Hazard Mitigation Plan

Pulaski County, Arkansas

2012

Alexander • Cammack Village • Jacksonville • Little Rock • Little Rock School District • Maumelle • North Little Rock
North Little Rock School District • Pulaski County Special School District •Sherwood • Wrightsville

Hazard Mitigation Plan

Pulaski County, Arkansas

2012

Prepared for:

Pulaski County
201 S. Broadway
Little Rock, AR 72201

In collaboration with:

Alexander, Cammack Village, Jacksonville, Little Rock, Little Rock School District, Maumelle, North Little Rock, North Little Rock School District, Pulaski County Special School District, Sherwood, and Wrightsville

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Cover Photo: *Planes were tossed by a tornado at the North Little Rock Airport in Pulaski County on April 3, 2008. Photo is courtesy of the National Weather Service Weather Forecast Office Little Rock, Arkansas.*

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Requirement § 201.6(c)(5): Documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).

Requirement § 201.6(c)(5): For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

Requirement §201.6(a)(3): Multi-jurisdictional plans (e.g., watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process … Statewide plans will not be accepted as multi-jurisdictional plans.

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1 GENERAL DESCRIPTION

Hazard Mitigation Plans (HMPs) form the foundation for a community's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage. The planning process is as important as the HMP itself. It creates a framework for risk-based decision making to reduce damages to lives, property, and the economy from future disasters. Hazard mitigation is defined as a sustained action taken to reduce or eliminate long-term risk to people and their property from hazards.

The following definitions of Hazard Mitigation Planning are provided by FEMA:

HAZARD MITIGATION – *Any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.*

PLANNING – *The act or process of making or carrying out plans; specifically, the establishment of goals, policies, and procedures for a social or economic unit.*

PREPAREDNESS – *Actions that strengthen the capability of government, citizens, and communities to respond to disasters.*

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 and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP). It also requires that communities have a Federal Emergency Management Agency (FEMA) approved HMP in order to receive Stafford Act assistance, excluding assistance provided pursuant to emergency provisions.

The goals of this Pulaski County HMP are to 1) reduce the loss of life and decrease property losses in Pulaski County due to natural and man-made hazards; 2) provide a framework and coordination to encourage all levels of government and public and private organizations to undertake mitigation to minimize potential disasters and to employ mitigation in the recovery following disasters; 3) improve data collection, use, and sharing; 4) facilitate sound development throughout Pulaski County to reduce or eliminate hazard risk; 5) enhance public awareness and understanding of hazard mitigation; and 6) identify and pursue grant opportunities to fund hazard mitigation actions and projects.

The 2012 HMP update was developed to assess the ongoing natural and man-made hazard mitigation activities in Pulaski County, to evaluate additional mitigation actions and projects, and to outline a strategy for better implementation of mitigation actions and projects over the next five years. Formal adoption and implementation of the HMP will provide many benefits to Pulaski County, its residents, and the business community. By identifying potential hazard risks and associated hazard mitigation actions in advance of a disaster, Pulaski County and participating jurisdictions will be in a more advantageous position to obtain pre- and post-disaster funding. Hazard Mitigation Assistance grants such as, HMGP, Pre-Disaster Mitigation Grant (PDM), Flood Mitigation Assistance (FMA) program, each require the jurisdiction applying for the grant to have an adopted HMP. In addition, the HMP can provide National Flood Insurance Program (NFIP) Community Rating System (CRS) communities with additional points to receive a reduction in flood insurance premiums for participating homeowners. Through actively maintaining and updating the HMP, Pulaski County and participating jurisdictions will reduce their vulnerability to hazards in the future and better allocate resources for hazard mitigation projects.

Pulaski County's HMP is divided into six sections with additional appendices:

- *Section 1 – Prerequisites* includes the purpose of the HMP, memorandum of understanding, authorities, and community description.
- *Section 2 – Planning Process* describes the process of how each element in the HMP was addressed and updated to meet FEMA requirements and the methods used to allow the public and neighboring communities an opportunity to comment and participate in the development of the HMP.
- *Section 3 – Risk Assessment* identifies all natural and man-made hazards affecting the County and municipalities, reviews the historical occurrence of each hazard, measures the potential probability and magnitude of occurrence, and identifies vulnerabilities within each jurisdiction.
- *Section 4 – Mitigation Strategy* serves as a long-term blueprint to reduce hazard losses. This section includes a description of Pulaski County's Hazard Mitigation Goals to mitigate long-term vulnerabilities to the identified hazards, prioritizes a comprehensive range of Hazard Mitigation Actions, and addresses each jurisdiction's participation in the NFIP, CRS, and the status of Digital Flood Insurance Rate Map (D-FIRM) adoption.
- *Section 5 – Plan Maintenance* describes the method for monitoring, evaluating, and updating the HMP within a five-year cycle and provides the process by which Pulaski County will incorporate the HMP into other planning mechanisms and continue to encourage public involvement.
- *Section 6 – References* provides a list of all source citations referenced throughout the document.

Jurisdictional adoption resolutions and Memorandums of Understanding will be provided in **Appendix I**; Public Advertisements, Meeting Sign-In Sheets, Meeting Minutes, and Meeting Materials are provided in **Appendix II**; Jurisdictional Hazard Mitigation Action Participation Forms are provided in **Appendix III**; Critical Facility and Manufactured Home Maps are provided in **Appendix IV**; Glossary is described in **Appendix V**; and annual progress reports are provided in **Appendix VI**.

2 ADOPTION PROCESS

2.1 Responsibilities

This is a multi-jurisdictional HMP, with a planning area that includes all of unincorporated Pulaski County and eight municipalities within the County including the Town of Alexander, City of Cammack Village, City of Jacksonville, City of Little Rock, City of Maumelle, City of North Little Rock, City of Sherwood, and City of Wrightsville. The Little Rock School District, North Little Rock School District, and Pulaski County Special School District also participated in the HMP planning process and will independently adopt the HMP.

Table 1.1 includes the primary representative from each participating jurisdiction. All jurisdictions participated in the HMP's development by adding information to the risk assessment, selecting hazard mitigation actions, and indentifying appropriate mechanisms for implementing the plan. They all participated in Hazard Mitigation Planning Team (HMPT) meetings, interviews, and/or conference calls. Additionally, all jurisdiction representatives and citizens had an opportunity to review the Draft HMP before its submittal to Arkansas Department of Emergency Management (ADEM) and FEMA.

Table 1.1 List of Jurisdiction Representatives		
Jurisdiction	Name of Primary Representative	Participation Classification since 2006 HMPs
Unincorporated Pulaski County	Andy Traffanstedt	Continuing Participant
Town of Alexander	Mayor Paul Mitchell	Continuing Participant
City of Cammack Village	Mayor Harry Light	Continuing Participant
City of Jacksonville	Jim Durham	Continuing Participant
City of Little Rock	Matt Burks	Continuing Participant
City of Maumelle	Jim Narey	Continuing Participant
City of North Little Rock	Rick Ezell	Continuing Participant
City of Sherwood	Tracy Sims	Continuing Participant
City of Wrightsville	Mayor McKinzie Riley	Continuing Participant
Little Rock School District	Margo Bushmiaer	New Participant
North Little Rock School District	Steve Canady	New Participant
Pulaski County Special School District	Jerry Guess	New Participant

2.2 Adoption Resolution

Upon Approval Pending Adoption status from ADEM and FEMA, the following draft resolution will be replaced with final signed and adopted resolutions for each participating jurisdiction. The resolution will be located in **Appendix I.** The final adopted resolutions for each participating jurisdiction will be sent to ADEM and FEMA to receive Final Approval Status. It is our understanding that both FEMA and State reviewers are in agreement with this sequence of events.

2.3 Memorandum of Understanding

As part of the adoption process, a new Memorandum of Understanding (MOU) has been executed between each of the participating jurisdiction's governing body, primary jurisdiction representative, and agencies and departments that will implement the HMP. The intent of this MOU is to ensure that the HMP is developed in an open manner, involving neighborhood stakeholders, and that it is consistent with existing policies and is an accurate reflection of the community's values. This MOU sets out the responsibilities of all parties and identifies the work to be performed by the HMPT, primary representative, and staff.

The MOUs for Alexander, Cammack Village, Jacksonville, Maumelle, Sherwood, Wrightsville, and Pulaski County Special School District establish that they will work with the Pulaski County Office of Emergency Management to implement the HMP. The Little Rock School District MOU establishes that it will work with the Little Rock Emergency Management Division to implement the HMP. The North Little Rock School District MOU establishes that it will work with the North Little Rock Office of Emergency Management to implement the HMP. Signed copies of these MOUs will be located in **Appendix I**.

RESOLUTION NO. _____

A RESOLUTION ADOPTING THE HAZARD MITIGATION PLAN FOR (City/County/School District)

WHEREAS, certain areas of Pulaski County, Arkansas are subject to periodic flooding and other natural and man-caused hazards with the potential to cause damages to peoples' properties within the area; and

WHEREAS, Pulaski County, Arkansas desires to prepare and mitigate for such circumstances; and

WHEREAS, under the Disaster Mitigation Act of 2000, the United States Federal Emergency Management Agency (FEMA) required that local jurisdictions have in place a FEMA- approved Hazard Mitigation Action Plan as a condition of receipt of certain future Federal mitigation funding after November 1, 2004; and

WHEREAS, to assist cities and counties in meeting this requirement, the County, with the assistance of CSA International, Inc., has initiated development of a county wide, multi-jurisdiction Hazard Mitigation Plan the county and all jurisdictions in the county, specifically the cities and school districts;

NOW, THEREFORE, BE IT RESOLVED BY THE GOVERNING BODY OF THE Pulaski County, AR:

That Pulaski County, AR, hereby adopts those portions of the Plan relating to and protecting its jurisdictional area against all hazards, from 2012-2017; and

Appoints the Emergency Management Director to assure that the Hazard Mitigation Plan be reviewed at least annually and that any needed adjustment to the Hazard Mitigation Plan be developed and presented to the governing board for consideration; and agrees to take such other official action as may be reasonably necessary to carry out the objectives of the Hazard Mitigation Plan.

APPROVED and ADOPTED on this ____ day of _____, 20_____.
APPROVED:

_____
County Judge/Mayor/School Superintendent
(Authorized Representative)

ATTEST:

_____
Secretary/Clerk
(Authorized Representative)

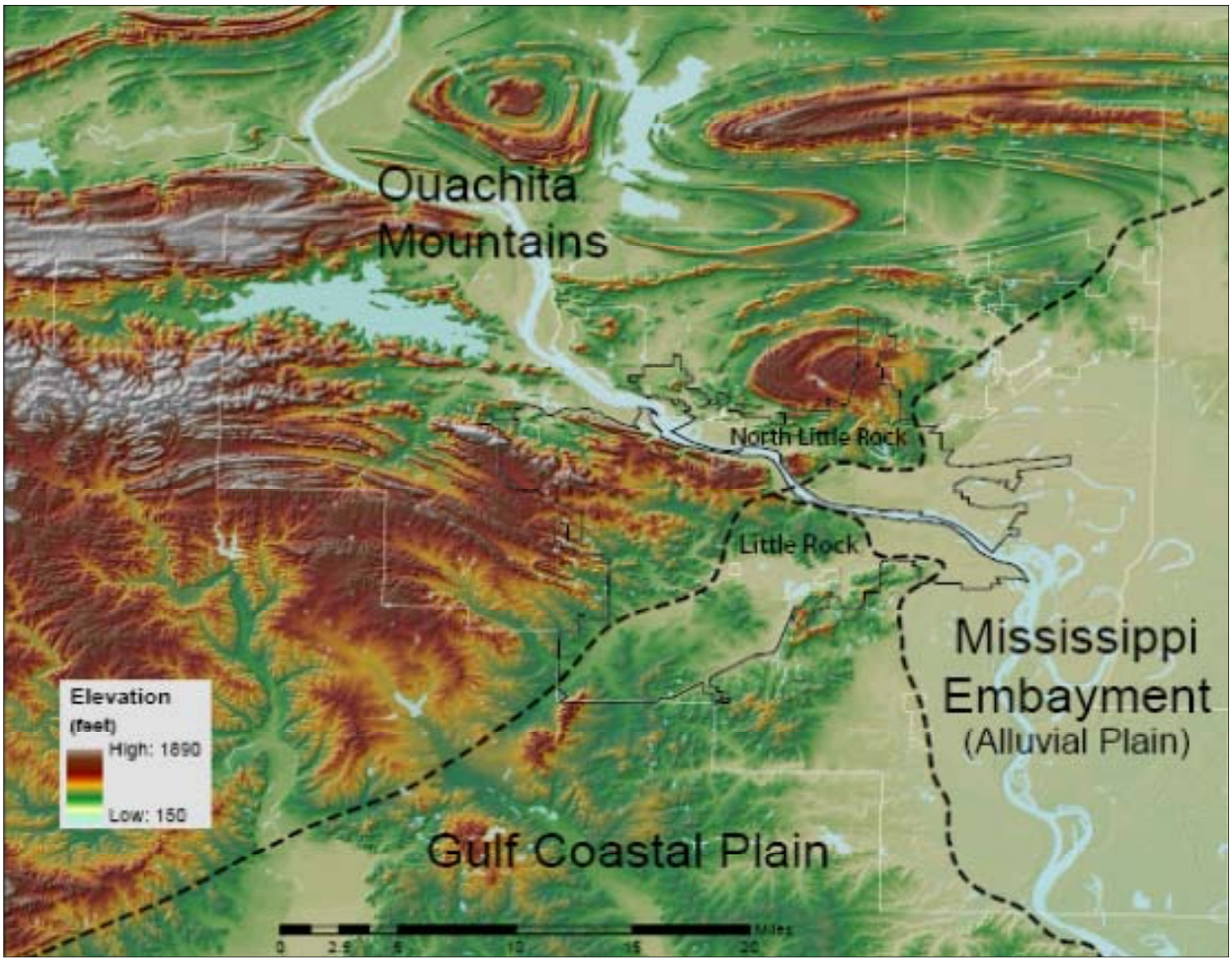
3 COMMUNITY DESCRIPTION

Pulaski County's rich history reflects significant eras in American history including western expansion in the 19th century, the Civil War, the Civil Rights Movement and the presidential elections at the close of the 20th century (Encyclopedia of Arkansas History & Culture, 2012). Currently, Pulaski County has a diverse population, economy, natural setting, and social structure. Its balanced economy results from state and local government, business and industry, and finance and nonprofit sectors.

3.1 Physiography and Geology

Of the five physiographic /geologic provinces present in Arkansas, three are present in Pulaski County (**Figure 1.1**). These include the Ouachita Mountains, Mississippi Embayment, and Gulf Coastal Plain Provinces. Each province exhibits distinctly different geology, soil type, and topography that may affect the occurrence and distribution of natural hazards in the Pulaski County and each participating jurisdiction (Pulaski County Planning Area).

Figure 1.1 Topography of Pulaski County



Source: Arkansas Geological Survey, 2006.

The Ouachita Mountains Province comprises the western and northern 3/4 of the County. This province is underlain primarily by well-consolidated Paleozoic age sandstone, shale, and chert that was deformed by folding and faulting. This deformation and subsequent erosion has shaped the topography in this area into a series of east-west trending ridges and valleys. Elevation in this part of the county ranges from approximately 240 to over 1,000 feet from sea level. Deep, loamy soils are characteristic of valleys in this part of the province, whereas moderately deep to shallow stony to loamy soils are characteristic of ridges in this area.

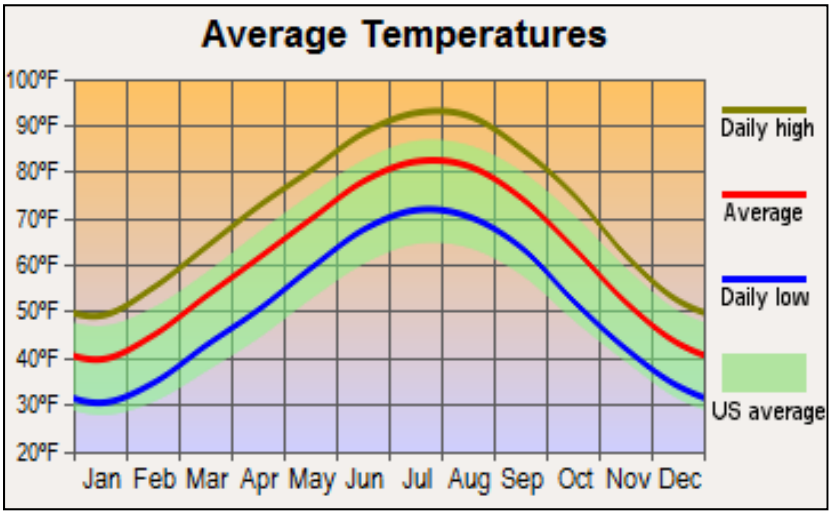
The Mississippi Embayment Province underlies the southeastern part of Pulaski County. This area is underlain by young (Quaternary), unconsolidated alluvium (sand, silt, and clay) deposited by the Arkansas River and other streams. Topographically, this area is quite flat with most changes in elevation resulting from variation in meandering stream deposits. Elevation in this part of the county ranges from approximately 200 to 250 feet. Soils are typically level and deep on bottomlands, and may be clayey, loamy, or sandy.

The Gulf Coastal Plain Province comprises the south-central part of Pulaski County. This part of the county is underlain mostly by Tertiary age unconsolidated to poorly consolidated sands, silts, and clays. Also, a large body of Cretaceous age igneous rock (syenite) occurs in the Granite Mountain area. With the exception of the steep slopes of Granite Mountain, the topography consists of rolling hills. Elevations range from approximately 250 to 600 feet. Soils of this part of the Gulf Coastal Plain are generally level to gently sloping, deep, and loamy and are developed on broad uplands.

3.2 Climate

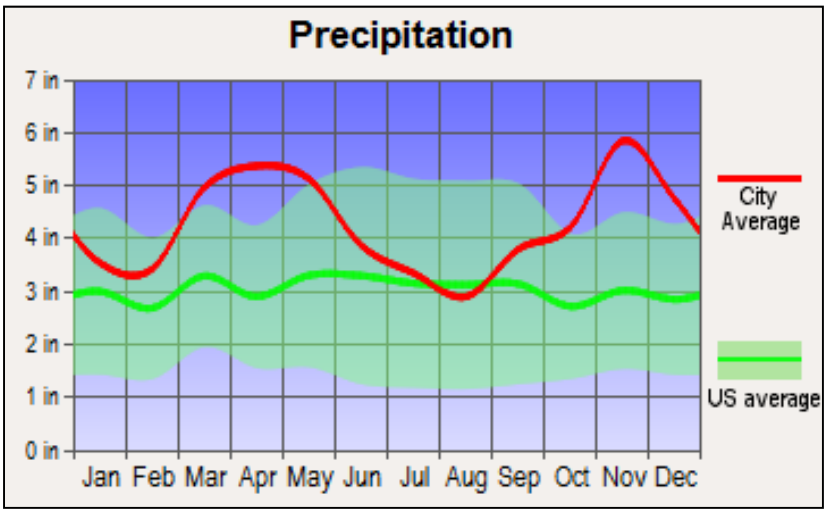
The average daily temperature in Pulaski County is 61˚F with a low daily average temperature of 38˚F in January and a high daily average temperature of 81˚F in July. The average maximum temperature for the year is 71˚F with a monthly high of 91˚F in July and a low of 48˚F in January. The average minimum temperature for the year is 51˚F with a monthly high of 71˚F in July and a low of 29˚F in January (**Figure 1.2**). The average precipitation for the year is 51 inches. The highest average monthly rainfall of 5.6 inches occurs in May and the lowest average monthly rainfall of 3.1 inches occurs in August (**Figure 1.3**).

Figure 1.2 Average Temperature by Month in Pulaski County (2000 – 2010)



Source: www.city-data.com/city/

Figure 1.3 Average Precipitation by Month in Pulaski County (2000 – 2010)

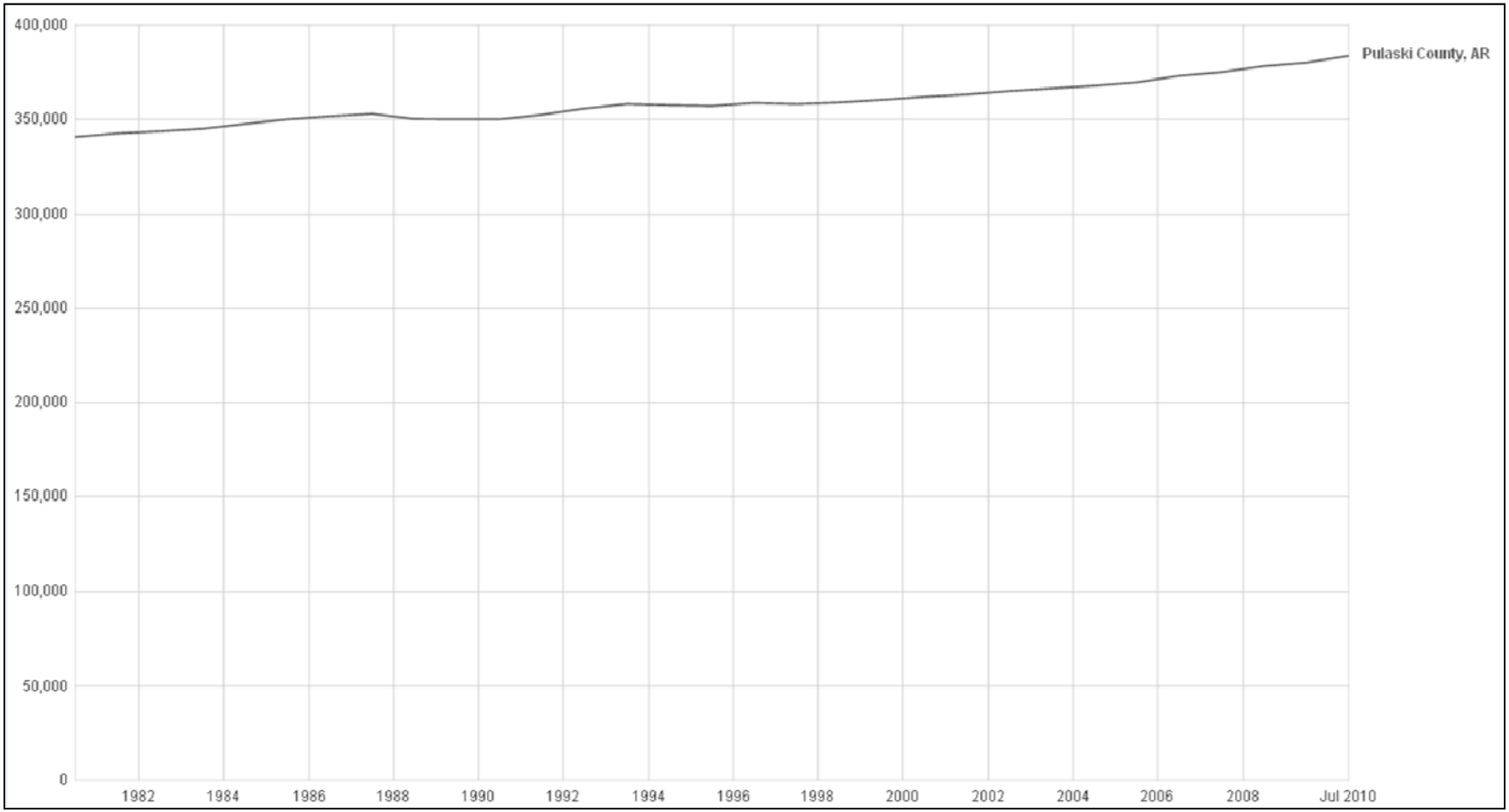


Source: www.city-data.com/city/

3.3 Population and Demographics

According to the 2010 Census, the population of Pulaski County has 382,748 residents, an increase of 5.9% since 2000. Since 1982, there has been continuous annual population growth for Pulaski County, (**Figure 1.4**). The majority of Pulaski County residents are White or African American and account for 57% and 35% of the population respectfully. Sixteen percent of the Pulaski County population is also living below the poverty level. Additional demographic variables are provided in **Table 1.2**. School District student and faculty population can be found in **Table 3.2** in *Section 3: Risk Assessment*.

Figure 1.4 Population Trend in Pulaski County (1982 – 2010)



Source: U.S. Census, 2010; 2006 – 2010 American Community Survey 5-Year Estimates.

Table 1.2 Population and Demographics of Pulaski County Jurisdictions

Characteristics	Pulaski County Total		Alexander		Cammack Village		Jacksonville		Little Rock		Maumelle		North Little Rock		Sherwood		Wrightsville	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Population and Age																		
Total Population	382,748	-	2,901	-	768	-	28,364	-	193,524	-	17,163	-	62,304	-	29,523	-	2,114	-
Male	183,938	48	1,456	50	330	43	13,974	49	92,245	48	8,155	48	29,457	47	14,001	47	1,434	68
Female	198,810	52	1,445	50	438	57	14,390	51	101,279	52	9,008	52	32,847	53	15,522	53	680	32
65 years and older	45,908	12	235	8	99	13	2,922	10	21,916	11	1,744	10	8,120	13	3,725	13	146	7
Race																		
Whites	220,051	57	1,973	68	744	97	16,364	58	94,665	49	14,220	83	33,655	54	22,232	75	716	34
Blacks	133,858	35	379	13	4	1	9,272	33	81,889	42	2,074	12	24,754	40	5,464	19	1,325	63
American Indians and Alaska Natives	1,555	0	17	1	0	0	169	1	686	0	61	0	244	0	155	1	7	0
Asians	7,505	2	18	1	9	1	597	2	5,131	3	395	2	584	1	464	2	7	0
Native Hawaiian and Other Pacific Islander	272	0	0	0	0	0	34	0	153	0	9	0	42	0	20	0	2	0
Some Other Race	11,646	3	439	15	4	1	767	3	7,626	4	114	1	1,689	3	481	2	26	1
Two or more races	7,861	2	75	3	7	1	1,161	4	3,374	2	290	2	1,336	2	707	2	31	1
Hispanic or Latino of any race	22,168	6	563	19	18	2	1,890	7	13,076	7	417	2	3,557	6	1,181	4	71	3
Social Characteristics																		
Married (% of population over 15 years of age)	149,743	50	644	28	351	49	11,517	53	69,586	46	8,540	68	22,933	46	12,999	57	854	45
High school graduate or higher (% of population over 25 years of age)	220,837	88	1,249	64	616	100	15,187	89	110,473	89	10,763	97	36,136	87	17,656	91	1,238	69
Economic Characteristics																		
In labor force (% of population over 16 years of age)	199,542	68	1,647	72	492	71	14,595	69	102,909	69	9,204	75	30,635	63	15,492	69	301	16
Individuals below poverty level	60,727	16	517	18	37	5	4,914	17	32,637	17	656	4	13,768	22	2,534	9	179	8
Housing Characteristics																		
Owner-occupied units (% of total residential units)	94,826	60	831	81	264	71	5,574	51	46,078	56	5,294	76	13,834	52	8,606	71	235	75

Source: U.S. Census, 2010; 2006 – 2010 American Community Survey 5-Year Estimates.

Requirement §201.6(b) and §201.6(c)(1): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;

(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and

(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information

Requirement §201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

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1 DESCRIPTION OF PLANNING PROCESS

In 2011, Pulaski County was awarded an HMGP grant to update Pulaski County's 2006 HMP as mandated every five years. The HMGP funds were used to pay 75% of the hazard mitigation planning consultant service costs. The remaining 25% of consultant service costs were paid by Pulaski County, the City of Little Rock, and the City of North Little Rock.

The HMP was developed over a period of eight months and in order to seek adoption and approval by the beginning of May 2012, CSA International, Inc. (CSA), based out of Stuart, Florida, was contracted by Pulaski County to assist in the HMP update process. CSA has over 20 years of experience in hazard mitigation planning and long-term recovery. Their expertise was utilized to ensure that the HMP update process met all of FEMA's requirements for hazard mitigation planning and was completed in a timely manner.

Figure 2.1: The Hazard Mitigation Planning Process

The rational planning method was used by the HMPT to update the HMP. First, the HMPT focused on obtaining the resources needed for successful mitigation planning. This included identifying and organizing interested members of the community and technical expertise. Next, the HMPT identified all hazards with the potential to impact community assets in the County and each participating jurisdiction. After identifying hazard risks and impacts, the HMPT developed a mitigation strategy to minimize the impacts of hazard events. The Hazard Mitigation Actions are prioritized based on the action's effectiveness in reducing moderate and severe-risk hazards and the preferences of the community. Finally, each jurisdiction implements the HMP through daily government operations and by selecting funding for larger projects. The HMP will be reviewed annually to track progress in meeting the County's Hazard Mitigation Goals. Refer to **Figure 2.1** for a flowchart of the FEMA's hazard mitigation planning process used by the HMPT.

2 HMPT INVOLVEMENT, ROLES, AND PARTICIPATION

The County and all participating jurisdictions provided an opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to participate in HMPT public meetings through public announcements on public boards, the Office of Emergency Management website, and the Arkansas Democrat-Gazette. Jurisdictional Representatives and the consultant also made phone calls and sent invitation letters to all relevant stakeholders. Refer to **Appendix II** for copies of advertising materials. Andy Traffanstedt, Director of Pulaski County's Office of Emergency Management, led the HMP development and creation of the HMPT at the staff level. Consultants' services were used to assist in the development of the HMP, including presenting at meetings, gathering and analyzing risk assessment information, as well as facilitating HMPT participation in developing a hazard mitigation strategy and maintenance schedule.

The 2012 HMPT representation was developed as part of the public outreach effort. The 2012 HMPT consists of representatives from all participating jurisdictions, sheriff's office, school board, public utilities, healthcare, academia, and the community at large. **Table 2.1** includes the complete list of participating HMPT members.

Table 2.1 Pulaski County HMPT Membership Members

Name	Title	Organization	Planning Role
Andy Traffanstedt	Director	Pulaski County Emergency Management	HMPT Lead and Jurisdictional Representative
Bud Gray	Deputy Emergency Coordinator	North Little Rock Emergency Management	Emergency management representative
Carey Woods	Director	NLR Health Department	Health needs expert
Chris Wilbourn	City Engineer	City of North Little Rock	Infrastructure needs expert
Dan Scott	Administrator	NLR Neighborhood Service	Community outreach expert
Debra McAfee	Superintendent	Pulaski County Special School District	Jurisdictional Representative
Doug Coney	Assistant Chief	Little Rock Fire Department	Emergency management representative
George Glenn	Chief	Maumelle Fire Department	Emergency management representative
Jerry Guess	Superintendent	Pulaski County Special School District	Jurisdictional Representative
Jim Durham	Director of Administration	City of Jacksonville	Jurisdictional Representative
Jim Narey	Director	Maumelle Planning	Jurisdictional Representative
John Burton	Flood Plain Manager	Pulaski County Road & Bridge	Flood Map and Repetitive loss structure data
John Vanderhoof	Chief	Jacksonville Fire Department	Emergency management representative
Karen Rollins	Secretary	North Little Rock Emergency Management	Emergency management representative
Larry Siefert	Pastor	Faith Base	Community outreach expert
Margo Bushmiaer	Superintendent	Little Rock School District	Jurisdictional Representative
Matt Burks	Director	Little Rock Emergency Management	Jurisdictional Representative
Max Spriggs	Captain	Little Rock Police Department	Emergency management representative
Mayor Harry Light	Mayor	City of Cammack Village	Jurisdictional Representative
Mayor McKinzie Riley	Mayor	City of Wrightsville Mayor's Office	Jurisdictional Representative
Mayor Paul Mitchell	Mayor	City of Alexander Mayor's Office	Jurisdictional Representative
Rick Ezell	Emergency Coordinator	North Little Rock Emergency Management	Jurisdictional Representative
Robert Barton	Captain	North Little Rock Fire	Emergency management representative
Ronnie Loe	Assistant Director	Little Rock Public Works	Infrastructure needs expert
Russ Elrod	Administrator	Code Enforcement	Building code expert
Sherman Smith	Director	Pulaski County Public Works	Infrastructure needs expert

Table 2.1 Pulaski County HMPT Membership Members			
Name	Title	Organization	Planning Role
Steve Canady	Superintendant	NLR School District	Jurisdictional Representative
Terry Hartwick	Associate	Chamber of Commerce	Business outreach expert
Tracy Sims	Director	Sherwood Public Works	Jurisdictional Representative
Van McClendon	Director	Pulaski County Planning	Infrastructure, land-use, and community needs expert
Wade Dunlap	Director	NLR Planning	Infrastructure, land-use, and community needs expert
Walter Malone	Planning Manager	Little Rock Planning	Infrastructure, land-use, and community needs expert

The major role of the HMPT during the planning process was to attend all planning meetings, and be available to provide information for the consultant to analyze and synthesize into the HMP. In addition, the HMP was to be reviewed by each HMPT member before its submittal to ADEM and FEMA. The HMPT's tasks during the planning process include:

- Developing a mission statement for the HMP;
- Increasing the public's involvement in the planning process;
- Identifying all hazards that have impacted or may impact the community;
- Revising the profiles of all identified hazard events;
- Updating the critical facilities list and vulnerability assessment;
- Estimating potential losses to community assets;
- Revising and evaluating Hazard Mitigation Goals and Actions;
- Updating the implementation strategy;
- Updating the plan maintenance strategy for the next five-year cycle; and
- Reviewing all section drafts and the Final Draft HMP.

2.1 HMP Update Meetings

The 2012 HMP planning process began with the Kick-off Meeting held on October 6, 2011, at 9:00 a.m. at the Pulaski County Office of Emergency Management. The meeting was chaired by Mr. Andy Traffanstedt and assisted by the consultant. All HMPT members and some members of the public attended the Kick-off Meeting. The purpose of the Kick-off Meeting was to introduce the consultants to the HMPT and for the consultants to brief the HMPT and the public on the update process, schedule and grant opportunities. After this briefing, the consultants reviewed its preliminary findings of the 2006 HMP's Risk Assessment. A discussion was facilitated by the consultant to identify additional hazards affecting the County and participating jurisdictions. During the remainder of the meeting, the HMPT began brainstorming on issues that arose during pervious hazard events. A further description of the Kick-off Meeting is provided in **Appendix II.**

The HMPT has held a total of three public meetings during the HMP update process. All meetings were chaired by Mr. Traffanstedt and assisted by Consultant. The sign-in sheets, meeting agendas, and meeting minutes are included in **Appendix II**. All meetings were held at the Pulaski County Office of Emergency Management. All meetings facilitated input for developing the Risk Assessment, Mitigation Strategy, and Plan Maintenance Chapters of the HMP. During each meeting, the HMPT and the public were given ample time to discuss, review, provide input, and evaluate each section of the HMP.

2.2 Community Interviews

Interviews were an essential method for collecting relevant information for the HMP update. Interviews with knowledgeable community members from each participating jurisdiction were conducted by the HMPT and consultant to clearly define hazard risk levels, identify community assets, describe community vulnerabilities, and establish appropriate mitigation strategies and implementation methods. There were multiple community interviews conducted during the planning process to ensure that each participating jurisdiction contributed and provided input into the HMP.

3 PUBLIC INVOLVEMENT PROCESS

Public participation is a key component to the HMP planning process. Public participation offers the members of the community a chance to voice their ideas, interests, and opinions, which ultimately increases the community acceptance and compatibility with community needs. To accomplish this end, the HMPT developed a public participation process consisting of the following four components:

1. Ensure the HMPT is comprised of knowledgeable individuals that are representative of Pulaski County and all participating jurisdictions;
2. Conduct multiple public meetings to identify common concerns and ideas regarding hazard mitigation and discuss specific goals and actions of the HMP (see **Appendix II**); and
3. Announce all public meetings through the local newspaper, the *Arkansas Democrat-Gazette,* County website, and governmental public announcement boards (see **Appendix II**).

The Draft 2012 HMP was advertised for public review on the Pulaski County Office of Emergency Management website, at http://co.pulaski.ar.us/oem/ for two weeks before submitting the Final HMP to ADEM and FEMA for preliminary approval. All comments were collected by Mr. Traffanstedt and incorporated into the HMP. Based on the public comments, all necessary changes were made to the Draft HMP by the consultant. This process increased public outreach to the members of the community who are unable to attend the public meetings.

4 REVIEW AND INCORPORATION OF PLANS, STUDIES, REPORTS, AND OTHER INFORMATION

DMA 2000 requires a review of and incorporation into, if appropriate, existing plans, studies, reports, and technical information. For the 2012 HMP, these elements are referred to as capabilities and their review and incorporation as capability identification. The capability identification provides the scope for what Hazard Mitigation Actions can be implemented. It identifies the specific capabilities of Pulaski County and each participating jurisdiction which may assist in the implementation of the identified Hazard Mitigation Actions. The capability identification, therefore, canvasses all aspects of County/participating jurisdiction's departments that relate both directly and indirectly to hazard mitigation activity.

The ability of a community to develop an effective HMP depends upon its capability to implement policies and programs. FEMA publication 386 describes a capability assessment and outlines the following types of capabilities that should be considered: 1) Legal and Regulatory; 2) Administrative and Technical; and 3) Political and Fiscal.

Legal and regulatory capabilities refer to the laws, regulations, authorities, and policies that govern current and potential mitigation actions. Administrative and technical capabilities refer to a jurisdiction's staff and technical resources, as well as completed plans and studies that have been considered, directly or indirectly, relating to mitigation of natural hazards. Technical capabilities also include the existing electronic and systemic resources. Political and fiscal capabilities refer to the level of support from elected officials for pursuing mitigation and the financial resources available to achieve the identified mitigation strategies. There are multiple planning mechanisms that will be used when implementing the 2012 HMP. Refer to *Section 5 – Plan Maintenance* for the process by which Pulaski County will use these planning mechanisms to implement the mitigation strategy.

Existing plans, studies, reports, and technical information relevant to mitigation planning were collected, reviewed and incorporated into the HMP by the HMPT. This information was used to identify existing, planned, and potential mitigation initiatives designed to reduce Pulaski County's vulnerability to natural hazards. The following list of plans, studies, reports, and documents were reviewed and incorporated into the HMP update:

- 2010 State of Arkansas Hazard Mitigation Plan;
- Pulaski County Emergency Operations Plan;
- Pulaski County LEPC All Hazards Plan;
- Central Arkansas Regional Transportation Study (CARTS);
- Metro 2025 Technical Report: An Update of the Metropolitan Transportation Plan;
- CARTS Intelligent Transportation Systems Plan;
- CARTS Unified Planning Work Program FY 2011;
- Metrotrends 2011 Demographic Review and Outlook;
- Metrotrends 2011 Economic Review and Outlook;
- Flood Insurance Study, Pulaski County Arkansas;
- Pulaski County: Master Street Plan, Subdivision Regulations, Floodplain Management, NFPA Fire Codes;
- City of Sherwood: Land-use map, zoning map, master street plan, subdivision rules, zoning regulations, and building codes;
- City of Jacksonville: Comprehensive Development Plan (currently being revised), Disaster Response Plan (City-wide plan in development), zoning management ordinances, subdivision management ordinances, floodplain management ordinances, building codes (Southern);
- City of Maumelle: Master Land Use plan, Zoning Map, existing basic Hazard Mitigation Plan, Storm water Management Ordinances, Stream Management Ordinances, Subdivision Management Ordinances, Erosion Management Ordinances, Floodplain Management Ordinances, Building Codes;
- Town of Alexander: Site Development Regulations, Permits, Floodplain Management;
- City of Cammack Village: Subdivision Regulations;
- City of Wrightsville: Land Use Plan, Zoning Regulations, Floodplain Management Regulations;
- Flood Insurance Study, Little Rock, Arkansas;
- Flood Insurance Study, North Little Rock, Arkansas;
- City of Little Rock: Building Codes, Zoning Regulations, Subdivision Regulations, Master Street Plan, Floodplain Management Regulations, Stormwater Management and Drainage Regulations;
- City of North Little Rock: Land Use Plan, Zoning Ordinance, Building Codes, Floodplain Management Regulations, Control of Development and Subdivision of Land Regulations;
- Pulaski County Commodity Flow Study;
- FEMA's RISKMAP Behind the Levee Analysis;

- 2010 Stormwater Management and Drainage Manual for the Lake Maumelle Drainage Basin; and
- 2010 Erosion and Sediment Control Field Guide for the Lake Maumelle Drainage Basin.

5 SECTION REVISIONS DURING THE HMP UPDATE

The update process involved combining two HMPs to accomplish one multi-jurisdictional HMP. Since 2006, the County had an HMP and Little Rock and North Little Rock had an HMP, from now on there will be one multi-jurisdictional HMP for all participating jurisdictions within Pulaski County. To combine the two HMPs, the HMPT decided to completely rewrite a new HMP during the update process. A rewrite of the HMP allowed for all the new FEMA requirements to be incorporated and ensure greater multi-jurisdictional coordination for mitigation planning efforts.

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

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

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

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

Requirement §201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

Table of Contents

1 RISK ASSESSMENT PROCESS

The purpose of *Section 3 – Risk Assessment* is to identify and analyze the hazards facing Pulaski County and all jurisdictions participating in the plan update process (Pulaski County Planning Area). The HMPT conducted a Hazard Identification exercise, during the Kickoff Meeting, to update which hazards threaten each participating jurisdiction. The hazards were divided into two classifications, natural and man-made. Natural hazards are defined as hazard events that occur naturally in the environment. Man-made hazards are defined as hazard events resulting from elements of human intent, negligence, or failure of a man-made system.

CSA International, Inc. (CSA), the consultant for Pulaski County's 2012 HMP Update, assisted in analyzing hazard risks for each participating jurisdiction using methods described in *FEMA 386-2 Understanding Your Risks: Identifying Hazards and Estimating Losses*. Hazard risk was determined by each hazard's annual probability of occurrence and magnitude of impact on community assets. The HMPT reviewed the results of the Risk Assessment and prioritized all hazards creating a Jurisdictional Hazard Prioritization List according to which would present the greatest risk to the Pulaski County Planning Area. Hazards prioritized as **Moderate Risk** or **Severe Risk** are profiled in **Subsections 4** and **5**. The Hazard Profiles describe each identified hazard in terms of its characteristics, historical occurrences, community vulnerabilities, estimated impact on vulnerable community assets, and variances in jurisdictional exposure.

FEMA's Hazards U.S. Multi-Hazard (HAZUS-MH) computer model was used to estimate impacts associated with flood and earthquake events, including potential dollar losses, shelters required, debris generated, and displaced populations. Estimated impacts associated with tornado events were calculated using FEMA's Benefit-Cost Analysis (BCA) software. The impacts are calculated by determining human injury costs for the entire Pulaski County Planning Area. Estimated impacts for hazards other than flood, earthquake, and tornado were calculated by data extrapolation methods and HMPT input. All loss estimates are approximations and are provided primarily to enhance the discussion of what each community could anticipate in losses from future hazard events. It is expected that future technological enhancements and data collection will further increase the accuracy of these loss estimates.

Subsection 6 reviews and analyzes future development trends that may change the community's vulnerability to hazard events. Development trends were provided through community interviews with Pulaski County Planning and Development, City of Little Rock Planning and Development, and North Little Rock Planning and Permits.

1.1 Risk Assessment Source Information

The hazard profiles are based on existing technical analyses from primary and secondary governmental and private sources. All source documentation can be found in *Section 6 – References*. Sources include:

- The State of Arkansas's 2010 Hazard Mitigation Plan;
- Arkansas Gazette;
- FEMA database of Presidential Major Disaster Declarations;
- NFIP flood data, the National Climatic Data Center (NCDC);
- National Oceanic and Atmospheric Administration (NOAA);
- Arkansas Forestry Commission, U.S. Geological Survey (USGS);
- Arkansas Natural Resource Commission;

- Arkansas Geological Survey;
- Geohazards & Environmental Geology;
- U.S. Army Corp of Engineers (USACE);
- HMPT expertise; and
- Interviews with local citizens, as well as County and participating jurisdictions' officials.

2 COMMUNITY ASSET IDENTIFICATION

2.1 Structural Asset Inventory

The Pulaski County Assessor's Office estimates that there are 70,308 buildings throughout the Pulaski County Planning Area. According to the Assessor's Office, the aggregate total replacement value of the Pulaski County Planning Area Asset Inventory is estimated to be approximately $19,778,103,920. **Table 3.1** identifies community assets by land use. Refer to **Appendix IV** for critical facility maps by jurisdiction.

Table 3.1 Structural Asset Inventory by Jurisdiction

Jurisdiction	Residential Structural Value	Commercial Structural	Industrial Structural	Agriculture Structural	School Facilities	Total Value of Structures
Alexander	$3,245,940	$1,233,180	-	-	-	**$4,479,120**
Cammack Village	$64,644,825	$106,650	-	-	-	**$64,751,475**
Jacksonville	$640,261,685	$200,924,550	$32,550	$32,550	-	**$841,251,335**
Little Rock	$8,220,769,800	$3,285,743,085	$17,575,640	$501,355	-	**$11,524,589,880**
Little Rock School District	-	-	-	-	$20,548,000	**$20,548,000**
Maumelle	$1,000,106,415	$199,835,265	-	-	-	**$1,199,941,680**
North Little Rock	$1,790,571,750	$990,958,655	-	$3,940	-	**$2,781,534,345**
North Little Rock School District	-	-	-	-	$236,400,111	**$236,400,111**
Pulaski County Special School District	-	-	-	-	N/A	**N/A**
Sherwood	$1,207,638,035	$212,820,815	-	$121,405	-	**$1,420,580,255**
Wrightsville	$14,057,610	$1,255,015	-	-	-	**$15,312,625**
Unincorporated Pulaski County	$1,739,463,875	$177,543,390	-	$8,655,940	-	**$1,925,663,205**
Pulaski County Planning Area	$14,680,759,935	$5,070,420,605	$17,608,190	$9,315,190	-	**$19,778,103,920**

Source: Pulaski County Assessor's Office, 2011 and each School District Insurance Statement.

2.2 Vulnerable Population Identification

According to the 2010 U.S. Census, Pulaski County Planning Area has a population of 382,748. The two largest populated jurisdictions within the Pulaski County Planning Area are the Cities of Little Rock (193,524) and North Little Rock (62,304). Out of the total population, the HMPT identified four

vulnerable population groups. These vulnerable population groups include: 1) populations over the age of 75; 2) populations below the age of 18; 3) populations living in poverty; and 4) populations living in mobile housing units or students being taught in school portables. Populations over the age of 75 and below the age of 18 are more vulnerable to hazard events because of increased rate of mental or physical impairments as well as a lack of transportation mobility (MDC, 2008). Cammack Village is the only jurisdiction with a significant population of residents aged 75 years or more (8.9%) and all of the School Districts have significant populations of students aged 18 or below (**Table 3.2**).

Populations living in poverty are also more vulnerable to hazard events. Poverty is an indicator of lack of access to resources and income opportunities, which correlate with many other social problems (Yodmani, 2001). The major vulnerability issues identified in populations living in poverty are lower educational attainment, reduced transportation mobility, reduced access to healthcare, and increased rate of living in substandard housing. According to the 2010 U.S. Census, the State of Arkansas Poverty Rate was 18.5%. The Cities of North Little Rock and Wrightsville have a higher rate of poverty than the State of Arkansas, 21.8% and 31.6%, respectfully.

The final vulnerable population group identified by the HMPT was populations living in mobile housing units or students educated in school portables. These populations are at increased risk to tornado, severe winter storm, and thunderstorm impacts because these structures are not anchored into the ground and can be more easily turned over during high wind events. According to a NOAA National Severe Storms Laboratory Report (1997), there is an average of 11.4 annual deaths per 10 million mobile home residents, while the average annual death is only 0.5 in other housing types. The report's conclusion is that mobile home residents die at a rate 22.6 times greater than non-mobile home residents (Brooks, 1997). **Table 3.2** identifies all the above stated vulnerable populations by participating jurisdiction.

Table 3.2 Vulnerable Population Groups by Jurisdiction

Jurisdiction	Total Population	Population Over the Age of 75 (%) of Total Population	Population Below the Age of 18 (%) of Total Population	% of Population Living in Poverty	Number of Mobile Housing Units or School Portables (%) of Total Structures
Alexander	2,901	70 (2.4%)	816 (28.1%)	18.5%	521 (66.9%)
Cammack Village	768	68 (8.9%)	158 (21.6%)	9.2%	2 (0.5%)
Jacksonville	28,364	1,251 (4.4%)	7,637 (26.9%)	15.9%	958 (7.0%)
Little Rock	193,524	10,677 (5.5%)	46,688 (24.1%)	16.1%	2,825 (3.2%)
Little Rock School District	29,394	N/A	25,594 (87.1%)	N/A	63 School Portables
Maumelle	17,163	698 (4.1%)	4,420 (25.8%)	4.0%	130 (1.9%)
North Little Rock	62,304	4,115 (6.6%)	15,042 (24.1%)	21.8%	571 (2.0%)
North Little Rock School District	10,000	N/A	9,300 (93.0%)	N/A	31 School Portables
Pulaski County Special School District	N/A	N/A	N/A	N/A	N/A
Sherwood	29,523	1,539 (5.2%)	7,098 (24.0%)	8.0%	564 (4.6%)
Wrightsville	2,114	63 (3.0%)	247 (11.7%)	31.6%	83 (20.4%)
Pulaski County Planning Area	382,748	21,095 (5.5%)	92,185 (24.1%)	16.7%	10,307 (5.9%)

Source: U.S. Census Bureau, 2011; School District Superintendants.

3 RISK ASSESSMENT SUMMARY

3.1 Hazard List

Hazard Identification, the process of identifying hazards that threaten a given area, is the first step in the risk assessment process. The Pulaski County Planning Area identified 11 natural hazards and 6 man-made hazards that pose significant risk to residents and the business community. These hazards were identified through an extensive process that utilized input from the HMPT, the public, NCDC historical records, review of existing plans and reports, discussions with emergency management experts, and secondary research through multiple sources. A list of all identified hazards, including how and why they were identified, is presented in **Table 3.3**.

Table 3.3 Identified Hazards with potential to affect the Pulaski County Planning Area

Natural Hazard	How Identified	Why Identified
Tornado	• Reviewed past disaster declarations • Reviewed NCDC Severe Storms Database • Reviewed National Weather Service input and data	• Pulaski County experiences a tornado nearly every year • Tornadoes have caused extensive damage and loss of life to County residents
Severe Winter Storm	• Reviewed past disaster declarations • Reviewed NCDC Severe Storms Database • Received public input	• Pulaski County is affected by severe winter storms every few years • Recent severe ice storms caused extensive damage and shut down parts of the County for weeks
Flood	• Reviewed past disaster declarations • Reviewed FIRM's • Input from County floodplain manager • Identified NFIP repetitive loss properties in the County	• Pulaski County is affected by flooding nearly every year • Floods have caused extensive damage and loss of life in the County in the past
Thunderstorm	• Reviewed NCDC Severe Storms Database • Received public input	• The County experiences several severe straight-line wind events annually • Some events have caused damage to structures and less commonly loss of life
Earthquake	• Reviewed USGS Peak Ground Association (PGA) and other hazard maps • Reviewed Arkansas Geological Commission data • Reviewed University of Arkansas at Little Rock research • Reviewed historical reports	• Although earthquakes have not caused significant damage in recent history, the local earthquake hazard is not well understood • County lies within the 6-9% PGA zone with 10% prob. exceedance in 50 yrs
Drought	• Reviewed National Weather Service Data • Analyzed NOAA Paleoclimatology Data	• A past emergency declaration in the State for drought • State Mitigation Plan
Wildfire	• Analyzed Arkansas Forestry Commission statistics • Analyzed USDA Forest Service Fire, Fuel, and Wildland-Urban Interface (WUI) mapping • Received public input	• Pulaski County experiences wildfires every year • Development in the western part of Pulaski County is occurring at the WUI
Landslide	• Analyzed USGS Landslide Hazard maps • Analyzed geology and topography	• Part of county lies within the high landslide susceptibility zone on National USGS map • No significant landslides have occurred recently in Pulaski County
Expansive Soils	• Analyzed USGS National Swelling Soils Map • Reviewed Natural Resource Conservation Service (NRCS) State Soil Geographic (STATSGO) Maps • Reviewed Pulaski County Soil Survey Maps	• Part of Pulaski County lies within areas of high soil swelling potential
Extreme Temperature	• Identified by the HMPT during the 2012 Update Kickoff Meeting	• Multiple weeks during the summer of 2011 had temperatures that reached 110° Fahrenheit

Mosquito-Borne Disease	• Identified by the HMPT during the 2012 Update Kickoff Meeting	• According to the 2010 Arkansas All Hazard Mitigation Plan, West Nile Virus is an ongoing issue throughout Pulaski County
Man-made Hazard	How Identified	Why Identified
Dam Failure	• Reviewed Arkansas National Resource Commission Dam Safety Program	• There are 96 dams throughout Pulaski County and all participating jurisdictions
Levee Failure	• Reviewed Unacceptably maintained levee projects by the USACE	• According to the USACE, there are three unacceptably maintained USACE
Chemical Spill	• Identified by the HMPT during the 2012 Update Kickoff Meeting	• The Pulaski County Commodity Flow Study identifies multiple chemicals that are transported throughout the County by freight and rail
Terrorism	• Reviewed the 2010 Arkansas All Hazard Mitigation Plan	• There are multiple national landmarks within Pulaski County • Little Rock is the Capitol of the State of Arkansas
Air Pollution	• Identified by the HMPT during the 2012 Update Kickoff Meeting	• Ozone warnings occur frequently throughout Pulaski County
Pandemic	• Identified by the HMPT during the 2012 Update Kickoff Meeting	• According to the 2010 Arkansas All Hazard Mitigation Plan urban areas within the State of Arkansas are at an increased risk to pandemic disease

3.2 Hazard Risk Assessment

The potential risk associated with each hazard identified in the Pulaski County Planning Area was determined as a function of two factors: 1) the annual probability that a natural or man-made hazard will occur and 2) the potential impact to vulnerable community assets. The annual probability of occurrence was determined by the number of years a hazard event was recorded divided by the total years of recorded data. The potential impact on vulnerable community assets was determined by estimating the community's losses during a hazard event by means of loss estimate models, historical loss extrapolation, and HMPT expertise. All potential impacts on vulnerable community assets were calculated in dollars.

The highest range of either 1) the annual probability of occurrence OR 2) the impact to vulnerable community assets determines each identified hazard's risk level. Refer to **Table 3.4** for the criteria use to determine Risk Levels as either **Not at Risk, Low Risk**, **Moderate Risk**, or **Severe Risk.** Refer to **Table 3.5** for a complete Hazard Risk Assessment by each identified hazard.

Table 3.4 Criteria Used to Determine Risk Level

Risk Level	Probability of Occurrence	Impact to Vulnerable Community Assets
Not at Risk	0%	$0
Low Risk	<0%–10%	≤$5,000
Moderate Risk	11%–35%	$5,001–$500,000
Severe Risk	≥36%	>$500,000

Table 3.5 Hazard Risk Assessment – The Pulaski County Planning Area			
Hazard Type	Probability of Annual Occurrence	Magnitude of Impact to Vulnerable Community Assets	Level of Risk
Natural Hazard Event			
Tornadoes	51%	$72,108,367	Severe
Severe Winter Storms	38%	$4,057,785	Severe
Floods	41%	$365,260,000	Severe
Thunderstorm	64%	$326,818	Severe
Earthquakes	1%	$234,620,000	Severe
Extreme Temperature	50%	$6,960,000	Severe
Wildfires	99%	$46,500	Severe
Drought	9%	$465,759	Moderate
Mosquito-Borne Disease	80%	$315,000	Severe
Landslides	10%	$5,000	Low
Expansive Soils	10%	$5,000	Low
Man-made Hazard Event			
Dam failure	2%	$500,000	Severe
Levee failure	1%	$277,070,000	Severe
Chemical spill	89%	$71,691	Severe
Terrorism	<1%	$5,000	Low
Air Pollution	10%	$5,000	Low
Pandemic	<1%	$5,000	Low

*<1% for probability of occurrence = no previous occurrences to date.
**$5,000 is a general Magnitude of Impact to Vulnerable Community Assets for Low Risk Hazards.

3.3 Presidential Major Disaster Declaration History (1972 – 2011)

A Presidential Major Disaster Declaration is the formal action by the President of the United States to make a State eligible for major disaster or emergency assistance under the Robert T. Stafford Relief and Emergency Assistance Act, Public Law 93-288, as amended. One way to prioritize hazard risk for a community, particularly those hazards with relatively short recurrence intervals, is to examine past Presidential Major Disaster Declarations. Since 1972, the Pulaski County Planning Area has been impacted by 18 Presidential Major Disaster Declarations. A list of all Presidential Major Disaster Declarations occurring in the Pulaski County Planning Area since 1972 is presented in **Table 3.6**.

FEMA 1751- DR: In North Little Rock, firefighters and city workers used sand to contain oil and fuel spilled from overturned and damaged airplanes.

Table 3.6 Presidential Major Disaster Declaration History – The Pulaski County Planning Area (1972 - 2011)

Declaration No.	Date	Type of Declaration	Type of Assistance
FEMA-375-DR	04/27/73	Thunderstorms and Flooding	Individual Assistance and Public Assistance
FEMA-498-DR	04/01/76	Tornadoes	Individual Assistance and Public Assistance
FEMA-564-DR	09/15/78	Thunderstorms and Flooding	Individual Assistance and Public Assistance
FEMA-617-DR	04/16/80	Thunderstorms and Tornadoes	Individual Assistance
FEMA-673-DR	12/13/82	Thunderstorms, Tornadoes and Flooding	Individual Assistance
FEMA-807-DR	12/31/87	Thunderstorms and Flooding	Individual Assistance
FEMA-817-DR	12/23/88	Thunderstorms and Tornadoes	Individual Assistance
FEMA-865-DR	05/15/90	Thunderstorms and Flooding	Individual Assistance and Public Assistance
FEMA-1162-DR	03/02/97	Thunderstorms and Tornadoes	Individual Assistance and Public Assistance
FEMA-1266-DR	01/23/99	Tornadoes	Individual Assistance and Public Assistance
FEMA-1354-DR	12/29/00	Winter Storm	Individual Assistance and Public Assistance
FEMA-3215-DR	09/02/05	Hurricane Katrina	Public Assistance
FEMA-1751-DR	03/26/08	Thunderstorms, Tornadoes, and Flooding	Individual Assistance and Public Assistance
FEMA-1758-DR	05/20/08	Thunderstorms, Tornadoes, and Flooding	Individual Assistance
FEMA-3301-DR	01/28/09	Severe Winter Storm	Public Assistance
FEMA-1861-DR	12/03/09	Thunderstorms, Tornadoes, and Flooding	Public Assistance
FEMA-1872-DR	02/04/10	Thunderstorms and Flooding	Public Assistance
FEMA-1975-DR	05/02/11	Thunderstorms, Tornadoes, and Flooding	Individual Assistance and Public Assistance

Source: FEMA Major Disaster Declaration, 2011.

3.4 Jurisdictional Hazard Prioritization List

The following hazards were determined to have no jurisdictional variation in exposure, probability, or impact to vulnerable community assets across jurisdictions:

- Tornado
- Severe Winter Storm
- Thunderstorm
- Drought
- Extreme Temperature
- Mosquito-Borne Disease
- Terrorism
- Air Pollution
- Pandemic

Jurisdictional variations in exposure, probability, or impact to vulnerable community assets were determined for flood, earthquake, wildfire, landslide, expansive soil, dam failure, chemical spill, and levee failure. The degree of hazard risk, as documented in the Jurisdictional Hazard Prioritization List (**Table 3.7**), determined which hazards would be profiled [see **Subsections 4** and **5**]. Only hazards classified as **Moderate Risk** or **Severe Risk** for any jurisdiction were profiled. We have omitted profiling landslide, expansive soil, terrorism, air pollution, and pandemic hazards after reviewing vulnerability maps and historical occurrence data from the USGS, Arkansas Forestry Commission, Arkansas Natural Resources Commission, NCDC, NWS, and, USACE.

Table 3.7 Jurisdictional Hazard Prioritization List

Hazard Type	Uni. Pulaski County	Alexander	Cammack Village	Little Rock	Little Rock School District	Jacksonville	Maumelle	North Little Rock	North Little Rock School District	Pulaski County Special School District	Sherwood	Wrightsville
Natural Hazard Event												
Tornadoes	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe
Severe Winter Storms	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe
Floods	Severe	Moderate	Low	Severe	Severe	Severe	Moderate	Severe	Severe	Severe	Severe	Moderate
Thunderstorm	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe
Earthquakes	Severe	Severe	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Severe
Drought	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Wildfires	Severe	Low	Low	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Severe	Moderate	Low
Landslides	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Expansive Soils	Low	Low	None	Low	Low	Low	Low	Low	Low	Low	Low	Low
Extreme Temperature	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe
Mosquito-Borne Disease	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe	Severe
Man-made Hazard Event												
Dam Failure	Severe	None	None	Severe	Severe	Severe	Low	Severe	Severe	Severe	Low	Low
Levee Failure	Severe	None	Moderate	Severe	Severe	None	Moderate	Severe	Severe	Severe	None	Severe
Chemical Spill	Severe	Moderate	Low	Severe	Severe	Severe	Severe	Severe	Severe	Moderate	Severe	Moderate
Terrorism	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Air Pollution	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Pandemic	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low

4 NATURAL HAZARDS

4.1 Tornado

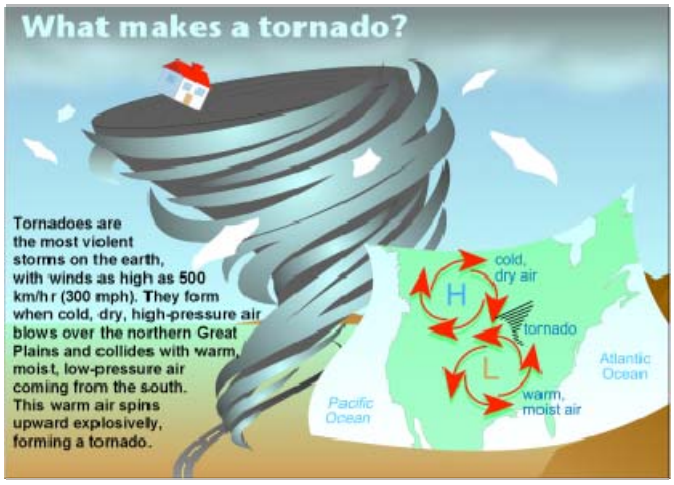
4.1.1 Profile

A tornado is a rapidly rotating vortex or funnel of air extending from a cumulonimbus cloud to the ground. It is usually spawned by a thunderstorm and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. Often, vortices remain suspended in the atmosphere as funnel clouds. When the lower tip of a vortex touches the ground, it becomes a tornado and a force of destruction.

Tornadoes can cause several kinds of damage to buildings. Tornadoes have been known to lift and move objects weighing more than 300 tons a distance of 30 ft, toss homes more than 300 ft from their foundations, and siphon millions of tons of water from water bodies. However, the less spectacular damage is much more common. Houses and other obstructions in the path of the wind cause the wind to change direction. This change in wind direction increases pressure on parts of the building. The combination of increased pressures and fluctuating wind speeds creates stress on the building that frequently causes connections between building components (e.g., roof, siding, windows, etc.) to fail. Tornadoes also generate a tremendous amount of flying debris or "missiles," which often becomes airborne shrapnel that causes additional damage. If wind speeds are high enough, missiles can be thrown at a building with enough force to penetrate windows, roofs, and walls.

A condensation funnel does not need to reach to the ground for a tornado to be present; a debris cloud beneath a thunderstorm is all that is needed to confirm the presence of a tornado, even in the total absence of a condensation funnel (refer to **Figure 3.1**). Tornado strength is measured using the Enhanced Fujita Scale (or EF Scale) with six levels of intensity as described in **Table 3.8**. When using the EF Scales wind speed is inferred from an analysis of wind damage. Most tornadoes are in the F0-F2 class. Modern building code wind standards provide significant protection from these hazard events; however, a community in the direct path of a violent tornado may experience extensive damages. Designing buildings to extreme wind speeds, such as those associated with an F3 or greater tornado, is beyond the scope of current building codes.

Figure 3.1 Precipitating Factors for a Tornado



Source: Reproduced with permission from George Tuggle, 2010.

The path width of a single tornado is generally less than 0.6 mile, although some damage path widths are in excess of one mile. The path length of a single tornado can range from a few hundred yards to over 200 miles. The average tornado in Arkansas moves from southwest to northeast, but tornadoes have been known to move in any direction. The average forward speed of a tornado is 30 mph, but may vary from nearly stationary to greater than 70 mph. The lifespan of a tornado is rarely longer than 30 minutes.

Table 3.8 Enhanced Fujita (EF) Scale					
Intensity Level	Wind Speed		Relative Frequency	Potential Damage	
	mph	km/h			
EF0	65 to 85	105 to 137	53.5%	Minor damage: Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e., those that remain in open fields) are always rated EF0.	
EF1	86 to 110	138 to 178	31.6%	Moderate damage: Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.	
EF2	111 to 135	179 to 218	10.7%	Considerable damage: Roofs torn off well constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.	
EF3	136 to 165	219 to 266	3.4%	Severe damage: Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.	
EF4	166 to 200	267 to 322	0.7%	Devastating damage: Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.	
EF5	>200	>322	<0.1%	Extreme damage: Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (300 ft); steel reinforced concrete structure badly damaged; high-rise buildings suffer significant structural deformation.	

Note: Images are for visual reference only and do not represent exact damage of tornado with specific EF level.

4.1.2 Previous Occurrences

According to the NCDC, Arkansas has the highest number of killer tornadoes per square mile of any state. Since 1950, the Pulaski County Planning Area has had 84 tornado events reported to NOAA and included in the database of reported storm events maintained by the NCDC. The early reports provide no details other than the type of event, date, location, and damages, but in 1997 reports began to regularly include descriptions of the event. The jurisdictions which have had tornado events include

Pulaski County, Cammack Village, Little Rock, and Jacksonville. Ten of these tornado events since 1972 were damaging enough to have resulted in Presidential Major Disaster Declarations (**Table 3.6**).

Table 3.9 presents records of tornado events from 1950 to 2011 that have caused property or crop damage exceeding $5,000 or have caused an injury or death within the Pulaski County Planning Area (NCDC, 2011). Two of the most devastating tornado events to affect the Pulaski County Planning Area occurred in 1997 and 2011. The 1997 tornado caused over $10,505,000 in property damages as well as injured 180 people and killed 5. The most significant tornado in 2011 caused approximately $129,015,000 in property damages and killed 4 people. Over the past 61 years, tornadoes have caused Pulaski and all participating jurisdictions a total of $300,130,000 in property damage, 313 deaths, and 27 injuries.

Table 3.9 Tornado Events – The Pulaski County Planning Area (1950 - 2011)

Jurisdiction	Date	Magnitude	Death	Injury	Property Damage
Pulaski County	3/26/1950	EF2	0	7	$250,000
Pulaski County	5/6/1960	EF2	0	0	$25,000
Pulaski County	3/12/1961	EF1	0	0	$25,000
Pulaski County	3/12/1961	EF2	0	0	$250,000
Pulaski County	5/6/1961	EF1	0	3	$250,000
Pulaski County	7/9/1964	EF1	0	0	$25,000
Pulaski County	3/5/1967	EF2	0	4	$250,000
Pulaski County	4/19/1973	EF2	0	0	$250,000
Pulaski County	2/22/1975	EF3	1	22	$2,500,000
Pulaski County	2/17/1976	EF1	0	0	$25,000
Pulaski County	4/17/1978	EF2	0	2	$250,000
Pulaski County	4/11/1979	EF2	0	0	$250,000
Pulaski County	6/28/1979	EF2	0	0	$2,500,000
Pulaski County	4/7/1980	EF2	0	5	$2,500,000
Pulaski County	4/25/1982	EF2	0	1	$2,500,000
Pulaski County	12/2/1982	EF3	1	25	$25,000,000
Pulaski County	12/3/1982	EF1	0	0	$25,000
Pulaski County	12/24/1982	EF2	0	0	$25,000
Pulaski County	11/15/1988	EF2	3	52	$25,000,000
Pulaski County	4/13/1991	EF1	0	0	$250,000
Pulaski County	3/1/1997	EF4	5	180	$10,505,000
Jacksonville	5/27/1997	EF1	0	0	$200,000
Little Rock	1/21/1999	EF3	3	2	$4,700,000
Little Rock	1/21/1999	EF2	8	6	$0
Pulaski County	4/3/2008	EF3	0	1	$50,000,000
Pulaski County	4/3/2008	EF2	0	1	$3,500,000
Pulaski County	4/30/2010	EF1	0	0	$1,200,000
Pulaski County	4/30/2010	EF0	0	0	$250,000
Pulaski County	10/24/2010	EF0	0	0	$10,000
Pulaski County	2/24/2011	EF1	0	0	$100,000
Cammack Village	4/15/2011	EF1	2	2	$38,500,000
Pulaski County	4/25/2011	EF2	4	0	$129,015,000
Total			**27**	**313**	**$300,130,000**

Source: National Climatic Data Center, 2011.

Historically significant tornadoes that occurred within the Pulaski County Planning Area are discussed below and highlight the type of damage that can be expected from a significant tornado event:

- **March 1, 1997 Event:** One of the most damaging recent tornadoes affecting Pulaski County occurred as part of a major tornado outbreak on March 1, 1997, when 15 tornadoes were spawned in Arkansas. This outbreak was unusual in the number of tornadoes generated, the lengths of the damage paths (some 50 to 100 miles in length), the strength of the tornadoes (8 of 15 caused EF2 or greater damage), and how deadly they were (25 people were killed, including 5 in Pulaski County).

  The tornado spawned in this outbreak that proved most damaging to Pulaski County began at 1:50 pm northeast of Hope in Hempstead County, then passed through northwestern Nevada County, and continued moving northeastward through Clark and Saline Counties. At 3:35 pm, a tornado warning was issued for Pulaski County, shortly after Pulaski County sheriff's deputies reported a tornado on the ground in Saline County between Benton and Sheridan. At 3:41 pm, the tornado moved into the Mablevale area of Pulaski County, southwest of Little Rock, where major damage and loss of life occurred. The tornado continued to move northeastward along U.S. Highway 67/167 through Little Rock before crossing into Lonoke County. This tornado event caused heavy damage consistent with an EF4 rating. The storm knocked down trees and power lines, as well as severely damaging over 100 homes and completely destroying 34 more homes in neighborhoods in the area of Pulaski County southwest of Little Rock. In addition, 10 mobile homes were destroyed and 1 nursing home suffered major damage. The damage path of this tornado through the Mablevale area showed a length of 11 miles and a width of over 1,400 yards. This tornado event resulted in 180 injuries and 5 fatalities in Pulaski County. The total property damage for Pulaski County caused by this tornado event totaled $10,505,000. Because of the extensive damage resultant of this tornado outbreak, President Clinton declared Pulaski County, along with 24 other affected counties, a Federally Declared Major Disaster on March 2, 1997.

1997 Tornado Damage in South Little Rock

- **January 21, 1999 Event:** On January 21, 1999 a record 56 tornadoes occurred statewide in Arkansas. Three of these tornadoes affected Pulaski County causing 2 fatalities. The first tornado of this outbreak to affect Pulaski County was a weak tornado spawned in northeast part of the county, approximately 5 miles north of Macon, at 4:49 pm. The tornado caused minimal damage associated with an EF1 rating, knocking down some trees down along its track. The tornado also caused some roof damage to a home along Highway 107 before moving into southeast Faulkner County. Its damage path showed a length of 2 miles and a width of approximately 100 yards.

  The next tornado in this system to affect the county was much greater in intensity, showing damage consistent with an EF3 rating. This strong tornado moved from eastern Saline County into southwest Pulaski County at approximately 6:33 pm. Trees were downed as the tornado entered Pulaski

County, with some roof damage to a business along Interstate 30 about 5 miles southwest of Little Rock. The tornado continued northeast into eastern sections of the downtown Little Rock area crossing near the intersection of Interstates 30 and 630. In this area, many homes and businesses (at least 235 structures) were heavily damaged or destroyed. It was estimated that around 750 structures sustained at least some damage. This included homes in a historic district built at the turn of the century. Trees were also downed throughout the area. One tree fell on a car, taking the life of a woman inside. The Governor's Mansion was not spared, with numerous trees down and one tree damaging a fence around the property. A grocery store was also destroyed at the corner of 17th and Main resulting in the loss of one life. Farther northeast, the tornado weakened as it crossed Interstate 40 just east of Highway 67/167. However, the tornado blew a tree down on a mobile home about 2 miles southeast of Sherwood. A man lost his life as a result. The tornado finally dissipated in Sherwood, after showing a damage path 15 miles long and 700 yards wide.

Another tornado associated with this system developed in southeast Pulaski County, about 7 miles southeast of Little Rock's downtown area at approximately 6:42 pm. This tornado formed to the southeast of the dissipating tornado that moved through Little Rock and displayed damage associated with an EF2 rating. It damaged a sprinkler system used for farming near the intersection of Highways 165 and 391, and farther to the northeast, the tornado destroyed a storage building and blew down some trees along Highway 70 about 1 to 2 miles east of Highway 391. The tornado then knocked at least four 18-wheelers over on Interstate 40 near Galloway before heading into Lonoke County. The damage path associated with this tornado was estimated to be 11 miles long and 400 yards wide.

The final tornado associated with this system was a weak tornado spawned at 7:59 pm in eastern Pulaski County to the southeast of Jacksonville on Valentine Road. The tornado was on the ground briefly, and caused minimal damage associated with an EF0 rating. Very little tree damage was noted, and the damage path of this tornado was estimated to be one mile long and 75 yards wide. Disaster costs for this tornado outbreak in Pulaski County totaled $4.7 million.

- **February 24, 2001 Event:** Another tornado outbreak in Pulaski County occurred on February 24, 2001, when a strong tornado moved from southeast Saline County into southwest Pulaski County about 7.5 miles west of Wrightsville at approximately 3:34 pm. The tornado moved quickly northeast, and closely followed the track of the violent March 1, 1997 tornado. In fact, a few of the homes and buildings that were rebuilt after the March 1st event were destroyed during this event. The tornado affected much of southern Pulaski County, including the Sweet Home and College Station communities. Several houses and mobile homes were damaged or destroyed, including a church. Eight people suffered minor injuries. Trees and power lines were also downed. The tornado showed damage consistent with that associated with a F3 rating. It had a damage path 12.3 miles long and 200 yards wide before the tornado dissipated about 5.5 miles east of Little Rock.

  A second tornado from this outbreak that affected Pulaski County was a weak tornado spawned about 1.6 miles west-southwest of Galloway (eastern Pulaski County) at 3:50 pm. The tornado showed damage associated with an EF1 rating and moved quickly northeast, damaging the roofs of a few buildings. A small mobile home was destroyed and was thrown against the corner of a local business. Trees and power lines were also downed. The tornado showed a damage path 2.2 miles wide and 85 yards wide, before dissipating just over one mile north of Galloway.

- **April 3, 2008 Event:** A tornado began in the western part of Little Rock, just west of the intersection of Interstate 630 and John Barrow Rd. It traveled through the Leawood subdivision of Little Rock and the City of Cammack Village, dropped off a bluff into Murray Park, crossed the Arkansas River, and ended in North Little Rock near the soccer fields in Burns Park. The vast majority of damage from this tornado was due to large trees falling on houses and vehicles. The approximate property damage reported from this event included 6 destroyed homes, 98 homes with major damage, 170 homes with minor damage, and 4 businesses with major damage. The total estimated damage from this event was $50 million.

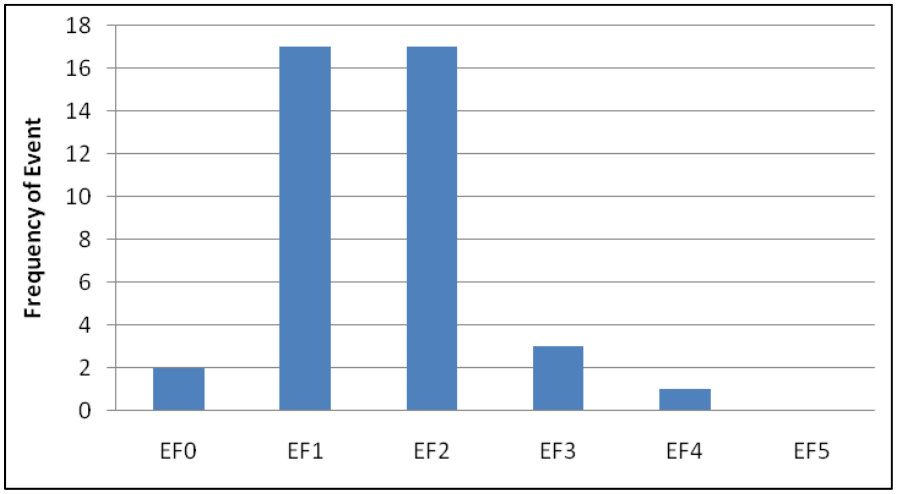
  A second tornado spawned in Saline County, southeast of East End, and moved into Pulaski County, southwest of Woodson. The approximate property damage reported from this event included 21 destroyed homes, 16 with major damage, and 26 with minor damage. Most of these homes were in the Hensley and Woodson areas. One woman was killed when her mobile home was destroyed on West Hensley Road. The total estimated damage from this event is $3.5 million.

- **April 25, 2011 Event:** This tornado event caused significant damage to the Little Rock Air Force Base. Five C-130 aircrafts, unit cost of approximately $48.5 million, were damaged. A number of buildings in the base shopping area and flight line area suffered damage, including having roofs torn off. The fire station had its roof taken off and its doors buckled. Altogether, more than 20 tons of sheet metal from roofs and buildings were recovered for recycling. Cars were overturned in the parking lot of the Base Exchange. More than 135 houses in the Base housing area were damaged or destroyed. Four people were injured at the Air Base. North Pulaski High School also suffered severe damage including the collapse of its auditorium and a wall in the chemistry building. The total estimated damage from this event was $129,015,000.

2011 Tornado Damage to Little Rock Air Force Base

The historical occurrence of tornadoes in the Pulaski County Planning Area indicates that as the intensity increases, the frequency rapidly declines. The distribution of historical tornadoes by magnitude in the Pulaski County Planning Area is shown in **Figure 3.2**. The highest magnitude tornado that has affected the Pulaski County Planning Area is an EF4. A tornado of this strength can destroy well-constructed houses and whole frame houses completely; cars can be thrown and small projectiles can be generated that could cause extensive damage, injury, or death. The majority of tornado events for the Pulaski County Planning Area fall within the EF1 to EF2 range. These events could cause considerable damage including roofs torn off well constructed houses, foundations of frame homes shifted, mobile homes completely destroyed, large trees snapped or uprooted; light-object missiles generated, and cars lifted off ground.

Figure 3.2 Historical Tornado Events by Magnitude in the Pulaski County Planning Area

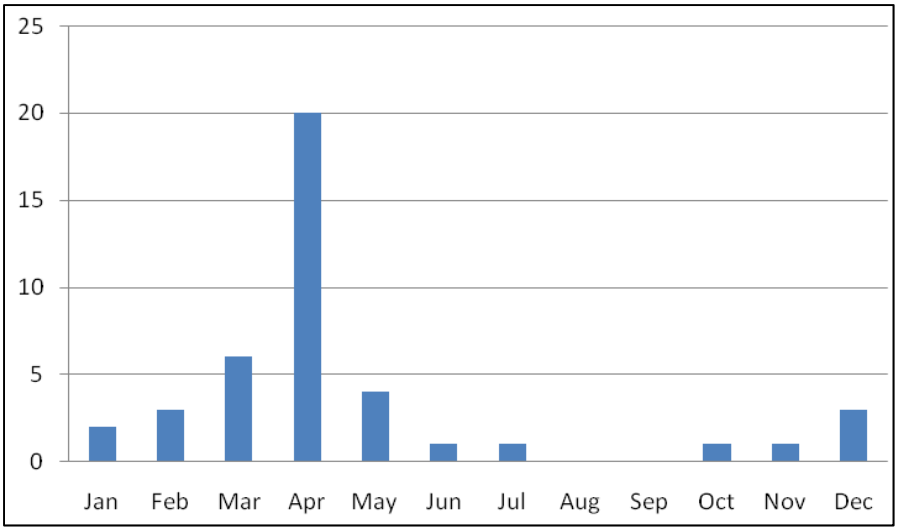


Source: National Climatic Data Center, 2011.

Although tornadoes may occur at any time of the year, peak tornado occurrence in Central Arkansas is during the spring months. **Figure 3.3** shows the number of tornadoes that occurred in the Pulaski County Planning Area during each month from 1950 through 2011. Over 71% of all tornadoes occurred during March through May, with 47% occurring in April alone.

Between 1950 and 2011, there have been 32 tornado events that have caused damages and human injury to the Pulaski County Planning Area. Extrapolating from historical data, the HMPT estimated that the Pulaski County Planning Area has a recurrence interval for tornadoes of 1.97 years or an annual occurrence probability of 51%.

Figure 3.3 The Pulaski County Planning Area Tornadoes Events per Month

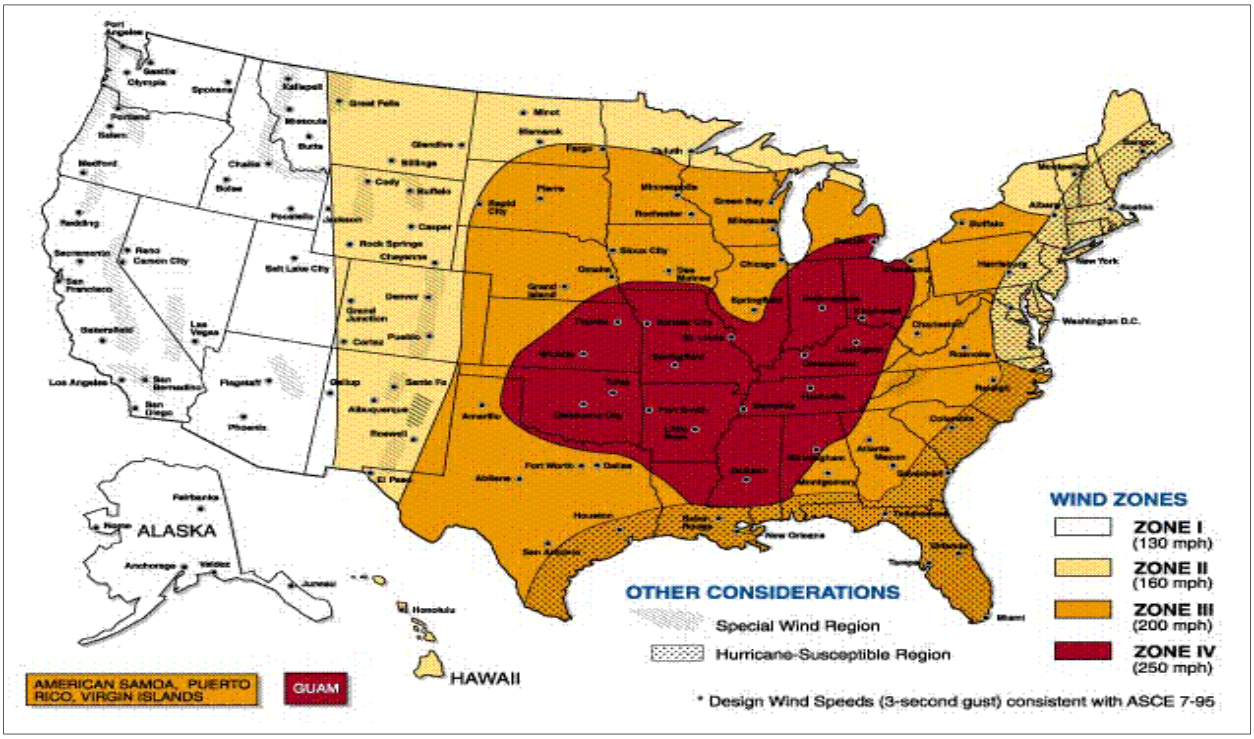


Source: National Climatic Data Center, 2011.

4.1.3 Vulnerability

The entire Pulaski County Planning Area can be affected by tornado events. Pulaski County is in a Wind Zone IV, which can experience tornado event magnitudes reaching speeds of 250 mph or EF5 (**Figure 3.4**). A 250-mph tornado leaves all structures, infrastructure, and crops vulnerable to damage within the County. Tornado wind speeds of this intensity can completely destroy any structure, infrastructure, or crop asset within its path.

Figure 3.4 Wind Zones in the United States



Source: FEMA, 2010.

Wooden structures and mobile homes have been identified as structures more vulnerable to damage from tornado events because they are less able to sustain high wind speeds. Approximately 70% of structures within the Pulaski County Planning Area are wood structures; another 5.9% are mobile homes. This is a substantial portion of the housing stock that is highly vulnerable to damages from tornado events. These structures could be completely destroyed from a tornado event. Persons within wooden structures or mobile homes should seek alternative shelter during a tornado event due to this high vulnerability.

Utilities most vulnerable to tornado winds include electrical power (e.g., power generation facility, above ground transmission lines, and substations) and communication structures (e.g., radio towers, cell phone towers). Most transportation systems (e.g., highways, railways) are not highly vulnerable to tornadoes. Exceptions include airport, port, and bus facilities. In addition, all of the 220 critical facilities in the Pulaski County Planning Area are vulnerable to tornadoes. This includes HAZMAT locations, water and wastewater treatment facilities, emergency response facilities, retirement homes, schools, childcare centers, medical facilities, and historic properties.

4.1.4 Estimated Impact on Vulnerable Community Assets

The Pulaski County Planning Area has recorded 84 tornadoes since 1950, of which 1 was recorded as EF4; 3 recorded as EF3; 17 recorded as EF2; 17 recorded as EF1; and 2 recorded as EF0. These numbers indicate that the Pulaski County Planning Area will experience 1 tornado about every 1.97 years. The County and jurisdictions will continue to see damages ranging from light to severe such as damaged chimneys, broken tree branches, shallow-rooted trees toppled to roofs with some walls torn from structures, some small buildings destroyed, non-reinforced masonry buildings destroyed, and several trees uprooted in the forest.

The following loss estimates are based on tornado severities ranging from EF0 to EF5. Total structural damage over the past 61 years was $300,130,000, an average of $4,920,164 per year. All structures and critical facilities within the Pulaski County Planning Area were determined to be at risk of impact from tornado events equally. It was estimated that for every $1,000 in assets, approximately $0.25 is vulnerable to tornado damage (**Table 3.10**).

3.10 Tornado Structural Loss Estimation for the Pulaski County Planning Area

Community Assets	Replacement Value	Estimated Damage	Method of Calculation
Residential	$14,680,759,935	$3,652,107	Historical Extrapolation
Commercial	$5,070,420,605	$1,261,360	Historical Extrapolation
Industrial	$17,608,190	$4,380	Historical Extrapolation
Agricultural	$9,315,190	$2,317	Historical Extrapolation
Total	**$19,778,103,920**	**$4,920,164**	Historical Extrapolation

The HMPT used FEMA's BCA software and annual exposure rates to estimate human injury or death associated with tornado events. The FEMA BCA software uses historic locational risk and the general radius of the County to calculate the probability of tornadoes at varying intensities. Once the data parameters were inputted into the BCA software, the HMPT was able to calculate loss of life and number of injuries for tornado classes EF0 to EF5. The estimated human injury from a tornado hazard event, in dollars, is $67,188,203. The total estimated impact on vulnerable community assets from the tornado hazard, both structural and human injury, is $72,108,367.

4.1.5 Jurisdictional Risk

Although some jurisdictions do have higher concentrations of manufactured housing, the HMPT has determined there is no jurisdictional variation in risk category. All participating jurisdictions are determined to be at **Severe Risk** from tornado events.

Unique construction characteristics that may affect tornado impact include concentrations of manufactured homes, the most vulnerable structure type. EF1 events can produce wind speeds that can turn over manufactured homes and EF2 events can produce wind speeds that can complete destroy manufactured homes. The increased impact to this population is taken into account when determining jurisdictional variance in tornado risk. High concentrations of manufactured housing stock are found in Unincorporated Pulaski County (25%), Alexander (66.9%), and Wrightsville (20.4%). Refer to **Table 3.2** for total manufactured housing stock by jurisdiction. Manufactured housing maps for all jurisdictions are provided in **Appendix IV**.

4.2 Severe Winter Storm

4.2.1 Profile

Severe winter storms affect every state in the continental United States. Areas where such weather is uncommon, including the Pulaski County Planning Area, are typically disrupted more heavily by severe winter storms than are regions that experience this weather more frequently because many of these communities are less prepared for these events. In addition, severe winter storms in Arkansas may spawn other hazards such as flooding, severe thunderstorms, tornadoes, and extreme winds. These additional hazard events may hamper recovery efforts from severe winter storm events. Severe winter storm hazards include snowstorms, ice storms, strong winds, and extreme cold. Refer to **Table 3.11** for a description of severe winter storm hazards and their potential impacts.

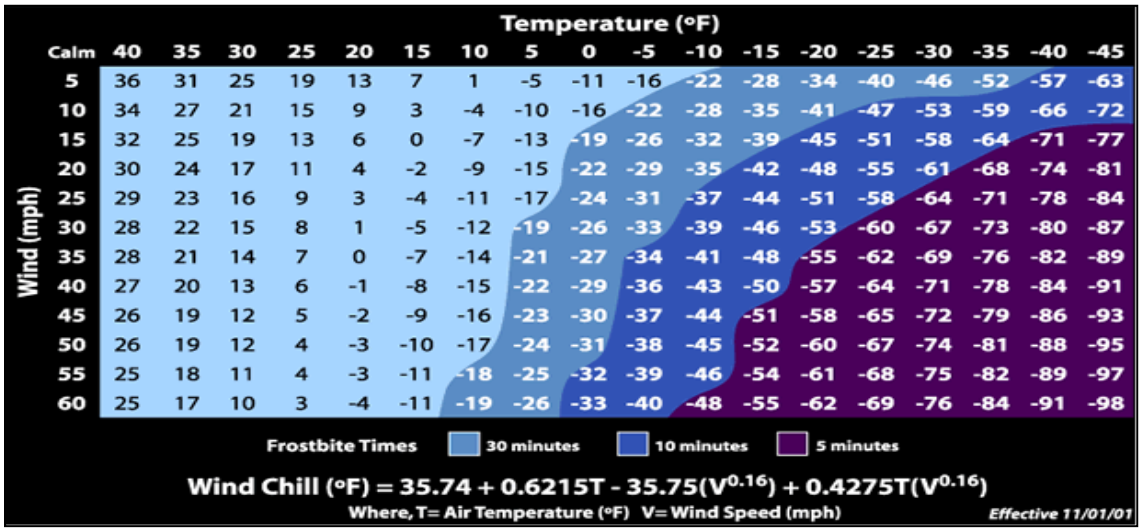
Table 3.11 Severe Winter Storm Event Hazards and Potential Impacts

Associated Severe Winter Storm Hazard	Potential Hazard Impact
Snow Storm	Heavy snow from a snowstorm can immobilize a region and paralyze a city, stranding commuters, stopping the flow of supplies, and disrupting emergency as well as medical services. Accumulations of snow can collapse buildings and down trees and power-lines. In rural areas, homes and farms may be isolated for days and unprotected livestock may be lost. Accumulation of snow can cause extreme hazards to motorists. Motorists in Pulaski County are generally unaccustomed to driving on snow-ridden roads resulting in an increase in traffic accidents, some of which may result in fatalities or human injury. The decrease in traffic mobility during these events often results in the closing of schools and businesses. Eighty percent of damages from severe winter storms are associated with heavy snow.
Ice Storm	Heavy accumulations of ice from ice storms can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the damage. Power and communications disruptions are common consequences of ice storms within Pulaski County. The monetary losses to power and communication infrastructure can become very significant. Excessive ice accumulation can result in building collapse and structural damage. The damage may be caused directly by excessive weight with from the ice and by ice-laden trees or branches falling on structures. In Pulaski County, poultry houses or older built structures are more at risk from collapse or structural damage. Accumulation of ice can cause extreme hazards to motorists. Motorists in Pulaski County are generally unaccustomed to driving on ice-ridden roads resulting in an increase in traffic accidents, some of which may result in fatalities or human injury. Motorist traveling across bridges have an increased risk of motor accidents because bridges freeze at higher temperatures than roads. The decrease in traffic mobility during these events often results in the closing of schools and businesses.
Strong Winds	Severe winter storms are sometimes accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, severe drifting, and dangerous wind chill. Strong winds with these intense storms and cold fronts can knock down trees, utility poles, and power lines. These conditions are rare in Pulaski County.

Table 3.11 Severe Winter Storm Event Hazards and Potential Impacts	
Associated Severe Winter Storm Hazard	Potential Hazard Impact
Extreme Cold	Extreme cold often accompanies or succeeds severe winter storms. Prolonged exposure to the cold can cause frostbite or hypothermia and become life threatening. Infants and elderly people are at increased risk of injury and death from extreme cold. In Pulaski County, near freezing temperatures are considered extreme cold events because the County's residents and infrastructure are unaccustomed to these events. Water and natural gas system pipes may break and cause residents to boil water and lose power.

Severe winter storms can pose a signficant risk to human life. According to the NWS Windchill Chart, frostbite can occur during low temperatures and high wind speeds (Figure 3.5). Frostbite is classified according to degree of severity: first degree frostbite affects the skin by making it appear yellow or white and may cause a burning sensation; second degree frostbite develops after continued exposure, symptoms include the disappearance of pain, reddening, swelling, and blistering of the skin; and third degree frostbite results in waxy, hard skin. It is during the third degree stage that the skin dies and edema may occur due to the lack of blood supply. If not treated immediately, damage can become permanent, including nerve damage, discolored skin pigment, infection, and loss of extremities.

Figure 3.5 NWS Windchill Chart



Source: National Weather Service, 2001.

4.2.2 Previous Occurrences

Since 1985, the Pulaski County Planning Area has had 10 severe winter storm events reported to NOAA and included in the database of reported storm events maintained by the NCDC. The severe winter storm event on December 25, 2000 was damaging enough to have resulted in a Presidential Major Disaster Declaration (**Table 3.6**). Historically significant winter storms that occurred within the County are discussed below and highlight the type of damage that can be expected from a significant severe winter storm event:

- ***Snowstorm (January 1988):*** The largest snowstorm of the century to affect Arkansas occurred in January of 1988, when the entire State was blanketed by heavy snow. Snow amounts of up to 16 inches accumulated in parts of the State, with 13 inches falling in Pulaski County, its heaviest snowfall of the century. Sleet and freezing rain also fell on the southern 1/3 of the state. Poultry growers were particularly hard hit by this storm. At least 215 poultry houses were crushed ($14.5 million damage to buildings) killing 3.5 million birds ($8.5 million loss). Many other structures, such as awnings, sheds, metal buildings, hangers, marinas, and greenhouses collapsed, damaging or destroying their contents. Cattle growers had problems because feed supplies could not be delivered to the animals. Many calves were lost due to stress from the heavy snow and harsh conditions. Significant damage also occurred to power lines and exposed cabling.

- ***Severe Winter Storm/Ice Storm (Early December 2000):*** A severe winter storm and ice storm severely affected Pulaski and most of Arkansas within a two-week period in December of 2000. In Pulaski County and southern Arkansas, one inch of freezing rain accumulated with sleet mixed in at times. Where icing occurred, there were massive power outages with branches and entire trees falling in some areas due to the weight of the ice. Falling trees and limbs resulted in property damage (mainly to roofs and vehicles), personal injury (many head lacerations and other injuries were reported), and blocked roads. Major power outages occurred in the northeast and southeast parts of the county, including 20,000 North Little Rock utility customers in North Little Rock, Sherwood, and northern Pulaski County. Many people were without power and heat for several days during which most businesses, schools, and government offices were closed. Entergy, the largest electric supplier in Arkansas (645,000 customers), brought in approximately 6,000 linemen and tree trimmers from 10 states (more than ever called upon in company history) to help restore power and remove tree debris from lines.

  Some additional reported consequences of the power losses included service stations unable to dispense fuel, community water systems unable to treat and distribute water, senior citizens unable to receive medical attention (such as dialysis or oxygen), retirement and nursing homes without electricity, many Red Cross shelters without electricity, airport closings because beacons were inoperable, loss of perishables in grocery stores and restaurants, and loss of phone service (including some cellular) and cable service in many areas of the state. There was also concern about accidental fires and/or carbon monoxide incidents by the many persons trying to heat homes using alternative methods.

- ***Ice Storm (Christmas 2000):*** Following the severe winter storm and ice storm on December 12th and 13th, a second ice storm developed during the morning of December 25th and continued through December 27th. Mostly freezing rain and sleet were noted, with one and a half to three inches of ice in western sections of the state and one-half to two inches of ice elsewhere. Roads were much icier during this second storm due to lower temperatures. Most major state highways were covered with two inches if ice and many roads were nearly impassible due to the ice and trees that had fallen due to the weight of the ice. Numerous traffic accidents were attributed to the ice. The National Guard was contacted to help stranded motorists.

  The loss of power during the second storm was even greater than the first, as about 320,000 customers lost power statewide – many for several days. The ice damaged or destroyed several main transmission lines connecting power grids to cities. Entergy mobilized more than 5,200 linemen and servicemen and nearly 4,000 tree trimmers from 24 states to restore service. In Pulaski County, major outages occurred in western Pulaski County and Little Rock.

The lack of electricity affected the ability of some communities to treat and deliver water. Little Rock National Airport was closed from the evening of the 25th until midday on the 27th due to ice on the runways stalling some 170 flights – the first time since 1975 that the airport had been closed for more than 24 hours. Other consequences of the ice storm included the loss of communication towers in many communities, loss of phone service for 25,000 customers, loss of power at some hospitals, and a shortage of supplies such as oxygen cylinders at nursing homes. Impassible roads kept some fire crews and emergency workers from responding to emergency calls.

Damages to pecan orchards in southeast Pulaski County exceeded $50,000. The Arkansas Forestry Commission estimates that private, nonindustrial landowners bore $50 million in damage and replacement costs throughout Pulaski County. Large paper companies, such as International Paper and Weyerhauser Co., expect losses to be in the millions as well. Ice-laden trees and branches fell in residential areas resulting in a massive and costly debris-removal effort. Federal and state government funded most of the cost of this cleanup. Other effects of the storm were not felt immediately.

Disaster and recovery and cleanup costs for Pulaski County and Communities for these two ice storms totaled almost $10 million. Costs per community were as follows: Alexander, $9,812; Cammack Village, $30,109; Jacksonville, $156,415; Little Rock, $2,983,247; Maumelle, $8,383; North Little Rock, $4,761,871; Sherwood, $198,921; Wrightsville, $1,030; and Pulaski County, $1,727,452.

- ***Severe Winter Storm/Ice Storm (January 2009):*** Freezing rain and sleet moved into Pulaski County during the afternoon and early evening on January 26, 2009, then spread rapidly eastward. By later on the night of the 26th, most of the precipitation was falling in the form of freezing rain. During the day of the 27th, almost continuous freezing rain fell across the north, with ice accumulating rapidly. Throughout Pulaski County, rain changed to freezing rain and sleet. Ice accumulations were mainly in the 1 to 2 inch range, with greater amounts at the highest elevations. The ice storm knocked out electricity to more than 300,000 electric customers. More than 10,000 power poles were broken or toppled, hundreds of miles of power lines fell to the ground, and thousands of transformers had to be replaced. In many rural areas, phone, water, and sewer services were disrupted for days.

Table 3.12 presents records of historical severe winter events from 1985 to 2011 that have caused property or crop damage exceeding $5,000 or have caused an injury or death within the Pulaski County Planning Area. Two of the most devastating severe winter storm events to affect the Pulaski County Planning Area occurred in 1988 and 2000. The 1988 winter storm caused approximately $14,500,000 in property damages and $8,500,000 in crop damages. The most significant severe winter storm in 2000 caused approximately $5,000,000 in property damages and $5,000,000 in crop damages. This event also resulted in 20 human deaths. Over the past 27 years, severe winter storm events have caused the Pulaski County Planning Area a total of $57,125,000 in property damage, $13,500,000 in crop damages, and 33 human deaths.

Table 3.12 Severe Winter Storm Events – The Pulaski County Planning Area (1985 - 2011)							
Jurisdiction	Date	Associated Severe Winter Storm Hazard	Magnitude (inches of snow or ice)	Injury	Death	Property Damage	Crop Damage
Pulaski County	01/20/1988	Snow Storm	13 inches of snow	0	0	$14,500,000	$8,500,000
Pulaski County	01/1/1989	Ice Storm	15 inches of ice	0	0	$2,000,000	$0
Pulaski County	01/16/1994	Ice Storm	1-2 inches of ice	0	0	$5,000,000	$0
Pulaski County	02/08/1994	Ice Storm	1-2 inches of ice	0	0	$500,000	$0
Pulaski County	03/08/1994	Snow Storm	18 inches of snow	0	0	$5,000,000	$0
Pulaski County	01/13/2000	Ice Storm	1 inch of ice	0	0	$5,000,000	$0
Pulaski County	01/27/2000	Ice Storm	1-3 inches of ice	0	20	$5,000,000	$5,000,000
Pulaski County	12/25/2000	Snow Storm	1-3 inches of ice	0	13	$10,000,000	$0
Pulaski County	01/26/2009	Ice Storm	1-2 inches of ice	0	0	$10,000,000	$0
Pulaski County	02/08/2010	Snow Storm	6-10 inches of snow	0	0	$125,000	$0
Total				**0**	**33**	**$57,125,000**	**$13,500,000**

Source: National Climatic Data Center, 2011.

Based on historical severe winter storm loss data from 1985 through 2011 from the NCDC's Database, the impact of the winter storm hazard can be estimated. Between 1985 and 2011, there have been 10 winter storm events that have caused damages or human injury to the Pulaski County Planning Area. Extrapolating from historical data, the HMPT estimated that the Pulaski County Planning Area has an average recurrence interval for winter storm events of 2.6 years or an annual probability of 38%.

4.2.3 Vulnerability

The entire Pulaski County Planning Area can be affected by severe winter storm events. The occurrence of severe winter storms can have a substantial impact on the Pulaski County Planning Area's structures, utility systems, transportation systems, and agriculture. Heavy accumulations of ice or snow commonly result in damage to structures. The damage may be caused directly by the excessive weight of the ice or snow accumulation, or by ice-laden trees or branches falling on structures. Homes, business, as well as weaker nonresidential structures (farmhouses, sheds, etc.) are most vulnerable to this type of structural damage. Wood structures (70% of structures in the Pulaski County Planning Area) and manufactured houses (5.9% of structures in the Pulaski County Planning Area) are more vulnerable to severe winter storm damage than steel, concrete, or masonry structures.

Heavy accumulations of ice or snow can also bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and electricity can be disrupted for days or weeks, while utility companies work to repair the damage. Communication and electrical disruptions occur frequently during winter storm events. Winter storms are sometimes accompanied by strong winds. These winds can knock down trees, utility poles, and power lines.

Pulaski County Planning Area's transportation systems are also vulnerable to severe winter storms. Although the storms rarely result in hazardous structural damage to transportation systems, accumulations of ice and snow may cause extreme hazards to motorists. Motorists in the Pulaski County Planning Area are generally unaccustomed to driving on icy roads resulting in an increase in traffic accidents, some of which may result in fatalities. The 163 bridges throughout the County are especially vulnerable to winter storms because they freeze more quickly than roadways. Motorists should limit the use of bridges and roads during winter storm events. All of the jurisdictions lack sufficient snow removal equipment and

road treatments (sand, salt) because of the infrequent occurrence of severe winter storm events. This prolongs severe winter storm impacts to transportation systems.

Substandard housing units throughout the Pulaski County Planning Area are also more vulnerable to damages and human injury from winter storm events. Accumulations of snow or ice on substandard housing units' roofs can collapse at lower weight levels. This can result in structural damage and or death of residents living in the structure. In addition, many of these units do not have proper insulation to protect residents from prolonged low temperatures. In the event of a power outage substandard housing residents could be more vulnerable to injury and death from freezing. These residents should seek shelter in well insulated structures.

4.2.4 Estimated Impact on Vulnerable Community Assets

Severe winter storm events vary in severity and the type of associated hazards that are produced. According to the NCDC and NWS Data, typical snow accumulations in the Pulaski County Planning Area during winter storm events that produce heavy snow have ranges from 1 to 8 inches. The heaviest recorded snow accumulation in the Pulaski County Planning Area was 18 inches in March 3, 1994. Typical ice storm accumulations from severe winter storm events range from 1/10 of an inch to 1 inch. The heaviest ice accumulation recorded in the Pulaski County Planning Area was approximately 3 inches on December 25, 2000.

Total property damage over this 26-year period was $57,125,000, an average of $936,475 per year. Total crop damage over this same period was $13,500,000, an average of $221,311 per year. By annualizing the historical losses to human life it amounts to approximately 0.50 persons or $2,900,000 per year (based on FEMA Injury Valuation).

It was estimated that for every $1,000 in structural assets, approximately $0.05 is vulnerable to winter storm damage (**Table 3.13**). It was also assumed that all agricultural assets within the Pulaski County Planning Area would be at risk of impact from winter storm events equally. It was estimated that for every $1,000 in agricultural assets, approximately $23.75 is vulnerable to winter storm damage. The total annual estimated impact on vulnerable community assets from severe winter storm hazard events is **$4,057,785.**

Table 3.13 Severe Winter Storm Structural Loss Estimation for the Pulaski County Planning Area

Community Assets	Replacement Value	Estimated Annual Damage	Method of Calculation
Residential	$14,680,759,935	$695,448	Historical Extrapolation
Commercial	$5,070,420,605	$240,192	Historical Extrapolation
Industrial	$17,608,190	$834	Historical Extrapolation
Agricultural	$9,315,190	$221,311	Historical Extrapolation
Total	**$19,778,103,920**	**$1,157,785**	

4.2.5 Jurisdictional Risk

Although some jurisdictions do have higher concentrations of manufactured housing, the HMPT has determined that all participating jurisdictions are at **Severe Risk** from thunderstorm events due to the high probability of occurrence and severity of impact.

4.3 Flood

4.3.1 Profile

Flood is an overflow of an expanse of water that submerges land and is usually caused by thunderstorms that produce heavy amounts of rain. Floods are natural events that occur hundreds of times each year, making it one of the most common hazard events nationwide. The Pulaski County Planning Area is subject to three types of flooding events: riverine flooding, closed-basin lake flooding, and flash flooding.

Flooding is location-specific to designated flood areas.

- **Riverine flooding** occurs when excess rainfall causes a water body like a river or bayou to overflow its banks and move into the lowlands adjacent to the water body that are susceptible to recurring inundation (the floodplain). Although a natural occurrence, it is also a hazard in many areas – floodplains in the United States are home to over 9 million households, and floods cause millions of dollars in damage and kill an average of 150 people a year.

- **Closed-basin lake flooding** occurs when excess water accumulates in lakes with either no outlet or a relatively small one.

- **Flash flooding** occurs when a relatively impervious, sloped area receives a large amount of rainfall from slow-moving thunderstorms or chains of thunderstorms moving one after the other over the same area. The resulting run-off flows down any terrain feature that will act as a channel (rivers, gullies, roads) carrying with it any debris or loose soil in its path. Flash floods usually occur within 6 hours of heavy rainfall, and according to the NWS, are usually more life threatening. The majority of deaths from flash flooding occur when people become trapped in automobiles that stall while driving through flooded areas. Nearly half of all flood fatalities are vehicle-related. Several factors determine the severity of floods, including rainfall intensity (or other water source) and duration. A small amount of rain can also cause flooding in locations where the soil is saturated from a previous wet period or if the rain is concentrated in a low area of impermeable surfaces such as large parking lots, paved roadways, or other impervious developed areas.

4.3.2 Previous Occurrences

Since 1994, the Pulaski County Planning Area has had 18 flood events, exceeding $5,000 in damages, reported to NOAA and included in the database of reported storm events maintained by the NCDC. Descriptions of historical events are provided from local newspaper accounts in the Arkansas Gazette and interviews with the County Floodplain Administrator as well as the State NFIP Coordinator. The jurisdictions which have had historical flood events include Pulaski County, Little Rock, Jacksonville, Maumelle, and North Little Rock. Since 1972, 10 of these historical flood events were damaging enough to have resulted in Major Presidential Disaster Declaration (**Table 3.6**). Historically significant flood events that occurred within the County are discussed below and highlight the type of damage that can be expected:

- ***Riverine Flooding (The 1927 Flood):*** The greatest flood on record in Arkansas occurred in 1927, when practically all levees were breached, 313 persons drowned, and 750,000 persons were left homeless. The Arkansas River crested at 31.3 feet at Little Rock on April 22, 1927. This is 13.3 above the legislatively mandated high water mark of the river at Little Rock. In Pulaski County, 38 prisoners at the Pulaski County Penal Farm were rescued by a combination of county employees and private citizens. A workforce of 600 men was required to keep the levees protecting the pumping station of the Arkansas Water Works from failing. Levee failure would have resulted in the pumping station being inundated by 30 feet of flood backwater from the Arkansas River. The Baring Cross Railroad Bridge, the oldest such structure in Arkansas, failed on April 21, 1927 after 54 years of service. It was rebuilt at a cost of approximately $2,000,000. Sixteen cars filled with coal also were lost. Dr. Austin F. Barr, Little Rock health officer, issued a call for all citizens to take advantage of free smallpox and typhoid inoculations to prevent outbreaks of the diseases. Inoculations were given to all who entered the white and black refugee centers.

- ***Flash Flooding (September 1978):*** The September 1978 flood extent in and around the Little Rock/North Little Rock metropolitan area of Pulaski County was mostly centered on the intersection of Fourche Creek and Rock Creek in Little Rock. The area of Rock Creek's flooding, if it occurred today, would include the growing West Little Rock community, especially the commercial zones of the area defined by the Barrow Road to the west, Chenal Parkway to the north, Shackelford Road to the east, and Colonel Glenn/Asher to the South. Damage along Fourche Creek affected an area from southwest Little Rock to the southern part of Adams Field, with the southern extent being the I-30 bypass and Granite Mountain. Heavily hit was the development on University and Asher Avenues, which included both businesses and the University of Arkansas at Little Rock campus. Flooding in either low-lying areas or around the Arkansas River occurred east of I-30 and north of 9th Street in Little Rock and in an area roughly outlined by I-40 to the north, Pike Avenue to the west, Broadway to the south, and the community of Eastgate to the east in North Little Rock. Property damage estimates from SHELDUS for Pulaski County from this flood event are $2,500,000. Little Rock reported that it had received $407,840 ($1,150,108 in 2003 dollars) from the federal government to repair public facilities. Eight deaths and 35 injuries in Pulaski County were attributed to this flood by SHELDUS.

- ***Flash Flooding (May 1990):*** Flooded areas in Pulaski County for the May 1990 flood include Shillcutt Bayou, Baring Cross, Eastgate, and the Dixie and Crockett Additions in North Little Rock, park areas along the south bank of the Arkansas River in Little Rock, locations near Pinnacle Mountain and Frazier Pike in Wrightsville (Morris, 1990). Damage in those areas include 48 homes, Rebsamen Park Golf Course, and Junior Deputy Ball Fields Also, the county experienced flooding to approximately 3,500 and 7,500 acres of farmland in Pulaski County. The flood magnitude was estimated to be a 50- to 70- year event. The Arkansas River crested in Little Rock at 27.68 feet (about 5 feet above flood stage) with a discharge of approximately 450,000 cubic feet per second at Murray Lock and Dam. Damage estimates for Pulaski County include 34 temporary housing grants for a total of $100,000 ($141,000) plus two business loans and eight other loans.

- ***Riverine, Closed-Basin, and Flash Flooding (Christmas 2009):*** The flood event started with a strong but slow-moving low-pressure system on December 23, 2009. Over two days this pressure system produced rainfall amounting to 7 to 10 inches in most areas throughout the County. As a result of the excessive rainfall, flash, riverine, and closed-basin flooding occurred. Damage impact from the event included inundation of numerous roads and the need to evacuate community residents from heavily flooded rural areas.

- ***Riverine and Closed Basin Flooding (The Great Flood of 2011):*** The flood event began on April 24th, 2011, from a slow-moving cold front and several low pressure systems that produced multiple rounds of thunderstorms and tornadoes. On April 25th, 2011, widespread riverine and closed basin flooding occurred throughout the County. Some of this flooding was due to heavy rain, while other events were caused by water from rivers, creeks, and bayous backing up onto adjacent land. On the night of April 29th, 2011, Arkansas Highway 10 was closed due to flooding in areas approximately 4 miles west of Interstate 430. The flood event left more than 140,000 electric customers in Central Arkansas without power for days. Flooding from this event was still impacting residents of Pulaski County in some areas for more than a month.

Great Flood of 2011 – Local road flooded from closed basin flooding near HW 10.

Table 3.14 presents records of historical flood events from 1994 to 2011 that have caused property or crop damage exceeding $5,000 or have caused an injury or death within the Pulaski County Planning Area (NCDC, 2011). Two of the most devastating flood events to affect Pulaski County both occurred in 2009. The October 29th, 2009 flood event caused an estimated $3,910,000 in total property damage. The most significant flood event was in December 24, 2009. This event caused approximately $8,030,000 in property damages. Over the past 17 years, flood events have caused Pulaski and all participating jurisdictions a total of $15,695,000 in property damage. A resulting incident caused by many of these flood events was the closing of transportation infrastructure and systems, including the inundation of roadways and bridges. During many of these flood events businesses and schools were significantly damaged and daily operations were disrupted.

Table 3.14 Flood Events – The Pulaski County Planning Area (1994 - 2011)

Jurisdiction	Date	Rainfall (inches)	Property Damage	Crop Damage
Jacksonville	4/12/1994	2-4	$50,000	$0
Little Rock	4/29/2006	4-6	$2,000,000	$0
Little Rock	11/15/2006	2-4	$100,000	$0
Pulaski County	4/3/2007	2-4	$10,000	$0
North Little Rock	7/2/2007	2-3	$50,000	$0
Pulaski County	3/3/2008	2-3	$10,000	$0
Jacksonville	3/18/2008	2-3	$15,000	$0
Maumelle	3/18/2008	2-3	$15,000	$0
Jacksonville	9/3/2008	5-11	$210,000	$0
Pulaski County	10/9/2009	2-3	$10,000	$0
Pulaski County	10/29/2009	7-10	$3,760,000	$0
Little Rock	10/29/2009	2-3	$150,000	$0
Pulaski County	12/24/2009	7-10	$7,930,000	$0
North Little Rock	12/24/2009	3-6	$100,000	$0
Pulaski County	5/16/2010	2-3	$150,000	$0

Table 3.14 Flood Events – The Pulaski County Planning Area (1994 - 2011)				
Jurisdiction	Date	Rainfall (inches)	Property Damage	Crop Damage
Pulaski County	7/12/2010	2-3	$110,000	$0
Pulaski County	4/25/2011	2-3	$25,000	$0
Pulaski County	4/26/2011	4-6	$1,000,000	$0
Total			**$15,695,000**	**$0**

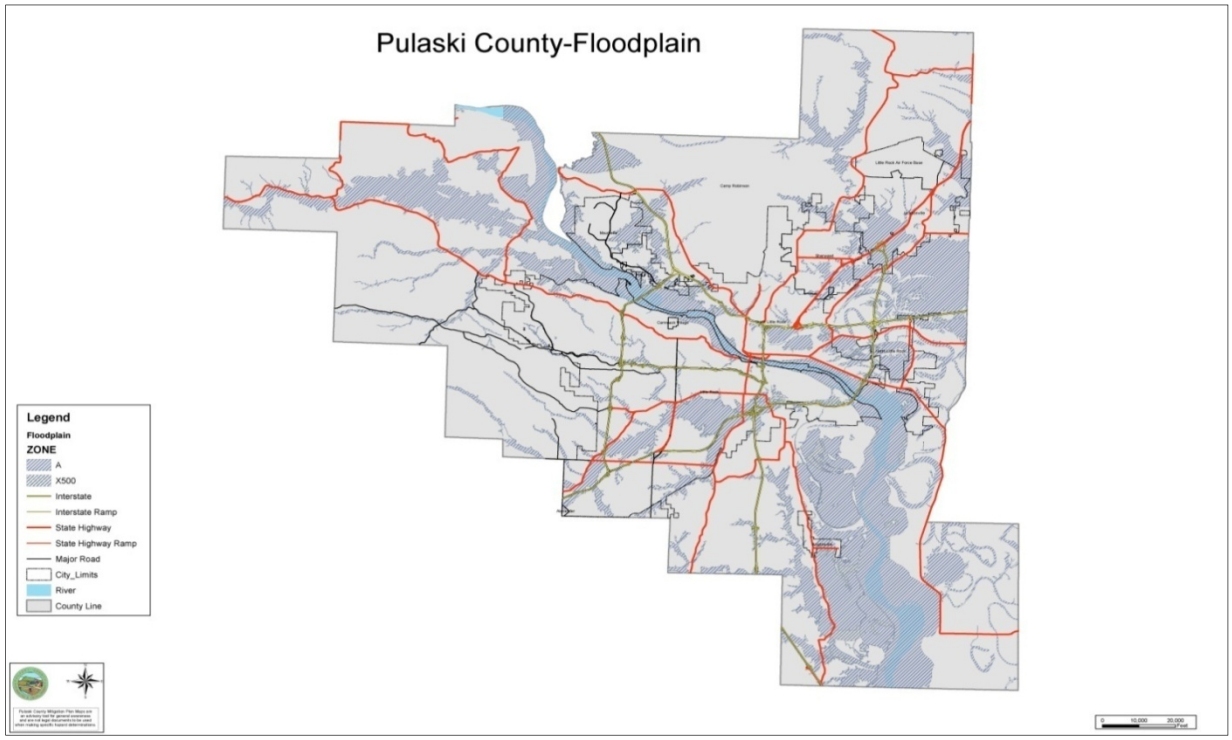
Source: National Climatic Data Center, 2011.

Based on flood loss data from 1994 through 2011 from the NCDC's Database, the annual probability of occurrence for the flood hazard can be estimated. Between 1994 and 2011, there have been 7 years with flood events that have caused damages and human injury to the Pulaski County Planning Area. Extrapolating from historical data, the HMPT estimated that the Pulaski County Planning Area has a recurrence interval for flood events of 2.43 years or an annual probability of 41%.

4.3.3 Vulnerability

Floodplains are the geographical areas affected by flood events in the Pulaski County Planning Area. The HMPT has reviewed Pulaski County's Flood Insurance Rate Maps (FIRMs) and Flood Insurance Study (FIS), as well as worked with the County Floodplain Administrator and State of Arkansas Natural Resource Commission to conduct a risk assessment of flooding events throughout the County. Refer to **Figure 3.6** for areas vulnerable to flooding. Refer to **Subsection 4.3.5** for vulnerable areas by jurisdiction.

Figure 3.6 Vulnerable Flooding Areas in the Pulaski County Planning Area



Riverine floods are most common in the Mississippi Alluvial Plain in the eastern part of the County and along the Arkansas River. These areas exhibit low relief and typically have flat, broad floodplains. The area surrounding the Arkansas River is subject to flood damage because of the large amounts of rainfall it receives; the wide, flat floodplain in the southeastern part of the County; large amounts of wetland area and oxbow lakes in the southeastern portion of the county; and the large numbers of structures located in the floodplain. Riverine flooding is usually caused by extensive rainfall over a period of several days or longer either in Central Arkansas or more often upstream to the west. Forty-seven years of stream gage data collected intermittently since 1923 along the Arkansas River at Little Rock indicates that the Arkansas River was above flood stage (23 feet) at least 8 times during the 47 years for which records are available, or approximately 1 flood event every 6 years.

Flash floods are most common in the western part of the county that lies within the Ouachita Mountains (**Figure 3.6**). This area exhibits high to moderate relief, steep to moderate slopes, and bedrock with low permeability, all facilitating rapid runoff, and the consequent potential for flash floods. Urban development in this part of the state exacerbates the flash flooding problem. Intense rainfall events may result in water flowing rapidly from higher elevations into valleys causing significant flood events. There have also been issues with the maintenance and clearing of drainage channels in this area resulting in obstructions restricting the flow of water during a storm.

The most vulnerable structures in the Pulaski County Planning Area are repetitive loss and severe repetitive loss structures. Repetitive Loss and Severe Repetitive Loss properties are identified by FEMA's National Flood Insurance Program (NFIP). Repetitive Loss properties are those for which two or more losses of at least $1,000 each have been paid under the NFIP within any 10-year period since 1978. Severe Repetitive Loss structures are NFIP-enrolled residential or commercial properties that have at least: 1) Four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or 2) For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion in such claims exceeding the market value of the building.

The Arkansas Natural Resource Commission Repetitive Loss List has recorded 131 properties throughout the Pulaski County Planning Area with a total of 364 claims amounting to $6,282,042 in NFIP payouts. Refer to **Table 3.15** for the complete Arkansas Natural Resource Commission Repetitive Loss List by jurisdiction.

Table 3.15 NFIP Repetitive Flood Losses by Jurisdiction

Jurisdiction	Losses	Properties	Claims
Alexander	$0	0	0
Cammack Village	$0	0	0
Jacksonville	$494,809	13	30
Little Rock	$2,466,457	62	195
Little Rock School District	$0	0	0
Maumelle	$0	0	0
North Little Rock	$398,034	6	18
North Little Rock School District	$0	0	0
Sherwood	$1,007,873	23	57
Wrightsville	$0	0	0
Unincorporated Pulaski County	$1,914,869	27	64
Total	**$6,282,042**	**131**	**364**

Source: Arkansas Natural Resource Commission, 2011.

The Arkansas Natural Resource Commission Severe Repetitive Loss list has recorded only 3 Severe Repetitive Loss properties in the Pulaski County Planning Area, all of them are within the City of Little Rock. All these properties are residential structures located in FEMA's identified special flood hazard areas. Since 1968, the total value paid out by the NFIP for Severe Repetitive Loss properties was $250,407.

4.3.4 Estimated Impact on Vulnerable Community Assets

A variety of factors affect the type and severity of flooding impact within the Pulaski County Planning Area, including topography, geology, development of growth, and location to floodplains. The HMPT has reviewed Pulaski County's Flood Insurance Rate Maps (FIRMs), Flood Insurance Study (FIS) and used FEMA's HAZUS-MH to conduct a risk assessment of flooding events throughout the Pulaski County Planning Area. Based on these reports and models, the extent of riverine, closed-basin, and flash flood events within the Pulaski County Planning Area can reach depths of 1/2 a foot to 56 feet. Damages ranging from light to severe such as debris production, structural damage, damage of contents in structures, inundation of roads, and reduction of transportation access of flooded roads.

To estimate the impact of flooding on vulnerable community assets in the Pulaski County Planning Area the HMPT used FEMA's HAZUS-MH model. Six HAZUS-MH-MH damage estimations for the 1%-annual-chance-flood were performed on segments of the Pulaski County Planning Area at 5 square mile resolution. HAZUS-MH analysis for Little Rock and North Little Rock were run separately. A summary of these results is presented in **Table 3.16**.

The total structure related losses by land use for the Pulaski County Planning Area for 1%-annual-chance-flood is estimated to be $208,920,000 (**Table 3.16**). The total business interruption losses for a 1%-annual-chance-flood are estimated to be $156,340,000. The total estimated impact of a 1%-annual-chance-flood event on vulnerable community assets is $365,260,000.

HAZUS-MH also estimates the number of households that are expected to be displaced from their homes due to a 1%-annual-chance-flood and the associated potential evacuation as well as the need for temporary shelters. The model estimates that 2,327 households will be displaced and 5,587 people will seek temporary shelter in public shelters (**Table 3.16**).

Table 3.16 Flood Loss Estimation for the Pulaski County Planning Area

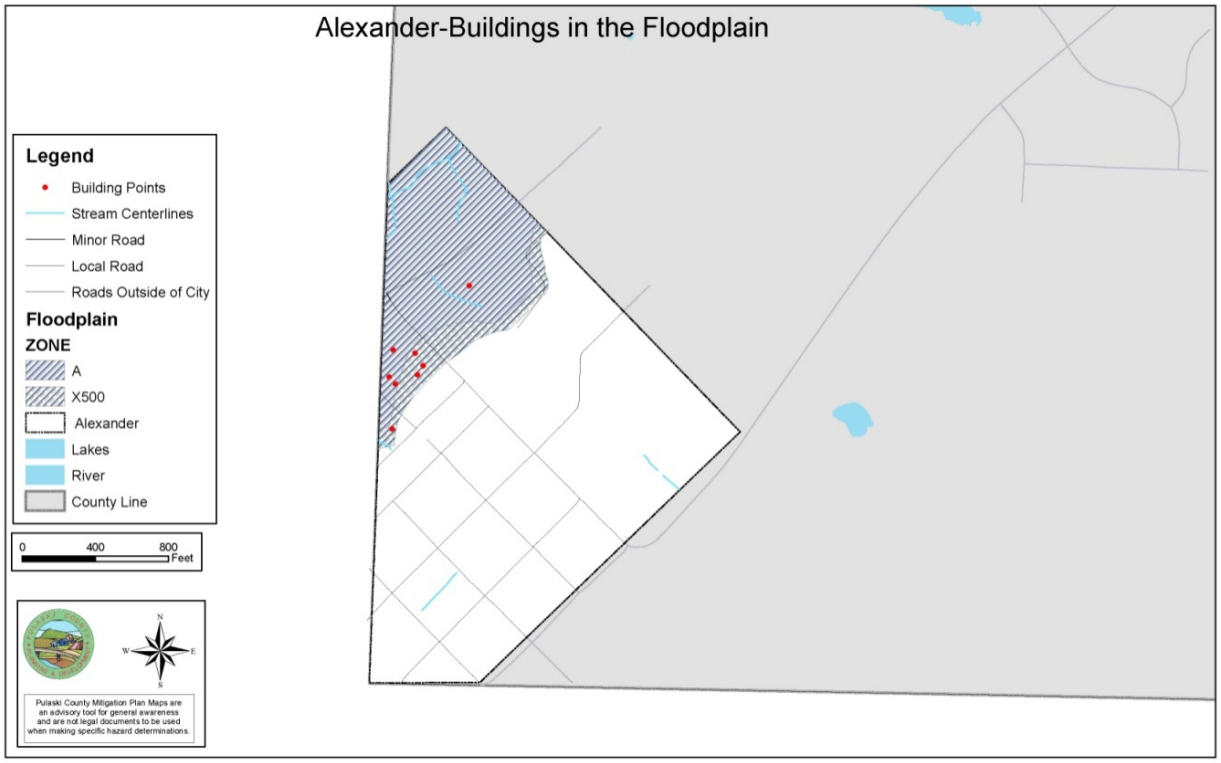
County Segment or Jurisdiction	Structure Related Loss	Business Interruption	Households Displaced	Persons Seeking Shelter
NE	$12,080,000	$7,260,000	55	136
N	$16,350,000	$11,560,000	57	34
SE	$10,760,000	$2,610,000	65	130
E	$17,230,000	$12,980,000	485	1,203
SW	$28,750,000	$8,420,000	94	198
W	$7,820,000	$2,910,000	20	15
City of Little Rock	$94,350,000	$70,680,000	710	1,689
City of North Little Rock	21,580,000	39,920,000	841	2,182
Total	**$208,920,000**	**$156,340,000**	**2,327**	**5,587**

4.3.5 Jurisdictional Risk

Flood risk in the Pulaski County Planning Area varies considerably by jurisdiction. Refer below for a description and map of each jurisdiction's exposure to flood events.

Alexander: The northern corner of Alexander (approximately northwest of Earl D. Miller Lane and W 2nd Street) lies within the regulatory floodplain of Crooked Creek. Four structures lie within the 100-year floodplain and 4 structures lie within the 500-year floodplain. Refer to **Figure 3.7** for a map of the buildings within the City of Alexander that are in the floodplain. The City of Alexander is at a Moderate Risk from flood events.

Figure 3.7 Map of Buildings in the Floodplain for the City of Alexander

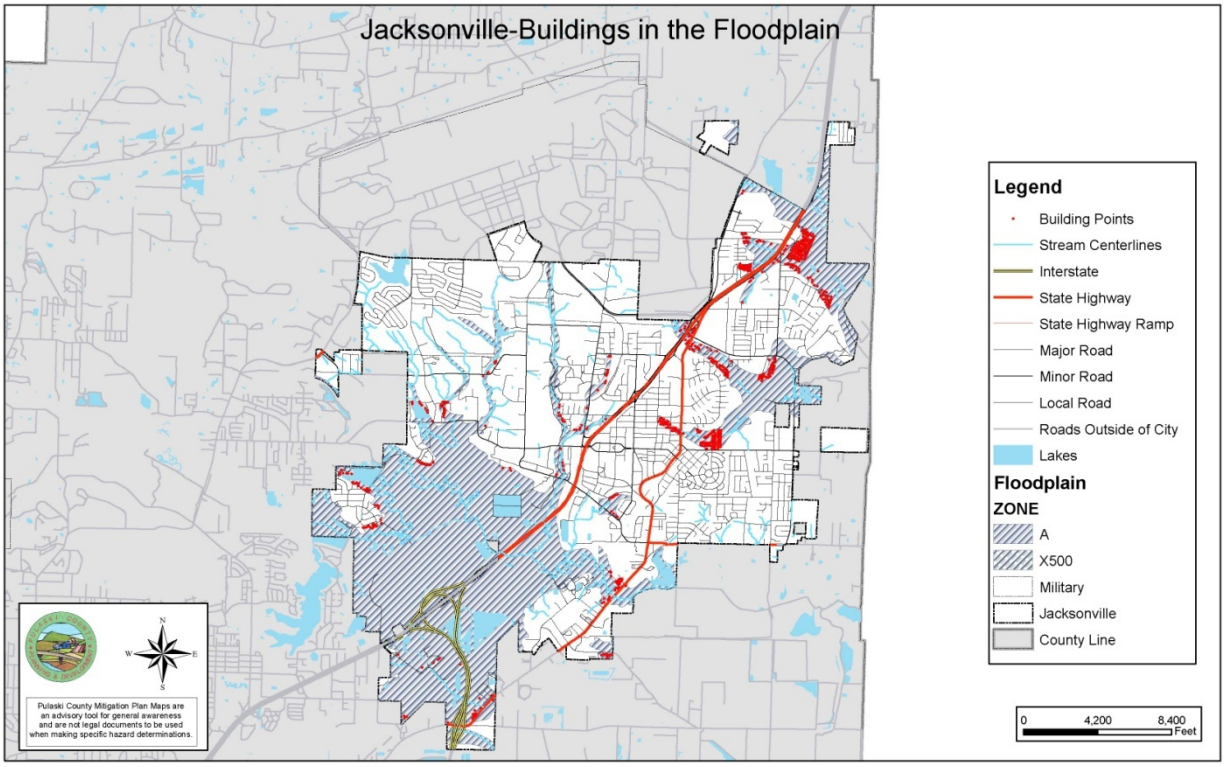


Cammack Village: No floodplain is located in Cammack Village, nor has Cammack Village been subject to flooding in the past. The City of Cammack Village is at a **Low Risk** from flood events.

Jacksonville: 658 structures in Jacksonville are located in the floodplain. The largest area of floodplain in Jacksonville includes most of the southwest portion of the City. Although sparsely populated in comparison to other parts of Jacksonville, significant numbers of structures are in the floodplain in several areas. These include structures along U.S. 161 near the I-440 interchange, along U.S.161 near Bayou Meto, between Bayou Meto and Kellogg Creek off of Oneida Street, and north of Jacksonville Cutoff Road near Harris Road. Significant numbers of structures are also located in the floodplain in the northeast corner of the City. Numerous structures are in the floodplain in neighborhoods between U.S. 167 and Foxwood Country Club, as well as west of U.S. 167 along Quince Hill Road and west of Evans Drive. Other floodplain areas with structures include north of Grahm Road along Cherry and

Laural Streets, and along U.S. 167 near Vandenburg Boulevard and south of Wright Loop Road. Refer to **Figure 3.8** for a map of the buildings within the City of Jacksonville that are in the floodplain. The City of Jacksonville is at a **Severe Risk** from flood events.

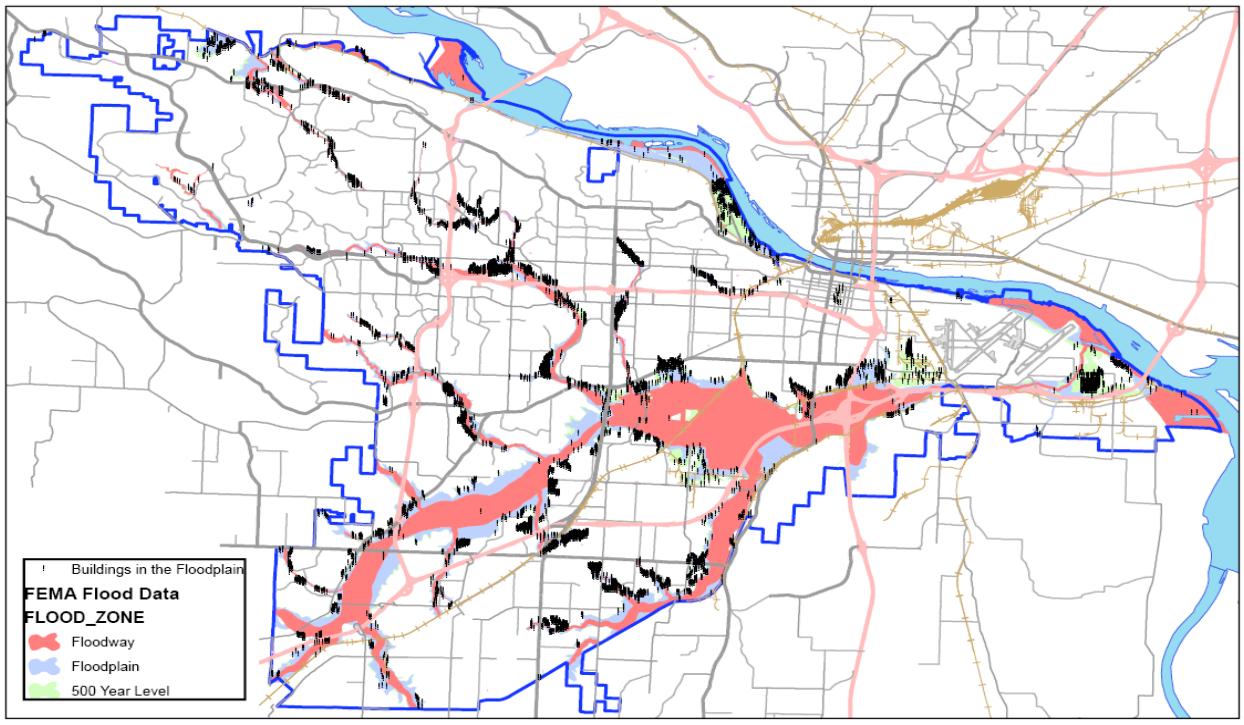
Figure 3.8 Map of Buildings in the Floodplain for the City of Jacksonville



Little Rock: Little Rock is subject to riverine and flash flooding. There are approximately 573 buildings located in the floodplain within the City of Little Rock. The majority of the City of Little Rock's floodplain area is located near the Arkansas River (**Figure 3.9**). Refer to **Figure 3.9** for a map of the buildings within the City of Little Rock that are in the floodplain. The City of Little Rock is at a **Severe Risk** from flood events.

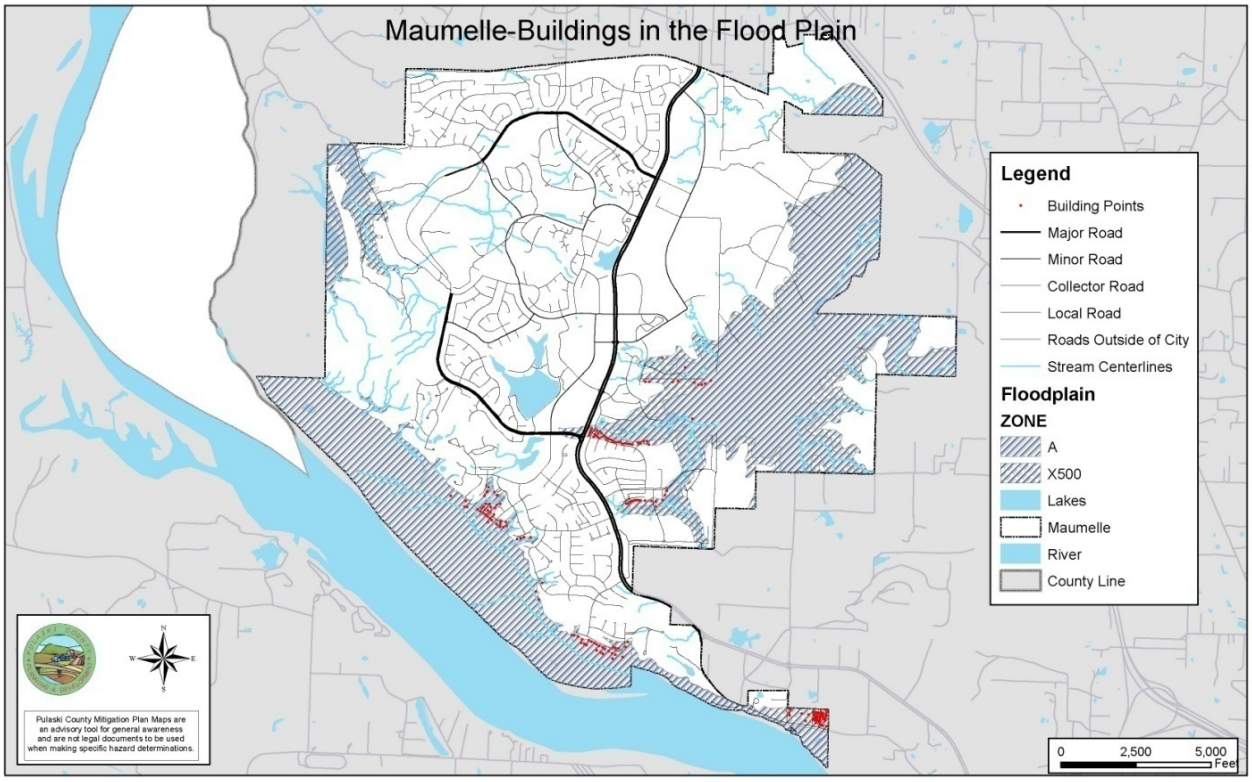
Little Rock School District: Little Rock School District is subject to riverine and flash flooding. Portions of the campus are within the flood zone. The majority of the Little Rock School District's floodplain area is located near the Arkansas River (**Figure 3.9**). Refer to **Figure 3.9** for a map of the buildings within the Little Rock School District that are in the floodplain. The Little Rock School District is at a **Severe Risk** from flood events

Figure 3.9 Map of Buildings in the Floodplain for the City of Little Rock



Maumelle: 175 structures in Maumelle are located in the floodplain. The largest areas of floodplain lie in the eastern part of the City and along the Arkansas River, which forms the southwestern City boundary. Numerous structures north of Crystal Hill Road at the extreme southeast part of the City lie within the floodplain, as well as structures along Crystal Mountain Lane south of Maumelle Country Club and along Riverwood Cove and adjacent streets. Houses along Calais Drive and Chantilly Circle and adjacent streets are built within the floodplain as well. Refer to **Figure 3.10** for a map of the buildings within the City of Maumelle that are in the floodplain. The City of Maumelle is at a **Moderate Risk** from flood events.

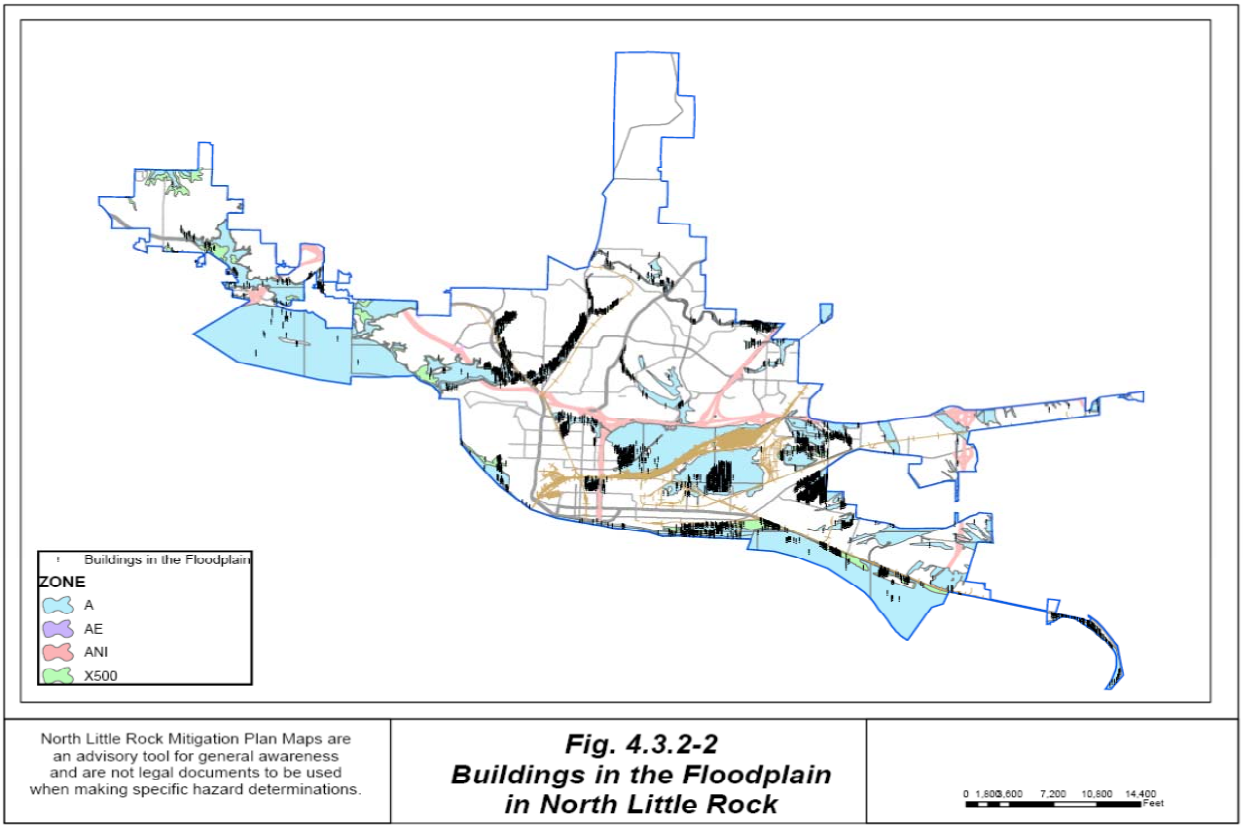
Figure 3.10 Map of Buildings in the Floodplain for the City of Maumelle



North Little Rock: North Little Rock is subject to riverine and flash flooding. There are approximately 104 buildings located in the floodplain within the City of North Little Rock. The majority of the City of North Little Rock's floodplain area is located near the Arkansas River (**Figure 3.11**). Refer to **Figure 3.11** for a map of the buildings within the City of North Little Rock that are in the floodplain. The City of North Little Rock is at a **Severe Risk** from flood events.

North Little Rock School District: North Little Rock School District is subject to riverine and flash flooding. A portion of some campuses is located in the floodplain. The majority of the North Little Rock School District's floodplain area is located near the Arkansas River (**Figure 3.11**). Refer to **Figure 3.11** for a map of the buildings within the North Little Rock School District that are in the floodplain. The City of North Little Rock is at a **Severe Risk** from flood events.

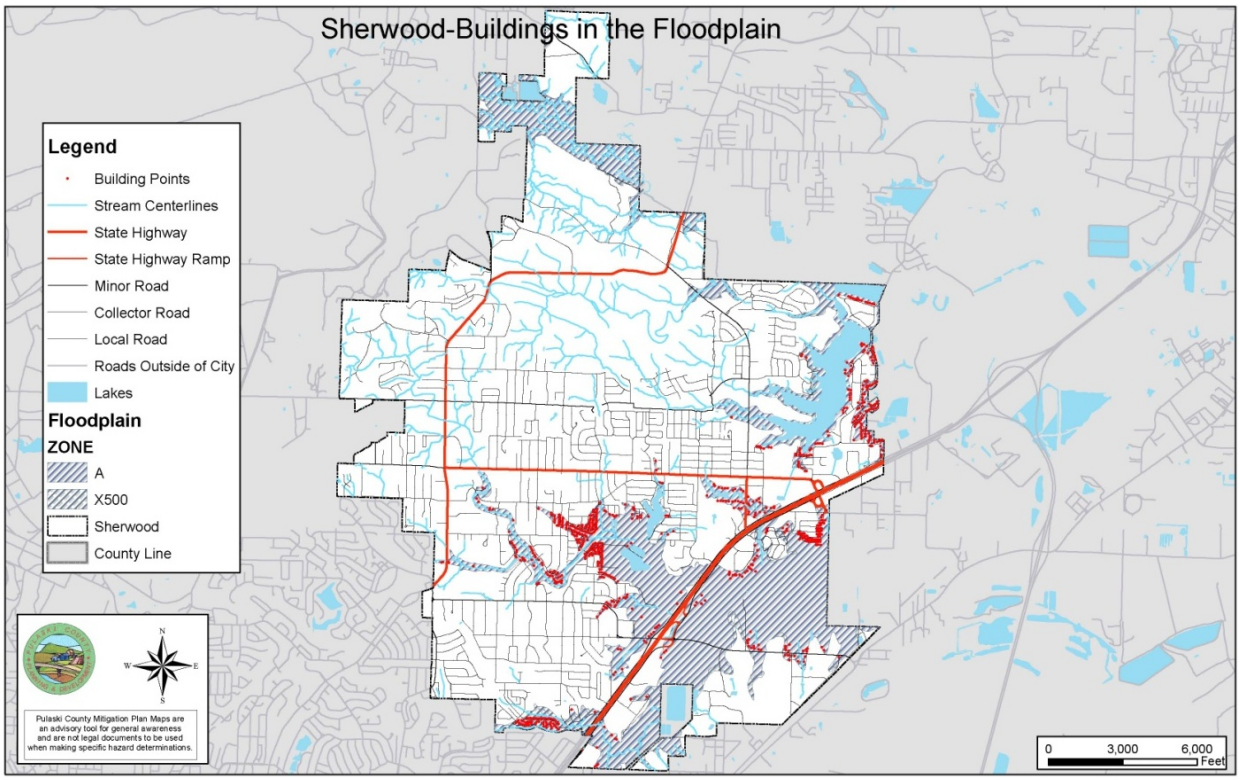
Figure 3.11 Map of Buildings in the Floodplain for the City of North Little Rock



Pulaski County Special School District: Refer to **Figure 3.6** for a map depicting the vulnerable flood areas in the Pulaski County Special School District. All structures within the floodplain are vulnerable to flood. Pulaski County Special School District is at **Severe Risk** from flood.

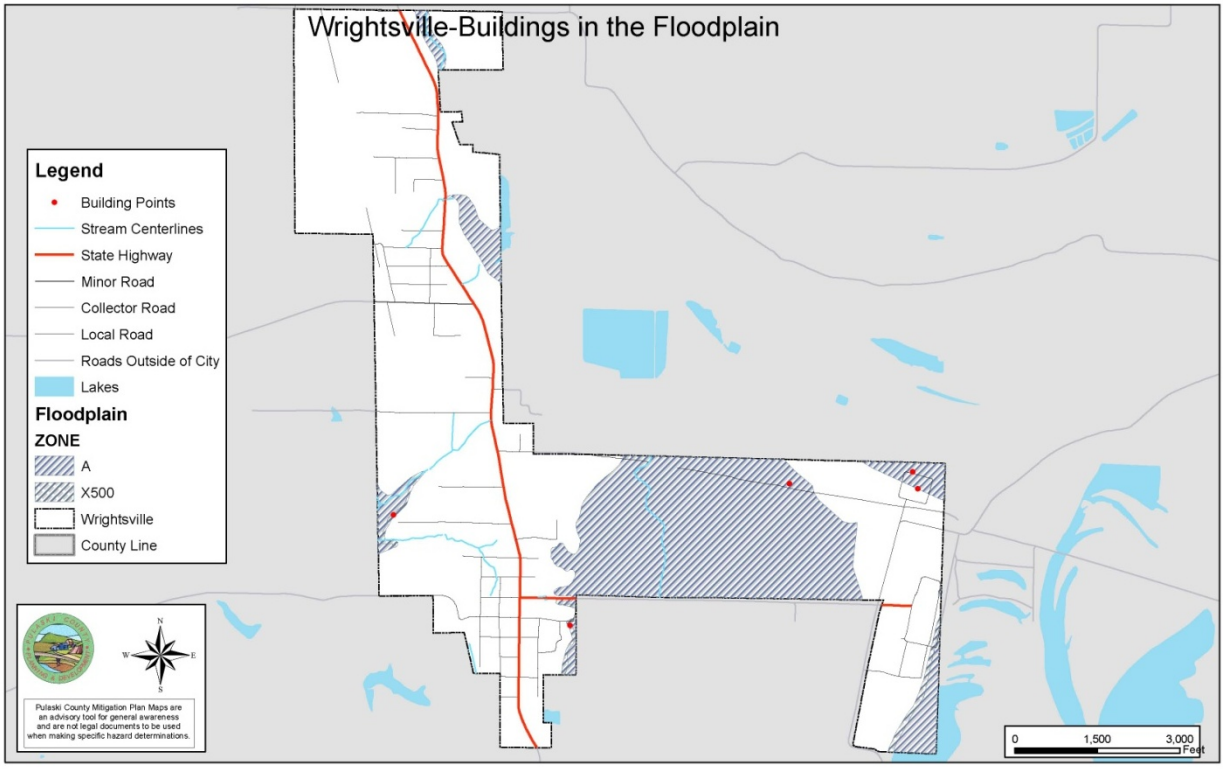
Sherwood: Seven hundred and forty-eight structures in Sherwood are located in the floodplain. Most of the floodplain lies in the east and southeast and southern parts of the City. Many structures are located within the floodplain east of Indianhead Lake near the eastern edge of the City and southeast of U.S. 167 surrounding Rest Hills. Other structures within the floodplain are found near Silver Creek Drive near the southern City boundary and along Bronco Lane and Palomino Drive among other nearby streets near the center of the city. Refer to **Figure 3.12** for a map of the buildings within the City of Sherwood that are in the floodplain. The City of Sherwood is at a **Severe Risk** from flood events.

Figure 3.12 Map of Buildings in the Floodplain for the City of Sherwood



Wrightsville: Five structures in Wrightsville are located within the floodplain. Three structures are along or north of Raney Drive, 1 structure is on Clark Street east of AR 365 and south of AR 386, and one structure lies just west of the end of North Street. No high or significant hazard class dams lie within or upstream from Wrightsville. Refer to **Figure 3.13** for a map of the buildings within the City of Wrightsville that are in the floodplain. The City of Wrightsville is at a **Moderate Risk** from flood events.

Figure 3.13 Map of Buildings in the Floodplain for the City of Wrightsville



Unincorporated Pulaski County: According to the 2001 Flood Insurance Study for unincorporated Pulaski County, significant flood problems are generally found along highways and roads crossing streams (**Figure 3.6**). Encroachment into the floodplains has continued in spite of recent flooding. Flood damages are generally limited to houses and commercial buildings that are scattered along streams in the county. Flooding of the Arkansas River is not severe except near the confluence of the Little Maumelle River.

The developed fringe areas adjacent to Faulkner Lake, Fivemile Creek, and Bayou Meto suffer flood damages in residential developments along these streams (**Figure 3.6**). Following construction of Interstate 440 north of Interstate 40 in the eastern and northeastern parts of the county, flooding problems from wetlands and oxbow lake overflows have been exacerbated. Houses along State Highway 103 are no longer protected from high water. Drainage is easily blocked with debris and beaver dams pose a huge problem. The County contracts to have beaver removed from problem areas. The oxbow lakes and wetlands associated with the Arkansas River in this part of the County hold more water and have not drained as easily in recent years as they have in past years. Communication with property owners in the area has helped define problem areas. Unincorporated Pulaski County is at a **Severe Risk** from flood events.

4.4 Thunderstorm

4.4.1 Profile

A thunderstorm is characterized by the presence of lightning and its resulting thunder. Cumulonimbus is the cloud type associated with a thunderstorm. Thunderstorms are usually accompanied by strong winds, heavy rain, and hail or sometimes no precipitation at all. Thunderstorms may line up in a series of rain bands known as a squall line. Strong or severe thunderstorms may rotate and are known as supercells.

Thunderstorms result from the rapid upward movement of warm, moist air such as thermals rising off a warm field or where two fronts collide, forcing air upward. As the warm, moist air moves upward, it cools, condenses, and forms a cumulus cloud. If cumulonimbus clouds reach an approximate height of 6 miles, as the rising air reaches its dew point causing water droplets and ice to form and begin falling the long distance through the clouds towards the Earth's surface. As the droplets fall, they collide with other droplets and become larger. The falling droplets create a downdraft of air that spreads out at the Earth's surface and causes strong winds associated with thunderstorms.

Thunderstorms can be accompanied by strong winds, heavy rain, and hail.

Thunderstorms can generally form and develop in any geographic location, perhaps most frequently within areas located at mid-latitude when warm moist air collides with cooler air. Thunderstorms are responsible for the development and formation of many severe weather phenomena that can pose numerous hazards to populations and landscapes. Damages that result from thunderstorms are mainly inflicted by downburst winds, large hailstones, and flash flooding caused by heavy precipitation. Stronger thunderstorm cells are capable of producing tornadoes and waterspouts. Dry thunderstorms with no precipitation can cause wildfires from cloud-to-ground lightning that accompanies them. The National Weather Service classifies a thunderstorm as severe if it contains hail of three-quarter inches or larger or wind gusts of 58 mph or higher.

4.4.2 Previous Occurrences

Numerous severe thunderstorm events have affected Pulaski County Planning Area. Since 2000, the Pulaski County Planning Area has had 45 thunderstorm events, with damages exceeding $4,000, reported to NOAA and included in the database of reported storm events maintained by the NCDC. The total historical property damage associated with these thunderstorm events is $3,595,000 (**Table 3.17**).

Table 3.17 Thunderstorm Events – The Pulaski County Planning Area (2000 – 2011)			
Location	Date	Magnitude in Knots (kts)	Property Damage
North Little Rock	7/27/2000	50	$25,000
Pulaski County	3/9/2006	60	$200,000
Pulaski County	10/17/2007	60	$400,000
Little Rock	3/15/2008	50	$5,000
Maumelle	4/22/2008	50	$75,000
Maumelle	6/1/2008	50	$200,000
Maumelle	4/9/2009	50	$50,000
Pulaski County	6/12/2009	50	$25,000
Jacksonville	6/12/2009	50	$75,000
Little Rock	6/12/2009	56	$75,000
Pulaski County	6/30/2009	50	$40,000
Maumelle	7/14/2009	50	$5,000
Jacksonville	8/5/2009	40	$15,000
Pulaski County	8/5/2009	42	$5,000
Pulaski County	5/16/2010	56	$200,000
Pulaski County	5/16/2010	61	$150,000
Pulaski County	5/27/2010	50	$5,000
Pulaski County	7/11/2010	52	$10,000
Pulaski County	8/2/2010	52	$100,000
Pulaski County	8/5/2010	52	$10,000
North Little Rock	8/21/2010	56	$40,000
Jacksonville	8/21/2010	55	$25,000
Pulaski County	10/24/2010	52	$25,000
Pulaski County	10/24/2010	52	$10,000
Pulaski County	10/24/2010	52	$10,000
Pulaski County	10/24/2010	52	$10,000
Pulaski County	10/24/2010	52	$5,000
Little Rock	10/24/2010	52	$20,000
Pulaski County	10/24/2010	56	$125,000
Pulaski County	10/24/2010	52	$5,000
Pulaski County	2/24/2011	52	$10,000
Pulaski County	2/24/2011	52	$15,000
Pulaski County	4/15/2011	52	$5,000
Pulaski County	4/15/2011	61	$40,000
Pulaski County	4/15/2011	61	$1,300,000
Pulaski County	4/15/2011	52	$5,000
Pulaski County	4/15/2011	52	$5,000
Pulaski County	4/15/2011	52	$45,000
Pulaski County	4/19/2011	52	$5,000
Sherwood	4/19/2011	52	$20,000
Pulaski County	4/19/2011	52	$10,000
Cammack Village	4/25/2011	52	$50,000
Pulaski County	4/25/2011	52	$50,000
Pulaski County	4/25/2011	52	$15,000
Pulaski County	4/25/2011	52	$75,000
Total			**$3,595,000**

Source: National Climatic Data Center, 2010.

General damages from these events include roof damage to structures, knocked down trees and power lines, and blown out windows on numerous buildings. Historically significant thunderstorm events that occurred within the Pulaski County Planning Area are discussed below and highlight the type of damage that can be expected from a significant thunderstorm event:

- ***Thunderstorm (October 2010):*** An upper level low-pressure system approached from the west on October 24, 2010. Ahead of the low-pressure system, warm moist air from the Gulf of Mexico approached Pulaski County from the south. When the low pressure encountered the warmth and moisture, thunderstorms erupted and some of the storms became severe. Damages from this thunderstorm event occurred about a mile southwest of Adams Field. An industrial building in the area had its roof and a canopy blown off. The roof took down power lines and power poles, while the canopy fell on two cars. Residents throughout the affected area reported power outages.

- ***Thunderstorm (April 2011):*** A cold front and strong area of low pressure approached Arkansas on April 14, 2011. The result was an outbreak of severe weather that lasted 2 days. Thunderstorms developed into straight-line segments which often bowed out, creating damaging thunderstorm winds. This thunderstorm event caused numerous trees to blow down in the Cherry Hill, Park, Hill, Lakewood, and Heritage Park neighborhoods of North Little Rock. A number of the trees fell on houses and power lines causing significant damage.

Between 2000 and 2011, there have been 45 thunderstorm events that have caused damages each exceeding $4,000 in the Pulaski County Planning Area. Extrapolating from historical data, the HMPT estimated that the Pulaski County Planning Area has an average recurrence interval for severe thunderstorm events of 1.57 years or an annual occurrence probability of 64%.

4.4.3 Vulnerability

The entire Pulaski County Planning Area can be affected by thunderstorm events. The Pulaski County Planning Area has recorded 45 thunderstorms since 2000, with wind speeds between 50 to 61 kts. These numbers indicate that the Pulaski County Planning Area will experience 1 thunderstorm about every 1.57 years. The County and jurisdictions will continue to see damages ranging from light to severe such as chimneys that are damaged, tree branches are broken, shallow-rooted trees are toppled to roofs and some walls are torn from structures, some small buildings are destroyed, and many trees in forest are uprooted.

Wooden structures and manufactured homes have been identified as structures more vulnerable to damage from thunderstorm events because they are less able to sustain high wind speeds. Approximately 70% of structures within the Pulaski County Planning Area are wood structures and 5.9% are mobile homes. This is a substantial portion of the housing stock that is vulnerable to damages from thunderstorm events.

Utilities most vulnerable to thunderstorm winds include electrical power (e.g., power generation facility, above ground transmission lines, and substations) and communication structures (e.g., radio towers, cell phone towers). Most transportation systems (highways, railways) are not highly vulnerable to thunderstorm events. Exceptions include airport, port, and bus facilities.

Nearly all of the Pulaski County Planning Area's critical facilities are vulnerable to thunderstorm events. These include vulnerable populations (e.g., retirement homes, schools, and childcare centers), HAZMAT locations, water and wastewater treatment facilities, and historic properties. Because they are essential to

responding to thunderstorm events, emergency response, and medical facilities should be considered highly vulnerable to this hazard.

4.4.4 Estimated Impact on Vulnerable Community Assets

Based on historical occurrences of thunderstorm events, the extent of a thunderstorm event within the Pulaski County Planning Area can range from a 50 to 61 kts winds. The severity of a tornado event will affect the impacts to the community's assets and population.

Total damages in dollars over this 11-year period were $3,595,000, an average of $326,818 per year. All structures and critical facilities within the Pulaski County Planning Area were determined to be at risk of impact from thunderstorm events equally. It was estimated that for every $1,000 in assets, approximately $0.01 is vulnerable to thunderstorm damage (**Table 3.18**).

3.18 Thunderstorm Loss Estimation for the Pulaski County Planning Area

Community Assets	Replacement Value	Estimated Damage	Method of Calculation
Residential	$14,680,759,935	$242,703	Historical Extrapolation
Commercial	$5,070,420,605	$83,824	Historical Extrapolation
Industrial	$17,608,190	$291	Historical Extrapolation
Agricultural	$9,315,190	-	Historical Extrapolation
Total	**$19,778,103,920**	**$326,818**	Historical Extrapolation

4.4.5 Jurisdictional Risk

Although some jurisdictions do have higher concentrations of manufactured housing, the HMPT has determined that all participating jurisdictions are at **Severe Risk** from thunderstorm events due to the high probability of occurrence and severity of impact.

Unique construction characteristics that may affect thunderstorm exposure by jurisdiction include concentrations of manufactured homes, the most vulnerable construction type. 50 knot (kt) wind thunderstorm events can produce wind speeds that have the potential to significantly damage manufactured homes. The increased impact to this population is taken into account when determining jurisdictional variance in thunderstorm risk. High concentrations of mobile housing stock are found in Unincorporated Pulaski County (25%), Alexander (66.9%), and Wrightsville (20.4%). Refer to **Table 3.2** for total mobile housing stock by jurisdiction. Maps of manufactured home locations by jurisdictions are provided in **Appendix IV**.

4.5 Earthquake

4.5.1 Profile

An earthquake is a sudden motion or trembling of the Earth caused by an abrupt release of stored energy in the rocks beneath the Earth's surface. The release of energy results in vibrations known as seismic waves that are responsible for the trembling and shaking of the ground during an earthquake. Ground motion is expressed as peak ground acceleration (PGA).

Earthquake intensity is a measure of the severity of the ground shaking as reflected in the degree of damage to man-made structures, the amount of disturbance to the surface of the ground and the reaction of animals to the shaking. Intensity is measured in the United States by the Modified Mercalli Scale

(**Table 3.19**). The Modified Mercalli Scale is composed of 12 increasing levels of intensity that range from negligible shaking to catastrophic disruption. In addition, local geology, shallow ground water, and building construction type may affect the intensities of earthquakes for different areas within the earthquake zone.

Table 3.19 Modified Mercalli Scale

Mercalli Scale	Damage Description
I	Not felt except by a very few under especially favorable conditions. (Negligible)
II	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing. (Negligible)
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated. (Negligible)
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motorcars rocked noticeably. (0.015g-0.02g)
V	Felt by nearly everyone; many awakened. Some dishes, windows broken; cracked plaster in a few places; unstable objects overturned. Disturbances of trees, poles, and other objects sometimes noticed. Pendulum clocks may stop. (0.03g-0.04g)
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster and damage chimneys. Damage slight. (0.06g-0.07g)
VII	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving cars. (0.10g-0.15g)
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving cars disturbed. (025g-0.30g)
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken. (0.50g-0.55g)
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from riverbanks and steep slopes. Shifted sand and mud. Water splashed, slopped over banks. (More than 0.60g)
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
XII	Damage total. Waves seen on ground. Lines of sight and level are distorted. Objects thrown into the air.

According to USGS, earthquakes in the central and eastern U.S. are typically felt over a much broader region than in the western U.S. East of the Rockies, an earthquake can be felt over an area as much as ten times larger than a similar magnitude earthquake on the west coast. A magnitude 4.0 eastern U.S. earthquake typically can be felt at many places as far as 60 miles from where it occurred, and it infrequently causes damage near its source. A magnitude 5.5 eastern U.S. earthquake usually can be felt as far as 300 miles from where it occurred, and sometimes causes damage as far away as 25 miles.

4.5.2 Previous Occurrences

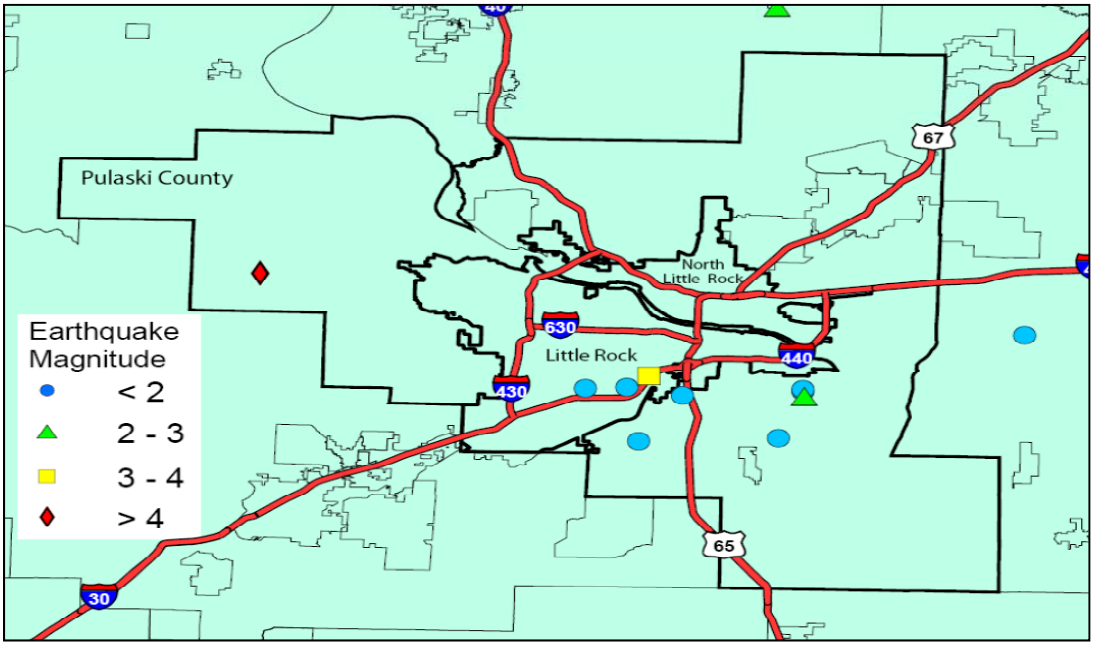
Since 1811, the Pulaski County Planning Area has experienced 145 insignificant earthquakes (Mercalli Scale I-III) and 5 significant earthquakes (Mercalli Scale IV-XII). Historically significant earthquake events that occurred within the Pulaski County Planning Area are discussed below and highlight the type of damage:

- ***Earthquakes (March 1911):*** A shock in March 1911, about 40 miles south of Little Rock, was so severe at Pine Bluff that hundreds of excited residents crowded into the streets in panic. Structural damage included broken windows throughout the city and cracked walls at one school. The shock was felt throughout southeastern Arkansas and into adjacent states. Pulaski County experienced an additional earthquake with a local Modified Mercalli Scale of V later that year. This event did not cause any property damage, but alarmed many Pulaski County residents.
- ***Earthquake (New Year's Day 1969):*** On New Year's Day, 1969, a tremor centered approximately about 19 miles northwest of Little Rock near Ferndale caused much unrest throughout the region. In Little Rock, plaster cracked, and furniture was moved about in some homes. Trees and utility wires swayed and shook throughout a wide area. The Center for Earthquake Research and Information (CERI) measured this earthquake with a local Modified Mercalli Scale of IV.
- ***Earthquake (January 1982):*** In January of 1982 Faulkner County, which adjoins Pulaski County to the north, was jolted by a small earthquake that initiated a series of seismic events. That swarm of seismic activity lasted for years and produced over 40,000 earthquakes throughout the region. Most of the thousands of seismic events were too small to be felt, but at least 93 earthquakes were felt in Pulaski County by at least one person during that first year. Three earthquakes were measured as magnitude V on the local Modified Mercalli Scale.
- ***Earthquake (May 2001):*** In May of 2001, Pulaski County was shaken by a magnitude IV local Mercalli Scale earthquake. The epicenter of this earthquake was located in Faulkner County about 3 miles northwest of Enola, the same area as the 1982 series of earthquake events. This event was felt widely in central Arkansas and some people were awakened in the night. The event did not cause any structural damage in Pulaski County.
- ***Earthquake (March 2011):*** A magnitude III earthquake on the local Mercalli Scale struck 2 miles outside of Pulaski County on the night of March 28, 2011. Some people were awoken and startled in the night, but no injuries or damage was reported.

Locations of historical earthquakes with epicenters in the Pulaski County Planning Area and its neighboring counties are shown in **Figure 3.14**. Only nine historical earthquake epicenters have been recorded within the Pulaski County Planning Area. The largest magnitude earthquake with its epicenter in the Pulaski County Planning Area occurred in the western part of the County near Ferndale and had an estimated magnitude of IV.

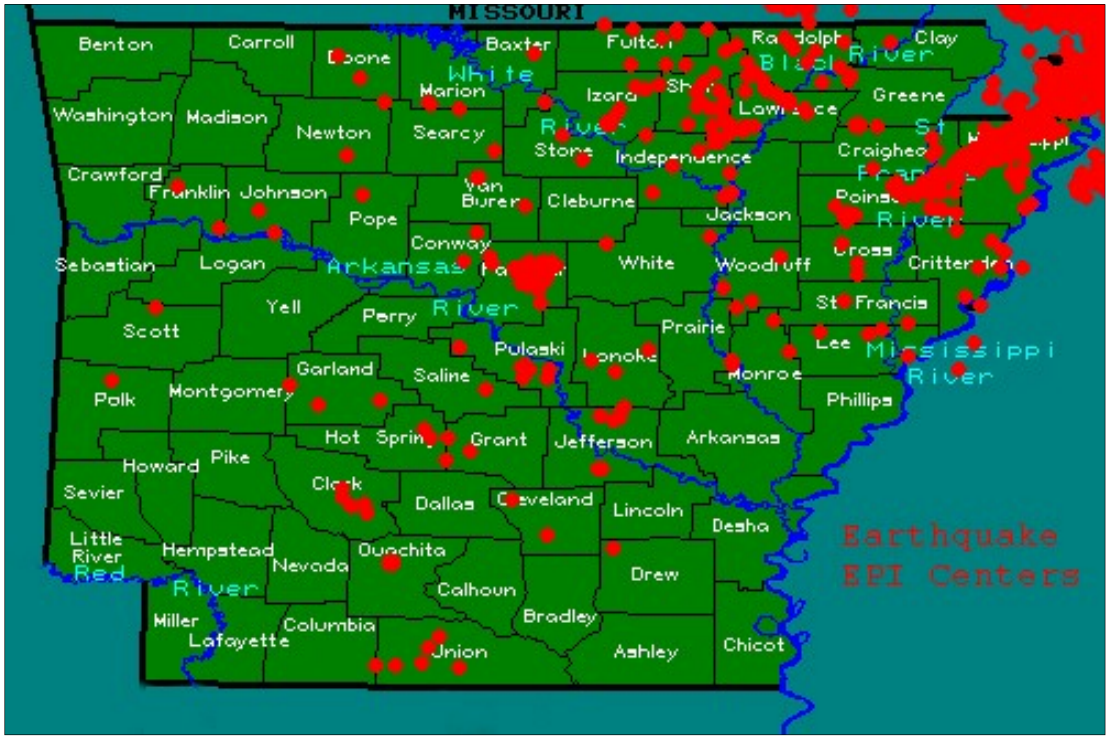
Earthquakes within the Central Arkansas Region can be felt over a large area from its epicenter. Therefore, neighboring counties' earthquake events may impact the Pulaski County Planning Area. Faulkner County, directly north of Pulaski County, has a very high earthquake occurrence rate and its seismic activity has been felt in the Pulaski County Planning Area. A magnitude V earthquake in the Central Arkansas Region usually can be felt as far as 300 miles from where its epicenter, and sometimes causes damage as far away as 25 miles. Refer to **Figure 3.15**, for a map of Arkansas's earthquake epicenters.

Figure 3.14 Earthquake Epicenter Points around the Pulaski County Planning Area



Source: Arkansas Geological Survey, 2010.

Figure 3.15 Earthquake Epicenters for the State of Arkansas



Source: University of Arkansas at Little Rock, 2011.

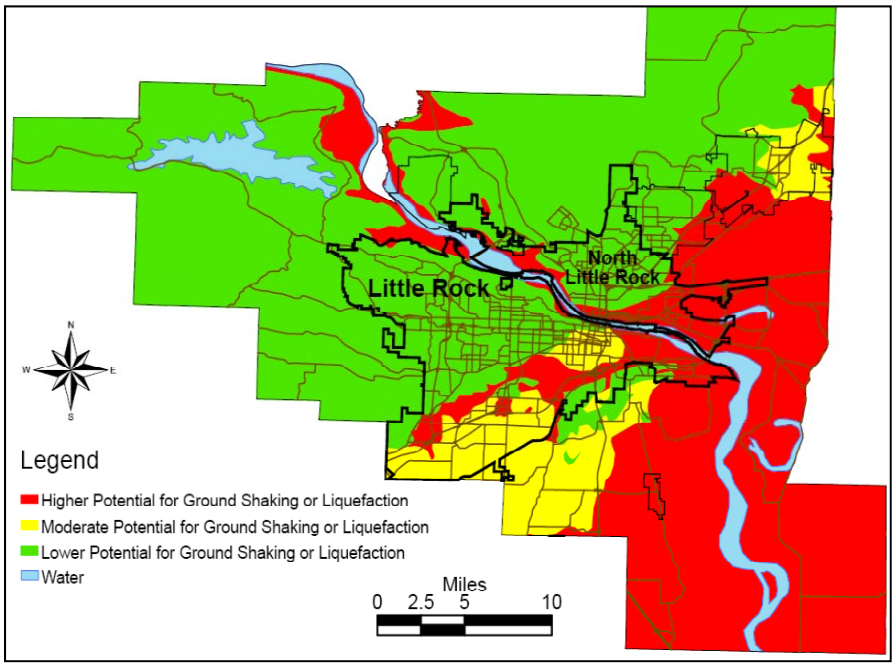
Between 1811 and 2011, there have been 5 years with significant earthquake events within the Pulaski County Planning Area. Extrapolating from historical data, the HMPT estimated that the Pulaski County Planning Area has an average recurrence interval for earthquake events of 40 years or an annual occurrence probability of 0.25%.

4.5.3 Vulnerability

The entire Pulaski County Planning Area can be affected by earthquake events. According to the Arkansas Geological Survey, the Pulaski County Planning Area could potentially be impacted from a I to XI magnitude earthquake. A XI magnitude earthquake would leave many structures and infrastructure assets damaged. The building types most vulnerable to ground shaking are those constructed of unreinforced masonry (13% of structures in the Pulaski County Planning Area) and concrete (0.6% of structures in the Pulaski County Planning Area). Infrastructure most vulnerable to earthquakes includes all utility distribution lines (water, wastewater, natural gas) and facilities. Transportation infrastructure most vulnerable to earthquakes includes 163 highway bridges and 3 railway bridges.

Other factors affecting the vulnerability of a structure to earthquakes include proximity to the earthquake epicenter and the underlying soil or bedrock characteristics. Because the most likely location for a large earthquake is the New Madrid Seismic Zone, the northeast portion of the Pulaski County Planning Area is more vulnerable to severe magnitude impacts. Structures in the eastern part of the Pulaski County Planning Area are slightly more vulnerable than structures in the west and southwest sections. Also, structures in the eastern part of the County are more vulnerable to severe shaking because they are constructed on unconsolidated alluvial soils of the Mississippi Alluvial Plain which have the effect of amplifying the shaking (**Figure 3.16**). Unconsolidated sands in this area may also be subject to liquefaction in the event of severe shaking.

Figure 3.16 Areas of Relative Potential for Ground Shaking and/or Liquefaction in the Pulaski County Planning Area



4.5.4 Estimated Impact on Vulnerable Community Assets

Based on historical occurrences of earthquake events, the extent of an earthquake event within the Pulaski County Planning Area can range between Mercalli Scale I to XI. The severity of an earthquake event will affect the impacts to the community's assets and population. Refer to **Table 3.19** for the range of impacts associated with different levels of earthquake severity.

No damaging earthquakes have affected the Pulaski County Planning Area since modern infrastructure has been in constructed. Historical earthquake damage estimates are therefore unavailable because the last major earthquake to affect the Pulaski County Planning Area occurred in a period where there was limited development in the area. FEMA's HAZUS-MH-MH software was used to estimate potential losses from a significant earthquake event as an alternative method to historic loss estimation.

An earthquake scenario was run using HAZUS-MH for the entire Pulaski County Planning Area. The scenario event used mimics the December 16, 1811 southern New Madrid Seismic Zone event near Marked Tree (eastern Poinsett County), Arkansas. This XI magnitude earthquake is near worst-case scenario, as earthquakes of magnitude of XI or greater occur approximately every 500 years in this area. The location of its epicenter was a likely site for an earthquake of any magnitude based upon current and historical seismic activity.

HAZUS-MH estimates that about 3,694 buildings will be at least moderately damaged – over 2% of the total number of buildings in the county. Building, transportation system, and utility system economic losses would be $188,800,000, $6,500,000, and $18,270,000 respectively (**Table 3.20**). Total economic loss in the Pulaski County Planning Area for this hypothetical event would be $213,570,000. The HAZUS-MH analysis also estimates that the Pulaski County Planning Area would suffer 105 injuries and 2 deaths ($21,050,000 FEMA Valuation). The total estimated impact from this scenario is $234,620,000.

3.20 Earthquake Structural and Economic Loss Estimates

Community Assets	Replacement Value	Estimated Damage	Method of Calculation
Structure	$19,768,788,730	$188,800,000	HAZUS-MH
Transportation and Utility System	$1,714,800,000	$6,500,000	HAZUS-MH
Economic Disruption	-	$18,270,000	HAZUS-MH
Total	**$21,483,588,730**	**$213,570,000**	HAZUS-MH

4.5.5 Jurisdictional Risk

Earthquake risk does vary by jurisdiction. The variation in risk is due to 1) proximity to the earthquake source, and 2) the underlying geology. Jacksonville, Sherwood, and northeastern unincorporated Pulaski County are closest to the highest probability earthquake source, the New Madrid Seismic Zone (NMSZ), and are therefore likely to experience slightly higher peak ground accelerations than jurisdictions to the southwest. The closest part of the NMSZ to Pulaski County is near Marked Tree, Arkansas, approximately 100 miles from Jacksonville and approximately 130 miles from Alexander.

A second factor in the varying risk facing the jurisdictions in the Pulaski County Planning Area involves the underlying geology. Most of the southeastern part of the Pulaski County Planning Area is underlain by unconsolidated alluvial sediments (Quaternary age) of the Mississippi Alluvial Valley or weakly consolidated sediments (Tertiary age) largely of the Gulf Coastal Plain (**Figure 3.16**). Most of the northwestern part of the County (with the exception of the floodplain along the Arkansas River) is underlain by consolidated bedrock (Paleozoic age). The unconsolidated sediments tend to amplify the

shaking making structures built on this sediment at higher risk to damage. Based on this assessment, Wrightsville, which is underlain entirely by unconsolidated sediment, is at highest risk. Alexander is underlain by partially consolidated sediments and is at slightly less risk. Jacksonville, Little Rock, North Little Rock, Sherwood, and Maumelle and unincorporated Pulaski County all show variable risk depending on the location within the jurisdiction. Cammack Village lies completely on bedrock and is therefore at lowest risk for amplification of ground shaking. Refer to **Figure 3.16** for a map detailing locations of relative potential for ground shaking and/or liquefaction.

Based on the above analysis, the HMPT determined each jurisdiction's earthquake risk assessment level. Refer to **Table 3.21** for each jurisdiction's risk assessment level.

3.21 Earthquake Risk Assessment by Jurisdiction

Jurisdiction	Risk Level
Alexander	Severe Risk
Cammack Village	Low Risk
Jacksonville	Moderate Risk
Little Rock	Moderate Risk
Little Rock School District	Moderate Risk
Maumelle	Moderate Risk
North Little Rock	Moderate Risk
North Little Rock School District	Moderate Risk
Pulaski County Special School District	Moderate Risk
Sherwood	Moderate Risk
Wrightsville	Severe Risk
Unincorporated Pulaski County	Severe Risk

4.6 Drought

4.6.1 Profile

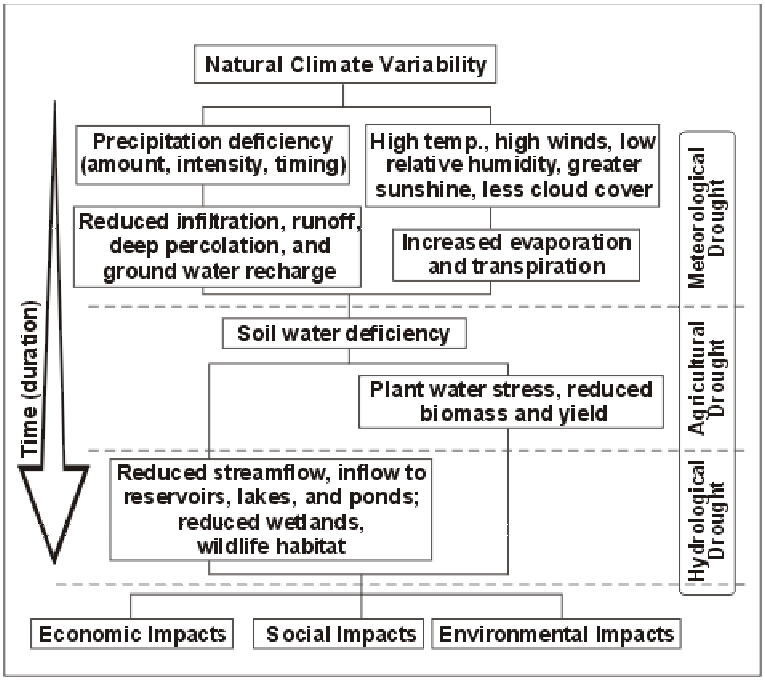
Drought is a normal, recurrent feature of climate. In the most general sense, drought originates from a deficiency of precipitation over an extended period of time, resulting in a water shortage for some activity, group, or environmental sector (U.S. Drought Monitor, 2011). This deficiency results in a water shortage for some activity, group, or environmental sector. Drought is a temporary aberration; it differs from aridity, which is restricted to low rainfall regions and is a permanent feature of climate.

Drought should be considered relative to some long-term average condition of balance between precipitation and evapotranspiration (i.e., evaporation + transpiration) in a particular area, a condition often perceived as "normal." It is also related to the timing (i.e., principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness (i.e., rainfall intensity, number of rainfall events) of the rains (U.S. Drought Monitor, 2011). Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with it in many regions of the world and can significantly aggravate its severity.

When drought begins, the agricultural sector is usually the first to be affected because of its heavy dependence on stored soil water. Soil water can be rapidly depleted during extended dry periods. If precipitation deficiencies continue, then people dependent on other sources of water will begin to feel the effects of the shortage. Those who rely on surface water (i.e., reservoirs and lakes) and subsurface water

(i.e., ground water), for example, are usually the last to be affected. A short-term drought that persists for 3 to 6 months may have little impact on these sectors, depending on the characteristics of the hydrologic system and water use requirements. Refer to **Figure 3.17** for the affects of drought over time on the community's resources and assets.

Figure 3.17 The Effect of Drought Events Over Time



Source: Arkansas Natural Resource Commission, 2005.

In 1965, W.C. Palmer developed an index to measure the departure of the moisture supply (Palmer, 1965). Palmer based his index on the supply-and-demand concept of the water balance equation, taking into account more than just the precipitation deficit at specific locations. The objective of the Palmer Drought Severity Index (PDSI), as this index is now called, was to provide measurements of moisture conditions that were standardized so that comparisons using the index could be made between locations and between months (Palmer, 1965).

The Palmer Index is most effective in determining long-term drought—a matter of several months—and is not as good with short-term forecasts (a matter of weeks). It uses a 0 as normal, and drought is shown in terms of minus numbers; for example, minus 2 is moderate drought, minus 3 is severe drought, and minus 4 is extreme drought (**Table 3.22**). The advantage of the Palmer Index is that it is standardized to local climate, so it can be applied to any part of the country to demonstrate relative drought or rainfall conditions.

3.22 Palmer Drought Severity Index (PDSI)	
Palmer Classification	Precipitation
4.0 or more	extremely wet
3.0 to 3.99	very wet
2.0 to 2.99	moderately wet
1.0 to 1.99	slightly wet
0.5 to 0.99	incipient wet spell
0.49 to -0.49	near normal
-0.5 to -0.99	incipient dry spell
-1.0 to -1.99	mild drought
-2.0 to -2.99	moderate drought
-3.0 to -3.99	severe drought
-4.0 or less	extreme drought

Scientists don't know how to predict drought a month or more in advance for most locations. Predicting drought depends on the ability to forecast two fundamental meteorological surface parameters, precipitation, and temperature. From the historical record we know that climate is inherently variable. We also know that anomalies of precipitation and temperature may last from several months to several decades. How long they last depends on air–sea interactions, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of dynamically unstable synoptic weather systems at the global scale.

4.6.2 Previous Occurrences

Recently, there have been more frequent occurrences of drought events that have affected the Pulaski County Planning Area. Since 2000, the Pulaski County Planning Area has had 12 drought events reported to NOAA and included in the database of reported storm events maintained by the NCDC (**Table 3.23**). There were no historical records of structural or crop losses as a result of these drought events.

Table 3.23 Drought Events – The Pulaski County Planning Area (1900 – 2011)				
Location	Date	Magnitude	Property Damage	Agriculture Damage
Pulaski County	4/11/1934	PDSI -3.5	$0	$0
Pulaski County	9/01/1953	PDSI -3.5	$0	$0
Pulaski County	6/01/1954	PDSI -3.5	$0	$0
Pulaski County	6/20/1980	PDSI -4.0	$0	$0
Pulaski County	9/8/2000	PDSI -3.5	$0	$0
Pulaski County	10/19/2010	PDSI -3.5	$0	$0
Pulaski County	11/01/2010	PDSI -3.5	$0	$0
Pulaski County	12/01/2010	PDSI -3.5	$0	$0
Pulaski County	01/01/2011	PDSI -3.5	$0	$0
Pulaski County	02/01/2011	PDSI -3.5	$0	$0
Pulaski County	03/01/2011	PDSI -3.5	$0	$0
Pulaski County	04/01/2011	PDSI -3.5	$0	$0
Total			**$0**	**$0**

Source: National Climatic Data Center, 2010.

- ***The Dust Bowl Drought:*** Arkansas was involved in a prolonged drought during the 1930's that resulted in dust storms and much economic misery to go along with the depression. Many summers from 1930 through 1939 were hot and dry. The worst dust storms in Arkansas came during 1934. The first dust storm was on April 11 and several others followed through the spring and summer. Note that the area of Pulaski County (the center of Arkansas) experienced a PDSI of 2.5 to 3.5 (moderate to severe drought) in 1934.

- ***The Droughts of 1953 and 1954*:** A statewide drought during the summer and fall of 1953 resulted in 100-degree weather through the month of September and even into early October in some areas. In 1954, a heat wave covered Arkansas from June 7 through September 10 and there was an accompanying drought. It was the hottest summer on record in Little Rock, and there were a record 46 days of 100° F weather and 115 days of 90° F weather. There was 100° F weather on 16 out of 17 days and 10 consecutive 100° F days during that period.

- ***The Summer of 1980:*** A heat wave and accompanying drought covered Arkansas from June 22 through September 17. It produced the hottest month on record in Little Rock. There was a record 20 consecutive days of 100° F weather that included 10 consecutive days of 105° F.

- ***Late Summer Heat Wave and Drought of 2000:*** A dry period began at the beginning of July and continued through October in most of Arkansas. This was part of a long-term drought that began in the spring of 1998. A heat wave set in by mid-August with widespread 100° F temperatures across the state through early September. Little Rock had its hottest month on record in August. There were 11 consecutive days of 100° F from August 25 through September 4, and Little Rock reached an all-time record high temperature of 111 degrees on August 30. Only .67 inches of rain was measured in July and August combined. A severe thunderstorm brought some rain to the Little Rock area on September 1st ending 27 straight days with no precipitation (a record). On September 8th, the Governor of Arkansas asked that all 75 counties in Arkansas be declared agricultural disaster areas. With foliage drying, grass fires became numerous.

Between 1900 and 2011, there have been 12 drought events in the Pulaski County Planning Area. Extrapolating from this historical data, the HMPT estimated that Pulaski County Planning Area has an average recurrence interval for droughts of 0.11 per year or an annual occurrence probability of 9%.

4.6.3 Vulnerability

The entire Pulaski County Planning Area can be affected by drought events. The HMPT concluded that structures are not vulnerable to drought events. The primary community assets that are vulnerable to drought events are Pulaski County Planning Area's water supply and agriculture.

4.6.4 Estimated Impact on Vulnerable Community Assets

Based on historical occurrences of drought events, the extent of a drought event within the Mississippi County Planning Area can range between PDSI -3.0 to PDSI -4.0. The severity of a drought event will affect the impacts to the community's assets and population. Expected drought impacts include crop and pasture losses, widespread water shortages, and burning restrictions.

Drought loss estimates were calculated by utilizing United States Department of Agriculture data and Steering Committee input. All crops within the Pulaski County Planning Area were determined to be at risk from drought events. The Steering Committee estimated that for every $1,000 in crop assets, $5.00 is

vulnerable to drought damage. The total estimated damage for a drought event is $465,759 in agricultural assets.

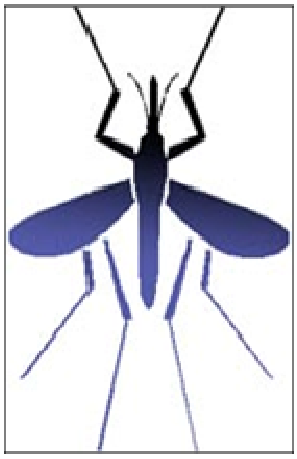
4.6.5 Jurisdictional Risk

The HMPT has determined there is no jurisdictional variation in exposure, probability, and impact to vulnerable community assets for drought events. All participating jurisdictions are at **Moderate Risk** from drought events due to the high probability of occurrence and severity of impact.

4.7 Mosquito-Borne Disease

4.7.1 Profile

Mosquitoes are a vector agent that carries disease-causing viruses and parasites from person-to-person without catching the disease themselves. Principal mosquito-borne diseases are viruses such as West Nile Virus, yellow fever, dengue fever, and Chikungunya, which are transmitted mostly by the *Aedes aegypti* mosquito, and malaria, which is carried by the genus Anopheles. Mosquitoes are estimated to transmit disease to more than 700 million people annually in Africa, South America, Central America, Mexico, and much of Asia resulting in millions of deaths, at least 2 million people annually. Methods used to prevent the spread of disease or to protect individuals in areas where disease is endemic include vector control aimed at mosquito eradication, disease prevention using prophylactic drugs, developing vaccines, and preventing mosquito bites with insecticides, nets, and repellents.



Mosquitoes are vector agents that carry disease – causing viruses and parasites.

The most deadly mosquito-borne disease is attributed to the West Nile Virus. Less than 1 percent of the people who are infected will develop serious illness. Healthy children and young adults are in the low-risk category, but people older than 50 are considered to be at a higher risk to develop a serious illness. Symptoms occur 3 to 15 days after the initial infection. Mild cases usually result in slight fever and headaches. More severe cases result in high fever or death.

4.7.2 Previous Occurrences

The Center for Disease Control (CDC) has consistently found West Nile Virus infections in birds, horses, and humans within the Pulaski County Planning Area. Since 2000, 35 cases have been confirmed by the CDC within the Pulaski County Planning Area. Refer to **Table 3.24** for annual historical occurrence of mosquito-borne disease from 2000 to 2010. The CDC does have data limitations on its recorded historical occurrence because symptoms of mosquito-borne disease often resemble symptoms of other diseases and may not be recorded.

3.24 Mosquito-Borne Disease – The Pulaski County Planning Area	
Year	Cases of Mosquito-Borne Disease
2000	2
2001	3
2002	3
2003	6
2004	6
2005	3
2006	8
2007	3
2008	1
2009	0
2010	0

Source: Center for Disease Control, 2010.

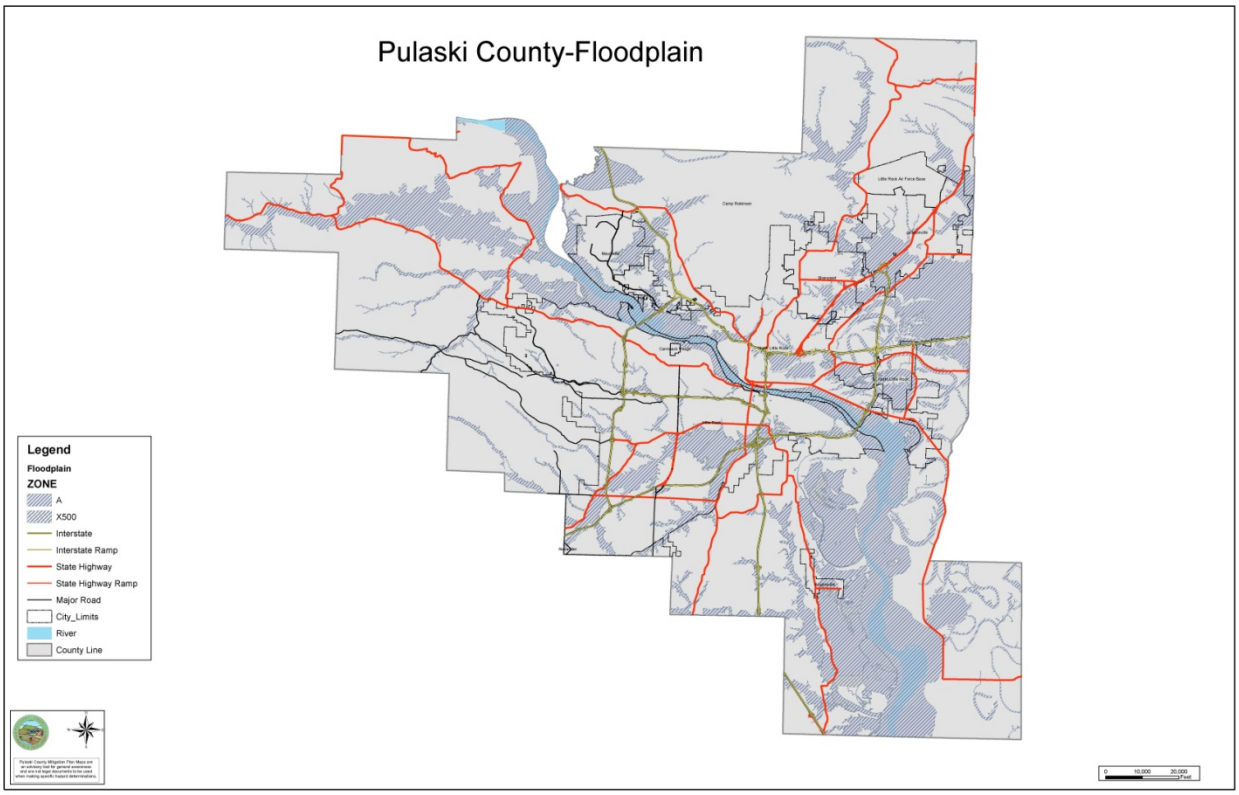
Between 2000 and 2010, there have been 35 mosquito-borne disease events that have caused human injury in the Pulaski County Planning Area. Extrapolating from this historical data, it is estimated that Pulaski County Planning Area has an average recurrence interval for mosquito-borne events of 1.25 years or an annual probability of 80%.

4.7.3 Vulnerability

The entire Pulaski County Planning Area can be affected by mosquito-borne disease events, but areas within the floodplains are may see higher occurrences. An outbreak of mosquito-borne disease for all participating jurisdictions could cause significant impact to the population's health. In the event of an outbreak of mosquito-borne disease, human illness and death rates could rise substantially within a short time period.

The Pulaski County Planning Area's low-lying areas have the potential to become breeding grounds for mosquitoes. Populations near bodies of water, identified in the floodplain maps, are more vulnerable to mosquito-borne disease (**Figure 3.18**). Mosquitoes breed and concentrate near fresh water bodies. Populations near fresh bodies of water should take additional precautions during nighttime hours to mitigate the risk of mosquito-borne disease. The impact on human health from mosquito-borne disease can include illness and death. The elderly and very young are more susceptible than those aged between 20 and 50 (CDC, 2011). These age groups tend to incur higher intensity of illness symptoms and mortality rates.

Figure 3.18 Pulaski County Planning Area Floodplain Map



4.7.4 Estimated Impact on Vulnerable Community Assets

Health-related ailments from extreme mosquito-borne disease events can include fever and death. Approximately 3.5 persons are treated and released annually or $315,000 in human injury losses (based on FEMA Injury Valuation). There are no impacts from mosquito-borne disease events on structures or agriculture. All populations within the Pulaski County Planning were determined to be at risk of impact from mosquito-borne disease events equally. The total annual estimated impact on vulnerable community assets from mosquito-borne disease events is $315,000.

4.7.5 Jurisdictional Risk

All three School Districts are at an increase risk of mosquito-borne disease because of their higher rates of population's aged below 18. These jurisdictions will need to take increased measures to mitigate long-term risk of mosquito borne disease. Little Rock School District, Pulaski County Special School District, and North Little Rock School District were determined to be at **Severe Risk** from mosquito-borne disease.

The HMPT has determined that all other participating jurisdictions are at **Moderate Risk** from mosquito-borne disease. These jurisdictions have no jurisdictional variation in exposure, probability, and impact to vulnerable community assets for mosquito-borne disease events.

4.8 Extreme Heat

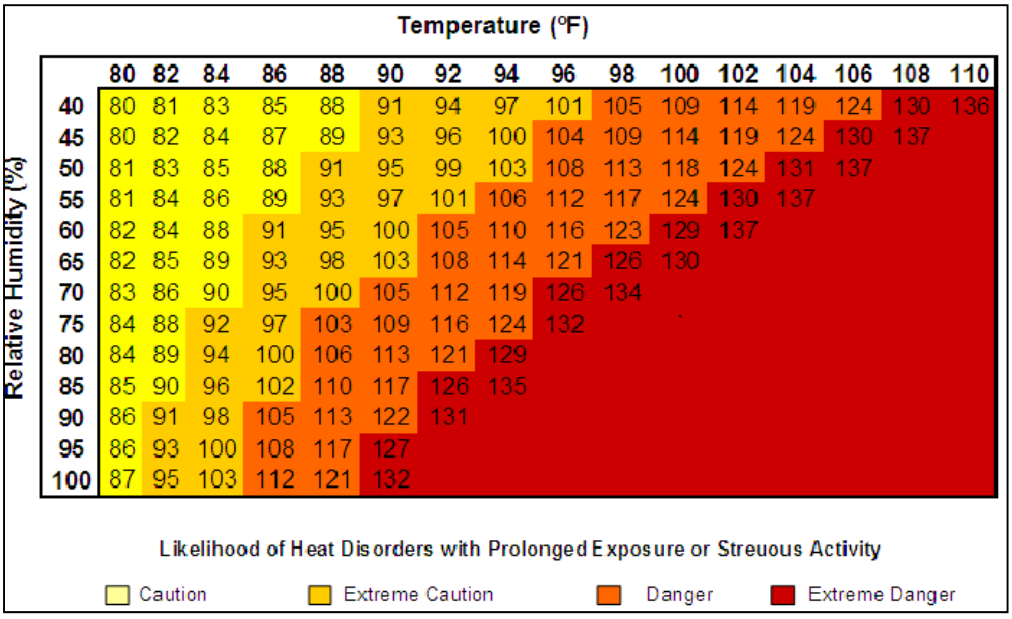
4.8.1 Profile

According to the National Oceanic and Atmospheric Association, extreme heat is the number one weather-related killer in the United States, resulting in hundreds of fatalities each year. In fact, on average, excessive heat claims more lives each year than floods, lightning, tornadoes, and hurricanes combined. In the disastrous heat wave of 1980, more than 1,250 people died nationally. In the heat wave of 1995 more than 700 deaths in the Chicago area were attributed to heat. In August 2003, a record heat wave in Europe claimed an estimated 50,000 lives.

Extreme heat events kill more people in the world annually then all other hazards combined.

Extreme heat is defined as temperatures which hover 10 degrees or more above the average high temperature for a region and last for several weeks. Created by the National Weather Service, the Heat Index (HI) is a chart which accurately measures apparent temperature of the air as it increases with the relative humidity (**Figure 3.19**).

Figure 3.19 Heat Index



Source: The National Weather Service, 2011.

The Heat Index can be used to determine what effects the temperature and humidity can have on the population. **Table 3.25** describes the adverse effects that prolonged exposures can have on individuals. To determine the Heat Index, you need the temperature and the relative humidity. Once both values are known, the Heat Index will be the corresponding number with both values. That number provides how hot it really feels. It is important to know that the Heat Index (HI) values are devised for shady, light wind

conditions. Exposure to full sunshine can increase HI values by up to 15 degrees. Also, strong winds, particularly with very hot, dry-air can be extremely hazardous to individuals.

Table 3.25 Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Category	Heat Index	Health Hazard
Extreme Damage	130°F - Higher	Heat Stroke is likely with continued exposure
Danger	105°F - 129°F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity
Extreme Caution	90°F - 105°F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and or physical activity
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity

Source: The National Weather Service, 2011.

The National Weather Service (NWS) provides alerts when the HI's approaches hazardous levels. The NWS alerts will include one of three following warnings:

- **Excessive Heat Outlooks** are issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to those who need considerable lead time to prepare for the event, such as public utilities, emergency management, and public health officials.

- **Excessive Heat Watches** are issued when conditions are favorable for an excessive heat event in the next 12 to 48 hours. A Watch is used when the risk of a heat wave has increased, but its occurrence and timing is still uncertain. A Watch provides enough lead time so those who need to prepare can do so, such as cities that have excessive heat event mitigation plans.

- **Excessive Heat Warnings/Advisories** are issued when an excessive heat event is expected in the next 36 hours. These advisories are issued when an excessive heat event is occurring, is imminent, or has a very high probability of occurring. The warning is used for conditions posing a threat to life or property. An advisory is for less serious conditions that cause significant discomfort or inconvenience and, if caution is not taken, could lead to a threat to life and/or property.

Exposure to excessive heat can pose a number of significant health risks to individuals. Refer to **Table 3.26** for the NWS description of health hazards and related symptoms.

Table 3.26 Health-related Ailments from Extreme Heat

Health Hazard	Symptom
Sunburn	Redness and pain. In severe cases: swelling of skin blisters fevers and headaches
Dehydration	Excessive thirst, dry lips, and slightly dry mucous membranes
Heat Cramps	Painful spasms, usually in muscles of legs and abdomen, and possible heavy sweating
Heat Exhaustion	Heavy sweating; weakness; cold, pale and clammy skin; weak pulse; possible fainting and vomiting
Heat Stroke	High body temperature (104°F or higher), hot and dry skin, rapid and strong pulse, and possible coma

Source: The National Weather Service, 2011.

4.8.2 Previous Occurrences

Numerous extreme heat events have affected the Pulaski County Planning Area. Since 1995, the Pulaski County Planning Area has had 16 extreme heat events, with recorded human injuries or deaths, reported to NOAA and included in the database of reported storm events maintained by the NCDC. Nineteen people died in association with these extreme heat events (**Table 3.27**).

Table 3.27 Extreme Heat Events – Pulaski County Planning Area (1995 - 2011)

Location	Date	Heat Index	Injury	Death	Property Damage	Crop Damage
Pulaski County	7/16/1995	110° - 115°	0	2	$0	$0
Little Rock	8/17/1995	100°	0	1	$0	$0
Little Rock	8/19/1995	102°	0	1	$0	$0
Pulaski County	8/21/1995	102°	0	1	$0	$0
Little Rock	8/22/1995	102°	0	1	$0	$0
North Little Rock	8/22/1995	102°	0	1	$0	$0
Pulaski County	8/25/1995	102°	0	1	$0	$0
Pulaski County	7/20/1998	100° - 107°	0	2	$0	$0
Pulaski County	8/26/1998	100°	0	0	$0	$0
Pulaski County	8/28/1998	100°	0	0	$0	$0
Pulaski County	9/05/1998	104° - 109°	0	0	$0	$0
Pulaski County	7/09/1999	100°	0	1	$0	$0
Little Rock	7/23/1999	100° - 105°	0	1	$0	$0
Pulaski County	7/26/1999	100° - 105°	0	1	$0	$0
Little Rock	7/31/1999	100° - 105°	0	1	$0	$0
Little Rock	7/08/2000	104° - 109°	0	1	$0	$0
Little Rock	08/17/2007	100° - 112°	0	3	$0	$0
Pulaski County	7/20/2008	90° - 105°	0	0	$0	$0
Pulaski County	6/24/2009	90° - 100°	0	1	$0	$0
Pulaski County	7/30/2010	100° - 110°	0	0	$0	$0
Pulaski County	8/1/2010	105° - 117°	0	0	$0	$0
Pulaski County	8/5/2010	105° - 117°	0	0	$0	$0
Pulaski County	8/8/2010	105° - 117°	0	0	$0	$0
Pulaski County	8/5/2010	105° - 117°	0	0	$0	$0
Total			**0**	**19**	**$0**	**$0**

Source: National Climatic Data Center, 2010.

In general, deaths from extreme heat events usually involve individuals that are working outside, the elderly, and people who live in substandard housing without air conditioning. Historically significant extreme events that occurred within the Pulaski County Planning Area are discussed below and highlight the type of damage that can be expected from a significant extreme heat event:

- ***Excessive Heat (August, 1995)*** In August 1995 a heat wave swept across Pulaski County for 3 weeks. During this extreme heat event 6 people died due to health complications. One death involved a 13-year-old boy who was overcome by heat at a junior high school football practice. The boy was taken to a hospital in Little Rock where he later died from complications arising from the heat. The other 5 deaths involved elderly persons whom did not have air condition in their housing unit.

- ***Excessive Heat (August 2007):*** A heat wave began on August 6th and continued through the 16th. By the 10th, many of the reporting stations were recording high temperatures of 100 degrees or higher. On the 11th and 12th, more than half of the reporting stations reached 100 degrees or higher. From the 13th through the 15th, nearly every station climbed to at least 100. The highest temperature reported during the heat wave was 112.

  This heat wave led to three deaths in the City of Little Rock. On August 12, 2011, two men were found dead in their homes. The temperature of each of their homes was in excess of 100 degrees. On August 17th a 52 year-old man was found dead outside a tractor-trailer park in unincorporated Pulaski County.

Based on historical extreme heat loss data from 1995 through 2011 from the NCDC's Database, the impact of the extreme heat hazard can be estimated. Between 1995 and 2011, there have been 8 recorded years of extreme heat events in the Pulaski County Planning Area that have caused human injury or death. Extrapolating from historical data, the HMPT estimated that the Pulaski County Planning Area has an average recurrence interval for extreme heat events of 2.0 or an annual probability of 50%.

4.8.3 Vulnerability

The entire Pulaski County Planning Area is at risk from extreme heat events. Extreme heat events vary in severity. According to the NCDC, typical temperature ranges during heat waves in the Pulaski County Planning Area range from 100° to 105° degrees Fahrenheit. The highest recorded temperature in the Pulaski County Planning Area was 117° degrees Fahrenheit in August of 2010.

The occurrence of extreme heat can have a substantial impact on the Pulaski County Planning Area's population. Temperatures ranging from 105°F - 129°F, can cause sunstroke, muscle cramps, and/or heat exhaustion with prolonged exposure and/or physical activity. These symptoms can also lead to hospitalization and/or human death.

The HMPT identified multiple population groups that are more vulnerable to impacts related to extreme heat events. The following groups could be considered vulnerable or at greater risk to extreme heat events:

- Homeless;
- Population below the age of 18;
- Population above the age of 75;
- Women who are pregnant;
- People who have obesity;
- People with medical conditions (e.g., heart disease, diabetes, high blood pressure);
- People who use medical equipment;
- People who work outside; and
- People living in poverty.

People living in substandard housing units or manufactured housing units throughout Pulaski County Planning Area are more vulnerable to injury from extreme heat events. Many of these units do not have proper insulation or air conditioning systems to protect residents from prolonged high temperatures. Temperatures can rise to above 100° F in substandard housing or manufactured housing units without proper insulation or air conditioning. Prolonged exposure to temperatures above 100° F can cause significant injury and/or death.

4.8.4 Estimated Impact on Vulnerable Community Assets

The extent of extreme heat events vary in severity. According to the NCDC, typical temperature ranges during heat waves in the Pulaski County Planning Area range from 100°F to 129°F. Health-related ailments from extreme heat events at these temperatures can include heat stroke and death.

There are no impacts from extreme heat events on structures or agriculture. To estimate future human injury, the HMPT annualized losses associated with historical extreme heat events based on extent of extreme heat events. This calculation amounted to an annual loss of life of approximately 1.187 persons or $6,960,000 (based on FEMA Injury Valuation).

4.8.5 Jurisdictional Risk

The HMPT has determined there is no jurisdictional variation in exposure, probability, and impact to vulnerable community assets for extreme heat events. All participating jurisdictions are determined to be at **Severe Risk** from extreme due to the high probability of occurrence and severity of impact.

4.9 Wildfire

4.9.1 Profile

A wildfire is an uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures. They often begin unnoticed and spread quickly and are usually signaled by dense smoke that fills the area for miles around. Naturally occurring and non-native species of grasses, brush, and trees fuel wildfires. A wildland fire is a wildfire in an area in which development is essentially nonexistent, except for roads, railroads, power lines, and similar facilities. A Wildland-Urban Interface (WUI) fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels. Areas with a large amount of wooded, brush and grassy areas are at highest risk of wildfires. Refer to **Figures 3.20** and **3.21** for an example of two dominate WUI areas, intermix and boundary.

Figure 3.20 Example of Wildland-Urban Intermix Zone

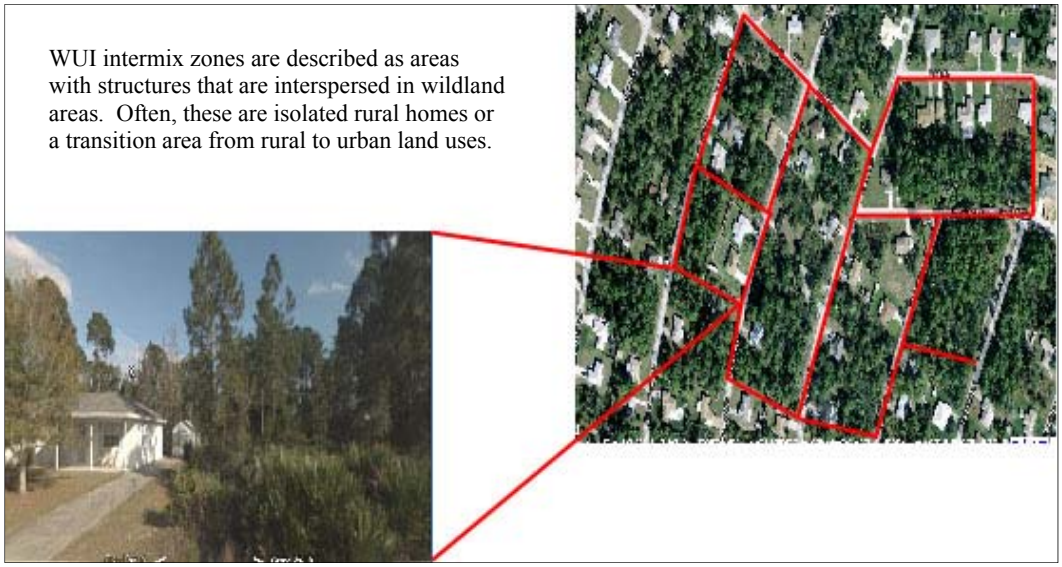


Image source: Google Earth 2010.

Figure 3.21 Example of Wildland-Urban Boundary Zone

Image source: Google Earth 2010.

Wildfire behavior is based on three primary factors: fuel, topography, and weather. The type, and amount of fuel, as well as its burning qualities and level of moisture affect wildfire potential and behavior. **Table 3.28** shows the effect of different fuel characteristics on fire behavior. Topography also is important because it affects the movement of air (and thus the fire) over the ground surface. The slope and shape of terrain can change the rate of speed at which the fire travels. Weather affects the probability of wildfire and has a significant effect on its behavior. Temperature, humidity and wind (both short and long term) affect the severity and duration of wildfires.

Table 3.28 Characteristics of Fuels Related to Fire Behavior

Fuel Characteristics	Relationship to Fire Behavior
Height of surface fuel (fuel depth) and total available fuel (fuel load)	If fuel depth and load are heavy, flames will be longer and more heat will be released. As fuel depth and load are reduced, the flame length and heat are reduced
Fuel loading by fuel size class (size classes range from fine to large fuels)	Fine fuels (e.g., pine needles) ignite more readily and burn more quickly. Larger fuels (e.g., branches) burn more slowly but generate more heat energy and can be difficult to extinguish
Compactness of fuels	Fuels that are tightly compacted will not burn as well. Fuels that are loosely compacted will burn better. Fuels that are very loose (e.g., sparse tree branches) may not be able to burn unless a nearby fire heats them
Vertical continuity of fuels (presence or absence of vertical fuels, called "ladder fuels")	Vertically continuous fuels, such as vines or understory trees, can carry fire into the canopy (crowns of trees). Breaks in vertical continuity can prevent wildfire from getting into the canopy
Dead-to-live fuels ratio	Although some of Arkansas's live fuels are very volatile, they generally only ignite and burn once they are heated by burning dead fuels. If the ratio of dead fuels to live fuels is high (as after a drought or killing frost), the fire behavior is more intense

Source: Florida Department of Community Affairs/Florida Department of Agriculture & Consumer Services (April 2004).

4.9.2 Previous Occurrences

Based on Arkansas Forestry Commission data from 1989 through 2010, 517 wildfires required suppression in the Pulaski County Planning Area (**Table 3.29**). The total acreage burned from these events totaled 9,756. Over this period, the average area burned annually was 443 acres. Historically significant wildfire events that occurred within the County are discussed below and highlight the type of damage that can be expected:

- ***Little Rock Wildfire (1987):*** About 20 acres of woods next to Walton Heights subdivision in west Little Rock was destroyed by fire- 20 houses were threatened on the south side of the Ridgecrest Drive. Wind apparently is to blame for spreading the fire, which resulted from a man burning leaves behind a business off Highway 10; 40 firemen and several residents spent 4 hours battling the fire. No fatalities, personal injuries, or personal property was lost.

- ***Unincorporated Pulaski County Wildfire (2009):*** A grass fire got out of control 2 miles southwest of Scott. A vacant mobile home and a large, abandoned barn were destroyed and another mobile home was damaged. Four fire departments managed to stop the fire before it could spread to several occupied mobile homes.

- ***Camp Robinson Wildfire (2010):*** A wildfire at Camp Robinson burned approximately 500 acres on the northern end of the post. The fire was started due to a round being fired on the M203 Grenade Launcher range. Camp Robinson's Fire and Public Safety Departments, Installation Support Unit, Range Control, and the National Guard's 77th Aviation Brigade fought the fire. A UH-60 Blackhawk helicopter used a 600-gallon Bambi Bucket to drop water on the fire. The water was obtained from Hunter Lake on the post. Some retired military vehicles used as targets on the range burned, but no structures or active inventory equipment was damaged.

Table 3.29 Wildfire Events – Pulaski County Planning Area (1989 – 2010)

Location	Year	Number of Wildfire Events	Total Acreage Burned
Pulaski County	1989	33	357
Pulaski County	1990	38	629
Pulaski County	1991	22	203
Pulaski County	1992	35	350
Pulaski County	1993	48	933
Pulaski County	1994	16	411
Pulaski County	1995	45	549
Pulaski County	1996	22	1,289
Pulaski County	1997	9	108
Pulaski County	1998	21	423
Pulaski County	1999	26	166
Pulaski County	2000	26	449
Pulaski County	2001	33	534
Pulaski County	2002	12	241
Pulaski County	2003	14	102
Pulaski County	2004	12	93
Pulaski County	2005	18	370
Pulaski County	2006	32	632
Pulaski County	2007	14	67
Pulaski County	2008	7	45
Pulaski County	2009	7	48
Pulaski County	2010	27	1,757
Total		**517**	**9,756**

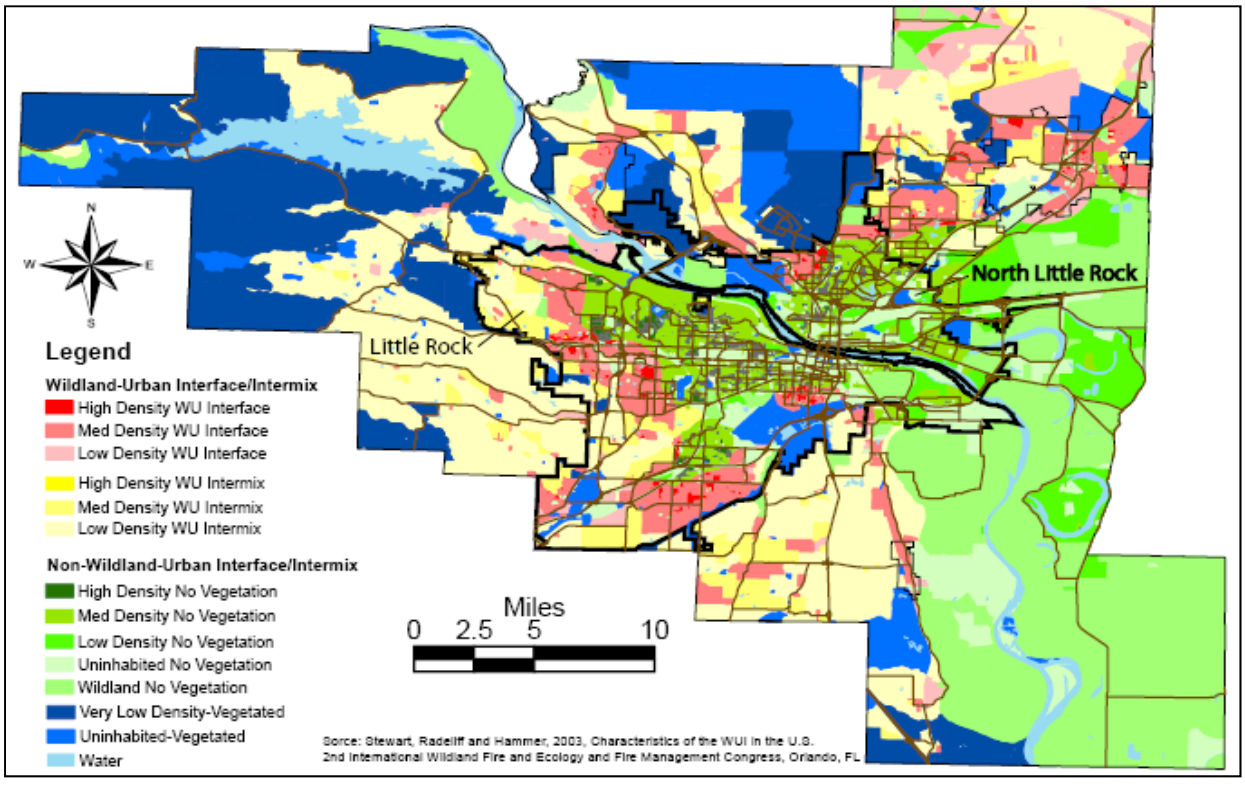
Source: Arkansas Forestry Commission, 2011.

Based on historical wildfire acreage burned data from 1989 through 2010 from the Arkansas Forestry Commission, the impact of the wildfire hazard can be estimated. Between 1989 and 2010, there have been 517 wildfire events that have burned land acreage within the Pulaski County Planning Area. Extrapolating from historical data, it is estimated that the Pulaski County Planning Area has an average recurrence interval for wildfire events of 0.99 years or an annual occurrence probability of 99%.

4.9.3 Vulnerability

WUI areas are the geographical areas affected by wildfire events in Pulaski County Planning Area. These are areas where structures and other human development meet or intermix with undeveloped wildland. The WUI creates an environment in which fire can move readily between structural and vegetation fuels. Its expansion in recent years has increased the likelihood that wildfires will threaten structures and people. A map depicting the interface and intermix WUI in Pulaski County is presented in **Figure 3.22**. All structures, including critical facilities and infrastructure within any yellow or red area on **Figure 3.22** are vulnerable to wildfire. Large numbers of structures are vulnerable in areas of the map that are dark red or dark yellow. Although all building construction types within the WUI are vulnerable, the most vulnerable construction type is wood, which comprises approximately 70% of the structures in the Pulaski County Planning Area. The Pulaski County Planning Area may become more vulnerable in the future if development continues to sprawl into WUI areas.

Figure 3.22 Pulaski County Planning Area's Wildland-Urban Interface Map



Source: Arkansas Forestry Commission, 2006.

4.9.4 Estimated Impact on Vulnerable Community Assets

Impacts from a wildfire event can include structural damage, crop damage, and burn bans. Currently, the Arkansas Forestry Commission does not record structural or crop losses due to wildfire events.

All structures and critical facilities within Pulaski County as well as all participating jurisdictions were determined to be at varying risk of impact from wildfire based on their respective location to WUI. It was estimated that out of the total 493,324 acres in the Pulaski County Planning Area, approximately 465 acres will burn annually. To estimate a crude dollar loss figure, the HMPT assumes that on average each of the 493,323 acres is worth $100. This amounts to wildfire loss of $46,500 annually.

4.9.5 Jurisdictional Risk

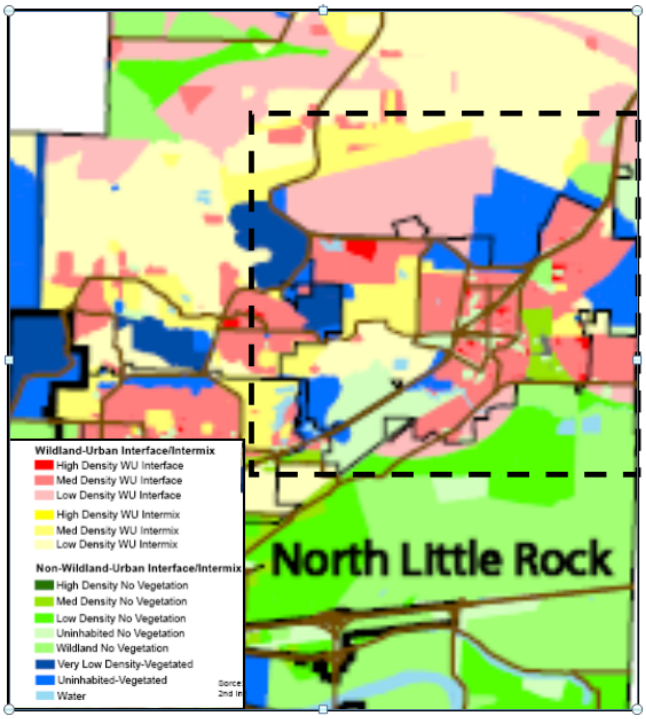
Wildfire risk in the Pulaski County Planning Area varies considerably by jurisdiction. Refer below for a description of each jurisdiction's exposure to wildfire events.

Alexander: The City of Alexander has no significant wildland-urban interface areas. The City of Alexander is at **Low Risk** from a wildfire event.

Cammack Village: The City of Cammack Village has no significant wildland-urban interface areas. The City of Cammack Village is at **Low Risk** from a wildfire event.

Jacksonville: Refer to **Figure 3.23** for a map depicting the interface and intermix WUI areas in the City of Jacksonville. All structures within any yellow or red area on **Figure 3.23** are particularly vulnerable to wildfire because of their location near wildland areas. The majority of the northern section of the City of Jacksonville is in a low or medium density WUI area. The City of Jacksonville is at **Moderate Risk** from a wildfire event.

Figure 3.23 City of Jacksonville Wildland-Urban Interface Map



Little Rock: Refer to **Figure 3.22** for a map depicting the interface and intermix WUI areas in the City of Little Rock. All structures within any yellow or red area on **Figure 3.22** are particularly vulnerable to wildfire because of their location near wildland areas. Many areas within the southern and western section of the City of Little Rock are in medium to high density WUI areas. The City of Little Rock is at **Moderate Risk** from a wildfire event.

Little Rock School District: The Little Rock School District is within the boundary of the City of Little Rock and has the same risk. The Little Rock School District is at **Moderate Risk** from a wildfire event.

Maumelle: The City of Maumelle has no significant wildland-urban interface areas. The City of Maumelle is at **Low Risk** from a wildfire event.

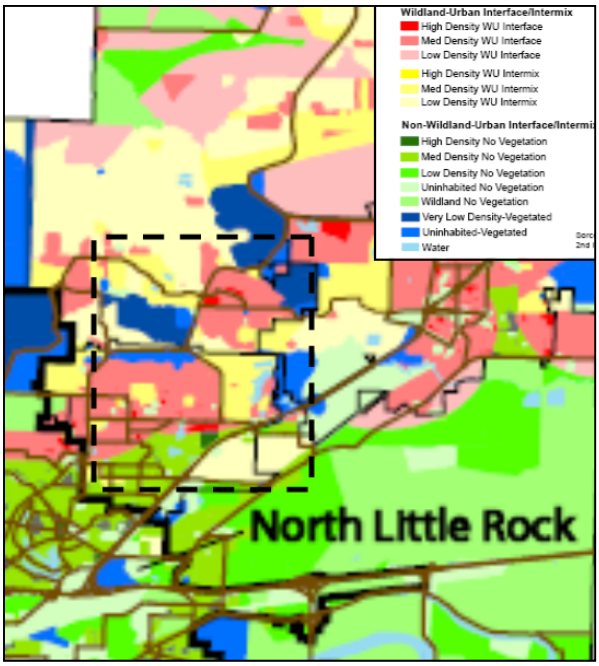
North Little Rock: Refer to **Figure 3.22** for a map depicting the interface and intermix WUI areas in the City of North Little Rock. All structures within any yellow or red area on **Figure 3.22** are particularly vulnerable to wildfire because of their location near wildland areas. The majority of the City of North Little Rock is not vulnerable to wildfire risk. An area approximately 2 miles north of the city center is identified to have some parcels in the medium and high-density WUI interface. The City of North Little Rock is at **Moderate Risk** from a wildfire event.

North Little Rock School District: The North Little Rock School District is within the boundary of the City of North Little Rock and has the same risk. The North Little Rock School District is at **Moderate Risk** from a wildfire event

Pulaski County Special School District: The Pulaski County Special School District is within the boundary of Unincorporated Pulaski County and has the same risk. The Pulaski County Special School District is at **Severe Risk** from a wildfire event.

Sherwood: Refer to **Figure 3.24** for a map depicting the interface and intermix WUI areas in the City of Sherwood. All structures within any yellow or red area on **Figure 3.24** are particularly vulnerable to wildfire because of their location near wildland areas. The majority of the City of Sherwood is in low or medium density WUI area. The City of Sherwood is at **Moderate Risk** from a wildfire event.

Figure 3.24 City of Sherwood Wildland-Urban Interface Map



Wrightsville: The City of Wrightsville has no significant wildland-urban interface areas. The City of Wrightsville is at **Low Risk** from a wildfire event.

Unincorporated Pulaski County: Refer to **Figure 3.22** for a map depicting the interface and intermix WUI areas in the Unincorporated Pulaski County. All structures within any yellow or red area on **Figure 3.22** are particularly vulnerable to wildfire because of their location near wildland areas. Historically, Unincorporated Pulaski County has suffered the largest number of wildfires events of any jurisdiction within Pulaski County Planning Area (112 wildfire events since 1984). Many areas in Unincorporated Pulaski County have low-density development which may reduce the potential for structural damage from wildfire events. Limited transportation and fire response accessibility in Unincorporated Pulaski County increases the potential for more wildfires to burn more acres before the wildfire is contained and then suppressed. Unincorporated Pulaski County is at **Severe Risk** from a wildfire event.

5 MAN-MADE HAZARDS

5.1 Dam Failure

5.1.1 Profile

According to the Dam Safety Performance Report for the State of Arkansas, "Dams are a critical part of the nation's infrastructure, providing vital benefits such as flood protection, water supply, hydropower, irrigation, and recreation. Yet thousands of U.S. dams have the potential to fail with tragic consequences. Our nation's dams are aging and deteriorating while downstream populations are increasing; this situation demands greater attention to and investment in measures that reduce risks to public safety and economic assets."

Little Rock Dam and Recreational Area

The three most common reasons for dam failure are 1) internal erosion of the piping system compromises the safety of the dam, 2) poor maintenance and over-topping of the dam, which causes erosion of the structure, and 3) structural damage caused by other hazard, slope instability, faulty construction, or poor maintenance. The consequences of a dam failure event can be catastrophic. In the past 30 years, there have been over 135 fatalities and more than $2.6 billion in property damage in the United States from dam failures.

Dam risk and impact potential is measured through Arkansas State Statute in Arkansas Article VII Sections 705.3 and 705.4. AR Law Article VII, Section 705.3 Size Classification Criteria states, "[Dam] size classification is based on the more stringent of two categories, either height of dam or maximum storage, and shall be in accordance with (**Table 3.30**) of this section."

Table 3.30 Dam Size Classification

Dam Size	Maximum Storage (Acre-Feet)	Height (Feet)
Small	50 - 1,000	25 - 40
Intermediate	1,000 - 50,000	40 - 100
Large	Over 50,000	Over 100

Source: AR Law Article VII Section 705.3.

AR Law Article VII, Section 705.4. Hazard Classification Criteria states, "Hazard classification shall be based on the more stringent of either potential loss of human life or economic loss in accordance with (**Table 3.31**) of this section. If doubt exists concerning classification, the more hazardous category must be selected. In addition, the hazard classification does not indicate the physical condition of the dam."

Table 3.31 Dam Hazard Classification Criteria		
Hazard Level	Loss of Human Life	Economic Loss
Low	No	Minimal (No significant structures; pastures, woodland, or largely undeveloped land); less than $100,000
Significant	No	Appreciable (Significant structures, industrial, or commercial development, or cropland); $100,000 to $500,000.
High	Yes	Excessive (Extensive public, industrial, commercial, or agricultural development); over $500,000
*Note: Loss of human life is based upon presence of habitable structures.		

Source: AR Law Article VII Section 705.4.

5.1.2 Previous Occurrences

According to data from the Arkansas Soil and Water Conservation Commission Dam Safety Program, no failure of a permitted dam has occurred in the Pulaski County Planning Area or anywhere in the State of Arkansas. Permitted dams are those that exceed 25 feet in height and impound at least 50-acre feet of water. Smaller, non-permitted dams have failed or been overtopped on occasion in Arkansas, although records of these events are not kept. These non-permitted dams are generally small, low hazard dams that lacked engineering design and have not caused significant damage in the past.

No dam failures have been reported in Pulaski County, therefore dam failure event's estimated impact on vulnerable structures in Pulaski County is not well known from a historical perspective. Based on this limited data, failure of permitted dams is not likely to be more frequent than once every 50 years or a 2% annual chance. Failure of smaller non-permitted dams may be more frequent (Arkansas Soil and Conservation Commission Dam Safety Program, 2011).

5.1.3 Vulnerability

The Pulaski County Planning Area's vulnerability to dam failure events is location specific. A variety of factors affect the type and severity of dam failure events within the Pulaski County Planning Area, including the dam's location to large populations, storage, maintenance, and surrounding area typography. The HMPT has reviewed the Arkansas Natural Resource Commission Dam Safety Program Hazard Classification List to conduct its risk assessment of dam failure events by jurisdiction.

There are 96 permitted dams within the Pulaski County Planning Area. Of these 96 permitted dams, 18 are classified as high hazard dams, 31 are classified as significant hazard dams, and 47 are classified as low hazard dams (**Table 3.32**). All high hazard class dams that are permitted by the State of Arkansas are required to have Emergency Action Plans (EAP's). EAPs provide a blueprint for responding to dam failure events and can be acquired through the dam's owner or the State of Arkansas Natural Resource Commission. The HMPT will only profile vulnerabilities and impacts for the 18 high hazard dams.

The HMPT has determined that the HMP will only profile vulnerabilities and impacts for the 18 high hazard dams due to the risks associated with these dams. In future updates, significant hazard dams may also be profiled in the HMP.

Table 3.32 Dams within Pulaski County Planning Area by Hazard Classification

Dam	River Stream	Jurisdiction	Height (ft)	Volume (acre ft)	Hazard Classification
Beall Lake Dam	Kellogg Creek	Pulaski County	14	59	High
Davis Lake Dam	Bayou Meto	Jacksonville	24	53	High
Ginger Hill Lake Dam	Little Maumelle River	Pulaski County	30	120	High
Green Lake Dam	Mc Henry Creek	Pulaski County	25	75	High
Todd Lake Dam	Kellogg Creek	Pulaski County	8	178	High
Florence Dam	Mchenry Creek	Pulaski County	24	135	High
Broadmoor Lake Dam	Coleman Creek	Little Rock	26	80	High
Foreman Lake Dam	Grassy Flat Creek	Little Rock	23	69	High
Jackson Reservoir Dam	Pumped Reservoir	Little Rock	66	353	High
Sprick Lake Dam	Fourche Creek Os	Little Rock	13	52	High
Spring Valley Lake No 1 Dam	Payne Branch	Little Rock	27	156	High
Twin Lakes Dam A	Rock Creek	Little Rock	20	188	High
Twin Lakes Dam B	Rock Creek	Little Rock	15	34	High
Wingate Lake Dam	Rock Creek	Little Rock	16	57	High
Lakewood Lake No 1 Dam	Arkansas River	North Little Rock	29	378	High
Lakewood Lake No 6 Dam	Arkansas River	North Little Rock	22	84	High
Little Indian Lake No 1 Dam	Five Mile Creek	North Little Rock	27	41	High
Little Indian Lake No 2 Dam	Five Mile Creek	North Little Rock	23	57	High
Murray Lock And Dam (Pool 7)	Arkansas River	Little Rock	23	87100	Significant
Sandpiper Lake Dam	Brodie Creek	Little Rock	0	36	Significant
Spring Lake Dam	Brodie Creek	Little Rock	0	38	Significant
Spring Valley Lake No 2 Dam	Payne Branch	Little Rock	0	42	Significant
Tall Timber Lake Dam	Brodie Creek	Little Rock	0	29	Significant
Lakewood Lake No 2 Dam	Dark Hollow Drain	North Little Rock	64	1434	Significant
Lakewood Lake No 3 Dam	Arkansas River	North Little Rock	30	140	Significant
Paradise Lake Dam	Bayou Meto	Jacksonville	10	51	Significant
Transvaal Company Lake Dam	Rocky Branch	Jacksonville	0	54	Significant
Beggs Lake Dam (Pine Crest Lake Dam)	Panther Creek	Pulaski County	30	204	Significant
Camp Robinson Lake Dam No 2	Fivemile Creek	Pulaski County	0	288	Significant
David D Terry Lock And Dam (Pool 6)	Arkansas River	Pulaski County	28	59600	Significant
Dupree Lake Dam	Bayou Meto	Pulaski County	0	166	Significant
Ferncrest Dam	Fletcher Creek Trib.	Pulaski County	57	610	Significant
Glover Lake Dam	Fourche Creek	Pulaski County	0	76	Significant
Hatcher Lake No 2 Dam	Bayou Meto	Pulaski County	16	160	Significant
Hatcher Lake Number 1 Dam	Bayou Meto	Pulaski County	0	78	Significant
Indianhead Lake Dam	Kellogg Creek	Pulaski County	0	2240	Significant
Jabo Lake Dam	Fletcher Creek	Pulaski County	32	250	Significant
Koban Lake Dam	Mc Henry Creek	Pulaski County	29	223	Significant
Lake Cherrywood Dam	Woodruff Creek	Pulaski County	0	140	Significant
Lake Maumelle Dam	Maumelle Creek	Pulaski County	65	220000	Significant
Lake Nixon Dam	Mc Henry Creek	Pulaski County	35	238	Significant
Lake Patricia Dam	Mc Henry Creek	Pulaski County	27	197	Significant
Lake Valencia Dam	White Oak Bayou	Pulaski County	0	68	Significant
Laman Lake Dam	Bayou Two Prairie	Pulaski County	20	168	Significant

Table 3.32 Dams within Pulaski County Planning Area by Hazard Classification

Dam	River Stream	Jurisdiction	Height (ft)	Volume (acre ft)	Hazard Classification
Landmark Lake Dam	Treadway Branch	Pulaski County	0	58	Significant
Maumelle Nursery Pond Dam (Frank Lyon Jr. Nursery Pond Dam)	Twin Creek	Pulaski County	60	1985	Significant
Sturgis Pond Dam	Little Maumelle River	Pulaski County	23	110	Significant
Tall Pine Lake Dam	Mchenry Creek	Pulaski County	0	61	Significant
Wilkins Lake Dam	Bayou Two Prairie	Pulaski County	29	110	Significant
Armstrong Dam	Ferndale Creek	Pulaski County	18	0	Low
Thomas Lake Dam (Jacksonville Air Force Base Lake Dam)	Bayou Meto	Jacksonville	0	522	Low
4-H Lake Dam	Ferndale Creek	Pulaski County	18	60	Low
Alneta Lake Dam	Little Maumelle River	Pulaski County	0	70	Low
Baldwin Lake Dam	Kinley Creek	Pulaski County	0	95	Low
Bredlow Reservoir Dam	Beaverdam Bayou	Pulaski County	0	144	Low
Brown Lake Dam	Bayou Meto	Pulaski County	18	88	Low
Camp Robinson Lake Dam No 1	Fivemile Creek	Pulaski County	0	120	Low
Cecil White Lake Dam	Fourche Creek	Pulaski County	0	72	Low
Dailey Lake Dam	Fourche Creek	Pulaski County	0	54	Low
Davidson Lake	Ross Hollow	Pulaski County	20	75	Low
Dougan Lake Dam	Little Maumelle	Pulaski County	18	72	Low
Dyke Ind. Lake Dam	Mc Henry Creek	Pulaski County	25	255	Low
Faulkner Lake Dam	Bayou Meto	Pulaski County	0	58	Low
Green Bear Lake Dam	Mchenry Creek	Pulaski County	0	58	Low
Gribble Lake Dam	Bayou Meto	Pulaski County	0	108	Low
Gropper Lake Dam	Harris Bayou	Pulaski County	0	78	Low
Harris Lake Dam	Ink Bayou	Pulaski County	15	240	Low
Hudmans Lake Dam No 1	Newton Creek	Pulaski County	0	62	Low
Hudmans Lake Dam No 2	Newton Creek	Pulaski County	18	108	Low
Jackson Lake Dam	Bayou Meto	Pulaski County	0	58	Low
Keener's Dam	Two Prairie Bayou	Pulaski County	25	252	Low
L D Rogers Lake Dam	Palarm Creek	Pulaski County	0	53	Low
Lake Willastein Dam	Arkansas River	Maumelle	20	192	Low
McConnell Lake Dam (Mattews Lake Dam)	Five Mile Creek	Pulaski County	0	53	Low
Mills Valley Lake Dam	Little Creek	Pulaski County	21	105	Low
Montgomery Lake Dam	Nowlin Creek	Pulaski County	0	94	Low
Sam Gray Lake Dam	Little Maumelle Riv	Pulaski County	0	79	Low
Sessions Lake Dam	Bayou Meto	Pulaski County	15	90	Low
Waldron Lake Dam	Clear Creek	Pulaski County	0	54	Low
Walton Lake Dam	Fish Creek	Pulaski County	0	91	Low
Willow Beach Lake Dam	Arkansas River	Pulaski County	0	720	Low
Eanes Minnow Farm Lake Dam No 1	Dry Bayou	Pulaski County	0	306	Low
Eanes Minnow Farm Lake Dam No 2 (Tull Lake Dam)	Dry Bayou	Pulaski County	0	288	Low
Kevin Mcreynolds Lake Dam	Fourche Creek	Pulaski County	25	280	Low
Lake Kuykendall Dam	Clark Bayou	Pulaski County	0	180	Low
Aldersgate Lake Dam	Brodie Creek	Little Rock	0	32	Low
Big Rock Settling Pond Dam	Fourche Creek Os	Little Rock	0	432	Low

Table 3.32 Dams within Pulaski County Planning Area by Hazard Classification					
Dam	River Stream	Jurisdiction	Height (ft)	Volume (acre ft)	Hazard Classification
Cook Lake Dam	Brodie Creek	Little Rock	18	50	Low
Coulter Lake Dam	Little Fourche Creek	Little Rock	22	50	Low
Jack Ward Lake Dam	Brodie Creek	Little Rock	35	62	Low
Kirk Lake Dam	Rock Creek	Little Rock	0	31	Low
Lower Spring Lake Dam	Brodie Creek	Little Rock	0	26	Low
Pleasant Valley Cc Lake Dam	Grassy Flat Creek	Little Rock	17	53	Low
St. Charles Lake Dam	Rock Creek	Little Rock	21	22	Low
Western Hills Lake Dam	Fourche Creek	Little Rock	24	76	Low
Wilson Lake Dam	Brodie Creek	Little Rock	17	73	Low

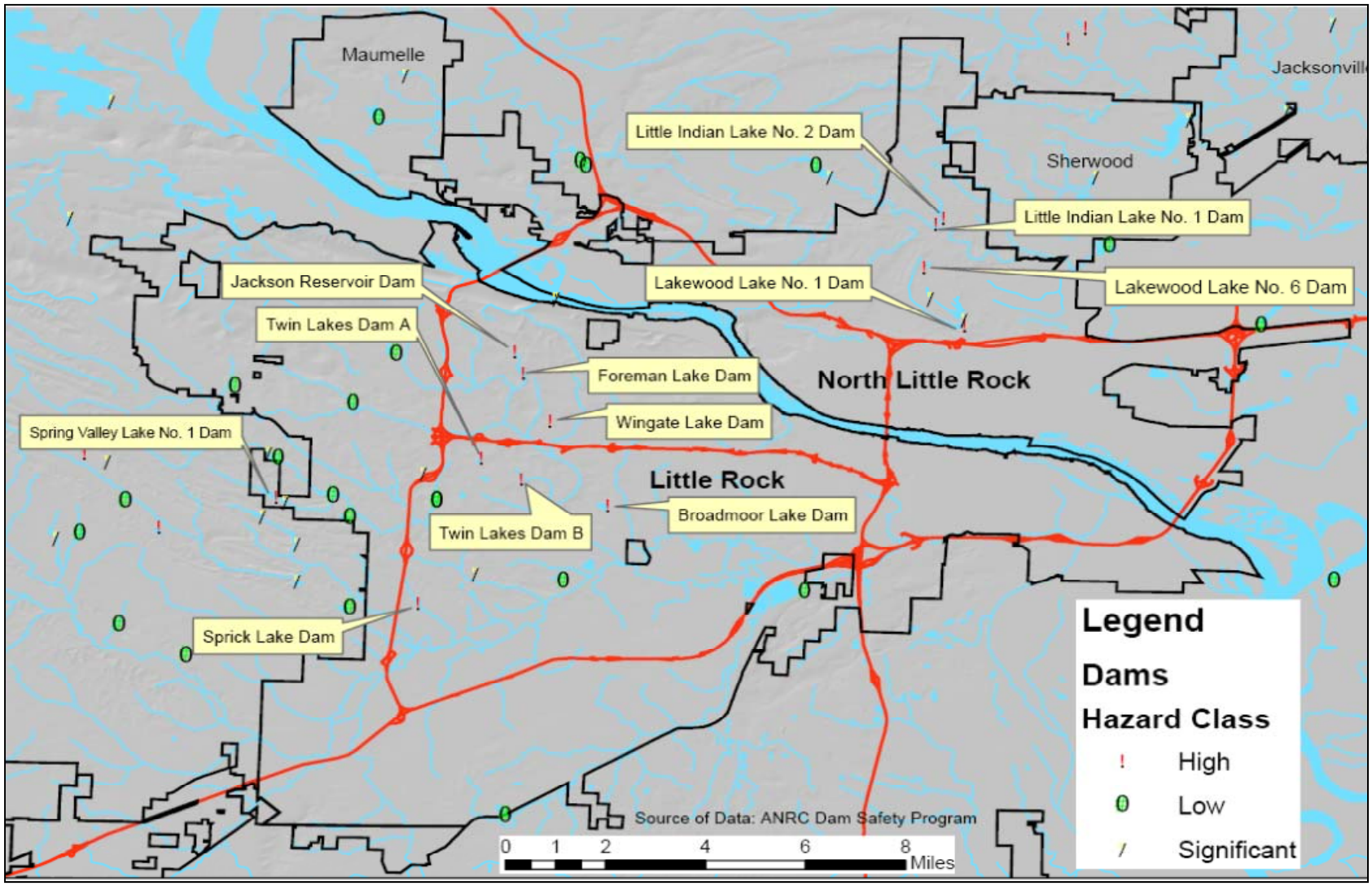
Source: Arkansas Natural Resource Commission Dam Safety Program, 2011.

High hazard dams are located throughout the Pulaski County Planning Area, but are most common in Ouachita Mountains in the southwest and northeast sections of the Pulaski County Planning Area where the topography is conducive to deep impoundments (**Figure 3.25**). People, property and infrastructure downstream of dams could be subject to devastating damage in the event of a dam failure. The areas that could be potentially impacted are delineated in red, using dam breech analyses that consider both "sunny day" failures and failures under flood conditions. The downstream extent of impact areas and the height to which waters will rise are largely functions of valley topography and the volume of water released during failure. Exposure is compounded in communities experiencing growth because the typical dam-break floodplain is more extensive than the floodplain outlined for regulatory purposes. The hazard classification of upstream dams is not often considered when permitting development. New development may therefore be occurring without full recognition of the potential hazard.

Structures vulnerable to dam-failure floods are those within and often beyond floodplains downstream from dams. In addition to the familiar water damage structures suffer during riverine or flash floods, the rapid rise of water, likely higher flood elevation, and potentially high water velocity associated with dam-failure floods present additional problems for structures in the inundation zone. A dam breach analysis will need to be performed by an engineering to determine exactly which areas are vulnerable for each dam failure event.

For planning purposes only the HMPT has determined that the surrounding area of each high hazard dam is vulnerable to a dam failure event. Refer to the yellow shaded areas in **Figures 3.26** to **3.43** for the vulnerable areas to each of the 18 high hazard dams in the event of a dam failure. Refer to **Subsection 5.1.5** for jurisdictional variation in risk.

Figure 3.25 Locations of Pulaski County Planning Area's Permitted Dams by Hazard Class



Source: Arkansas Natural Resource Commission Dam Safety Program, 2011.

Figure 3.26 Beal Lake Dam Failure Event Vulnerable Areas

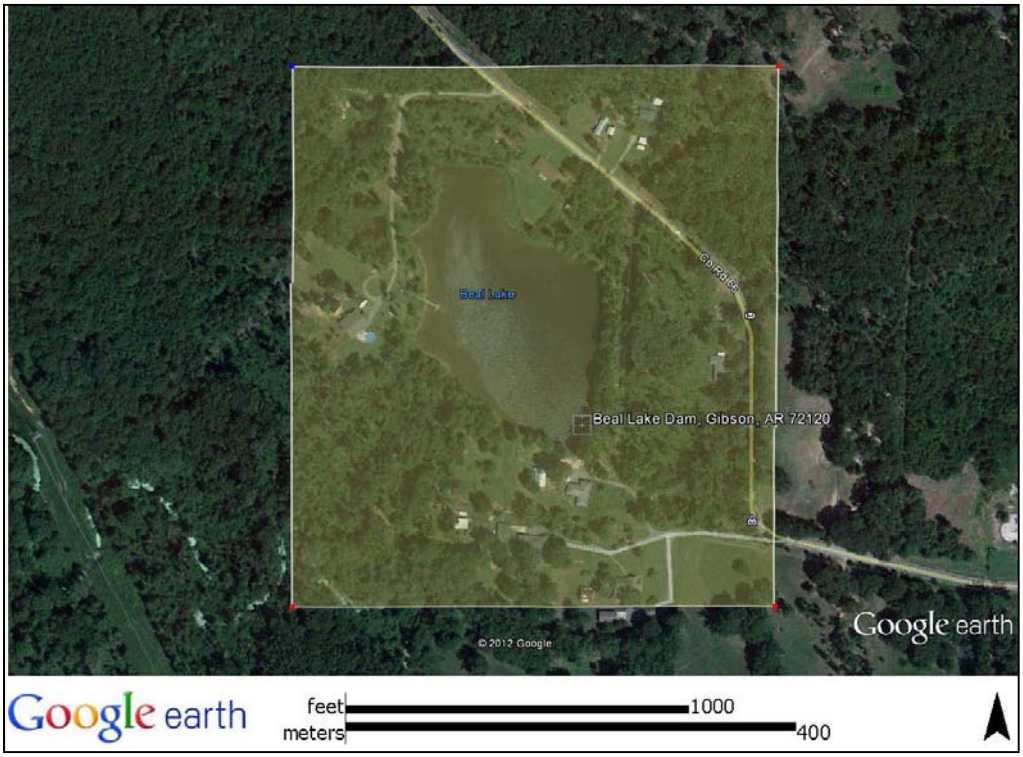


Figure 3.27 Davis Lake Dam Failure Event Vulnerable Areas

Figure 3.28 Ginger Hill Lake Dam Failure Event Vulnerable Areas

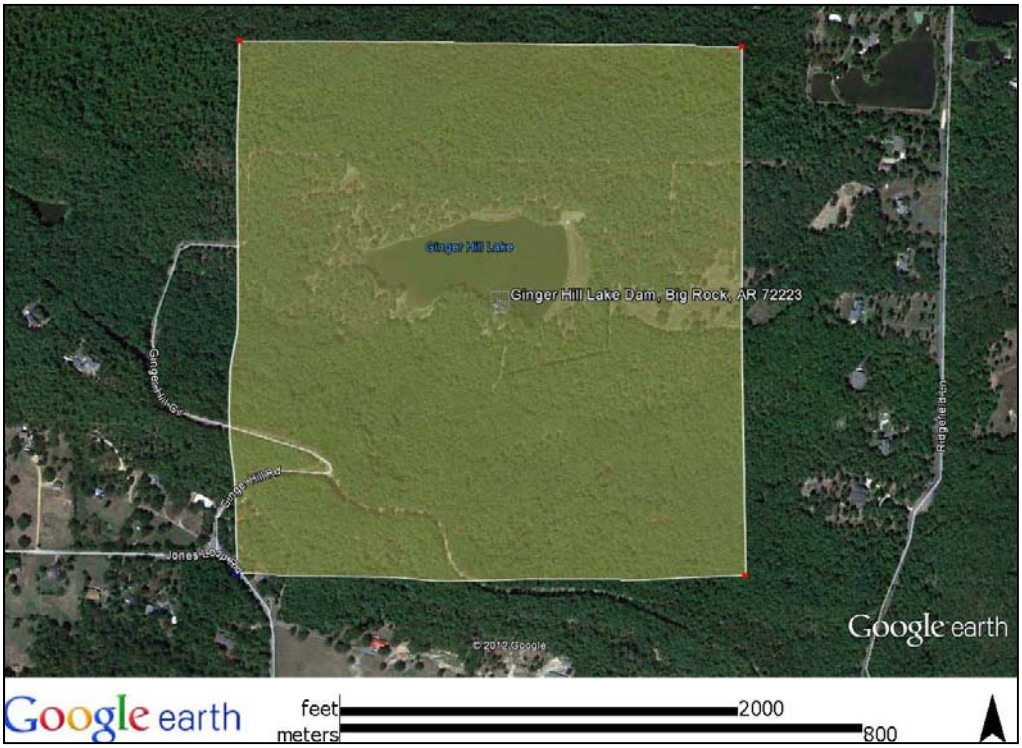


Figure 3.29 Green Lake Dam Failure Event Vulnerable Areas

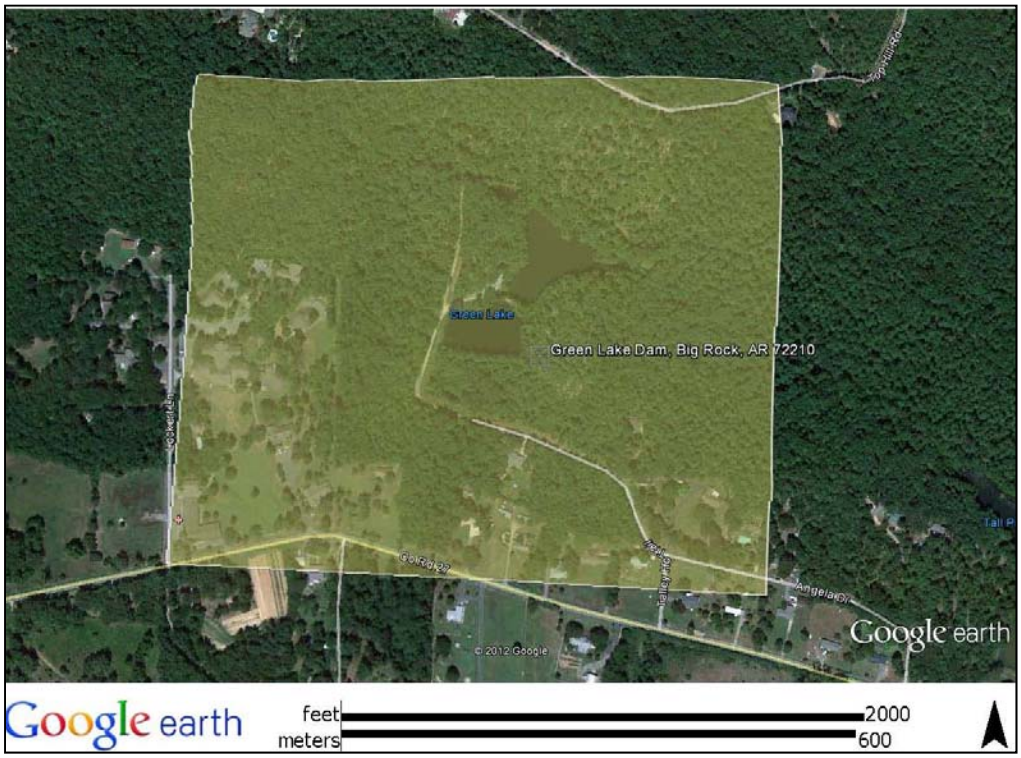


Figure 3.30 Todd Lake Dam Failure Event Vulnerable Areas

Figure 3.31 Florence Dam Failure Event Vulnerable Areas

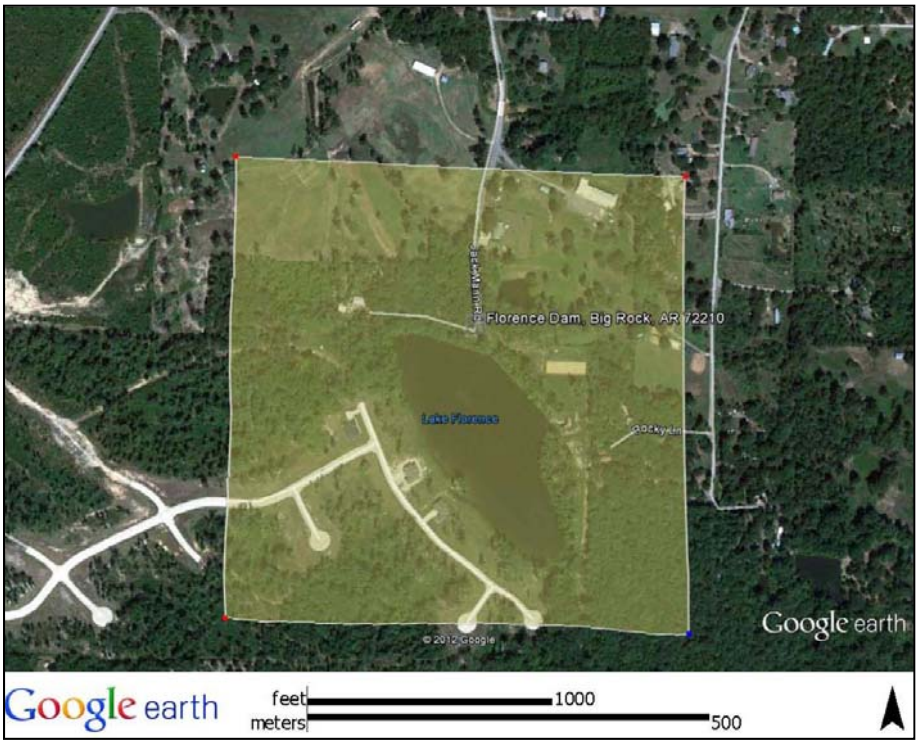


Figure 3.32 Broadmoor Lake Dam Failure Event Vulnerable Areas

Figure 3.33 Foreman Lake Dam Failure Event Vulnerable Areas

Figure 3.34 Jackson Reservoir Dam Failure Event Vulnerable Areas

Figure 3.35 Sprick Lake Dam Failure Event Vulnerable Areas

Figure 3.36 Spring Lake Dam Number 1 Failure Event Vulnerable Areas

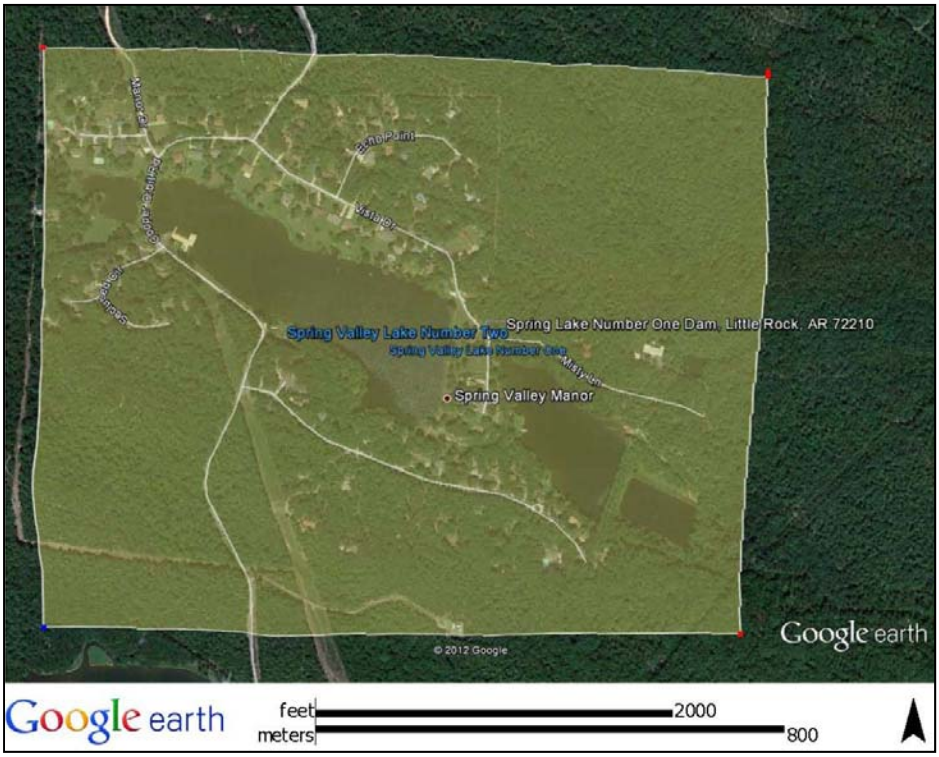


Figure 3.37 Spring Lake Dam Number 2 Failure Event Vulnerable Areas

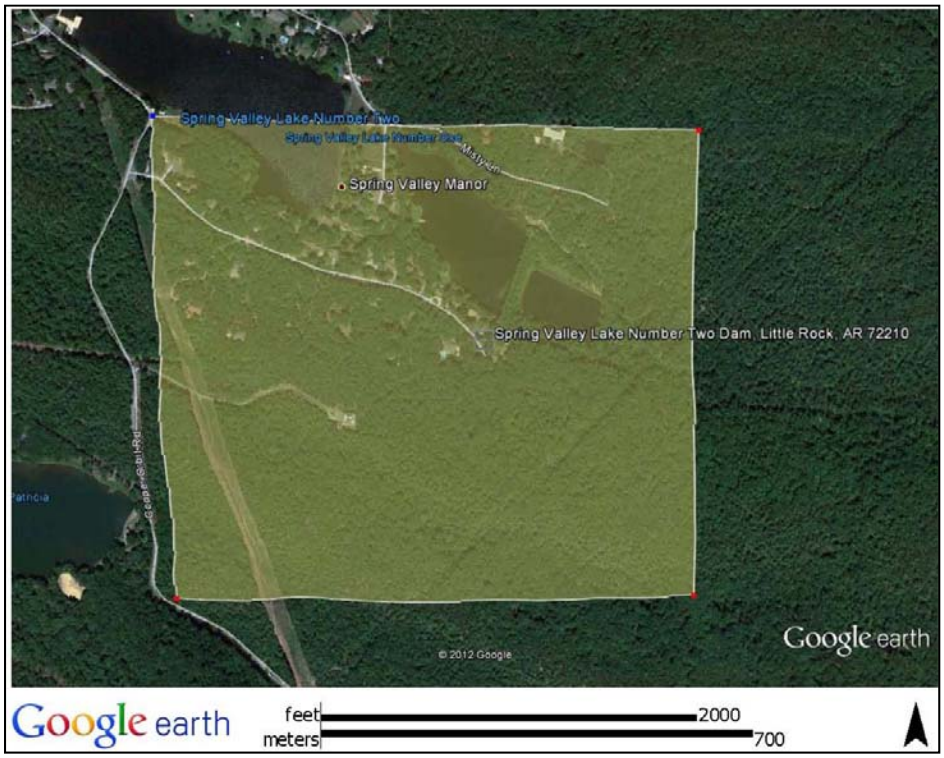


Figure 3.38 Twin Lakes Dam A and B Failure Event Vulnerable Areas

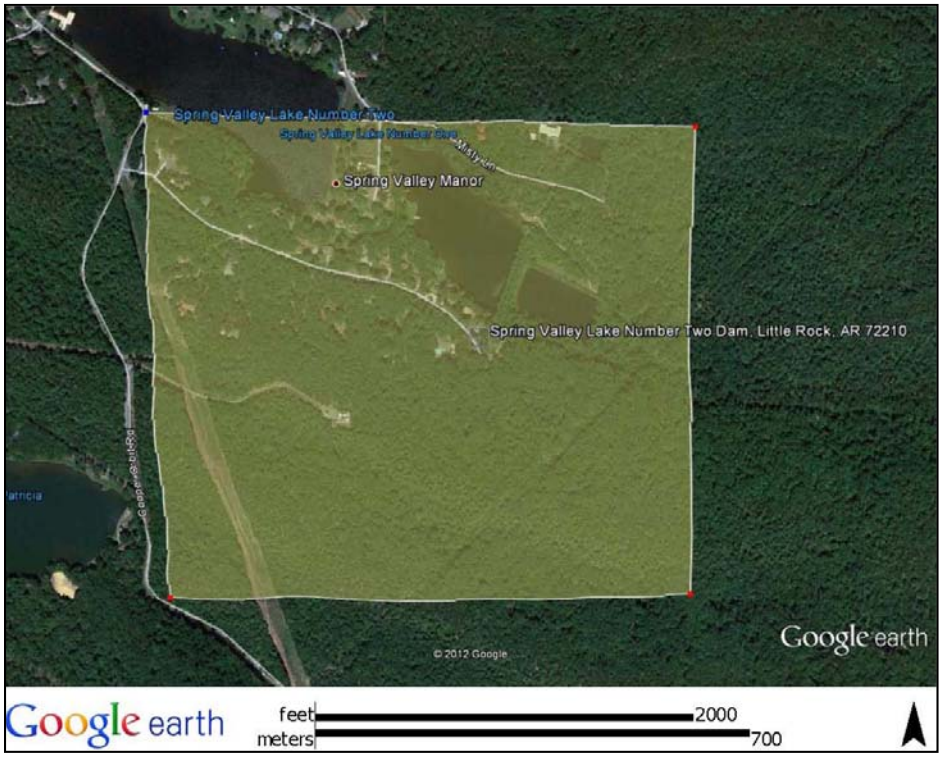


Figure 3.39 Wingate Lake Dam Failure Event Vulnerable Areas

Figure 3.40 Lakewood Lake Dam Number 1 Failure Event Vulnerable Areas

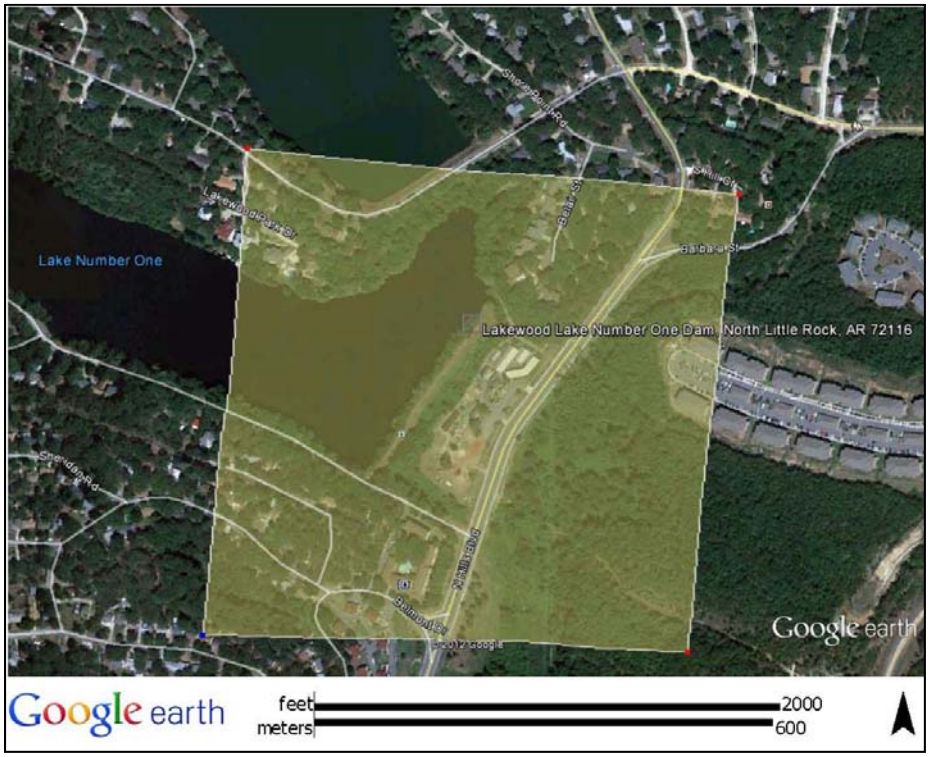


Figure 3.41 Lakewood Lake Dam Number 6 Failure Event Vulnerable Areas

Figure 3.42 Little Indian Lake Number 1 Dam Failure Event Vulnerable Areas

Figure 3.43 Little Indian Lake Number 2 Dam Failure Event Vulnerable Areas

5.1.4 Estimated Impact on Vulnerable Community Assets

A variety of factors affect the type and severity of flooding impact from a dam failure event within the Pulaski County Planning Area, including topography, geology, development of growth, and location to the dam that has failed. Damages from a dam failure event would be severe, such as debris production, structural damage, damage of contents in structures, inundation of roads, reduction of transportation access of flooded roads, and human injury or death. In the event of a dam failure, populations in the impacted area will most likely need sheltering for a prolonged period of time.

For example purposes, failure of a significant hazard class dam could result in between $100,000 to $500,000 in losses to vulnerable structures whereas failure of a high hazard class dam could result in over $500,000 in losses to vulnerable structures (including buildings, infrastructure, critical facilities and activities including evacuation and emergency services) (AR Law Article VII Section 705.4).

5.1.5 Jurisdictional Risk

Dam failure risk in the Pulaski County Planning Area varies considerably by jurisdiction. Refer to **Table 3.32** above for which vulnerable dams are located in each jurisdiction. Refer below for a description of each jurisdiction's exposure to dam failure events.

Alexander: No dams are located within or upstream from the City of Alexander. The City of Alexander is **Not at Risk** from a dam failure event.

Cammack Village: No dams are located within or upstream from the City of Cammack Village. The City of Cammack Village is at **Not at Risk** from a dam failure event.

Jacksonville: One high hazard dam (Davis Lake Dam) is located within the City of Jacksonville. The Davis Lake Dam has a height of 24 feet and holds a volume of 53 acres. It is located near a significant population area and in the event the Davis Lake Dam fails it could cause severe structural damage and human life loss. There are also two significant hazard dams and one low hazard dam within the City limits. The City of Jacksonville is at **Severe Risk** from a dam failure event.

Little Rock: There are 24 dams located within the City of Little Rock. There are 8 high hazard class dams located within the City of Little Rock, including Broadmoor Lake Dam, Foreman Lake Dam, Jackson Reservoir Dam, Sprick Lake Dam, Spring Valley Lake No. 1 Dam, Twin Lakes Dam A, Twin Lakes Dam B, and Wingate Lake Dam. Four of the high hazard class dams hold significant water volume that could flood substantial acreages of land during a dam failure event. The Broadmoor Lake Dam has a height of 26 feet and holds a volume of 80 acres. The Jackson Reservoir Dam has a height of 66 feet and holds a volume of 353 acres. The Spring Valley Lake Dam has a height of 27 feet and holds a volume of 156 acres. The Twin Lakes Dam A has a height of 20 feet and holds a volume of 188 acres.

Dense population development located near high hazard class dams poses a significant risk in the City of Little Rock. The University District, a redevelopment area, is located within a quarter-mile radius of Broadmoor Lake Dam. The University District houses approximately 10,000 people and employs over 7,000 people, as well as educates 12,000 students at the University of Arkansas at Little Rock. A dam failure event in this area could be catastrophic.

There are also 5 significant hazard class dams and 11 low hazard class dams within the City of Little Rock. Some of the significant hazard dams are located near developed areas and could cause some structural damage in the event of a dam failure. The City of Little Rock is at **Severe Risk** from a dam failure event.

Little Rock School District: The 24 dams located in the City of Little Rock put pose a significant risk to the Little Rock School District. Therefore, the HMPT assumed that the Little Rock School District would have the same risks to dam failure events as the City of Little Rock. The Little Rock School District is at **Severe Risk** from a dam failure event.

Maumelle: No high hazard class dams are located within or upstream from the City of Maumelle. One low hazard permitted dam (Lake Willastein Dam) and one non-permitted significant hazard dam are present within the City limits. The City of Maumelle is at **Low Risk** from a dam failure event.

North Little Rock: There are 6 dams located within the City of North Little Rock. There are 4 high hazard class dams located within the City of North Little Rock, including Lakewood Lake No. 1 Dam, Lakewood Lake No. 6 Dam, Little Indian Lake No. 1 Dam, and Little Lake No. 2 Dam. Two of the high hazard class dams hold significant water volume that could flood substantial acreages of land during a dam failure event. The Lakewood Lake No. 1 Dam has a height of 29 feet and holds a volume of 378 acres. The Lakewood Lake No. 6 Dam has a height of 22 feet and holds a volume of 84 acres.

Residential development located near high hazard class dams is a significant risk in the City of North Little Rock. According to the Lakewood Property Owners' Association, there are numerous residential structures that have been developed along the banks of the Lakewood Lake No. 1. In the event this dam would fail this area could sustain significant flood damage.

There are also 2 significant hazard class dams within the City of North Little Rock. Both significant hazard dams are located near developed areas and could cause some structural damage in the event of a dam failure. The City of North Little Rock is at **Severe Risk** from a dam failure event.

North Little Rock School District: The 6 dams located in the City of North Little Rock pose a significant risk to the North Little Rock School District. Therefore, the HMPT assumed that the North Little Rock School District would have the same risks to dam failure events as the City of North Little Rock. The North Little Rock School District is at **Severe Risk** from a dam failure event.

Pulaski County Special School District: There are 62 dams located within Unincorporated Pulaski County and upstream dams pose a significant risk to the Pulaski County Special School District. Therefore, the HMPT assumed that the Pulaski County Special School District would have the same risks to dam failure events as Unincorporated Pulaski County. The Pulaski County School District is at **Severe Risk** from a dam failure event.

Sherwood: No high hazard class dams are located within or upstream from the City of Sherwood. Two non-permitted significant hazard dams are present within the City limits. The City of Sherwood is at **Low Risk** from a dam failure event.

Wrightsville: No high or significant hazard class dams are located within or upstream from the City of Wrightsville. One non-permitted low hazard class dam is located just south of the City, but does not pose any significant threat. The City of Wrightsville is at **Low Risk** from a dam failure event.

Unincorporated Pulaski County: There are 62 dams located within Unincorporated Pulaski County. There are 4 high hazard class dams located within Unincorporated Pulaski County, including Ginger Hill Lake Dam, Green Lake Dam, Todd Lake Dam, and Florence Dam. All four high hazard dams hold significant water volume that could flood substantial acreages of land during a dam failure event. The Ginger Hill Dam has a height of 30 feet and holds a volume of 120 acres. The Green Lake Dam has a height of 25 feet and holds a volume of 75 acres. The Todd Lake Dam has a height of 8 feet and holds a volume of 178 acres. The Florence Dam has a height of 24 feet and holds 135 acres.

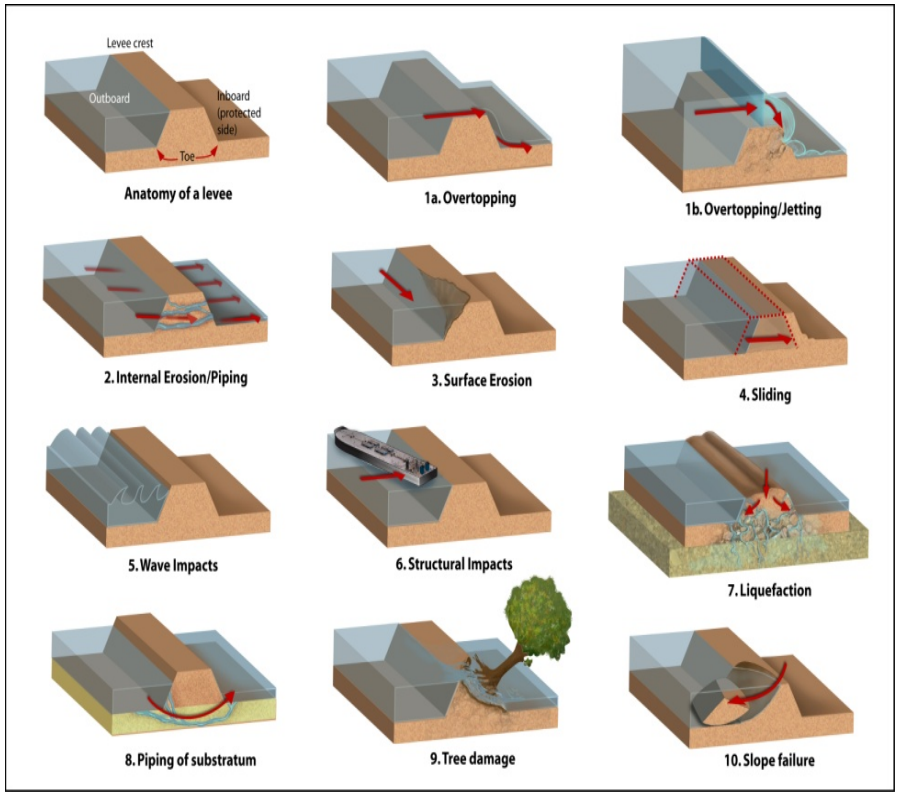
There are also 22 significant hazard class dams and 35 low hazard class dams within Unincorporated Pulaski County. Some of the significant hazard dams are located near developed areas and could cause some structural damage in the event of a dam failure. Unincorporated Pulaski County is at **Severe Risk** from a dam failure event.

5.2 Levee Failure

5.2.1 Profile

According to FEMA, levee systems are designed to provide a specific level of risk reduction from temporary flooding. The level of risk reduction may diminish over time if the levee is not continuously maintained or is breached due to another precipitating event. A levee failure event is defined as water overtopping and/or breaching of a levee during flood and non-flood events. Refer to **Figure 3.44** for the 11 most common causes of levee failure events.

Figure 3.44 Common Causes of Levee Failure



Source: Natural Science Foundation, 2008.

5.2.2 Previous Occurrences

The only historical levee failure event that affected the Pulaski County Planning Area was the Great Flood of 1927, which was one of the most impactful disasters of the 1900s. Following several months of unusually heavy rain during late 1926 and early 1927, the Mississippi River flooded. The swollen Mississippi River backed up into the Arkansas, White, and St. Francis rivers. This surge of water forced every levee in between Fort Smith (Sebastian County) and Little Rock to fail. According to the September 1927 National Geographic, "[When the levee broke] waters from the rivers poured into the City of Little Rock and had nowhere to go. Homes and stores stood for months in six to thirty feet of murky water. Dead animals floated everywhere. Rich Arkansas farmland was covered with sand, coated in mud, or simply washed away, still bearing shoots from spring planting."

Once the levees were breached the floodwater had nowhere to go and much of Arkansas remained under water through the spring and summer and into September of 1927. The agricultural land was destroyed by the sitting water and was unable to be cultivated by farmers. This caused significant economic disruption for the entire State of Arkansas. In addition to economic hardship, this event caused 246 human deaths and displaced 750,000 (Red Cross, 1927).

Due to the fact there has not been any recent levee breaks in the Pulaski County Planning Area, the HMPT used USACE certification levels to determine the probability of future occurrence for levee failure events. All of the levees within Pulaski County are engineered to withstand a 100- year or a 1% annual occurrence flood event. The HMPT has used this as a basis for determining the annual probability of a levee failure event. The HMPT estimated that the Pulaski County Planning Area has an annual occurrence probability of 1% for levee failure events

5.2.3 Vulnerability

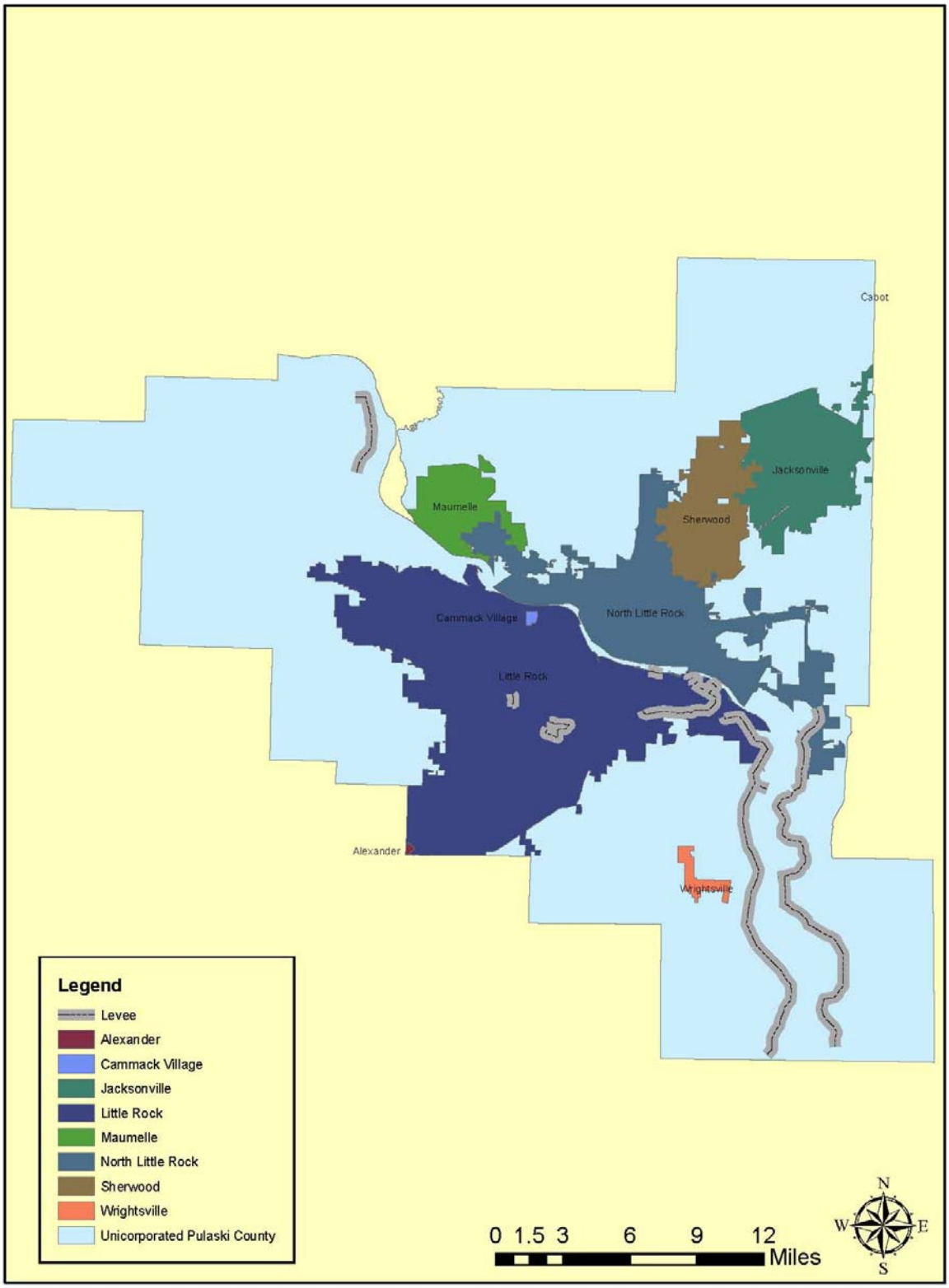
The Pulaski County Planning Area's vulnerability to levee failure events is location specific. A variety of factors affect the type and severity of levee failure events within the Pulaski County Planning Area, including levee's location to large populations, maintenance, and surrounding area typography. Refer to **Table 3.33** for a list of Pulaski County Planning Area is 9 levee systems and their FEMA accreditation status. The Pulaski County Planning Area's 9 levee systems are concentrated along the Arkansas River throughout the southeast section of the County and northwest of Maumelle as well as portions of Fourche Creek in Little Rock (**Figure 3.45**).

Table 3.33 Levees within Pulaski County Planning Area by Accreditation Status

Levee System	Levee Status
36th Street and Boyle Park Levee	Accredited
Fourche Island Drainage District No. 2	Accredited
North Little Rock and Floodwall	Deaccredited
Baucum Levee	Deaccredited
Little Rock-Pulaski County Levee	Deaccredited
Roland Levee	Deaccredited
Old River Levee	Deaccredited
Plum Bayou Levee	Deaccredited
Riverdale Levee	Deaccredited

* Note: FEMA does not certify levees, but it does accredit levees that meet the criteria of 44 CFR 65.10 as providing protection from a 1-percent annual flood chance based on the certification provided by levee owner. FEMA's accreditation is for the sole purpose of establishing appropriate flood insurance risk zone determination on the DFIRMs.

Figure 3.45 Pulaski County Planning Area Levee Location Map



In 2009, FEMA began its Risk Mapping, Assessment, and Planning (Risk MAP) program to begin modernizing flood risk maps, including levee failure events. Risk MAP used increasingly-available technology to increase the quality, reliability, and availability of flood hazard maps for levee failure events. Risk Map's levee analysis involved three major steps. First, each levee system was modeled with the levee in place ("with" levee scenario). This established the interior flood elevation for the mapping update. The elevation determined for this analysis is shown within the levee system. Generally, the flood elevation is the highest water-surface elevation that will be determined and is sometimes called the "contained" elevation.

The next step in the levee analysis was to review and analyze the "without" levee scenario. A hydraulic model was produced and the levee system was completely removed from the model. The modeling prepared for this scenario established the elevation which was the basis of mapping on the landward side of the levee system. This elevation is generally lower than that determined in the "with" levee scenario. In the case of a river with levees on either bank (double levees), the "without" levee analysis is prepared two times. Each levee was individually removed and the other remains in place for the analysis. The resultant water surface elevations calculated are then mapped.

The final phase of this Risk MAP project was the creation and preparation of flood hazard data known as "floodplains" which were mapped based on the results determined in the levee analysis phase of the project. The floodplains prepared were then transferred onto the Base Map and the Digital Flood Insurance Rate Map (DFIRM) panels were prepared. Refer to **Figures 3.46** through **Figure 3.54** for areas vulnerable to levee failure events.

Figure 3.46 36th Street and Boyle Park Levee

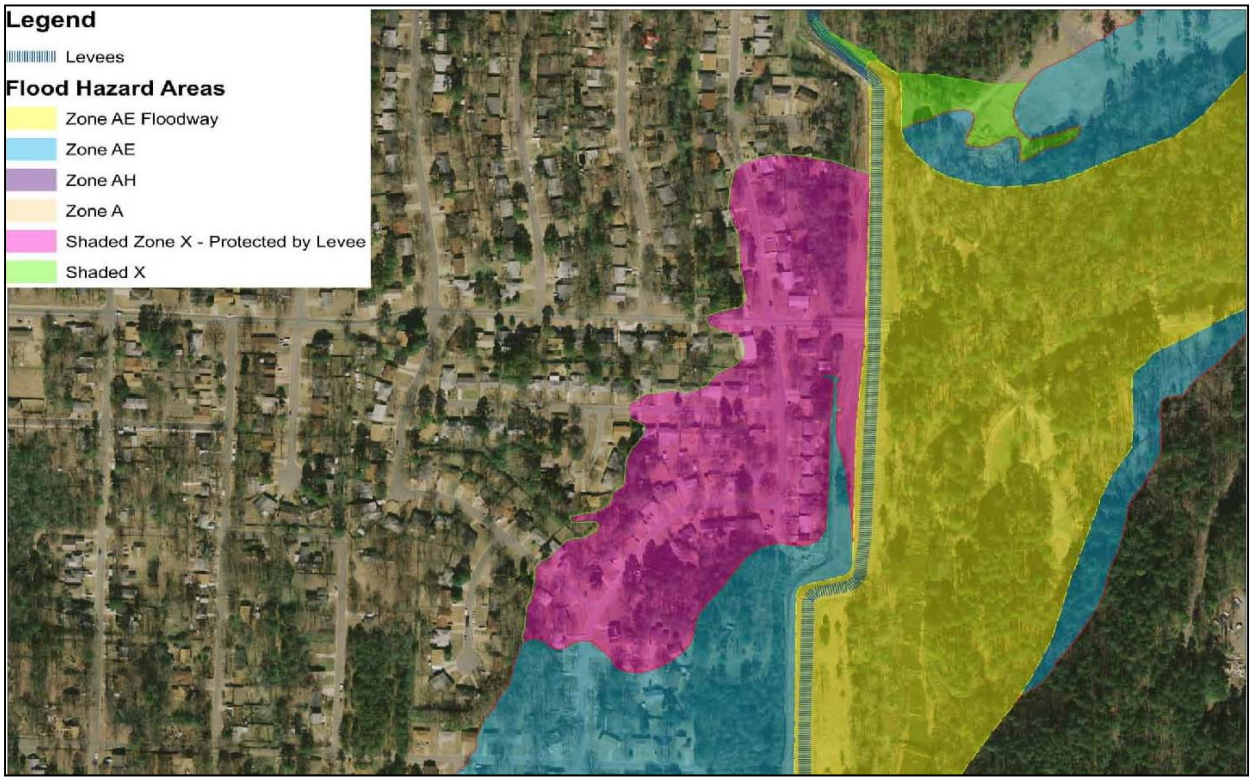


Figure 3.47 Fourche Island Drainage District No. 2

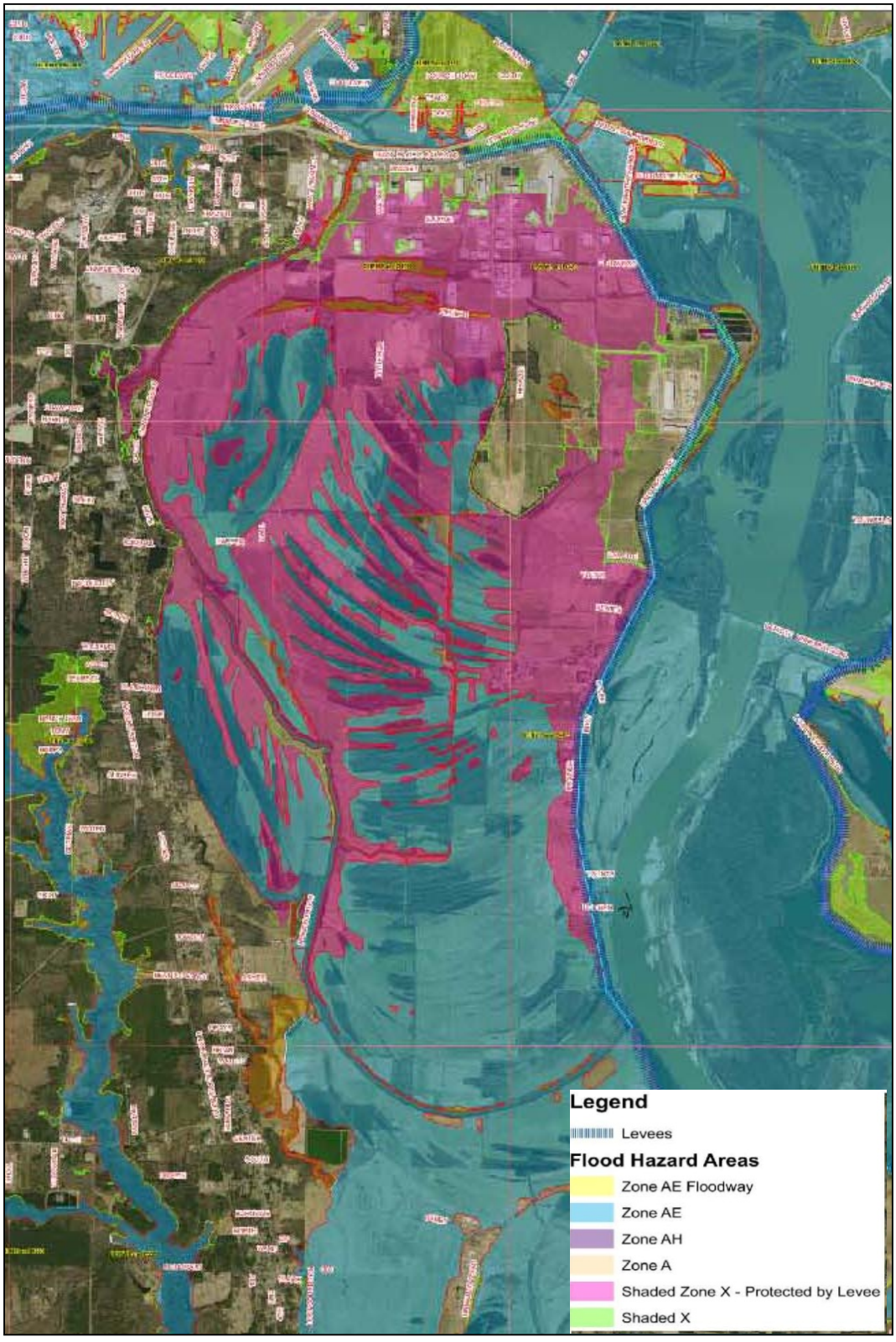


Figure 3.48 North Little Rock and Floodwall

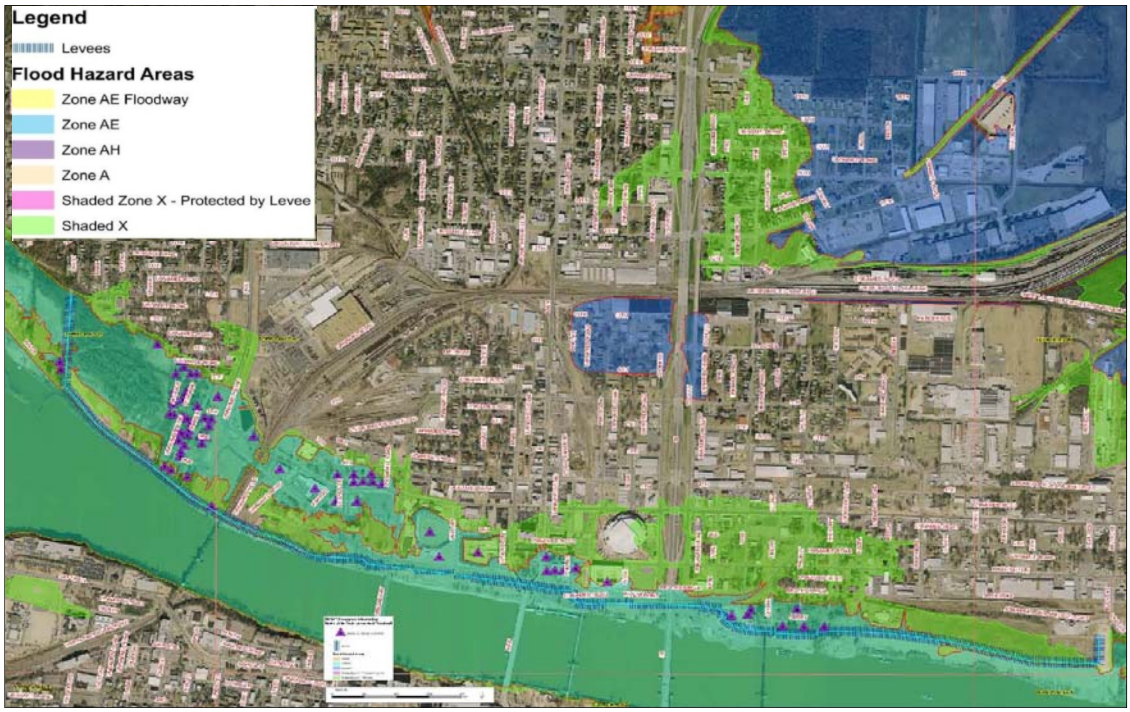


Figure 3.49 Baucum Levee

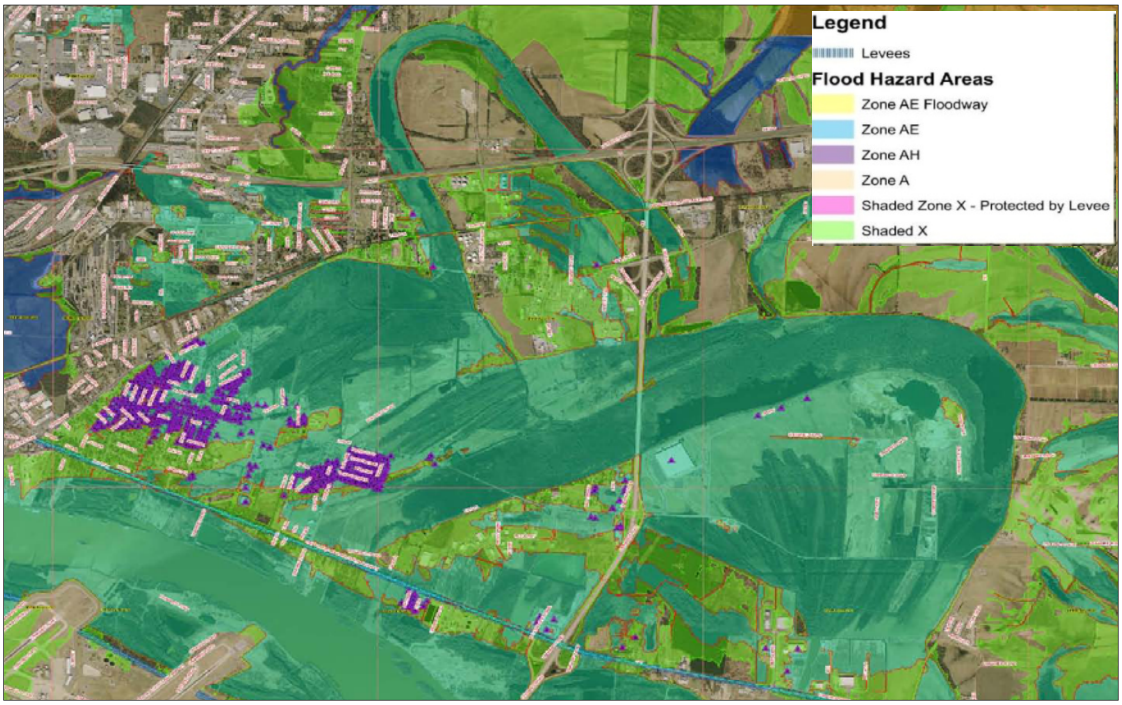


Figure 3.50 Little Rock-Pulaski County Levee

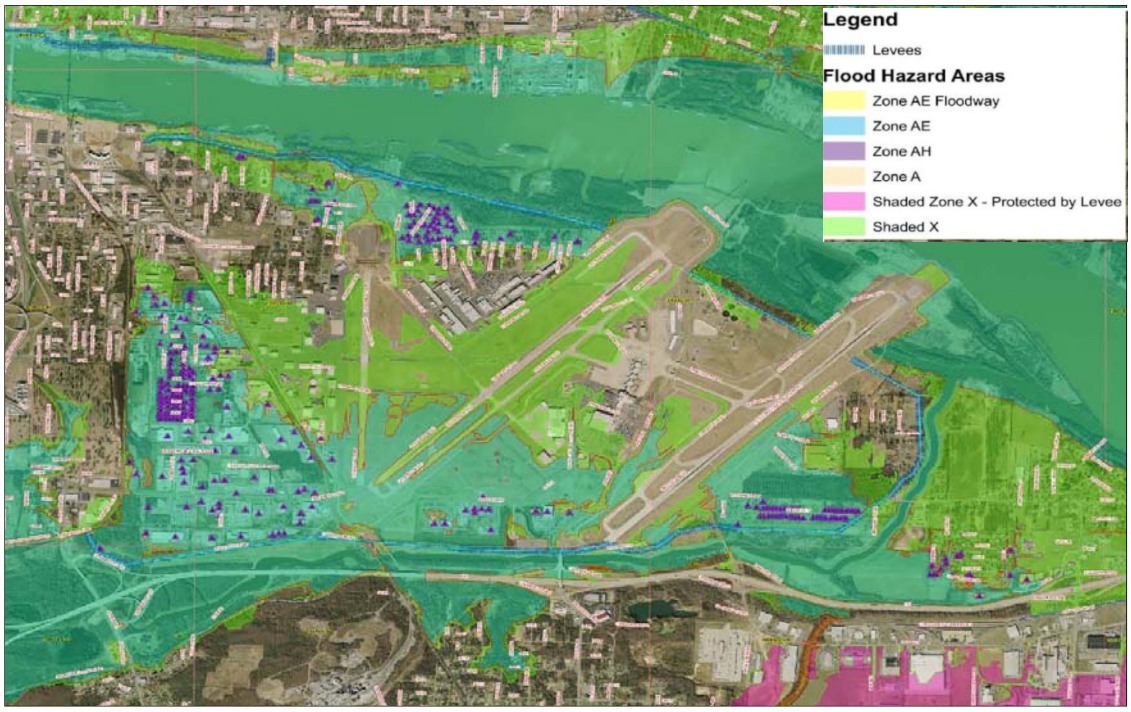


Figure 3.51 Roland Levee

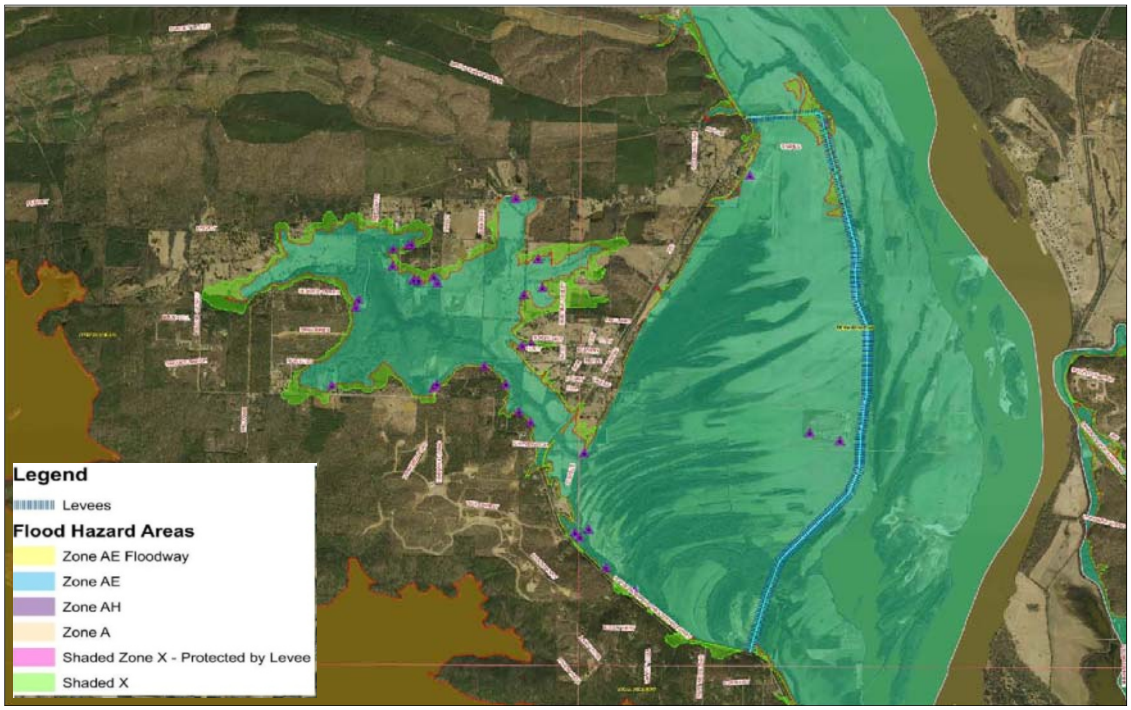


Figure 3.52 Old River Levee

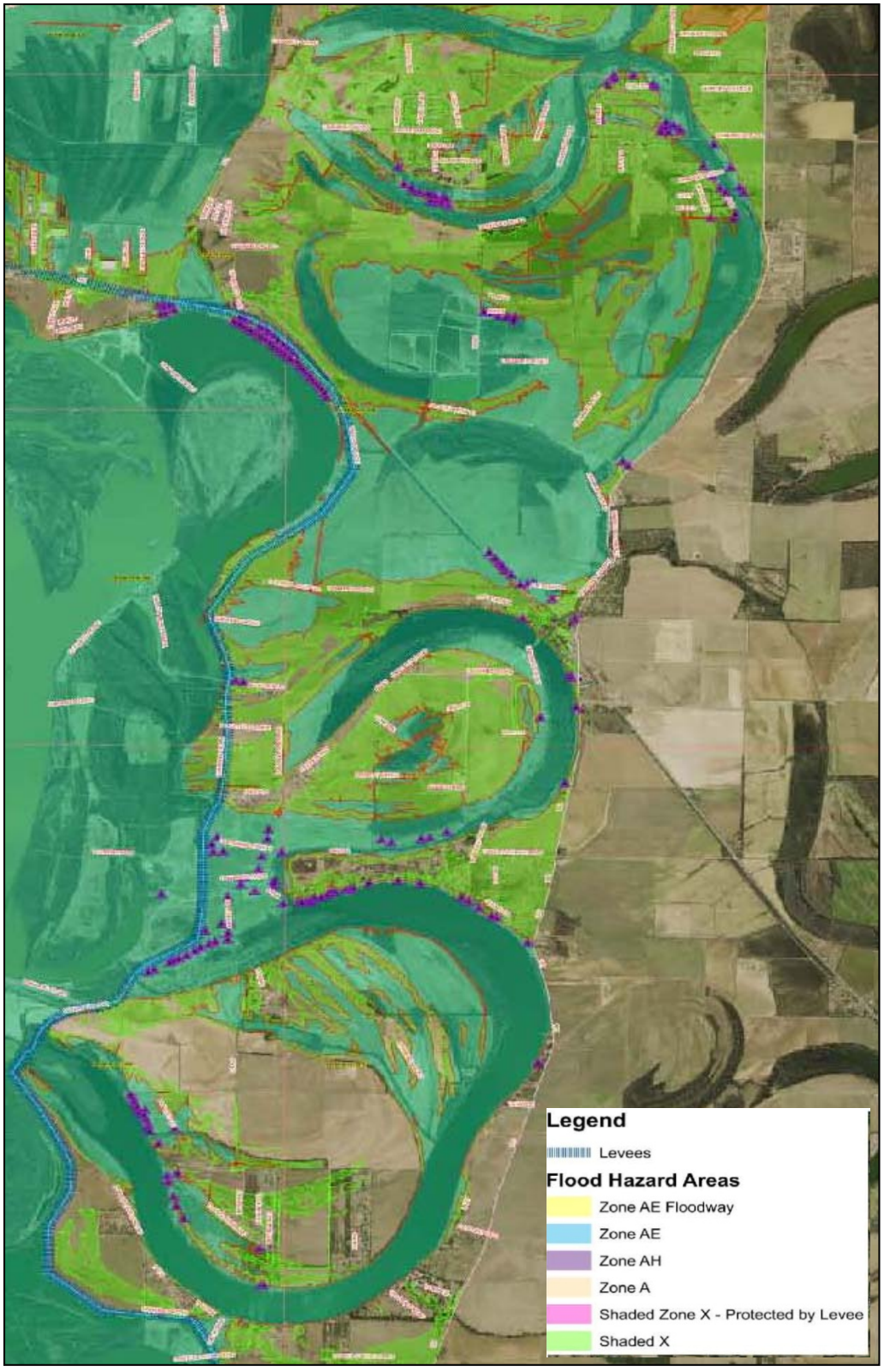
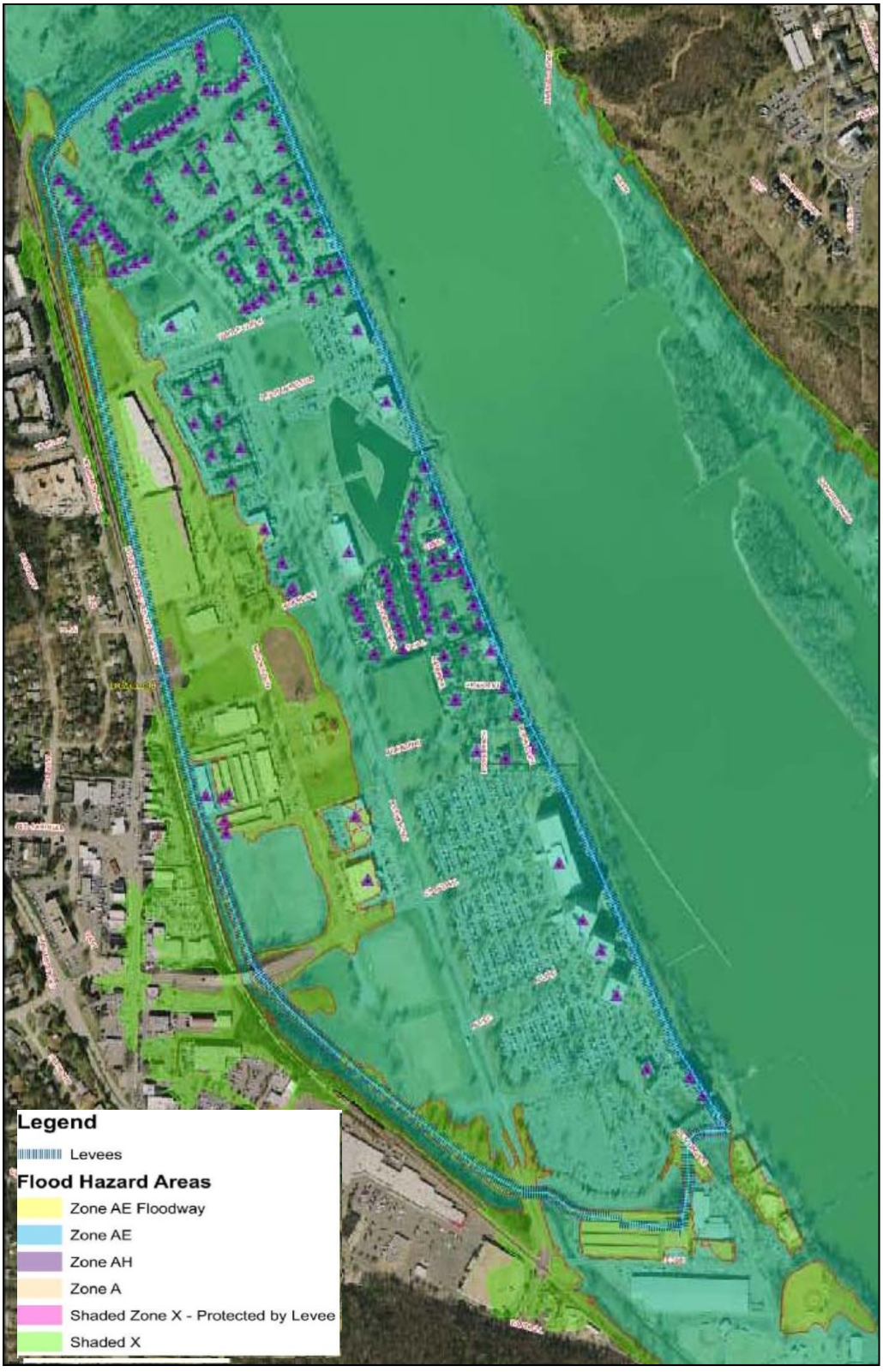


Figure 3.53 Plum Bayou Levee

Figure 3.54 Riverdale Levee



5.2.4 Estimated Impact on Vulnerable Community Assets

To estimate the impact of levee failure events on vulnerable community assets in the Pulaski County Planning Area the HMPT used FEMA's HAZUS-MH flood model. In the event of a levee failure, the HMPT estimates that the surrounding area would be impacted by a 1%-annual-chance-flood. The areas identified as being affected by a levee failure event are the Southeast and Northwest County Segments, as well as the City of Little Rock, and the City of North Little Rock. A summary of these results is presented in **Table 3.34**.

The total structure related losses for the Pulaski County Planning Area for a levee failure event is estimated to be $155,440,000 (**Table 3.34**). The total business interruption losses for a levee failure event are estimated to be $121,630,000. The total estimated impact of a levee failure event on vulnerable community assets is **$277,070,000**.

HAZUS-MH also estimates the number of households that are expected to be displaced from their homes due to a levee failure event and the need for temporary shelters. The model estimates that 1,710 households will be displaced and 4,199 people will seek temporary shelter in public shelters (**Table 3.34**).

Table 3.34 Flood Loss Estimation for the Pulaski County Planning Area

County Segment or Jurisdiction	Structure Related Loss	Business Interruption	Households Displaced	Persons Seeking Shelter
SE	$10,760,000	$2,610,000	65	130
SW	$28,750,000	$8,420,000	94	198
City of Little Rock	$94,350,000	$70,680,000	710	1,689
City of North Little Rock	21,580,000	39,920,000	841	2,182
Total	**$155,440,000**	**$121,630,000**	**1,710**	**4,199**

5.2.5 Jurisdictional Risk

Levee failure risk in the Pulaski County Planning Area varies considerably by jurisdiction. Refer below for a description of each jurisdiction's exposure to levee failure events.

Alexander: There are no levees located within or upstream from the City of Alexander. The City of Alexander is at **Not at Risk** from a levee failure event.

Cammack Village: No levees are located within the City of Cammack Village, but Roland Levee is located upstream from Cammack Village and could impact vulnerable structures in the event of a levee failure. The City of Cammack Village is at **Moderate Risk** from a levee failure event.

Jacksonville: There are no levees located within or upstream from the City of Jacksonville. The City of Jacksonville is at **Not at Risk** from a levee failure event.

Little Rock: There are 4 levee systems within the City of Little Rock including: 36th Street and Boyle Park Levee, Riverdale Levee System, Little Rock-Pulaski County Levee, and Fourche Island Drainage District No. 2. In addition, North Little Rock Levee and Floodwall and Baucum Levee are upstream from the City of Little Rock and could impact vulnerable structures in the event of a levee failure. The City of Little Rock is at **Severe Risk** from a levee failure event.

Little Rock School District: The four levee systems within the City of Little Rock, including 36th Street and Boyle Park Levee, Riverdale Levee System, Little Rock-Pulaski County Levee, and Fourche Island Drainage, all pose a significant risk to the Little Rock School District. Therefore, the HMPT assumed that the Little Rock School District would have the same risks to levee failure events as the City of Little Rock. The Little Rock School District is at **Severe Risk** from a levee failure event.

Maumelle: No levees are located within the City of Maumelle, but Roland Levee is located upstream from Maumelle and could impact vulnerable structures in the event of a levee failure. The City of Maumelle is at **Moderate Risk** from a levee failure event.

North Little Rock: North Little Rock Levee and Floodwall and Baucum Levee are located within the City of North Little Rock. There are no levees located upstream from the City of North Little Rock. The City of North Little Rock is at **Severe Risk** from a levee failure event.

North Little Rock School District: North Little Rock Levee and Floodwall and Baucum Levee pose a significant risk to the Little Rock School District. Therefore, the HMPT assumed that the North Little Rock School District would have the same risks to levee failure events as the City of North Little Rock. The North Little Rock School District is at **Severe Risk** from a levee failure event.

Sherwood: There are no levees located within or upstream from the City of Sherwood. The City of Sherwood is at **Not at Risk** from a levee failure event.

Pulaski County Special School District: The 36th Street and Boyle Park Levee, Fourche Island Drainage District No. 2, North Little Rock and Floodwall, Baucum Levee, Little Rock-Pulaski County Levee, Roland Levee, Old River Levee, Plum Bayou Levee, Riverdale Levee all pose significant risk to the Pulaski County Special School District. Therefore, the HMPT assumed that the Pulaski County Special School District would have the same risks to levee failure events as Unincorporated Pulaski County. The Pulaski County Special School District is at **Severe Risk** from a levee failure event.

Wrightsville: Plum Bayou Levee is located east of the City of Wrightsville and could impact vulnerable structures in the event of a levee failure. Fourche Island Drainage District No. 2, Baucum Levee, and Old River Levee are all located upstream from the City of Wrightsville and could impact vulnerable structures in the event of a levee failure. The City of Wrightsville is at **Severe Risk** from a levee failure event.

Unincorporated Pulaski County: There are 9 levees located within or upstream from Unincorporated Pulaski County. These levees include 36th Street and Boyle Park Levee, Fourche Island Drainage District No. 2, North Little Rock & Floodwall, Baucum Levee, Little Rock-Pulaski County Levee, Roland Levee, Old River Levee, Plum Bayou Levee, and Riverdale Levee. Vulnerable structure in close proximity or downstream from these levees could be severely impacted from a levee failure event. Unincorporated Pulaski County is at **Severe Risk** from a levee failure event.

5.3 Chemical Spill

5.3.1 Profile

A chemical spill is anything that may cause damage to persons, property, or the environment when substances are released into soil, water, or air. As many as 700,000 products pose physical or health hazards that can be defined as hazardous chemicals. Each year, over 1,000 new synthetic chemicals are introduced into our communities nationwide. Hazardous substances are categorized as toxic, corrosive, flammable, irritant, or explosive (PHMSA, 2011).

Crews from numerous agencies, including the North Little Rock Fire Department, work for more than 18 hours to dilute ethanol spill (March, 2011).

- **Toxic chemicals** often produce injuries to communities, people, environments, and to almost any part of the body they come into contact with, typically the skin and the mucous membranes of the eyes, nose, mouth, or respiratory tract.
- **Corrosive substances** can cause severe damage by chemical action to living tissue, other freight, or the means of transport.
- **Flammable substances** are materials that are liable to cause fire by friction, absorption of water, spontaneous chemical changes, or retained heat from manufacturing or processing, or that can be readily ignited and burn vigorously.
- **Irritants** are substances that produce local irritation or inflammation such as on skin or eyes, or that will, after inhalation, produce local irritation or inflammation of nasal or lung tissue.
- **Explosives** are solid or liquid materials, or a mixture of materials, that are capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to its surroundings.

In the Pulaski County Planning Area, chemical spill events typically take two forms, fixed facility incident, or transportation incident. A fixed facility incident includes chemical spill events that occur in commercial facilities. A transportation incident includes chemical spill events that occur during transportation of chemicals through railways, highways, and pipelines. Both types of chemical spill events will be profiled.

5.3.2 Previous Occurrences

Since 2002, the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) Office of Hazardous Materials Safety's Incident Reports Database has recorded 21 highway, 9 rail transportation, and 3 fixed facility chemical spill events amounting to $645,223 in damages (**Table 3.35**).

Table 3.35 Chemical Spill Events – The Pulaski County Planning Area (2002 – 2011)

Jurisdiction	Type of Chemical Spill Event	Date	Total Losses
North Little Rock	Highway	4/22/2002	$1,800
Maumelle	Highway	6/14/2004	$2,010
Jacksonville	Rail	12/23/2004	$5,000
North Little Rock	Highway	1/14/2005	$3,500
Little Rock	Highway	8/26/2006	$5,000
North Little Rock	Highway	8/26/2006	$187,479
Little Rock	Highway	10/20/2006	$1,500
North Little Rock	Rail	11/13/2006	$1,204
Little Rock	Highway	11/22/2006	$8,000
Little Rock	Rail	5/6/2007	$5,000
Wrightsville	Rail	5/6/2007	$1,232
Little Rock	Highway	1/7/2008	$1,079
Little Rock	Highway	4/12/2008	$2,035
North Little Rock	Rail	5/18/2008	$3,110
North Little Rock	Rail	6/17/2008	$1,160
Little Rock	Highway	9/10/2008	$2,000
Little Rock	Highway	11/19/2008	$5,000
Little Rock	Highway	11/24/2008	$2,500
North Little Rock	Highway	12/4/2008	$148,900
North Little Rock	Highway	4/18/2009	$2,550
Little Rock	Rail	5/22/2010	$30,000
Little Rock	Rail	5/22/2010	$32,000
Little Rock	Highway	6/17/2010	$1,050
Maumelle	Highway	7/26/2010	$2,000
North Little Rock	Rail	8/12/2010	$5,000
Little Rock	Highway	12/6/2010	$138,314
North Little Rock	Highway	1/22/2011	$2,000
Little Rock	Highway	6/27/2011	$35,300
Little Rock	Fixed Site	3/1/2011	$5,000
Little Rock	Highway	9/22/2011	$1,000
Little Rock	Fixed Site	10/1/2011	$1,000
Little Rock	Fixed Site	11/5/2011	$1,500
Little Rock	Highway	12/16/2011	$1,000
Total			**$645,223**

Source: PHMSA Office of Hazardous Materials Safety's Incident Reports Database, 2011.

Historically significant chemical spill events that have occurred within the Pulaski County Planning Area are discussed below and highlight the type of damage that can be expected from a significant chemical spill event:

- ***Transportation Incident (December 23, 2004):*** On December 23, 2004, the City of Jacksonville Fire Department requested Pulaski County Hazmat to respond to a 9-car train derailment. All railroad cars were tank cars carrying chemicals. All cars were derailed on their side, except one Vinyl Chloride car was upside down. The Pulaski County Hazmat was delayed from arriving at the scene because of icy road conditions during the event. Pulaski County Hazmat discovered there were no chemical leaks

found in any of the cars. Approximately 150 residents from a 1/2 mile radius of the derailment site were evacuated. A shelter was setup at Jacksonville Community Center for evacuated residents. No injuries were recorded and local residents were able to return to their homes.

- ***Transportation Incident (August 26, 2006):*** An overturned tanker in North Little Rock caused a major fuel spill and backup on Interstate 440. The toxic effects were still being felt on the roadways hours after the accident. It happened just after 10:00 AM when a truck overturned in the westbound lanes of Interstate 440 near Highway 70. Something caused the truck to overturn, unleashing nearly 7,500 gallons of fuel across the highway. Pulaski County Fire Department and HAZMAT crews were on the scene working to try to stop the spill, but were only able to reduce it.

- ***Transportation Incident (May 06, 2007):*** All Emergency Management units responded to a train derailment on May 6, 2007. Six tank cars were involved in the accident. One of the tank cars leaked cresylic acid. The primary dangers posed in handling cresylic acids are those resulting from physical exposure. Cresylic acids are corrosive and contact with exposed skin or mucous membranes causes severe burns. One railroad employee received a small burn to his hand, but no other serious injuries occurred.

- ***Fixed Facility Incident (March 1, 2011):*** A 300-gallon ethanol release near the intersection of Broadway and Buckeye. The release was due to a holding tank overflowing while offloading a rail car at a warehouse. No injuries occurred from this event.

Between 2002 and 2011, there have been 8 years with chemical spill events in the Pulaski County Planning Area. Extrapolating from historical data, the HMPT estimated that Pulaski County Planning Area has an average recurrence interval for chemical spills of 1.13 per year or an annual occurrence probability of 89%.

5.3.3 Vulnerability

The magnitude of a chemical spill event varies depending on the chemical's characteristics. Depending on the chemical that spills, the overall damage to structures and human life can be severe. The surrounding environment may also be impacted and its effects can persist for years. The HMPT has identified four vulnerable areas to chemical spill events including:

- All Tier II chemical facilities;
- 1/4 mile radius around all rail transportation;
- 1/4 mile radius around freight transportation routes on all interstate highways; and
- 1/4 mile around liquid natural gas pipelines and plants near populated areas.

Tier II Chemical Facilities: There are 198 Tier II Chemical Sites located in the Pulaski County Planning Area. Tier II Chemical Sites are covered by Emergency Planning and Community Right-to-Know Act (EPCRA) and are required by Emergency Managers to be submitted in an Emergency and Hazardous Chemical Inventory Form to the Local Emergency Planning Committee (LEPC), the State Emergency Response Commission (SERC), and the local fire department annually. Chemical site facilities within the Pulaski County Planning Area are collected on Tier II forms to identify the presence of:

- **Extremely Hazardous Substances (EHSs):** This list currently contains more than 300 chemicals. Because of their extremely toxic properties, these chemicals were chosen to provide an initial focus

for chemical emergency planning. If these chemicals are released in certain amounts, they may be of immediate concern to the community. Releases must be reported immediately.

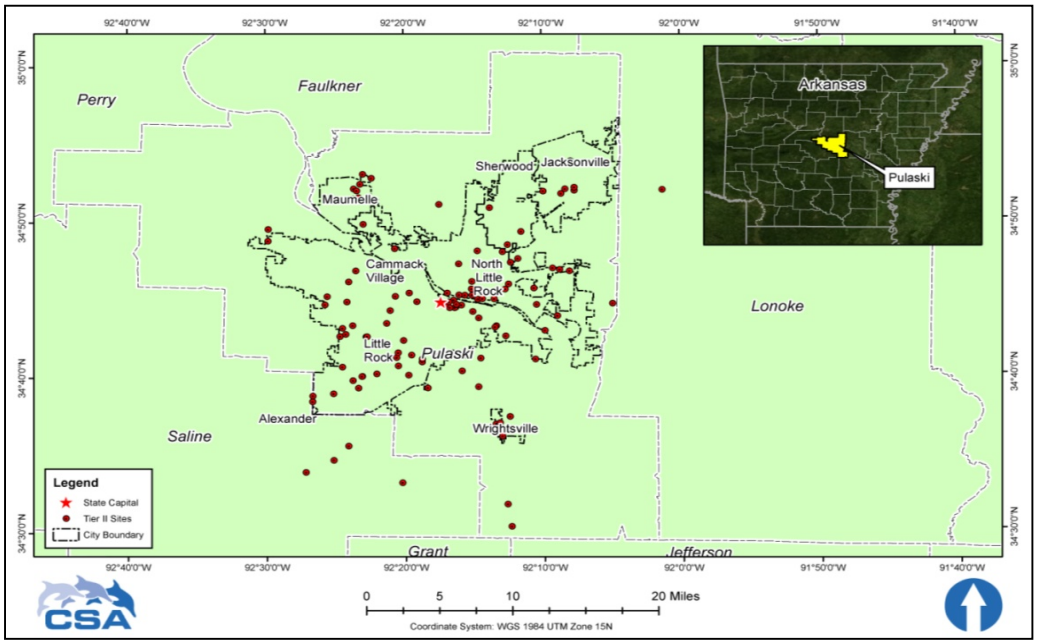
- **Hazardous Substances:** These are hazardous substances listed under previous Superfund hazardous waste cleanup regulations (Section 103(a) of the Comprehensive Environmental Resource and Conservation Liability Act - Superfund). The current list contains about 720 substances. Releases of these chemicals above certain amounts must be reported immediately because they may represent an immediate hazard to the community.

- **Hazardous Chemicals:** Hazardous chemicals are not on a list at all, but are defined by Occupational Safety and Health Administration regulations as chemicals which represent a physical or health hazard. Under this definition many thousands of chemicals can be subject to reporting requirements if a facility manufactures, processes, or stores them in certain amounts. Inventories of these chemicals and material safety data sheets for each of them must be submitted if they are present in the facility in certain amounts.

- **Toxic Chemicals:** There are now more than 320 chemicals or chemical categories on this list, which were selected by Congress primarily because of their chronic or long-term toxicity. Estimates of releases of these chemicals into all media – air, land, and water – must be reported annually and entered into a national database.

Tier II inventory reporting is designed to provide information on the amounts, location and storage conditions of hazardous chemicals and mixtures containing hazardous chemicals present at facilities. A chemical spill event at a Tier II chemical facility can cause human injury, structural damage, and harm the surrounding environment. The HMPT assumes that all structures and population near Tier II chemical sites are vulnerable to chemical spill events. Refer to **Figure 3.55** for the location of all Tier II chemical sites.

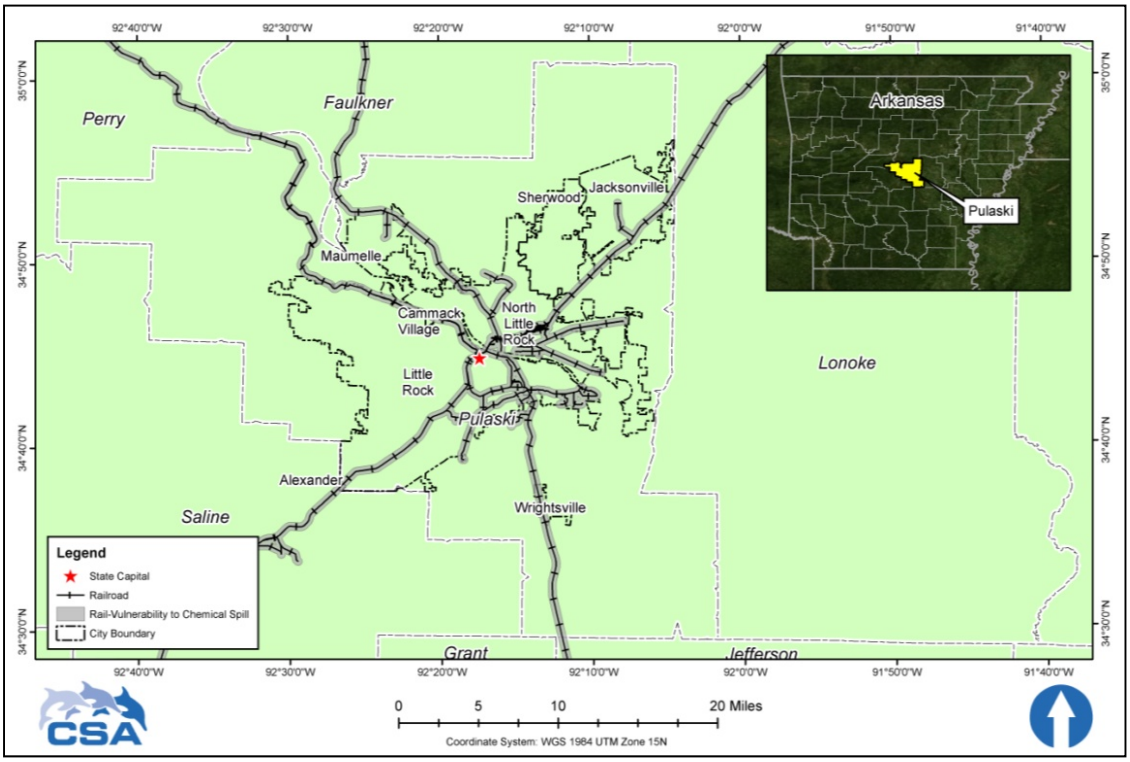
Figure 3.55 Pulaski County Planning Area - Vulnerable Locations of Tier II Chemical Sites within the Pulaski County Planning Area



Rail Transportation: The Little Rock Port Authority Railroad, a Class III railroad, directly serves 10 industries in the industrial park and shippers from the central Arkansas area through its railcar switching operations with other railroads. The Complex is served by two Class I railroads, the Union Pacific (UP) Railroad and the BNSF Railway. Class I railroads provide nationwide, long-haul service including shipment of goods to Canada and Mexico and freight exchanges at international coastal ports of entry. Thousands of chemicals are transported through these rail-lines daily. A chemical spill event on the rail-line can stop all rail access on the line, cause human injury, damage rail infrastructure, and harm the surrounding environment.

According to the 2010 Central Arkansas Regional Transportation Study, railroad lines run through several densely populated areas, particularly in the Cities of Little Rock and North Little Rock, where grade crossings are very prevalent. The Pulaski County Planning Area contains 212 grade crossings. Eighty-three of these grade crossings do not have any warning devices and may be more vulnerable to chemical spill events. The HMPT determined that populations and structures located within a 1/4 mile of rail-lines are vulnerable to chemical spill events. Refer to **Figure 3.56** for vulnerable locations to chemical spill events from rail transportation.

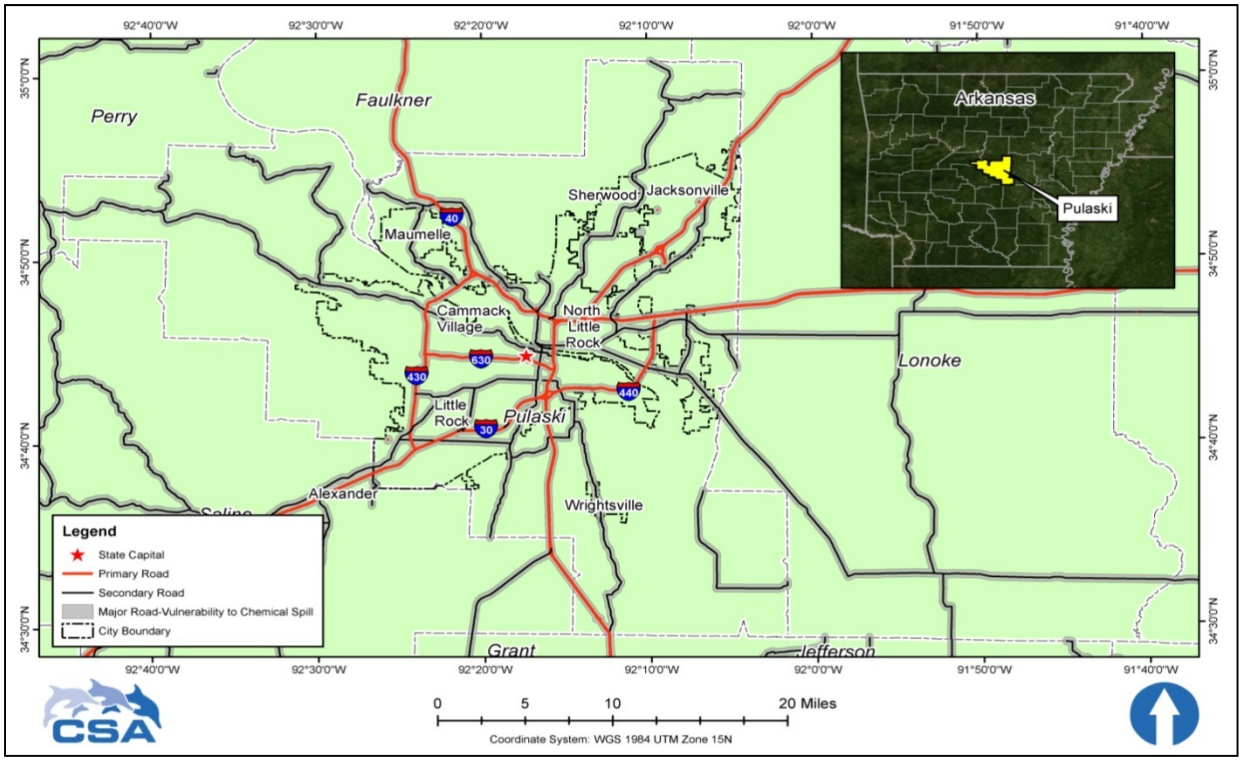
Figure 3.56 Pulaski County Planning Area – Vulnerable Locations to Chemical Spill Events from Rail Transportation



Interstate Highway Transportation: There are 6 interstate highways, I-30, I-40, I-140, I-440, I-530, and I-630, which are used as chemical transportation routes daily within the Pulaski County Planning Area. According to the Pulaski County Commodity Flow Study, there are more than 271 different hazardous materials transported through the Pulaski County Planning Area daily. A chemical spill event on these routes can restrict transportation for hours, cause human injury, damage highway infrastructure, and harm

the surrounding environment for years. The HMPT determined that populations and structures located within a 1/4 mile of major or minor roadways are vulnerable to chemical spill events (**Figure 3.57**).

Figure 3.57 Pulaski County Planning Area - Vulnerable Locations to Chemical Spill Events from Primary and Secondary Roadways



Liquid Natural Gas Pipelines and Plants: Another vulnerable area for chemical spill events is areas where populations or structures are near hazardous gas and liquid pipelines, as well as liquid natural gas plants. Natural gas and liquid pipelines and liquid natural gas plants can cause significant explosions, which can damage structures and kill people. The hazard area radius from a pipeline can reach 0.22 miles (Pipeline Safety Trust, 2010). Refer to **Figure 3.58** for locations of highly populated areas near hazardous gas and liquid pipelines and liquid natural gas plants.

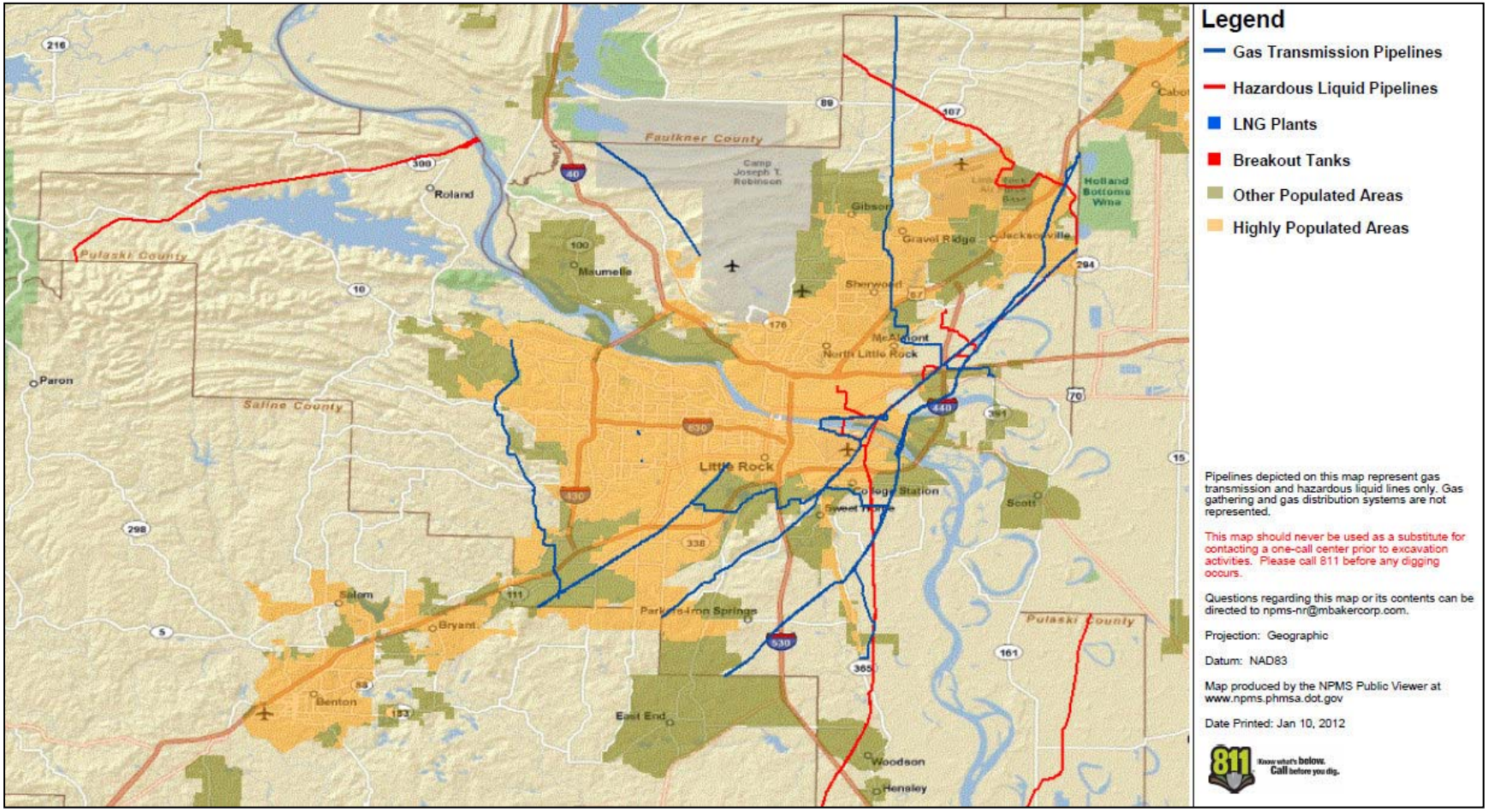
5.3.4 Estimated Impact on Vulnerable Community Assets

Total damages over this 9-year period were $645,223, an average of $71,691 per year. The total annual estimated impact on vulnerable community assets from chemical spill events is $71,691.

5.3.5 Jurisdictional Risk

Chemical spill risk in the Pulaski County Planning Area varies considerably by jurisdiction. Refer below for a description of each jurisdiction's exposure to chemical spill events.

Figure 3.58 Pulaski County Planning Area – Hazardous Gas and Liquid Pipelines and Liquid Natural Gas Plants



Source: Pipeline and Hazardous Materials Safety Administration, 2011.

Alexander: There are no Tier II Chemical Sites located within the City of Alexander; however, a rail-line is located directly in the middle of the City (**Figure 3.59**). Structures and populations within a 1/4 mile radius of the rail-line are vulnerable to chemical spill events from rail transportation. There is a secondary roadway that is located through the City that can also pose a risk of chemical spill (**Figure 3.60**). The City of Alexander is at **Moderate Risk** from a chemical spill event.

Figure 3.59 City of Alexander – Vulnerable Locations to Chemical Spill Events from Tier II Sites and Rail Transportation

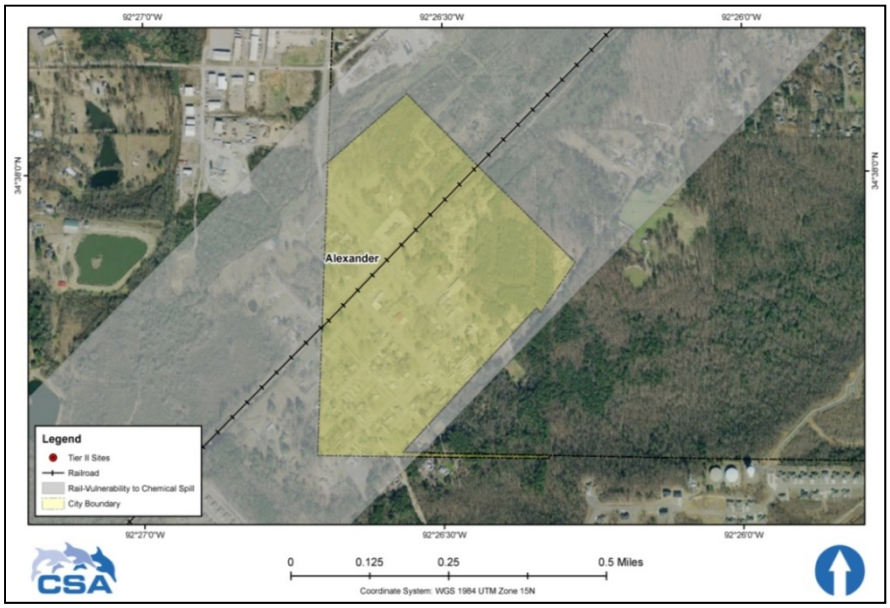
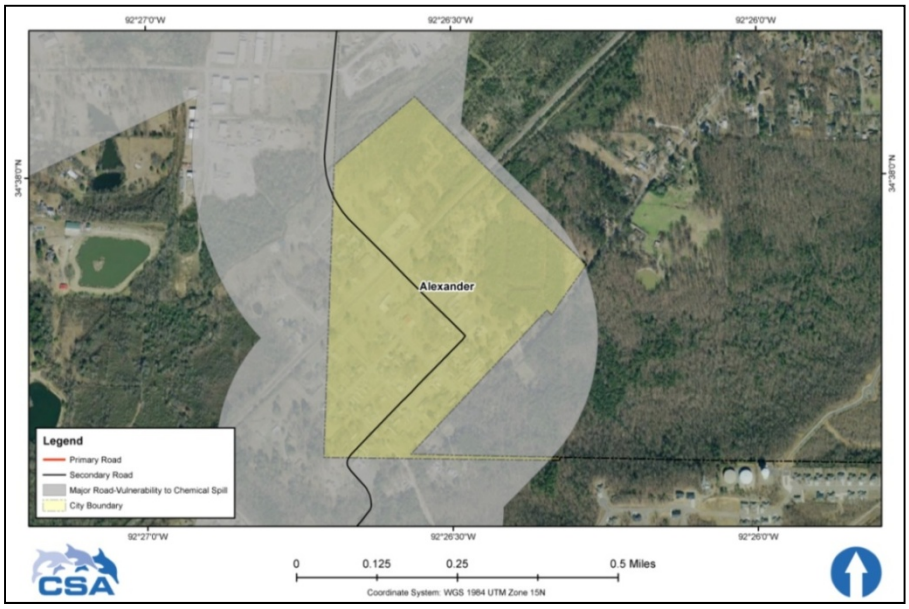


Figure 3.60 City of Alexander – Vulnerable Locations to Chemical Spill Events from Primary and Secondary Roadways



Cammack Village: There are no Tier II Chemical Sites located within the City of Cammack Village; however, a rail-line is located north of the City (**Figure 3.61**). Structures and populations within this area are vulnerable to chemical spill events from rail transportation. There are no primary or secondary roadways located through the City (**Figure 3.62**). The City of Cammack Village is at **Low Risk** from a chemical spill event.

Figure 3.61 City of Cammack Village – Vulnerable Locations to Chemical Spill Events from Tier II Sites and Rail Transportation

Figure 3.62 City of Cammack Village – Vulnerable Locations to Chemical Spill Events from Primary and Secondary Roadways

Jacksonville: There are 6 Tier II Chemical Sites located within the City of Jacksonville (**Figure 3.63**). A rail-line is located directly in the middle and along the eastern border of the City. Structures and populations within a 1/4 mile of these areas are vulnerable to chemical spill events from rail transportation. There is also a primary and secondary roadway that runs through the City (**Figure 3.64**). Structures and populations located 1/4 mile of these roadways are vulnerable to chemical spill events from primary and secondary roadways. The City of Jacksonville is at **Severe Risk** from a chemical spill event.

Figure 3.63 City of Jacksonville – Vulnerable Locations to Chemical Spill Events from Tier II Sites and Rail Transportation

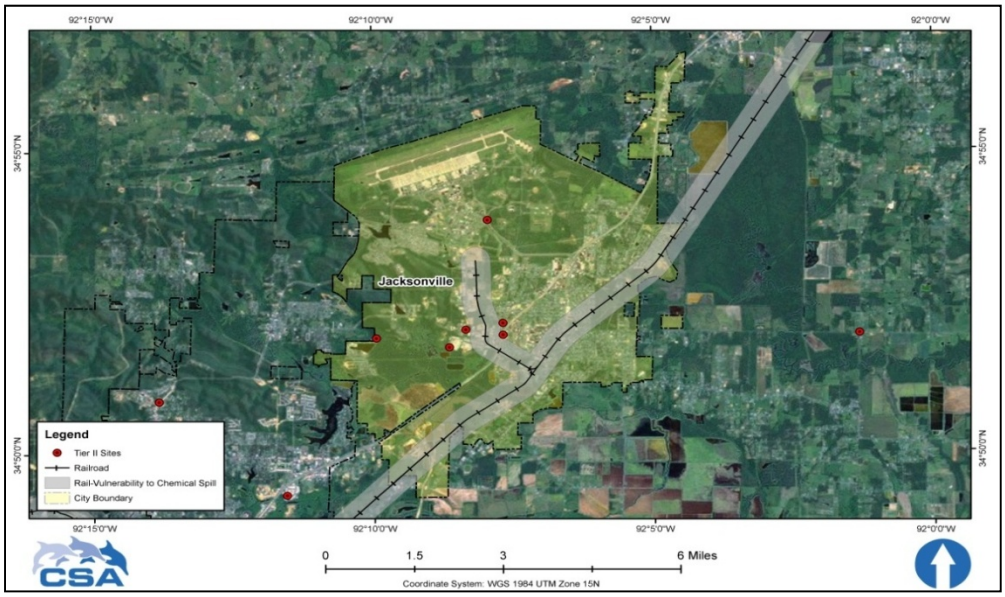
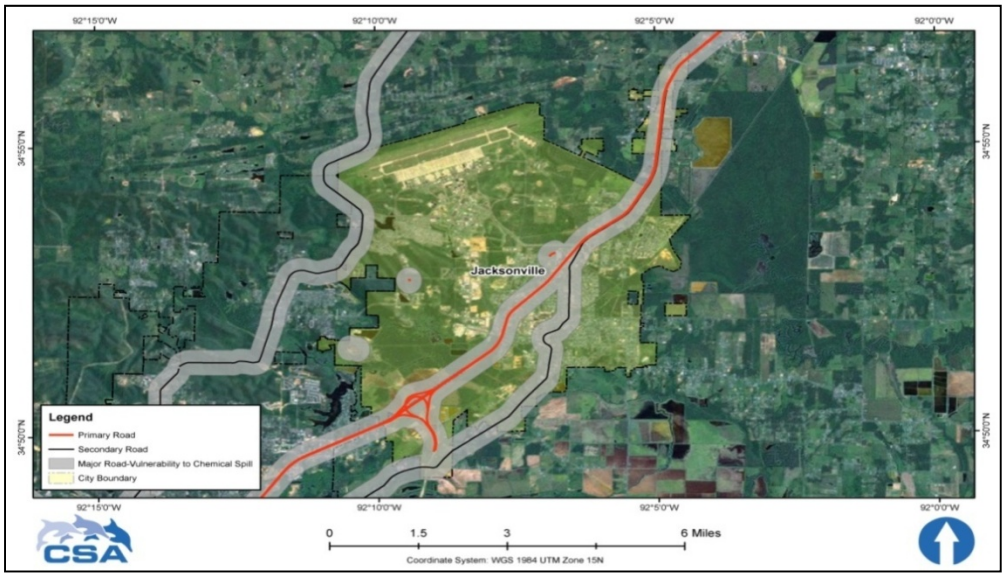


Figure 3.64 City of Jacksonville – Vulnerable Locations to Chemical Spill Events from Primary and Secondary Roadways



Little Rock: There are 48 Tier II Chemical Sites located within the City of Little Rock (**Figure 3.65**). The City of Little Rock has a hub for rail transportation and there are multiple rail-lines located throughout the City. Structures and populations 1/4 mile from these Tier II sites and rail-lines are vulnerable to chemical spill events from fixed sites and rail transportation. There are also multiple primary and secondary roadways throughout the City (**Figure 3.66**). Structures and populations located 1/4 mile near these roadways are vulnerable to chemical spill events from primary and secondary roadways. The City of Little Rock is at **Severe Risk** from a chemical spill event.

Figure 3.65 City of Little Rock – Vulnerable Locations to Chemical Spill Events from Tier II Sites and Rail Transportation

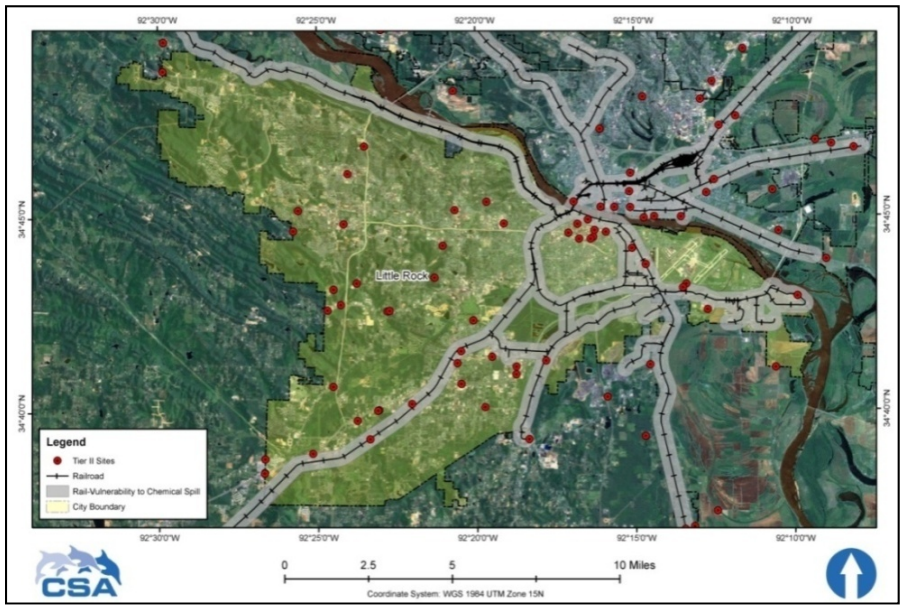
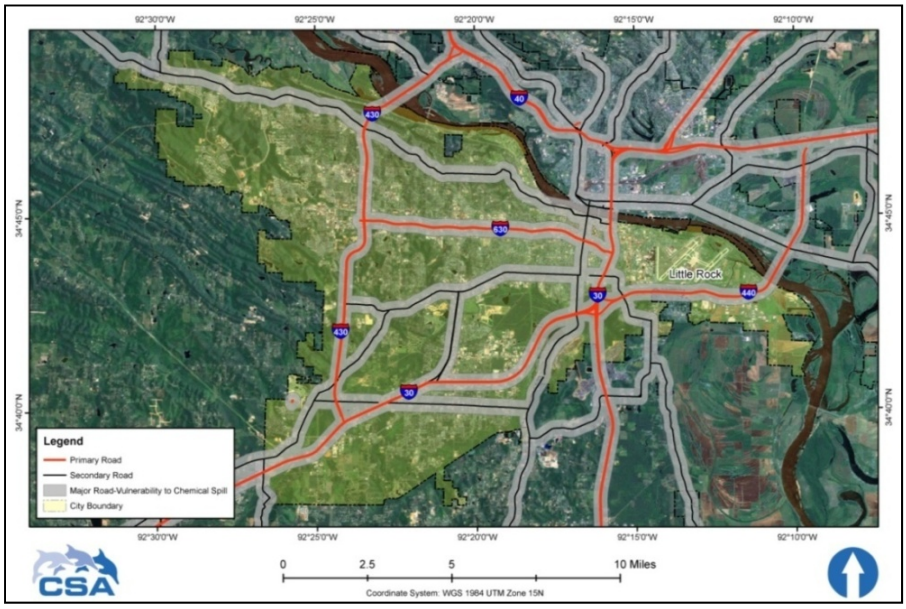


Figure 3.66 City of Little Rock – Vulnerable Locations to Chemical Spill Events from Primary and Secondary Roadways



Little Rock School District: There are 48 Tier II Chemical Sites located within the Little Rock School District (**Figure 3.67**). The Little Rock School District has a hub for rail transportation and there are multiple rail-lines located throughout the District. Structures and populations 1/4 mile near these Tier II sites and rail-lines are vulnerable to chemical spill events from fixed sites and rail transportation. There are also multiple primary and secondary roadways throughout the District that transport chemicals through freight (**Figure 3.68**). Structures and populations located 1/4 mile near these roadways are vulnerable to chemical spill events from primary and secondary roadways. Little Rock School District is at **Severe Risk** from a chemical spill event.

Figure 3.67 Little Rock School District – Vulnerable Locations to Chemical Spill Events from Tier II Sites and Rail Transportation

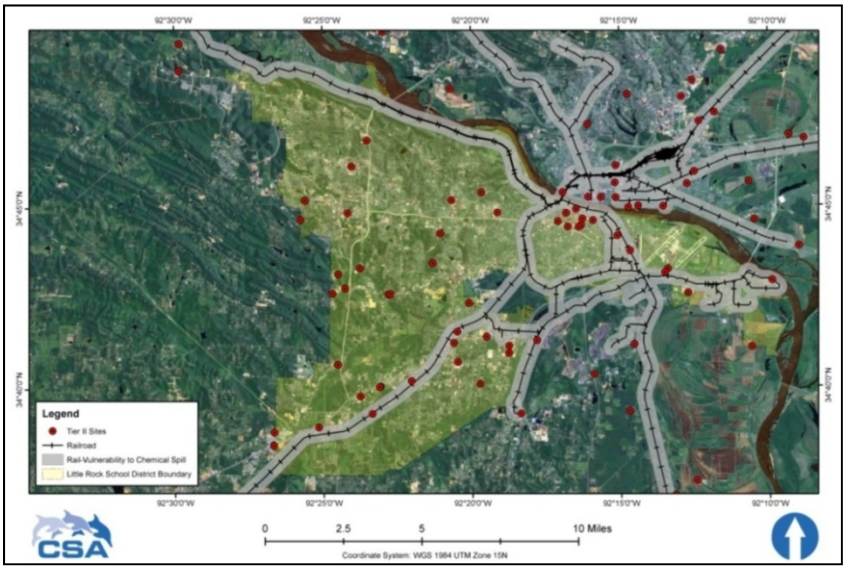
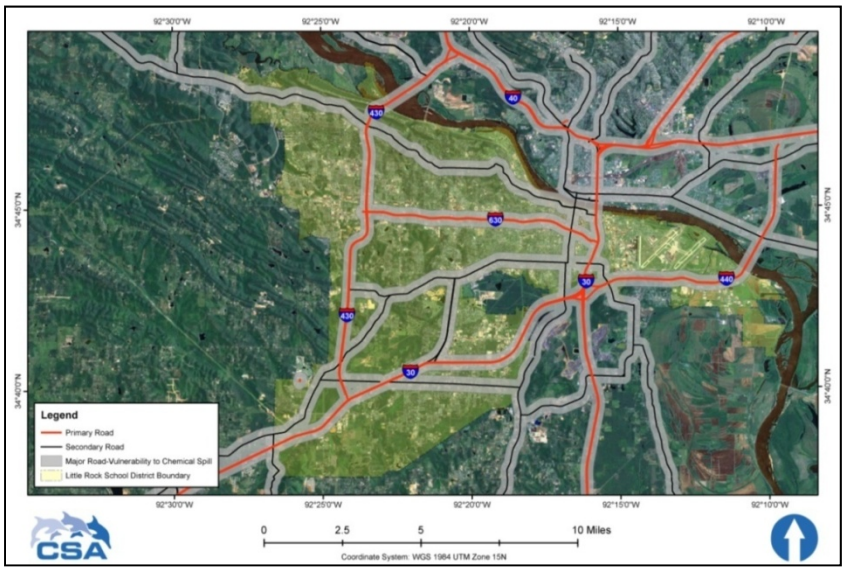


Figure 3.68 Little Rock School District – Vulnerable Locations to Chemical Spill Events from Primary and Secondary Roadways



Maumelle: There are 6 Tier II Chemical Sites located within the City of Maumelle (**Figure 3.69**). A rail-line is located directly in the middle and along the northern border of the City. Structures and populations 1/4 mile near these Tier II sites and rail-lines are vulnerable to chemical spill events from fixed sites and rail transportation. There is also a primary roadway on the eastern border of the City and a secondary roadway directly in the middle of the City that transport chemicals through freight (**Figure 3.70**). Structures and populations located 1/4 mile near these roadways are vulnerable to chemical spill events from primary and secondary roadways. The City of Maumelle is at **Severe Risk** from a chemical spill event.

Figure 3.69 The City of Maumelle – Vulnerable Locations to Chemical Spill Events from Tier II Sites and Rail Transportation

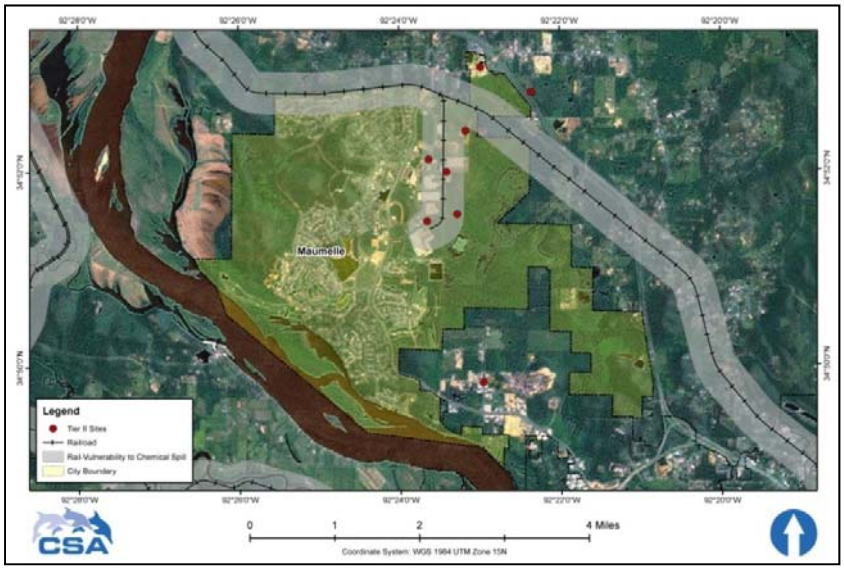
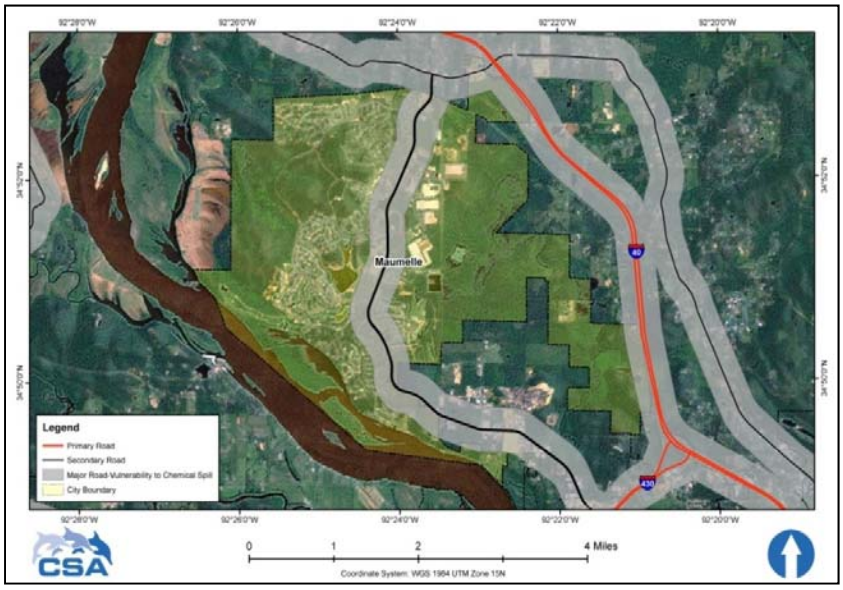


Figure 3.70 City of Maumelle – Vulnerable Locations to Chemical Spill Events from Primary and Secondary Roadways



North Little Rock: There are 22 Tier II Chemical Sites located within the City of North Little Rock (**Figure 3.71**). The City of North Little Rock has a hub for rail transportation and there are multiple rail-lines located throughout the City. Structures and populations 1/4 mile near these Tier II sites and rail-lines are vulnerable to chemical spill events from fixed sites and rail transportation. There are also multiple primary and secondary roadways throughout the City (**Figure 3.72**). Structures and populations located 1/4 mile near these roadways are vulnerable to chemical spill events from primary and secondary roadways. The City of North Little Rock is at **Severe Risk** from a chemical spill event.

Figure 3.71 The City of North Little Rock – Vulnerable Locations to Chemical Spill Events from Tier II Sites and Rail Transportation

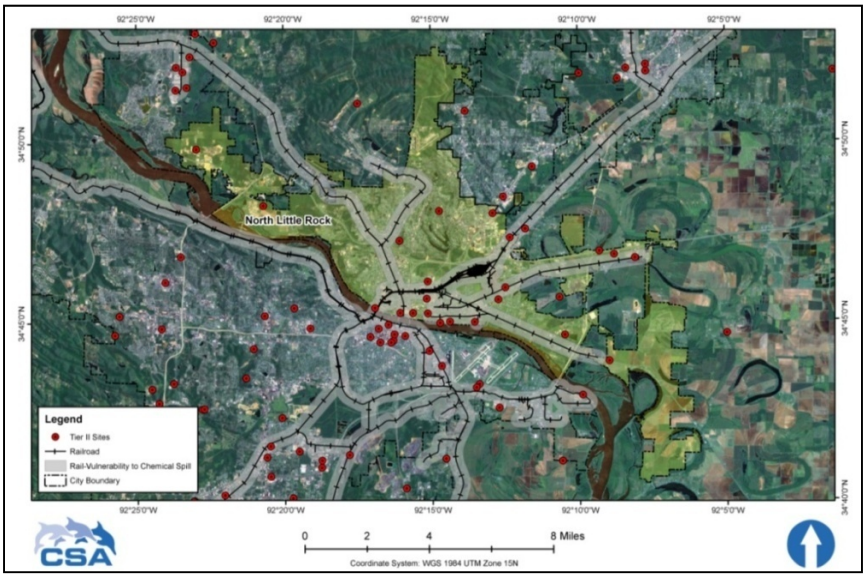
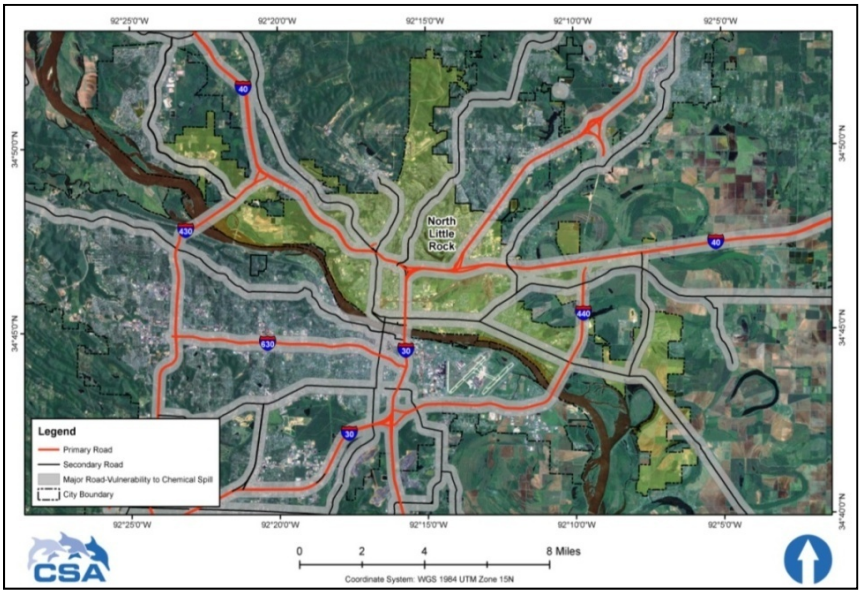


Figure 3.72 City of North Little Rock – Vulnerable Locations to Chemical Spill Events from Primary and Secondary Roadways



North Little Rock School District: There are 14 Tier II Chemical Sites located within the North Little Rock School District (**Figure 3.73**). The North Little Rock School District has a hub for rail transportation and there are multiple rail-lines located throughout the District. Structures and populations 1/4 mile near these Tier II sites and rail-lines are vulnerable to chemical spill events from fixed sites and rail transportation. There are also multiple primary and secondary roadways throughout the District (**Figure 3.74**). Structures and populations located 1/4 mile near these roadways are vulnerable to chemical spill events from primary and secondary roadways. The North Little Rock School District is at **Severe Risk** from a chemical spill event.

Figure 3.73 North Little Rock School District – Vulnerable Locations to Chemical Spill Events from Tier II Sites and Rail Transportation

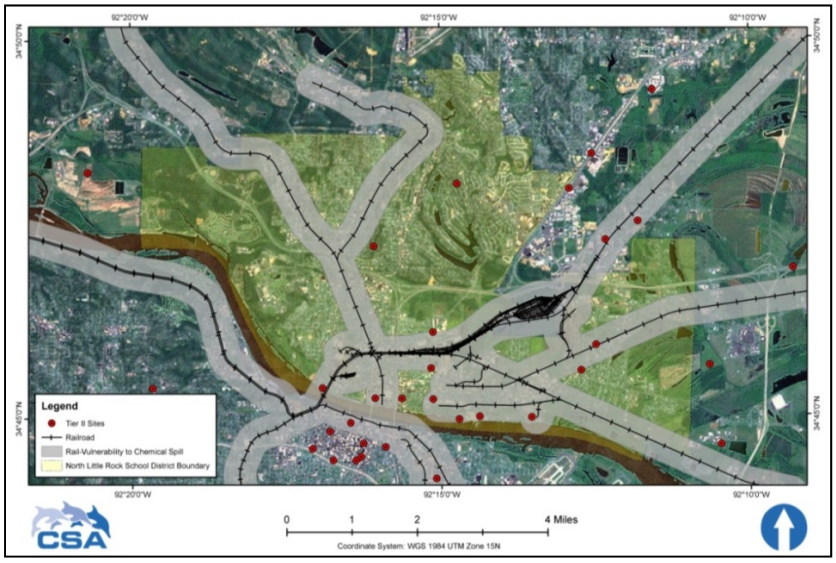
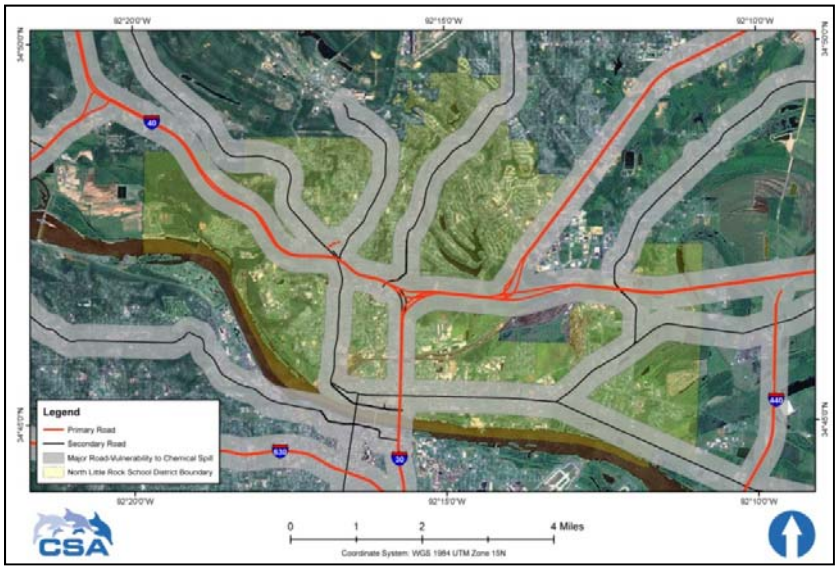


Figure 3.74 North Little Rock School District – Vulnerable Locations to Chemical Spill Events from Primary and Secondary Roadways



Sherwood: There are 5 Tier II Chemical Sites located within the City of Sherwood (**Figure 3.75**). The City of Sherwood has a rail-line located on the eastern southern border. Structures and populations 1/4 mile near these Tier II sites and rail-lines are vulnerable to chemical spill events from fixed sites and rail transportation. There is also 1 primary and 1 secondary roadway within the City (**Figure 3.76**). Structures and populations located 1/4 mile near these roadways are vulnerable to chemical spill events from primary and secondary roadways. The City of Sherwood is at **Moderate Risk** from a chemical spill event.

Figure 3.75 The City of Sherwood – Vulnerable Locations to Chemical Spill Events from Tier II Sites and Rail Transportation

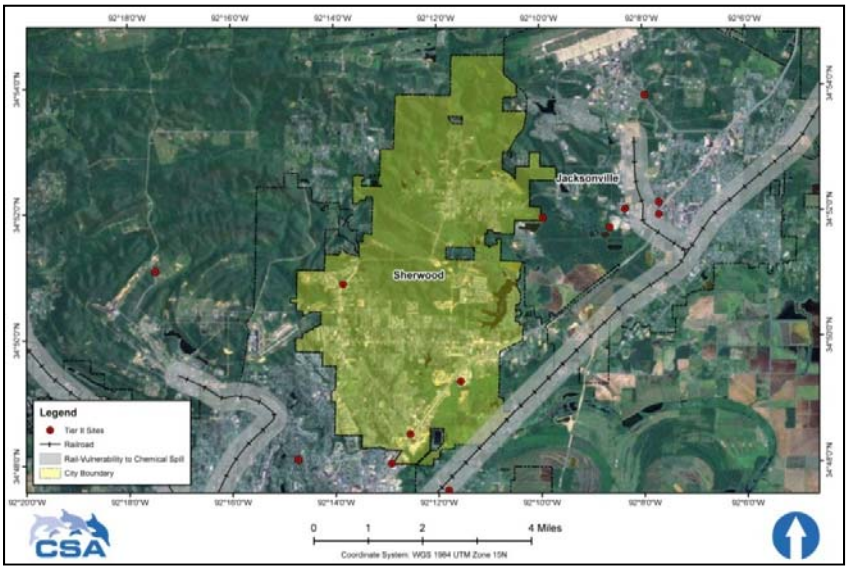
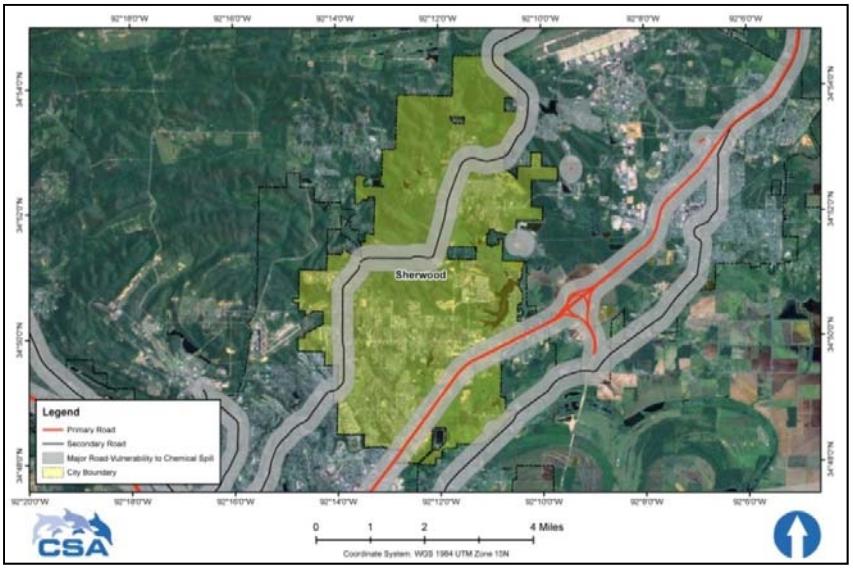


Figure 3.76 The City of Sherwood – Vulnerable Locations to Chemical Spill Events from Primary and Secondary Roadways



Pulaski County Special School District: The Pulaski County Special School District has the same boundaries as Unincorporated Pulaski County and has the same risk to chemical spill events. Pulaski County Special School District is at **Severe Risk** from a chemical spill event.

Wrightsville: There are 3 Tier II Chemical Sites located within the City of Wrightsville (**Figure 3.77**). The City of Wrightsville has a rail-line located through the western portion of the City. Structures and populations 1/4 mile near these Tier II sites and rail-lines are vulnerable to chemical spill events from fixed sites and rail transportation. There also is one secondary roadway through the western portion of the City (**Figure 3.78**). Structures and populations located 1/4 mile near these roadways are vulnerable to chemical spill events from primary and secondary roadways. The City of Sherwood is at **Moderate Risk** from a chemical spill event.

Figure 3.77 The City of Wrightsville – Vulnerable Locations to Chemical Spill Events from Tier II Sites and Rail Transportation

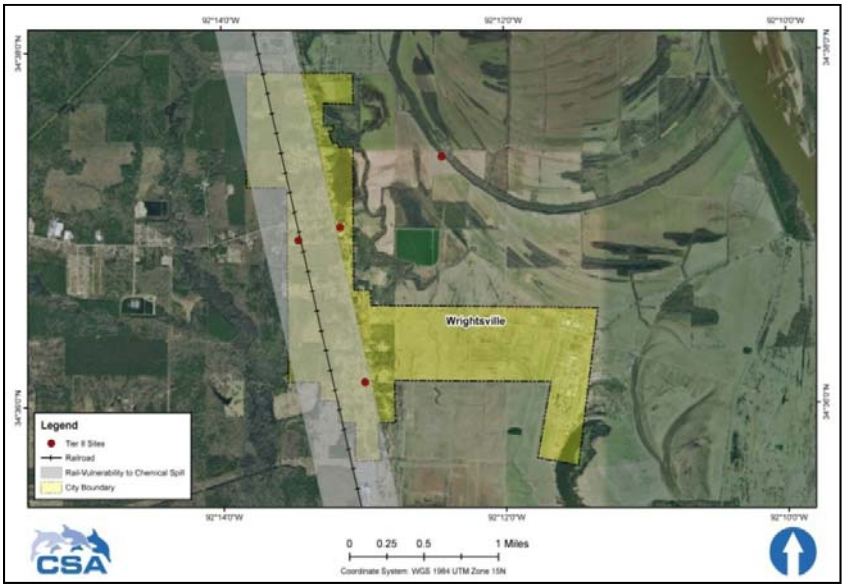
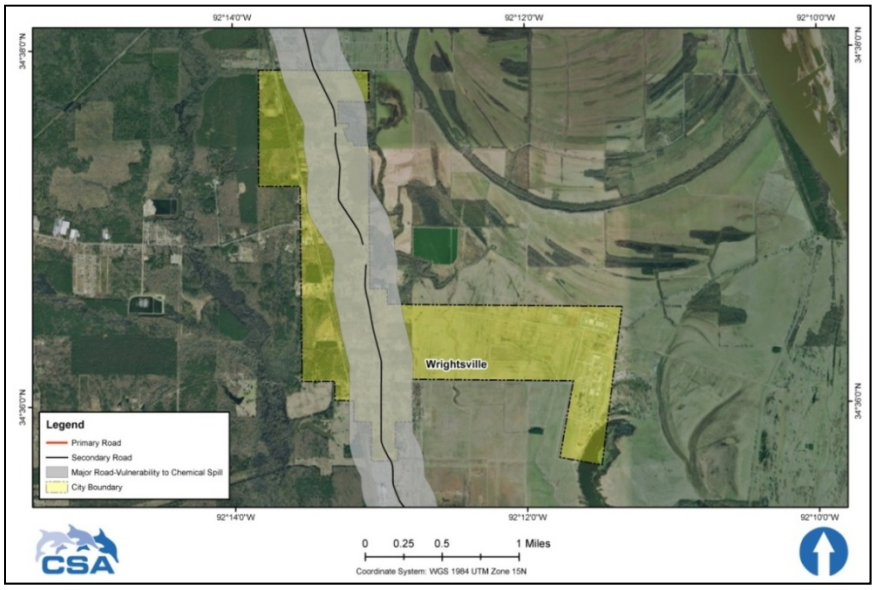


Figure 3.78 The City of Wrightsville – Vulnerable Locations to Chemical Spill Events from Primary and Secondary Roadways



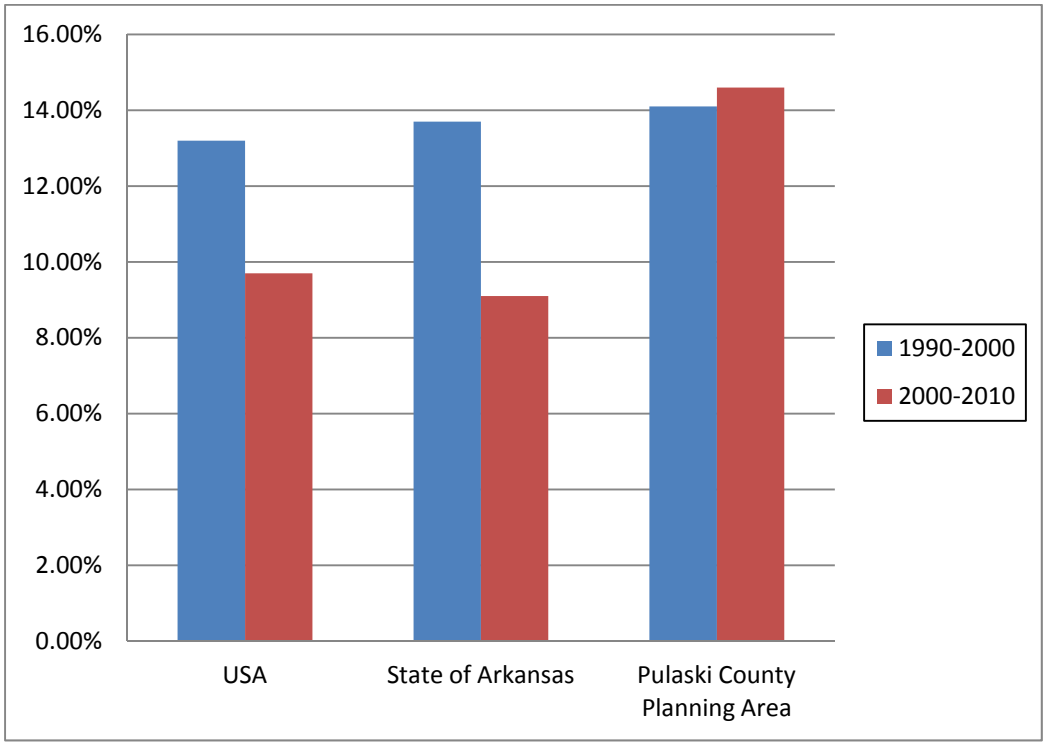
Unincorporated Pulaski County: There are 198 Tier II Chemical Sites located in Unincorporated Pulaski County (**Figure 3.55**). Unincorporated Pulaski County contains 212 grade crossings and multiple rail lines throughout its jurisdiction (**Figure 3.56**). Structures and populations 1/4 mile near these Tier II sites and rail-lines are vulnerable to chemical spill events from fixed sites and rail transportation. There are also multiple primary and secondary roadways throughout Unincorporated Pulaski County (**Figure 3.57**). Structures and populations located 1/4 mile near these roadways are vulnerable to chemical spill events from primary and secondary roadways. Unincorporated Pulaski County is at **Severe Risk** from a chemical spill event.

6 COMMUNITY DEVELOPMENT TRENDS

According to the 2010 United States Census, the Pulaski County Planning Area continues to grow at a faster pace than the State of Arkansas and National averages (**Figure 3.79**). At the city level, growth trends have seen similar rates of change (Metrotrends, 2010). Little Rock grew at a rate of 5.7%, which was at a faster rate than other South Central Metropolitan Areas such as, Springfield, Missouri (5.2%), Memphis, Tennessee (-0.5%), Baton Rouge, Louisiana (0.7%, and Jackson, Mississippi (-5.8%).

North Little Rock grew by 3.1%, lead by growth in single-family homes in the Baucum/Scott area to the east and several large new apartment complexes near Maumelle Blvd. in the west (Metrotrends, 2010). Wrightsville grew faster than previous decades. Its population grew by 54% from 2000 to 2010. Much of this growth was group quarters population (dormitories, nursing facilities, group homes, military barracks, and correctional facility), but occupied housing units also grew by about 20%. Alexander grew by a factor of 14 due to an annexation of land in 2006. Sherwood grew by 37.2% and Maumelle grew by 62.6%. The only jurisdiction that saw negative growth was the City of Jacksonville (-5.2%).

Figure 3.79 Population Growth Rate by Decade 1990 - 2010



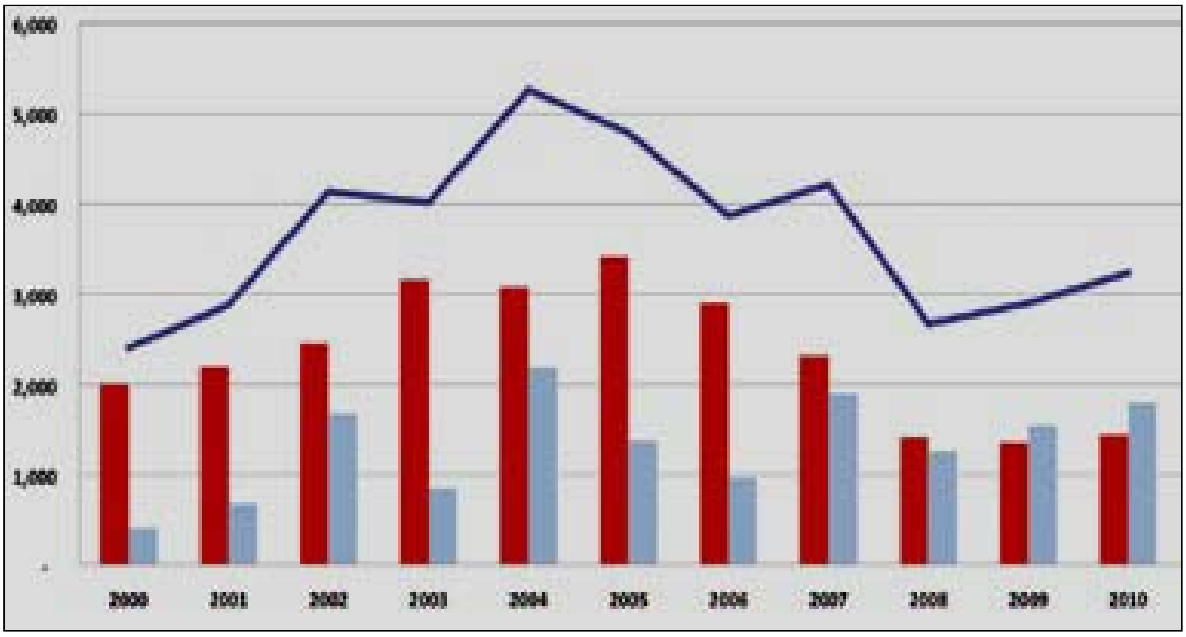
Source: U.S. Census, 2010.

Since 2008, housing construction has remained slow in the Pulaski County Planning Area. During 2010, single-family construction index dropped to 0.37, slightly lower than the previous year's single family construction index of 0.38 (Metrotrends, 2010). A modest bright spot in construction for the Pulaski County Planning Area was in multi-family housing. In 2010, the Pulaski County Planning Area saw a second straight year in which multi-family construction outpaced single-family housing in the region (**Figure 3.80**). Metrotrends has concluded that cultural changes in the area may be moving toward apartments and condos to provide more flexible and adaptable changing family situations.

There are two major areas that have been identified as areas with high-density development, multi-family housing, and high growth potential within the Pulaski County Planning Area. Little Rock's Central Business District, which includes the River Market, has had a 62% growth rate in occupied housing units since 2000 (Metrotrends, 2011). Census Tract 25 in the City of North Little Rock, including Argenta neighborhood saw 42% growth in occupied housing units over this same period. Although the current bulk of the Pulaski County Planning Area's housing stock remains in low-density suburbs, some of the fastest growing areas, like Little Rock's Central Business District and Argenta neighborhood, are in high density multi-family development areas.

Each local jurisdiction's planning and growth management departments should take into account location-specific hazard risk (flood, wildfire, dam failure, levee failure, chemical spill) when determining building permits or zoning changes. This process will ensure growth does not continue in vulnerable areas and reduce location-specific hazard risk levels overtime.

Figure 3.80 The Pulaski County Planning Area's Regional Housing Unit Permit Totals 2010



Source: Metrotrends, 2010.

§201.6(c)(3)(i): [The Hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

§201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

§201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.

§201.6(c)(3)(iii): [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

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

Table of Contents

1 HAZARD MITIGATION STRATEGY DEVELOPMENT

Section 4 – Mitigation Strategy serves as the long-term blueprint for reducing the potential losses profiled in *Section 3 – Risk Assessment*. *Section 4* begins with a description of the Hazard Mitigation Goals. Hazard Mitigation Goals are broad concepts, which taken together provide a framework for carrying out the HMP's intent to mitigate or permanently reduce hazard risk. Hazard Mitigation Goals are expressed in a manner that reflects Pulaski County's values and culture.

Hazard Mitigation Actions are polices or specific rules of conduct to be followed in achieving Hazard Mitigation Goals. The Hazard Mitigation Actions expressed in this section form the core of the HMP and provide specific steps for the County and each participating jurisdiction to mitigate hazard risk. At a minimum, each Hazard Mitigation Action contains a brief description, an approximate cost, the name of the sponsoring agency/department, funding source, benefit/cost review, and a proposed timeframe for implementation.

Because funding is limited and the opportunity to take advantage of it is often short, it is important that Hazard Mitigation Actions be prioritized before funding becomes available. Since the majority of federal funding is provided in the aftermath of a disaster, agreement on funding priorities during the pre-disaster, "blue sky" period can help communities resist the pressure to select projects based on short term, often political needs at the expense of the community's long term Hazard Mitigation Goals. The method adopted by the HMPT for Hazard Mitigation Action selection and prioritization is FEMA's Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE) method. The STAPLEE method is a systematic process for identifying opportunities and constraints likely to occur during the implementation stage of each Hazard Mitigation Action. The STAPLEE method evaluates each identified Hazard Mitigation Action's cost effectiveness, political and community values, environmental soundness, legal constraint, and economic reality. The result is a prioritized list of Hazard Mitigation Actions that are technically and administratively feasible, socially and politically acceptable, legal, economically sound and not harmful to the environment. The above identified rational planning process increases the likelihood of the successful implementation of Hazard Mitigation Actions for Pulaski County and each participating jurisdiction. It was determined by the HMPT that Hazard Mitigation Actions would be implemented only for hazards assessed as **Moderate Risk** or **Severe Risk**.

2 HAZARD MITIGATION GOALS

The HMPT met on February 29, 2011, to evaluate and update all Hazard Mitigation Goals that would provide the greatest benefit in hazard reduction to Pulaski County and each participating jurisdiction. The Hazard Mitigation Goals were selected on the basis of their ability to address community issues and the vulnerabilities identified in *Section 3 – Risk Assessment.* In an effort to make Pulaski County's Hazard Mitigation Goals more consistent with the State of Arkansas's Hazard Mitigation Goals, four additional Hazard Mitigation Goals were added to the 2012 update process. The HMPT identified the following Hazard Mitigation Goals to guide long-term Mitigation Strategy:

Hazard Mitigation Goal 1:	Reduce the potential for loss of life, injury and economic damage created by exposure to natural and man-made hazards for residents of Pulaski County.
Hazard Mitigation Goal 2:	Improve data collection, use, and sharing.
Hazard Mitigation Goal 3:	Facilitate sound development in the County and all participating jurisdictions to reduce or eliminate hazard risk.
Hazard Mitigation Goal 4:	Enhance public awareness and understanding of hazard mitigation.

Hazard Mitigation Goal 5: Identify and pursue grant opportunities to fund hazard mitigation actions and projects.

3 HAZARD MITIGATION ACTION CATEGORIES

FEMA has identified six broad categories of Hazard Mitigation Actions: prevention, property protection, public education and awareness, natural resource protection, emergency services, and structural projects. All six Hazard Mitigation Action categories are included in the Pulaski County HMP. The following definitions were included in the FEMA How to Guide 3: Developing the Mitigation Plan (FEMA, 2008).

1. **Prevention:** Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and stormwater management regulations.
2. **Property Protection:** Actions that involve the modification of existing buildings or structures to protect them from a hazard, or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters and shatter-resistant glass.
3. **Public Education and Awareness:** Actions to inform and educate citizens, elected officials and property owners about the hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.
4. **Natural Resource Protection:** Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems. These actions include sediment and erosion control, steam corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
5. **Emergency Services:** Actions that protect people and property during and immediately after a disaster or hazard event. Services include warning systems, emergency responses services, and protection of critical facilities.
6. **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, levees, floodwalls, seawalls, retaining walls, and safe rooms.

4 BENCHMARKS FOR PROGRESS

The 2006 Pulaski County HMP and the 2006 Little Rock and North Little Rock HMP established 33 Hazard Mitigation Actions to be implemented for reducing the identified hazard risks affecting Pulaski County and all participating jurisdictions. During the 2012 update process the responsible agency and department representatives determined the progress of implementing each 2006 Hazard Mitigation Action. Refer to **Table 4.1** below for the progress of all 33 original Hazard Mitigation Actions.

Table 4.1 Benchmarks for Progress		
Hazard Mitigation Action	Benchmark of Progress (Completed, In-Progress, Not-Completed, or Deferred)	Reasoning for Deferment
The Pulaski County Local Emergency Planning Committee (PCLEPC) will provide information on acquisition of all-hazard radios for all schools, city halls, large businesses, churches, and other locations where large numbers of people congregate.	Deferred	Insufficient funding and staff capabilities
Develop brochures, a website, educational programs, and PSA's to increase public awareness of hazards to which County and City residents are exposed and potential mitigation measures that may be undertaken.	In-Progress	N/A
Arrange for jurisdictions to produce studies to determine losses due to dam failure for high vulnerability dams.	Deferred	Insufficient funding and staff capabilities
Obtain funding for safe-room construction for all critical facilities.	Deferred	Insufficient funding and staff capabilities
Ensure that the current version of the Hazard Mitigation Plan is easily accessible to the general public (e.g., online, in local libraries).	In-Progress	N/A
Acquire generators for all shelters, city halls, emergency operations centers, and other critical facilities that do not have them.	Deferred	Insufficient funding and staff capabilities
Identify and maintain outside water sources in neighborhoods.	Deferred	Insufficient funding and staff capabilities
Require the use of clips and anchors in new construction and retrofitting existing structures.	Deferred	Insufficient funding and staff capabilities
Require anchoring manufactured and mobile structures to permanent foundations.	Deferred	Insufficient funding and staff capabilities
Work with Arkansas Forestry Commission to improve risk assessment by determining losses due to wildland fires in all jurisdictions.	Deferred	Insufficient funding and staff capabilities
Encourage Arkansas Geology Commission and Arkansas Highway and Transportation Department to improve risk assessment by mapping landslide deposits and determining losses sue to landslides.	Deferred	Insufficient funding and staff capabilities
Encourage Arkansas Geology Commission and Arkansas Highway and Transportation Department to improve risk assessment by mapping expansive soils and determining losses due to disruptions due to expansive soils.	Deferred	Insufficient funding and staff capabilities
Work with Arkansas Soil and Water Conservation Commission to determine losses in Pulaski County due to drought.	Deferred	Insufficient funding and staff capabilities
Provide support for structural and non-structural mitigation measures for properties in the 1%-annual-chance floodplain.	Deferred	Insufficient funding and staff capabilities
All Emergency Management Offices will study effectiveness of tornado warning sirens and continually monitor siren status.	In-Progress	N/A
Continue acquisition of repetitively-damaged properties.	Deferred	Insufficient funding and staff capabilities

Table 4.1 Benchmarks for Progress		
Hazard Mitigation Action	Benchmark of Progress (Completed, In-Progress, Not-Completed, or Deferred)	Reasoning for Deferment
The PCLEPC will encourage adoption of building codes to ensure safe construction.	Deferred	Insufficient funding and staff capabilities
All communities should join Fire Wise program at www.firewise.org.	Deferred	Insufficient funding and staff capabilities
Work with Arkansas Forestry Commission to improve risk assessment by determining losses due to wildfire in the County and Cities.	Deferred	Insufficient funding and staff capabilities
Conduct an engineering study to determine if spillways are adequate and safe in all high hazard class dams with spillways that have been found in an earlier Corps of Engineers study to have potentially inadequate spillways.	Deferred	Insufficient funding and staff capabilities
The PCLEPC will provide information on acquisition of all-hazard radios for all schools, city halls, large businesses, churches, and other locations where large numbers of people congregate.	Deferred	Insufficient funding and staff capabilities
Arrange for jurisdictions to produce studies to determine losses due to dam failure for high vulnerability dams.	Deferred	Insufficient funding and staff capabilities
Develop brochures, a website, educational programs, and Public Service Announcement's to increase public awareness of hazards to which County residents are exposed and potential mitigation measures that may be undertaken.	In-Progress	N/A
Acquire generators for all Pulaski County shelters, city halls, emergency operations centers, and other critical facilities that do not have them.	Deferred	Insufficient funding and staff capabilities
Require anchoring manufactured and mobile structures to permanent foundations.	Deferred	Insufficient funding and staff capabilities
The PCLEPC will encourage adoption of building codes to ensure safe construction.	Deferred	Insufficient funding and staff capabilities
Continue acquisition of repetitively-damaged properties.	Deferred	Insufficient funding and staff capabilities
Provide support for structural and non-structural mitigation measures for properties in the 1%-annual-chance floodplain.	Deferred	Insufficient funding and staff capabilities
Update Flood Insurance Rate Maps (FIRMs) for Pulaski County and local jurisdictions.	Deferred	Insufficient funding and staff capabilities
Mitigate the repetitively flooded property near Highway 161 and Jim Hall Road in unincorporated Pulaski County.	Deferred	Insufficient funding and staff capabilities
Improve drainage in northeast portion of County.	Deferred	Insufficient funding and staff capabilities
Channelize a portion of Five-Mile Creek in Sherwood to reduce flooding of houses in this area.	Deferred	Insufficient funding and staff capabilities
Study the watershed of Little Maumelle River including Isom Creek and Taylor Loop Creek to determine baseline for sustainable development.	Deferred	Insufficient funding and staff capabilities

5 HAZARD MITIGATION ACTIONS

The implementation of appropriate Hazard Mitigation Actions allows Pulaski County and each participating jurisdiction to successfully achieve its Hazard Mitigation Goals. On April 3, 2012, the HMPT participated in identifying and analyzing a comprehensive range of Hazard Mitigation Actions for each hazard assessed as **Moderate Risk** or **Severe Risk**. Each Hazard Mitigation Action was evaluated according to 10 items (**Table 4.2**). Each criterion was measured based on cost estimates[1], administrative capacity[2], local knowledge[3], and technical research. Refer to **Table 4.3** for a prioritized list of Hazard Mitigation Actions.

Table 4.2 Hazard Mitigation Action Review Items

Items	How Reviewed
1. STAPLEE Assigned Priority	What is the Hazard Mitigation Action's Priority based on the STAPLEE Method?
2. Hazard Mitigation Action	Name of hazard mitigation activity.
3. Hazard(s) Mitigated	What hazard is mitigated from the Hazard Mitigation Action?
4. Affect on New and/or Existing Structures and/or Populations	Does the Hazard Mitigation Action reduce risk for new and/or existing structures and/or populations?
5. Funding Source(s) and Situation	Local budget
	State and Federal grants (specific grant programs if identified)
	Additional grant source (specific grant programs if identified)
	All funding sources
	No potential funding source can be readily identified
6. Estimated Cost	How much will the Hazard Mitigation Action cost to implement? N/A means that cost estimations are not available at this time.
7. Cost-Benefit Review	Cost/Benefit Review According to the STAPLEE Method
8. Administration/Agency Responsible	The agency/department(s) implementing the Hazard Mitigation Action
9. Timeline	**Achieved:** Hazard Mitigation Action has already been achieved by Pulaski County
	In Progress: Hazard Mitigation Action, which Pulaski County is already implementing
	Short Term: Hazard Mitigation Action is capable of implementation within one to two years
	Long Term: Hazard Mitigation Action may require new or additional resources or authorities, and may take from two to five years to implement
10. Benefiting Jurisdiction	Which participating jurisdiction is benefiting from the Hazard Mitigation Action?

[1] Cost estimates are determined by reviewing similar project costs within other communities and direct costs from suppliers.
[2] Administrative capacity is a determining factor for the lead jurisdiction of the action or project.
[3] Local knowledge was acquired through interviews with knowledgeable members of the community and public administrators.

Table 4.3 Hazard Mitigation Action Matrix

STAPLEE Assigned Priority	Hazard Mitigation Action	Hazard(s) Mitigated	Affect on New and/or Existing Structures and/or Populations	Funding Source and Situation	Estimated Cost	Cost-Benefit Review	Administration/Agency Responsible	Timeframe	Benefiting Jurisdiction
1	Construct public safe-rooms at current and future critical facilities.	Tornado and Thunderstorm	New and Existing Populations	Local Budget, State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	$90 - $490 per square-foot	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, each participating Jurisdiction's Mayor's Office and each School District's Facility Administration	Long Term	All Jurisdictions
2	Install an all-hazard alert system, Red Alert, CodeRed, reverse 9-1-1 call, warning sirens, IPAWS, or other effective method.	All Hazards	New and Existing Populations	All Funding Sources	N/A	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, and each participating Jurisdiction's Mayor's Office	Short Term	All Jurisdictions
3	Advertise to homeowners about the Arkansas Department Emergency Management's Safe Room/Shelter Program.	Tornado and Thunderstorm	Existing Structures and Populations	Local Budget	$1,000	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, each participating Jurisdiction's Mayor's Office	Short Term	All Jurisdictions
4	Retrofit existing and install in all new critical facilities roof clips and anchors.	Tornado and Thunderstorm	Existing Structures and Populations	Local Budget, State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	N/A	Cost-effective	Each participating Jurisdiction's Building and Permits Department	Long Term	All Jurisdictions
5	Construct or retrofit a building to be a designated "cool-down" shelter.	Extreme Heat	New and Existing Populations	Local Budget, State and Federal Grants	$20,000 – $150,000	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, each participating Jurisdiction's Mayor's Office	Long Term	All Jurisdictions
6	Conduct a Commodity Flow Study to determine what chemicals are being transported through the County and each participating jurisdiction.	Chemical Spill	New and Existing Structures and Populations	Local Budget, State, and Federal Grants	$20,000	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, each participating Jurisdiction's Mayor's Office	Short Term	All Jurisdictions
7	Acquire generators for all critical facilities and shelters.	All Hazards	New and Existing Structures and Populations	All Funding Sources	$25,000 - $50,000	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, and each participating Jurisdiction's Mayor's Office	Short Term	All Jurisdictions

Table 4.3 Hazard Mitigation Action Matrix

STAPLEE Assigned Priority	Hazard Mitigation Action	Hazard(s) Mitigated	Affect on New and/or Existing Structures and/or Populations	Funding Source and Situation	Estimated Cost	Cost-Benefit Review	Administration/Agency Responsible	Timeframe	Benefiting Jurisdiction
8	Ensure that the Hazard Mitigation Plan is available to the public in hard copy and on the Pulaski County OEM website.	All Hazards	New and Existing Structures and Populations	Local Budget	N/A	Cost-effective	Pulaski County OEM, and each participating Jurisdiction's Mayor's Office	Short Term	All Jurisdictions
9	Apply to the Community Rating System to receive a 5% reduction in flood insurance rates for all citizens.	Flood	New and Existing Structures and Populations	Local Budget	$15,000	Cost-effective	Pulaski County OEM, North Little Rock OEM, and each participating Jurisdiction's Mayor's Office	Short Term	Pulaski County, Alexander, Cammack Village, Maumelle, North Little Rock, Sherwood, Wrightsville
10	Obtain additional points in the Community Rating System to receive flood insurance premium discounts for residents.	Flood	New and Existing Structures and Populations	Local Budget and Federal Grants	$5,000 – $20,000	Cost-effective	Cities of Little Rock and Jacksonville	Short Term	Little Rock and Jacksonville
11	Implement a Master Drainage Plan.	Flood, Levee Failure, and Dam Failure	New and Existing Structures and Populations	Local Budget	$200,000 - $500,000	Cost-effective	Each participating Jurisdiction's Mayor's Office and School District's Facility Administration	Long Term	All Jurisdictions
12	Structurally harden all existing and future critical facilities to withstand strong winds.	Tornado and Thunderstorm	New and Existing Structures	Local Budget, State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	N/A	Cost-effective	Each participating Jurisdiction's Building and Permits Department	Long Term	All Jurisdictions
13	Replace critical facility windows with shatter-proof glass.	Tornado and Thunderstorm	New and Existing Structures	Local Budget, State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	N/A	Cost-effective	Each participating Jurisdiction's Building and Permits Department	Long Term	All Jurisdictions
14	Develop a weatherization education outreach program.	Severe Winter Storm and Extreme Heat	New and Existing Populations	Local Budget, State and Federal Grants	$5,000	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, each participating Jurisdiction's Mayor's Office	Long Term	All Jurisdictions

Table 4.3 Hazard Mitigation Action Matrix

STAPLEE Assigned Priority	Hazard Mitigation Action	Hazard(s) Mitigated	Affect on New and/or Existing Structures and/or Populations	Funding Source and Situation	Estimated Cost	Cost-Benefit Review	Administration/Agency Responsible	Timeframe	Benefiting Jurisdiction
15	Identify substandard housing without proper air-conditioning or insulation.	Extreme Heat	Existing Populations	Local Budget, State and Federal Grants	N/A	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, each participating Jurisdiction's Mayor's Office	Long Term	All Jurisdictions
16	Identify and maintain water sources.	Drought	Existing Populations	Local Budget	N/A	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, each participating Jurisdiction's Mayor's Office	In Progress	All Jurisdictions
17	Provide brochure to new and existing homeowners on their home's proximity to natural-gas pipelines.	Chemical Spill	New and Existing Structures and Populations	Local Budget	$1,000	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, each participating Jurisdiction's Mayor's Office	Short Term	All Jurisdictions
18	Certify NLR Levee.	Levee Failure	New and Existing Structures and Populations	Local Budget, State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	N/A	Cost-effective	City of North Little Rock's Department of Public Works	Short Term	North Little Rock
20	Implement a mosquito-borne disease educational outreach program.	Mosquito-borne Disease	New and Existing Populations	Local Budget	$5,000	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, each participating Jurisdiction's Mayor's Office	In Progress	All Jurisdictions
19	Implement a mosquito-borne disease abatement program.	Mosquito-borne Disease	New and Existing Populations	Local Budget	$25,000	Cost-effective	Pulaski County Health Department, North Little Rock Health Department, Little Rock Health Department and each participating Jurisdiction's Mayor's Office	In Progress	All Jurisdictions
21	Construct special public saferoom for at-risk populations.	Tornado and Thunderstorm	New and Existing Populations	Local Budget, State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	$90 - $490 per square-foot	Cost-effective	City of Jacksonville's Department of Engineering	Long Term	Jacksonville

Table 4.3 Hazard Mitigation Action Matrix

STAPLEE Assigned Priority	Hazard Mitigation Action	Hazard(s) Mitigated	Affect on New and/or Existing Structures and/or Populations	Funding Source and Situation	Estimated Cost	Cost-Benefit Review	Administration/Agency Responsible	Timeframe	Benefiting Jurisdiction
22	Develop brochures, websites, educational programs, and Public Service Announcements that increase public awareness of hazard risk and mitigation activities.	All Hazards	New and Existing Structures and Populations	Local Budget	$5,000	Cost-effective	Pulaski County OEM, Little Rock OEM, and North Little Rock	Short Term	All Jurisdictions
23	Implement burn bans during wildfire events.	Wildfire	New and Existing Populations	Local Budget	N/A	Cost-effective	Each Participating Jurisdiction's Career or Volunteer Fire Department	In Progress	All Jurisdictions
24	Assist communities to become a Firewise Communities.	Wildfire	New and Existing Populations	Local Budget and State Grants	$5,000	Cost-effective	Each Participating Jurisdiction's Career or Volunteer Fire Department	In Progress	All Jurisdictions
25	Acquire all-hazard weather radios for all schools, city halls, large businesses, churches, and other critical facilities.	All Hazards	New and Existing Structures and Populations	Local Budget	$30 per unit	Cost-effective	Pulaski County OEM, Little Rock OEM, and North Little Rock	Short Term	All Jurisdictions
26	Meet the guidelines for the National Weather Service "Storm Ready Program."	All Hazards	New and Existing Structures and Populations	Local Budget	N/A	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, and each participating Jurisdiction's Mayor's Office	Short Term	All Jurisdictions
27	Study the watershed of Taylor Creek to determine baseline for sustainable development and needs for drainage capacity improvements.	Flood	New and Existing Structures and Populations	Local Budget	N/A	Cost-effective	Pulaski County Public Works	Short Term	Pulaski County
28	Perform engineering studies for Five Mile Creek/Shilcott Bayou.	Flood	New and Existing Structures and Populations	Local Budget, State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	N/A	Cost-effective	City of North Little Rock's Department of Public Works	Long Term	North Little Rock
29	Increase drainage capacity in areas of the County that are inadequate.	Flood, Levee Failure, and Dam Failure	New and Existing Structures and Populations	Local Budget, State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	N/A	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, and each participating Jurisdiction's Mayor's Office	Long Term	All Jurisdictions

Table 4.3 Hazard Mitigation Action Matrix

STAPLEE Assigned Priority	Hazard Mitigation Action	Hazard(s) Mitigated	Affect on New and/or Existing Structures and/or Populations	Funding Source and Situation	Estimated Cost	Cost-Benefit Review	Administration/Agency Responsible	Timeframe	Benefiting Jurisdiction
30	Require anchoring of all new manufactured structures to permanent foundations.	Tornado and Thunderstorm	New and Existing Structures and Populations	Local Budget	N/A	Cost-effective	Each participating Jurisdiction's Building and Permits Department	Long Term	All Jurisdictions
31	Secure building contents on shelves in all critical facilities.	Earthquake	Existing Structures	Local Budget	N/A	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, each participating Jurisdiction's Mayor's Office	Short Term	All Jurisdictions
32	Collaborate with the Arkansas Geological Survey and USGS to develop more accurate earthquake risk maps.	Earthquake	New and Existing Populations	Local Budget	N/A	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, each participating Jurisdiction's Mayor's Office	Short Term	All Jurisdictions
33	Advertise National Flood Insurance Program through a Public Service Announcement.	Flood	New and Existing Structures and Populations	Local Budget	$5,000	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, and each participating Jurisdiction's Mayor's Office and School Board	Short Term	All Jurisdictions
34	Mitigate repetitively flooded property on Jim Hall Road.	Flood	Existing Structure	Local Budget, State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	N/A	Cost-effective	City of Jacksonville's Department of Engineering	Short Term	Jacksonville
35	Perform engineering studies for Redwood Tunnel Drainage System.	Flood	New and Existing Structures and Populations	Local Budget, State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	N/A	Cost-effective	City of North Little Rock's Department of Public Works	Long Term	North Little Rock
36	Improve drainage at State HW 161/Bethany.	Flood	New and Existing Structures and Populations	Local Budget, State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	N/A	Cost-effective	City of North Little Rock's Department of Public Works	Long Term	North Little Rock
37	Implement water restriction ordinance during drought event.	Drought	New and Existing Populations	Local Budget	N/A	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, each participating Jurisdiction's Mayor's Office	In Progress	All Jurisdictions

Table 4.3 Hazard Mitigation Action Matrix

STAPLEE Assigned Priority	Hazard Mitigation Action	Hazard(s) Mitigated	Affect on New and/or Existing Structures and/or Populations	Funding Source and Situation	Estimated Cost	Cost-Benefit Review	Administration/Agency Responsible	Timeframe	Benefiting Jurisdiction
38	Incorporate all-hazard education program into school curriculum.	All Hazards	New and Existing Structures and Populations	Local Budget	N/A	Cost-effective	Each participating School District's School Board or School Messenger	Short Term	Little Rock School District, North Little Rock School District, Pulaski County Special School District
39	Acquire repetitive loss and severe repetitive loss structures.	Flood	Existing Structures and Populations	State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	N/A	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, and each participating Jurisdiction's Mayor's Office	Long Term	All Jurisdictions
40	Elevate existing and future structures within the special flood areas above the base flood elevation.	Flood	New and Existing Structures and Populations	State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	N/A	Cost-effective	Pulaski County OEM, Little Rock OEM, North Little Rock, and each participating Jurisdiction's Mayor's Office	Long Term	All Jurisdictions
41	Improve drainage capacity in northeast portion of the County.	Flood	Existing Structure	Local Budget, State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	N/A	Cost-effective	Pulaski County Public Works	Short Term	Pulaski County
42	Mitigate flooding by Northlake subdivision emergency access route.	Flood	New and Existing Structures and Populations	Local Budget	N/A	Cost-effective	City of Jacksonville's Department of Engineering	In Progress	Jacksonville
43	Enact zoning buffer to minimize the intensity of new development around natural-gas pipelines.	Chemical Spill	New Structures and Populations	Local Budget	N/A	Cost-effective	Each participating Jurisdiction's Planning Department or Mayor's Office	Short Term	All Jurisdictions
44	Mitigate flooding into lowest level of building located at 2300 Poplar Street, North Little Rock with construction of levee, check drainage pump, or demolition of a portion of the building.	Flood, Levee Failure, and Dam Failure	Existing Structures and Populations	Local Budget, State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	N/A	Cost-effective	North Little Rock's Facility Administration	Long Term	North Little Rock School District

Table 4.3 Hazard Mitigation Action Matrix

STAPLEE Assigned Priority	Hazard Mitigation Action	Hazard(s) Mitigated	Affect on New and/or Existing Structures and/or Populations	Funding Source and Situation	Estimated Cost	Cost-Benefit Review	Administration/Agency Responsible	Timeframe	Benefiting Jurisdiction
45	Remediate/ Rehabilitate Main Street Pump Station Outfall.	Flood, Levee Failure, and Dam Failure	New and Existing Structures and Populations	Local Budget, State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	N/A	Cost-effective	City of North Little Rock's Department of Public Works	Short Term	North Little Rock
46	Construct new utility lines underground.	Severe Winter Storm	New Structures	Local Budget, State and Federal Grants: HMGP, PDM, FMA, RL and SRL Grant Program	N/A	Cost-effective	Each participating Jurisdiction's Building and Permits Department or Department of Engineering	Long Term	All Jurisdictions
47	Arrange for floodplain management workshops & training for local jurisdictions to improve program administration & effectiveness and qualifications of managers.	Flood	New and Existing Structures and Populations	Local Budget	N/A	Cost-effective	Each participating Jurisdiction's Floodplain Managers	In Progress	All Jurisdictions
48	Adopt a land use plan with zoning and development restrictions to protect residents from special flood areas.	Flood	New and Existing Structures and Populations	Local Budget	N/A	Cost-effective	Each participating Jurisdiction's Floodplain Managers	In Progress	All Jurisdictions

Table 4.3 Hazard Mitigation Action Matrix

STAPLEE Assigned Priority	Hazard Mitigation Action	Hazard(s) Mitigated	Affect on New and/or Existing Structures and/or Populations	Funding Source and Situation	Estimated Cost	Cost-Benefit Review	Administration/Agency Responsible	Timeframe	Benefiting Jurisdiction
49	Implement alternative floodplain management means for small jurisdictions such as the Cammack Village and Pulaski County Special School District that are lacking personnel for this job through meetings between the Village and School District and Pulaski County. MOUs and MOAs between Village, District, and County allow the County to regulate this alternative flood plain management.	Flood	New and Existing Structures and Populations	Local Budget	N/A	Cost-effective	Pulaski County Planning and Development	Short Term	Cammack Village and Pulaski County Special School District
50	Implement alternative floodplain management means for small jurisdictions such as the Little Rock School District, that are lacking personnel for this job through meetings between School District and the City of Little Rock. MOUs and MOAs between District and City allow the City to regulate this alternative flood plain management.	Flood	New and Existing Structures and Populations	Local Budget	N/A	Cost-effective	City of Little Rock Planning and Development	Short Term	Little Rock School District

Table 4.3 Hazard Mitigation Action Matrix

STAPLEE Assigned Priority	Hazard Mitigation Action	Hazard(s) Mitigated	Affect on New and/or Existing Structures and/or Populations	Funding Source and Situation	Estimated Cost	Cost-Benefit Review	Administration/Agency Responsible	Timeframe	Benefiting Jurisdiction
51	Implement alternative floodplain management means for small jurisdictions such as the North Little Rock School District, that are lacking personnel for this job through meetings between School District and the City of North Little Rock. MOUs and MOAs between District and City allow the City to regulate this alternative flood plain management.	Flood	New and Existing Structures and Populations	Local Budget	N/A	Cost-effective	Pulaski County Planning and Development	Short Term	North Little Rock School District

6 EVALUATION CRITERIA FOR HAZARD MITIGATION ACTIONS

Each Hazard Mitigation Action is prioritized in the order to which it will be implemented by Pulaski County. The prioritization process relies on the identified hazard risks and vulnerabilities of Pulaski County and each participating jurisdiction, the STAPLEE method, the HMPT's local expertise, and public input.

Over the course of several weeks, the HMPT presented, outlined, categorically defined, and ranked each Hazard Mitigation Action. FEMA's STAPLEE method was then used to systematically measure the opportunities and constraints of implementing each Hazard Mitigation Action. This method analyzes each Hazard Mitigation Action for factors of cost effectiveness, political will, community values, environmental issues, legal constraints and economic realities. Each action is given an overall score, which is used in its prioritization (higher scores translate into higher priority). The HMPT ranked each individual criteria of the STAPLEE method to represent the concerns of the community. They gave additional weight to costs, benefits, and community acceptance. Hazard Mitigation Actions that were measured to have a low cost effectiveness and low community acceptance received a substantially low prioritization. **Table 4.4** contains the STAPLEE matrix with all the scores for each weighted criteria. Actions with the same score totals were prioritized based on HMPT expertise. This systematic method provides a list of actions that are technically and administratively feasible, socially and politically acceptable, legal, economically sound, and not harmful to the environment. This method also allows additional actions to be prioritized against original actions during subsequent updates.

Table 4.4 STAPLEE Scoring Matrix

Alternative Actions	Social		Technical			Administrative			Political			Legal			Economic				Environmental					Total Points
	Community Acceptance (1-5 points)	Effects on Segment of Population (1-5 points)	Technical Feasibility (1-3 points)	Long-term Solution (1-3 points)	Secondary Impacts (1-3 points)	Staffing (1-3 points)	Funding Allocated (1-3 points)	Maintenance/Operations (1-3 points)	Political Support (1-3 points)	Local Champion (1-3 points)	Public Support (1-5 points)	State Authority (1-3 points)	Existing Local Authority (1-3 points)	Potential Legal Challenges (1-3 points)	Benefit of Action (1-5 points)	Cost of Action (1-5 points)	Contributes to Economic Goals (1-3 points)	Outside Funding Required (1-3 points)	Effect on Land/Water (1-3 points)	Effect on Endangered Species (1-3 points)	Effect on HAZMAT/Waste Sites (1-3 points)	Environmental Goals (1-3) points)	Federal Environmental laws (1-3points)	
Construct public safe-rooms at current and future critical facilities.	5	5	3	3	3	3	3	3	3	3	5	3	3	3	5	4	3	3	3	3	3	3	3	78
Install an all-hazard alert system, Red Alert, CodeRed, reverse 9-1-1 call, warning sirens, IPAWS, or other effective method.	5	5	3	2	3	3	2	3	3	3	5	3	3	3	5	5	3	3	3	3	3	3	3	77
Advertise to homeowners about the Arkansas Department Emergency Management's Safe Room/Shelter Program.	5	5	3	3	3	3	3	3	3	3	5	3	3	3	3	5	3	3	3	3	3	3	3	77
Retrofit existing and install in all new critical facilities roof clips and anchors.	5	5	3	3	3	3	3	3	3	3	4	3	3	3	4	5	3	3	3	3	3	3	3	77
Construct or retrofit a building to be a designated "cool-down" shelter.	5	5	3	3	3	3	3	3	3	3	4	3	3	3	5	4	3	3	3	3	3	3	3	77
Conduct a Commodity Flow Study to determine what chemicals are being transported through the County and each participating jurisdiction.	5	5	3	3	3	3	3	3	3	3	5	3	3	3	3	5	3	3	3	3	3	3	3	77

Table 4.4 STAPLEE Scoring Matrix

Alternative Actions	Social		Technical			Administrative			Political			Legal			Economic				Environmental					Total Points
	Community Acceptance (1-5 points)	Effects on Segment of Population (1-5 points)	Technical Feasibility (1-3 points)	Long-term Solution (1-3 points)	Secondary Impacts (1-3 points)	Staffing (1-3 points)	Funding Allocated (1-3 points)	Maintenance/Operations (1-3 points)	Political Support (1-3 points)	Local Champion (1-3 points)	Public Support (1-5 points)	State Authority (1-3 points)	Existing Local Authority (1-3 points)	Potential Legal Challenges (1-3 points)	Benefit of Action (1-5 points)	Cost of Action (1-5 points)	Contributes to Economic Goals (1-3 points)	Outside Funding Required (1-3 points)	Effect on Land/Water (1-3 points)	Effect on Endangered Species (1-3 points)	Effect on HAZMAT/Waste Sites (1-3 points)	Environmental Goals (1-3) points)	Federal Environmental laws (1-3points)	
Acquire generators for all critical facilities and shelters.	5	5	3	3	3	3	2	3	3	3	4	3	3	3	5	4	3	3	3	3	3	3	3	76
Ensure that the Hazard Mitigation Plan is available to the public in hard copy and on the Pulaski County OEM website.	5	5	3	2	3	3	3	3	3	3	5	3	3	3	4	5	2	3	3	3	3	3	3	76
Apply to the Community Rating System to receive a 5% reduction in flood insurance rates for all citizens.	5	5	3	3	3	3	2	3	3	3	4	3	3	3	5	5	2	3	3	3	3	3	3	76
Obtain additional points in the Community Rating System to receive flood insurance premium discounts for residents.	5	5	3	3	3	3	2	3	3	3	4	3	3	3	5	5	2	3	3	3	3	3	3	76
Implement a Master Drainage Plan.	5	5	3	3	3	3	2	3	3	3	5	3	3	3	5	3	3	3	3	3	3	3	3	76
Structurally harden all existing and future critical facilities to withstand strong winds.	5	5	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	3	3	3	3	3	76
Replace critical facility windows with shatter-proof glass.	5	5	3	3	3	3	3	3	3	3	3	3	3	3	4	5	3	3	3	3	3	3	3	76

Table 4.4 STAPLEE Scoring Matrix

Alternative Actions	Social		Technical			Administrative			Political			Legal			Economic				Environmental					Total Points
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Develop a weatherization education outreach program.	5	5	3	3	3	3	3	3	3	3	4	3	3	3	3	5	3	3	3	3	3	3	3	76
Identify substandard housing without proper air-conditioning or insulation.	5	5	3	3	3	3	3	3	3	3	4	3	3	3	3	5	3	3	3	3	3	3	3	76
Identify and maintain water sources.	5	5	3	3	3	3	3	3	3	3	4	3	3	3	3	5	3	3	3	3	3	3	3	76
Provide brochure to new and existing homeowners on their home's proximity to natural-gas pipelines.	5	5	3	3	3	3	3	3	3	3	4	3	3	3	3	5	3	3	3	3	3	3	3	76
Certify the NLR Levee.	5	3	3	3	3	3	3	3	3	3	4	3	3	3	4	5	3	3	3	3	3	3	3	75
Implement a mosquito-borne disease abatement program.	5	5	3	3	3	2	3	3	4	3	5	3	3	3	3	3	3	3	3	3	3	3	3	75
Implement a mosquito-borne disease educational outreach program.	5	5	3	3	3	2	3	3	4	3	5	3	3	3	3	3	3	3	3	3	3	3	3	75
Construct special public saferoom for at-risk populations.	5	5	3	3	3	3	2	3	3	3	5	3	3	3	5	2	3	3	3	3	3	3	3	75

Table 4.4 STAPLEE Scoring Matrix

Alternative Actions	Social		Technical			Administrative			Political			Legal			Economic				Environmental					Total Points
	Community Acceptance (1-5 points)	Effects on Segment of Population (1-5 points)	Technical Feasibility (1-3 points)	Long-term Solution (1-3 points)	Secondary Impacts (1-3 points)	Staffing (1-3 points)	Funding Allocated (1-3 points)	Maintenance/Operations (1-3 points)	Political Support (1-3 points)	Local Champion (1-3 points)	Public Support (1-5 points)	State Authority (1-3 points)	Existing Local Authority (1-3 points)	Potential Legal Challenges (1-3 points)	Benefit of Action (1-5 points)	Cost of Action (1-5 points)	Contributes to Economic Goals (1-3 points)	Outside Funding Required (1-3 points)	Effect on Land/Water (1-3 points)	Effect on Endangered Species (1-3 points)	Effect on HAZMAT/Waste Sites (1-3 points)	Environmental Goals (1-3) points)	Federal Environmental laws (1-3points)	
Develop brochures, websites, educational programs, and Public Service Announcements that increase public awareness of hazard risk and mitigation activities.	5	5	3	2	3	3	2	3	3	3	5	3	3	3	4	5	2	3	3	3	3	3	3	75
Implement burn bans during wildfire events.	5	4	3	3	3	2	3	3	4	3	5	3	3	3	3	3	3	3	3	3	3	3	3	74
Assist communities to become a Firewise Communities.	5	4	3	3	3	2	3	3	4	3	5	3	3	3	3	3	3	3	3	3	3	3	3	74
Acquire all-hazard weather radios for all schools, city halls, large businesses, churches, and other critical facilities.	5	5	3	2	3	3	2	3	3	3	4	3	3	3	4	5	2	3	3	3	3	3	3	74
Meet the guidelines for the National Weather Service “Storm Ready Program.”	5	5	3	2	3	3	2	3	3	3	4	3	3	3	4	5	2	3	3	3	3	3	3	74
Study the watershed of Taylor Creek to determine baseline for sustainable development and needs for drainage capacity improvements.	5	4	3	3	3	3	2	3	3	3	4	3	3	3	5	4	2	3	3	3	3	3	3	74
Perform engineering studies for Five Mile Creek/ Shilcott Bayou.	5	3	3	3	3	3	2	3	3	3	4	3	3	3	5	4	3	3	3	3	3	3	3	74

Table 4.4 STAPLEE Scoring Matrix

Alternative Actions	Social		Technical			Administrative			Political			Legal			Economic				Environmental					Total Points
	Community Acceptance (1-5 points)	Effects on Segment of Population (1-5 points)	Technical Feasibility (1-3 points)	Long-term Solution (1-3 points)	Secondary Impacts (1-3 points)	Staffing (1-3 points)	Funding Allocated (1-3 points)	Maintenance/Operations (1-3 points)	Political Support (1-3 points)	Local Champion (1-3 points)	Public Support (1-5 points)	State Authority (1-3 points)	Existing Local Authority (1-3 points)	Potential Legal Challenges (1-3 points)	Benefit of Action (1-5 points)	Cost of Action (1-5 points)	Contributes to Economic Goals (1-3 points)	Outside Funding Required (1-3 points)	Effect on Land/Water (1-3 points)	Effect on Endangered Species (1-3 points)	Effect on HAZMAT/Waste Sites (1-3 points)	Environmental Goals (1-3) points)	Federal Environmental laws (1-3points)	
Increase drainage capacity in areas of the County that are inadequate.	5	4	3	3	3	3	2	3	3	3	4	3	3	3	5	3	3	3	3	3	3	3	3	74
Require anchoring of all new manufactured structures to permanent foundations.	4	5	3	3	3	3	3	3	3	3	2	3	3	3	4	5	3	3	3	3	3	3	3	74
Secure building contents on shelves in all critical facilities.	5	5	3	3	3	3	3	3	3	3	3	3	3	3	2	5	3	3	3	3	3	3	3	74
Collaborate with the Arkansas Geological Survey and USGS to develop more accurate earthquake risk maps.	5	5	3	3	3	2	3	3	3	3	4	3	3	3	2	5	3	3	3	3	3	3	3	74
Advertise National Flood Insurance Program through a Public Service Announcement.	5	5	3	2	3	3	2	3	3	3	4	3	3	3	3	5	2	3	3	3	3	3	3	73
Mitigate repetitively flooded property on Jim Hall Road.	5	3	3	3	3	3	3	3	3	3	4	3	3	3	5	4	2	2	3	3	3	3	3	73
Perform engineering studies for Redwood Tunnel Drainage System.	5	3	3	3	3	3	2	3	3	3	4	3	3	3	5	3	3	3	3	3	3	3	3	73
Improve drainage at State HW 161/Bethany.	5	3	3	3	3	3	2	3	3	3	4	3	3	3	5	3	3	3	3	3	3	3	3	73

Table 4.4 STAPLEE Scoring Matrix

Alternative Actions	Social		Technical			Administrative			Political			Legal			Economic				Environmental					Total Points
	Community Acceptance (1-5 points)	Effects on Segment of Population (1-5 points)	Technical Feasibility (1-3 points)	Long-term Solution (1-3 points)	Secondary Impacts (1-3 points)	Staffing (1-3 points)	Funding Allocated (1-3 points)	Maintenance/Operations (1-3 points)	Political Support (1-3 points)	Local Champion (1-3 points)	Public Support (1-5 points)	State Authority (1-3 points)	Existing Local Authority (1-3 points)	Potential Legal Challenges (1-3 points)	Benefit of Action (1-5 points)	Cost of Action (1-5 points)	Contributes to Economic Goals (1-3 points)	Outside Funding Required (1-3 points)	Effect on Land/Water (1-3 points)	Effect on Endangered Species (1-3 points)	Effect on HAZMAT/Waste Sites (1-3 points)	Environmental Goals (1-3) points)	Federal Environmental laws (1-3points)	
Implement water restriction ordinance during drought event.	2	5	3	3	3	3	3	3	3	3	2	3	3	3	4	5	3	3	3	3	3	3	3	72
Incorporate all-hazard education program into school curriculum.	5	5	3	2	3	3	2	3	3	3	2	3	3	3	3	5	2	3	3	3	3	3	3	71
Acquire repetitive loss and severe repetitive loss structures.	5	5	3	3	3	3	1	3	3	3	4	3	3	3	5	3	2	1	3	3	3	3	3	71
Elevate existing and future structures within the special flood areas above the base flood elevation.	5	5	3	3	3	3	1	3	3	3	4	3	3	3	5	3	2	1	3	3	3	3	3	71
Improve drainage capacity in northeast portion of the County.	5	4	3	3	3	3	1	3	3	3	4	3	3	3	5	2	3	2	3	3	3	3	3	71
Mitigate flooding by Northlake subdivision emergency access route.	4	5	3	3	3	3	1	3	3	3	4	3	3	3	5	2	3	2	3	3	3	3	3	71
Enact zoning buffer to minimize the intensity of new development around natural-gas pipelines.	2	5	3	3	3	3	3	3	3	3	1	3	3	3	4	5	3	3	3	3	3	3	3	71

Table 4.4 STAPLEE Scoring Matrix

Alternative Actions	Social		Technical			Administrative			Political			Legal			Economic				Environmental					Total Points
	Community Acceptance (1-5 points)	Effects on Segment of Population (1-5 points)	Technical Feasibility (1-3 points)	Long-term Solution (1-3 points)	Secondary Impacts (1-3 points)	Staffing (1-3 points)	Funding Allocated (1-3 points)	Maintenance/Operations (1-3 points)	Political Support (1-3 points)	Local Champion (1-3 points)	Public Support (1-5 points)	State Authority (1-3 points)	Existing Local Authority (1-3 points)	Potential Legal Challenges (1-3 points)	Benefit of Action (1-5 points)	Cost of Action (1-5 points)	Contributes to Economic Goals (1-3 points)	Outside Funding Required (1-3 points)	Effect on Land/Water (1-3 points)	Effect on Endangered Species (1-3 points)	Effect on HAZMAT/Waste Sites (1-3 points)	Environmental Goals (1-3) points)	Federal Environmental laws (1-3points)	
Mitigate flooding into lowest level of building located at 2300 Poplar Street, North Little Rock with construction of levee, check drainage pump, or demolition of a portion of the building.	5	4	3	3	3	3	1	3	3	3	3	3	3	3	5	2	3	2	3	3	3	3	3	70
Remediate/ Rehabilitate Main Street Pump Station Outfall.	5	3	3	3	3	3	1	3	3	3	3	3	3	3	3	5	3	2	3	3	3	3	3	70
Construct new utility lines underground.	5	5	3	3	3	3	1	3	3	3	3	3	3	3	5	2	3	1	3	3	3	3	3	70
Arrange for floodplain management workshops and training for local jurisdictions to improve program administration and effectiveness and qualifications of managers.	4	5	3	3	3	3	1	3	3	3	3	3	3	3	5	2	3	1	3	3	3	3	3	69
Adopt a land use plan with zoning and development restrictions to protect residents from special flood areas.	4	5	3	3	3	3	1	3	3	3	3	3	3	3	5	2	3	1	3	3	3	3	3	69

Table 4.4 STAPLEE Scoring Matrix

Alternative Actions	Social		Technical			Administrative			Political			Legal			Economic				Environmental					Total Points
	Community Acceptance (1-5 points)	Effects on Segment of Population (1-5 points)	Technical Feasibility (1-3 points)	Long-term Solution (1-3 points)	Secondary Impacts (1-3 points)	Staffing (1-3 points)	Funding Allocated (1-3 points)	Maintenance/Operations (1-3 points)	Political Support (1-3 points)	Local Champion (1-3 points)	Public Support (1-5 points)	State Authority (1-3 points)	Existing Local Authority (1-3 points)	Potential Legal Challenges (1-3 points)	Benefit of Action (1-5 points)	Cost of Action (1-5 points)	Contributes to Economic Goals (1-3 points)	Outside Funding Required (1-3 points)	Effect on Land/Water (1-3 points)	Effect on Endangered Species (1-3 points)	Effect on HAZMAT/Waste Sites (1-3 points)	Environmental Goals (1-3) points)	Federal Environmental laws (1-3points)	
Implement alternative floodplain management means for small jurisdictions such as the Cammack Village and Pulaski County Special School District that are lacking personnel for this job through meetings between the Village and School District and Pulaski County. MOUs and MOAs between Village, District, and County allow the County to regulate this alternative flood plain management.	4	5	3	3	3	3	1	3	3	3	3	3	3	3	5	2	3	1	3	3	3	3	3	69

Table 4.4 STAPLEE Scoring Matrix

Alternative Actions	Social		Technical			Administrative			Political			Legal			Economic				Environmental					Total Points
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Implement alternative floodplain management means for small jurisdictions such as the Little Rock School District, that are lacking personnel for this job through meetings between School District and the City of Little Rock. MOUs and MOAs between District and City allow the City to regulate this alternative flood plain management.	4	5	3	3	3	3	1	3	3	3	3	3	3	3	5	2	3	1	3	3	3	3	3	69
Implement alternative floodplain management means for small jurisdictions such as the North Little Rock School District, that are lacking personnel for this job through meetings between School District and the City of North Little Rock. MOUs and MOAs between District and City allow the City to regulate this alternative flood plain management.	4	5	3	3	3	3	1	3	3	3	3	3	3	3	5	2	3	1	3	3	3	3	3	69

7 JURISDICTIONAL PARTICIPATION IN THE NFIP

Alexander, Jacksonville, Little Rock, Maumelle, North Little Rock, and Sherwood participate in the NFIP. Refer to **Table 4.5** for each jurisdiction's initial date of participation into the NFIP and adoption of initial Flood Insurance Rate Maps (FIRM). Each jurisdiction adopted the minimum standards required by FEMA, including a floodplain management ordinance. This is each of the jurisdiction's primary regulatory tool to manage development in floodplains. NFIP participation has mitigated a significant portion of the flood risk for each participating jurisdiction's residents that have purchased flood insurance.

4.5 Each Jurisdiction's Date of NFIP Initial Participation and Adoption of FIRM Maps

Jurisdiction	NFIP Participation Date	Current Effective Map Date
Alexander	04/18/1975	06/19/2012
Cammack Village	Not Participating	N/A
Little Rock	02/21/1975	10/19/2001
Little Rock School District	Not Participating	N/A
Jacksonville	02/01/1974	08/16/1995
Maumelle	11/02/1994	11/02/1994
North Little Rock	11/02/1973	09/05/1990
North Little Rock School District	Not Participating	N/A
Pulaski County Special School District	Not Participating	N/A
Sherwood	05/17/1974	08/16/1995
Wrightsville	Not Participating	N/A
Unincorporated Pulaski County	Not Participating	N/A

Currently, the Cities of Little Rock and Jacksonville are participating in the NFIP's Community Rating System (CRS). The CRS is a program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP standards. The participation of the City of Little Rock and Jacksonville in the program has led to a 15% and 10% premium reduction for all homeowners who purchase flood insurance. The HMPT has determined that many of the Hazard Mitigation Actions will be more easily implemented through the CRS because the program provides financial incentives to community for becoming more resistant to flood damages. A Hazard Mitigation Action was included to have each non-participating jurisdiction to participate in the CRS.

Requirement §201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

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1 HMP MAINTENANCE REQUIRMENTS

The HMP is a living document that may need to be amended as new funding becomes available or changes in community priorities arise. In accordance with Section 201.6(c)(4), the HMP's maintenance procedures will ensure that the HMP remains relevant to these changes. *Section 5 - Plan Maintenance* includes:

- The methods and schedules for monitoring, evaluating, and updating the HMP within a 5-year cycle;
- The identification and incorporation of the HMP into existing planning mechanisms; and
- The process for continuing public participation in the HMP implementation and maintenance.

2 MONITORING, EVALUATING AND UPDATING THE HMP

Pulaski County's method and schedule for monitoring, evaluating, and updating the HMP over the next five years provides a structure for encouraging collaboration, transferring information, and fostering innovation among the Jurisdictional Representatives, Designated OEM Directors, the HMPT and the public. Refer to **Table 5.1** for a list of Designated OEM Directors and the jurisdictions they are responsible for monitoring. This subsection describes the schedules and criteria that will be used to monitor, evaluate, and update the HMP over the next five-year cycle.

2.1 HMP Monitoring

Each Jurisdictional Representative, Designated OEM Director, the HMPT, and the public are all responsible for monitoring the HMP over the next five years. Monitoring meetings will occur each year and coincide with grant submission deadlines for the State of Arkansas Hazard Mitigation Grant Program and PDM Grant program. During these annual monitoring meetings, Jurisdictional Representatives and Designated OEM Directors will review the status of their Hazard Mitigation Actions. The Designated OEM Director will then fill out an Annual Progress Report for each Hazard Mitigation Action. Completed Annual Progress Reports will be added to **Appendix VI** and sent to each Jurisdictional Representative and HMPT member within 6 months of the annual monitoring meeting.

Table 5.1 Pulaski County HMPT Membership Members

Designated OEM Director	Title	Jurisdictions Monitoring
Andy Traffanstedt	Pulaski County OEM Director/HMPT Chairman	Unincorporated Pulaski County, Alexander, Cammack Village, Jacksonville, Maumelle, Sherwood, Wrightsville, and Pulaski County School District
Matt Burks	Little Rock OEM Director	Little Rock and Little Rock School District
Rick Ezell	North Little Rock OEM Director	North Little Rock and North Little Rock School District

2.2 HMP Evaluation

The HMPT Chairman has the option to reconvene the HMPT if it is deemed necessary to evaluate the entire HMP. The following criteria will be used by the HMPT Chairman to determine if an evaluation meeting is needed:

- Are there any changes in the HMP requirements for funding programs and grants?
- Is there little progress on implementing the Hazard Mitigation Actions?
- Does the review of the Annual Progress Reports indicate that any changes to the HMP are necessary?
- Have any identified or unidentified hazard risk levels changed or need to be added?
- Does the Hazard Mitigation Action Prioritization List need to be changed?
- Are there any major changes within the HMPT membership?

The evaluation process should review each major section of the HMP. An evaluation of *Section 3 – Risk Assessment* should address the following items:

- **Hazard Identification** – Are new hazards affecting the community? Has a disaster occurred?
- **Profile Hazard Events** – Are additional maps or new hazard studies available? Have chances of future events changed? Has future development in the community been checked for its effect on hazard risk?
- **Asset Inventory** – Do community assets need to be updated? Are there any new high risk population groups? Is future land development accounted for in the inventories?
- **Loss Estimate** – Do we need to update loss estimation methods?
- **Repetitive Loss Properties** – Are there any new Repetitive Loss or Severe Repetitive Loss Properties?

An evaluation of *Section 4 – Mitigation Strategy* should address the following items:

- **Hazard Mitigation Goals** – Do any new Hazard Mitigation Goals need to be added? Are the Hazard Mitigation Goals Relevant?
- **Benchmark for Progress** – Has there been any progress on meeting the Hazard Mitigation Goals or implementing the Hazard Mitigation Actions?
- **Hazard Mitigation Actions** – Do any new Hazard Mitigation Actions need to be added? Do the Hazard Mitigation Actions need to be reprioritized?

An evaluation of *Section 5 – Plan Maintenance* should address the following items:

- **HMP Integration** – Has the HMP been integrated into the identified planning mechanism? Are there problems with integrating the HMP into planning mechanisms?
- **Continuing Public Participation** – Has the public had ample time to participate in the planning process? Do we need additional public meetings? Does the public have access to review changes to the HMP?

2.3 HMP Update

The HMPT will meet two years in advance of the five-year deadline to determine if the update process will be administered with local staff or a consultant. In the event that a consultant is required to update the HMP, the Pulaski County OEM Director will advertise the opening, based on federal and state procurement rules regarding funding. To meet FEMA's five year update deadline, the HMP update process must begin no later than one year before the HMP's expiration date. The HMP update process will utilize the most up-to-date methods and requirements provided by ADEM and FEMA to stay within compliance. The HMPT Chairman will manage the HMP update process to ensure timely completion before the out of compliance date.

3 INCORPORATING THE HMP INTO EXISTING PLANNING MECHANISMS

3.1 Planning Mechanism Identification

Each Jurisdictional Representative will be responsible for ensuring that the HMP is incorporated into their respective planning activities. Refer below for jurisdictional planning mechanisms identified by the HMPT for incorporation into the HMP:

- **Unincorporated Pulaski County:**
  - Master Road Plan Ordinance
  - Subdivision Rules and Regulations
  - Floodplain Management Ordinances
  - Lake Maumelle Watershed Ordinance
  - Pulaski County Emergency Operations Plan
  - Pulaski County Commodity Flow Study
- **Alexander**
  - Site Development Regulations
  - Permits
  - Floodplain Management Regulations
- **Cammack Village**
  - Subdivision Regulations
- **Jacksonville**
  - Comprehensive Development Plan
  - Disaster Response Plan
  - Zoning Management Ordinances
  - Subdivision Management Ordinances
  - Floodplain Management Ordinances
  - Building Codes
  - Community Rating System Participation Program
- **Little Rock**
  - Building Codes
  - Zoning Regulations
  - Subdivision Regulations
  - Master Road Plan
  - Floodplain Management Regulations
  - Stormwater Management and Drainage Regulations
  - Community Rating System Participation Program
- **Little Rock School District**
  - Facility Maintenance Plan
  - Utilize the City of Little Rock's Planning Mechanisms

- **Maumelle**
  - Master Land Use plan
  - Zoning Map
  - Storm water Management Ordinances
  - Stream Management Ordinances
  - Subdivision Management Ordinances
  - Erosion Management Ordinances
  - Floodplain Management Ordinances
  - Building Codes
  - Lake Maumelle Watershed Ordinance
- **North Little Rock**
  - Building Codes
  - Land Use Plan
  - Zoning Ordinance
  - Floodplain Management Regulations
  - Control of Development and Subdivision of Land Regulations
- **North Little Rock School District**
  - Facility Maintenance Plan
  - Utilize the City of Little Rock's Planning Mechanisms
- **Pulaski County Special School District**
  - Facility Maintenance Plan
  - Utilize Unincorporated Pulaski County's Planning Mechanisms
- **Sherwood**
  - Land-Use Map
  - Zoning Map and Regulations
  - Master Road Plan
  - Subdivision Rules
  - Building Codes
- **Wrightsville**
  - Land Use Plan
  - Zoning Regulations
  - Floodplain Management Regulations

3.2 Incorporation Process

After each participating jurisdiction officially adopts the HMP, the identified planning mechanisms will incorporate the HMP in accordance with appropriate State laws for local government planning.

3.2.1 HMP Integration Steps

Each Jurisdictional Representative will encourage its respective jurisdiction's officials to integrate appropriate sections of the HMP into the identified planning mechanisms through Quorum Courts, governmental meetings, and the amendment process of the given planning mechanism. Jurisdictional

Representatives will also conduct periodic reviews to determine how well the HMP is being implemented into each of its planning mechanisms.

A major part of incorporation process will be for Jurisdictional Representatives to educate building code and/or planning officials on hazard vulnerabilities and strategies that can be taken to mitigate risk. This may include enhancing or adopting land use, zoning, and building codes that will incorporate hazard mitigation elements. Jurisdictional Representatives will attend all relevant building code and planning meetings to encourage building code and planning officials to take the necessary steps for integrating the HMP into the building codes and Master Land Use Plan.

Jurisdictional Representatives will also attend their respective budgeting meetings to encourage elected officials to allocate local monies for implementing mitigation actions. If possible, elected officials should develop a local hazard mitigation action fund to implement hazard mitigation actions and ensure local match funds are available for acquiring grants. Dedicating local funds to mitigation activities will ensure that the HMP is implemented.

3.2.2 Statutes Regulating HMP Incorporation into Planning Mechanisms

The process by which each participating jurisdiction will incorporate mitigation recommendations in other plans are controlled by Arkansas State statutes. State of Arkansas Planning Statues are outlined in the Arkansas Code Annotated (A.C.A.) Title 14, Chapter 56, Sections 401-425. These statutes control planning in Arkansas including “Adoption of plans, ordinances, and regulations” (14-56-422) and “Change in plans, etc.” (14-56-423) for cities. A summary of State statutes relevant to mitigation recommendation implementation for Little Rock and North Little Rock follows:

- **City Planning (§14-56-401 *et seq*.)** Cities and incorporated towns in Arkansas have the power to adopt and enforce plans for the coordinated development of the municipality and its environs. The legislative bodies of each local jurisdiction have created planning commissions and conferred on the planning commissions the powers necessary to carry out municipal plans. The municipality's plans should promote the general welfare of the citizens while considering present and future needs, safety, and morals. Suggestions of what the municipality's plans may include are: efficiency and economy in development, the appropriate and best use of the land, convenience of traffic and circulation, safety, adequate air and light considerations, design, adequate public facilities and utilities, and wise use of funds. A municipality's land use plan is not a zoning ordinance, nor is it as specific as a zoning ordinance. Rather it is a declaration of policy, specifying the present and future uses of the land within the municipality's reach.

  The planning commissions shall prepare a plan for the municipality, make recommendations on public and private proposals for development, prepare and administer planning regulations, prepare for the legislature recommended ordinances implementing plans, and advise the city government and other public bodies with respect to planning matters. Duties of the planning commission include: preparing a long-term coordinated municipal plan; preparing a work program and comprehensive studies of present conditions and future growth both within and surrounding the municipality; preparing and maintaining a "planning area map"; preparing maps, charts, and other descriptive documents such as a master street plan, a land use plan, and a community facilities plan; and preparing for the legislative body ordinances and regulations to facilitate in the implementation of the commission's plans. The commission may also prepare a public improvement program and conduct land examinations and surveys.

The planning commissions shall undertake studies related to plans after completing the planning area map, but before preparing the plans. Studies may address issues such as open space, natural features, existing uses, and proposed uses. The commission may prepare a community facilities plan showing the location and services of schools, hospitals, governmental buildings, and transportation lines. Additionally, the commission may prepare a master street plan or such other plans it deems helpful in facilitating planning.

- **Regulations to control the development of land (§14-56-417)** The planning commissions may prepare regulations controlling the development of land, and may administer these regulations upon approval of the legislative body. The regulations may cover access to lots and parcels, the provision of utilities, subdivision of land, parceling of land resulting in the need for access and utilities, information to be included on the plat, design of lots and blocks, and standards for improvement. The legislative body of the city may adopt the planning commission's recommendations for setback lines along highways, and provide for the control of entry into any major streets and highways in the plan.

- **Municipal Zoning (§14-56-416)** Following the adoption of a land use plan, the planning commissions may submit to the legislative body a recommended zoning ordinance for the municipality, consisting of a map and text. The ordinance shall include provisions for administration and enforcement, and shall provide for a board of zoning adjustment to hear appeals from the decisions of administrative officers in the enforcement and application of the zoning ordinance.

- **Zoning Regulations (§14-56-301 *et seq*)** Cities may establish zones limiting the character of buildings erected within. There are three zone classes: manufacturing, business other than manufacturing, and residences. Planning commissions may exercise extra-territorial jurisdiction. The amount of land within this jurisdiction varies according to the population of the city extending its jurisdiction. Cities lying along a navigable stream may also exercise extra-territorial jurisdiction, dependent upon their population and the approval of the county court and the other cities having zoning authority over the area.

- **Zoning Board of Adjustments (§14-17-209)** The zoning board of adjustment shall hear appeals from administrative decisions with respect to the enforcement and application of the zoning ordinance, as well as hear requests for variances.

- **Flood Loss Prevention (§14-268-104)** Each city, town, or county has the authority to enact, adopt, and enforce ordinances, building or zoning codes, or other appropriate measures for regulating and controlling the management and use of land, structures, and development in flood prone zones.

- **Community Redevelopment Financing (§14-168-201 *et seq*.)** To facilitate financing the cost of public works or improvements within a municipality, Arkansas enacted the Arkansas Community Redevelopment Financing Act. Among the powers a municipality are: to create redevelopment project areas and define the boundaries of the districts, cause project plans to be prepared, and approve the plans, and adopt ordinances and bylaws regulating the design, construction, and use of buildings. The project plan for a municipality shall set forth an estimate of project costs and sources of funds to be used to defray costs, including provisions for tax increment financing. The plan shall include a statement listing the kind and number of proposed public works, an economic feasibility study, a list of estimated project costs, a description of the methods of financing of project costs, a map showing existing and proposed uses, proposed changes in zoning, a master plan, map, and building codes, a list of non-project costs, and proposed methods for relocation of displaced persons.

3.2.3 Current Elements of the HMP that have been Incorporated

Currently, the HMP has been incorporated into floodplain ordinances for Pulaski County and the Cities of Alexander, Jacksonville, Little Rock, Maumelle, North Little Rock, and Sherwood. The floodplain ordinances use the floodplain vulnerability maps, in the *Section 3- Risk Assessment,* for determining areas where development should be restricted or built above the base flood elevation.

The Cities of Little Rock and Jacksonville have also incorporated the HMP into their Community Rating Systems Participation Program. This allows each jurisdiction to gain additional points for receiving insurance premium discounts to local homeowners with flood insurance. Both cities incorporated the HMP into their Community Rating System Participation Program in the following ways:

- To maintain better base maps;
- To prepare, adopt, implement, and update a comprehensive flood hazard mitigation plan using standard planning process;
- Acquire and/or relocate flood-prone buildings so that they are out of the floodplain;
- Protect existing floodplain development by floodproofing, elevation, or minor structural projects; and
- To keep flood and property data on computer records.

4 CONTINUED PUBLIC INVOLVEMENT

Pulaski County is dedicated to continuing public involvement and education during all evaluations and updates of the HMP. All HMPT meetings will be advertised on public notice boards, in all main municipal buildings, the Pulaski County OEM Website, and the Arkansas Democrat-Gazette. Public members who would like to participate in the planning process of the HMP will be invited to attend HMPT meetings and be given an opportunity to express their concerns and ideas. The Pulaski County OEM Director will be responsible for keeping track of public comments concerning the HMP. All public comments will be reviewed and incorporated in the HMP as seen appropriate by the Pulaski County OEM Director. All HMP updates will be made available to the public for review on the Pulaski County OEM Website and in hard copy at the jurisdictional libraries for two weeks prior to adoption. A final copy of the adopted HMP will be catalogued on the Pulaski County OEM Website and available for public download.

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Appendix I

Adoption Resolutions
Memorandums of Understanding

Appendix II

Public Advertisements
Meeting Sign-In Sheets
Meeting Minutes
Meeting Materials

Public Advertisement – Meeting #1 – October 6, 2011

Dear HMPT Member:

In 2006, Pulaski County, the City of Little Rock, and North Little Rock each adopted a Hazard Mitigation Plan (HMP), in accordance with federal requirements set out in 44 CFR 201. Under the same regulations, their HMPs must be updated and readopted within five years of the original adoption. One of the first steps in the updating process is the reactivation of the Hazard Mitigation Planning Team.

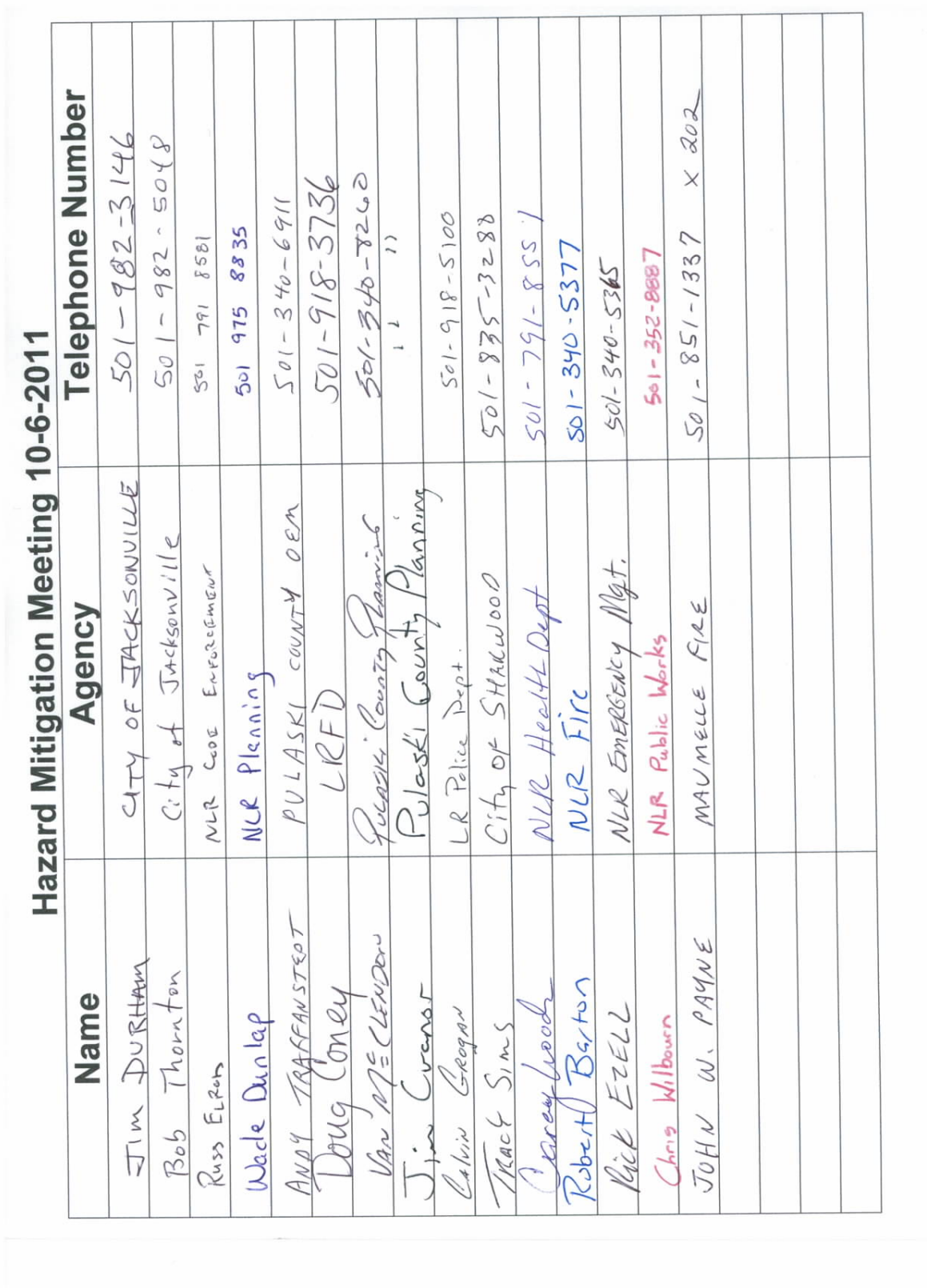
Public involvement is a key element of the updating process. With this letter we invite you to participate as a member of the Hazard Mitigation Planning Team. The Kickoff Meeting will be held from **9:00 – 11:00 AM on Thursday, October 6, 2011, at the Pulaski County Office of Emergency Management, 3200 Brown, Little Rock, Arkansas**. Refer to the attached map for directions.

The Hazard Mitigation Planning Team will not only guide the updating process, but will have an important role in ensuring that the recommendations and actions set out in the HMP are implemented, as well as enhance the ability of the HMP to reflect the needs of the community. We strongly encourage you to be an active participant in this planning process to reduce the susceptibility of Pulaski County and all of its jurisdictions to hazard events. If you have any questions about the meeting or the planning process please feel free to contact me.

Best regards,

John Antapasis
Community Planner
CSA International
8502 SW Kansas Avenue
Stuart, Florida 34997
(772) 219-3069 (Direct)
(954) 415-1075 (Cell)
jantapasis@conshelf.com

Meeting Sign-In Sheet – Meeting #1 – October 6, 2011



Hazard Mitigation Meeting 10-6-2011

Name	Agency	Telephone Number
Jim Durham	City of Jacksonville	501-982-3146
Bob Thornton	City of Jacksonville	501-982-5048
Russ Elrod	NLR Code Enforcement	501 791 8581
Wade Dunlap	NLR Planning	501 975 8835
ANDY TRAFFANSTEDT	PULASKI COUNTY OEM	501-340-6911
Doug Comey	LRFD	501-918-3736
Van McClendon	Pulaski County Planning	501-340-8262
Jim Cremar	Pulaski County Planning	" " "
Calvin Grogan	LR Police Dept.	501-918-5100
TRACY SIMS	City of SHERWOOD	501-835-3288
Carey Lucas	NLR Health Dept	501-791-8551
Robert Barton	NLR Fire	501-340-5377
Nick Ezell	NLR Emergency Mgt.	501-340-5365
Chris Wilbourn	NLR Public Works	501-352-8887
JOHN W. PAYNE	MAUMELLE FIRE	501-851-1337 x 202

Meeting Minutes – Meeting #1 – October 6, 2011

Pulaski County Hazard Mitigation Plan Update

Kickoff Meeting - October 6, 2011 at 9:00 a.m.

Location: 3200 Brown Street

Little Rock, Arkansas 72204

Attendees

Hazard Mitigation

Planning Team:	Robert Barton, Doug Coney, Jim Cranor, Wade Dunlap, Jim Durham, Russ Elrod, Rick Ezell, Calvin Grogan, Van McClendon, John W. Payne, Tracy Sims, Bob Thornton, Andy Traffanstedt, Chris Wilbourn, Carey Woods
Public:	None
CSA International, Inc.:	John Antapasis, Lincoln Walther

Meeting Objectives

- Introductions
- Defining Hazard Mitigation
- Purpose of a Hazard Mitigation Plan
- Federal and State Grant Opportunities
- Hazard Mitigation Plan Update Process
- Status of Hazard Mitigation Plan Update
- Public Input on Hazard Identification

Introductions

- Andy Traffanstedt opened the meeting with a roll call of all Hazard Mitigation Planning Team (HMPT) members in attendance.
- Consultants, Lincoln Walther and John Antapasis of CSA International, Inc. (CSA), were introduced.
- Meeting objectives were reviewed.

Defining Hazard Mitigation

- Because a number of HMPT members were not familiar with the hazard mitigation planning process, some time was spent familiarizing the team with some of the key concepts such as FEMA's definition of hazard mitigation and its role in the Emergency Management Cycle.

- CSA discussed of the benefits of planning ahead with emphasis on the cost savings derived from implementing hazard mitigation projects and their effect on breaking the cycle of disaster damage, reconstruction, and repeated damage.
- CSA reviewed and provided case studies of initiatives representing each type of hazard mitigation category (prevention, property protection, public education and awareness, natural resource protection, emergency services, and structural projects).
- Jim Dunham of the City of Jacksonville discussed his city's implementation of Code Red emergency call back system. He mentioned that it enabled the City to efficiently alert residents of an impending disaster such as a tornado or high winds. A Pulaski County Planning representative highlighted that development in unincorporated areas do not need permits and are not required to elevate outside the base flood elevation required by the National Flood Insurance Program.

Purpose of a Hazard Mitigation Plan

- CSA reviewed the benefits implementing a Hazard Mitigation Plan including: identifying risks, assessing jurisdictional vulnerabilities, reducing future damage, meeting community needs, promoting public participation, promoting cooperation, increasing funding eligibility, increasing the efficiency of fund allocations, and lessening the impact of disasters.
- It was discussed that without a FEMA approved Hazard Mitigation Plan jurisdictions will not be eligible for post-disaster assistance and Hazard Mitigation Assistance grants. In addition, all disasters have a financial impact on local revenue. By mitigating hazards, local governments can realize a reduction in local costs following a disaster event.

Federal and State Grant Opportunities

- The Funding Sources for Local Hazard Mitigation Projects Handout distributed to the HMPT members and was reviewed.
- A discussion ensued when a member of the HMPT asked whether a levee strengthening project was eligible for Pre-Disaster Mitigation Grant funds. He indicated without strengthening the levee, the Army Corp of Engineers is likely to decertify the levee's ability to withstand a 100-year flood.
- Different jurisdictions praised the State funded Safe Room/Shelter Program; however, due to the popularity of the program, not only in Pulaski County but statewide, there is not sufficient funds to meet the demand.

Hazard Mitigation Plan Update Process

- The Consultants are basing the Hazard Mitigation Plan Update process on FEMA's How-To Guidance. By following the Guidance document, definitely improves how quickly the Hazard Mitigation Plan can obtain the necessary approvals needed to obtain approval from the State of Arkansas and FEMA. There are 4 phases in the plan update process.
    - Phase 1 includes organizing resources, developing a HMPT with a diverse background, and establishing connections with members of the local community.
    - Phase 2 will update the Risk Assessment Chapter of the Hazard Mitigation Plan. This includes updating hazard profiles, historical hazard losses, loss estimations, and vulnerabilities within each participating jurisdiction.

- Phase 3 consists of updating the Hazard Mitigation Plans Goals and Actions. After Hazard Mitigation Actions are selected, they will be reprioritized based on FEMA's STAPLEE method and HMPT input.
- Phase 4 will establish a method for implementing and monitoring the plan. The method will identify responsible departments for each Hazard Mitigation Action and planning mechanisms for implementing the actions over the next 5 years.

Status of Hazard Mitigation Plan Update Process

- The Consultants have begun reviewing both the Pulaski County Hazard Mitigation Plan and the Little Rock and North Little Rock Hazard Mitigation Plan. The separate Plans will be combined during the update process.
- To date the following has been accomplished:
  - Historical hazard losses have been updated according to the National Climatic Data Center.
  - All Repetitive Loss and Severe Repetitive Loss data has been updated with data from the Arkansas Natural Resource Commission.
  - Relevant information from the 2010 State of Arkansas All Hazard Mitigation Plan has applied to the hazard profiles for all identified hazards.
  - Man-made hazards are included in the update process.

Public Input on Hazard Identification

- Natural Hazards that were identified by the HMPT included: tornado, severe winter storm, flood, earthquake, wildfire, landslide, expansive soil, straight-line wind, drought, and severe heat event.
- Man-made hazards that were identified by the HMPT included: dam failure, levee failure, chemical spill, terrorism, air pollution, pandemics, and mosquito-borne disease.
- Preliminary vulnerable areas and communities identified by the HMPT included: mobile home structures, areas surrounding the rail-lines, the Clinton Library, growth in unincorporated Pulaski County, and areas with higher concentrations of poverty.

Adjournment

- Meeting adjourned at 11:00 a.m.

Meeting Materials – Meeting #1 – October 6, 2011

Pulaski County
Hazard Mitigation Plan Update
Kick-off Meeting
October 6, 2011

Sponsored by:
Pulaski County Office of Emergency Management
City of Little Rock
City of North Little Rock
The Arkansas Department of Emergency Management, and
The Federal Emergency Management Agency (FEMA Region VI)

Consultants:
CSA International, Stuart, FL

Introductions

- Lincoln Walther, FAICP, Director, Planning Division, CSA International, Inc. Tel. (772) 219-3017, lwalther@conshelf.com
- John D. Antapasis, MSP, MPA, Community Planner, CSA International, Inc. Tel. (772) 219-3069, jantapasis@conshelf.com

Stakeholder List

- Emergency Management
- Planning
- Public Works
- Fire Departments
- Police Departments
- Chamber of Commerce
- Code Enforcement
- NLR Health Department
- NLR School District
- NLR Neighborhood Service
- Faith-Based

Meeting Objectives

- What is Hazard Mitigation?
- Purpose of a Hazard Mitigation Plan
- Federal and State Grant Opportunities
- Hazard Mitigation Plan Update Process
- Status of Hazard Mitigation Plan Update
- Public Input on Hazard Identification
- Questions

What is Hazard Mitigation?

Hazard mitigation is any sustained action taken to reduce or eliminate long-term risk to people and their property from hazards.

Hazard Mitigation Categories

- **Prevention:** Administrative or regulatory actions that influence land and buildings development
- **Property Protection:** Modification of existing buildings
- **Public Education and Awareness:** Inform or educate citizens and elected officials
- **Natural Resource Protection:** Minimize hazards losses and restore the functions of natural systems
- **Emergency Services:** Actions that protect people and property during and immediately after a disaster
- **Structural Projects:** Structures that reduce the impact of hazards

Prevention

- **Examples:** Planning and zoning, building codes, capital improvement programs, open space preservation, and stormwater management regulations.

Property Protection

- **Examples:** Property acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.

Public Awareness

- **Examples:** Public outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

Natural Resource Protection

Example: Sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

Emergency Services

- **Example:** Services include warning systems, emergency responses services, protection of critical facilities, and auxiliary power generators.

Structural Projects

Example: Dams, levees, floodwalls, retaining walls, and safe rooms.

Purpose of a Hazard Mitigation Plan

- Tornado Damage:
  - $344,200,000
  - 15 Deaths
  - 388 Injuries
- Flood Damage
  - $22,895,000
- Winter Storm Damage
  - $20,625,000
  - 1 Death

Purpose of a Hazard Mitigation Plan

- Identify Risks
- Assess Jurisdictional Vulnerabilities
- Reduce Future Damage
- Meet Community Needs
- Promote Public Participation
- Promote Cooperation
- Increase Funding Eligibility
- Increase the efficiency of fund allocations
- Lessens the financial impact of disasters on individuals and communities.

Purpose of a Hazard Mitigation Plan

- Fulfill the federal regulations for FEMA Mitigation Planning, under CFR Title 44 Part 201.
- Without an approved HMP, Jurisdictions are not eligible for post-disaster assistance, such as PA funds.
- All jurisdictions are required to adopt and update local HMPs every 5 years in order to remain eligible for FEMA disaster assistance funds

Federal and State Grant Opportunities

Federal and State Grant Opportunities

- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation Grant (PDM)
- Flood Mitigation Assistance (FMA)
- Repetitive Flood Claims Program (RFC)
- Severe Repetitive Loss Program (SRL)
- Public Assistance Grant Program (PA)

Hazard Mitigation Plan Update Process

FEMA's guidance to develop a hazard mitigation plan is the basis for updating Pulaski County's HMP


Hazard Mitigation Plan Update Process
organize resources
From the start, communities should focus the resources needed for a successful mitigation planning process. Essential steps include identifying and organizing interested members of the community as well as the technical expertise required during the planning process.


Hazard Mitigation Plan Update Process
assess risks
Next, communities need to identify the characteristics and potential consequences of natural hazards. It is important to understand how much of the community can be affected by specific hazards and what the impacts would be for important community assets.

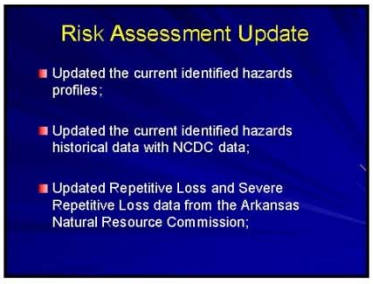

Hazard Mitigation Plan Update Process
develop a mitigation plan
Armed with an understanding of the risks posed by natural hazards, communities need to determine what their priorities should be and then look at possible ways to avoid or minimize the undesired effects. The result is a natural hazard mitigation plan and strategy for implementation.

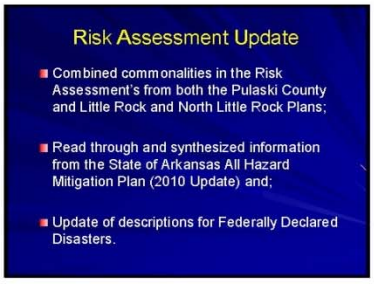

Hazard Mitigation Plan Update Process
implement the plan and monitor progress
Communities can bring the plan to life in a variety of ways ranging from implementing specific mitigation projects to changes in the day-to-day operation of the local government. To ensure the success of an on-going program, it is critical that the plan remains effective. Thus, it is important to conduct periodic evaluations and make revisions as needed.

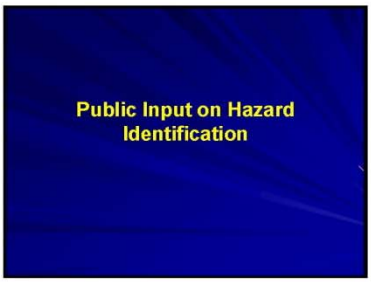

Project Deliverables
Task 1: Initiating the Planning Process
– Formation of Hazard Mitigation Team
– Develop a Community Input Strategy
Task 2: Risk Assessment
– Hazard Assessment Update
– Community Asset Inventory


Project Deliverables
Task 3: Mitigation Strategy
– Capability to Address Hazards
– Update Mitigation Goals and Objectives
– Update Hazard Mitigation Action Plan
Task 4: Plan Maintenance and Finalization
– Update Plan Maintenance
– Public Review of Draft HMP
– Submittal of Plan Update Review to ADEM and FEMA


Status of Hazard Mitigation Plan
Hazard Mitigation Plan
Pulaski County, Arkansas
Hazard Mitigation Plan
Little Rock and
North Little Rock,
Arkansas


Risk Assessment Update
Updated the current identified hazards profiles;
Updated the current identified hazards historical data with NCDC data;
Updated Repetitive Loss and Severe Repetitive Loss data from the Arkansas Natural Resource Commission;


Risk Assessment Update
Combined commonalities in the Risk Assessment's from both the Pulaski County and Little Rock and North Little Rock Plans;
Read through and synthesized information from the State of Arkansas All Hazard Mitigation Plan (2010 Update) and;
Update of descriptions for Federally Declared Disasters.


Public Input on Hazard Identification


Current Identified Hazards
Natural Hazards
Tornados
Severe Winter Storms
Floods
Earthquakes
Wildfires
Landslides
Expansive Soils
Straight-line Winds (Thunderstorms)
Drought
Man-Made Hazards
Dam Failure
Levee Failure
Chemical Spill
Terrorism


Vulnerabilities
Lessons learned from previous hazard events
Growth trends
Critical facilities
Transportation routes vulnerable to chemical spills
Economic disruption.


Next Meeting
Draft Risk Assessment
Potential Mitigation Strategies
Take STAPLEE Survey


ADDITIONAL QUESTIONS?

Public Advertisement – Meeting #2 – February 29, 2012

Dear HMPT Member:

In 2006, Pulaski County, the City of Little Rock, the City of North Little Rock and other participating jurisdictions each adopted a Hazard Mitigation Plan (HMP), in accordance with federal requirements set out in 44 CFR 201. Under the same regulations, their HMPs must be updated and readopted within five years of the original adoption to maintain eligibility to FEMA's Hazard Mitigation Assistance Grants. Since our first meeting to reactivate the Hazard Mitigation Planning Team in October 2011, a preliminary draft of the Risk Assessment Chapter of the HMP has been completed.

The purpose of the Risk Assessment Chapter of the HMP is to identify and analyze the hazards facing Pulaski County and all jurisdictions participating in the plan update process (Pulaski County Planning Area) are at risk from. During the update process, hazards were divided into two classifications, natural and man-made. Natural hazards are defined as hazard events that occur naturally in the environment. Man-made hazards are defined as hazard events resulting from elements of human intent, negligence, or failure of a man-made system. Multiple tools and methods were used to identify hazard vulnerabilities throughout the community and to estimate potential impacts from future hazard events. During the 2nd Hazard Mitigation Planning meeting we will discuss the major findings of the Risk Assessment and begin identifying strategies to reduce long-term hazard risks.

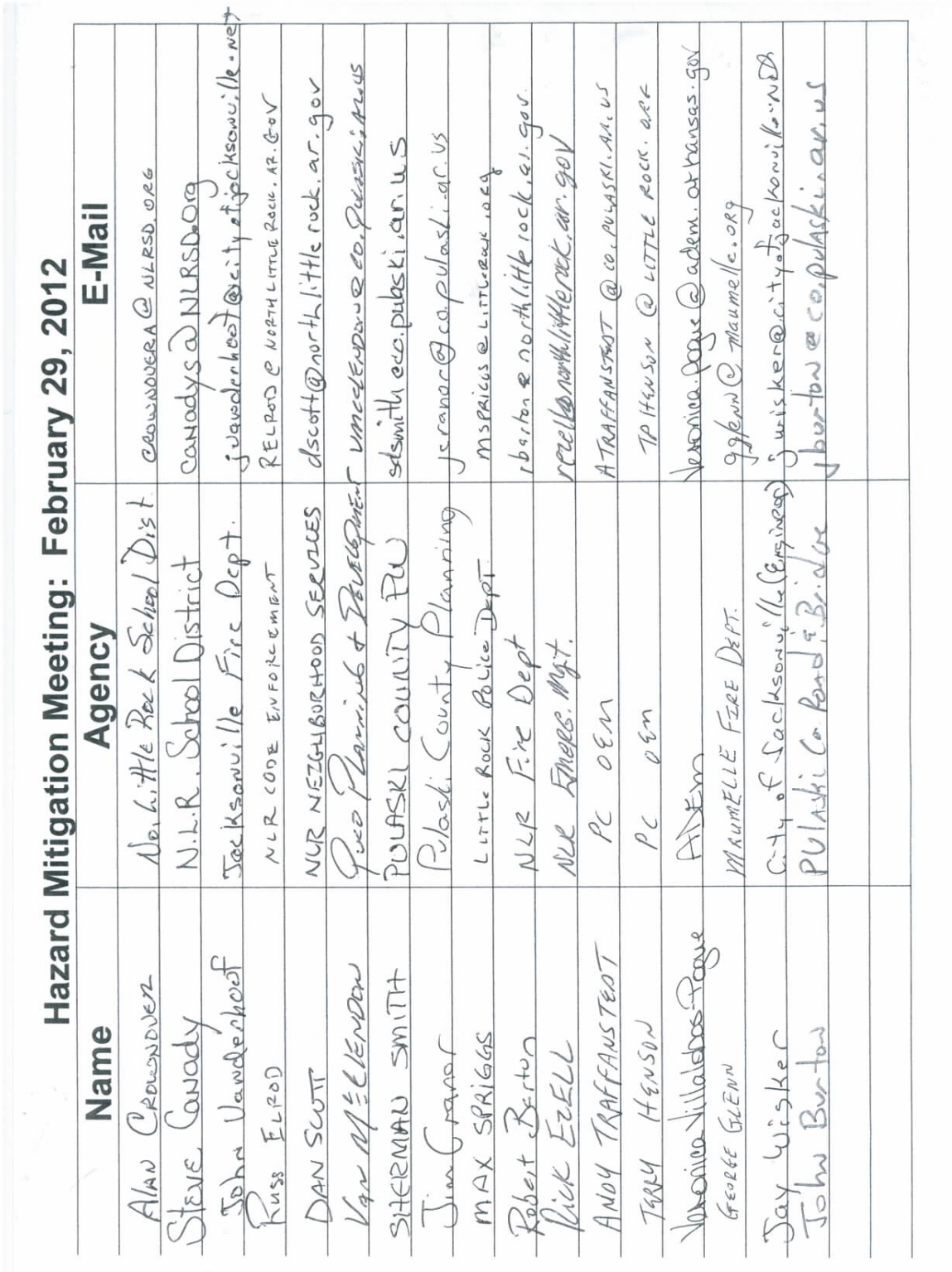
Public involvement is a key element of the updating process. With this letter we invite you to attend the 2nd Hazard Mitigation Planning Meeting as a member of the Hazard Mitigation Planning Team. The 2nd Hazard Mitigation Planning Meeting will be held from **10:00 – 12:00 p.m. on Wednesday, February 29, 2012, at the Pulaski County Office of Emergency Management, 3200 Brown, Little Rock, Arkansas.** Refer to the below map for directions.

The Hazard Mitigation Planning Team will not only guide the updating process, but will have an important role in ensuring that the recommendations and actions set out in the HMP are implemented, as well as enhance the ability of the HMP to reflect the needs of the community. We strongly encourage you to be an active participant in this planning process to reduce the susceptibility of Pulaski County and all participating jurisdictions to hazard events. If you have any questions about the meeting or the planning process please feel free to contact me.

Thank you for your participation,

John Antapasis
Hazard Mitigation Planner
CSA International
8502 SW Kansas Avenue
Stuart, Florida 34997
(954) 415-1075 (Cell)
jantapasis@conshelf.com

Meeting Sign-In Sheet – Meeting #2 – February 29, 2012



Hazard Mitigation Meeting: February 29, 2012

Name	Agency	E-Mail
Alan Crowndover	No. Little Rock School Dist	crowndovera@nlrsd.org
Steve Canady	N.L.R. School District	canadys@nlrsd.org
John Vandenhoff	Jacksonville Fire Dept.	jvandenhoff@cityofjacksonville.net
Russ Elrod	NLR Code Enforcement	RELROD@NORTHLITTLEROCK.AR.GOV
Dan Scott	NLR Neighborhood Services	dscott@northlittlerock.ar.gov
Van McElenden	Pulaski County Planning & Development	vmcelenden@co.pulaski.ar.us
Sherman Smith	Pulaski County PW	ssmith@co.pulaski.ar.us
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Max Spriggs	Little Rock Police Dept	mspriggs@littlerock.org
Robert Burton	NLR Fire Dept	rburton@northlittlerock.ar.gov
Rick Ezell	NLR Emerg. Mgt.	rezell@northlittlerock.ar.gov
Andy Traffanstedt	PC OEM	ATRAFFANSTEDT@CO.PULASKI.AR.US
Terry Henson	PC OEM	TPHENSON@LITTLEROCK.ARK
Veronica Villalobos-Faye	FEMA	Veronica.faye@adem.arkansas.gov
George Glenn	Maumelle Fire Dept.	gglenn@maumelle.org
Jay Wiskes	City of Jacksonville (Engineer)	jwiskes@cityofjacksonville.net
John Burton	Pulaski Co Road & Br. Dept	jburton@co.pulaski.ar.us

Meeting Minutes – Meeting #2 – February 29, 2012

Pulaski County Hazard Mitigation Plan Update

Meeting # 2 - February 29, 2012 at 10:00 a.m.

Location: 3200 Brown Street

Little Rock, Arkansas 72204

Attendees

Hazard Mitigation

Planning Team:	Robert Barton, Doug Coney, Jim Cranor, Wade Dunlap, Jim Durham, Russ Elrod, Rick Ezell, Calvin Grogan, John W. Payne, Tracy Sims, Bob Thornton, Andy Traffanstedt, Chris Wilbourn, Carey Woods, Alan Crownover, Steve Canady, John Vanderhoof, Russ Elrod, Dan Scott, Van McClendon, Sherman Smith, Jim Cranor, Max Springgs, Robert Barton, Terry Henson, Veronica Villalobos-Pougue, George Glenn, Jay Wisker, and John Burton.
Public:	None
CSA International, Inc.:	John Antapasis

Meeting Objectives

- Status of Hazard Mitigation Plan Update
- Discussion of Risk Assessment Findings
- Preliminary Input on Mitigation Strategies
- Next Meeting and Adjournment

Introductions

- Andy Traffanstedt opened the meeting with a roll call of all Hazard Mitigation Planning Team (HMPT) members in attendance.
- Consultant, John Antapasis of CSA International, Inc. (CSA), was introduced.
- Meeting objectives were reviewed.

Status of Hazard Mitigation Plan Update

- The project schedule dates were reviewed and updated to meet the HMP expiration date.
- Section 1: Introduction is partially complete, all 12 participating jurisdictions were updated and a re-adoption resolution draft has been completed.
- Section 2: Pulaski County Planning Area Profile has been completed. During the update process of this Section, demographic data was updated with 2010 census data, and 2010 American

Factfinder data was updated to highlight social, economic, and educational characteristics of for the Pulaski County Planning Area.

- Section 3: Planning Process is partially complete, current HMPT member list has been updated, a description of the update process for Sections 1, 2, and 4 has been completed.
- Section 4: Risk Assessment has been completed.
    - 6 new hazards were identified and a new man-made hazards subsection was profiled;
    - Updated all hazard profiles;
    - Updated the current hazard analysis to include new historical events and re-prioritized by risk if necessary;
    - Reevaluated all risk levels by measuring each identified hazard's probability of occurrence and magnitude of damage;
    - Included an analysis of Repetitive Loss Properties in the risk assessment for flooding;
    - Included a development trends subsection.
- Section 5: Mitigation Strategy is in process of being complete. During the next month, the HMPT will evaluate and update goals to meet community hazard mitigation needs and be consistent with the State of Arkansas HMP Goals. In addition, each jurisdiction will develop hazard mitigation actions to address location-specific hazard risks. Finally the HMPT will reprioritize all hazard mitigation actions based on the STAPLEE method.
- Section 6: Plan Implementation and Maintenance Schedule is in process of being complete. During the next month the HMPT will develop a 5-year schedule for monitoring, evaluating, and updating the HMP. This process will include a strategy for keeping the public involved in the planning process and implementation of the HMP.

Discussion of Risk Assessment Findings

- CSA reviewed The HMP's Risk Assessment Chapter findings and received input from the HMPT. Each hazard was reviewed for its profile, pervious occurrences, vulnerable areas, potential impacts, and jurisdictional exposure.

Preliminary Input on Mitigation Strategies

- Added 4 Hazard Mitigation Goals
    - Improve data collection, use, and sharing.
    - Facilitate sound development in the County and all participating jurisdictions to reduce or eliminate hazard risk.
    - Enhance public awareness and understanding of hazard mitigation.
    - Identify and pursue grant opportunities to fund hazard mitigation actions and projects.
- Will begin updating hazard mitigation actions for each participating jurisdiction by next meeting.

Adjournment

- Meeting adjourned at 12:00 P.M.

Meeting Materials – Meeting #2 – February 29, 2012

Pulaski County Hazard Mitigation Plan Update
Public Meeting

AGENDA

February 29, 2012, 10:00 a.m. - 12:00 p.m.

Pulaski County Office of Emergency Management

Location: 3200 Brown Street

Little Rock, Arkansas 72204

Introductions **10:00 – 10:05 a.m.**

Meeting Objectives **10:05 – 10:15 a.m.**

- Status of Hazard Mitigation Plan Update
- Discussion of Risk Assessment Findings
- Preliminary Input on Mitigation Strategies
- Next Meeting and Adjournment

Status of Hazard Mitigation Plan Update **10:15 – 10:30 a.m.**

- Update of Section 1 – Introduction/Parish Profile
- Update of Section 2 – The Planning Process
- Update of Section 3 – The Risk Assessment

Discussion of Risk Assessment Findings **10:30 – 11:00 a.m.**

- Risk Assessment Findings

Preliminary Input on Mitigation Strategies **11:00 – 11:55 a.m.**

- Review Hazard Mitigation Goals
- Review potential new Hazard Mitigation Actions
- Take Hazard Mitigation Action Survey

Next Meeting and Adjournment **11:55 – 12:00 p.m.**

Pulaski County Hazard Mitigation Plan Update

Meeting # 2

February 29, 2012

Sponsored by:
Pulaski County Office of Emergency Management
City of Little Rock
City of North Little Rock
The Arkansas Department of Emergency Management, and
The Federal Emergency Management Agency (FEMA Region VI)

Consultants:
CSA International, Stuart, FL

Introductions

- John D. Antapasis, MSP, MPA, Hazard Mitigation Planner, CSA International, Inc. Tel. (772) 219-3069, Cell (954) 415-1075, jantapasis@conshelf.com

Meeting Objectives

- Status of Hazard Mitigation Plan Update
- Discussion of Risk Assessment Findings
- Preliminary Input on Mitigation Strategies
- Next Meeting and Adjournment

Hazard Mitigation Plan Composition

- The Pulaski County Hazard Mitigation Plan contains the following Sections:
  - Section 1 - Introduction
  - Section 2 – Pulaski County Planning Area Profile
  - Section 3 - Planning Process
  - Section 4 - Risk Assessment
  - Section 5 - Mitigation Strategy
  - Section 6 - Plan Maintenance Procedures
- Appendices (Maps and Figures)

Project Schedule

	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12
Planning Process	◆											
Risk Assessment												
Mitigation Strategy					◆							
Plan Implementation and Maintenance												
Draft HMP							◆					
ADEM and FEMA Review												

◆ = Public Meeting

Status of Hazard Mitigation Plan Update

Section 1 – Introduction Federal Requirements

- Updated Plan Shall include a copy of the resolution or documentation of the formal adoption of the updated plan dated within one year of FEMA's "approval pending adoption", regardless of the degree of modification.
- Required to review and revise the Plan, and resubmit it for approval within 5 years in order to continue eligibility for mitigation project grant funding.
- The update must identify all participating jurisdictions, new or continuing and those no longer participating the plan.

Section 1 – Introduction (Partially Complete)

- There are 12 Jurisdictions that are participating in the 2012 HMP update process.
- The re-adoption resolutions will be included in the HMP after it receives Preliminary Approval from ADEM and FEMA.

Section 2 – Pulaski County Planning Area Profile (Complete)

- Update Area demographics with 2010 census data.
- Add 2010 American Factfinder data (i.e. social, economic, education characteristic table).
- Update building and population exposure

Section 3 – Planning Process Federal Requirements

- The updated plan shall describe the process used to review and analyze each section of the plan (i.e. Planning Process, Risk Assessment, Mitigation Strategy and Plan Maintenance).
- If a section warrants and update, and others do not, the process the team undertook to make that decision must be documented in the Plan

Section 3 – Planning Process Current Status (Partially Complete)

- Amend to include a description of the current updating process including:
  - Current Committee Members
  - Review of data in current Introduction and Planning Process
  - Description of the Risk Analysis revisions
  - Projection of the planning process to be used in updating the remainder of the plan

Section 4 - Risk Assessment Federal Requirements

- The local risk Assessment update shall address any newly identified hazards that have been determined to pose a threat.
- Continue to describe occurrences of hazards included in the previously approved plan and discuss new occurrence.
- Incorporate new historical records, data or studies.
- Address all deficiencies identified in the pervious plan
- County vulnerabilities, impacts, and extent shall be updated
- Must continue to address repetitive loss structures

Section 4 - Risk Assessment (Completed)

- 6 new hazards were identified and man-made hazards were profiled
- Updated all hazard profiles
- Updated the current hazard analysis to include new historical events and re-prioritized by risk if necessary
- Revaluated all risk levels by measuring each identified hazard's probability of occurrence and magnitude of damage
- Included an analysis of Repetitive Loss Properties in the risk assessment for flooding (Required of all plans approved after October 1, 2008)
- Included a development trends subsection

Section 5 – Mitigation Strategy (In Process)

- We need to evaluate and update goals to meet community needs and to be consistent with State of Arkansas HMP Goals
- Evaluate and update mitigation actions
  - Add new actions as needed for each jurisdication
- Reprioritize mitigation actions for implementation (utilize STAPLEE Method)

Section 6 – Plan Implementation and Maintenance Schedule (In Process)

- Provide updated 5-year schedule for monitoring, evaluating and updating this plan
- Provide a plan for continuing public involvement
- Also provide Emergency Managers and jurisdictional representatives with a hazard mitigation action implementation form

Discussion of Risk Assessment Findings

Identified Hazards

Natural Hazards

- Tornados
- Severe Winter Storms
- Floods
- Thunderstorm
- Earthquakes
- Extreme Temperature
- Wildfires
- Drought
- Mosquito-Borne Disease
- Landslides
- Expansive Soils

Man-Made Hazards

- Dam failure
- Levee failure
- Chemical spill
- Terrorism
- Air Pollution
- Pandemic

Presidential Major Disaster Declaration History (1972 – 2011)

- 18 Presidential Major Disaster Declarations (7 in the last decade)
  - These events include: thunderstorms, flooding, tornados, severe winter storm
- Received Individual and Public Assistance

Tornado Hazard (Severe Risk)

- Enhanced Fugita Scale
  - EF0: 65-85 mph
  - EF1: 86-110 mph
  - EF2: 111-135 mph
  - EF3: 136-165 mph
  - EF4: 166-200 mph
  - EF5: 200+ mph

Tornado Hazard (Severe Risk)

- Historical tornado losses (1950 – 2011)
  - Property Damage: $300,130,000
  - Deaths: 27
  - Injury: 313
- 71% of historic tornado events occurred in the months of March through May
- Tornado annual occurrence probability is 51%
- Magnitude of impact on losses for a tornado event: $72,108,367

Severe Winter Storm (Severe Risk)

- Associated Severe Winter Storm Hazards
  - Snow (1 - 8 inches)
  - Ice (1/10 – 1 inch)
  - Strong Winds (70 mph)
  - Extreme Cold (0°F - 12°F)

Vulnerable community assets include, power lines, road blocks, structural damage, and can cause human injuries and deaths

Severe Winter Storm (Severe Risk)

- Historical severe winter storm losses (1985 – 2011)
  - Property Damage: $57,125,000
  - Crop Damage: $13,500,000
  - Deaths: 33
- Severe Winter Storm annual occurrence probability is 38%
- Magnitude of impact on losses for a severe winter storm event: $4,057,785

Flood (Location-Specific Risk)

- Types of Flooding
  - Riverine Flood
  - Closed-Basin Flood
  - Flash Flood

Flooding is location specific to designated flood areas

Flood (Location-Specific Risk)

- Historical flood losses (1994 – 2011)
  - Property Damage: $15,695,000
- NFIP Losses
  - 131 properties
  - 364 claims
  - $6,282,041
- Food annual occurrence probability is 41%
- Magnitude of impact on losses for a 1% annual flood event event: $365,260,000

Jurisdictional Flood Risk

- Unincorporated Pulaski County: Severe Risk
- Alexander: Moderate Risk
- Cammack Village: Low Risk
- Little Rock: Severe Risk
- Little Rock School District: Severe Risk
- Jacksonville: Severe Risk
- Maumelle: Moderate Risk
- North Little Rock: Severe Risk
- North Little Rock School District: Severe Risk
- Pulaski County Special School District: Severe Risk
- Sherwood: Severe Risk
- Wrightsville: Moderate Risk

Thunderstorm (Severe Risk)

- Associated thunderstorm events
  - Strong Wind (57 - 70 MPH)
  - Lightning
  - Hail (1/4 inch 2 inch)

Thunderstorms can be accompanied by strong winds, heavy rain, and hail

Severe Winter Storm (Severe Risk)

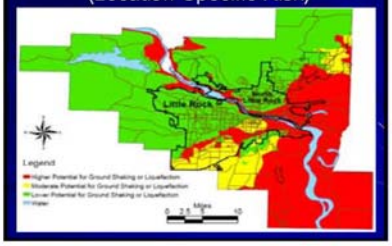
- Historical thunderstorm losses (2000 – 2011)
  - Property Damage: $3,595,000
- Thunderstorm annual occurrence probability is 64%
- Magnitude of impact on losses for a thunderstorm event: $326,818

Earthquake (Location-Specific Risk)

Earthquake (Location-Specific Risk)

- Historical thunderstorm losses (2000 – 2011)
  - 5 significant earthquakes and 145 insignificant earthquakes
- Earthquake NMSZ annual occurrence probability is 1%
- Magnitude of impact on losses for a thunderstorm event: $234,620,000

Earthquake (Location-Specific Risk)



Drought (Moderate Risk)

Palmer Classification	Precipitation
4.0 or more	extremely wet
3.0 to 3.99	very wet
2.0 to 2.99	moderately wet
1.0 to 1.99	slightly wet
0.5 to 0.99	incipient wet spell
0.49 to -0.49	near normal
-0.5 to -0.99	incipient dry spell
-1.0 to -1.99	mild drought
-2.0 to -2.99	moderate drought
-3.0 to -3.99	severe drought

Drought (Moderate Risk)

- 12 Historical drought events (1900 – 2011)
- Severity of drought events in the Pulaski County Planning Area can range from -3.0 to -4.0
- Drought Event annual occurrence probability is 9% (hard to predict and could last multiple yrs.)
- Magnitude of impact on losses for a thunderstorm event: $465,759

Mosquito-Borne Disease (Moderate Risk)

- Mosquitoes are vector agents for disease causing viruses and parasites
  - West Nile Virus
  - Yellow Fever
  - Dengue Fever
  - Malaria

Mosquito-Borne Disease (Moderate Risk)

- 35 confirmed cases (2000 – 2010)
- Outbreaks can occur quickly
- Mosquito-borne disease annual occurrence probability is 80%
- Magnitude of impact on losses for a mosquito-borne disease event: approximately 3.5 persons a year

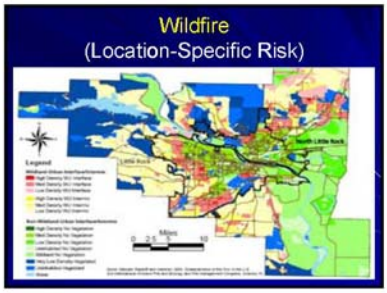
Extreme Heat (Severe Risk)

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity		
Category	Heat Index	Health Hazard
Extreme Danger	130°F - Higher	Heat Stroke is likely with continued exposure
Danger	105°F - 129°F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity
Extreme Caution	90°F - 105°F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and or physical activity
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity

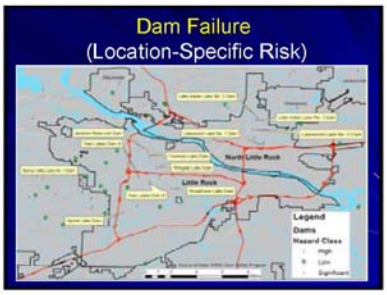
Extreme Heat (Severe Risk)

- 16 extreme heat events that caused 19 deaths (1995 – 2011)
  - Junior high school football student death
  - Many involved elderly persons in substandard housing
- Extreme heat annual occurrence probability is 50%
- Magnitude of impact on losses for a extreme heat event: approximately 1 death per event


Wildfire
(Location-Specific Risk)


Wildfire
(Location-Specific Risk)


Jurisdictional Wildfire Risk
Unincorporated Pulaski County: Severe Risk
Alexander: Low Risk
Cammack Village: Low Risk
Little Rock: Moderate Risk
Little Rock School District: Moderate Risk
Jacksonville: Moderate Risk
Maumelle: Low Risk
North Little Rock: : Moderate Risk
North Little Rock School District: : Moderate Risk
Pulaski County Special School District: Severe Risk
Sherwood: Moderate Risk
Wrightsville: Low Risk


Dam Failure
(Location-Specific Risk)
North Little Rock
Little Rock
Legend
Dams
Hazard Class


Levee Failure
(Location-Specific Risk)


Levee Failure
(Location-Specific Risk)


Chemical Spill
(Location-Specific Risk)
Since 2002, the U.S. there has been 21 highway, 9 rail transportation, and 3 fixed facility chemical spill events amounting to $645,223 in damages.
Crews from numerous agencies, including the North Little Rock Fire Department, work for more than 18 hours to dilute ethanol spill (March, 2011).


Chemical Spill
(Location-Specific Risk)


Chemical Spill
(Location-Specific Risk)

Chemical Spill (Location-Specific Risk)

Chemical Spill (Location-Specific Risk)

Chemical Spill (Location-Specific Risk)

Preliminary Input on Mitigation Strategies

- Update Hazard Mitigation Goals
- STAPLEE hazard mitigation action prioritization survey
- Hazard Mitigation Actions for each jurisdiction and responsible departments or agencies

Pulaski County Planning Area Hazard Mitigation Goals

1. Reduce the potential for loss of life, injury and economic damage created by exposure to natural hazards for residents of Pulaski County.

State of Arkansas Hazard Mitigation Goals

1. The reduction of vulnerability in Arkansas to all hazards and the promotion of sustainable infrastructure and environment.
2. Identify mitigation grant opportunities for state and local governments, their subjurisdictions and the general public, and provide effective technical support.

State of Arkansas Hazard Mitigation Goals

3. Offer training, education, and technical assistance to local jurisdictions as they develop local hazard mitigation plans and mitigation projects.
4. Formulate objectives using state of the art knowledge to reduce vulnerability to all identified hazards.

Hazard Mitigation Goal Suggestions?

1. Improve data collection, use, and sharing.
2. Facilitate sound development in the County and all participating jurisdictions to reduce or eliminate hazard risk.
3. Enhance public awareness and understanding of hazard mitigation.
4. Identify and pursue grant opportunities to fund hazard mitigation actions.

Any Questions?

John Antapasis
(954) 415-1075

Public Advertisement – Meeting #3 – April 3, 2012

Dear HMPT Member:

Since the completion of our two meetings, the Risk Assessment Chapter of the HMP has been completed. The Mitigation Strategies Chapter is currently in progress of being completed. The Hazard Mitigation Planning Team's involvement is key in updating the Mitigation Strategies Chapter. The Final Meeting will have an emphasis on discussing which projects and actions Pulaski County and each participating jurisdiction would like to pursue to reduce risks associated with hazard events identified in the Risk Assessment Chapter. Hazard Mitigation Actions can be regulatory, structural, educational, or preventive, and should representative the community's culture and ideals. During the Final Meeting, we will receive final input from the Team to complete a Draft Plan for review by the public and submission to ADEM and FEMA.

With this letter we invite you to attend the Final Hazard Mitigation Planning Meeting as a member of the Hazard Mitigation Planning Team. The Final Hazard Mitigation Planning Meeting will be held from **10:00 – 12:00 p.m. on Tuesday, April 3, 2012, at the Pulaski County Office of Emergency Management, 3200 Brown, Little Rock, Arkansas.** Refer to the below map for directions. We strongly encourage you to be an active participant in this planning process to reduce the susceptibility of Pulaski County and all participating jurisdictions to hazard events. If you have any questions about the meeting or the planning process please feel free to contact me.

Thank you for your participation,

John Antapasis
Hazard Mitigation Planner
CSA International
8502 SW Kansas Avenue
Stuart, Florida 34997
(954) 415-1075 (Cell)
jantapasis@conshelf.com

Meeting Sign-In Sheet – Meeting #3 – April 3, 2012

Hazard Mitigation Meeting April 3, 2012

Name	Agency	Email Address
Steve Cawady	N.L.R. School District	Cawadys@NLRSD.org
Alan Crownover	N.L.R School District	CROWNOVERA@NLRSD.ORG
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John Vanderhoof	City of Jacksonville	jvanderhoof@cityofJacks
Rick Ezell	City of North Little Rock	rezell@northlittlerock.ar.gov .net
Chris Wilbourn	City of North Little Rock	cwilbourne@northlittlerock.ar.gov
Mike Marlar	Marlar Engineering Co., Inc.	mikemarlar@marlareng.com
Matt Burks	LR OEM	[redacted]. mburks@littlerock.gov
Nathan Spicer	LR EM	nspicer@littlerock.org
Russ Elrod	NLR Code Enforcement	RELROD@NORTHLITTLEROCK.AR.GOV
Dani Scott	NLR Neighborhood Services	dscott@northlittlerock.ar.gov
Jim Cranor	Pulaski County Planning	jcranor@co.pulaski.ar.us
Margo Bushmiaer	LRSD	margo.bushmiaer@lrsd.c
Van McClendon	Pulco Planning & Development	VMCCLENDON@CO.PULASKI.AR.US
Andy Traffanstedt	Pulaski Co. OEM	ATRAFFANSTEDT@CO.PULASKI.AR.US
Veronica Villalobos-Pogue	ADEM	
Max Spriggs	L.R.P.D.	mspriggs@littlerock.org
J.T. Cantrell	PCOEM	JCANTRELL@CO.PULASKI.AR.US

Meeting Minutes – Meeting #3 – April 3, 2012

Pulaski County Hazard Mitigation Plan Update

Meeting # 3 – April 3, 2012 at 10:00 a.m.

Location: 3200 Brown Street

Little Rock, Arkansas 72204

Attendees

Hazard Mitigation

Planning Team:	Robert Barton, Doug Coney, Jim Cranor, Wade Dunlap, Jim Durham, Russ Elrod, Rick Ezell, Calvin Grogan, John W. Payne, Tracy Sims, Bob Thornton, Andy Traffanstedt, Chris Wilbourn, Carey Woods, Alan Crownover, Steve Canady, John Vanderhoof, Russ Elrod, Dan Scott, Van McClendon, Sherman Smith, Jim Cranor, Max Springgs, Robert Barton, Terry Henson, Veronica Villalobos-Pougue, George Glenn, Jay Wisker, and John Burton.
Public:	Mike Marlar and Ray Roberts
CSA International, Inc.:	John Antapasis

Meeting Objectives

- Status of Hazard Mitigation Plan Update
- Hazard Mitigation Action Examples
- Hazard Mitigation Action Collaboration
- Turning Hazard Mitigation Actions into Projects

Introductions

- Andy Traffanstedt opened the meeting with a roll call of all Hazard Mitigation Planning Team (HMPT) members in attendance.
- Consultant, John Antapasis of CSA International, Inc. (CSA), was introduced.
- Meeting objectives were reviewed.

Status of Hazard Mitigation Plan Update

- The project schedule dates were reviewed.
- Section 1: Introduction is complete.
- Section 2: Pulaski County Planning Area Profile is complete.
- Section 3: Planning Process is partially complete, current HMPT member list has been updated, a description of the update process for Sections 1, 2, and 4 has been completed.
- Section 4: Risk Assessment is complete.

- Section 5: Mitigation Strategy is in the process of being completed.
    - Goals were updated
    - Benchmark of Progress updated
    - Mitigation Actions and prioritization were to be completed during the Final Meeting
- Section 6: Plan Implementation and Maintenance Schedule is complete.

Hazard Mitigation Action Examples

- Reviewed Hazard Mitigation Action examples.
- Reviewed FEMA case studies of mitigation actions throughout Arkansas, Missouri, and Virginia that saved lives and prevented damages to structures and infrastructure.

Hazard Mitigation Action Collaboration

- The HMPT collaborated and filled out Jurisdictional Hazard Mitigation Action Forms.

Adjournment

- Final Hazard Mitigation Plan Draft will be available online for review in the next few weeks.

Meeting Materials – Meeting #3 – April 3, 2012

Pulaski County
Hazard Mitigation Plan Update
Meeting # 3
April 3, 2012

Sponsored by:
Pulaski County Office of Emergency Management
City of Little Rock
City of North Little Rock
The Arkansas Department of Emergency Management, and
The Federal Emergency Management Agency (FEMA Region VI)

Consultants:
CSA International, Stuart, FL

Introductions

- **John D. Antapasis, MSP, MPA, Hazard Mitigation Planner, CSA International, Inc. Tel. (772) 219-3069, Cell (954) 415-1075, jantapasis@conshelf.com**

Meeting Objectives

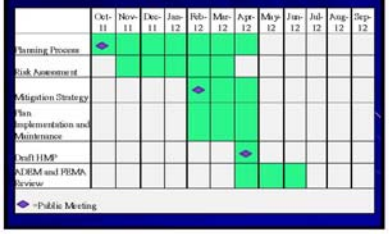
- Status of Hazard Mitigation Plan Update
- Hazard Mitigation Action Examples
- Hazard Mitigation Action Collaboration
- Turning Hazard Mitigation Actions into Projects

Status of Hazard Mitigation Plan Update

Status of Hazard Mitigation Plan Sections

- The Pulaski County Hazard Mitigation Plan contains the following Sections:
  - Section **1** - Introduction (Complete)
  - Section 2 – Pulaski County Planning Area Profile (Complete)
  - Section **3** - Planning Process (In-Process)
  - Section **4** - Risk Assessment (Complete)
  - Section **5** - Mitigation Strategy (In-Process)
  - Section **6** - Plan Maintenance Procedures (In-Process)
  - Appendices (In-Process)

Project Schedule



Section 5 – Mitigation Strategy (In Process)

- Updated Goals (Completed)
- Benchmark of Progress (In-Process)
- Hazard Mitigation Action List (In-Process)
- Reprioritize mitigation actions for implementation (utilize STAPLEE Method) (In-Process)

Section 6 – Plan Implementation and Maintenance Schedule (In Process)

- Provide updated 5-year schedule for monitoring, evaluating and updating this plan (Complete)
- Provide a plan for continuing public involvement (Complete)

Hazard Mitigation Action Examples

All-Hazard Examples

- Acquire weather radios for critical facilities
- Develop educational brochures, programs, websites.
- Acquire generators for all critical facilities and shelters
- Install an all-hazard alert system
- NWS Storm Ready Program http://www.stormready.noaa.gov/
- Ensure the HMP is available online

Flood, Levee, and Dam failure Examples

- Participate in NFIP and advertise flood insurance
- Acquire and relocate or demolition RL/SRL properties
- Participate in CRS and gain more points
- Elevate structures
- Improve drainage capacity
- Implement a Master Drainage Plan
- Floodproofing structures

NFIP and CRS Participation

- NFIP Participation
  - Application
    - Community Name
    - Chief Executive
    - Person Responsible
    - Community inspection of flood maps
    - Estimate population in and out of floodplain
  - Adopt resolution for communities desire to participate
  - Must adopt floodplain ordinance
- CRS
  - Public information
  - Mapping and Regs.
  - Flood Damage Reduction
  - Flood Preparedness

Flood Case Studies

Crawford County, AR
- Elevation Project

Baxter County, AR
- Elevation and tie-down

Tornado and Thunderstorm Examples

- Construct public safe-rooms
- Advertise ADEM Safe Room Program
- Require anchoring all new manufactured structures to permanent foundations
- Retrofit critical facilities with clips and anchors
- Structurally harden critical facilities
- Replace windows with shatter-resistant glass
- Enact higher building code standards
- Require all new structures to have a safe room.

Tornado and Thunderstorm Case Studies

Little Rock, AR
- Arkansas School for the Deaf Public Saferoom

Van Buren County, AR
- Residential Safe Room

Severe Winter Storm Examples

- Construct new utility lines underground.
- Develop Weatherization education outreach program
- Enact building codes that have standards for roof snow loads for new structures

Severe Winter Storm Case Studies

Jackson County, MO
- Underground Utility-Lines

- $9 Million (75% FEMA Match)
- Will stop recurring damages and power outages during events.
- Makes town more attractive for investment

Extreme Heat Examples

- Construct or retrofit a building as a designated "cool-down" shelter.
- Identify substandard housing without proper air-conditioning or insulation.
- Develop a weatherization outreach program

Drought Examples

- Identify and maintain water sources
- Enact water restriction ordinance
- Educate farmers about agricultural insurance

Earthquake Examples

- Adopt international building codes for all new structures.
- Secure building contents on shelves in all critical facilities
- Ensure infrastructure systems are resilient to earthquake events

Earthquake Case Studies

- 5.9 Magnitude Earthquake
- Utilizing international building code techniques, residents received limited damage

Louisa County, VA
- International Building Code

Chemical Spill Examples

- Provide brochure to new and existing homeowners on their home's proximity to natural-gas pipelines. Enact water restriction ordinance
- Enact zoning buffer to minimize the intensity of new development around natural-gas pipelines
- Conduct a Commodity Flow Study to determine what chemicals are being transported through the County

Mosquito-Borne Disease Examples

- Implement a mosquito-borne disease educational outreach program
- Implement a mosquito-borne disease abatement program

Wildfire Examples

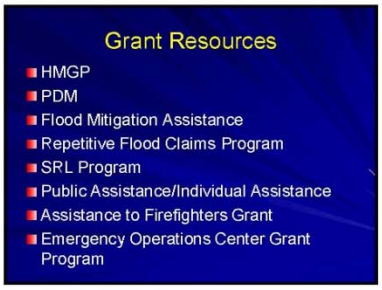
- Implement burn bans during wildfire events.
- Assist communities to become a Firewise Communities
- Develop a Community Wildfire Protection Plan
- Utilize prescribe burning, mowing and other mechanical fuel reduction techniques.

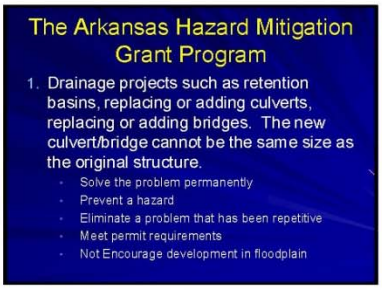
Wildfire Case Studies

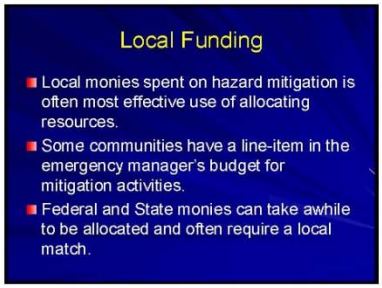
Florida
- Wildfire Mitigation Techniques

Hazard Mitigation Action Collaboration


Turning Hazard Mitigation Actions into Projects


Grant Resources
HMGP
PDM
Flood Mitigation Assistance
Repetitive Flood Claims Program
SRL Program
Public Assistance/Individual Assistance
Assistance to Firefighters Grant
Emergency Operations Center Grant Program


The Arkansas Hazard Mitigation Grant Program
1. Drainage projects such as retention basins, replacing or adding culverts, replacing or adding bridges. The new culvert/bridge cannot be the same size as the original structure.
Solve the problem permanently
Prevent a hazard
Eliminate a problem that has been repetitive
Meet permit requirements
Not Encourage development in floodplain


Local Funding
Local monies spent on hazard mitigation is often most effective use of allocating resources.
Some communities have a line-item in the emergency manager's budget for mitigation activities.
Federal and State monies can take awhile to be allocated and often require a local match.


Any Questions?
John Antapasis
(954) 415-1075

Appendix III

Jurisdictional Hazard Mitigation Action Participation Forms

PULASKI COUNTY

Table A.12 Unincorporated Pulaski County Hazard Mitigation Action Participation Form

Jurisdiction Priority	Hazard Mitigation Action	Hazard Mitigated	Affect on New or Existing Structures and/or Populations	Estimated Cost	Timeframe	Administration/Agency Responsible
5	Acquire all-hazard weather radios for all schools, city halls, large businesses, churches, and other critical facilities.	All Hazards	New and Existing Structures and Populations	≈ $30 @		Office of Emergency Management
	Develop brochures, websites, educational programs, and Public Service Announcements that increase public awareness of hazard risk and mitigation activities.	All Hazards	New and Existing Structures and Populations	$5,000		Office of Emergency Management
6	Acquire generators for all critical facilities and shelters.	All Hazards	New and Existing Structures and Populations	$25,000 - $50,000		Office of Emergency Management
2	Ensure that the Hazard Mitigation Plan is available to the public in hard copy and online. - WEBSITE	All Hazards	New and Existing Structures and Populations	N/A		Office of Emergency Management
1	Install an all-hazard alert system, Red Alert, CodeRed, revere 9-1-1 call, warning sirens, or other effective method. IPAWS	All-Hazards	New and Existing Populations	N/A		Office of Emergency Management
14	Meet the guidelines for the National Weather Service "Storm Ready Program"	All-Hazards	New and Existing Structures and Populations	N/A		Office of Emergency Management
	Advertise National Flood Insurance Program through a Public Service Announcement.	Flood	New and Existing Structures and Populations	$5,000		Office of Emergency Management
	Acquire repetitive loss and severe repetitive loss structures.	Flood	Existing Structures and Populations	N/A		Office of Emergency Management

WWW. STORMREADY. NOAA. GOV

Pulaski County

Table A.12 Unincorporated Pulaski County Hazard Mitigation Action Participation Form

Jurisdiction Priority	Hazard Mitigation Action	Hazard Mitigated	Affect on New or Existing Structures and/or Populations	Estimated Cost	Timeframe	Administration/Agency Responsible
	Apply to the Community Rating System to receive a 5% reduction in flood insurance rates for all citizens.	Flood	New and Existing Structures and Populations	$15,000	CRS - PC NOT IN	Office of Emergency Management
4	Study the watershed of Taylor Creek to determine baseline for sustainable development and needs for drainage capacity improvements.	Flood	New and Existing Structures and Populations	N/A		Office of Emergency Management
	Elevate existing and future structures within the special flood areas above the base flood elevation.	Flood	New and Existing Structures and Populations	N/A		Office of Emergency Management
3	Mitigate repetitively flooded property on Jim Hall Road.	Flood	Existing Structure	N/A		Office of Emergency Management
12	Improve drainage capacity in northeast portion of the County.	Flood	Existing Structure	N/A		Office of Emergency Management
[illegible]	Implement a Master Drainage Plan	Flood, Levee Failure, and Dam Failure	New and Existing Structures and Populations	N/A		Office of Emergency Management
7	Increase drainage capacity in areas of the ~~City~~ COUNTY that are inadequate.	Flood, Levee Failure, and Dam Failure	New and Existing Structures and Populations	N/A		Office of Emergency Management
8	Construct public safe-rooms at current and future critical facilities.	Tornado and Thunderstorm	New and Existing Populations	$90 - $490 a square-foot		Office of Emergency Management
IN PLACE ON WEBSITE	Advertise to homeowners about the Arkansas Department Emergency Management's Safe Room/Shelter Program	Tornado and Thunderstorm	Existing Structures and Populations	$1,000		Office of Emergency Management

Pulaski County

Table A.12 Unincorporated Pulaski County Hazard Mitigation Action Participation Form						
Jurisdiction Priority	Hazard Mitigation Action	Hazard Mitigated	Affect on New or Existing Structures and/or Populations	Estimated Cost	Timeframe	Administration/Agency Responsible
	Require anchoring all new manufactured structures to permanent foundations.	Tornado and Thunderstorm	New and Existing Structures and Populations	N/A		Office of Emergency Management
11	Retrofit existing and install in all new critical facilities roof clips and anchors.	Tornado and Thunderstorm	Existing Structures and Populations	N/A		Office of Emergency Management
10	Structurally harden all existing and future critical facilities to withstand strong winds.	Tornado and Thunderstorm	New and Existing Structures	N/A		Office of Emergency Management
9	Replace critical facility windows with shatter-proof glass.	Tornado and Thunderstorm	New and Existing Structures	N/A		Office of Emergency Management
	Construct new utility lines underground.	Severe Winter Storm	New Structures	N/A		Office of Emergency Management
	~~Enact building codes that have standards for roof snow loads~~ for new structures.	~~Severe Winter~~ Storm	~~New Structures~~	~~N/A~~		~~Office of Emergency~~ Management
	Develop a weatherization education outreach program.	Severe Winter Storm and Extreme Heat	New and Existing Populations	$5,000		Office of Emergency Management
	Construct or retrofit a building to be a designated "cool-down" shelter.	Extreme Heat	New and Existing Populations	$20,000 – $150,000		Office of Emergency Management
	Identify substandard housing without proper air-conditioning or insulation.	Extreme Heat	Existing Populations	N/A		Office of Emergency Management
	Identify and maintain water sources.	Drought	Existing Populations	N/A		Office of Emergency Management
	Implement water restriction ordinance during drought event.	Drought	New and Existing Populations	N/A		Office of Emergency Management

Pulaski County

Table A.12 Unincorporated Pulaski County Hazard Mitigation Action Participation Form

Jurisdiction Priority	Hazard Mitigation Action	Hazard Mitigated	Affect on New or Existing Structures and/or Populations	Estimated Cost	Timeframe	Administration/Agency Responsible
	Adopt international building codes for all new structures.	Earthquake	New Structures and Populations	N/A		Office of Emergency Management
	Secure building contents on shelves in all critical facilities.	Earthquake	Existing Structures	N/A		Office of Emergency Management
	Provide brochure to new and existing homeowners on their home's proximity to natural-gas pipelines.	Chemical Spill	New and Existing Structures and Populations	$1,000		Office of Emergency Management
	Enact zoning buffer to minimize the intensity of new development around natural-gas pipelines.	Chemical Spill	New Structures and Populations	N/A		Office of Emergency Management
IN PLACE - 2001	Conduct a Commodity Flow Study to determine what chemicals are being transported through the City.	Chemical Spill	New and Existing Structures and Populations	$20,000		Office of Emergency Management
13	Implement a mosquito-borne disease educational outreach program	Mosquito-borne Disease	New and Existing Populations	$5,000		Office of Emergency Management
✓ IN PLACE	Implement a mosquito-borne disease abatement program	Mosquito-borne Disease	New and Existing Populations	$25,000		Office of Emergency Management
✓ IN PLACE	Implement burn bans during wildfire events.	Wildfire	New and Existing Populations	N/A		Office of Emergency Management
	Assist communities to become a Firewise Communities	Wildfire	New and Existing Populations	$5,000		Office of Emergency Management

City of Jacksonville
John Vanderhoof
501-985-1252

Jurisdictional Hazard Mitigation Action Participation Form

Jurisdiction Priority	Hazard Mitigation Action	Mitigated Hazard	Affect on New or/Existing Structures	Estimated Cost	Timeframe	Administration/Agency Responsible
1	Northlake subdiv. Emergency access due to Flooding area above the Base Flood Elevation	Flood	new and existing structure & Population.	NA	Present	City of Jacksonville
2.	Safe rooms For large & vulnerable special needs at risk populations.	Tornado & Thunderstorms	Existing Structure & Populations	1,000.00 per room NA for large areas.	Present.	City of Jacksonville.
4.	Install Emergency warning Sirens in City Replacing 10 sirens (to total)	Tornado & all Hazards.	new & existing populations.	$12,000 per location need 6	Present	City of Jacksonville
5.	Purchase backup generators for Critical Facilities to Maintain power.	Tornado & all Hazards.	new & existing Population	NA	Present	City of Jacksonville
6	Purchasing of NOAA weather radio for large congregation of people.	Tornado & all Hazards weather.	new & existing population	NA.	Present	City of Jacksonville
7.	mosquito Abatement program.	Health. viruses.	new & existing population	NA.	Present	City of Jacksonville
2	Implement a Master Drainage Plan Levels. Drainage.	Flood	new & existing Structure & population	phase 1 $200,000 phase 2 $200,000	5 years.	City of Jacksonville
8.	Code Red. Education	all Hazards.	new & existing population	NA	Present	City of Jacksonville

Table A.3 Little Rock School District Hazard Mitigation Action Participation Form						
Jurisdiction Priority	Hazard Mitigation Action	Hazard Mitigated	Affect on New or Existing Structures and/or Populations	Estimated Cost	Timeframe	Administration/Agency Responsible
	Acquire generators				$25-50K	
	Post HM Plan in library				NA	
	Install warning sirens				NA	
	Advertise Flood Insurance $5,000 and Safe Room Shelter Program through PTA					(#1,000)
	Implement Mosquito borne disease education program			$5,000		
	Increase drainage capacity					
	Construct "cool down" structures in HS			$20-$100K		

Little Rock

Jurisdictional Hazard Mitigation Action Participation Form

Jurisdiction Priority	Hazard Mitigation Action	Mitigated Hazard	Affect on New or/Existing Structures	Estimated Cost	Timeframe	Administration/Agency Responsible
1	Storm Ready Program	All-Hazards	New + Existing	N/A	2 yrs.	LREOEM
2	Advertise NFIP thru PSA	Flood	New + Existing	N/A	6 Months	LREOEM
3	Conduct Commodity Flow Study	Chemical Spill	New + Existing	Funded locally	Current	LREOEM
4	Increase Drainage Capacity	Flood, Levee Dam Failure	New + Existing	unknown	Ongoing	LR PW
5	Implement Master Drainage	" "	" "	N/A	Ongoing	LR PW
6	CRS	Flood	Existing	N/A	Ongoing	LR PW
7	Acquire repetitive loss structures	Flood	Existing	N/A	Ongoing	LR PW

North Little Rock Community - Rick Ezell - 340-5365

Jurisdictional Hazard Mitigation Action Participation Form

Jurisdiction Priority	Hazard Mitigation Action	Mitigated Hazard	Affect on New or/Existing Structures	Estimated Cost	Timeframe	Administration/Agency Responsible
1	Remediation/Rehabilitation of Main Street Pump Station Outfall	Regulatory/ Flood Prevention	N/A	$250,000	Present	CNLR, Public Work
2	Certification of NLR Levee	Regulatory/ Flood Protection	N/A	$25,000	Present	CNLR, Public Works
3	Install/Replace Old Existing Emergency Warning Sirens	Tornados High Wind Events	New/Existing Population	$10,000 To $12,000 per Location	2 Year	CNLR, Emergency Services
4	Generator For Critical Facilitys	Storm Damage Power Outage	New/Existing Population Fire Stations/Police Stations	$25,000 To $30,000 per Location	2 Year	CNLR, Emergency Services
5	Continued Engineering Studies Redwood Tunnel Drainage System	Flood Protection	New/Existing Population	$250,000	4 To 5 Year	CNLR, Public Work
6	State Hwy. 161/ Bethany Drainage Improvements	Flood Prevention	New/Existing Population	$1,000,000	4 To 5 Year	CNLR, Public Works
7	Continued Engineering Studies Five Mile Creek/ Shiloath Bayou	Flood Prevention	New/Existing Population	$100,000 To $150,000	4 To 5 Year	CNLR, Public Works

Little Rock

Jurisdictional Hazard Mitigation Action Participation Form

Jurisdiction Priority	Hazard Mitigation Action	Mitigated Hazard	Affect on New or/Existing Structures	Estimated Cost	Timeframe	Administration/Agency Responsible
8	Acquire Generator for critical facilities	All Hazards	New + Existing	Completed	completed	LR Building Services
9	Ensure that Hazmit Plan is available to public	All - Hazards	New + Existing	N/A	6 months	LR EM

North Little Rock School District.

~~Jurjsdictional~~ Hazard Mitigation Action Participation Form

Jurisdiction Priority	Hazard Mitigation Action	Mitigated Hazard	Affect on New or/Existing Structures	Estimated Cost	Timeframe	Administration/Agency Responsible
	Mitigate flooding into lowest level of Bldg located at 2300 Poplar St No. Little Rock, with construction of LEVEE, check DRAINAGE/pump or Demo Portion of Bldg in flood plain where other facilities can be built to accommodate students	Flood	Existing Structure	$100,000	3-6yrs.	Facility Administrator

North

Table A.3 Little Rock School District Hazard Mitigation Action Participation Form

Jurisdiction Priority	Hazard Mitigation Action	Hazard Mitigated	Affect on New or Existing Structures and/or Populations	Estimated Cost	Timeframe	Administration/Agency Responsible
	Incorporate hazard mitigation practices and hazard risk education into the school curriculum. (example: Red Cross Masters of Disasters Program)	All Hazards	New and Existing Structures and Populations	$10,000	Based on Approval of Curriculum Administration	Safe Schools Coordinator
	Acquire all-hazard weather radios for all schools campuses.	All Hazards	New and Existing Structures and Populations	N/A	DONE.	Safe Schools Coordinator
	Develop brochures, websites, educational programs, and Public Service Announcements that increase public awareness of hazard risk and mitigation activities.	All Hazards	New and Existing Structures and Populations	$5,000	Defer to city/County Gvrnmnt.	Safe Schools Coordinator
	Acquire generators for all school campuses.	All Hazards	New and Existing Structures and Populations	$25,000 - $50,000	2-6 yrs.	Facility Administrator ~~Safe Schools Coordinator~~
	Ensure that the Hazard Mitigation Plan is available at the library.	All Hazards	New and Existing Structures and Populations	N/A	Defer to Gvrnmnt.	Safe Schools Coordinator
	Install an all-hazard alert system, Red Alert, CodeRed, revere 9-1-1 call, warning sirens, or other effective method.	All Hazards	New and Existing Populations	N/A	School Messenger Alert	Safe Schools Coordinator
	Advertise National Flood Insurance Program through PTA meetings.	Flood	New and Existing Structures and Populations	$5,000	2 yrs.	VIPS Coord. ~~Safe Schools Coordinator~~
	Apply to the Community Rating System to receive a 5% reduction in flood insurance rates for all citizens.	Flood	New and Existing Structures and Populations	$15,000	Participate w/ city	Safe Schools Coordinator ?

Table A.3 Little Rock School District Hazard Mitigation Action Participation Form

Jurisdiction Priority	Hazard Mitigation Action	Hazard Mitigated	Affect on New or Existing Structures and/or Populations	Estimated Cost	Timeframe	Administration/Agency Responsible
	Elevate ~~existing and~~ future structures within the special flood areas above the base flood elevation.	Flood	New and Existing Structures and Populations	N/A	2-6 yrs.	Facility Administrator ~~Safe Schools Coordinator~~
	Increase drainage capacity in areas of the District that are inadequate.	Flood, Levee Failure, and Dam Failure	New and Existing Structures and Populations	N/A	2-6 yrs.	Facility Admin. ~~Safe Schools Coordinator~~
	Collaborate with the Army Corp of Engineers to ensure adequate maintenance of all levee systems.	Flood, Levee Failure, and Dam Failure	New and Existing Structures and Populations	N/A	City/County Govmnts	Safe Schools Coordinator
	Construct public safe-rooms at current and future critical facilities.	Tornado and Thunderstorm	New and Existing Populations	$90 - $490 a square-foot	$	Facility Admin. ~~Safe Schools Coordinator~~ ?
	Advertise to student's parents about the Arkansas Department Emergency Management's Safe Room/Shelter Program	Tornado and Thunderstorm	Existing Structures and Populations	$1,000	1-2 yrs.	Safe Schools Coordinator (school messenger)
	Require anchoring all new manufactured structures to permanent foundations.	Tornado and Thunderstorm	New and Existing Structures and Populations	N/A	2-6 yrs.	Fac. Admin. ~~Safe Schools Coordinator~~
	Retrofit existing and install in all new critical facilities roof clips and anchors.	Tornado and Thunderstorm	Existing Structures and Populations	N/A	2-6 yrs.	Fac. Admin. ~~Safe Schools Coordinator~~
	Structurally harden all existing and future critical facilities to withstand strong winds.	Tornado and Thunderstorm	New and Existing Structures	N/A	2-6 yrs.	Fac. Admin. ~~Safe Schools Coordinator~~
	Replace school building windows with shatter-proof glass.	Tornado and Thunderstorm	New and Existing Structures	N/A	2-6 yrs.	Fac. Admin. ~~Safe Schools Coordinator~~

Table A.3 Little Rock School District Hazard Mitigation Action Participation Form

Jurisdiction Priority	Hazard Mitigation Action	Hazard Mitigated	Affect on New or Existing Structures and/or Populations	Estimated Cost	Timeframe	Administration/Agency Responsible
	Weatherize existing and future structures.	Severe Winter Storm and Extreme Heat	New and Existing Populations	$5,000	2-6 yrs.	Fac. Admin. ~~Safe Schools Coordinator~~
	Construct or retrofit a building to be a designated "cool-down" shelter.	Extreme Heat	New and Existing Populations	$20,000 – $150,000	2-6 yrs.	Fac. Admin. ~~Safe Schools Coordinator~~
	Identify substandard structures without proper air-conditioning.	Extreme Heat	Existing Populations	N/A	2-6 yrs.	Fac. Admin. ~~Safe Schools Coordinator~~
	Identify and maintain water sources.	Drought	Existing Populations	N/A	N/A	Safe Schools Coordinator
	Build new structures to meet the international building code.	Earthquake	New Structures and Populations	N/A	2-6 yrs.	Fac. Admin. ~~Safe Schools Coordinator~~
	Secure building contents (computers, books, ect.) on shelves in all structures.	Earthquake	Existing Structures	N/A	1-4 yrs.	Fac. Admin. ~~Safe Schools Coordinator~~
	Provide brochure to student's parents about chemical spill hazards.	Chemical Spill	New and Existing Structures and Populations	$1,000	1-2 yrs.	Safe Schools Coordinator (School Messenger)
	Build new school structures away from natural-gas pipelines.	Chemical Spill	New Structures and Populations	N/A	Immediately	Fac. Admin. ~~Safe Schools Coordinator~~
	Implement a mosquito-borne disease educational outreach program	Mosquito-borne Disease	New and Existing Populations	$5,000	1-2 yrs.	Health Coord. ~~Safe Schools Coordinator~~ (School Messenger)
	Monitor mosquito-borne disease outbreaks if they occur.	Mosquito-borne Disease	New and Existing Populations	$25,000	Immediately	~~Health Coord.~~ ~~Safe Schools Coordinator~~

CITY OF SHERWOOD - TRACY SIMS (501) 835-3288

Table A.6 City of Sherwood Hazard Mitigation Action Participation Form

Jurisdiction Priority	Hazard Mitigation Action	Hazard Mitigated	Affect on New or Existing Structures and/or Populations	Estimated Cost	Timeframe	Administration/Agency Responsible
1	ELEVATE EXISTING AND FUTURE STRUCTURES WITHIN THE SPECIAL FLOOD AREAS ABOVE THE BASE FLOOD ELEVATION	FLOOD	NEW AND EXISTING STRUCTURES AND POPULATIONS	N/A	PRESENT	CITY OF SHERWOOD NFIP - FEMA
2	AQUIRE REPETITIVE LOSS AND SEVERE REPETITIVE LOSS STRUCTURES	FLOOD	EXISTING STRUCTURES AND POPULATIONS	N/A	PRESENT	CITY OF SHERWOOD FEMA
3	IMPLEMENT A MASTER DRAINAGE PLAN	FLOOD	NEW AND EXISTING STRUCTURES AND POPULATIONS	PHASE 1 $ 200,000 PHASE 2 $ 200,000	3 YEARS	CITY OF SHERWOOD
4	IMPLEMENT BURN BANS DURING WILDFIRE EVENTS,	WILDFIRE	NEW AND EXISTING POPULATION	N/A	PRESENT	CITY OF SHERWOOD
5	ADVERTISE TO HOMEOWNERS ABOUT THE ARKANSAS DEARTMENT OF EMERGENCY MANAGEMENT SAFE ROOM SHELTER PROGRAM	TORNADO AND THUNDERSTORM	EXISTING STRUCTURES AND POPULATIONS	$1,000	1 YEAR	CITY OF SHERWOOD
6	INSTALL AN ALL-HAZARD SYSTEM, RED ALERT, CODE RED, REVERSE 911 WARNING SIRENS OR OTHER EFFECTIVE METHODS.	ALL-HAZARDS	NEW AND EXISTING POPULATIONS	N/A	PRESENT	CITY OF SHERWOOD NCIC - ALERT EXPRESS City of Sherwood
7	MOSQUITO ABATEMENT	HEALTH	NEW & EXISTING POPULATIONS	~20,000	PRESENT	CITY OF SHERWOOD

Table A.6 City of Maumelle Hazard Mitigation Action Participation Form						
Jurisdiction Priority	Hazard Mitigation Action	Hazard Mitigated	Affect on New or Existing Structures and/or Populations	Estimated Cost	Timeframe	Administration/Agency Responsible
	Acquire repetitive loss and severe repetitive loss structures.	Flood	Existing Structures and Populations	N/A		
	Apply to the Community Rating System to receive a 5% reduction in flood insurance rates for all citizens.	Flood	New and Existing Structures and Populations	$15,000		
	Study the watershed of Taylor Creek to determine baseline for sustainable development and needs for drainage capacity improvements.	Flood	New and Existing Structures and Populations	N/A		Not in the City of Maumelle??
	Elevate existing and future structures within the special flood areas above the base flood elevation.	Flood	New and Existing Structures and Populations	N/A		
	Study the watershed of Little Maumelle River to determine baseline for sustainable development.	Flood	New and Existing Structures and Populations	N/A		Not in the City of Maumelle
	Implement a Master Drainage Plan	Flood, Levee Failure, and Dam Failure	New and Existing Structures and Populations	N/A		
	Increase drainage capacity in areas of the City that are inadequate.	Flood, Levee Failure, and Dam Failure	New and Existing Structures and Populations	N/A		
	Construct public safe-rooms at current and future critical facilities.	Tornado and Thunderstorm	New and Existing Populations	$90 - $490 a square-foot		
	Advertise to homeowners about the Arkansas Department Emergency	Tornado and Thunderstorm	Existing Structures and Populations	$1,000		Should be done at state level vs. local via PSA and media

Table A.6 City of Maumelle Hazard Mitigation Action Participation Form						
Jurisdiction Priority	Hazard Mitigation Action	Hazard Mitigated	Affect on New or Existing Structures and/or Populations	Estimated Cost	Timeframe	Administration/Agency Responsible
	Acquire all-hazard weather radios for all schools, city halls, large businesses, churches, and other critical facilities.	All Hazards	New and Existing Structures and Populations	N/A	Q1 of 2012	Utilizing Code Red system for local notifications
	Develop brochures, websites, educational programs, and Public Service Announcements that increase public awareness of hazard risk and mitigation activities.	All Hazards	New and Existing Structures and Populations	$5,000		
	Acquire generators for all critical facilities and shelters.	All Hazards	New and Existing Structures and Populations	$25,000 - $50,000		Should increase amount to $80,000 in order to purchase adequate sized generators
	Ensure that the Hazard Mitigation Plan is available to the public in hard copy and online.	All Hazards	New and Existing Structures and Populations	N/A		
	Install an all-hazard alert system, Red Alert, CodeRed, revere 9-1-1 call, warning sirens, or other effective method.	All-Hazards	New and Existing Populations	N/A	Implemented in Q1 of 2012	Fire Dept.
	Meet the guidelines for the National Weather Service "Storm Ready Program"	All-Hazards	New and Existing Structures and Populations	N/A		
	Advertise National Flood Insurance Program through a Public Service Announcement.	Flood	New and Existing Structures and Populations	$5,000		Should be done statewide vs. at local levels

Table A.6 City of Maumelle Hazard Mitigation Action Participation Form						
Jurisdiction Priority	Hazard Mitigation Action	Hazard Mitigated	Affect on New or Existing Structures and/or Populations	Estimated Cost	Timeframe	Administration/Agency Responsible
	Management's Safe Room/Shelter Program					
	Require anchoring all new manufactured structures to permanent foundations.	Tornado and Thunderstorm	New and Existing Structures and Populations	N/A		
	Retrofit existing and install in all new critical facilities roof clips and anchors.	Tornado and Thunderstorm	Existing Structures and Populations	N/A		
	Structurally harden all existing and future critical facilities to withstand strong winds.	Tornado and Thunderstorm	New and Existing Structures	N/A		
	Replace critical facility windows with shatter-proof glass.	Tornado and Thunderstorm	New and Existing Structures	N/A		
	Construct new utility lines underground.	Severe Winter Storm	New Structures	N/A		Almost all city electric utilities are underground with the exception of the industrial park and transmission lines
	Enact building codes that have standards for roof snow loads for new structures.	Severe Winter Storm	New Structures	N/A	Current IBC building code provides this	
	Develop a weatherization education outreach program.	Severe Winter Storm and Extreme Heat	New and Existing Populations	$5,000		
	Construct or retrofit a building to be a designated "cool-down" shelter.	Extreme Heat	New and Existing Populations	$20,000 – $150,000		
	Identify substandard housing without proper air-conditioning or insulation.	Extreme Heat	Existing Populations	N/A		

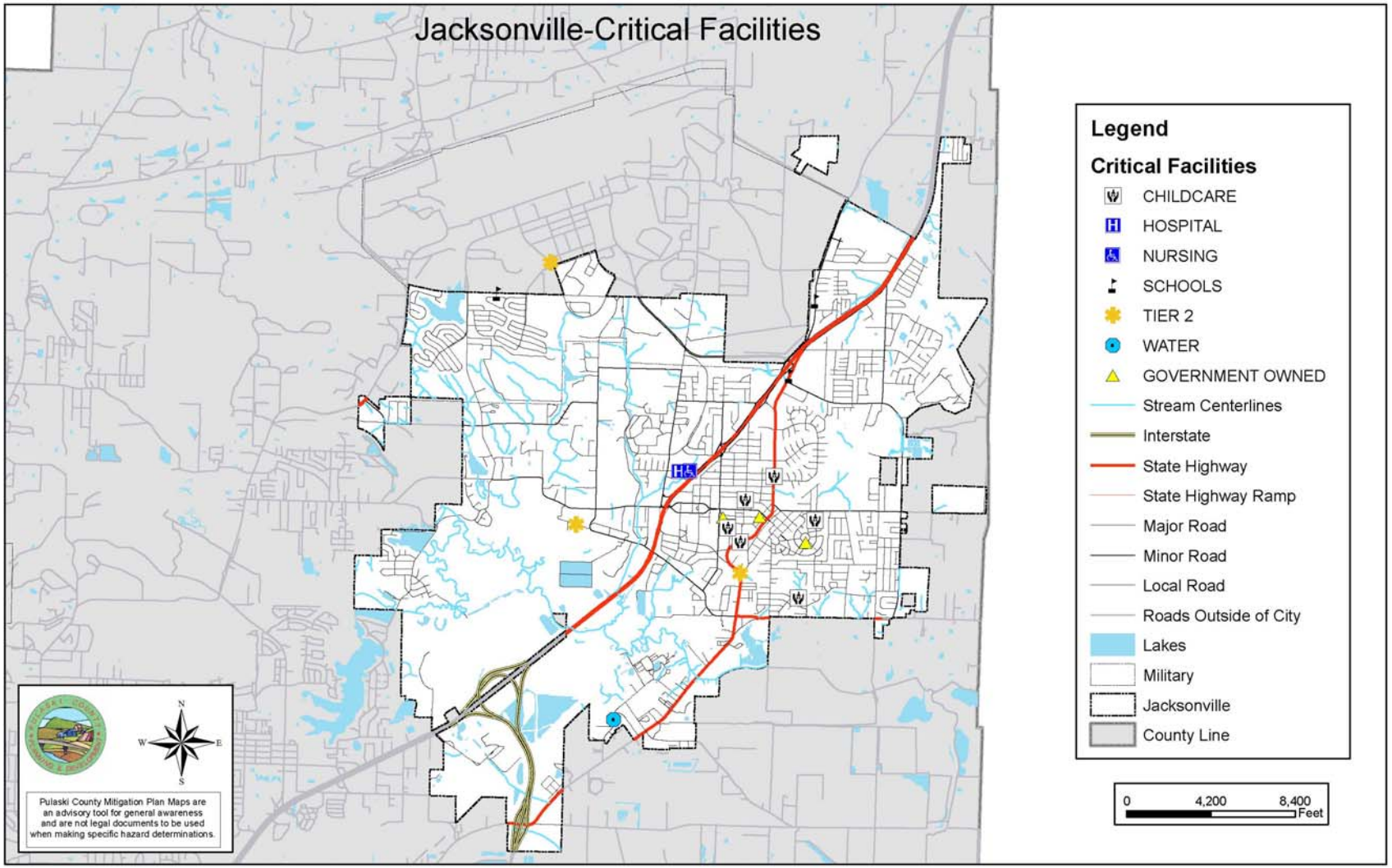
Table A.6 City of Maumelle Hazard Mitigation Action Participation Form						
Jurisdiction Priority	Hazard Mitigation Action	Hazard Mitigated	Affect on New or Existing Structures and/or Populations	Estimated Cost	Timeframe	Administration/Agency Responsible
	Identify and maintain water sources.	Drought	Existing Populations	N/A	Done	Maumelle Water Mgmt./SID #500 has adequate wellfield and cross-connections with Central Ark. Water
	Implement water restriction ordinance during drought event.	Drought	New and Existing Populations	N/A		
	Adopt international building codes for all new structures.	Earthquake	New Structures and Populations	N/A	Currently use IBC Bldg. Code and Ark. Fire Prev. Code	
	Secure building contents on shelves in all critical facilities.	Earthquake	Existing Structures	N/A		
	Provide brochure to new and existing homeowners on their home's proximity to natural-gas pipelines.	Chemical Spill	New and Existing Structures and Populations	$1,000		
	Enact zoning buffer to minimize the intensity of new development around natural-gas pipelines.	Chemical Spill	New Structures and Populations	N/A		No large distribution natural gas lines in the City other than on Maumelle Blvd.
	Conduct a Commodity Flow Study to determine what chemicals are being transported through the City.	Chemical Spill	New and Existing Structures and Populations	$20,000		Data currently available via state for I-40 and U.P. Railroad
	Implement a mosquito-borne disease educational outreach program	Mosquito-borne Disease	New and Existing Populations	$5,000		
	Implement a mosquito-borne disease abatement program	Mosquito-borne Disease	New and Existing Populations	$25,000	Done. Public Works sprays	

Table A.6 City of Maumelle Hazard Mitigation Action Participation Form						
Jurisdiction Priority	Hazard Mitigation Action	Hazard Mitigated	Affect on New or Existing Structures and/or Populations	Estimated Cost	Timeframe	Administration/Agency Responsible
					citywide 2-3 time per year	

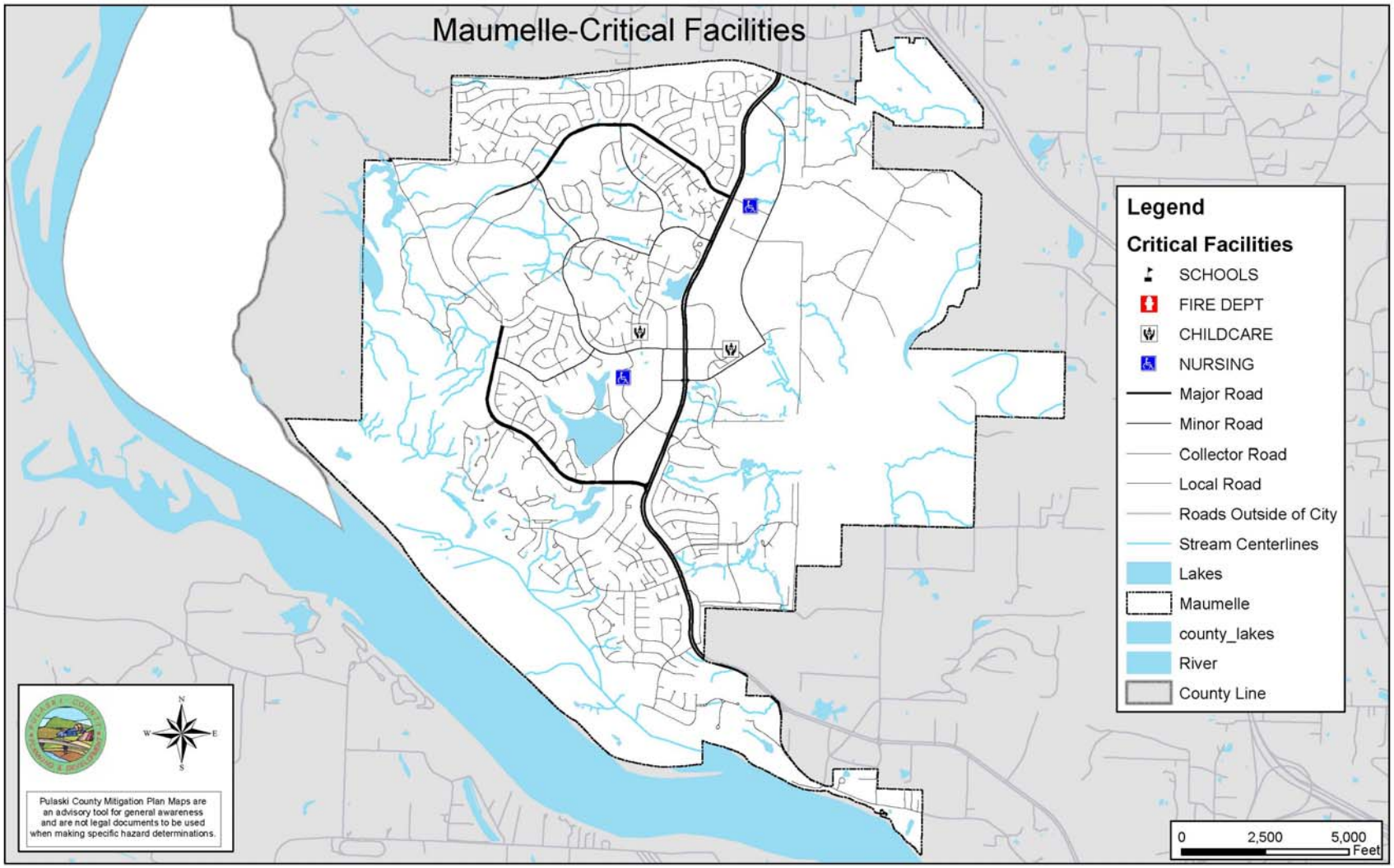
Appendix IV

Critical Facility Maps
Manufactured Home Maps

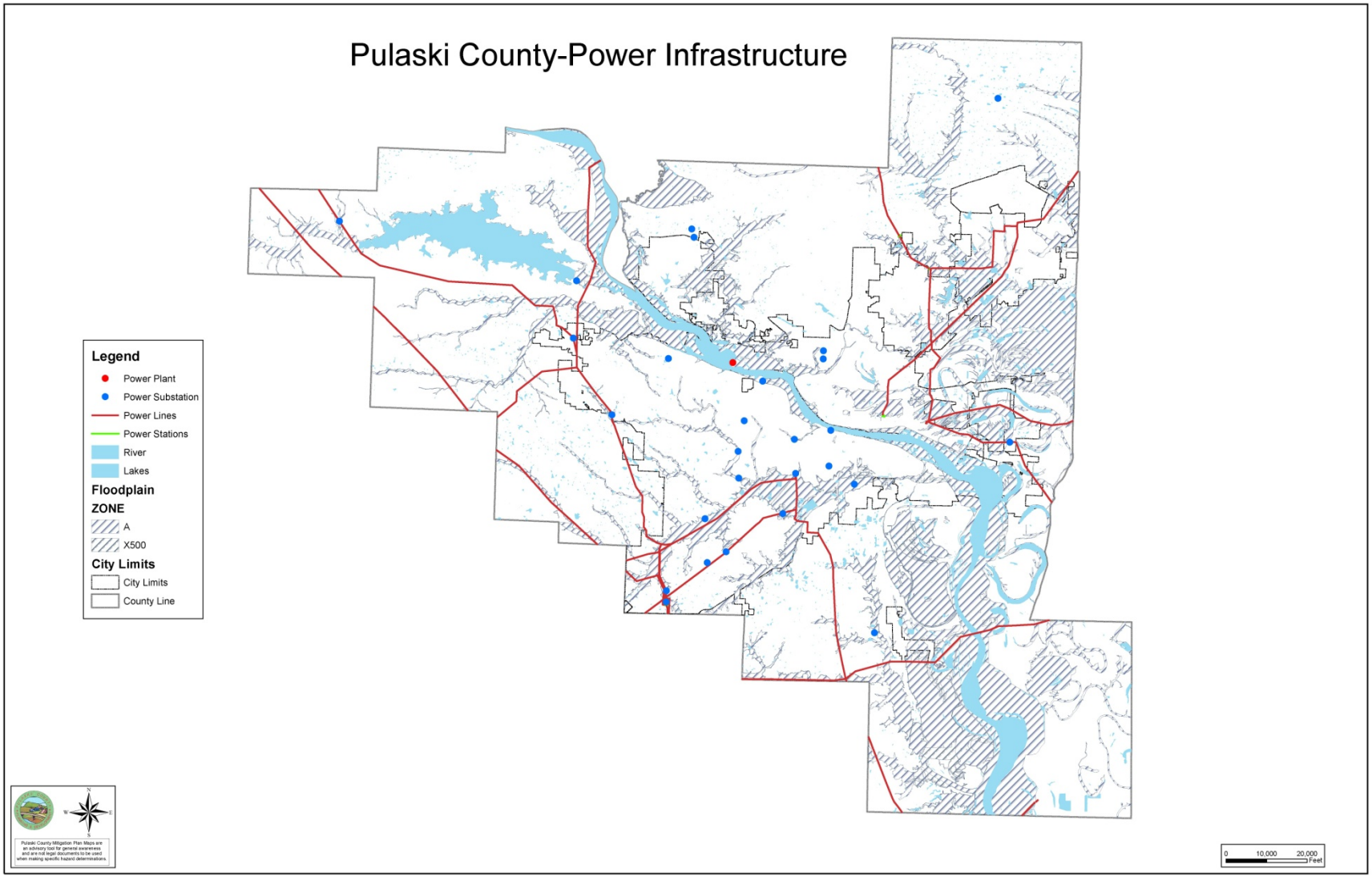
City of Jacksonville Critical Facility Map



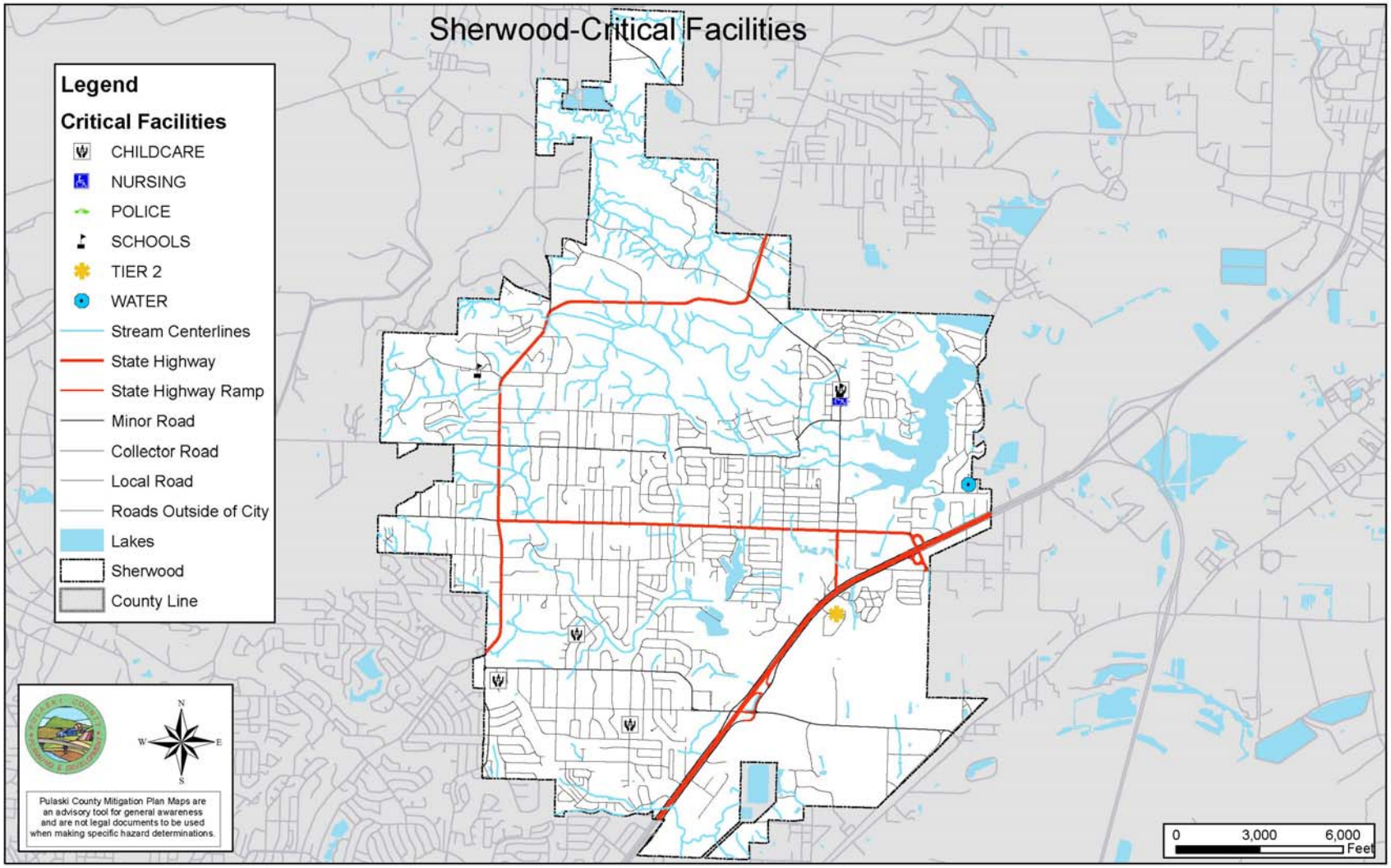
City of Maumelle Critical Facility Map



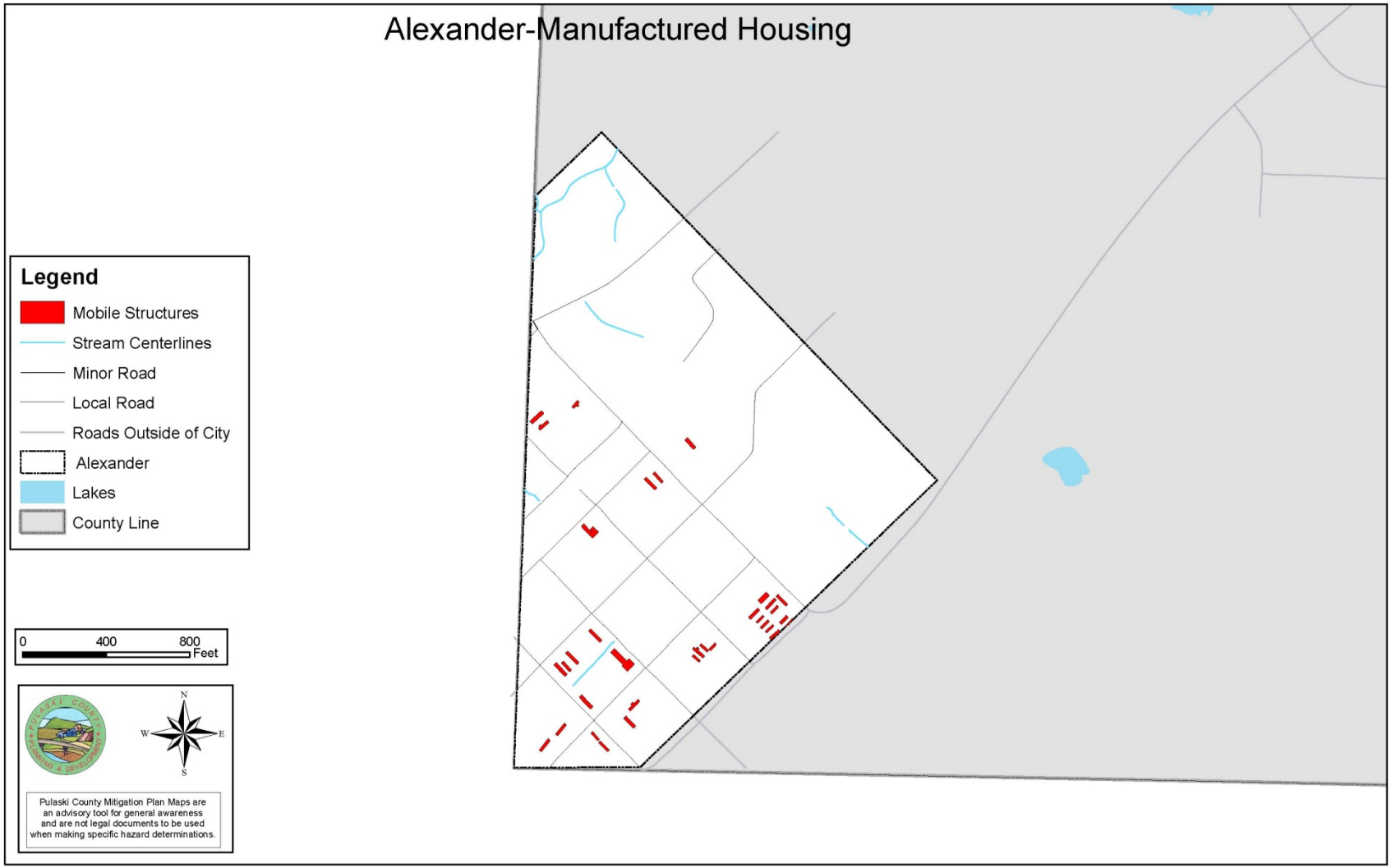
Pulaski County Critical Facility Map



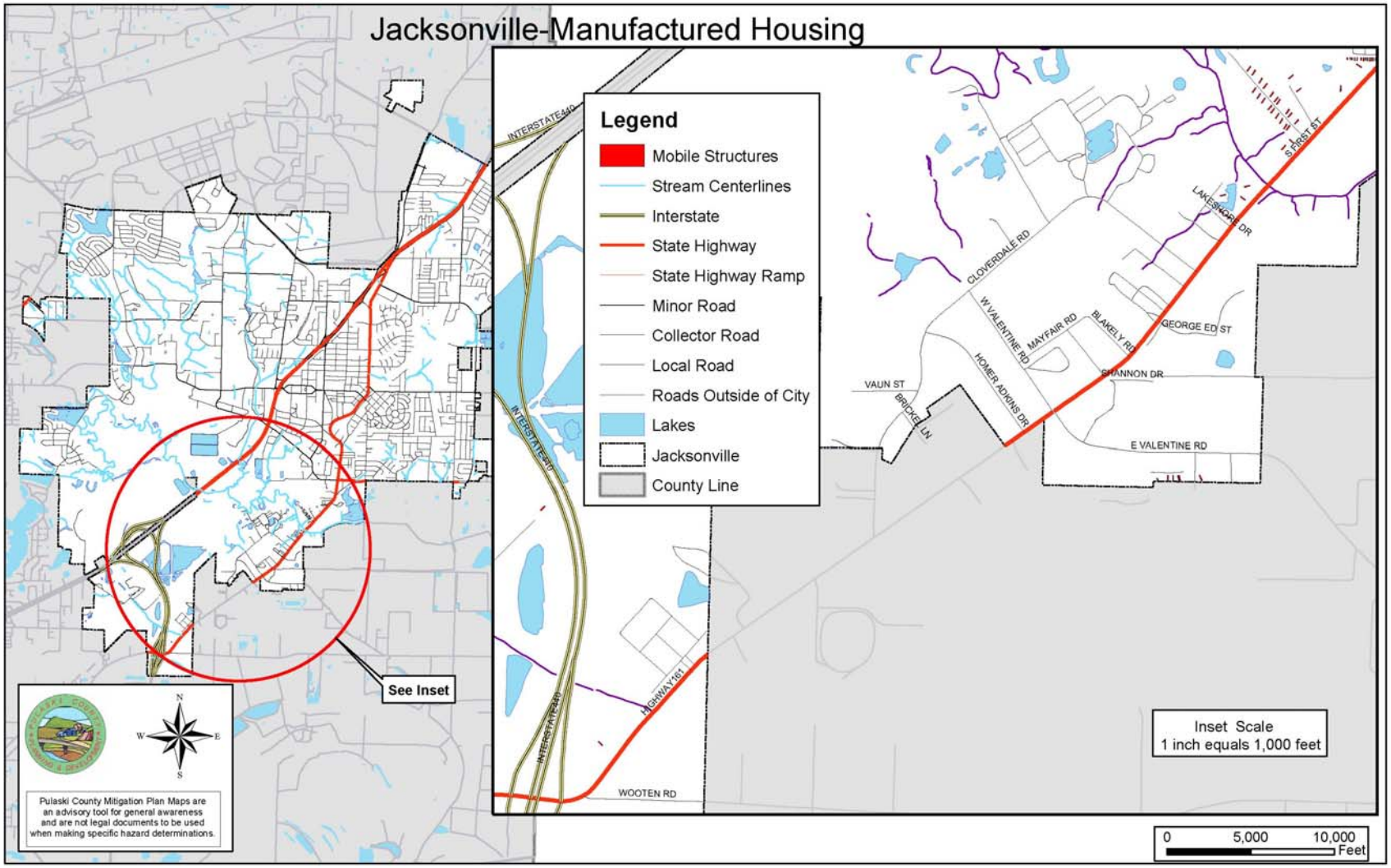
City of Sherwood Critical Facility Map



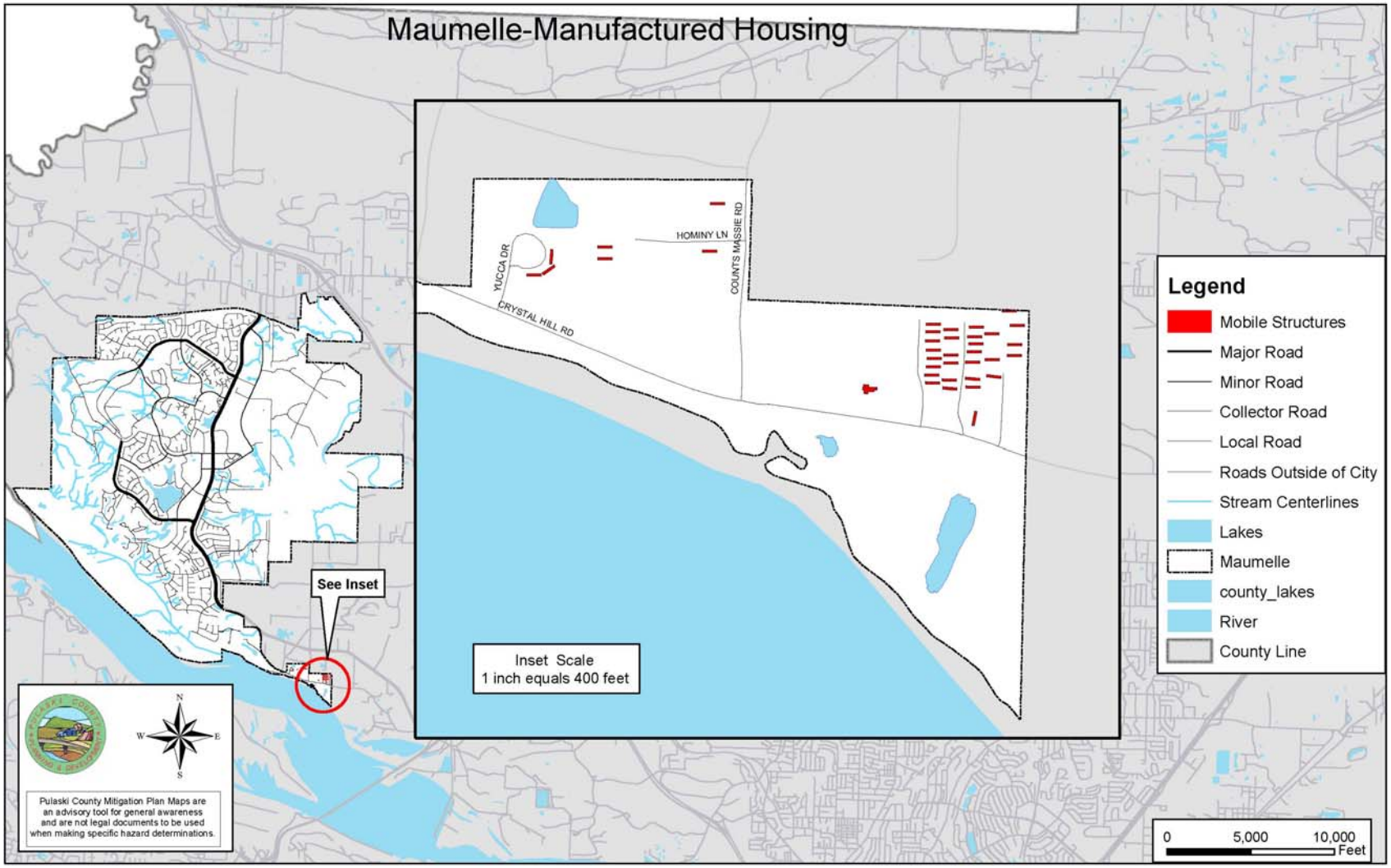
City of Alexander Manufactured Housing Map



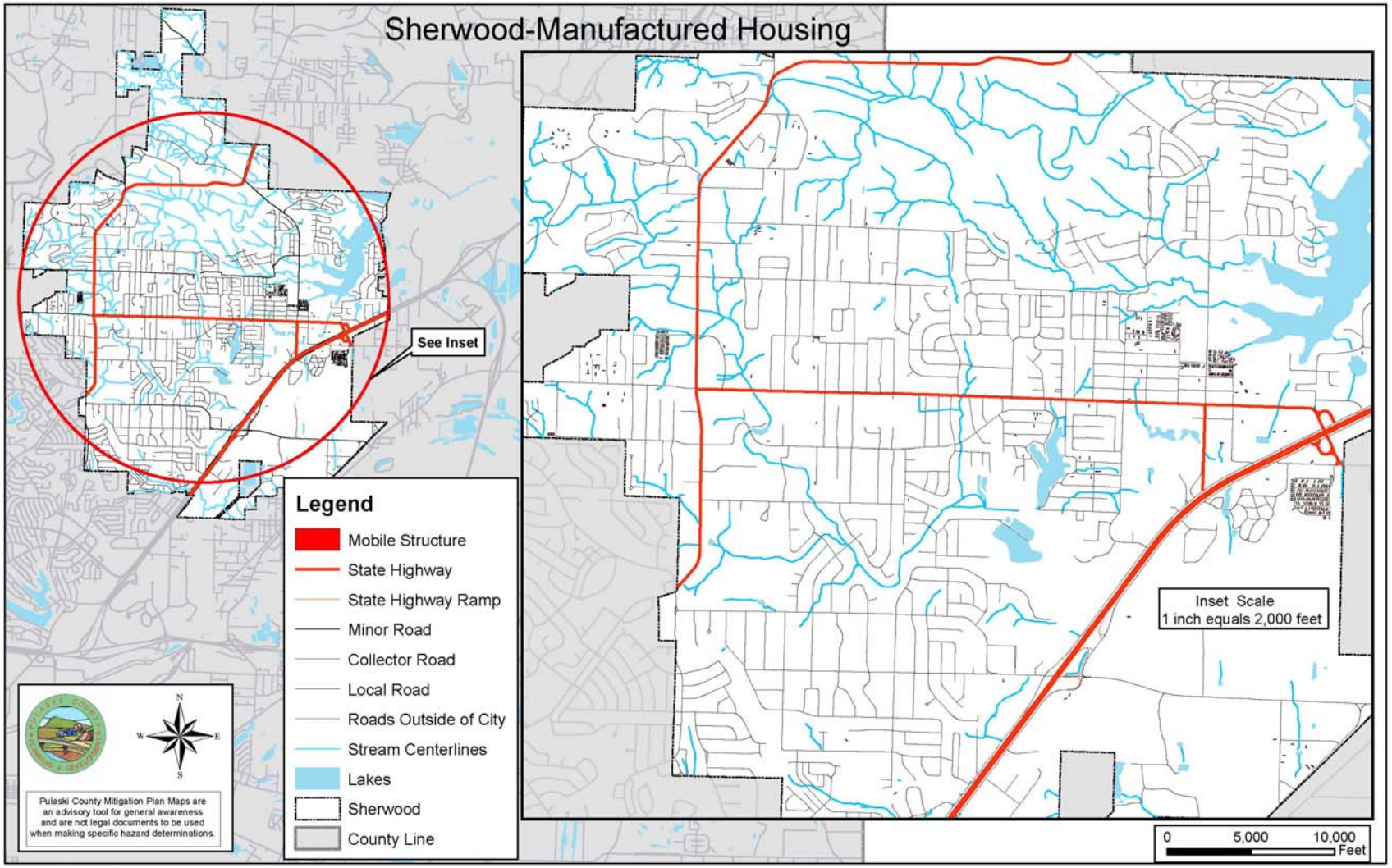
City of Jacksonville Manufactured Housing Map



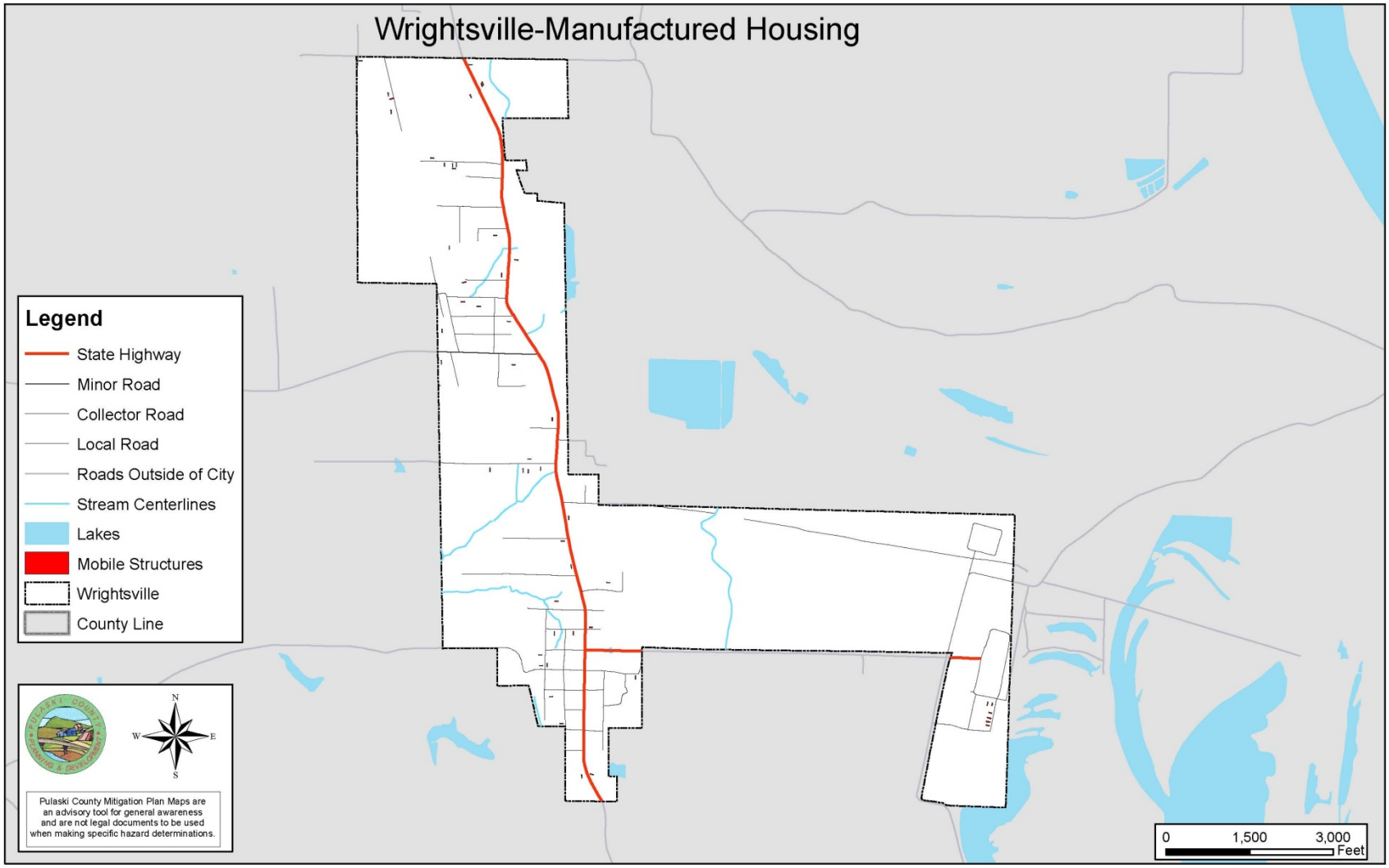
City of Maumelle Manufactured Housing Map



City of Sherwood Manufactured Housing Map



City of Wrightsville Manufactured Housing Map



Appendix V

Glossary

Acquisition: Local governments can acquire lands in high hazard areas through conservation easements, purchase of development rights, or outright purchase of property.

Asset: Any manmade or natural feature that has value, including, but not limited to people; buildings; infrastructure like bridges, roads, and sewer and water systems; lifelines like electricity and communication resources; or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks.

Building: A structure that is walled and roofed, principally above ground and permanently affixed to a site. The term includes a manufactured home on a permanent foundation on which the wheels and axles carry no weight.

Coastal Zone: The area along the shore where the ocean meets the land as the surface of the land rises above the ocean. This land/water interface includes barrier islands, estuaries, beaches, coastal wetlands, and land areas having direct drainage to the ocean.

Community Rating System (CRS): CRS is a program that provides incentives for National Flood Insurance Program communities to complete activities that reduce flood hazard risk. When the community completes specified activities, the insurance premiums of the policyholders in those communities are reduced.

Contour: A contour line depicts equal ground elevation on a topographic (contour) map.

Debris: The scattered remains of assets broken or destroyed in a hazard event. Debris caused by a wind or water hazard event can cause additional damage to other assets.

Digital Flood Insurance Rate Map (D-FIRM): Map of a community, prepared by FEMA, shows both the special flood hazard areas and the risk premium zones applicable to the community under the National Flood Insurance Program.

Disaster Mitigation Act of 2000 (DMA 2000): DMA 2000 (Public Law 106-390) is the latest legislation to improve the planning process. It was signed into law on October 10, 2000. This new legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur.

Earthquake: A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of Earth's tectonic plates.

Erosion: Wearing away of the land surface by detachment and movement of soil and rock fragments, during a flood or storm or over a period of years, through the action of wind, water, or other geologic processes.

Exposure: The condition of being at risk and subject to some effect or influence.

Extent: The size of an area affected by a hazard or hazard event.

Federal Emergency Management Agency (FEMA): Independent agency created in 1979 to provide a single point of accountability for all federal activities related to disaster mitigation and emergency preparedness, response, and recovery.

Flood Depth: Height of the floodwater surface above the ground surface.

Flood Hazard Area: The area inundated by a flood of a given magnitude on a map.

Flood Mitigation Assistance Program (FMA): The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FEMA provides FMA funds to assist States and communities implement measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insured under the National Flood Insurance Program.

Flood Zone: A geographical area shown on a Flood Insurance Rate Map (FIRM) that reflects the severity or type of flooding in the area.

Floodplain: Any land area, including watercourse, susceptible to partial or complete inundation by water from any source.

Governor's Office of Homeland Security & Emergency Preparedness (GOSHEP): GOSHEP coordinates State Disaster Declarations authorized by the Governor. Activities include preparedness, prevention, response, mitigation, and recovery.

Hazard: A source of potential danger or adverse condition.

Hazard Event: A specific occurrence of a particular type of hazard.

Hazard Identification: The process of identifying hazards that threaten an area.

Hazard Mitigation: Sustained actions taken to reduce or eliminate long-term risk from hazards and their effects.

Hazard Mitigation Grant Program (HMGP): The Hazard Mitigation Grant Program (HMGP) provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

HAZUS (Hazards U.S.): A GIS-based, nationally standardized, loss estimation tool developed by FEMA.

Hurricane: An intense tropical cyclone, formed in the atmosphere over warm ocean areas, in which wind speeds reach 74 miles per hour or more and blow in a large spiral around a relatively calm center or "eye." Hurricanes develop over the North Atlantic Ocean, northeast Pacific Ocean, or the South Pacific Ocean east of 1600E longitude. Hurricane circulation is counter-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.

Impact: The force of impression of one thing on another with significant or major effect.

Infrastructure: Refers to the public services of a community that have a direct impact on the quality of life. Infrastructure includes communication technology such as phone lines or Internet access, vital services such as public water supplies and sewer treatment facilities, and includes an area's transportation system such as airports, heliports, highways, bridges, tunnels, roadbeds, overpasses, railways, bridges, rail yards, depots; and waterways, canals, locks, seaports, ferries, harbors, dry docks, piers, and regional dams.

Landslide: Downward movement of a slope and materials under the force of gravity.

Land Use: Land use is the human use of land. Land use involves the management and modification of natural environment or wilderness into built environment such as fields, pastures, and settlements. It has also been defined as "the arrangements, activities, and inputs people undertake in a certain land cover type to produce, change or maintain it"

Local Emergency Planning Committee (LEPC): LEPC's consist of community representatives and are appointed by the State Emergency Response Commissions (SERC's), as required by Superfund Amendments and Reauthorization Act (SARA), Title III. They develop an emergency plan to prepare for and respond to chemical emergencies. They are also responsible for coordinating with local facilities to find out what they are doing to reduce hazards, prepare for accidents, and reduce hazardous inventories and releases. The LEPC serves as a focal point in the community for information and discussions about hazardous substances, emergency planning, and health and environmental risks.

Magnitude: A measure of the strength of a hazard event. The magnitude (also referred to as severity) of a given hazard event is usually determined using technical measures specific to the hazard.

Mitigate: To cause something to become less harsh or hostile, to make less severe or painful.

Mitigation Plan: Systematically evaluating community policies, actions, and tools, and setting goals for implementation over the long term that will result in a reduction in risk and minimize future losses community-wide.

National Climatic Data Center (NCDC): NCDC is the world's largest active archive of weather data. NCDC produces numerous climate publications and responds to data requests from all over the world. NCDC operates the World Data Center for Meteorology which is co-located at NCDC in Asheville, North Carolina, and the World Data Center for Paleoclimatology which is located in Boulder, Colorado.

National Flood Insurance Program (NFIP): Federal program created by Congress in 1968 that makes flood insurance available in communities that enact minimum floodplain management regulations as indicated in 44 CFR §60.3.

National Weather Service (NWS): Prepares and issues flood, severe weather, and coastal storm warnings and can provide technical assistance to federal and state entities in preparing weather and flood warning plans.

Planning: The act or process of making or carrying out plans; the establishment of goals, policies, and procedures for a social or economic unit.

Preparedness: Actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Presidential Major Disaster Declaration: A formal action by the President of the United States to make a State eligible for major disaster or emergency assistance under the Robert T. Stafford Relief and Emergency Assistance Act, Public Law 93-288, as amended.

Probability: A statistical measure of the likelihood that a hazard event will occur.

Recovery: The actions taken by an individual or community after a catastrophic event to restore order and lifelines in a community.

Regulatory Power: Local jurisdictions have the authority to regulate certain activities in their jurisdiction. With respect to mitigation planning, the focus is on such things as regulating land use development and construction through zoning, subdivision regulations, design standards, and floodplain regulations.

Repetitive Loss Properties (RL): Repetitive loss Properties are NFIP insured properties for which two or more losses of at least $1,000 each have been paid under the NFIP within any 10-year period since 1978.

Response: The actions taken during an event to address immediate life and safety needs and to minimize further damage to properties.

Risk: The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to a specific type of hazard event. It also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Scale: A proportion used in determining a dimensional relationship; the ratio of the distance between two points on a map and the actual distance between the two points on the Earth's surface.

Severe Repetitive Loss (SRL): SRL are NFIP insured properties in which either Four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or for which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building

Stafford Act: The Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-107 was signed into law November 23, 1988 and amended the Disaster Relief Act of 1974, PL 93-288. The Stafford Act is the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs.

Stakeholder: Individual or group that will be affected in any way by an action or policy. They include businesses, private organizations, and citizens.

State Hazard Mitigation Officer (SHMO): The representative of state government who is the primary point of contact with FEMA, other state and federal agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities.

Substantial Damage: Damage of any origin sustained by a structure in a Special Flood Hazard Area whereby the cost of restoring the structure to its before-damaged condition would equal or exceeds 50 percent of the market value of the structure before the damage.

Tectonic Plate: Torsionally rigid, thin segments of the Earth's lithosphere that may be assumed to move horizontally and adjoin other plates. It is the friction between plate boundaries that cause seismic activity.

Topographic: Characterizes maps that show manmade features and indicate the physical shape of the land using contour lines.

Tornado: A violently rotating column of air extending from a thunderstorm to the ground.

Tropical Cyclone: A generic term for a cyclonic, low-pressure system over tropical or sub-tropical waters.

Tropical Storm: A tropical storm or cyclone having maximum sustained winds greater than 39 mph and less than 74 mph.

Tsunami: Great sea wave produced by submarine earth movement or volcanic eruption.

United States Army Corps of Engineers (USACE): USACE provides vital public engineering services in peace and war to strengthen our Nation's security, energize the economy, and reduce risks from disasters.

Vulnerability: Describes how exposed or susceptible to damage an asset is. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, since many businesses depend on uninterrupted electrical power, if an electric substation is flooded it will affect not only the substation itself, but a number of businesses as well. Often, indirect effects can be much more widespread and damaging than direct ones.

Vulnerability Assessment: The extent of injury and damage that may result from a hazard event of a given intensity in a given area. The vulnerability assessment should address impacts of hazard events on the existing and future built environment.

Wildfire: An uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures.

Appendix VI

Annual Progress Reports

ANNUAL PROGRESS REPORT

PARTICIPATION:

1. Did the Steering Committee, localities, agencies and other partners participate as originally proposed?

2. Have responsibilities of the lead agencies/manager changed?

3. Were workloads realistically distributed?

4. Was there a successful coordination process during the HMP monitoring, implementation, evaluation, and update process between the Steering Committee?

5. Was the public involved in implementing and monitoring the HMP? If so, how?

6. Have new agencies, departments and staff been included in the plan implementation process? What affect did this have?

CAPABILITY ASSESSMENT:

1. Have the capabilities of participating jurisdictions changed?

2. Is there political support for the HMP?

3. Is there adequate human, technical, and financial resources to monitor, evaluate and review the HMP?

4. Were there adequate human, technical, and financial resources to implement the plan?

5. Were previously identified Mitigation Actions feasible or do they need revisions?

FUNDING:

1. Were sufficient funds available (local and federal) for plan implementation? Please specify.

2. Was there an effort to search for non-federal funding? Please elaborate.

TIMEFRAME/TIMELINE:

1. Were previously identified project implementation timeframes feasible or do they need revision?

2. Was the HMP revised more frequently or less frequently then planned? Due to what reason (new or revised state policy, a major disaster, availability of funding, etc.)?

HAZARD MITIGATION GOALS AND ACTIONS:

1. Were the goals achieved as planned? To what extent? Are they still current and relevant?

2. What percentage of the HMP's Mitigation Actions was implemented?

3. List all Mitigation Actions, its current status (finished, in-progress, will be completed within 2 years, will be completed within 5 years, removed from HMP), and its Lead Manager.

EVALUATION OF RESULTS:

1. Are the completed mitigation projects achieving the desired results?

   a. Were these mitigation actions cost-effective?

   b. Were losses avoided (i.e., is there a lessened vulnerability)? Please specify.

2. Was an effort made to implement high priority projects as identified in your formerly approved plan? How?

3. Was new information discovered about the risks or community that made implementation difficult or no longer sensible? Please specify.

4. What are the HMP Annually Report conclusions? What were the accomplishments?

LESSONS LEARNED:

1. What worked particularly well (i.e., new opportunities that arose that accelerated project implementation)?

2. What did not work as well and what would you do differently next time in terms of the following?

   - Monitoring:
   - Reporting/Tracking:
   - Evaluation:
   - Project Implementation:
   - Plan Update:

3. Identify successes and how the plan monitoring, evaluation, update and implementation process can be improved upon based on the following:

   - Project completion:
   - Meeting goals and objectives:
   - Availability of resources:
   - Substantial timeframes:
   - Availability of funds:
   - Lead/support agencies commitment:
   - Project feasibility:

Pulaski County's Annual Progress Report is adapted from information provided by the Virginia Department of Emergency Management.