorporated Areas
- Zone G**: Unincorporated Areas
- Zone H**: Unincorporated Areas
- Zone I**: Unincorporated Areas
- Zone J**: Unincorporated Areas
- Zone K**: Unincorporated Areas
- Zone L**: Unincorporated Areas
- Zone M**: Unincorporated Areas
- Zone N**: Unincorporated Areas
- Zone O**: Unincorporated Areas
- Zone P**: Unincorporated Areas
- Zone Q**: Unincorporated Areas
- Zone R**: Unincorporated Areas
- Zone S**: Unincorporated Areas
- Zone T**: Unincorporated Areas
- Zone U**: Unincorporated Areas
- Zone V**: Unincorporated Areas
- Zone W**: Unincorporated Areas
- Zone X**: Unincorporated Areas
- Zone Y**: Unincorporated Areas
- Zone Z**: Unincorporated Areas
- Zone AA**: Unincorporated Areas
- Zone AB**: Unincorporated Areas
- Zone AC**: Unincorporated Areas
- Zone AD**: Unincorporated Areas
- Zone AE**: Unincorporated Areas
- Zone AF**: Unincorporated Areas
- Zone AG**: Unincorporated Areas
- Zone AH**: Unincorporated Areas
- Zone AI**: Unincorporated Areas
- Zone AJ**: Unincorporated Areas
- Zone AK**: Unincorporated Areas
- Zone AL**: Unincorporated Areas
- Zone AM**: Unincorporated Areas
- Zone AN**: Unincorporated Areas
- Zone AO**: Unincorporated Areas
- Zone AP**: Unincorporated Areas
- Zone AQ**: Unincorporated Areas
- Zone AR**: Unincorporated Areas
- Zone AS**: Unincorporated Areas
- Zone AT**: Unincorporated Areas
- Zone AU**: Unincorporated Areas
- Zone AV**: Unincorporated Areas
- Zone AW**: Unincorporated Areas
- Zone AX**: Unincorporated Areas
- Zone AY**: Unincorporated Areas
- Zone AZ**: Unincorporated Areas

PANEL 03330

**FIRM FLOOD INSURANCE RATE MAP**  
**JOHNSON COUNTY, ARKANSAS**  
**AND INCORPORATED AREAS**

PANEL 335 OF 475

DATE: NOVEMBER 26, 2010

MAP NUMBER: 031703330

EFFECTIVE DATE: NOVEMBER 26, 2010

Federal Emergency Management Agency

**NOTES TO USERS**

This map is for use in determining the flood insurance rate for the community and is not intended to be used for individual property insurance purposes. It is not intended to be used as a basis for individual property insurance purposes. It is not intended to be used as a basis for individual property insurance purposes. It is not intended to be used as a basis for individual property insurance purposes.

**General Note:** Flood insurance rates are determined by the Federal Emergency Management Agency (FEMA) and are based on the risk of flooding. The flood insurance rate for a community is determined by the risk of flooding. The flood insurance rate for a community is determined by the risk of flooding. The flood insurance rate for a community is determined by the risk of flooding.

**Special Note:** Flood insurance rates are determined by the Federal Emergency Management Agency (FEMA) and are based on the risk of flooding. The flood insurance rate for a community is determined by the risk of flooding. The flood insurance rate for a community is determined by the risk of flooding. The flood insurance rate for a community is determined by the risk of flooding.

**Other Note:** Flood insurance rates are determined by the Federal Emergency Management Agency (FEMA) and are based on the risk of flooding. The flood insurance rate for a community is determined by the risk of flooding. The flood insurance rate for a community is determined by the risk of flooding. The flood insurance rate for a community is determined by the risk of flooding.



**LEGEND**

- ZONE A: Special Flood Hazard Areas (SFHA) - Zone A
- ZONE B: Special Flood Hazard Areas (SFHA) - Zone B
- ZONE C: Special Flood Hazard Areas (SFHA) - Zone C
- ZONE D: Special Flood Hazard Areas (SFHA) - Zone D
- ZONE E: Special Flood Hazard Areas (SFHA) - Zone E
- ZONE F: Special Flood Hazard Areas (SFHA) - Zone F
- ZONE G: Special Flood Hazard Areas (SFHA) - Zone G
- ZONE H: Special Flood Hazard Areas (SFHA) - Zone H
- ZONE I: Special Flood Hazard Areas (SFHA) - Zone I
- ZONE J: Special Flood Hazard Areas (SFHA) - Zone J
- ZONE K: Special Flood Hazard Areas (SFHA) - Zone K
- ZONE L: Special Flood Hazard Areas (SFHA) - Zone L
- ZONE M: Special Flood Hazard Areas (SFHA) - Zone M
- ZONE N: Special Flood Hazard Areas (SFHA) - Zone N
- ZONE O: Special Flood Hazard Areas (SFHA) - Zone O
- ZONE P: Special Flood Hazard Areas (SFHA) - Zone P
- ZONE Q: Special Flood Hazard Areas (SFHA) - Zone Q
- ZONE R: Special Flood Hazard Areas (SFHA) - Zone R
- ZONE S: Special Flood Hazard Areas (SFHA) - Zone S
- ZONE T: Special Flood Hazard Areas (SFHA) - Zone T
- ZONE U: Special Flood Hazard Areas (SFHA) - Zone U
- ZONE V: Special Flood Hazard Areas (SFHA) - Zone V
- ZONE W: Special Flood Hazard Areas (SFHA) - Zone W
- ZONE X: Special Flood Hazard Areas (SFHA) - Zone X
- ZONE Y: Special Flood Hazard Areas (SFHA) - Zone Y
- ZONE Z: Special Flood Hazard Areas (SFHA) - Zone Z

**FIRM FLOOD INSURANCE RATE MAP**  
**JOHNSON COUNTY, ARKANSAS**  
**AND INCORPORATED AREAS**

PANEL 0335D

**FIRM FLOOD INSURANCE RATE MAP**  
**JOHNSON COUNTY, ARKANSAS**  
**AND INCORPORATED AREAS**

PANEL 0335D OF 475

DATE OF THIS MAP: 05/01/2010

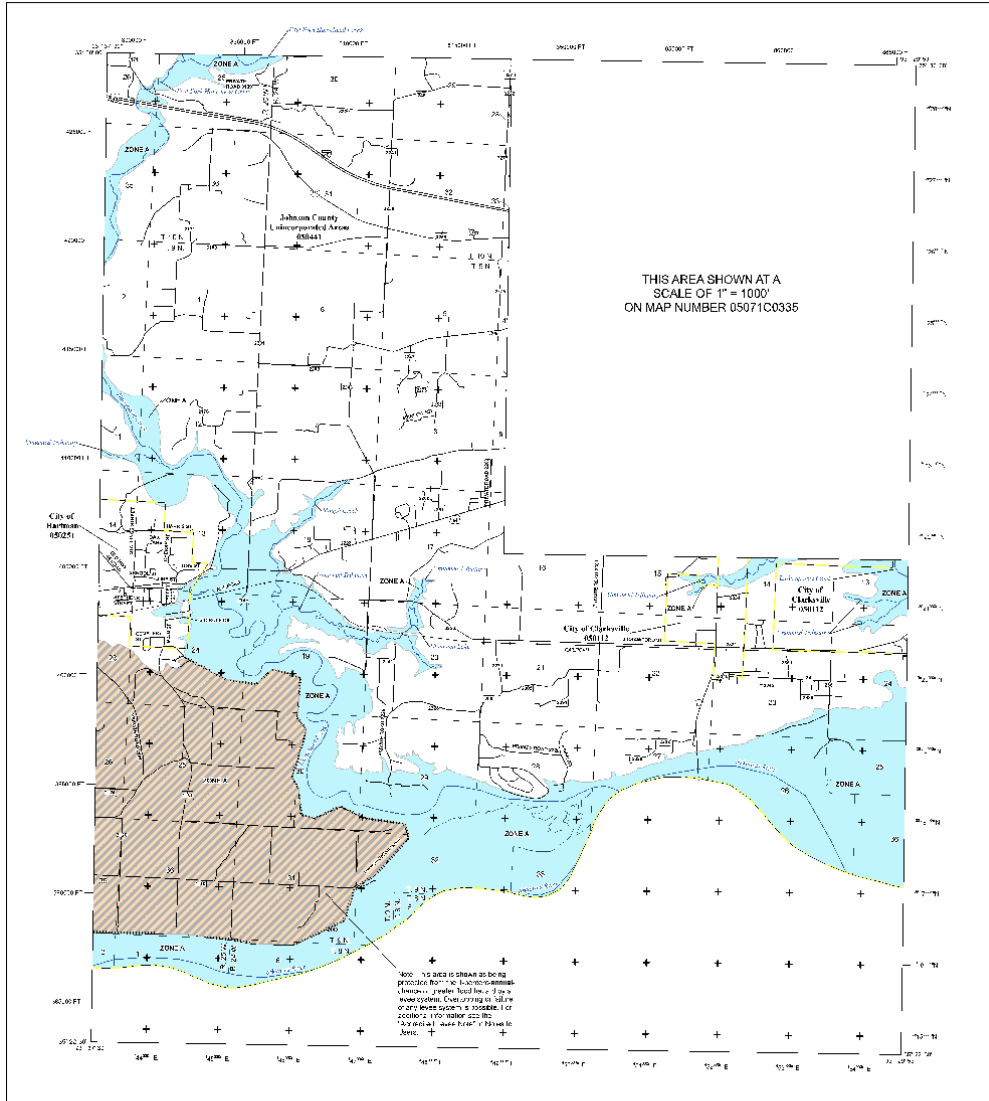
CONTACT: 800/368-7672

MAP NUMBER: 5017C0335D

EFFECTIVE DATE: NOVEMBER 26, 2010

Federal Emergency Management Agency

<https://map1.msc.fema.gov/firm?id=05071C0335D>



THIS AREA SHOWN AT A  
SCALE OF 1" = 1000'  
ON MAP NUMBER 05071C0335

**FLOOD HAZARD INFORMATION**

- SPECIAL FLOOD HAZARD AREAS**

  - W Flood Hazard (WHA) Areas
  - 100-Year Flood Hazard (100-Year FFA) Areas
  - Regulatory Floodway
  - 0.2% Annual Chance Flood Hazard (0.2% ACF) Areas
  - 1% Annual Chance Flood Hazard (1% ACF) Areas
  - 5% Annual Chance Flood Hazard (5% ACF) Areas
  - Areas with Flood Hazard (A) Areas
  - Areas with Flood Hazard (A) Areas
  - Areas with Flood Hazard (A) Areas
- OTHER AREAS OF FLOOD HAZARD**

  - NO SCOPED Areas of Unsettled Flood Hazard
- OTHER AREAS**

  - Areas of Unsettled Flood Hazard
- CANAL STRUCTURES**

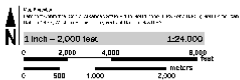
  - Canal
  - Canal
  - Canal
  - Canal
  - Canal
  - Canal
  - Canal
- OTHER FEATURES**

  - Canal
  - Canal
  - Canal
  - Canal
  - Canal

**NOTES TO USERS**

The information on this map is for informational purposes only and is not intended to be used as a basis for any engineering or construction project. The information on this map is based on the most current information available at the time of publication. The information on this map is subject to change without notice. The information on this map is not intended to be used as a basis for any engineering or construction project. The information on this map is based on the most current information available at the time of publication. The information on this map is subject to change without notice. The information on this map is not intended to be used as a basis for any engineering or construction project.

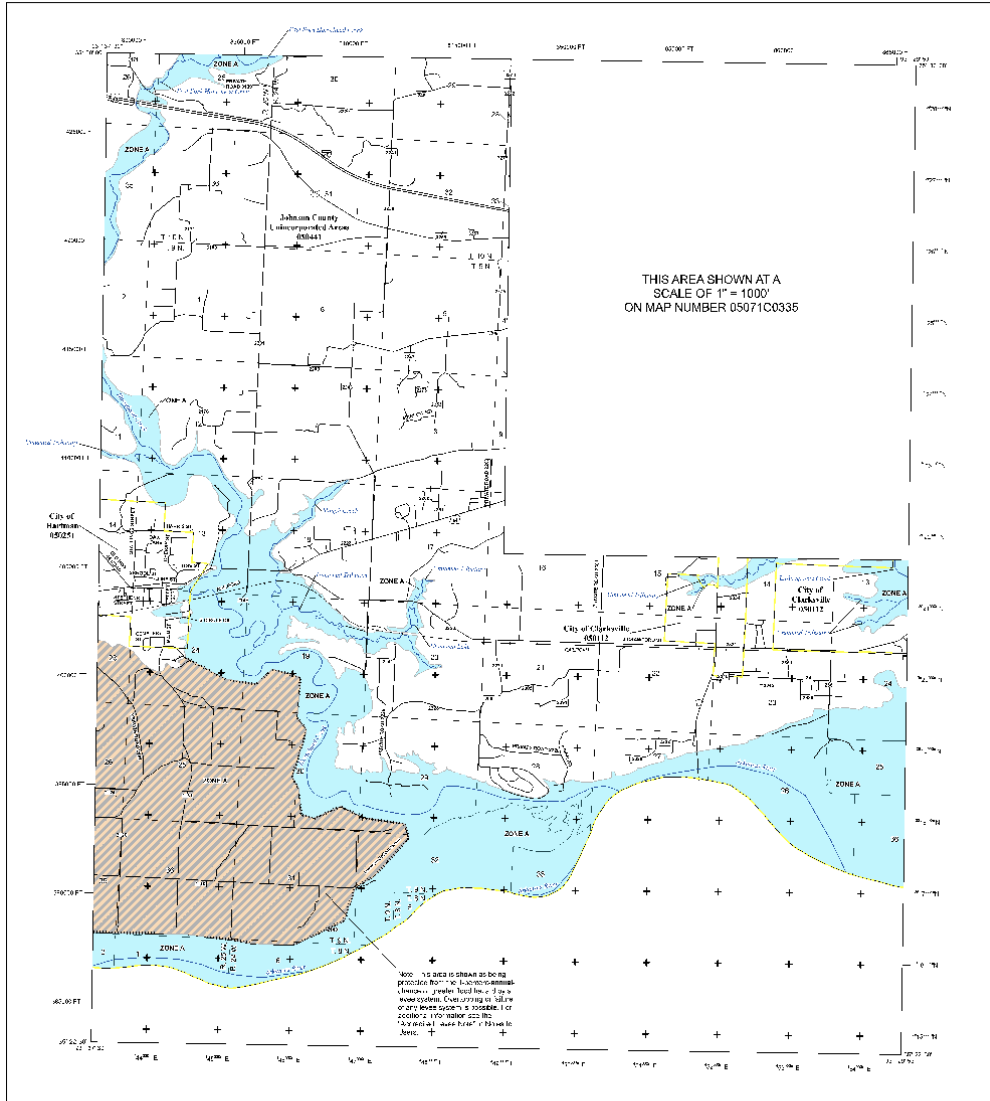
**SCALE**



**PANEL LOCATOR**



**NATIONAL FLOOD INSURANCE PROGRAM**  
**FLOOD INSURANCE RATE MAP**  
 JOHN SON COUNTY,  
 MISSISSIPPI  
 MAP NUMBER 330-1-475  
 FEDERAL EMMA



**FLOOD HAZARD INFORMATION**

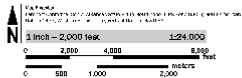
FOR FURTHER INFORMATION, REFER TO THE FIRM NUMBER AND THE FIRM NUMBER LOCATED ON THE FIRM MAP. THE INFORMATION DEPICTED ON THIS MAP IS A SUPPORTING DOCUMENT AND NOT BE USED AS A BASIS FOR ANY OTHER ACTION. FOR MORE INFORMATION, VISIT US ONLINE AT [HTTPS://MAP1.MSC.FEMA.GOV](https://map1.msc.fema.gov)

- 1% Annual Chance Flood Hazard (VHA)
- 1% Annual Chance Flood Hazard (VHA)
- SPRINKLE FLOOD HAZARD AREAS**
- 2.2% Annual Chance Flood Hazard (VHA) - 2.2% Annual Chance Flood Hazard (VHA) - 2.2% Annual Chance Flood Hazard (VHA)
- 1% Annual Chance Flood Hazard (VHA) - 1% Annual Chance Flood Hazard (VHA)
- 1% Annual Chance Flood Hazard (VHA) - 1% Annual Chance Flood Hazard (VHA)
- OTHER AREAS OF FLOOD HAZARD**
- Areas with Flood Hazard (VHA) - Areas with Flood Hazard (VHA)
- Areas with Flood Hazard (VHA) - Areas with Flood Hazard (VHA)
- OTHER AREAS**
- Areas of Undetermined Flood Hazard (VHA)
- CELESTIAL BODIES**
- Ebb and Flow of Stream or River
- Low Water of High Water
- Coast Section with 1% Annual Chance Flood Hazard
- Coast of Protected Area
- Profile Channel
- Flood Hazard (VHA)
- Flood Hazard (VHA)
- OTHER FEATURES**
- Dam
- Dam

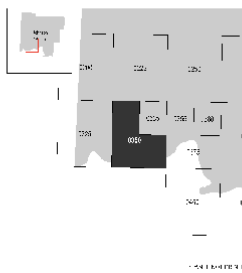
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**SCALE**



**PANEL LOCATOR**



**NATIONAL FLOOD INSURANCE PROGRAM**  
**FLOOD INSURANCE RATE MAP**

**JOHNSON COUNTY, MISSOURI**

FIRM NUMBER: 5501-01-0001  
 DATE: 05/01/12

Panel Coordinates: 390° 475'

Map Scale: 1:24,000  
 Date: 05/01/12

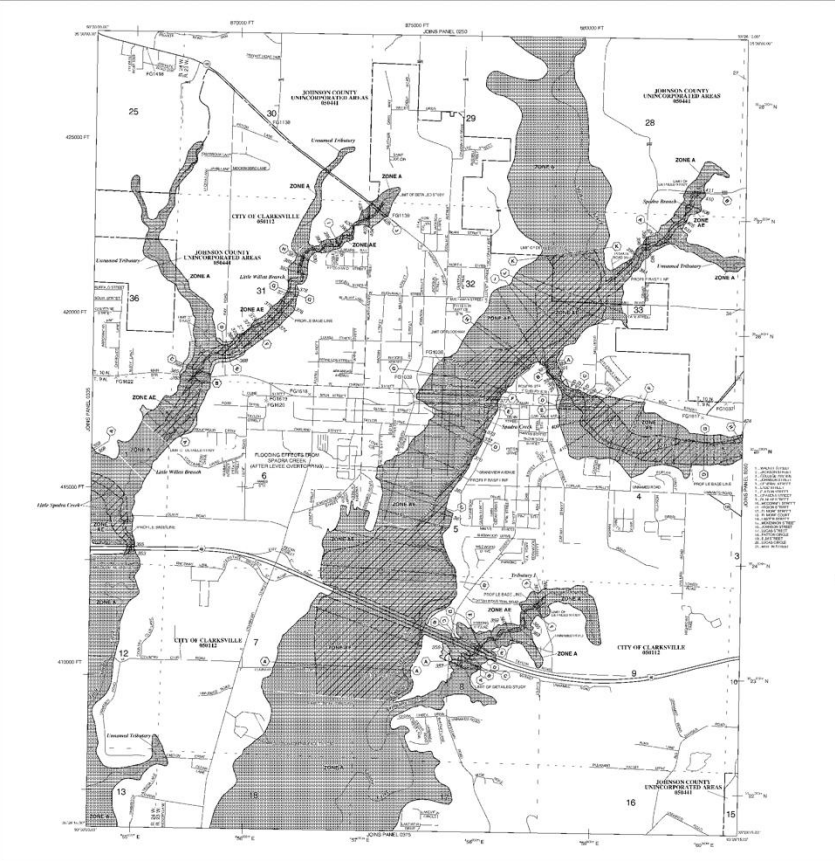
<https://map1.msc.fema.gov/firm?id=05071C0350E>

**NOTES TO USERS**

The user is to use this information for Flood Insurance Rate Maps (FIRM) only. It is not to be used for any other purpose. The user is to use the information for Flood Insurance Rate Maps (FIRM) only. It is not to be used for any other purpose.

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**LEGEND**

**ZONE A** Special Flood Hazard Area subject to a 1% Annual Chance Flood (100-Year Return Period)

**ZONE AE** Special Flood Hazard Area subject to an Annual Chance Flood (100-Year Return Period)

**ZONE AH** Special Flood Hazard Area subject to a 1% Annual Chance Flood (100-Year Return Period)

**ZONE AO** Special Flood Hazard Area subject to an Annual Chance Flood (100-Year Return Period)

**ZONE AR** Special Flood Hazard Area subject to a 1% Annual Chance Flood (100-Year Return Period)

**ZONE AV** Special Flood Hazard Area subject to an Annual Chance Flood (100-Year Return Period)

**ZONE B** Special Flood Hazard Area subject to a 1% Annual Chance Flood (100-Year Return Period)

**ZONE C** Special Flood Hazard Area subject to an Annual Chance Flood (100-Year Return Period)

**ZONE D** Special Flood Hazard Area subject to a 1% Annual Chance Flood (100-Year Return Period)

**ZONE E** Special Flood Hazard Area subject to an Annual Chance Flood (100-Year Return Period)

**ZONE F** Special Flood Hazard Area subject to a 1% Annual Chance Flood (100-Year Return Period)

**ZONE G** Special Flood Hazard Area subject to an Annual Chance Flood (100-Year Return Period)

**ZONE H** Special Flood Hazard Area subject to a 1% Annual Chance Flood (100-Year Return Period)

**ZONE I** Special Flood Hazard Area subject to an Annual Chance Flood (100-Year Return Period)

**ZONE J** Special Flood Hazard Area subject to a 1% Annual Chance Flood (100-Year Return Period)

**ZONE K** Special Flood Hazard Area subject to an Annual Chance Flood (100-Year Return Period)

**ZONE L** Special Flood Hazard Area subject to a 1% Annual Chance Flood (100-Year Return Period)

**ZONE M** Special Flood Hazard Area subject to an Annual Chance Flood (100-Year Return Period)

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**ZONE P** Special Flood Hazard Area subject to a 1% Annual Chance Flood (100-Year Return Period)

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**ZONE S** Special Flood Hazard Area subject to an Annual Chance Flood (100-Year Return Period)

**ZONE T** Special Flood Hazard Area subject to a 1% Annual Chance Flood (100-Year Return Period)

**ZONE U** Special Flood Hazard Area subject to an Annual Chance Flood (100-Year Return Period)

**ZONE V** Special Flood Hazard Area subject to a 1% Annual Chance Flood (100-Year Return Period)

**ZONE W** Special Flood Hazard Area subject to an Annual Chance Flood (100-Year Return Period)

**ZONE X** Special Flood Hazard Area subject to a 1% Annual Chance Flood (100-Year Return Period)

**ZONE Y** Special Flood Hazard Area subject to an Annual Chance Flood (100-Year Return Period)

**ZONE Z** Special Flood Hazard Area subject to a 1% Annual Chance Flood (100-Year Return Period)

**NATIONAL FLOOD INSURANCE PROGRAM**

**FIRM FLOOD INSURANCE RATE MAP**

**JOHNSON COUNTY, ARKANSAS**

**AND INCORPORATED AREAS**

PANEL 0550

PANEL 055 OF 475

DATE: 11/26/10

SCALE: 1" = 1000'

MAP NUMBER: 0507C0550

REVISION DATE: NOVEMBER 26, 2010

Federal Emergency Management Agency









**NOTES TO USERS**

This map is an update to the National Flood Insurance Program (NFIP) Flood Insurance Rate Map (FIRM) for Johnson County, Arkansas. The map is based on the latest available data and is subject to change without notice. The map is intended for informational purposes only and should not be used as a basis for any legal action.

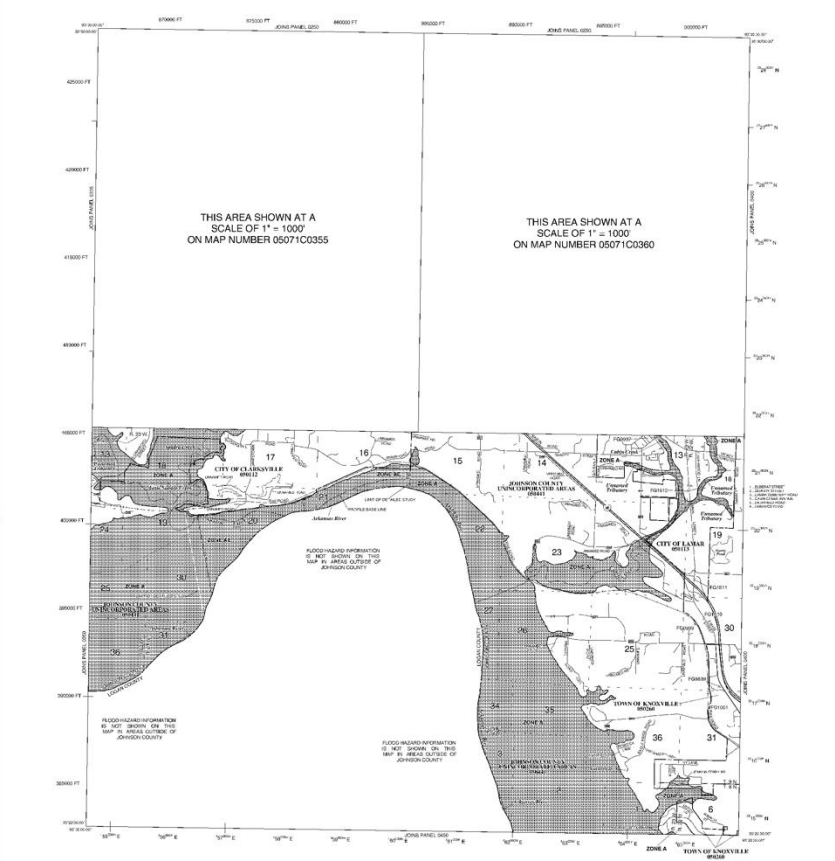
**Legend:**

- Zone A:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone B:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone C:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone D:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
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- Zone U:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone V:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone W:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone X:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone Y:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone Z:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Scale:** 1" = 1000'

**Map Number:** 05071C0355

**Map Number:** 05071C0360



**LEGEND**

**Zone A:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone B:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone C:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone D:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone E:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone F:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone G:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone H:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone I:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone J:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone K:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone L:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone M:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone N:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone O:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone P:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone Q:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone R:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone S:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone T:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone U:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone V:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone W:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone X:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone Y:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone Z:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Scale:** 1" = 1000'

**Map Number:** 05071C0355

**Map Number:** 05071C0360

**Map Number:** 05071C0370

**Effective Date:** November 28, 2010

**Firm:** National Flood Insurance Program

**Arkansas:** Johnson County, Arkansas and Incorporated Areas

**Panel 0355**

**Scale:** 1" = 1000'

**Map Number:** 05071C0370

**Effective Date:** November 28, 2010

**Firm:** National Flood Insurance Program

**NOTES TO USERS**

This map is an update to the National Flood Insurance Program's Flood Insurance Rate Map (FIRM) for Johnson County, Arkansas. The map is based on the most recent available data and is intended to provide accurate information for insurance purposes.

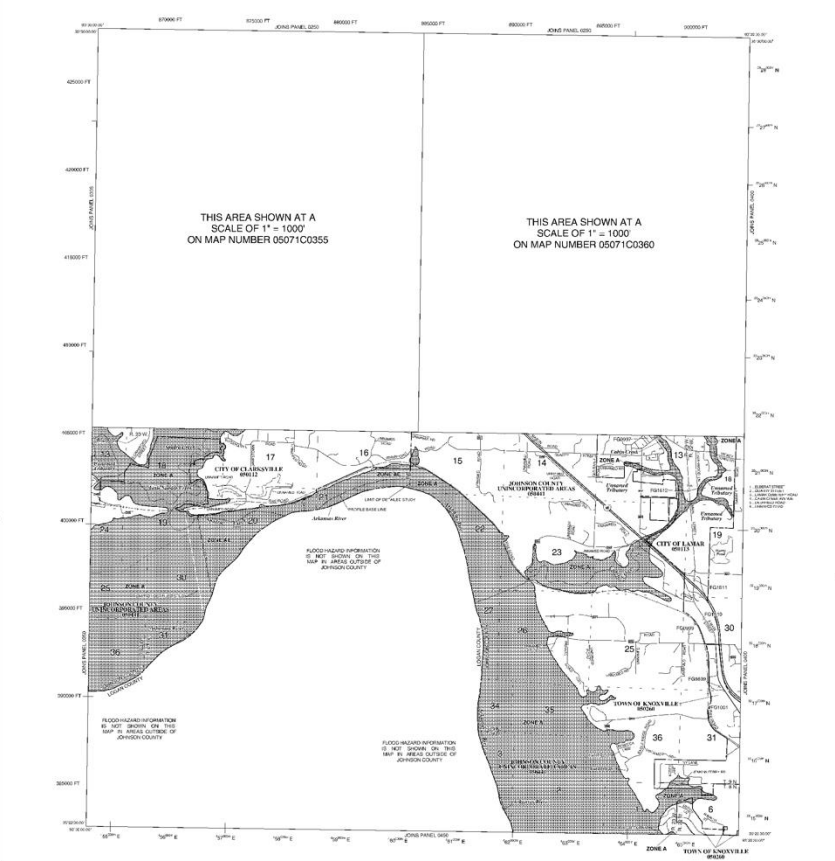
**Legend:**

- Zone A:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone B:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone C:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone D:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
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- Zone J:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone K:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone L:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone M:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone N:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone O:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone P:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone Q:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone R:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone S:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone T:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone U:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone V:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone W:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone X:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone Y:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard
- Zone Z:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Scale:** 1" = 1000'

**Map Number:** 05071C0375D

**Effective Date:** November 26, 2010



**LEGEND**

**Zone A:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone B:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone C:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone D:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone E:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone F:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone G:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone H:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone I:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone J:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone K:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone L:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone M:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone N:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

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**Zone P:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone Q:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone R:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone S:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone T:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone U:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone V:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone W:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone X:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone Y:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Zone Z:** Special Flood Hazard Area (SFHA) - 1% Annual Flood Hazard

**Scale:** 1" = 1000'

**Map Number:** 05071C0375D

**Effective Date:** November 26, 2010

**FIRM FLOOD INSURANCE RATE MAP**

**JOHNSON COUNTY, ARKANSAS**

**AND INCORPORATED AREAS**

**PANEL 0375D**

**Scale:** 1" = 1000'

**Map Number:** 05071C0375D

**Effective Date:** November 26, 2010

<https://map1.msc.fema.gov/firm?id=05071C0375D>

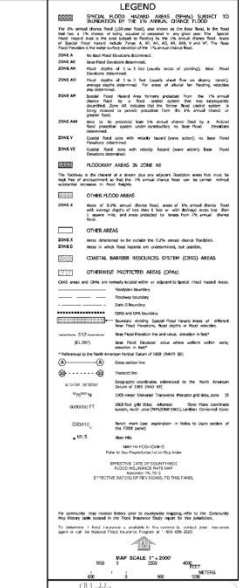
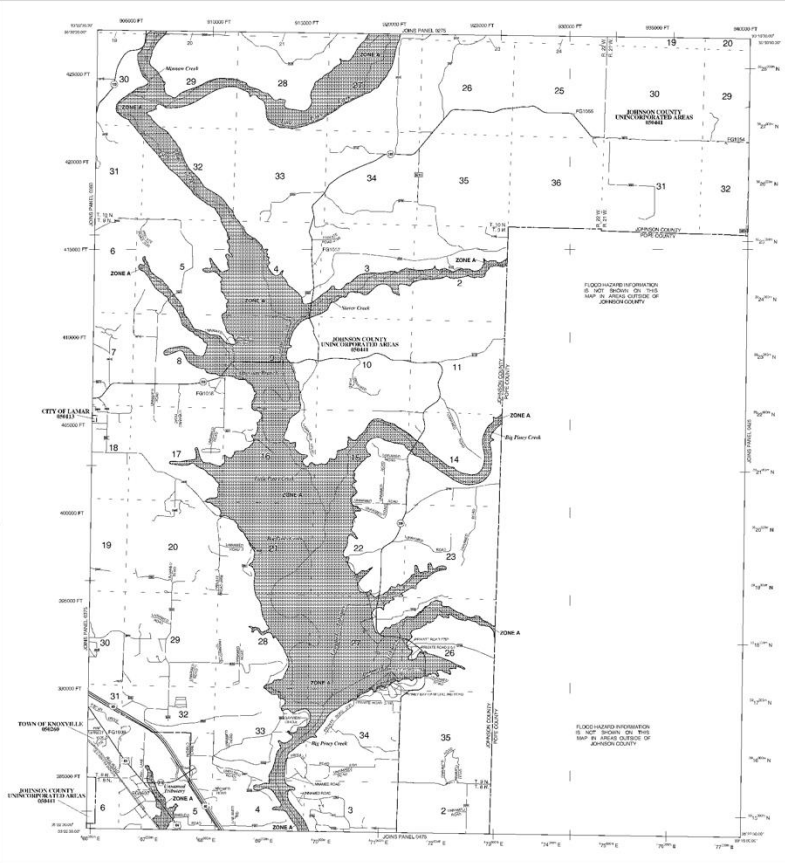
**NOTES TO USERS**

This map is for use in accordance with the National Flood Insurance Program & the National Flood Insurance Act. It is not to be used for any other purpose. The insurance carrier is not responsible for any damage or loss resulting from the use of this map. The insurance carrier is not responsible for any damage or loss resulting from the use of this map. The insurance carrier is not responsible for any damage or loss resulting from the use of this map.

**General:** Flood Hazard Information is shown where Flood Hazard Insurance is available. Flood Hazard Insurance is available in areas where Flood Hazard Insurance is available. Flood Hazard Insurance is available in areas where Flood Hazard Insurance is available. Flood Hazard Insurance is available in areas where Flood Hazard Insurance is available.

**Map Symbols:** Flood Hazard Information is shown where Flood Hazard Insurance is available. Flood Hazard Insurance is available in areas where Flood Hazard Insurance is available. Flood Hazard Insurance is available in areas where Flood Hazard Insurance is available. Flood Hazard Insurance is available in areas where Flood Hazard Insurance is available.

**Map Scale:** 1 inch = 1 mile. The map scale is 1 inch = 1 mile. The map scale is 1 inch = 1 mile. The map scale is 1 inch = 1 mile. The map scale is 1 inch = 1 mile. The map scale is 1 inch = 1 mile.



PANEL 0400D

**FIRM FLOOD INSURANCE MAP**

**JOHNSON COUNTY, ARKANSAS**

**AND INCORPORATED AREAS**

PANEL 400 OF 476

DATE: 11/26/2010

MAP NUMBER: 0400D

EFFECTIVE DATE: NOVEMBER 26, 2010

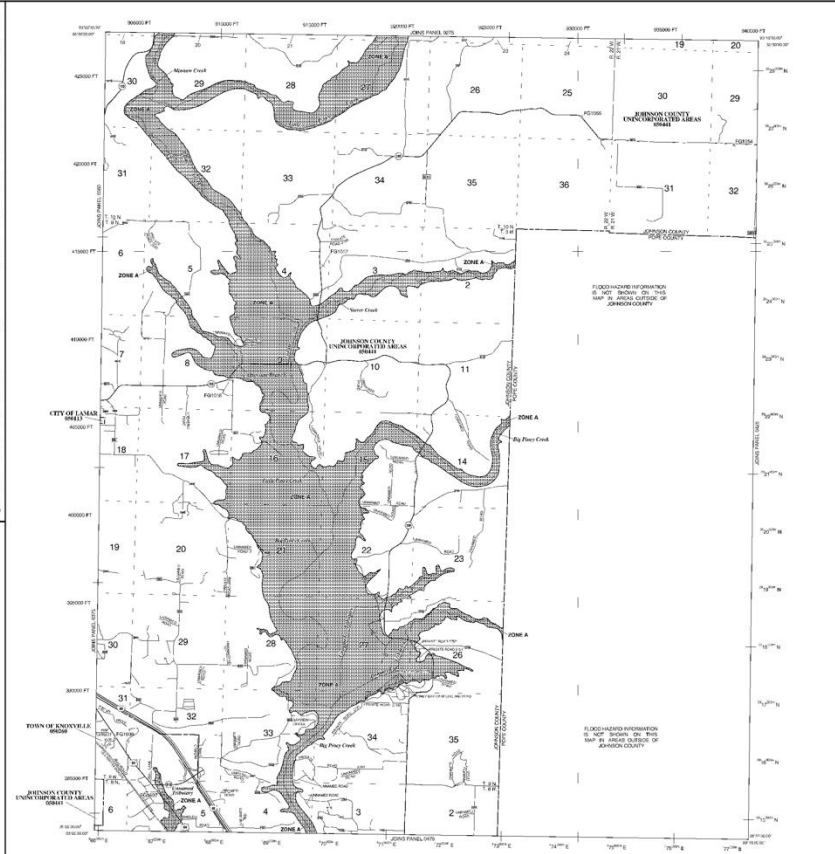
Federal Emergency Management Agency

### NOTES TO USERS

This map is for use in conjunction with the National Flood Insurance Program. It was prepared for the purpose of showing the locations of Special Flood Hazard Areas (SFHAs) which are subject to flooding from the action of waves from coastal storms or other natural forces of wind, waves, and storm surge, and are identified by the Federal Emergency Management Agency (FEMA) in its National Flood Insurance Program (NFIP) Flood Insurance Study (FIS) for the area shown. It is not intended to be used for other purposes, such as for determining the location of Special Flood Hazard Areas for areas not shown on this map, or for determining the location of Special Flood Hazard Areas for areas shown on this map but not covered by the NFIP.

**Special Flood Hazard Areas (SFHAs) which are subject to flooding from the action of waves from coastal storms or other natural forces of wind, waves, and storm surge, and are identified by the Federal Emergency Management Agency (FEMA) in its National Flood Insurance Program (NFIP) Flood Insurance Study (FIS) for the area shown.**

**Special Flood Hazard Areas (SFHAs) which are subject to flooding from the action of waves from coastal storms or other natural forces of wind, waves, and storm surge, and are identified by the Federal Emergency Management Agency (FEMA) in its National Flood Insurance Program (NFIP) Flood Insurance Study (FIS) for the area shown.**



### LEGEND

**SPECIAL FLOOD HAZARD INFORMATION**

**Zone A** - Areas subject to a 1% annual chance flood from the action of waves from coastal storms or other natural forces of wind, waves, and storm surge, and are identified by the Federal Emergency Management Agency (FEMA) in its National Flood Insurance Program (NFIP) Flood Insurance Study (FIS) for the area shown.

**Zone B** - Areas subject to a 1% annual chance flood from the action of waves from coastal storms or other natural forces of wind, waves, and storm surge, and are identified by the Federal Emergency Management Agency (FEMA) in its National Flood Insurance Program (NFIP) Flood Insurance Study (FIS) for the area shown.

**Zone C** - Areas subject to a 1% annual chance flood from the action of waves from coastal storms or other natural forces of wind, waves, and storm surge, and are identified by the Federal Emergency Management Agency (FEMA) in its National Flood Insurance Program (NFIP) Flood Insurance Study (FIS) for the area shown.

**Zone D** - Areas subject to a 1% annual chance flood from the action of waves from coastal storms or other natural forces of wind, waves, and storm surge, and are identified by the Federal Emergency Management Agency (FEMA) in its National Flood Insurance Program (NFIP) Flood Insurance Study (FIS) for the area shown.

**Zone E** - Areas subject to a 1% annual chance flood from the action of waves from coastal storms or other natural forces of wind, waves, and storm surge, and are identified by the Federal Emergency Management Agency (FEMA) in its National Flood Insurance Program (NFIP) Flood Insurance Study (FIS) for the area shown.

**Zone F** - Areas subject to a 1% annual chance flood from the action of waves from coastal storms or other natural forces of wind, waves, and storm surge, and are identified by the Federal Emergency Management Agency (FEMA) in its National Flood Insurance Program (NFIP) Flood Insurance Study (FIS) for the area shown.

**PANEL 0400D**

**FIRM FLOOD INSURANCE MAP**  
JOHNSON COUNTY,  
ARKANSAS  
AND INCORPORATED AREAS

**PANEL 400 OF 476**

**CONTRACT** AR 140-0000-0000  
**SCALE** AS SHOWN  
**DATE** NOVEMBER 26, 2010

Federal Emergency Management Agency

<https://map1.msc.fema.gov/firm?id=05071C0400D>









**NOTES TO USERS**

This map is for use in determining Flood Insurance Rates for the National Flood Insurance Program. It is not to be used for other purposes. The information contained herein is for informational purposes only and does not constitute a warranty. The user assumes all responsibility for the use of this information.

To obtain the actual information on which these Flood Insurance Rates are based, the user should consult the National Flood Insurance Program's Flood Insurance Rate Maps. The National Flood Insurance Program's Flood Insurance Rate Maps are available for purchase from the National Flood Insurance Program, 1205 N. 17th Street, Tallahassee, Florida 32310. The National Flood Insurance Program's Flood Insurance Rate Maps are also available on the National Flood Insurance Program's website at [www.flood.gov](http://www.flood.gov).

**Legend**

The following legend explains the symbols and shading used on this map to indicate flood hazard areas. For a complete description of the symbols and shading used on this map, refer to the National Flood Insurance Program's Flood Insurance Rate Maps.

**00000** Special Flood Hazard Areas (SFHA)

**01** Zone A: Shaded light blue

**02** Zone B: Unshaded light blue

**03** Zone C: Unshaded white

**04** Zone D: Unshaded white

**05** Zone E: Unshaded white

**06** Zone F: Unshaded white

**07** Zone G: Unshaded white

**08** Zone H: Unshaded white

**09** Zone I: Unshaded white

**10** Zone J: Unshaded white

**11** Zone K: Unshaded white

**12** Zone L: Unshaded white

**13** Zone M: Unshaded white

**14** Zone N: Unshaded white

**15** Zone O: Unshaded white

**16** Zone P: Unshaded white

**17** Zone Q: Unshaded white

**18** Zone R: Unshaded white

**19** Zone S: Unshaded white

**20** Zone T: Unshaded white

**21** Zone U: Unshaded white

**22** Zone V: Unshaded white

**23** Zone W: Unshaded white

**24** Zone X: Unshaded white

**25** Zone Y: Unshaded white

**26** Zone Z: Unshaded white

**Other Flood Hazard Areas (OFHA)**

**01** Zone AA: Unshaded white

**02** Zone AB: Unshaded white

**03** Zone AC: Unshaded white

**04** Zone AD: Unshaded white

**05** Zone AE: Unshaded white

**06** Zone AF: Unshaded white

**07** Zone AG: Unshaded white

**08** Zone AH: Unshaded white

**09** Zone AI: Unshaded white

**10** Zone AJ: Unshaded white

**11** Zone AK: Unshaded white

**12** Zone AL: Unshaded white

**13** Zone AM: Unshaded white

**14** Zone AN: Unshaded white

**15** Zone AO: Unshaded white

**16** Zone AP: Unshaded white

**17** Zone AQ: Unshaded white

**18** Zone AR: Unshaded white

**19** Zone AS: Unshaded white

**20** Zone AT: Unshaded white

**21** Zone AU: Unshaded white

**22** Zone AV: Unshaded white

**23** Zone AW: Unshaded white

**24** Zone AX: Unshaded white

**25** Zone AY: Unshaded white

**26** Zone AZ: Unshaded white

**Other Flood Hazard Areas (OFHA) - Contour Lines**

**01** 100 Year Flood Contour

**02** 500 Year Flood Contour

**03** 1000 Year Flood Contour

**04** 2000 Year Flood Contour

**05** 5000 Year Flood Contour

**06** 10000 Year Flood Contour

**07** 20000 Year Flood Contour

**08** 50000 Year Flood Contour

**09** 100000 Year Flood Contour

**010** 200000 Year Flood Contour

**011** 500000 Year Flood Contour

**012** 1000000 Year Flood Contour

**013** 2000000 Year Flood Contour

**014** 5000000 Year Flood Contour

**015** 10000000 Year Flood Contour

**016** 20000000 Year Flood Contour

**017** 50000000 Year Flood Contour

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**021** 1000000000 Year Flood Contour

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**037** 200000000000000 Year Flood Contour

**038** 500000000000000 Year Flood Contour

**039** 1000000000000000 Year Flood Contour

**040** 2000000000000000 Year Flood Contour

**041** 5000000000000000 Year Flood Contour

**042** 10000000000000000 Year Flood Contour

**043** 20000000000000000 Year Flood Contour

**044** 50000000000000000 Year Flood Contour

**045** 100000000000000000 Year Flood Contour

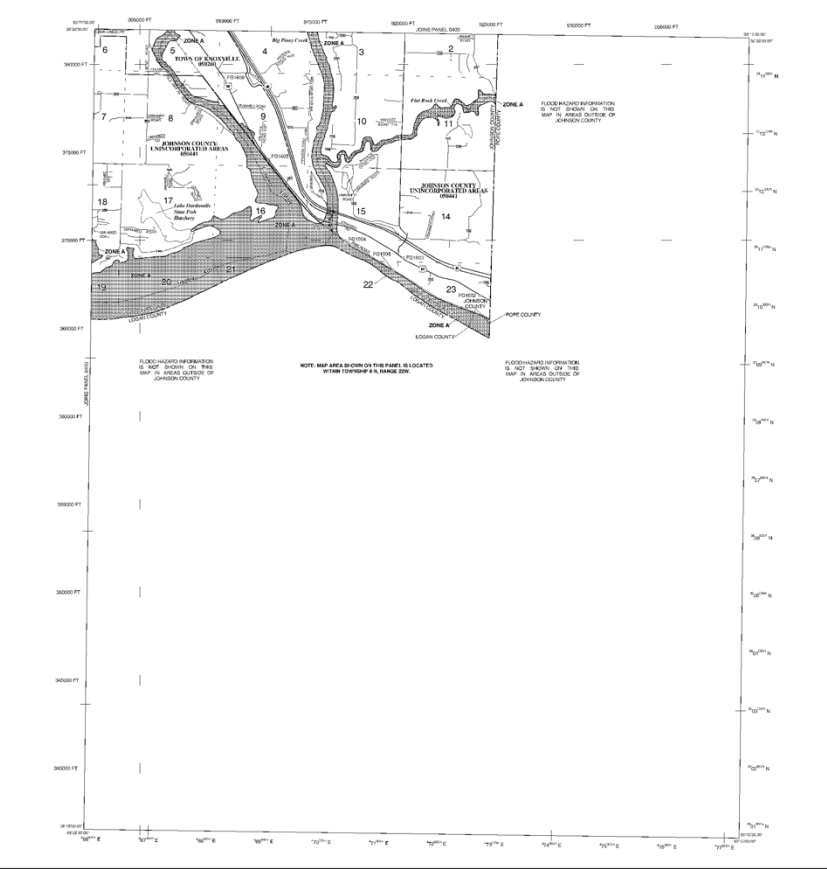
**046** 200000000000000000 Year Flood Contour

**047** 500000000000000000 Year Flood Contour

**048** 1000000000000000000 Year Flood Contour

**049** 2000000000000000000 Year Flood Contour

**050** 5000000000000000000 Year Flood Contour



**LEGEND**

00000 Special Flood Hazard Areas (SFHA)

01 Zone A: Shaded light blue

02 Zone B: Unshaded light blue

03 Zone C: Unshaded white

04 Zone D: Unshaded white

05 Zone E: Unshaded white

06 Zone F: Unshaded white

07 Zone G: Unshaded white

08 Zone H: Unshaded white

09 Zone I: Unshaded white

10 Zone J: Unshaded white

11 Zone K: Unshaded white

12 Zone L: Unshaded white

13 Zone M: Unshaded white

14 Zone N: Unshaded white

15 Zone O: Unshaded white

16 Zone P: Unshaded white

17 Zone Q: Unshaded white

18 Zone R: Unshaded white

19 Zone S: Unshaded white

20 Zone T: Unshaded white

21 Zone U: Unshaded white

22 Zone V: Unshaded white

23 Zone W: Unshaded white

24 Zone X: Unshaded white

25 Zone Y: Unshaded white

26 Zone Z: Unshaded white

Other Flood Hazard Areas (OFHA)

01 Zone AA: Unshaded white

02 Zone AB: Unshaded white

03 Zone AC: Unshaded white

04 Zone AD: Unshaded white

05 Zone AE: Unshaded white

06 Zone AF: Unshaded white

07 Zone AG: Unshaded white

08 Zone AH: Unshaded white

09 Zone AI: Unshaded white

10 Zone AJ: Unshaded white

11 Zone AK: Unshaded white

12 Zone AL: Unshaded white

13 Zone AM: Unshaded white

14 Zone AN: Unshaded white

15 Zone AO: Unshaded white

16 Zone AP: Unshaded white

17 Zone AQ: Unshaded white

18 Zone AR: Unshaded white

19 Zone AS: Unshaded white

20 Zone AT: Unshaded white

21 Zone AU: Unshaded white

22 Zone AV: Unshaded white

23 Zone AW: Unshaded white

24 Zone AX: Unshaded white

25 Zone AY: Unshaded white

26 Zone AZ: Unshaded white

Other Flood Hazard Areas (OFHA) - Contour Lines

01 100 Year Flood Contour

02 500 Year Flood Contour

03 1000 Year Flood Contour

04 2000 Year Flood Contour

05 5000 Year Flood Contour

06 10000 Year Flood Contour

07 20000 Year Flood Contour

08 50000 Year Flood Contour

09 100000 Year Flood Contour

010 200000 Year Flood Contour

011 500000 Year Flood Contour

012 1000000 Year Flood Contour

013 2000000 Year Flood Contour

014 5000000 Year Flood Contour

015 10000000 Year Flood Contour

016 20000000 Year Flood Contour

017 50000000 Year Flood Contour

018 100000000 Year Flood Contour

019 200000000 Year Flood Contour

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