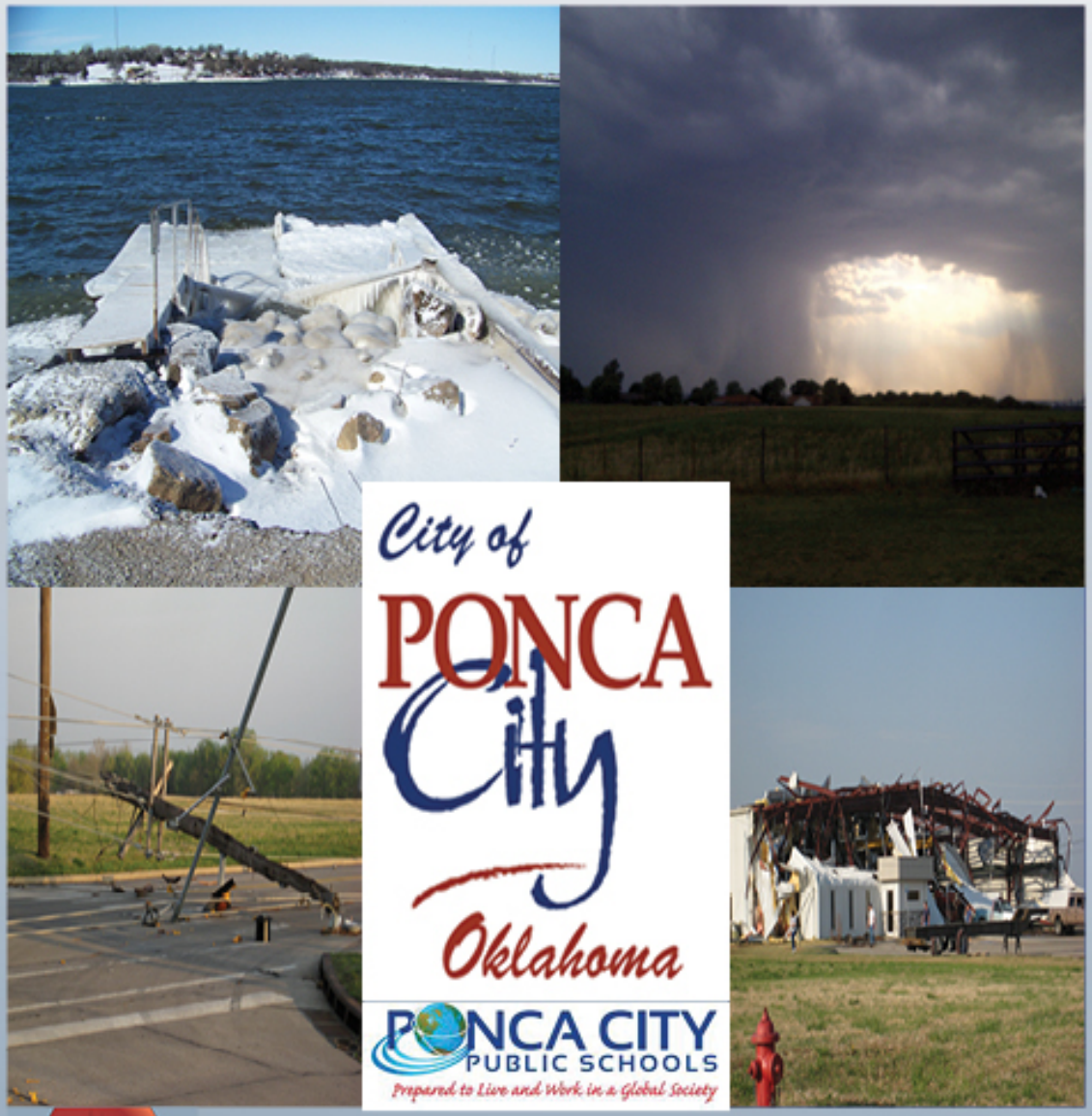
Ponca City Hazard Mitigation Plan

Including Public School District #71

June 2015



City of PONCA City Oklahoma

PONCA CITY PUBLIC SCHOOLS
Prepared to Live and Work in a Global Society

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CHAPTER 1

Update Revisions for Chapter Since Last FEMA Approval	
Section	Description
Chapter 1	• Changed dates and names to be relevant to the hazard mitigation plan

INTRODUCTION

Hazard mitigation is a sustained action taken to reduce or eliminate long-term risk to people and property from hazards. Mitigation distinguishes actions that have a long-term impact from those that are more closely associated with preparedness for, immediate response to, and short-term recovery from a specific event.

Indeed, one reality is clear: **Communities and Schools** that have not planned and prepared for such an eventuality will be less equipped to face the complexities of such an event than those which have planned. Moreover, once a planning process is undertaken, it will become clear that serious ethical decisions are vital to shaping any community or school district's disaster response. It is important to realize that once a disaster strikes, difficult choices will have to be made. The more fully the ethical issues are discussed prior to making choices relating to a disaster, the greater the potential for the choices to be ethically sound.

PURPOSE

The purpose of this **Hazard Mitigation Plan** is to provide valuable insights and information to community leaders and emergency management personnel at local, State and Federal levels to assist with their efforts to plan and mitigate for disasters. This plan aims to present the community leaders with approaches and strategies that would enable them to provide the most appropriate means to prevent or reduce the effects of hazards within the City of Ponca City. The Ponca City Plan is for the City of Ponca City and The Ponca City Public School District #71

AUTHORITY

Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. 5165, under Section 104 of the Disaster Mitigation Act (DMA) of 2000 (P.L. 106-390), provides alternative approaches to mitigation planning. Section 322, along with other sections of the Act, provides opportunities of reducing the Nation's disaster losses through mitigation planning. The act highlights the need for State, local and tribal entities to coordinate mitigation planning and implementation efforts.

This Act requires State, Local and Tribal Nations to develop hazard mitigation plans. The Act states that the plans must be approved by FEMA before November 1, 2004, in order for the jurisdictions to be eligible for mitigation funding. The local mitigation plans must be reviewed, updated, submitted to Oklahoma Department of Emergency Management, and re-approved by FEMA every five years to remain eligible for mitigation funding.

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This Mitigation Plan was developed and updated to meet the requirements of the Interim Final Rule for a local plan under the 44 CFR 201.6.

- Understand that DMA 2000 compliant pre-disaster mitigation planning typically is focused on: physical projects that reduce risks from natural hazards; changes in land development regulation; public education; and, addressing information and data deficiency needs to develop or upgrade a plan

- Develop a mitigation strategy that prioritizes hazards, identifies, evaluates, and prioritizes mitigation actions and activities, and includes an implementation strategy

- Implement the plan and monitor progress over time

- Organize the process for preparing a mitigation plan

FUNDING

The City of Ponca City received grant funding through the Oklahoma Department of Emergency Management (ODEM) to develop a Hazard Mitigation Plan for the city and the public school district within the city.

GRANT PROGRAMS

One of the benefits to a Hazard Mitigation Plan is to make the community and school district eligible for Federal and State grant funding. A populated city such as Ponca City and the school district within the city rely on Federal and State assistance whenever possible to accommodate the growing needs of the community. Listed below are some of the Federal grants in which Ponca City and the school district can utilize for hazard preparedness:

Hazard Mitigation Grant Program: 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.

Pre-Disaster Mitigation Program: The Pre-Disaster Mitigation (PDM) program provides funds to states, territories, Indian tribal governments, local governments, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are to be awarded on a competitive basis and without reference to state allocations, quotas or other formula-based allocation of funds.

Flood Mitigation Assistance Program: 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 insurable under the National Flood Insurance Program.

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Three types of FMA grants are available to States and communities:

- **Planning Grants** to prepare Flood Mitigation Plans. Only NFIP-participating communities with approved Flood Mitigation Plans can apply for FMA Project grants

- **Project Grants** to implement measures to reduce flood losses, such as elevation, acquisition, or relocation of NFIP-insured structures. States are encouraged to prioritize FMA funds for applications that include repetitive loss properties; these include structures with 2 or more losses each with a claim of at least $1,000 within any ten-year period since 1978.
- **Technical Assistance Grants** for the State to help administer the FMA program and activities. Up to ten percent (10%) of Project grants may be awarded to States for Technical Assistance Grants.

Repetitive Flood Claims Program: The Repetitive Flood Claims (RFC) grant program was authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 (P.L. 108–264), which amended the National Flood Insurance Act (NFIA) of 1968 (42 U.S.C. 4001, et al). Up to $10 million is available annually for FEMA to provide RFC funds to assist States and communities reduce flood damages to insured properties that have had one or more claims to the NFIP.

Eligible Mitigation Activities: Acquisition of properties, and either demolition or relocation of flood prone structures, where the property is deed restricted for open space uses in perpetuity.

Federal / Non-Federal Cost Share: FEMA may contribute up to 100 percent of the total amount approved under the RFC grant award to implement approved activities. This funding is only available, if the Applicant has demonstrated that the proposed activities cannot be funded under the FMA Program, due to lack of State or local capacity, which includes either inability to manage the sub-grant or lack of the 25% match.

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CHAPTER 2

Community Demographics

Update Revisions for Chapter Since Last FEMA Approval	
Section	Description
Chapter 2	• Added updated city & school information

Ponca City

Veteran's Day Parade down Grand Avenue in front of the Ponca City Civic Center and Town Hall

Location of Ponca City, Oklahoma

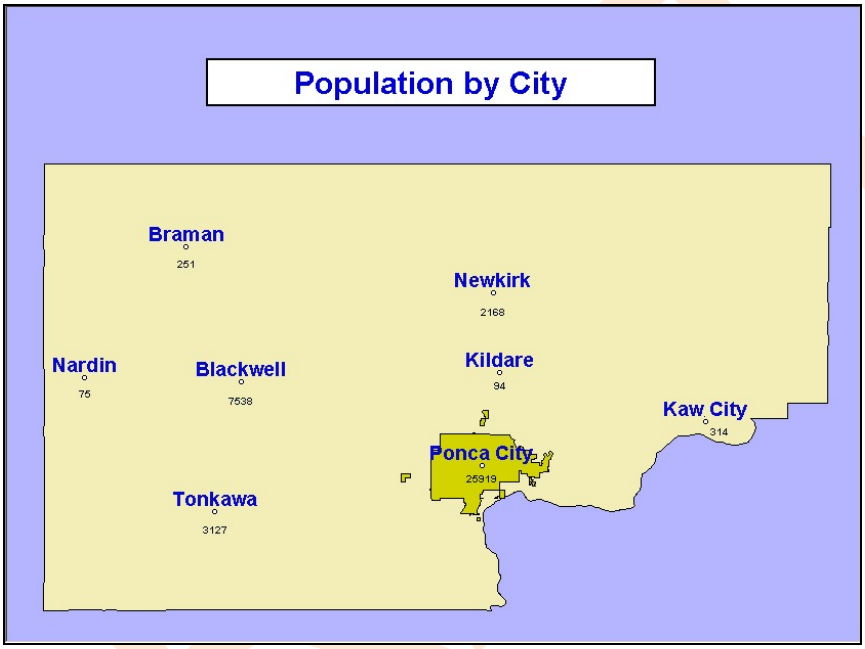
Coordinates: 36°42′45″N 97°4′21″ W36.7125°N 97.0725°W

State	Oklahoma
Counties	Kay, Osage
Founded	1893
Incorporated	1899
Area	
- Total	19.3 sq mi (50.0 km^2)
- Land	18.1 sq mi (46.9 km^2)
- Water	1.2 sq mi (3.1 km^2)
Elevation	1,010 ft (308 m)
Population (2010)	
- Total	25,387
- Density	1,382/sq mi (533.5/km^2)
Time zone	Central (CST) (UTC-6)
ZIP codes	74601-74604

Ponca City is a city in Kay and Osage counties in the State of Oklahoma named after the Ponca Tribe. It is called *Pánka Thánwangthan* pronounced [ˈpːãŋkːa ˌtʰãwãŋðã] in Ponca and *Pánka Chína* in Otoe, the languages of two nearby tribes. Located in north central Oklahoma, it lies 18 miles (29 km) south of the Oklahoma border and 15 miles (24 km) east of Interstate 35. The population was 25,389 at the 2010 census, making it the largest city in Kay County. The city is near the Salt Fork of the Arkansas River and Kaw Lake which provide recreational opportunities. Ponca City is served by Ponca City Regional Airport.

Geography

Ponca City is located at 36 42′45″N 97°4′21″W36.7125°N 97.0725°W (36.712422, -97.072431). According to the United States Census Bureau, the city has a total area of 19.3 square miles (50.0 km²), of which, 18.1 square miles (46.9 km²) of it is land and 1.2 square miles (3.1 km²) of it (6.26%) is water.



Demographics

As of the census of 2010, there were 25,387 people (532 less than in 2000), 10,440 households (196 less than in 2000) and 7,019 families residing in the city. The population density was 1,431.0/sq mi (552.5/km^2). There were 11,950 housing units at an average density of 655.4/sq mi (253.1/km^2). The racial makeup of the city was 84.18% White, 2.99% African American, 6.27% Native American, 0.70% Asian, 0.03% Pacific Islander, 2.08% from other races, and 3.75% from two or more races. Hispanic or Latino of any race were 4.43% of the population.

In 2000, there were 25,919 people, 10,636 households, and 7,019 families residing in the city. The population density was 1,431.0 people per square mile (552.6/km²). There were 11,871 housing units at an average density of 655.4/sq mi (253.1/km²). The racial makeup of the city was 84.18% White, 2.99% African American, 6.27% Native American, 0.70% Asian, 0.03% Pacific Islander, 2.08% from other races, and 3.75% from two or more races. Hispanic or Latino of any race were 4.43% of the population. According to the Center for Applied Economic Research at the Oklahoma State University, Ponca City's per-capital personal income for 2006 was $35,071, steadily climbing from the 2000 census numbers listed below. There were 10,636 households out of which 31.4% had children under the age of 18 living with them, 51.3% were married couples living together, 11.1% had a female householder with no husband present, and 34.0% were non-families. 30.0% of all households were made up of individuals and 13.7% had

someone living alone who was 65 years of age or older. The average household size was 2.38 and the average family size was 2.95. In the city the population was spread out with 26.2% under the age of 18, 8.5% from 18 to 24, 25.5% from 25 to 44, 22.1% from 45 to 64, and 17.7% who were 65 years of age or older. The median age was 38 years. For every 100 females there were 90.7 males. For every 100 females age 18 and over, there were 85.8 males. The median income for a household in the city in 2000 was $31,406, and the median income for a family was $39,846. Males had a median income of $32,283 versus $20,098 for females. The per capita income for the city was $17,732. About 12.7% of families and 16.0% of the population were below the poverty line, including 23.6% of those under age 18 and 9.3% of those age 65 or over.

Growth Area And Population Trends

Historic census and 30 year population projections for both Ponca City and Kay County are shown on the table that follows. The population projects were from the Oklahoma Department of Commerce and reflect a small average annual growth rate of only 0.3%. Those population projections must be used for obtaining federally funded improvements. They are probably adequate for the first 400 new jobs added to the Ponca City economy. After the addition of 400 more jobs the population projections will need to be recalculated and significantly raised.

HISTORIC CENSUS AND PROJECTED POPULATION FOR PONCA CITY

Year	Population
1900	2,528
1910	2,521
1920	7,051
1930	16,136
1940	18,794
1950	20,180
1960	24,411
1970	25,940
1980	26,238
1990	26,359
2000	25,919
2005	26,150
2010	26,470
2015	26,950
2020	27,390
2025	27,760
2030	28,090

The preceding population projections for the City of Ponca City are for the entire City and appropriate for use for the Ponca City Wastewater Treatment Plant. Of course, those projections do not indicate in which subbasin growth will occur. A detailed growth potential was performed for each individual sanitary sewage subbasin based upon the following factors.

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Early History

Ponca City was founded after the Cherokee Outlet was opened for settlement in the Cherokee Strip land run, the largest land run in United States history. Ponca City was founded in 1893 as New Ponca after the Cherokee Outlet was opened for settlement in the Cherokee Strip land run, the largest land run in United States history. The site for Ponca City was selected because of its proximity to the Arkansas River and a fresh water spring near the river. The city was founded by Burton Barnes who drew up the first survey of the city and sold lottery tickets for the lots he had surveyed. After the drawing for lots in the city was completed, Barnes was elected the city's first mayor. Another city, Cross, vied with Ponca City to become the leading city in the area. The Atchison, Topeka and Santa Fe Railway had originally opened a station in Cross and refused to open one in Ponca City saying the two cities were too close to warrant another station. Citizens of Ponca City jacked up the train depot in Cross and moved it to Ponca City in the dead of night making Ponca City the railroad connection. Cross was later incorporated into Ponca City.

Influence of the Petroleum Industry

The statue of oilman E. W. Marland, founder of Marland Oil (later Conoco) who later became Oklahoma Governor and U.S. Congressman. Ponca City's history has been shaped for the most part by the ebb and flow of the petroleum industry. The Marland Oil Company, which once controlled approximately 10 percent of the world's oil reserves, was founded by eventual

Oklahoma governor and U.S. congressman E. W. Marland, who founded the 101 Ranch Oil Company located on the Miller Brothers 101 Ranch and drilled his first successful oil well on land he leased from the Ponca Tribe of American Indians in 1911. Marland's luck and tenacity would fuel growth and wealth that were previously unimaginable on the Oklahoma prairie, and his company virtually built the city from the ground up. Decadent 1920s mansions -- including the famed Marland Mansion and Grand Home -- were built by Marland and his associates. Because of this period of wealth and affluence, Ponca City has an unusually high concentration of buildings that exemplify the popular Spanish revival architecture of the period, as well as art deco-influenced buildings and homes. The so-called "Roaring 20s" would come to an end for Ponca City shortly before the Great Depression. After a takeover bid by J.P. Morgan Jr., son of famed financier J.P. Morgan, Marland Oil Co. eventually merged with Continental Oil Co. (Conoco) in the late 1920s and would be known as Conoco for more than 70 years. The company maintained its headquarters in Ponca City during this time and continued to grow into a global corporation. During the oil boom years of the 1980s, Conoco was owned by the DuPont Corp., which took control of the company in 1981. After nearly two decades of ownership and an oil bust that crippled Oklahoma's economy in the late 1980s, DuPont eventually sold off its Conoco assets in 1998. By 2002, Conoco had merged with Phillips Petroleum (interestingly, another major petroleum player with roots in northern Oklahoma) to become ConocoPhillips. ConocoPhillips is now one of the five largest oil companies in the world and maintains a significant presence in its historic home state. Based in Houston, Texas, ConocoPhillips continues to operate one of the United States' largest refineries in Ponca City, as well as offices at the former Phillips Petroleum corporate headquarters in Bartlesville, Oklahoma. The company's presence is much smaller than it once was, and Ponca City's population has declined steadily since the early 1990s as a result. In February 2009, ConocoPhillips announced that all of its remaining non-refinery operations in Ponca City (representing 750 jobs) would be moved out of the city. However, recent efforts to grow the city's economy beyond the petroleum industry have landed a number of technology, manufacturing and service jobs. In 2005, ConocoPhillips announced plans to build a $5 million dollar museum across from its Ponca City refinery. Opened to the public in May, 2007, the Conoco Museum features artifacts, photographs and other historical items related to the petroleum industry and its culture in northern Oklahoma. A sister museum -- Phillips Petroleum Company Museum -- will also be opened in Bartlesville, Oklahoma. The Conoco Museum is funded by a private foundation, and ConocoPhillips allows free admission.

Native American History

The Statue of Standing Bear honors the Ponca Native American chief who successfully argued in U.S. District Court in a landmark civil rights case in 1879 that Native Americans are "persons within the meaning of the law" and have the rights of citizenship.

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Native American young people hold flags of their tribes at the dedication of the Standing Bear Museum. Historical accounts of white settlers and the oil industry in Ponca City have often overshadowed the area's Native American population and its influences on the culture and history of the city and its environs. Ponca City is named after the Ponca Tribe, part of which relocated from Nebraska to northern Oklahoma from 1877 to 1880. Like all of the forced American Indian removals of the 19th century, the Poncas' trek was arduous. A number of Poncas who made the initial journey died from illness and exposure to the elements while following a group of leaders to northern Indian Territory (now northern Oklahoma). Part of the tribe was displeased with the living conditions on the land where they initially settled, and they were led on a journey toward their traditional home by the legendary civil rights leader Standing Bear in 1879. However, Standing Bear was arrested, and most of the tribal members who left eventually returned to the reservation in Oklahoma. The story of Standing Bear is perhaps best told by the memorial in his name, which stands at the intersection of Highway 60 and South Fourth Street in Ponca City. The Ponca Nation, which has kept its headquarters south of Ponca City since 1879, played a major part in developing the Marland Oil Co. and the city proper when Chief White Eagle signed away valuable portions of the tribe's allotted land. In fact, the respected Ponca leader signed over the lease to the land on which E.W. Marland made his fortune in 1910. In recent years, the Ponca Tribe has made a number of moves to build its infrastructure and improve services for its people. In February 2006, the tribe received a grant of more than $800,000 from the Shakopee Mdewakanton Sioux Community of Minnesota for debt retirement and economic development. Ponca City is bordered by, or in close proximity to, other Native American tribes, including the Kaw, Osage, Otoe-Missouria, Pawnee, and Tonkawa. The Ponca Tribe of Indians of Oklahoma conducts business from here.

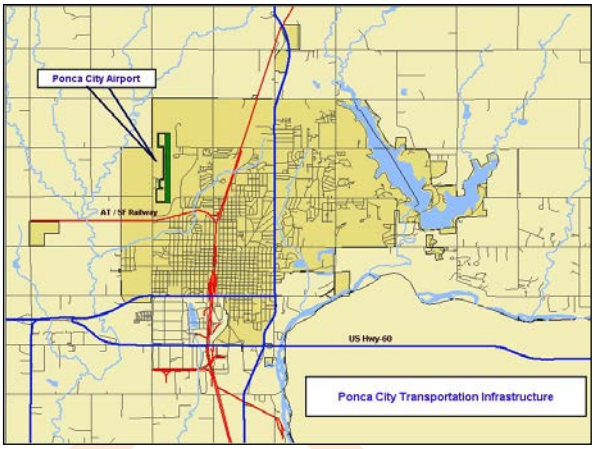
Pioneer Woman Statue & Museum

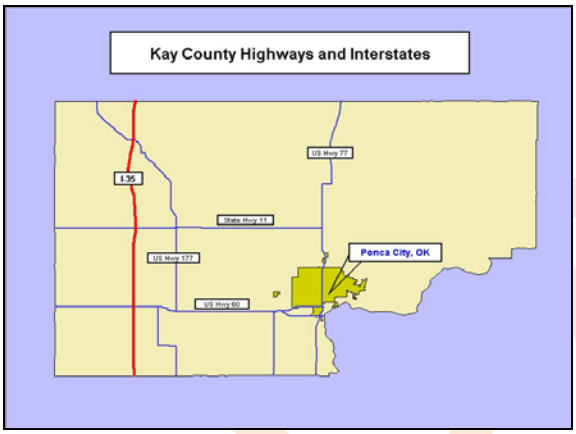
The Pioneer Woman statue was constructed by sculptor Bryant Baker and was unveiled in a public ceremony on April 22, 1930 when forty thousand guests came to hear Will Rogers pay tribute to Oklahoma's pioneers. The statue is 27 feet (8.2 m) high and weighs 12,000 pounds. Ponca City has the Pioneer Woman Museum and the Pioneer Woman Statue. The statue was erected to commemorate women pioneers. In 1928, twelve miniature 3-foot (0.91 m) sculptures were submitted by U.S. and international sculptors and traveled to twelve cities where they were viewed by 750,000 people who cast votes for their favorite. The twelve original submissions have been on display at the museum at Woolaroc near Bartlesville, Oklahoma since the 1930s when E. W. Marland sold them to Frank Phillips after Marland lost control of the Marland Oil Company. The winning statue was produced by British-born American sculptor Bryant Baker and was unveiled in a public ceremony on April 22, 1930 when forty thousand guests came to hear Will Rogers pay tribute to Oklahoma's pioneers. The statue is 27 feet (8.2 m) high and weighs 12,000 pounds. A museum was added in 1958 on the 65th anniversary of the Cherokee Strip land run. The museum contains exhibits commemorating Oklahoma women. Native American as well as

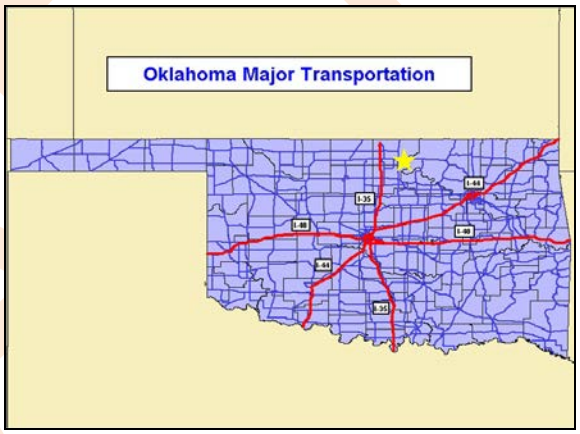
European women are acknowledged for their leadership and stamina creating homes, raising children, and taking care of the daily business of sustaining life.

Airport (KPNC)

Ponca City Regional Airport (1007 feet above Mean Sea Level) is located at the northwest corner of the city at 36 degrees 43.84 north latitude and 97 degrees 05.99 west longitude. The facility has a 7,201 foot 17-35 runway which is 150 feet wide and the untowered facility has a full-length taxiway. The local airport booster club hosts a fly-in breakfast every first Saturday of the month, year around, "rain or shine."







Green Energy

The Ponca City region receives hydro-electrically generated service from the Kaw Reservoir, a United States Army Corps of Engineers project. The facility, located seven miles east of Ponca City, dams the Oklahoma River. The electric utility is managed by the Oklahoma Municipal Power Authority of Edmond, Oklahoma.

Education

- Pioneer Technology Center is located in Ponca City.
- Ponca City Public Schools serves the general population's education requirements.
- First Lutheran School (private) educates local students through the 8th grade.
- St. Mary's Catholic School educates local Catholic students through the 8th grade.

Points of Interest

The Marland Mansion

The Poncan Theatre was built in 1927 in Art Deco Style.

Ponca City Senior High School

- 101 Ranch Memorial
- Camp McFadden
- Cann Memorial Botanical Gardens
- City Hall
- Conoco Museum
- Conoco Phillips Refinery
- Festival of Angels
- Historic downtown
- Hutchins Memorial
- Kaw Lake
- Lake Ponca
- Lew Wentz Public Pool and Golf Course
- Louise Fluke Flag Plaza
- Marland Grand Home
- Marland Mansion
- Pioneer Woman Statue
- Pioneer Woman Museum

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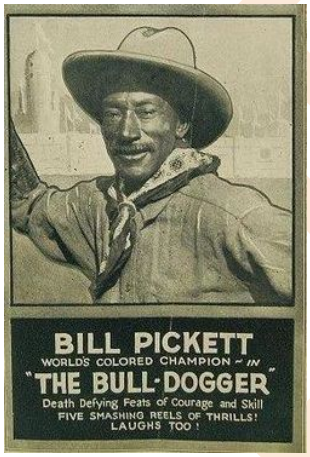
- Ponca City High School
- Ponca City Library
- Ponca Tribe Headquarters
- Poncan Theatre
- Standing Bear Memorial
- University Multispectral Lab (UML)

Notable Natives and Residents

- Burton S. Barnes (1844 - 1906), Founder and first Mayor of Ponca City
- Douglas Blubaugh (1934 -), 1960 Olympic Gold Medalist in wrestling, named head wrestling coach at Indiana University in 1972
- Mike Boettcher (1947? -) news correspondent, CNN, NBC
- Stanley Ann Dunham (1942 – 1995), Mother of U.S. President Barack Obama
- Louise Fluke (1900 - 1986), Creator of the Oklahoma State Flag
- Jon Kolb (1947 -) former offensive lineman with the Pittsburgh Steelers, where he played for 13 seasons.
- Candy Loving (1956 -), Playboy Playmate - January, 1979
- E. W. Marland (1874 - 1941), Founder of Marland Oil Company and 101 Ranch Oil Company, Governor of Oklahoma, United States Congressman, philanthropist
- Lydie Marland (1900 - 1987), First Lady of Oklahoma
- W. H. McFadden (1869 - 1956), Oilman and philanthropist
- J. J. McGraw (died 1928), banker and oilman
- Don Nickles (1948 -), former United States Senator
- Bill Pickett (1870 - 1932), cowboy, invented Bulldogging
- Don Puddy (1937 - 2004), NASA Flight Director, Johnson Space Center
- Kareem Salama (1977 -), Country and Western Singer
- Standing Bear (1834 - 1908), Poncan Native American Leader
- Joyce Carol Thomas (1938 -), African American author of over 50 children's books
- Lew Wentz (1877 - 1949), Oilman and philanthropist
- Shelby Wilson - 1960 Olympic Gold Medalist, wrestling



Bill Pickett's image on a handbill advertising the movie "The Bull-Dogger," released in 1921 by The Norman Film Manufacturing Company. Pickett was billed as "the world's colored champion" in "death-defying feats of courage and skill."

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Ponca City Public School District

The Administration Center, located at 111 West Grand, serves as the main office for the district's activities. The Ponca City Public School District is located in the north central part of the state and is comprised of seven elementary schools (pre-kindergarten through 5th), one middle school (7th graders & 6th graders), one middle school (8th graders), one Senior High School (9-12), and an Alternative School (7-12). Serving a population of over 5000 students, Ponca City Schools has an operating budget of $30 million dollars. Ponca City Schools is whole heartedly supported by the community it serves by forming business partnerships and participating in our many volunteer and/or mentoring programs.

BASIC FACTS

Enrollment: 5247
Budget: $34,200,000.00
Accreditation: All schools are accredited through the Oklahoma State Department of Education, and the high school is accredited through the North Central Association.
Student/Teacher Ratio: 15.67/1
Schools: 1 high school, 1 West Middle School (6th and 7th), 1 East Middle (8th), 7 elementary schools, 1 alternative school, and 1 teen pep center
District Area: 1,153,736 square feet
Employees: 789
Free/Reduced: 67%
Graduation Rate: 98.3

Climate

The climate of the Ponca City, Oklahoma is continental, as is all of the Great Plains. Summers are long and usually quite hot. Winters are shorter and less rigorous than those of the more northern Plains States. Periods of extreme cold are infrequent, and those lasting more than a few days are rare. Annual average relative humidity ranges from about 60 percent to just over 70 percent in the east and southeast. Average annual lake evaporation varies from 48 inches in the extreme east to 65 inches in the southwest, numbers that far exceed the average yearly rainfall in those areas. Evaporation and percolation preclude use of about 80 percent of Oklahoma's precipitation. Prevailing winds are southerly to southeasterly throughout most of the State during the spring through autumn months. These prevailing winds veer from south-to-southwest in far western Oklahoma. March and April are the windiest months, while July, August and September are the calmest.

Based on data reported by over 4,000 weather stations

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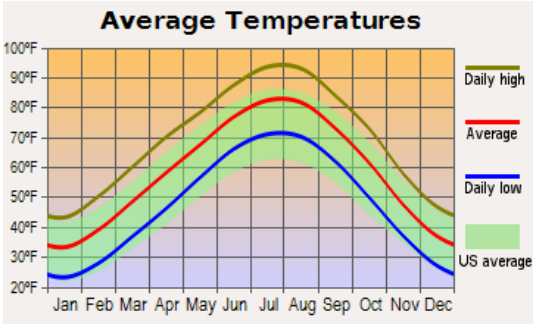

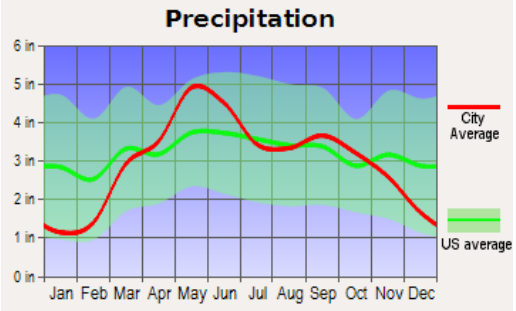

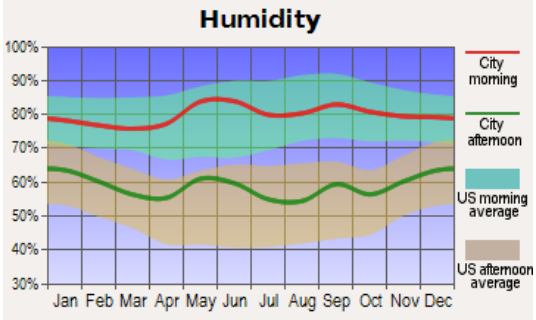

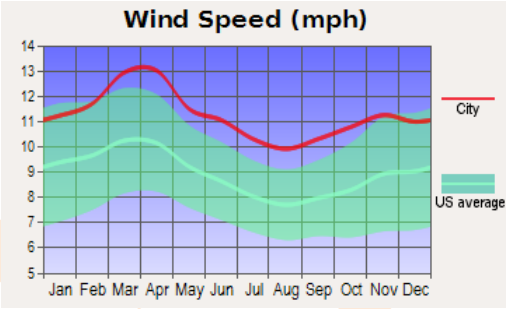

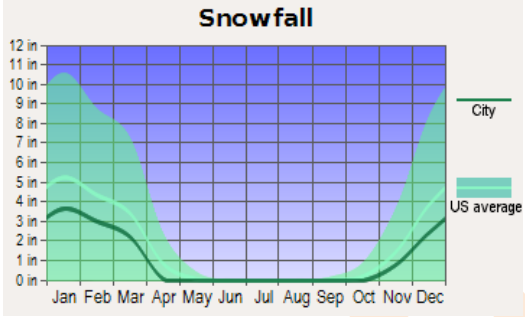

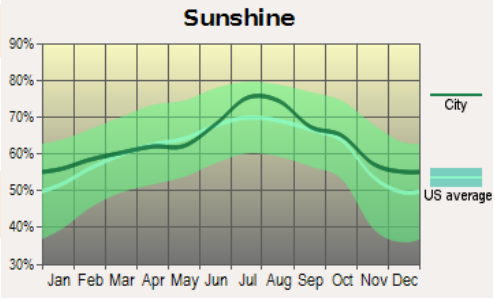

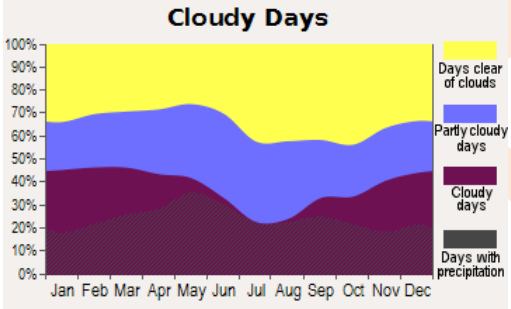

Transportation

The Ponca City has Interstate 77 that runs north and south through the city and interstate 60 that run east and west through the city. The BNSF Railway is another source of transportation that passes through the community.

CHAPTER 3
PLANNING PROCESS

Update Revisions for Chapter Since Last FEMA Approval	
Section	Description
Chapter 3	• Updated the committee members & 10 step process

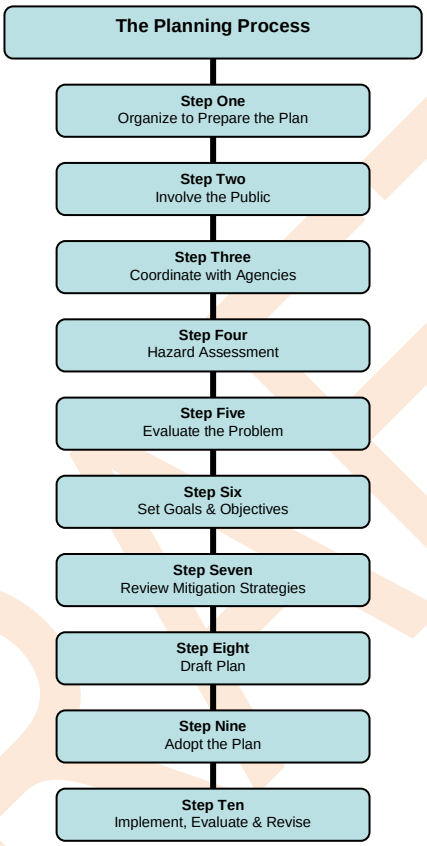

Figure 1: Planning Process (Chart)

Description

The planning process is a step-by-step approach to develop the Hazard Mitigation Plan for the City of Ponca City and participating entities. The city and school district participated by providing necessary documents, resource materials, essential information and personnel throughout the planning process. Each committee member contributed time, research and valuable details regarding their field of expertise (See Explanation of Meetings **Error! Bookmark not defined.**). The Ponca City Emergency Manager is active in the regional emergency management meetings and is in touch with the surrounding county and community emergency managers. Mitigation is one of the topics during these meetings and invitations were extended to surrounding county and local emergency managers to be participants in the Ponca City Hazard Mitigation Planning Committee. See Appendix B "Explanation of Meetings". The Committee reviewed each section of the plan and the revisions are noted in a table at the beginning of every chapter.

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Planning Committee

The Ponca City Hazard Mitigation Planning Committee was formed at the beginning of the planning process with community leaders, community officials, county officials, and participating entities.

The committee members listed below provided vital information (Contribution) and continued research during the planning process.

Update Planning Committee

PONCA CITY HAZARD MITIGATION PLANNING COMMITTEE		
NAME	**TITLE**	**CONTRIBUTION**
Paula Cain(Chairperson)	Ponca City Emergency Manager,	Provided information on the city's critical facilities, comprehensive plans, past hazard history for the city, and organized the planning committee
Kevin O'Meilia	OMPA, Kaw Operations Supervisor	Provided pertinent information in regards to Kaw Lake Dam
Arlyn Hendricks	Corps of Engineers	Provided information on Structures, and Dams to help in the develop the Hazard Mitigation Plan
Joe Randall	Hospital	Provided information on the Ponca City Hospital and its critical facilities to help in the development of the hazard mitigation plan
Bret Smith	Ponca City Schools Director of Maintenance and Risk Management	Provided information on the School's critical facilities and past hazard history.
Johnny Bar	Assistant City Engineer	Provided pertinent information regarding all hazards, structures, dams, city projects, and flood insurance history to help in the development of the hazard mitigation plan. Good looks
Rob Dick	Assistant Director of Public Works	Provided information regarding water district policy, procedure and past incidents
Kevin Roe	Fire Training Officer	Provided information on wildfire history, disaster history, and emergency response
John Rhyne	Fire Training Officer	Provided information on wildfire history, disaster history, and emergency response
Darwin Haney	Water Distribution	Provided information on the Ponca city water district
David VanBuskirk	Fire Marshall	Provided information on wildfire history, disaster history, and emergency response
David Horinek	Solid Waste	Provided information on the solid waste management facilities and past hazard history
Terry Stags	GIS Specialist	Computed GIS and Mapping information
Alan Loch	Kay County Health Dept.	Provided information on Kay County Health services and past disaster history
Annette O'Conner	Kay County Health Dept.	Provided information on Kay County Health services and past disaster history
Erika Macy	Kay County Health Dept.	Provided information on Kay County Health services and past disaster history
Rick Sanders	ConocoPhillips	Provided past hazard history for the ConocoPhillips facilities
Clayton Johnson	Police Chief	Provided past disaster history and emergency response
Chris Henderson	Community Development	Pertinent information in regards to community development
Todd Smith	Water Treatment-Waste Water	Provided information regarding water district policy, procedure and past incidents
Richard Stone	Public/Planning Commission	History of hazards in Ponca city and provided planning insight
Robert Erner	Public/Planning Commission	History of hazards in Ponca city and provided planning insight
David Baur	Public/Planning Commission	History of hazards in Ponca city and provided planning insight
Burl Herring	Fire Chief	Provided information on wildfire history, disaster history, and emergency response
Jim Sindelar	Park Department	Provided information on parks and past disaster history
Sherry Bowers	911	Provided past disaster history and emergency response
Margie Tebow	911	Provided past disaster history and emergency response
Ben Brake	Consultant Brake & Associates	Provided information on hazard mitigation and developed the hazard mitigation plan

Figure 2: Hazard Mitigation Planning Committee (Table)

10 Step Process

Step 1 – Organize to Prepare the Plan
Organization was the initial step of the planning process. The governing body selected a chairperson to form the Ponca City Hazard Mitigation Planning Committee. The individual they chose is a strong leader that can bring the best possible people in the community together to form a hazard mitigation planning committee to develop a plan for mitigation strategies that could possibly save the lives of their families, friends, neighbors, and their community as a whole. They wanted citizens with innovative ideas and the initiative to complete a plan that would be a resource for implementing disaster planning and mitigation. They evaluated the available resources and identified interested community leaders, government staff, local community members, and school staff that could be the best possible participants for the planning committee. Once established, the committee reviewed available planning documents, existing plans and departmental data at the city and school. The committee developed a strategic plan with obtainable results and completion dates to provide public officials an estimated timeline and to assist the committee on a projected path to meet the goals set by public officials. The FEMA How-To-Guide *Getting Started* (FEMA 386-1) provided ample guidance on this process for the planning committee.
Steps to Organize
1. The Ponca City and participating entities made a commitment to have a functional and active hazard mitigation plan and select a chairperson to lead the committee. 2. The chairperson contacted community stakeholders, local community officials, business leaders, non-profit organizations, and other organizations that may have an interest in the importance of a hazard mitigation plan. 3. The chairperson identified resources that were available and necessary to complete the effort. The interested parties were invited to participate in the planning process and provide planning materials that were helpful in the efforts of the planning process. Additional resources included the FEMA How-To-Guides, Emergency Operations Plans, Capital Improvement Plans, building codes, flood ordinances, Ponca City Public School Districts Emergency Preparedness Plans. 4. Forming a Planning Committee began with selecting members that had resources and a working knowledge of disaster preparedness and response. These members included, city officials, school district administration, police and fire chiefs, emergency managers, etc…
Step 2 – Involve the Public
The Ponca City Hazard Mitigation Planning Committee took efforts to involve the public, solicit feedback and provided public information on the planning process. The public was invited and informed via public postings at city halls and the school buildings; there were no members who participated from the public during the life of the planning process. The public will continue to be informed by public notices throughout the life of the plan.
Steps to Involve the Public
1. The meeting itineraries were delivered via phone calls and emails. 2. Flyers announcing meetings were posted at the city hall and school buildings one week prior to the meeting date. 3. No citizens attended the meetings, they were invited to participate and present ideas. 4. The citizens had the opportunity to participate and comment during the planning process and the draft plan was available for review 30 days prior to submitting to Oklahoma Division of Emergency Management and FEMA. A copy was made available at the Ponca City Emergency Management Office.

Step 3 - Coordinate with Agencies and Organizations
Public agencies, private organizations and businesses were contacted during the planning process. Committee members contacted them to collect data on hazards and vulnerabilities to determine how their entity or programs can best support the community's multi-hazard mitigation planning process. Information was obtained from Federal, State and local agencies, and private non-profit groups. Steps 1 and 3 of the planning process work concurrently with one another. When these agencies, departments and leaders were contacted, they were invited to participate in the planning process as team members and for technical information.

Federal
Federal Emergency Management Agency (FEMA)
US Army Corps of Engineers
National Weather Service (NWS)
Natural Resource Conservation Service (NRCS)
US Fish and Wildlife Service
US Geological Survey
National Non-Profit
American Red Cross
State
State Department of Emergency Management
State Water Resources Board
State National Flood Insurance Program (NFIP) Coordinator
State Dam Safety Coordinator
State Conservation Commission
State Department of Wildlife Conservation
State Department of Labor
State Geological Survey
State Department of Environmental Quality
Regional
Council of Governments
City
City Departmental Managers
City Health Department
City Emergency Management Agency
Neighboring Communities
Kay county
Osage County
City of Blackwell
Local Communities
Office of the City Managers
Department of Community Developments
Department of Public Works

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Police Departments
Fire Departments

Steps to Coordinate with Other Agencies

1. The committee invited agencies to be part of the planning process, or submit available pertinent data. The committee also researched websites for significant data.
2. Obtained a point of contact for the different agencies and contact information
3. Maintained contact with the agencies throughout the process; obtained new data or requested specific data that was discovered during the planning process
4. Gave agencies the opportunity to review draft plans and completed plans to verify information and data utilized in the plan for accuracy.

Step 4 – Hazard Identification and Risk Assessment

The hazard identification and risk assessment identified hazards that present potential risk to the community and the assets that are vulnerable to those hazards. The community assessed the risks and their vulnerability to the citizens, commercial and residential properties, critical facilities, and government owned structures, infrastructures and areas that would reduce the normal flow of business if struck by a disaster.

The Ponca City Hazard Mitigation Planning Committee looked into the possibilities of secondary hazards, as well as primary hazards. The secondary hazards can be just as devastating as the actual disaster - especially if the community is not prepared.

The FEMA How-To-Guide *Identifying Your Risks* (FEMA 386-2) provided useful guidance on this process for the planning committee.

Steps Taken to Identify Hazards and Assess the Risks

1. The committee identified hazards that could affect the community, prioritized them and determined those that are not a threat or are a minimal threat to the community.
2. The committee profiled the hazards identified. Profiling the hazards consisted of descriptions of the hazard, location of the hazard, extent, magnitude, impact, and vulnerability.
3. The committee inventoried the assets that the city and the schools own and operate.
4. The committee estimated losses for each hazard from the risk assessment.

Step 5 – Evaluate the Problem

Evaluating the problem worked in conjunction with the “Risk Assessment” in Step 4 of the planning process. The committee analyzed hazard data for how it may affect public safety, health, buildings, transportation, infrastructure, critical facilities, and the economy. The committee examined information from the risk assessment, Emergency Operations Plans, past history data and available resources to evaluate threats from the past and determine risks for the future.

The inventory of assets was a best estimate at the time of submission of the plan to show all property assets and contents that the city, and the schools own. This information proved to be invaluable during the planning process and allowed the committee to see what the vulnerabilities are in relation to the hazards with a cost estimate attached.

Steps Taken to Evaluate the Problem

1. The committee addressed the problems in accordance to the hazard threat to the community from the prioritization during the risk assessment.
2. The committee addressed the issue of unique and varied risk for each hazard; (i.e. does the hazard only affect a certain area of the community or does it affect the community as a whole).
3. The committee determined the vulnerabilities of the community that would be in the path of the hazards.

Step 6 – Set Goals and Objectives
The planning committee obtained information from the "Hazard Identification and Risk Assessment" and "Evaluate the Problem" to determine what the goals and objectives should be for the community. The goals are broad general statements of what the community wishes to achieve. The Objectives are statements of how to achieve the goals.
Steps Taken to Set Goals and Objectives
1. The committee reviewed the findings in the Risk Assessment and Assessing the Problems of the planning process. 2. The committee looked at the findings to determine what they want this plan to do for the community and set the goals. 3. The committee narrowed their focus to determine the objectives for the plan.

Step 7 - Mitigation Strategies
Mitigation strategies are also referred to as "Action Items". These are the items the city, and school district would like to implement to make their facilities, structures, families, friends, neighbors, students, and loved ones safe from the elements that can harm them. These are the specific action items that will reduce or eliminate the hazards from the community.
Steps Taken for Mitigation Strategies
1. The committee reviewed the goals and objectives of the plan. 2. The committee discussed what strategies would work to meet the goals and objectives. 3. The committee prioritized the strategies and explained the methodology used. (i.e. STAPLEE)

Step 8 – Draft Plan
The development of the draft plan was the collection of all the information from the first seven steps of the planning process. This information was then compiled into a plan format. Once all the information was gathered and the plan developed, the committee completed a review of the crosswalk with the plan. The Crosswalk is what the State and FEMA utilizes to review the plan to ensure that the plan meets all the DMA 2000 requirements. The crosswalk is a pass / fail examination tool of the plan and is not graded on a percentage.
Steps Taken for a Draft Plan
1. The committee gathered information from the planning process. 2. The committee formatted the data according to the crosswalk guide. 3. The committee completed a crosswalk review of the draft plan. 4. The committee submitted the draft plan to the community and school district leaders for their review and approval. 5. The committee then submitted the plan to the State and FEMA for approval.

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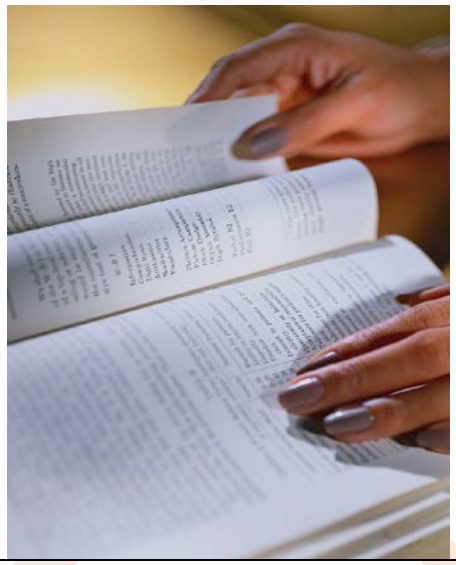
Step 9 – Adopt the Plan
Adoption of the plan will take place once all required revisions from State and FEMA are completed. When FEMA notifies the State that the plan will pass review, the State will notify the city that the plan is ready for adoption by the entities in the plan. After all entities adopt the plan, the resolutions are then sent to the State and FEMA with a final CD of the plan. The State and FEMA will issue approval letters and the city, and school district will then be eligible for mitigation grant funding as available. 
Steps to be Taken for Adopting the Plan
1. FEMA will notify the State when the plan is ready for adoption. 2. Ponca City and participating entities will adopt the plan according to their rules and regulations. 3. Resolutions and final CD's will be sent to the State and FEMA.

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Step 10– Implement, Evaluate & Revise
Upon FEMA approval and the adoption of the plan by the community, the Hazard Mitigation Plan becomes a “living document”. The hazard mitigation plan will need to be implemented, evaluated and revised on a continual basis to retain an existing document status for the community. Implementation consists of the adoption, resolution and setting the document into action for the city, and school district. By adopting the plan both entities state that the plan will be in place to make the efforts needed to reduce or prevent the effects of future disasters to the community. Evaluation of the plan will need to be initiated in a manner set forth by the planning committee. It is crucial for the evaluation to determine that the plan is being utilized in accordance to the procedures developed in the plan, or if revisions are necessary for the plan. Revisions of the plan may be necessary after the committee has made its evaluation and determined whether the goals were set too high or too low, and if the goals will need to be adjusted to accomplish the priorities of the community or the political agendas. It will also be important to evaluate the plan and make necessary revisions shortly following a disaster to see what can and will be done to mitigate those areas affected by the disaster or if other solutions have been determined from lessons learned.
Steps for Implementation, Evaluation and Revisions
1. The implementation was accomplished by the adoption of the plan after FEMA Approval. 2. Evaluation will need to take place on a scheduled basis that is determined by the Ponca City Hazard Mitigation Planning Committee. 3. Evaluation will also need to take place after a disaster occurs in the community. 4. Revisions will be determined by the outcome of the evaluations. 5. If revisions are needed, the committee will need to make the appropriate revisions and send the plan to the political leaders for re-adoption.

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Resources

Description	Website
NIMS Manual	http://www.fema.gov/nims
National Response Plan	http://www.fema.gov/nims
National Weather Service, SR	http://www.srh.weather.gov
Geological	http://www.usgs.gov/
Weather Channel	http://www.weather.com/
National Climatological Data Center	http://www.ncdc.noaa.gov
Wikipedia	http://en.wikipedia.org
Pandemic	http://www.pandemicflu.gov
Office of Hazardous Materials	http://hazmat.dot.gov/
World Commissions on Dams	http://www.dams.org/
Lightning Protection Inst.	http://www.lightning.org
Centers for Disease Control	http://www.bt.cdc.gov
US Geological Survey	http://earthquake.usgs.gov/
Weather.Org	http://weather.org/
Wildfire	http://www.smokeybear.com/
ODEQ	http://www.deq.state.ok.us
Project Wildfire	http://www.projectwildfire.org/
US Forestry Service	http://www.fs.fed.us/
NOAA	http://www.noaa.gov
FEMA EMI	http://www.training.fema.gov/emiweb/
Disaster Center	http://www.disastercenter.com
Dept of Transportation	http://www.dot.gov
National Communication System	http://www.ncs.gov
US Army Corp of Engineers	www.usace.army.mil
FEMA	http://www.fema.gov/
US Dept of Agriculture	http://www.usda.gov
American Red Cross	http://www.redcross.org
Dept of Health & Human Services	http://www.okdhs.org
Environmental Protection Agency	http://www.epa.gov
Dept of Energy	http://www.energy.gov
US Northern Command	http://www.northcom.mil/
US Senate	http://www.senate.gov/
US House of Representatives	http://www.house.gov/house/MemberWWW_by_State.shtml#nh
Information about Counties/cities	http://www.naco.org
Population estimates	http://quickfacts.census.gov/qfd/index.html

Review of Existing Plans

The Ponca City Hazard Mitigation Planning Committee reviewed the county and city's capital improvement plans, Emergency Operations Plans, National Flood Insurance Programs, local building codes, Ponca City Public School Districts Capital Improvement Plans, and Emergency Preparedness Plans to assist the committee in the planning process. Goals, objectives, and mitigation items have been incorporated from the review of the community comprehensive plans. Below is a list of comprehensive plans located in the city and participating entities.

Documents reviewed but not produced by the city or school district:

Chapters 2 & 19, *Climate Change Impacts in the United States: The Third National Climate Assessment*, 2014

Contemporary Changes of the Hydrological Cycle over the Contiguous United States: Trends Derived from In Situ Observations, *Journal of Hydrometeorology*, Volume 5, 2004

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Community Plans	Ponca City	Public school District # 71
Biological Hazard Plan		
Risk Assessment Studies	♦	
Flood Insurance Studies	♦	
General Plans	♦	
Sustainability Plans		
Local Comprehensive Plans	♦	
Land Development Plans	♦	
Capital Improvement Plans	♦	
Redevelopment Plans		
Post -disaster Plans		
Regional development Plans		
Watershed Plans	♦	
Open Space Area Plans	♦	
Flood Mitigation Plans	♦	
Fire Mitigation Plans		
Zoning Ordinances	♦	
Building Codes	♦	
Soil Erosion Ordinance		
Landscape Codes	♦	
Tree Protection Ordinance		
Subdivision Regulations	♦	
Property Deed Restrictions		
Historical Preservation Program	♦	
Airport development Program	♦	
Construction/Retrofit Programs		
Land Buyout Program		
Transportation Plans	♦	
School Plans		
Mutual Aid Agreement	♦	
Evacuation Plans		
Debris Management Plans		
School Incident Mgt Plans		♦
Fire rescue Plans		
Temp Animal Relocation Plan	♦	
Local Storm Water Program	♦	
Emergency Operations Plan	♦	
School Preparedness Plan		♦

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Public Involvement

The Hazard Mitigation Planning Committee posted notices of the planning meeting with the local news paper and at the City Hall buildings (Ponca City Courthouse, and School District #71). Notices were placed on public notice boards one week prior to each of the hazard mitigation planning meeting; however, there were no public responses other than the LEPC members and members of the Ponca City Planning Commission. Citizens had the opportunity to participate and comment during the planning process and the draft plan was available for review 30 days prior to submitting to Oklahoma Division of Emergency Management and FEMA. A copy was made available at the Ponca City Emergency Management Office.

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CHAPTER 4

RISK ASSESSMENT

Update Revisions for Chapter Since Last FEMA Approval	
Section	Description
Chapter 4	• Updated hazard profiles, data, CPRI, Hazard Probability Matrix

Hazard Identification

A natural disaster is the consequence of the combination of a natural hazard and human activities. Human vulnerability, caused by the lack of appropriate emergency management, leads to financial, structural and human losses. The resulting loss depends on the capacity of the population to support or resist any disaster. This understanding is concentrated in the formulation: "disasters occur when hazards meet vulnerability". A natural hazard will never result in a natural disaster in areas without vulnerability. The term "natural" has consequently been disputed because the events simply are not hazards or disasters without human involvement. The degree of potential loss can also depend on the nature of the hazard itself, ranging from wildfires - which threaten individual buildings, to impact events - which have the potential to end civilization.

Some 90 percent of all presidential declared disasters across the United States are weather-related, and account for approximately 500 deaths and nearly $14 billion in damages per year. Each year, Americans cope with an average of 10,000 thunderstorms, 2,500 floods and 1,000 tornadoes.

In order to coordinate emergency management, a community must identify and describe all natural hazards capable of occurring within its borders. The community must also be able to assess the vulnerabilities of each hazard so that an appropriate action can be taken to minimize loss of life and property. Each community should recognize that a natural disaster cannot be fully predicted, and that the demands of such a situation will not always be anticipated. However, by being aware of the community's possible hazards, each home or business can take preventive measures and disaster response can be planned.

Records regarding weather events can be found through *The National Climatic Data Center*, which breaks down weather patterns each year since 1950. Studies obtained from this database, along with the information gathered from the Ponca City's hazard mitigation meetings, a profile was prepared that assesses each hazard capable of occurring within the community. Twelve hazards were identified and addressed individually in this plan. The following table, "Hazards for the Ponca City Plan" lists each hazard and explains how and why that particular hazard could be a disaster for the Ponca City and the Ponca City Public School District.

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Hazards How and Why Identified

HAZARD	HOW IDENTIFIED	WHY IDENTIFIED
Dam Failure/Levees	➢ National Inventory of Dams ➢ OWRB ➢ FIRMS ➢ ODEM	➢ Ponca City has three high hazard dams located within the boundaries. There are no levees listed for Ponca City.
Drought	➢ USGS ➢ Water Department ➢ Lake and pond levels ➢ Dept. of Agriculture	➢ Low water levels at area ponds (including raw water supply reservoir) and lake ➢ Low crop yields
Earthquake	➢ USGS ➢ NCDC ➢ State Hazard Mitigation Officer	➢ Low-level earthquakes measured by the Richter Scale have been recorded.
Extreme Heat	➢ Local News Stations ➢ State Hazard Mitigation Officer ➢ Local EMS ➢ Local Fire Department	➢ Local EMS, Fire and Police Departments respond to numerous heat related calls each year during the elevated temperature period
Flooding	➢ Review of FIRMS ➢ Risk Assessments ➢ Public Input ➢ OWRB	➢ History of flash floods
Hail	➢ Emergency Management Storm Watchers ➢ NCDC	➢ Ponca City has records of past occurrences of frequent Thunderstorms including: Hail, Lightning, and High Wind
High Wind	➢ Emergency Management Storm Watchers ➢ NCDC	➢ Ponca City has records of past occurrences of frequent Thunderstorms including: Hail, Lightning, and High Wind
Lightning	➢ Emergency Management Storm Watchers ➢ NCDC	➢ Ponca City has records of past occurrences of frequent Thunderstorms including: Hail, Lightning, and High Wind
Thunderstorm	➢ Emergency Management Storm Watchers ➢ NCDC	➢ Ponca City has records of past occurrences of frequent Thunderstorms including: Hail, Lightning, and High Wind
Tornados	➢ Emergency Management Storm watchers ➢ NCDC ➢ Local Citizens	➢ Kay County has records of past occurrence.
Wildfires	➢ Local Fire Department ➢ Local Emergency Manager ➢ NCDC	➢ Ponca City has reports of wildfires.
Winter Storms	➢ Local Emergency Manager ➢ NCDC ➢ Ponca City Public Works Dept	➢ Ponca City has history of winter storms.

Figure 3: Hazards Identified (Table)

Hazard Assessments

Each hazard identified from the table will be assessed and rated using the following eight categories.

1) Definition of Hazard

The ***definition*** of each hazard describes the hazard and the possible affects it may have on the city of Ponca City and participating entities.

2) Location of Hazard

The ***location*** of the hazard tells where in the community that hazard will likely occur and what type of properties it might affect.

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3) Extent

The ***extent*** reflects what magnitude or impact each hazard will have on the Ponca City and participating entities. The severity of a hazard might also be predicted by comparing previous events to established technical measures.

4) Previous Occurrences

The ***previous occurrences*** will tell how many times this type of hazard has made an impact on this community.

5) Probability Method

Probability describes the likelihood that the hazard will occur within the community. Each hazard is assigned a probability rating based on the criteria and methods described below in the Probability Method information.

6) Vulnerability

The ***vulnerability*** describes why and where the particular hazard can occur within the community. Vulnerability depends on an asset's construction, its contents and the economic value of its functions. An asset will have varied vulnerability depending on each hazard. Indirect effects can often be much more widespread and damaging than the direct effects of a hazard.

7) Impact

The ***impact*** will tell what the hazard can destroy and what influence it will have on Ponca City and participating entities.

8) Unique and Varied Risk

This assessment will be used to tell what is different about a hazard that determines how it may be unique with varied risks and why it can affect a certain part of the Ponca City and participating entities. Some of the hazards will not be a ***unique and varied risk*** due to the fact that research cannot pinpoint a destruction path for that particular hazard.

Probability Methodology

Probability describes the likelihood that the hazard will occur within the Ponca City and participating entities. Each hazard is assigned a probability rating based on the criteria described below:

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Probability Rating

The probability rating was based on the following criteria:

Highly likely	=	Event possible in the next year
Likely	=	Event possible in the next 3 years
Possible	=	Event possible in the next 5 years
Unlikely	=	Event possible in the next 10 years

Probability of Future Events is quantified as follows

Highly likely	=	Event has 1 in 1 year chance of occurring (1.0 or greater)
Likely	=	Event has 1 in 3 years chance of occurring (.33 to .99)
Possible	=	Event has 1 in 5 years chance of occurring (.20 to .32)
Unlikely	=	Event has 1 in 10 years chance of occurring (Less than .19)

Highly Likely	=	(H)
Likely	=	(L)
Possible	=	(P)
Unlikely	=	(U)
Data for county only	=	(Co)
No data available	=	(n/a)

Minimal = Less than 6 hours

Magnitude/ Severity

Catastrophic
- Multiple Deaths
- More than 50% severely damaged property
- Complete shutdown of facilities for more than 30 days

Critical
- Injuries or illnesses result in permanent disability
- 25% to 50% severely damaged property
- Complete shutdown of facilities for at least 2 weeks

Limited
- Injuries or illnesses do not result in permanent disability
- 10% to 24% severely damaged property
- Complete shutdown of facilities for more than one days

Negligible
- Injuries or illnesses are treatable by first aid
- Less that 10% of facilities severely damaged
- Shutdown of facilities for 24 hours or less

Source: Mitigationplan.com

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Hazard Probability Matrix

Hazard Event	Ponca City	School District #71	County data used
Dam Failure/ Levees	U	U	☐
Drought	L	L	☒
Earthquake	U	U	☒
Extreme Heat	U	U	☒
Flooding	H	U	☐
Hail	H	H	☐
High Wind	L	L	☐
Lightning	U	U	☐
Thunderstorms	H	H	☐
Tornados	L	L	☒
Wildfires	U	U	☐
Winter storms	H	H	☒

Figure 4: Hazard Probability Matrix (Table)

Hazard History

Ponca City, Oklahoma Recorded Hazard Events Since 1998 By the National Climatic Data Center	
	Events in Kay County
Hazards	2005 to 2015
Dam Failure	0
Drought (County only data)	4
Earthquake (since 2005) 3.0 or Greater	2
Extreme Heat	2
Flood/Flash Flood	15
Hail	98
High Wind	7
Lightning (2005-2009)	1
Thunderstorms	132
Tornado	9
Wildfire	0
Winter Storms	13

Note: Not all hazard events are reported to the NCDC.

* Information from USGS

** Information from Local Fire Department

Figure 5: Hazard History (Table)

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Profile Hazard Event Worksheet

Hazard	Frequency	Magnitude Impacted Area	Warning Time	Severity Population Property	Data Available/ Needed	*Risk* Priority
Dam Failure	☐ Highly likely ☐ Likely ☐ Possible ☒ Unlikely	☐ Catastrophic >50% ☐ Critical 25 – 50% ☐ Limited 10-25% ☒ Negligible < 10%	☐ Minimal ☒ 6-12 Hours ☐ 12-24 Hours ☐ 24 + Hours	☐ Catastrophic ☐ Critical ☐ Limited ☒ Negligible		**1.5**
Drought	☐ Highly likely ☒ Likely ☐ Possible ☐ Unlikely	☐ Catastrophic >50% ☐ Critical 25 – 50% ☒ Limited 10 – 25% ☐ Negligible < 10%	☐ Minimal ☐ 6-12 Hours ☐ 12-24 Hours ☒ 24 + Hours	☐ Catastrophic ☐ Critical ☐ Limited ☒ Negligible		**1.85**
Earthquake	☐ Highly likely ☐ Likely ☐ Possible ☒ Unlikely	☐ Catastrophic >50% ☐ Critical 25 – 50% ☐ Limited 10 – 25% ☒ Negligible < 10%	☒ Minimal ☐ 6-12 Hours ☐ 12-24 Hours ☐ 24 + Hours	☐ Catastrophic ☐ Critical ☐ Limited ☒ Negligible		**2.1**
Extreme Heat	☐ Highly likely ☐ Likely ☐ Possible ☒ Unlikely	☐ Catastrophic >50% ☐ Critical 25 – 50% ☒ Limited 10 – 25% ☐ Negligible < 10%	☐ Minimal ☐ 6-12 Hours ☒ 12-24 Hours ☐ 24 + Hours	☐ Catastrophic ☒ Critical ☐ Limited ☐ Negligible	Limited reported data available	**1.65**
Flooding	☒ Highly likely ☐ Likely ☐ Possible ☐ Unlikely	☒ Catastrophic >50% ☐ Critical 25 – 50% ☐ Limited 10 – 25% ☐ Negligible < 10%	☒ Minimal ☐ 6-12 Hours ☐ 12-24 Hours ☐ 24 + Hours	☒ Catastrophic ☐ Critical ☐ Limited ☐ Negligible		**3.5**
Hail	☒ Highly likely ☐ Likely ☐ Possible ☐ Unlikely	☐ Catastrophic >50% ☒ Critical 25 – 50% ☐ Limited 10 – 25% ☐ Negligible < 10%	☐ Minimal ☒ 6-12 Hours ☐ 12-24 Hours ☐ 24 + Hours	☐ Catastrophic ☒ Critical ☐ Limited ☐ Negligible		**3.35**
High Wind	☐ Highly likely ☒ Likely ☐ Possible ☐ Unlikely	☐ Catastrophic >50% ☒ Critical 25 – 50% ☐ Limited 10 – 25% ☐ Negligible < 10%	☐ Minimal ☒ 6-12 Hours ☐ 12-24 Hours ☐ 24 + Hours	☐ Catastrophic ☒ Critical ☐ Limited ☐ Negligible		**3**
Lightning	☐ Highly likely ☐ Likely ☐ Possible ☒ Unlikely	☐ Catastrophic >50% ☒ Critical 25 – 50% ☐ Limited 10 – 25% ☐ Negligible < 10%	☒ Minimal ☐ 6-12 Hours ☐ 12-24 Hours ☐ 24 + Hours	☐ Catastrophic ☒ Critical ☐ Limited ☐ Negligible		**2.25**
Thunderstorms	☒ Highly likely ☐ Likely ☐ Possible ☐ Unlikely	☐ Catastrophic >50% ☒ Critical 25 – 50% ☐ Limited 10 – 25% ☐ Negligible < 10%	☐ Minimal ☒ 6-12 Hours ☐ 12-24 Hours ☐ 24 + Hours	☐ Catastrophic ☒ Critical ☐ Limited ☐ Negligible		**3.35**
Tornados	☐ Highly likely ☒ Likely ☐ Possible ☐ Unlikely	☒ Catastrophic >50% ☐ Critical 25 – 50% ☐ Limited 10 – 25% ☐ Negligible < 10%	☒ Minimal ☐ 6-12 Hours ☐ 12-24 Hours ☐ 24 + Hours	☒ Catastrophic ☐ Critical ☐ Limited ☐ Negligible		**3.65**
Wildfires	☐ Highly likely ☐ Likely ☐ Possible ☒ Unlikely	☐ Catastrophic >50% ☐ Critical 25 – 50% ☐ Limited 10 – 25% ☒ Negligible < 10%	☒ Minimal ☐ 6-12 Hours ☐ 12-24 Hours ☐ 24 + Hours	☐ Catastrophic ☐ Critical ☒ Limited ☐ Negligible		**2**
Winter Storms	☒ Highly likely ☐ Likely ☐ Possible ☐ Unlikely	☐ Catastrophic >50% ☒ Critical 25 – 50% ☐ Limited 10 – 25% ☐ Negligible < 10%	☐ Minimal ☐ 6-12 Hours ☒ 12-24 Hours ☐ 24 + Hours	☐ Catastrophic ☒ Critical ☐ Limited ☐ Negligible		**3.1**

Source: NCDC

Frequency:	Highly Likely = 4	Likely = 3	Possible = 2	Unlikely = 1
Magnitude:	Catastrophic = 4	Critical =3	Limited = 2	Negligible =1
Warning Time:	Minimal = 4	6-12 Hours = 3	12- 24 Hours = 2	24+ Hours =1
Severity Population Property:	Catastrophic =4	Critical =3	Limited =2	Negligible =1

Calculated Priority Risk Index (CPRI). The CPRI factors the elements of risk -- Probability (P), Magnitude (M), Warning Time (WT) and Severity (S) -- to create an index which allows for the prioritization of mitigation activities based on the level of risk. The CPRI for the Dam Failure hazard:

Probability + Magnitude + Warning Time + Severity = CPRI

1 X .35 + **3** X .15 + **4** X .25 + **3** X .25 = **2.55**

Figure 6: Hazard Event Worksheet (Table)

Calculated Priority Ranking Index									
Hazard	Prob. (.35)	P(.35)	Mag (.15)	M(.15)	Warn Time (.25)	W(.25)	Sev (.25)	S(.25)	CPRI
Tornados	3	1.05	4	0.6	4	1	4	1	3.65
Flooding	4	1.4	4	0.6	2	0.5	4	1	3.5
Hail	4	1.4	3	0.45	3	0.75	3	0.75	3.35
Thunderstorms	4	1.4	3	0.45	3	0.75	3	0.75	3.35
Winter Storms	4	1.4	3	0.45	2	0.5	3	0.75	3.1
High Wind	3	1.05	3	0.45	3	0.75	3	0.75	3
Lightning	1	0.35	1	0.15	4	1	3	0.75	2.25
Wildfires	1	0.35	1	0.15	4	1	2	0.5	2
Drought	3	1.05	2	0.3	1	0.25	1	0.25	1.85
Earthquake	1	0.35	1	0.15	4	1	1	0.25	1.75
Extreme Heat	1	0.35	2	0.3	2	0.5	2	0.5	1.65
Dam Failure	1	0.35	1	0.15	3	0.75	1	0.25	1.5

Calculated Priority Ranking Index									
Hazard	Prob. (.35)	P(.35)	Mag (.15)	M(.15)	Warn Time (.25)	W(.25)	Sev (.25)	S(.25)	CPRI
Dam Failure	1	0.35	1	0.15	3	0.75	1	0.25	1.5
Drought	3	1.05	2	0.3	1	0.25	1	0.25	1.85
Earthquake	1	0.35	1	0.15	4	1	1	0.25	1.75
Extreme Heat	1	0.35	2	0.3	2	0.5	2	0.5	1.65
Flooding	4	1.4	4	0.6	2	0.5	4	1	3.5
Hail	4	1.4	3	0.45	3	0.75	3	0.75	3.35
High Wind	3	1.05	3	0.45	3	0.75	3	0.75	3
Lightning	1	0.35	1	0.15	4	1	3	0.75	2.25
Thunderstorms	4	1.4	3	0.45	3	0.75	3	0.75	3.35
Tornados	3	1.05	4	0.6	4	1	4	1	3.65
Wildfires	1	0.35	1	0.15	4	1	2	0.5	2
Winter Storms	4	1.4	3	0.45	2	0.5	3	0.75	3.1

The Calculated Priority Risk Index (CPRI) Risk Matrix is further explained in Appendix B.

The CPRI factors the elements of risk -- Probability (P), Magnitude (M), Warning Time (WT) and Severity (S) -- to create an index which allows for the prioritization of mitigation activities based on the level of risk. Each hazard is evaluated based on potential or probability using the elements of the index, and a weighting factor to determine the impact, in the following manner:

Weighting Factors

.35 Probability of Occurrence	.15 Magnitude Expected of Hazard	.25 Warning Time Possible to Event	.25 Severity Expected to Community
4 Highly Likely	4 Catastrophic	4 Less than 6 Hrs	4 Catastrophic
3 Likely	3 Critical	3 6-12 Hours	3 Critical
2 Possibly	2 Limited	2 12-24 Hours	2 Limited
1 Unlikely	1 Negligible	1 24 + Hours	1 Negligible

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Glossary

Hazard:
Any situation that has potential to cause damage. (Take these from the "Potential Hazards" form)

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

Intensity:
Is a measure of the effects of a hazard event at a particular place. Probability is a statistical measure of the likelihood that a hazard event will occur.

Probability:
Is the likelihood that the particular hazard will result in damages at this location.

Risk:
Is the estimated impact that a hazard event would have on people, service, 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.

Severity:
An estimation of how serious the potential problem might be in terms of harm to people and/or damage to property

Vulnerability:
Describes how exposed of 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.

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PROFILING HAZARDS

Dam/Levee Failure

(The Ponca City and participating entities are not equally at risk for this hazard.)

Description

A dam is an artificial barrier that has the ability to impound water, wastewater or any liquid-borne material for the purpose of storage or the control of water. Dams typically are constructed of earth, concrete or mine tailings. A dam can fail for one or a combination of the following reasons:

- Overtopping caused by floods that exceed the capacity of the dam
- Deliberate acts of sabotage
- Structural failure of materials used in dam construction
- Movement and/or failure of the foundation supporting the dam
- Settlement and cracking of concrete or embankment dams
- Piping and internal erosion of soil in embankment dams
- Inadequate maintenance and upkeep

The amount of water impounded in a reservoir behind a dam is measured in acre-feet. An acre-foot is the volume of water that covers an acre of land to a depth of one foot, or approximately 325,000 gallons. As a function of upstream topography, even a very small dam may impound or detain many acre-feet or millions of gallons of water.

According to the 2005 update to the National Inventory of Dams, there are 75,900 dams in the United States, Approximately one third of these pose a "high" or "significant" hazard to life and property if failure occurs.

Dam failure or levee breeches can occur with little or no warning. Intense storms may produce a flood in a few hours or even minutes for upstream locations. Flash floods occur within six hours of the beginning of heavy rainfall, and dam failure may occur within hours of the first signs of breaching.

The National Inventory of Dams has given a rating for each dam determining the potential for destructiveness, and they are rated as follows; high hazard, significant hazard and low hazard. The hazard rating has nothing to do with whether the dam is about to collapse immediately or

will last forever. It does not relate to the condition or structure of the dam. Basically, it has to do with whether there are people living downstream in the floodplain area, which would be endangered in the event of a dam failure.

Location

Ponca City has three "High Hazard" dams located within the city borders. FEMA does not list any levees in Ponca City as of 2005. The Ponca Lake, Kaw Lake and Cremers Park Regional Detention Pond dams are rated as the only high risk dams in the city; Ponca Lake is located to the east of Ponca City to the east of that is Kaw Lake and Cremers Regional Detention Pond is in the Northern section of the city. Kaw Dam and Ponca Lake dam pose minimal downstream threat to Ponca City; however, in the event of a dam failure several hundred acres of farmland would have devastation to crops, animals, roads and bridges, along with environmental concerns. Ponca City does not have any levees on record with FEMA Region VI or Oklahoma Division of Emergency Management.

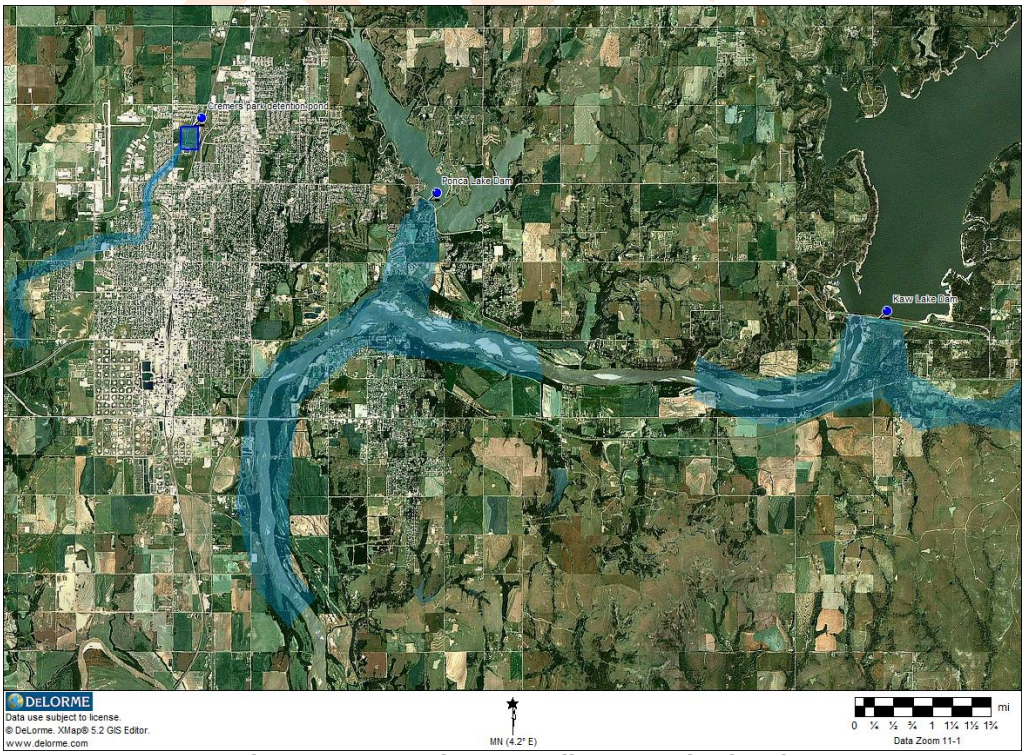


Figure 7: Ponca City Dam Failure Overview(Map)

Areas in Blue : Projected downstream path in the event of Dam Failure.

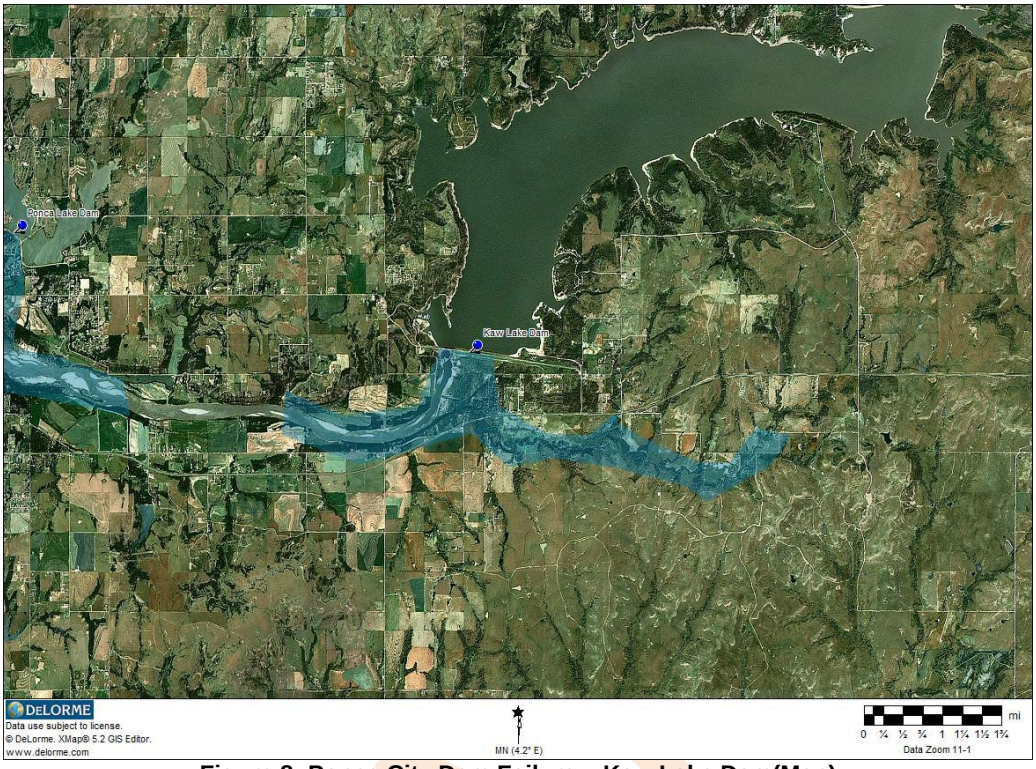


Figure 8: Ponca City Dam Failure – Kaw Lake Dam(Map)

Areas in Blue : Projected downstream path in the event of Dam Failure.

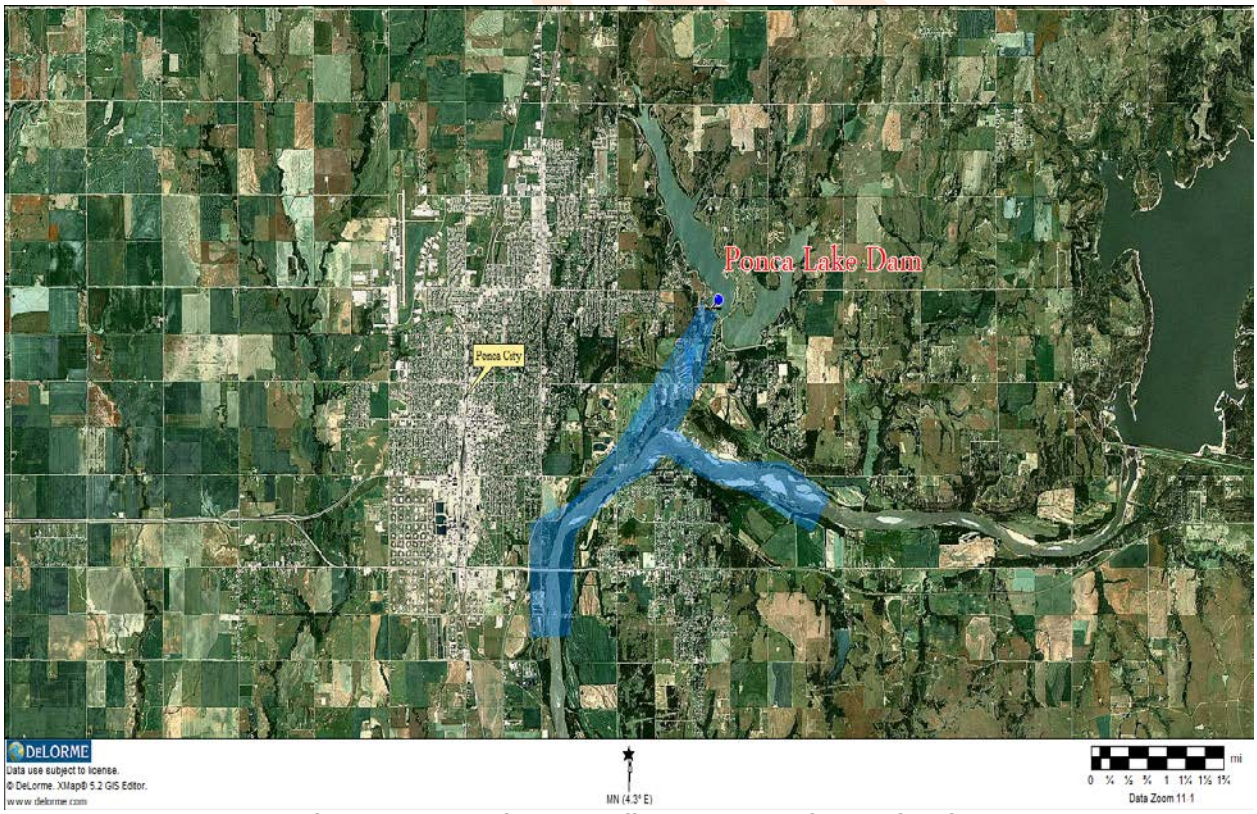


Figure 9: Ponca City Dam Failure – Ponca Lake Dam(Map)

Areas in Blue : Projected downstream path in the event of Dam Failure.

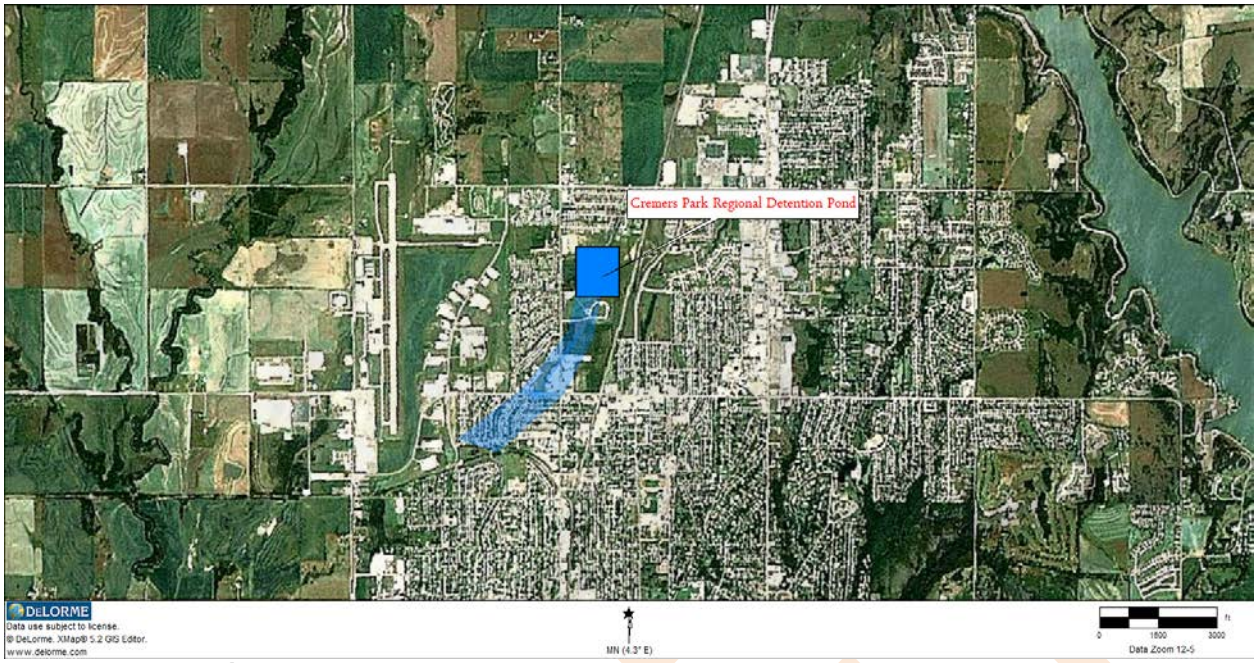
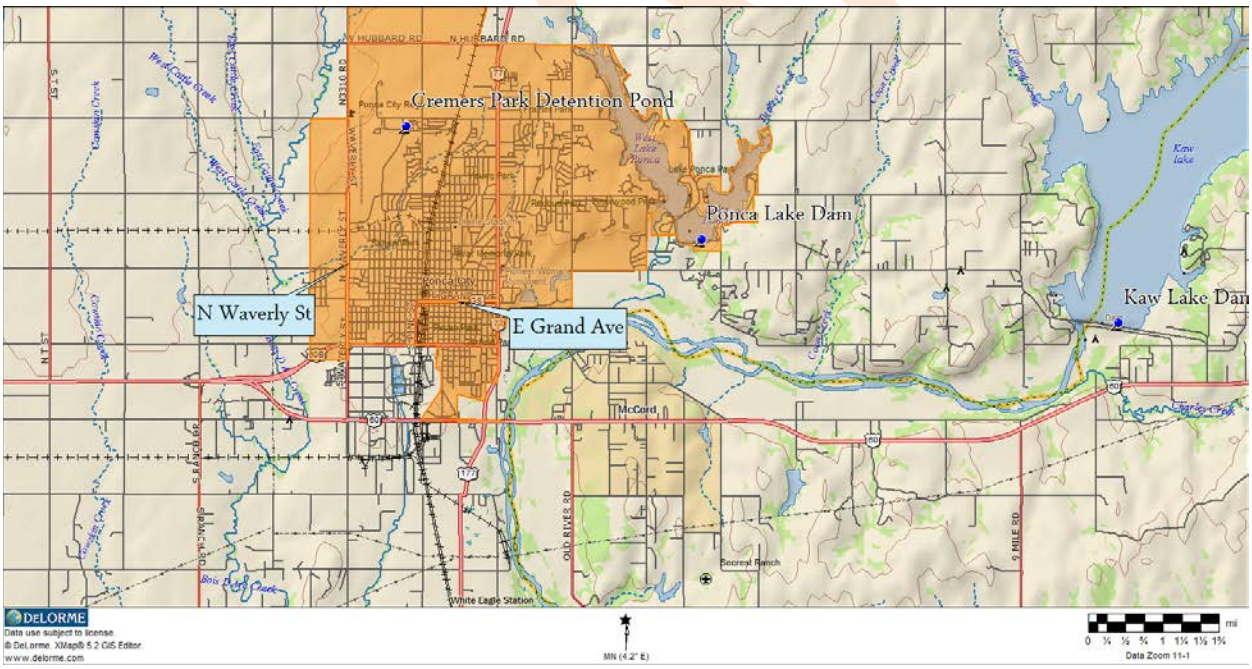


Figure 10: Ponca City Dam Failure – Cremers Park Detention Pond(Map)

Areas in Blue : Projected downstream path in the event of Dam Failure.



Ponca City Dam Failure Map Overview

Area in Orange : City Limits of Ponca City

Extent

There have not been any dam failures between 2005 and 2015. The estimated loss of structures is $0 and there has not been any loss of life due to dam failure. The Ponca Lake, Kaw Lake and the Cremers Park Regional Detention Pond Dams are considered to be "High Hazard" dams by the OWRB. The City of Ponca City considers a minor breach of the dam where only one foot of water is released to be a minor severity doing minimal damage or staying only in the river channel and causing low or no damage to be a minimum severity and a complete breach where water is released that is two or more feet high and goes down stream 5 miles to be a major severity.

The following explains what the hazard classification means:

A. Hazard Classification 1 -- **High Hazard**; Dam failure would probably result in loss of life, vital services, or major property damage.

B. Hazard Classification 2 -- **Significant Hazard**; Dam failure could possibly cause some loss of life, vital services, or property damage.

C. Hazard Classification 3 -- **Low Hazard**; Dam failure would be unlikely to cause loss of life, vital services, or property damage

Previous Occurrences

There have been no reported incidents of dam failure in Ponca City between the years of 2005 and 2015 and no reported damages. NCDC data from 2005 through 2015 can be found in Appendix D.

Dam Failure/ Levee Incidents in Ponca City	
Jurisdiction	**Incidents**
Ponca City	0
Ponca City School District	0
Total	0

Probability of Future Events

The probability of a dam failure is rated as **Unlikely** for Ponca City and the Ponca City School District due to the fact that there have been no reported incidents. More than likely, Ponca City and participating entities will not feel the effects of a dam failure within the next 10 years using the probability method; however, no one can predict unforeseen situations that may cause a dam failure. See Hazard Probability Matrix for the risk of all the communities in the city on page 37.

Vulnerability

There are approximately 17 structures at risk and 1 bridge with a failure of the Lake Ponca Dam. There approximately 134 structures including Liberty Elementary School and 6 major road crossings at risk with a failure of the Cremers Park Regional Detention Pond. Of course, those will also endanger public utilities.

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If Kaw Dam fails the Ponca City Water Treatment Plant and Ponca City Wastewater Treatment Plant would be a great risk. Ponca City has prevented development of the floodplain in the Main Channel of the Arkansas River so no other buildings in Ponca City limits would be at risk. Failure of Kaw Dam could damage the Big Snake Bridge and US Highway 60 Bridge causing disruption of traffic along US Highway 60 which would be very bad for Ponca City. Even without failure of Kaw Dam, a discharge of more than 52,400 cfs from Kaw Reservoir could cause flooding in Ponca City. See Types and Numbers by Hazard on page 118

Impact

Dams are made to retain large amounts of water. If they fail or are overtopped, they can cause large amounts of damage with little or no warning to the public. If a dam suffers a partial or a complete failure, the potential energy of the water stored behind even a small dam can cause loss of life and great environmental damage downstream.

The following factors influence the impact of a dam failure:

- Level of failure (partial or complete)
- Rapidity of failure (sudden or gradual)
- Amount of water released
- Nature of the development or infrastructure located downstream

The Cremers Park Regional Detention Pond Dam could cause damage to local residential houses located downstream in Ponca City. The Lake Ponca Dam would pose more of a downstream threat to the town of McCord, OK located in Kay County. The Kaw Lake Dam poses virtually no downstream threat to the city of Ponca City. Some local businesses, residence, and roadways could see damages from water flow and flooding. Ponca City would have a loss of potable water and electric services to the community, roadway destruction, flooding and it would influence recreational areas around the lake. Residents will have to seek alternate sources of water, temporary housing and alternate routes to home and work. Some residents may have to seek housing or jobs in another city in the event of a dam failure.

Unique and Varied Risk

Ponca City would have minimal damage in the event of a dam breach or failure. A dam failure would fall under a unique and varied risk because if it happens, the line of water would follow the downstream path. The Cremers Park Regional Detention Pond Dam could cause damage to residential houses and Liberty Elementary located downstream in Ponca City. The Lake Ponca Dam would pose more of a downstream threat to the town of McCord, OK in Kay County. The Kaw Lake Dam poses virtually no downstream threat. All of these could affect Some local businesses, residence, and roadways could see damages from water flow and flooding. Dam failure has a CPRI Index of 1.5.

Drought

(The Ponca City and participating entities are equally at risk for this hazard.)

Description

A drought is a period of time when there is not enough water to support agricultural, urban, human, or environmental water needs. A drought usually refers to an extended period of below-normal rainfall, but can also be caused by drying bores or lakes, or anything that reduces the amount of water available. Although what is considered "normal" varies from one region to another, drought is a recurring feature of nearly all the world's climatic regions. The effects of drought vary greatly, depending on agricultural, urban and environmental water needs. Water companies, farmers and ranchers are those that suffer the worst as a result of drought.

Conceptually, there are three main types of drought:

- **Meteorological drought** is brought about when there is a prolonged period with less than average precipitation. Meteorological drought usually precedes the other kinds of drought.
- **Agricultural drought** is brought about when there is insufficient moisture for crop or range production. This condition can arise, even in times of average precipitation, owing to soil conditions or agricultural techniques.
- **Hydrological drought** is brought about when the water reserves available in sources such as aquifers, lakes and reservoirs falls below the statistical average. This condition can arise, even in times of average (or above average) precipitation, when increased usage of water diminishes the reservoirs.

Periods of drought can have significant environmental, economic and social consequences. The most common consequences are:

- Wildfires
- Ground drag and Desertification
- Loss of agricultural production
- Disease
- Thirst
- Famine due to lack of water for irrigation
- Social unrest
- Migration or relocation of those impacted
- War for water and foods

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Location

Ponca City as a whole is susceptible to drought. Agricultural areas can be affected more than urban areas; however, when the water supply is low those people in the urban areas may be asked to conserve water.

The Third National Climate Assessment predicts increased dry periods. "Large parts of Texas and Oklahoma are projected to see longer dry spells (up to 5 more days on average by mid-century)." (Projected Climate Change, Chapter 19 Great Plains, *Climate Change Impacts of the United States: The Third National Climate Assessment*, 2014, page 445)

"The trend towards more dry days and higher temperatures across the south will increase evaporation, decrease water supplies, reduce electricity transmission capacity, and increase cooling demands. These changes will add stress to limited water resources and affect management choices related to irrigation, municipal use, and energy generation… Increased drought frequency and intensity can turn marginal lands into desserts. Reduced per capita water storage will continue to increase vulnerability to water shortages …" (Key Message 1: Energy Water and Land Use, Chapter 19 Great Plains, *Climate Change Impacts of the United States: The Third National Climate Assessment*, 2014, page 446)

"Projected declines in precipitation in the south and greater evaporation everywhere due to higher temperatures will increase irrigation demand and exacerbate current stresses on agricultural productivity." (Key Message 2: Sustaining Agriculture, Chapter 19 Great Plains, *Climate Change Impacts of the United States: The Third National Climate Assessment*, 2014, page 447)

Extent

The extent of a drought could be devastating to Ponca City area because the city has a large agricultural community and it relies on livestock production and crop creation. Also, drought might affect the water supply, which would be harmful to the city of Ponca City. Most farmers could be overwhelmed by the financial loss that can accompany a drought. On the Palmer Drought Severity Index, Ponca City considers a "mild drought" as severe.

Palmer Drought Severity Index

Palmer Classifications (PDSI)	
+4.0 in. or more	Extremely wet
3.0 in to 3.99 in	Very wet
2.0 in to 2.99 in	Moderately wet
1.0 in to 1.99 in	Slightly wet
0.5 in to 0.99 in	Incipient wet spell
0.49 in to -0.49 in	Near normal
-0.5 in to -0.99 in	Incipient dry spell
-1.9 in to -1.99 in	Mild drought
-2.0 in to -2.99 in	Moderate drought
-3.0 in to -3.99 in	Severe drought
-4.0 in or less	Extreme drought

(Source: National Oceanic and Atmospheric Association)

Figure 11: Palmer Drought Index (Table)

Previous Occurrences

There have been 4 incidents of drought reported to the NCDC that have affected Ponca City between the years of 2005 and 2015. NCDC data from 2005 through 2015 can be found in Appendix D. For the purpose of planning, to determine a drought event, each event was determined by the beginning of the drought event and every continuous month the event was listed without out a separation.

Drought Incidents in Ponca City	
Community	**Incidents**
Kay County	4
Ponca City	0
Total	4

Various Previous Occurrences For Drought Source: NCDC	
March 01, 2014 To March 31, 2014	With gradually warming temperatures and little to no precipitation through the month, drought conditions worsened across much of Oklahoma.
December 01, 2011 To December 31, 2011	The above normal rainfall for many in Oklahoman continued to make a dent in the historic drought that had lasted for months. The more general rainfall over October and November, as opposed to flooding rainfall, had allowed for a good start to the winter wheat planting. Unfortunately, December remained fairly dry. This is not unusual as the winter months (December through February) typically have the lowest average precipitation. Because of the strong end to the autumn months, many have reported a better beginning crop than what was experienced a year ago.
August 01, 2006 To August 31, 2006	The drought conditions continued across parts of Oklahoma through the month of August. However, a few areas did show some improvement by the end of the month. At the first of the month drought conditions ranged from extreme to exceptional (D3-D4), with the worst conditions in southern Oklahoma. By the end of the month, extreme to exceptional drought conditions were still in place across southern and parts of central Oklahoma. However, northern and the rest of central Oklahoma improved to severe conditions (D2). The dry conditions maintained an increase in wildfire potential across the region with burn bans issued across part of the area. However, this did not stop some wildfires from occurring. Most fires burned less than 100 acres causing some damage to pasture, etc. Some of these fires were believed to have been started by lightning, while others were caused by humans. On one of the smaller fires that occurred south of Madill in early August, four firefighters were injured when they succumbed to heat exhaustion. One fire did become rather large burning approximately 1500 acres in the Arbuckle Mountains in Murray County. The fire began around 10:00 CST on August 17 near the scenic turnout on Interstate 35 near mile marker 49. The fire eventually jumped I-35 near mile marker 50 and mostly burned land between the interstate and Highway 77. Campers in the area were evacuated while Interstate 35 between mile marker 40 and 59 and parts of Highway 77 were shut down for about 7 hours from early afternoon to late evening. The traffic was diverted into the town of Sulphur which caused a traffic jam approximately 15 miles long. The flames of the fire reportedly shot 80 feet into the air. Two planes, at least 3 helicopters, and 51 fire departments were used to fight this large fire. Only one structure was known to have been damaged. The roof of the old trout restaurant located near Turner Falls along Highway 77 was damaged. Fires have not been the only problems associated with the drought conditions. Many communities continued to institute voluntary or mandatory water rationing programs. Low lake levels also caused problems for recreation and wildlife. Two fish kills were reported in August. One occurred at the Great Salt Plains Lake in Alfalfa county in northern Oklahoma. Officials estimated 10,000 fish were killed due to the low water levels and hot temperatures. Another fish kill occurred on Lake Texoma in south central Oklahoma. Several thousand fish were found dead in the Wilson Creek Cove area of the lake. For the recreation industry, some lakes have been closed to boating, swimming, and fishing. Receding shorelines caused many boat ramps and docks to become dry. Boaters on area lakes have also had several accidents due to the low water levels bringing objects on the floor of the lakes closer to the surface. The agriculture community also continued to be hit hard by the drought conditions. Oklahoma had been declared a disaster area allowing for federal assistance. Ranchers and farmers continued to sell part or all of their livestock herds due to dried up farm ponds, lack of pasture land, and the lack of hay. Summer crops were also affected by the dry conditions. Officials say part of the cotton crop had suffered from the dry and hot conditions. Those crops or areas that rely on irrigation were also adversely affected by the drought.
June 01, 2006 To June 30, 2006	The drought continued to affect the region during June. The drought remained at severe to extreme (D2-D3) levels throughout the area during the month with the worst conditions occurring in western Oklahoma. The month of June was the heart of the winter wheat harvest which showed losses to the wheat crop due to the drought. The area had been declared a federal disaster area so that farmers and ranchers could receive aid through loans. Only 53% of the acres of wheat planted were actually harvested with the rest of the acreage abandoned for loss. The average amount harvested in a year is usually about 75%. The quality of the wheat crop was also down with 23 bushels per acre produced compared to a 45 year average of 28.6 bushels per acre. The amount per acre is the lowest since 1995 and 1996. With the low wheat production of crop actually harvested and the amount of acres that were abandoned, the total monetary loss of the wheat crop due to the drought was roughly estimated at $150 million. The winter wheat crop was not the only aspect of the agriculture community that was affected by the drought. Pastures and hay production continued to remain low which affected ranchers and farmers that raise livestock. Farm ponds also continued to dry up. With the lack of food and adequate water, many farmers and ranchers continued to sell part or all of their herds. Those businesses that rely on the harvest of crops were also adversely impacted. The lack of rainfall continued to impact communities and outdoor recreation activities and their associated businesses. Additional towns instigated some level of water rationing in their communities. Low lake, river, and pond levels had also affected fishing, swimming, and boating activities. In some cases, the lakes had receded enough that boat docks and ramps were on dry land. The low lake levels also caused some parts of the lakes to become dangerous to boaters due to the lake bottom and the things laying on them being closer to the surface which had caused some accidents. The ongoing dry conditions also caused an increase in fire danger over the area, with much of the vegetation beginning to cure again after becoming green for a short time in the spring. Several wildfires occurred over the area during the month of June. Firefighters were able to contain the fires causing only a few hundred acres or less to burn per fire.

Probability of Future Events

Drought poses a risk to the city of Ponca City. Using NCDC data since 2005 It is **Likely** that a drought will affect this community within the next three years, it is also **Likely** for the Ponca City School District #71. The NCDC lists 49 separate occurrences within Kay County; however, each drought event lasts for several months. See Hazard Probability Matrix for the risk of all the communities in the city on page 37.

Vulnerability

Due to potential loss of crops or agricultural production, local area farmers will be affected by a drought more significantly than those living in the urban areas of Ponca City. The community might suffer from water shortages, which could include the inability to fight wildfires, or the powerlessness to supply all households with adequate water. See Types and Numbers by Hazard on page 119

Impact

Drought impacts in a number of ways, spanning all regions, and is capable of affecting the economy as well as the environment. Specific impacts can include

- Reduced crop and rangeland
- Increased livestock and wildlife mortality rates
- Reduced income for farmers and agribusiness
- Increased fire hazard
- Reduced water supplies for municipal/industrial, agricultural and power uses
- Damage to fish and wildlife habitat
- Increased consumer prices for food
- Reduced tourism and recreational activities
- Unemployment
- Reduced tax revenues because of reduced expenditures
- Foreclosures on bank loans to farmers and businesses

The most direct impact of drought is economic rather than loss of life or immediate destruction of property. While drought impacts in Oklahoma are numerous and often dependent upon the timing and length of individual drought episodes, the greatest impacts of drought are usually experienced in the agricultural community. In addition to the obvious direct losses of both crop and livestock production due to a lack of surface and subsurface water, drought is frequently associated with increases in insect infestations, plant disease, and wind erosion.

Of course, one of the most significant potential impacts of drought relates to public water supply. In metropolitan areas there may be a need to stop washing cars, cease watering the grass and take other water conservation steps. In smaller communities, reduced flow in rivers and streams can have a significant effect on the water amount allowed for municipal use. Hot weather during the summer increases demand and subsequent use of supplies, as well as evaporation. In turn, increased water demand can stress many smaller and / or antiquated delivery and treatment facilities to the point of collapse. Prolonged drought has a much greater impact on rural communities, which usually rely on relatively small watersheds and are especially vulnerable during such periods.

Water shortages can also affect fire-fighting capabilities in both urban and rural settings through reduced water flows and pressures. Most droughts dramatically increase the danger of fires on wild land. When wild lands are destroyed by fire, the resulting erosion can cause heavy silting of streams, rivers and reservoirs. Serious damage to aquatic life, irrigation and power production then occurs.

Unique and Varied Risk

Drought does not pose a unique and varied risk. If a drought does occur, the entire community is susceptible; however, agricultural areas of the community may experience more loss due to crop damage, insect infestations or livestock losses.

DRAFT

Earthquake

(The Ponca City and participating entities are equally at risk for this hazard.)

Need more specific information for Ponca City

Description

One of the most frightening and destructive phenomena of nature is a severe earthquake and it's terrible after effects.

An earthquake is a phenomenon that results from the sudden release of stored energy in the Earth's crust that creates seismic waves. At the Earth's surface, earthquakes may manifest themselves by a shaking or displacement of the ground, which may lead to loss of life and destruction of property. An earthquake is caused by tectonic plates getting stuck and putting a strain on the ground. The strain becomes so great that rocks give way and fault lines occur.

Earthquakes may occur naturally or as a result of human activities. In its most generic sense, the word earthquake is used to describe any seismic event — whether a natural phenomenon or an event caused by humans generating seismic waves.

Earthquakes strike suddenly, violently, and without warning at any time of the day or night. If an earthquake occurs in a populated area, it may cause many deaths, injuries and extensive property damage.

Although there are no guarantees of safety during an earthquake, identifying potential hazards ahead of time and advance planning can save lives and significantly reduce injuries and property damage.

DRAFT

Location

The entire Ponca City would be susceptible to an earthquake. Earthquakes are not limited in their destruction path. An earthquake is regional in nature and could occur in any community or county. All buildings would be at danger; however, structures that are not built to withstand violent hazards may be potentially at a greater risk.

There was an earthquake on January 24, 1991 at 5:00 PM. The epicenter was approximately 9 miles SW of Red Rock.

The largest earthquake ever recorded in Oklahoma occurred on April 9, 1952, at 4:29 PM, and caused moderate damage at El Reno, Oklahoma City and Ponca City, including toppled chimneys and smokestacks, cracked and loosened bricks on buildings, and broken windows and dishes. One crack in the State Capitol at Oklahoma City was 15 meters long. Slight damage was reported from many other towns in Oklahoma and from some towns in Kansas and Texas. The quake registered 5.5 on the Richter scale and was caused by slippage along the Nemaha fault. It was felt over most of Oklahoma, and in Arkansas, Iowa, Kansas, Missouri, Nebraska and Texas.

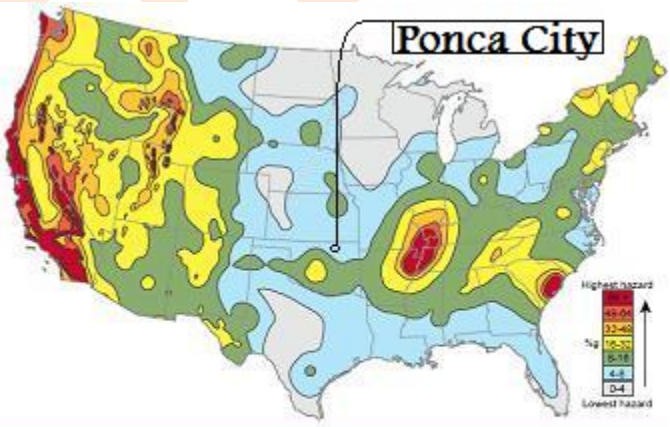
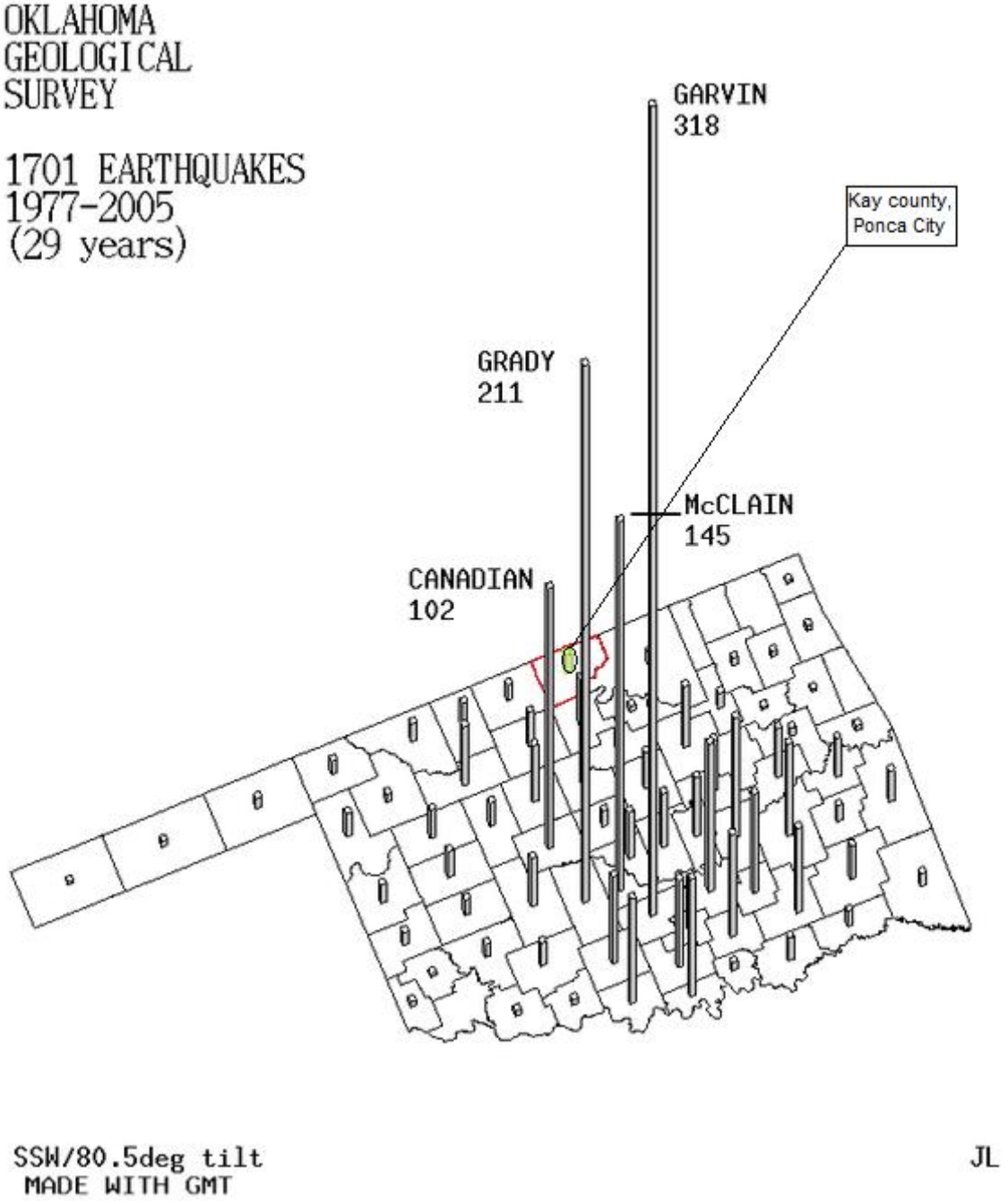


Figure 2. The U.S. Geological Survey shaking-hazard maps for the United States are based on current information about the rate at which earthquakes occur in different areas and on how far strong shaking extends from earthquake sources. Colors on this particular map show the levels of horizontal shaking that have a 1-in-50 chance of being exceeded in a 50-year period. Shaking is expressed as a percentage of g (g is the acceleration of a falling object due to gravity).

Figure 12: USGS Shaking-Hazard (Map)

NUMBER OF EARTHQUAKES IN EACH OKLAHOMA COUNTY 1977-2005



Extent

The effect of an earthquake on the Earth's surface is measured by the intensity. The intensity scale consists of a series of certain key responses such as people awakening, movement of furniture, damage to chimneys, and finally - total destruction. Although numerous intensity scales have been developed over the last several hundred years to evaluate the effects of earthquakes, one commonly used in the United States is the Modified Mercalli (MM) Intensity Scale. It was developed in 1931 by the American seismologists Harry Wood and Frank Neumann. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects. Ponca City is located in the 4-8 range on the USGS Shaking-Hazard map.

The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the nonscientist than the magnitude because intensity refers to the effects actually experienced at that place. After the occurrence of widely-felt earthquakes, the Geological Survey mails questionnaires to postmasters in the disturbed area requesting the information so that intensity values can be assigned. The results of this postal canvass and information furnished by other sources are used to assign intensity within the felt area. The maximum observed intensity generally occurs near the epicenter.

The lower numbers of the intensity scale generally deal with the manner in which the earthquake is felt by people. The higher numbers of the scale are based on observed structural damage. Structural engineers usually contribute information for assigning intensity values of VIII or above.

DRAFT

The following is an abbreviated description of the 12 levels of Modified Mercalli intensity.

Modified Mercalli Intensity Scale	
Level	**Description**
I	Not felt except by a very few under especially favorable conditions.
II	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
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 motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	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.
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
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.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Figure 13: Modified Mercalli Intensity Scale (Table)

Richter Scale

Magnitude Recorded	Description
M = 1 to 3	Recorded on local seismographs, but generally not felt.
M = 3 to 4	Often felt, with little to no damage reported.
M = 5	Felt widely, slight damage near epicenter.
M = 6	Damage to poorly constructed buildings and other structures within 10 kms.
M = 7	"Major" earthquake. Causes serious damage up to 100 km
M = 8	"Great" earthquake, great destruction, loss of life over several 100 km San.
M = 9 to 12	Rare great earthquake, major damage over a large region over 1000 km

Figure 14: Richter Scale (Table)

The severity of an earthquake can be expressed in several ways. The *magnitude* of an earthquake, usually expressed by the *Richter Scale*, is a measure of the amplitude of the seismic waves. The Richter Scale, named after Dr. Charles F. Richter of the California Institute of Technology, is the best known scale for measuring the magnitude of earthquakes. The scale is logarithmic so that a recording of 7, for example, indicates a disturbance with ground motion 10 times as large as a recording of 6. A quake of magnitude 2 is the smallest quake normally

felt by people. Earthquakes with a Richter value of 6 or more are commonly considered major; great earthquakes have magnitude of 8 or more on the Richter scale. Ponca City considers a VIII as severe on the Modified Mercalli Intensity Scale and a M-5 on the Richter Scale.

Previous Occurrences

Ponca City has had 2 reported earthquakes with magnitudes of 3.0 or greater since 1950 according to the USGS; Ponca City is located to the west of the New Madrid Fault Line that centers in Missouri, Illinois, Arkansas, and Tennessee. NCDC data from 1950 through 2009 can be found in Appendix D; however, for better statistical probability a 10 year historical timeframe was used.

Various Previous Occurrences For Drought Source: NCDC	
April 9, 1952	The magnitude 5.5 April 9, 1952, earthquake centered near El Reno affected most of Oklahoma and parts of Arkansas, Iowa, Kansas, Missouri, Nebraska, and Texas. Damage from the 10:30 a.m. CST earthquake was not extensive, but many people in the epicentral area were alarmed, some to near panic. Portions of chimneys fell in El Reno and Ponca City (intensity VII). Bricks loosened from a building wall and tile facing of commercial buildings bulged at Oklahoma City. Also, plate glass windows were shattered in the business district of El Reno. The total damage amounted to several thousand dollars. Aftershocks were felt on April 11, 15, and 16, July 16, and August 14; an earthquake that was felt (IV) at Holdenville and Wewoka on October 7 apparently was unrelated to the April 9th event. Homes and buildings shook and some persons were awakened (V) at El Reno from the April 16th shock, which occurred 5 minutes after midnight. Felt reports were also received from Kingfisher, Oklahoma City, Tulsa, and Union City.
June 26, 2009	An earthquake measured at 3.6 on the Richter scale has hit Garfield County in northwestern Oklahoma.

Earthquakes Incidents 3.0 or Greater in Ponca City	
Community	**Incidents**
Ponca City	2
Total	2

Probability of Future Events

Ponca City has had 2 recorded earthquakes of magnitude 3.0 or greater on the Richter Scale since 1950; therefore, earthquakes have a probability rating of **unlikely** to occur in the next year, it is also **unlikely** for Ponca City School District #71; however, the city is located west of the New Madrid Fault Line and is listed on the Shake Hazard Map on the 4 to 8 range. See Hazard Probability Matrix for the risk of the communities in the city on page 37.

Vulnerability

The entire city of Ponca City has high vulnerability in the event of an earthquake; structures that are volatile due to age or susceptible building materials may be more at risk. Citizens that are in or near these buildings may be in danger from falling materials or collapsing infrastructures. In the event of an earthquake roadways may be damaged, which could delay emergency response times. Earthquakes may possibly interrupt utilities. Although these events are rare, each earthquake could potentially be dangerous. There has been some reported damage to structures since 1952. See Types and Numbers by Hazard on page 120.

Impact

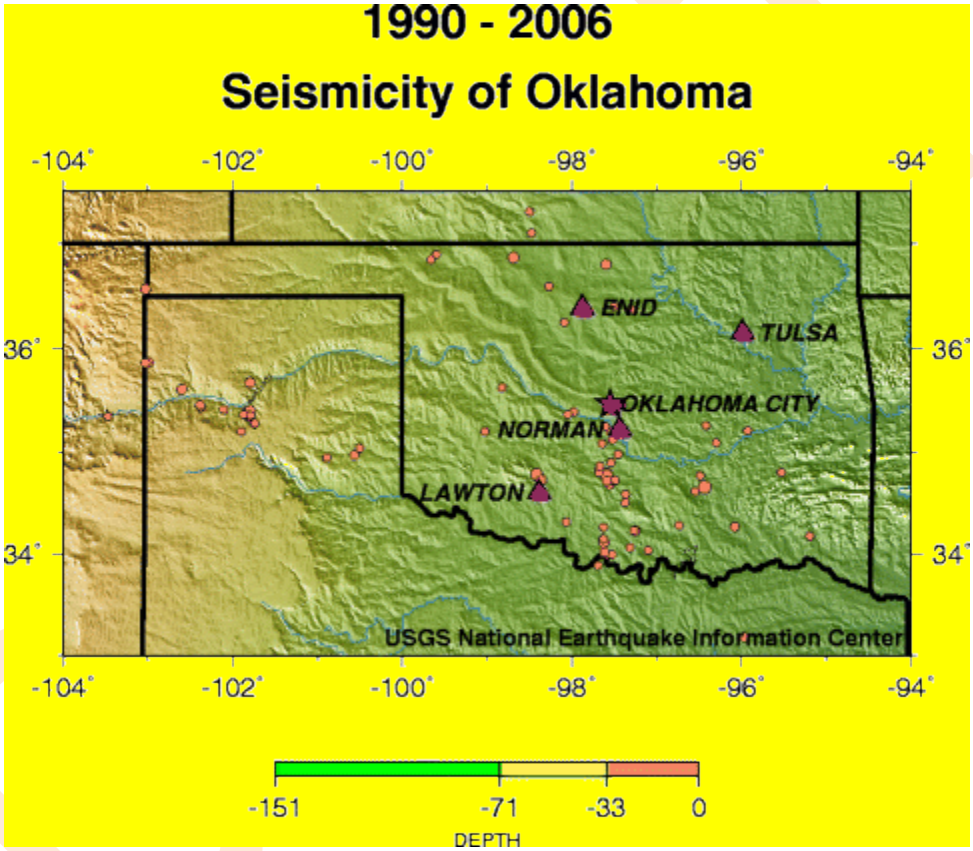
The impact of an earthquake in Ponca City could vary depending on the magnitude of such an event. For instance, if the earthquake registered low on the Richter scale the community would suffer little or no damage. However, if the earthquake was severe, then the structures would be at risk, as well as the lives of the people in the area. If a highly intense earthquake hit Ponca City community, the emergency response might be limited due to structure failure, damaged roadways or injured personnel. While utility disruptions can be dangerous, their effects can be

averted or diminished when proper precautions are taken. If severe, impacts of earthquakes could be costly, but the chance of such an event in Ponca City is unlikely. Residents will have to seek temporary housing and alternate routes to home and work. Some residents may have to seek housing or jobs in another city.

Unique An earthquake does not fall under the unique and varied risk category; however, the activity will follow a fault line. According to the USGS, the New Madrid Fault Line is to the east of Oklahoma. Ponca City is located in the north east section of Oklahoma. According to the USGS, Ponca City has a rating of 4-8%g.

Change to show some unique and varied risk

and Varied Risk



Seismic activity

Figure 15: Ponca City Oklahoma Seismicity Scales (Table)

Extreme Heat

(The Ponca City and participating communities are equally at risk for this hazard.)

Description

Generally, extreme heat is defined by temperatures that maintain 10 degrees or more above the average high temperature for the region, last for prolonged periods of time, and are accompanied by high humidity.

Heat kills by pushing the human body beyond its limits. In extreme heat and high humidity, evaporation is slowed and the body must work extra hard to maintain a normal temperature.

Most heat disorders occur because the victim has been overexposed to heat or has over-exercised for his or her age and physical condition. Older adults, young children and those who are sick or overweight are more likely to succumb to extreme heat.

Conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality. Consequently, people living in urban areas may be at greater risk from the effects of a prolonged heat wave than those living in rural areas. Urban areas have more asphalt and concrete roadways, buildings and structures that store heat longer and gradually release heat at night, which can produce higher nighttime temperatures known as the "urban heat island effect."

A heat wave's duration plays an important role in how people are affected. Studies show that a significant rise in heat-related illnesses occurs when excessive heat lasts for more than two days. Heat waves are particularly dangerous for children, seniors and people with special needs.

Individuals that spend at least two hours per day in air-conditioned spaces may significantly reduce the risk of a heat-related illness.

Location

Due to the nature of the event, no one municipality is more susceptible than another. Therefore, the location is on a countywide basis. Ponca City experiences over 30 days a year with a temperature of 90 ºF or higher. These high temperatures reach the entire community.

The Third National Climate Assessment predicts increased periods of extreme heat.
"For an average of seven days per year, maximum temperatures reach more than 100°F in the Southern Plains. These high temperatures are projected to occur much more frequently…with days over 100°F projected to…quadruple in the south by mid-century…These increases in extreme heat will have many negative consequences in surface water losses, heat stress, and demand for air conditioning…More overwintering insect populations are also expected." (Projected Climate Change, Chapter 19 Great Plains, *Climate Change Impacts of the United States: The Third National Climate Assessment*, 2014, page 444)
Emergency management personnel should be aware of the increasing potential for prolonged extreme heat events.

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution Extreme Caution Danger Extreme Danger

Figure 16: Relative Humidity Scale (Table)

Extent

It is often extremely hot and humid during the summer in Oklahoma including the City of Ponca City. A prolonged, higher than normal temperature, will result in the heat becoming a hazard to life and property.

Apparent temperature heat stress index

Category	Apparent temperature	Dangers
Caution	80-90°F	Exercise more fatiguing than usual
Extreme caution	90-105°F	Heat cramps, exhaustion possible
Danger	105-130°F	Heat exhaustion likely
Extreme danger	Greater than 130°F	Heat stroke imminent

The Heat Index is how the heat and humidity in the air combine to make individuals feel. Higher humidity plus higher temperatures often combine to make us feel a superficial temperature that is higher than the actual air temperature. The City of Ponca City considers any extended period with temperatures of 90 degrees with 60% humidity to be hazardous and cause for concern with periodic check-ups on the elderly and other at risk populations.

Previous Occurrences

The National Climatic Data Center has reported 2 extreme heat related periods for Ponca City in the last 10 years. Since there are only 2 events recorded for the county for this hazard and does not specify the communities, the city would consider this a data limitation. This plan contains action items for better data gathering of all hazards. NCDC data from 2005 through 2015 can be found in Appendix D.

Various Previous Occurrences For Extreme Heat Source: NCDC	
August 01, 2006 To August 13, 2006	The triple digit heat that began at the end of July continued through at least the first half of August across Oklahoma. Overnight lows also remained high with temperatures only falling into the upper 70s to low 80s most nights. The heat caused the deaths of 5 women and 3 men across the area. One woman was found dead in her home, which did not have the air conditioner operating, in Shawnee in Pottawatomie County. Another woman was found in her home in Ada in Pontotoc County. The air conditioner was not on in this home either. A woman in Medford in Grant County was working in her flower garden when she collapsed and died from the heat. Two women in Carter county died from the heat. One woman was found in her home in Lone Grove. There was a window air conditioner unit. However, this was not adequate to cool the whole house. The second woman to die in Carter county in August was 94 years old. However, the circumstances of her heat death were unknown. Two of the three men that died were from Oklahoma City. One of these men was found under a shade tree in front of his home that did not have air conditioning. The second man was found dead in a field behind a storage shed. The third man that died in August collapsed in Johnston county while he was walking outside. The man eventually died at a hospital in Oklahoma City from the effects of the heat. Emergency services also made numerous calls across the area due to heat related illnesses. The heat caused several streets to buckle across the area. F94OT, F72PH, F83OU, M32OU, M52OU, M54OU, F78PH, F79PH
July 16, 2006 To July 31, 2006	Temperatures reached triple digits across the area starting in mid-July and continued through the end of the month. Many locations at times reached 105 degrees of greater with higher heat index values. Overnight lows remained warm for much of this time also with most location only falling to 75 degrees or higher. The heat caused 10 fatalities across the area during this time period. Many fatalities occurred in homes that did not have fans or working air conditioners. Two men and three women died in the Oklahoma City metro area. One man was found dead on the northeast side of the city in his home where the air conditioner was broken. Another man died mowing his lawn at his home in the town of Harrah. A woman in The Village was found dead in her house where the A/C was not turned on. Another women was found dead in her home on the southwest side of the city. Her home did not have an air conditioner or fans. A third woman died at her home where the air conditioner was broken. In Mooreland in Woodward county, a woman died outside when she went to check on the water levels at a pond on her property. The woman fell and broke her hip which kept her from getting back to her home. Two people in Chickasha in Grady county died. The man was found dead in his home that did not have any air conditioning. A women had spent the day outside with friends. She then collapsed at her home which did not have air conditioning. In Lindsay in Garvin county, two people also died. One woman died in her home where the air conditioner was not running. A second woman was found dead on a dirt road near her home. She was walking from one home to another when she collapsed and eventually died. The paramedic services also made numerous calls for heat-related illnesses during this time. The heat also caused a portion of Interstate 44, on the west side of Oklahoma City, to buckle. The heat also caused a strain on several power grids causing local authorities to ask for people to minimize the consumption of power during the hottest parts of the day to prevent brown outs. F77PH, F51OU, M64PH, F83PH, M76PH, F62PH, F72PH, F87PH, M60OU, F88OU
July 04, 2001 To July 31, 2001	M76PH, F82PH, M62PH, M29OU, F85PH, M52PH, M49PH, M78BU An extended period of excessive heat affected all of western and central Oklahoma in July. Daily mean temperatures ranged from the mid 80s to near 90 degrees, which is four to five degrees above normal. Most areas regularly experienced high temperatures at or above 100 degrees, particularly western and north central Oklahoma. Eight fatalities resulted from the heat. A 78 year-old male died July 6th in Stillwater (Payne County) while loading equipment at a storage facility. An 82 year-old female died July 14th in her residence in Oklahoma City (Oklahoma County). A 62 year-old male died July 15th in his residence in Edmond (Oklahoma County). A 29 year-old male died July 17th in an Oklahoma City parking lot. Two persons died July 21st, one a 76 year-old male in a residence in Lawton (Comanche County), and the other an 85 year-old female in her residence in Oklahoma City. A 52 year-old male died July 24th in his residence in Oklahoma City, and a 49 year-old male died July 28th in his residence in Oklahoma City. In addition to the excessive heat, rainfall averaged about one-third of normal, resulting in a drought.

Extreme Heat Incidents in Ponca City	
Community	**Incidents**
Kay County	2
Ponca City	0
Total	2

Probability of Future Events

The city of Ponca City could experience another extreme temperature event given the previous occurrences; however, there has only been four events reported. The probability of an extreme heat event occurring in any given summer is **Unlikely**, it is also **Unlikely** for Ponca City School District #71. See Hazard Probability Matrix for the risk of all the communities in the city on page 37.

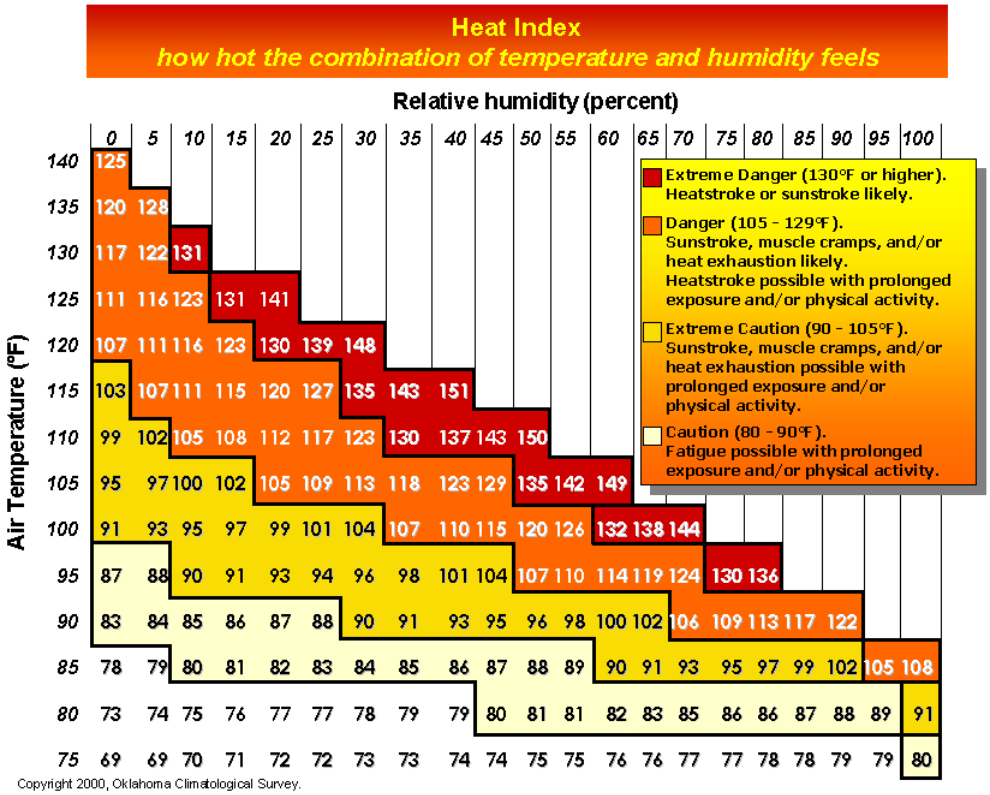


Figure 17: Heat Index (Table)

Vulnerability

An extreme heat hazard affects all areas within Ponca City and the vulnerability of this hazard on the residents of Ponca City is prone due to the number of days the temperature is above 100 degrees Fahrenheit. The elderly, young children and those with certain medical conditions, such as heart disease or overweight individuals are more likely to be at risk to extreme heat. However, even young and healthy individuals can succumb to heat, if they participate in strenuous physical activities during hot weather. During periods of extreme heat the electrical demand increases greatly. Most electrical motors and controls are designed to operate with ambient air temperatures of 104 degrees Fahrenheit or less. The increased heat from the increased electrical demand by electrical equipment with ambient air temperatures above 104 degrees F will result in electrical power outages. Those electrical power outages will reduce the available cooling capacity and could also reduce the treatment and distribution of the domestic water supply. See Types and Numbers by Hazard on Page 120.

Impact

Extreme heat can lead to the following impacts:

- Heat stroke, heat exhaustion and heat cramps are the major human risks from exposure to extreme heat
- Extreme heat is life threatening to elderly and frail persons who live alone

- Extreme heat diminishes water supplies and increases fire danger
- Peak daily electricity spikes when people run air conditioners and fans during a heat wave
- Roads, bridges and railroad tracks may suffer damage from extreme heat conditions

The impact of extreme heat can affect anyone outside or those inside without adequate air conditioning. In the event of extreme heat, emergency personnel responding to a fire or another crisis can be at risk, especially when the situation requires additional protective gear. Also, other outside professions, such as road or construction crews, and anyone enjoying physical recreational activities are at risk. The increased heat generated by the elevated electrical demand and higher ambient air temperatures surrounding electrical equipment needing to disperse the heat caused by the transport and use of electricity will also result in power outages.

Unique and Varied Risk

An extreme heat occurrence is not unique in that it does not affect a specific area within the community. However, the elderly, young and those that cannot afford cooling devices and utility costs are more at risk. The population at risk increases with associated power outages and the reduction in cooling opportunities. Extreme Heat has a CPRI Index of 1.65.

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Flooding

(Ponca City and participating entities are **not** equally at risk for this hazard.)

Description

Floods are one of the most common hazards in the United States. Flood effects can be confined, impacting a neighborhood or community, or wide-spread, affecting entire river basins and multiple states. However, all floods are not alike. Some floods develop slowly, sometimes over a period of days. But flash floods can produce flood waters quickly, sometimes in just a few minutes even when the rain clouds have dissipated. Flash floods often have a dangerous wall of roaring water that carries rocks, mud and other debris and can sweep away most things in its path. Overland flooding occurs outside a defined river or stream, such as when a levee is breached, but still can be destructive. Flooding can also occur when a dam breaks, producing effects similar to flash floods. Flood hazards can occur anywhere, especially in low-lying areas, near bodies of water or downstream from a dam. Storm drainage areas and ground below base flood elevation can appear harmless in dry weather; however, during heavy rain events those areas can be vulnerable to flooding.

In addition, structures out of the floodplains can also incur flood damage due to roof damage; seepage of groundwater into basements; localized blockages and obstructions in the drainage system for the structure roof drains and downspouts; settlement of the grading of the lots, improper grading, or the addition of permanent or temporary obstructions of drainage on the lot; blockage of street drain grates and inlets: or obstructions of street gutters and storm sewers; sanitary sewer backups; obstruction of drainage channels; and electrical power failure to sump pumps. During high runoff events a tremendous amount of debris will be transported with the flood waters that could result in those blockages or obstructions to cause flood damage. There is virtually no structure that cannot be flooded.

The Third Climate Assessment Report reports that very heavy precipitation events have already increased 16% for the great plains region.

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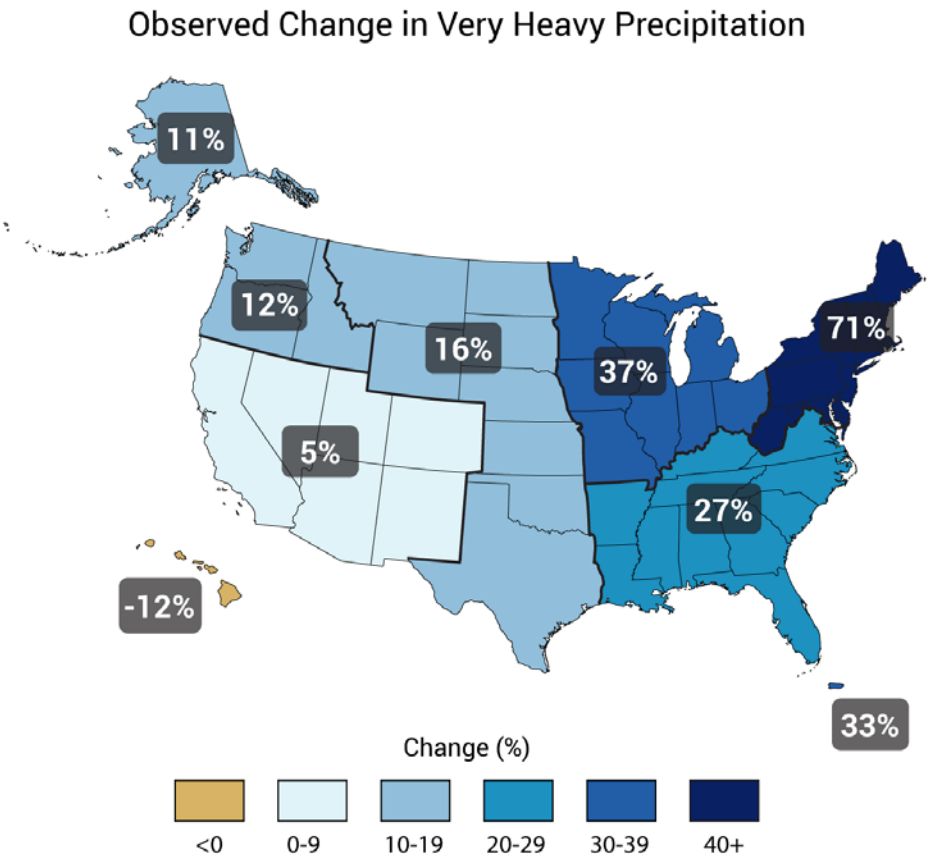

The map shows percent increases in the amount of precipitation falling in very heavy events (defined as the heaviest 1% of all daily events) from 1958 to 2012 for each region of the continental United States. These trends are larger than natural variations for the Northeast, Midwest, Puerto Rico, Southeast, Great Plains, and Alaska. The trends are not larger than natural variations for the Southwest, Hawai‘i, and the Northwest. The changes shown in this figure are calculated from the beginning and end points of the trends for 1958 to 2012. ((Figure 2.18, Chapter 2: Our Changing Climate, Climate Change Impacts in the United States: The Third National Climate Assessment, 2014, p. 37)

“Warmer air can contain more water vapor than cooler air. Global analyses show that the amount of water vapor in the atmosphere has in fact increased over both land and oceans…there is an upward trend in extreme precipitation in the vicinity of fronts associated with mid-latitude storms.” (Figure 2.18, Chapter 2: Our Changing Climate, Climate Change Impacts in the United States: The Third National Climate Assessment, 2014, p. 37)

“Changes in extremes in precipitation are projected across all seasons, including higher likelihood of both increasing heavy rain and snow events.” (Key Message 1: Energy Water and Land Use, Chapter 19 Great Plains, *Climate Change Impacts of the United States: The Third National Climate Assessment*, 2014, page 446)

While there is still some uncertainty regarding climate predictions it would be unwise to assume that future flooding will closely resemble past flooding. Floodplain managers should be prepared for more extreme floods than we have seen in the past.

Location

Ponca City has minor drainage backup around watersheds throughout the city. During heavy rain events, the city has several creeks, watersheds and tributaries that are located throughout the city, these areas fill the banks and overflow into nearby communities. A flood can affect any area in Ponca City; however, low-lying areas, neighborhoods near watersheds, creeks, lakes and tributaries can be more susceptible. The neighborhoods that are located in Zone AE and shaded Zone X on the FEMA flood maps do however experience minor flooding. In addition to the identification of only areas of flooding problems indicated from the Kay County FIRM effective September 25, 2009. The City of Ponca City (utilizing Meshek & Associates, PA) performed extensive hydrology and hydraulic studies of the drainageways in Ponca City that extends well beyond the limits of detailed study on the FIRM. The FIRM roughly studies drainage basins larger than typically 40 Acres. The Ponca City Stormwater Master Plan studied drainage basins and subsequent detailed hydrology and hydraulic studies of about 10 Acres of drainage basins. After seeking and receiving extensive public input over approximately a 4 year period. It was determined that there were 10 flooding problem areas in the Bois d' Arc tributaries and 8 areas of flooding problems in the Arkansas River tributaries. Those 18 flooding problem areas follow the Flood Insurance Rate Maps (FIRM's) in this report. The Ponca City Public Schools do not have any of their facilities located in the floodplains.

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Extent

Ponca City considers three to four inches of heavy rainfall in a short period of time a severe event. During this amount of rainfall, flash flooding will start to occur and the storm water drainage system will not accommodate the excess rainfall. Generally, the only flooding that occurs is in low-lying areas and in the one hundred year flood plain. There are several low water bridges and culverts in the City of Ponca City that frequently flood whenever 1-2 inches of rainfall in a few hours, which usually occurs with overnight rainfall. When about 3.5 inches of rainfall occurs over a 24 hour period some street flooding will occur and some structures could begin to be flooded, if over about 4.25" inches of rainfall occurs in 24 hours there will be widespread street flooding and flooding of structures is expected.

Flood: 100 year flood area;

Flood Zones		
Zone A	The 100-year or Base Floodplain. There are six types of A zones:	
	A	The base floodplain mapped by approximate methods, i.e., BFEs are not determined. This is often called an unnumbered A zone or an approximate A zone.
	A1-30	These are known as numbered A zones (e.g., A7 or A14). This is the base floodplain where the firm shows a BFE (old format).
	AE	The base floodplain where base flood elevations are provided. AE zones are now used on new format FIRMs instead of A1-30 zones.
	AO	The base floodplain with sheet flow, ponding, or shallow flooding. Base flood depths (feet above ground) are provided.
	AH	Shallow flooding base floodplain. BFE's are provided.
	A99	Area to be protected from base flood by levees or Federal flood protection systems under construction. BFEs are not determined.
	AR	The base floodplain that results from the de-certification of a previously accredited flood protection system that is in the process of being restored to provide a 100-year or greater level of flood protection
Zone V and VE	V	The coastal area subject to velocity hazard (wave action) where BFEs are not determined on the FIRM.
	VE	The coastal area subject to velocity hazard (wave action) where BFEs are provided on the FIRM.
Zone B and Zone X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and the 500-year floods. B zones are also used to designate base floodplains or lesser hazards, such as areas protected by levees from the 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.	
Zone C and Zone X (unshaded)	Area of minimal flood hazard, usually depiction FIRMs as exceeding the 500-year flood level. Zone C may have ponding and local drainage problems that do not warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood.	
Zone D	Area of undetermined but possible flood hazards.	
Source: Understanding Your Risks, identifying hazards and estimating losses, FEMA 386-2		

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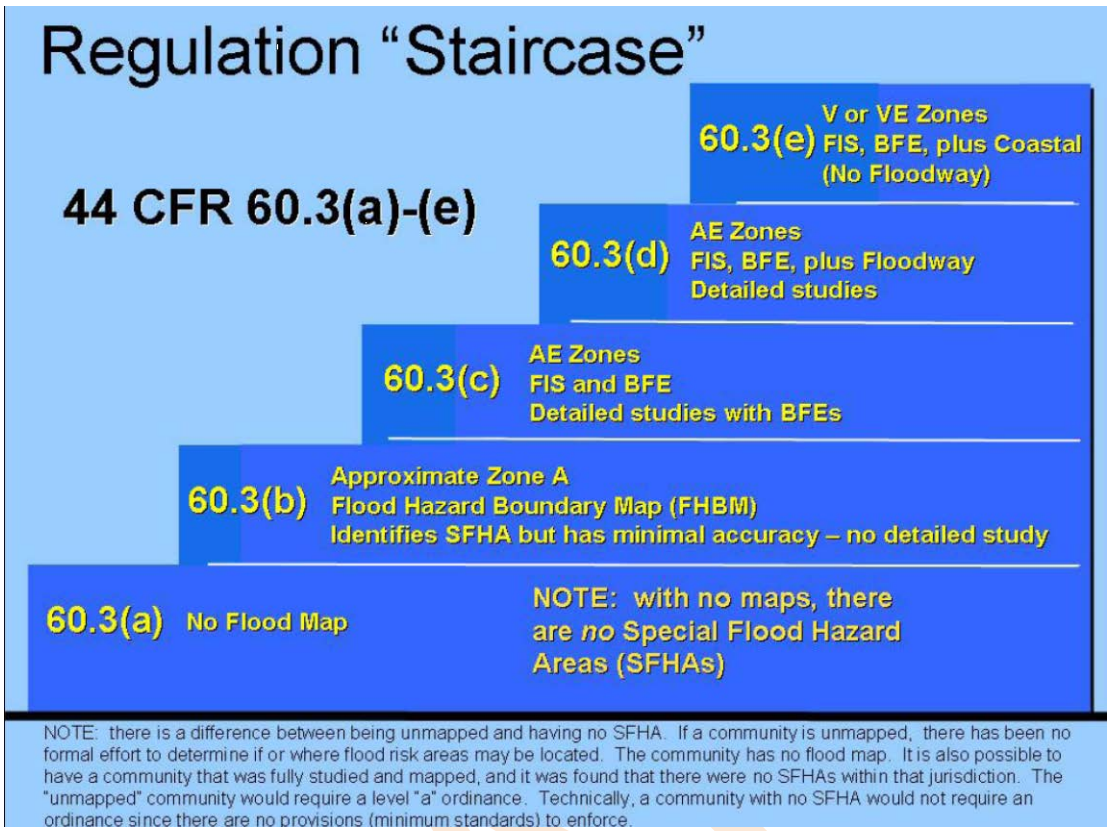

Previous Occurrences

There have been 15 flood events reported to the National Climatic Data Center since 2005-2015 in Ponca City. Approximately 2/3rds of flood damage producing events in Ponca City are due to short duration (less than 6 hours) of high intensity (greater than 2-3 inches per hour) rainfall even when the total rainfall for the day is less than 31/2 inches. Another source of flooding along the Main Channel of the Arkansas River will occur if the releases from Kaw Reservoir exceed 52,400 cubic feet per second. NCDC data from 2005 through 2015 can be found in Appendix D.

Various Previous Occurrences For Flooding Source: NCDC	
April 29, 2012	Widespread street flooding occurred from near Tonkawa to Ponca City. Several inches of water forced the closure of several city streets and county roads, and also caused some automobiles to stall. I-35 also had about 6 to 8 inches of water running over it north-northwest of Tonkawa. Some of the water entered residences on the west side of Ponca City.
March 20, 2007	Heavy rainfall totals of 3 to 7 inches over northern Kay County during the morning hours of March 20 produced flash flooding in the area. At 1200 CST, the Kay County emergency manager reported that flash flooding from along Turkey Creek had covered and closed Oklahoma State Highway 11 four miles northeast of Ponca City and one miles east of the intersection with U.S. Highway 77. The powerful forces of the floodwaters damaged a temporary low water crossing on OK State Highway 11, tearing a 10-foot-wide section from the highway and damaging culverts under the highway. A cold front moved into the northwest third of Oklahoma during the afternoon of the 19th before stalling during the early evening hours. As an upper level storm system approached the southern plains, moist air from the Gulf of Mexico began spreading north into Oklahoma. Scattered showers and thunderstorms formed over north central Oklahoma late on the 19th. Several of these thunderstorms became severe, producing large hail and flooding rainfall. After midnight, the stationary front became a warm front and lifted to the north. Additional thunderstorms developed in western and northwest Oklahoma. Several of these thunderstorms also became severe with large hail and very heavy rainfall. Flooding was reported in several areas of northern Oklahoma.
April 26, 2006	Heavy rainfall amounts of 2.5 to 5 inches produced flash flooding during the late evening of April 28 in Kay County where Ponca City law enforcement reported numerous residential roads closed due to high water on the west side of Ponca City at 9:05 pm CST.
September 18, 2002	Numerous streets were covered with water. A large line of strong to severe thunderstorms developed over western Oklahoma during the late afternoon of the 18th and moved eastward as the evening progressed. Mangum, in Greer County, sustained structural damage inside the city limits, and there were two, brief, weak tornadoes verified over northern Oklahoma. One tornado formed near Nash in Grant County, while the other formed near Braman in Kay County. Both tornadoes were rated F0.

Flooding Incidents in Ponca City	
Community	**Incidents**
Ponca City	15
Total	15

Probability of Future Events

Given the history of flood events in Ponca City the probability method was used and it was determined that a flood event in the city is **Highly Likely**. It is **Unlikely** for the Ponca City School District #71. See Hazard Probability Matrix for the risk of all the communities in the city on page 37.

Vulnerability

Floods pose a risk to any low-lying areas or neighborhoods near watersheds and tributaries. As stated before, highways may be shut down due to high water or schools could be closed. Any home or business could be at risk from a heavy downpour where water rises quickly. Septic systems tend to fail during floods and could cause backup into homes. Motorists are at risk as well because of failure to stop when water covers the road. See Types and Numbers by Hazard on page 119.

Impact

While floods are natural occurrences, and while they bring benefits from a biological and ecological perspective, they can leave a wave of damage to crops, residences, businesses and public infrastructure. Floods can result in significant economic loss from disruptions to the operation of business and government.

***Property Damage*:** Property damage includes the damage to homes, businesses or personal property and is the most recognized impact of flooding. While some sites may include a single structure, other areas include entire subdivisions or neighborhoods.

***Public Health and Safety**:* Homes and businesses not directly flooded may be impacted by lost utilities or flooded roads. Many septic systems fail during floods, while in other cases sewer systems may backup into basements. Both can make structures unusable for a period of time after the flood has receded and may result in public health risks.
Examples of several additional sources of public health risk during and after a flood event include: flooded garbage, disposal of tainted foods and disposal of damaged containers, electrocution through standing water until electrical power supply is disconnected, electrocution by discharge of capacitors in most household appliances even after disconnection of the electrical power supply to the structure, gas explosions due to pilot lights being quenched by flood waters and subsequent accumulation of natural gas then ignition by a spark, slips and falls by walking on an slick wet surface that cannot be seen due to submergence with flood waters, puncture wounds from stepping on sharp debris hidden by flood waters and subsequent debris, and injuries from wild animals and pets dislocated and stressed by flood waters. Household waste, commercial chemicals and biological contaminants associated with flood waters, such as *e coli* bacteria, could be distributed causing a risk. Flooding is also frequently associated with interruption of power supply causing spoilage of refrigerated foods

6 inches of flowing water can sweep a person off their feet and a horizontal person with as little as 1 foot/second water velocity can carry a person along with floodwaters. That person trapped in only 1 foot/second of water velocity will probably be unable to remove themselves from the stream without assistance from others.

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Transportation: Road blockages and congestion can cut off access to homes and businesses. Closed bridges and roads could cause traffic snarls that extend the flood impact well beyond the flooded area. These concerns result in missed work, extra transportation costs and reduced commerce.

Flooding can result in hazardous driving conditions, which could cause loss of life, when vehicles are driven or swept into floodwaters. As little as 12 inches of standing water over roadways can stall many vehicles. Only 18 inches of flowing water can sweep most vehicles off roadways. The driving hazard is also increased due to traffic congestion, interruption of traffic signals, and infrastructure damage to roadways and bridges during a flood and afterwards during repairs.

Critical Facilities: The flooding of critical facilities usually represents a loss of necessary emergency services to the community. The most common critical facilities that may be affected by flooding are: emergency operations centers, police and fire stations, hospitals, nursing homes, schools, highway departments, public works facilities, and utility companies. Many of these facilities employ staff that is vital for flood fighting and recovery. Although the problem is not widespread, the loss of critical facility services may have a significant community impact. Critical facilities are therefore a high priority for flood protection.

In addition to protecting the actual buildings, access to the facility over local roads and bridges must also be maintained for the facilities to operate effectively. Examples of public works facilities at risk from flooding include water and wastewater treatment plants. These treatment plants are often located in floodplains, which put them at risk during severe flood events. If a water supply becomes contaminated, water must be brought into the community until dependable service can be restored. If wastewater treatment plants become flooded, there is a risk of raw sewage entering streams or rivers.

Social and personal impacts of flooding can be devastating. In addition to the loss of possessions and building damage, frequently the victim will have time lost from their employment to allow for clean-up and repair. Loss of personal possessions and property, combined with the stresses of clean-up and repairs, can have a significant psychological impact on flood victims.

Unique and Varied Risk

Flooding is unique and varied due to the fact that following previous occurrences, it can be predicted where this hazard will execute damage. According to FEMA flood maps, it is determined that homes in Zone AE and shaded Zone X will experience flood damage. It can be assumed that these structures have and will have a risk of flooding; however, any building or roadway can be damaged in a flood event. As always, during a flood, lives are at the most critical risk. The Ponca City FIRM maps are located at the end of the flooding profile. Ponca City has ten repetitive flood loss properties listed with FEMA National Flood Insurance Program (NFIP). Ponca City is a participant in the NFIP and to remain compliant, follows the rules and regulations of the program. The following table shows the communities and participation or non-participation in the NFIP. The CPRI Index for Flooding is 3.5.

National Flood Insurance Program

Communities in Ponca City in the NFIP							
CID	Community	County	Init FHMB Identified	Init FIRM Identified	Current Eff Map Date	Reg Emer Date	Tribal
400080#	PONCA CITY, CITY OF	Kay County	02/01/74	07/02/80	09/25/09(>)	07/02/80	NO
	Ponca City Public Schools	N/A					

Figure 18: NFIP Participation (Table)

The National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS:

1. Reduce flood losses;
2. Facilitate accurate insurance rating; and
3. Promote the awareness of flood insurance

For CRS participating communities, flood insurance premium rates are discounted in increments of 5%; i.e., a Class 1 community would receive a 45% premium discount, while a Class 9 community would receive a 5% discount (a Class 10 is not participating in the CRS and receives no discount). The CRS classes for local communities are based on 18 creditable activities, organized under four categories:

1. Public Information,
2. Mapping and Regulations,
3. Flood Damage Reduction, and
4. Flood Preparedness.

Currently the city of Ponca City was approved in May of 2014 by FEMA Nation Flood Insurance Program's Community Rating System (CRS) with a Class 5 rating which qualifies the community for a 25% discount on flood insurance. The following were submitted to the NFIP to be approved in the CRS program:

1. Activity 310 Elevation Certificates
2. Activity 320 Map Information Service
3. Activity 330 Outreach Projects
4. Activity 340 Hazard Disclosure
5. Activity 350 Flood Protection Information
6. Activity 360 Flood Protection Assistance
7. Activity 410 Additional Flood Data
8. Activity 420 Open Space Preservation
9. Activity 430 Higher Regulatory Standards
10. Activity 440 Flood Data Maintenance
11. Activity 450 Stormwater Maintenance
12. Activity 510 Floodplain Management Planning
13. Activity 530 Flood Protection
14. Activity 540 Drainage System Maintenance
15. Activity 610 Flood Warning Program
16. Activity 630 Dam Safety

Once per year a report must be submitted to ISO/FEMA reporting on the status of compliance with the CRS program and ISO CRS specialists must perform a site visit and inspection to confirm compliance by Ponca City. OWRB/FEMA Community Assistance Contacts and Community Assistance Visits to verify compliance with the requirements of the National Flood Insurance Program are in addition to the CRS compliance activities.

Repetitive Loss Analysis

A high priority in Oklahoma and nationwide is the reduction of losses to repetitive loss structures. These structures strain the National Flood Insurance Fund. They increase the NFIP's annual losses and the need for borrowing and, more importantly, they drain resources needed to prepare for catastrophic events. The NFIP defines a repetitive loss property as "any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. At least two of the claims must be more than 10-days apart."

The Table below illustrates the number of Ponca City's repetitive loss properties.

Check with Johnny

Community Name	Address Line	Mitigated?	Insured?	Total Paid	Losses	Comm Nbr
PONCA CITY*	Property #1	NO	No	$14,849.36	2	140007
PONCA CITY*	Property #2	NO	No	$26,641.33	2	0041133
PONCA CITY*	Property #3	NO	Yes	$34,428.48	2	0055774
PONCA CITY*	Property #4	NO	Yes	$18,826.06	2	0117981
PONCA CITY*	Property #5	NO	Yes	$64,977.78	3	0118479
PONCA CITY*	Property #6	NO	No	$7,505.29	2	0077927
PONCA CITY*	Property #7	NO	Yes	$36,843.96	4	0054008
PONCA CITY*	Property #8	NO	Yes	$13,975.49	3	0099459
PONCA CITY*	Property #9	NO	Yes	$52,073.78	5	0118638
PONCA CITY*	Property #10	NO	Yes	$24,565.12	2	0172602

Figure 19: Repetitive Loss (Table)

As a Class 5 CRS Community the City of Ponca City must annually reevaluate the Repetitive Loss list and prepare, implement, and update a Repetitive Loss Property Mitigation Plan. That was prepared and included in the Ponca City Stormwater Master Plan adopted by Ordinance No. 6106 on September 28, 2009. The Ponca City Stormwater Master Plan is an extremely lengthy companion document to the Hazard Mitigation Plan. The flooding mitigation projects presented herein were developed from the Ponca City Stormwater Master Plan.

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Ponca City FIRM Maps

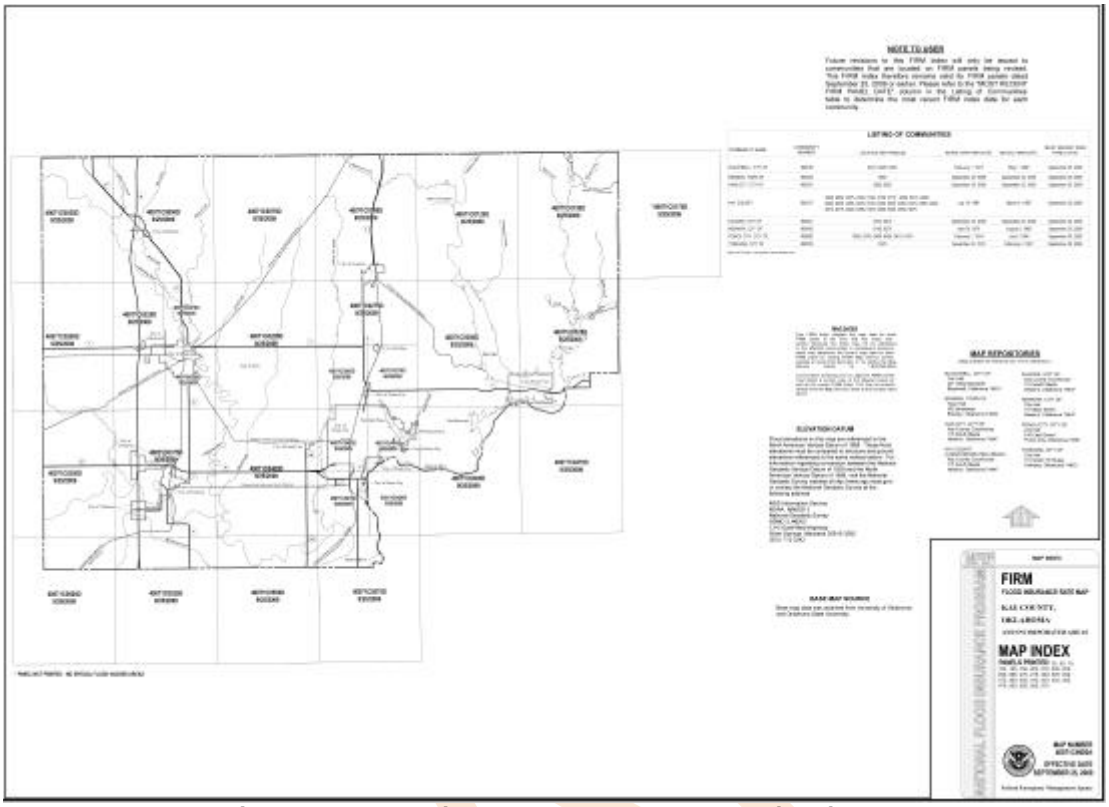


Figure 20: Ponca City FIRM Maps 40071CIND0A (Map)

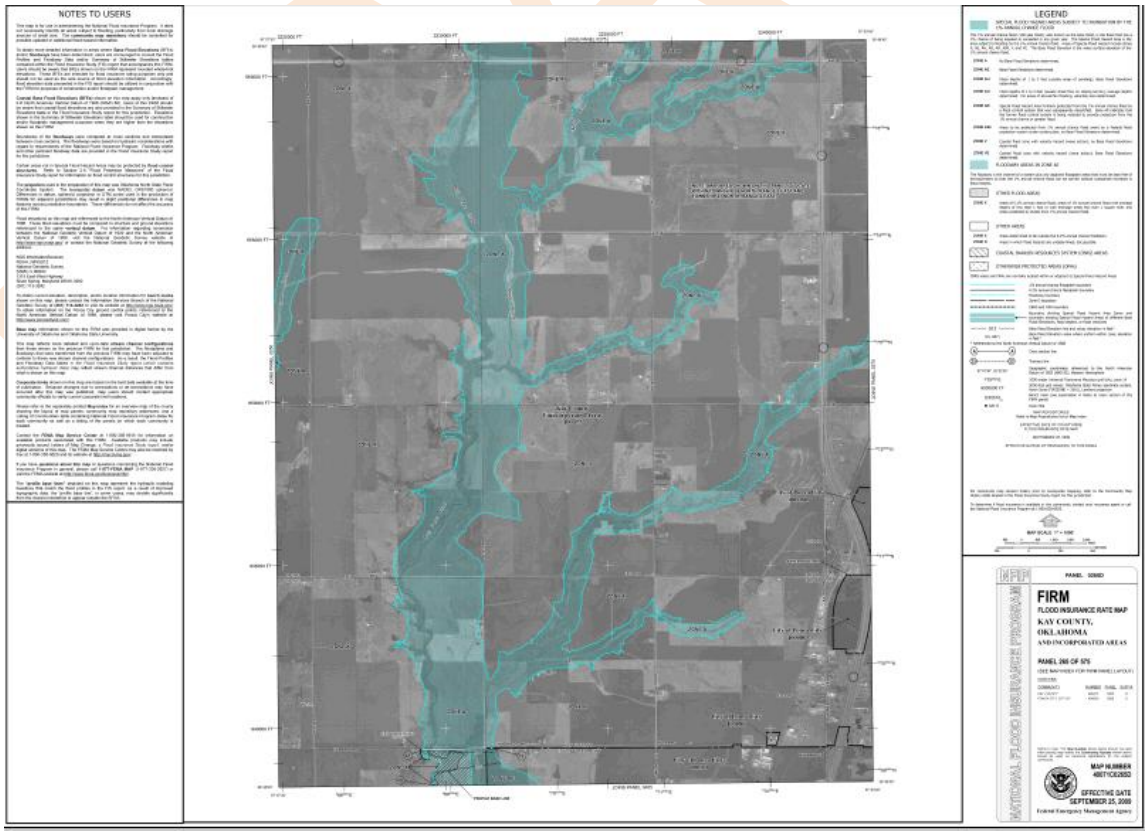


Figure 21: Ponca City FIRM Maps 40071C0265D (Map)

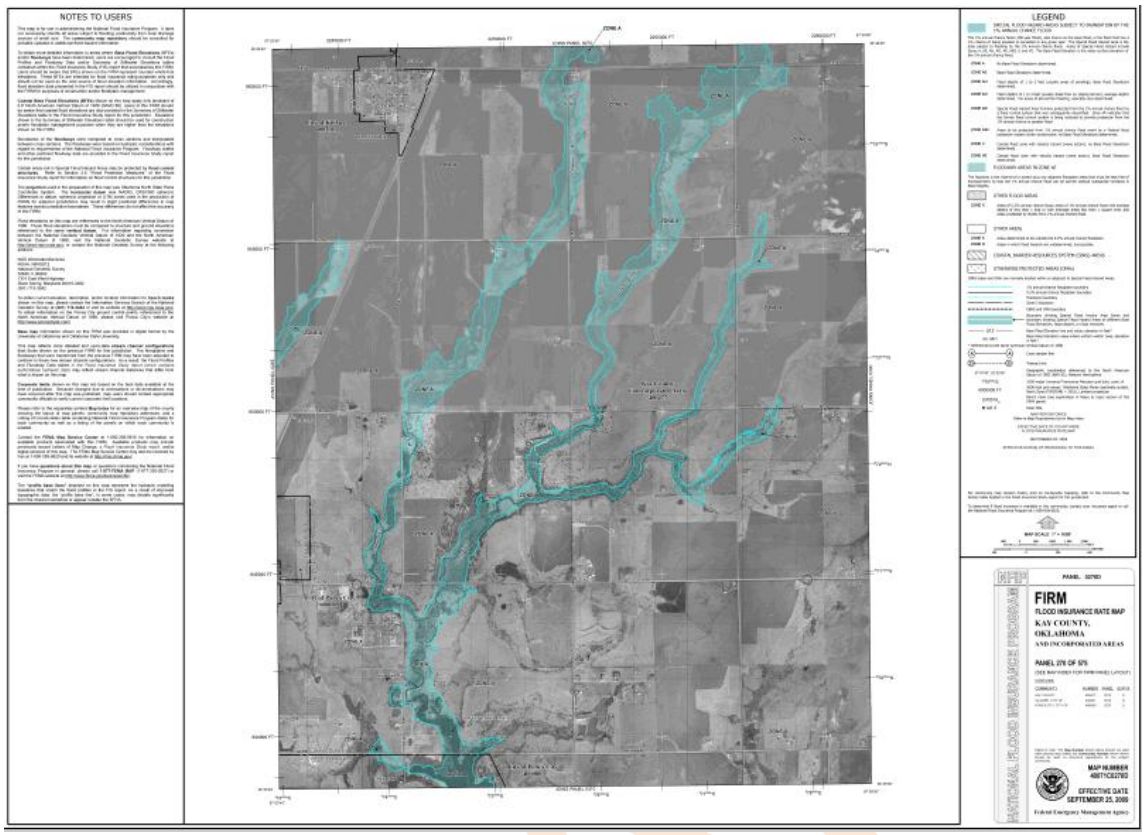


Figure 22: Ponca City FIRM Maps 40071C0270D (Map)

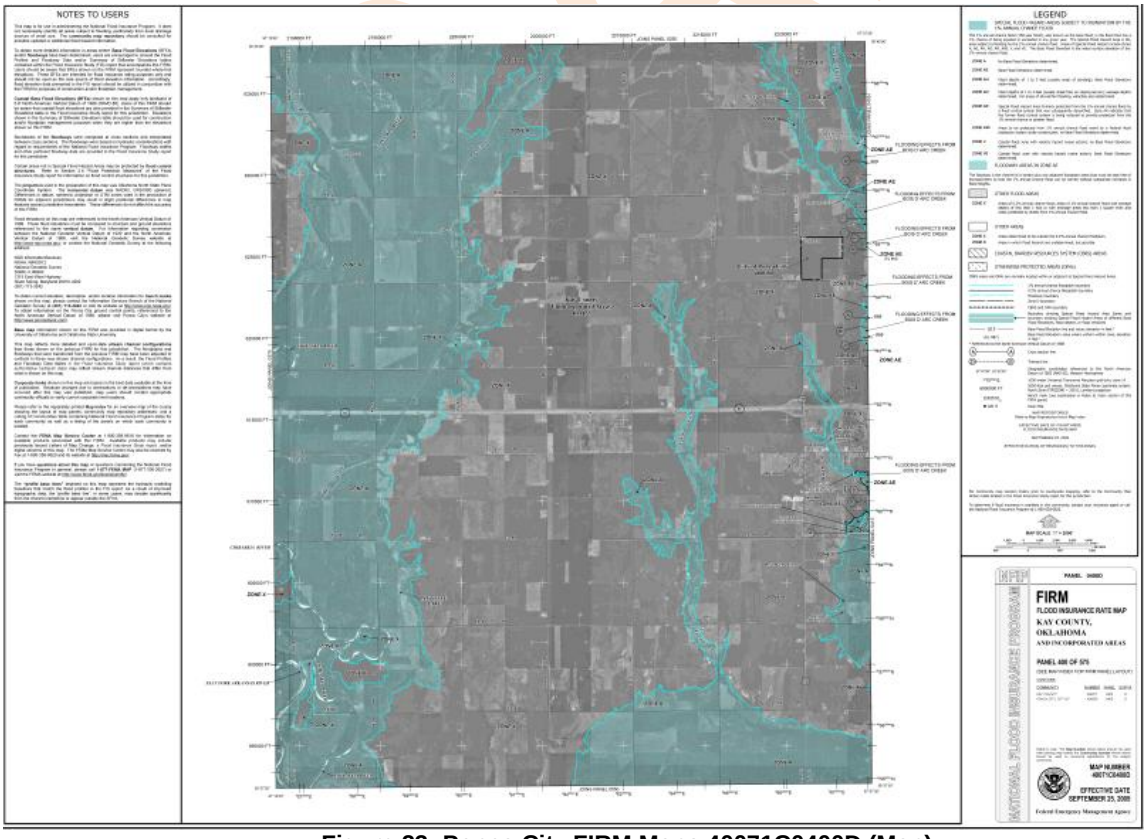


Figure 23: Ponca City FIRM Maps 40071C0400D (Map)

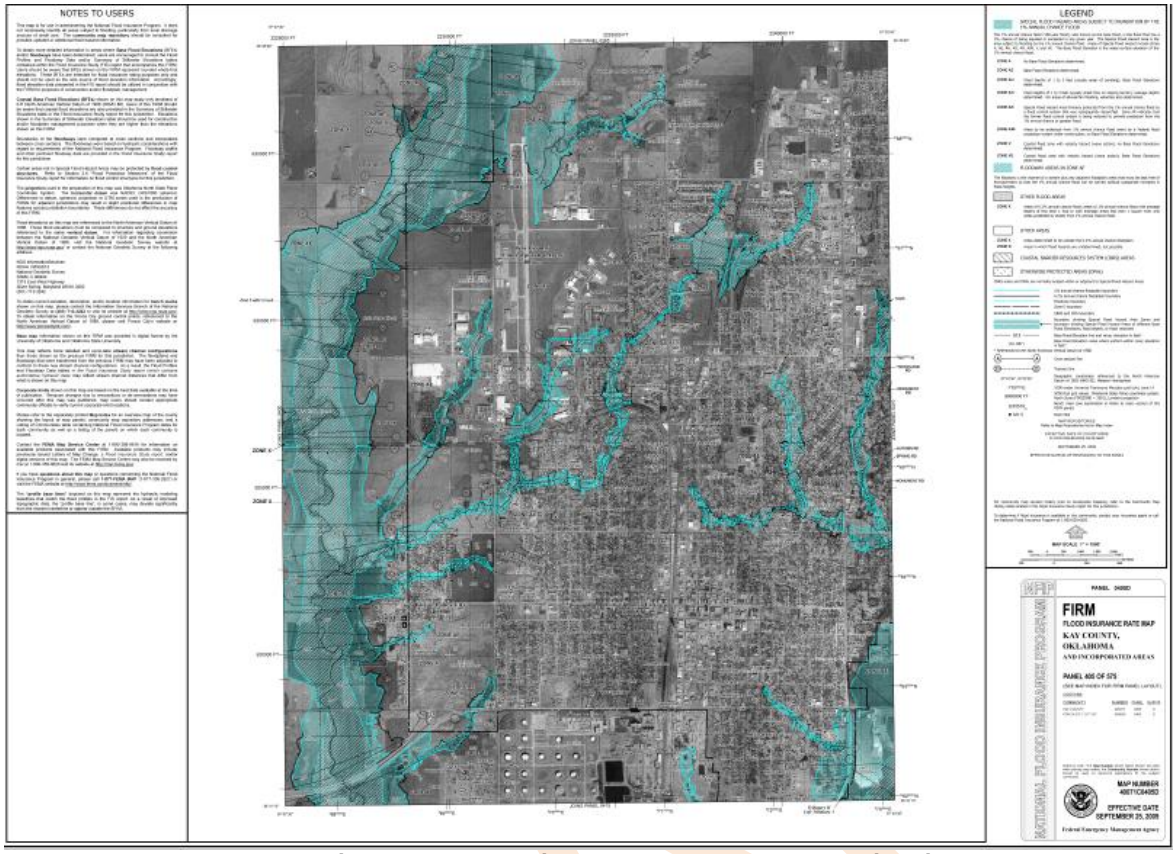


Figure 24: Ponca City FIRM Maps 40071C0405D (Map)

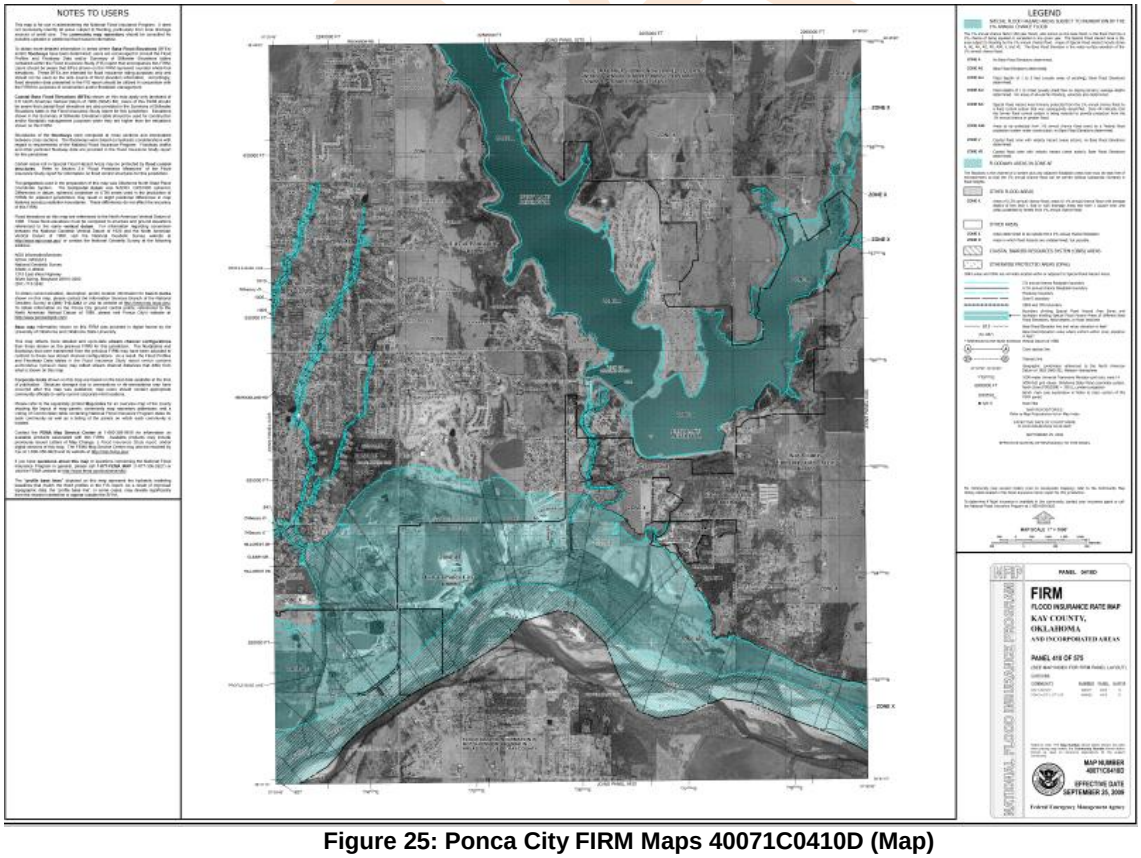


Figure 25: Ponca City FIRM Maps 40071C0410D (Map)

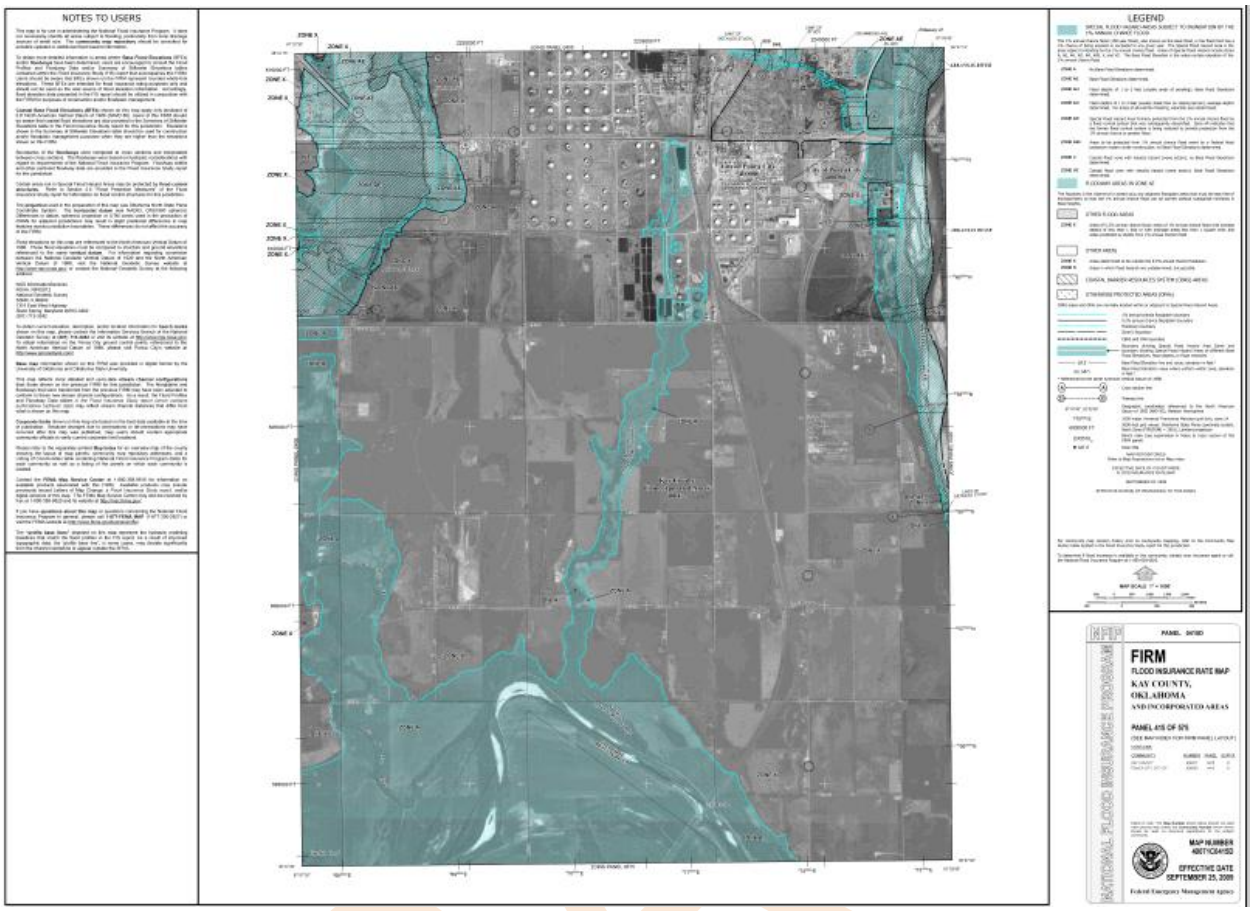
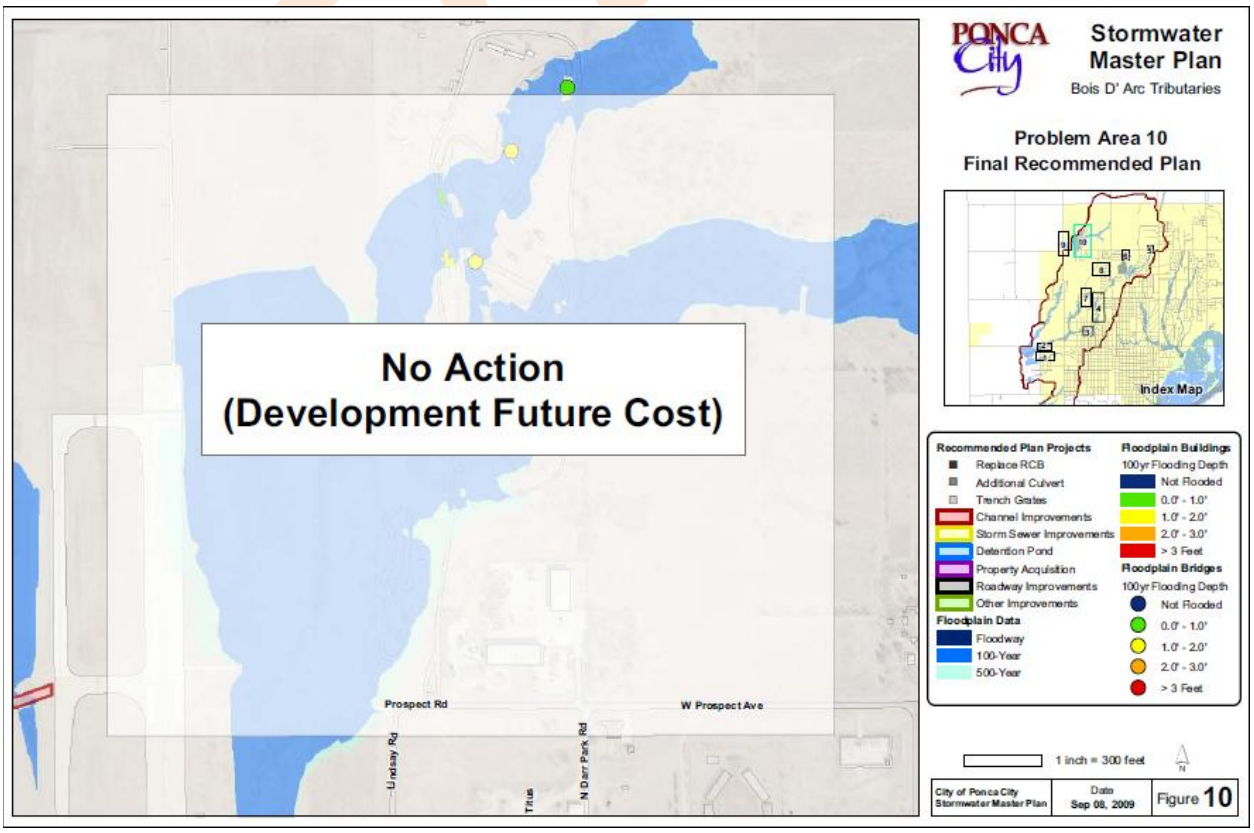
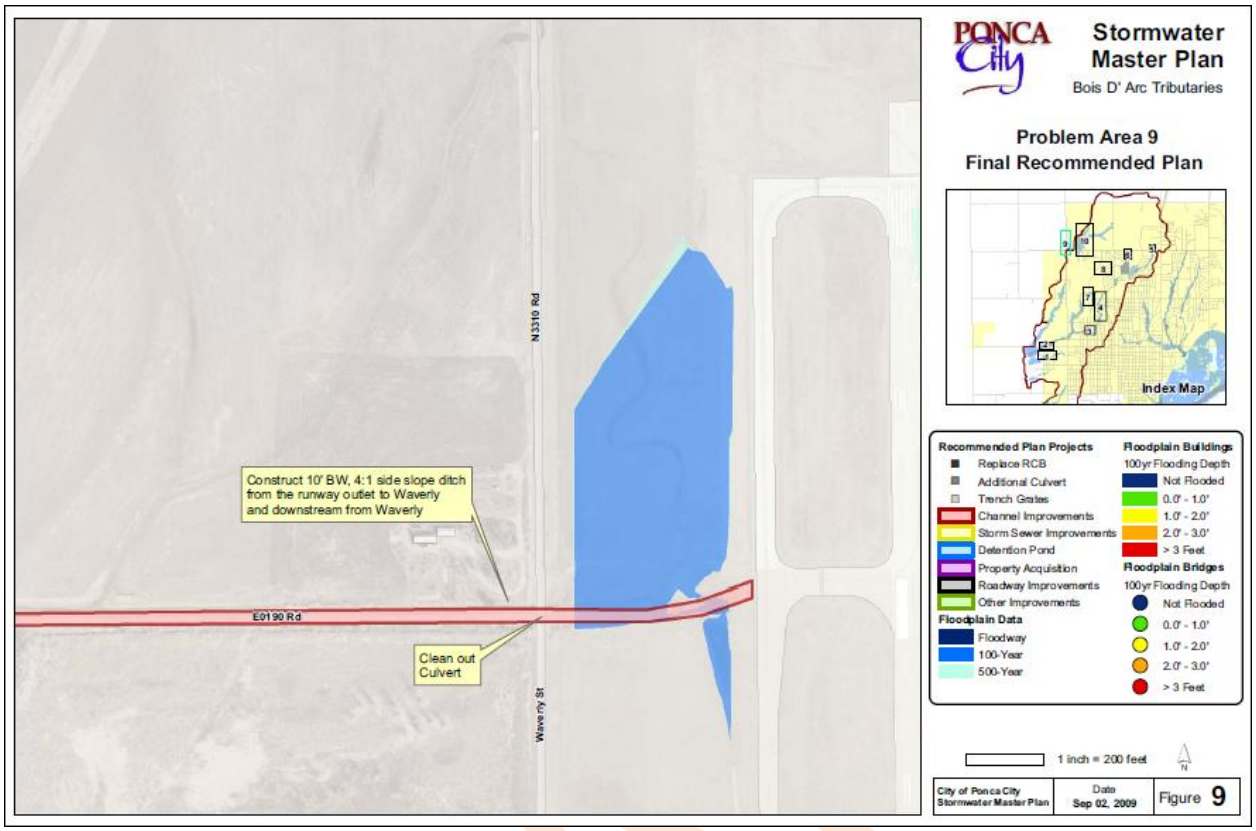
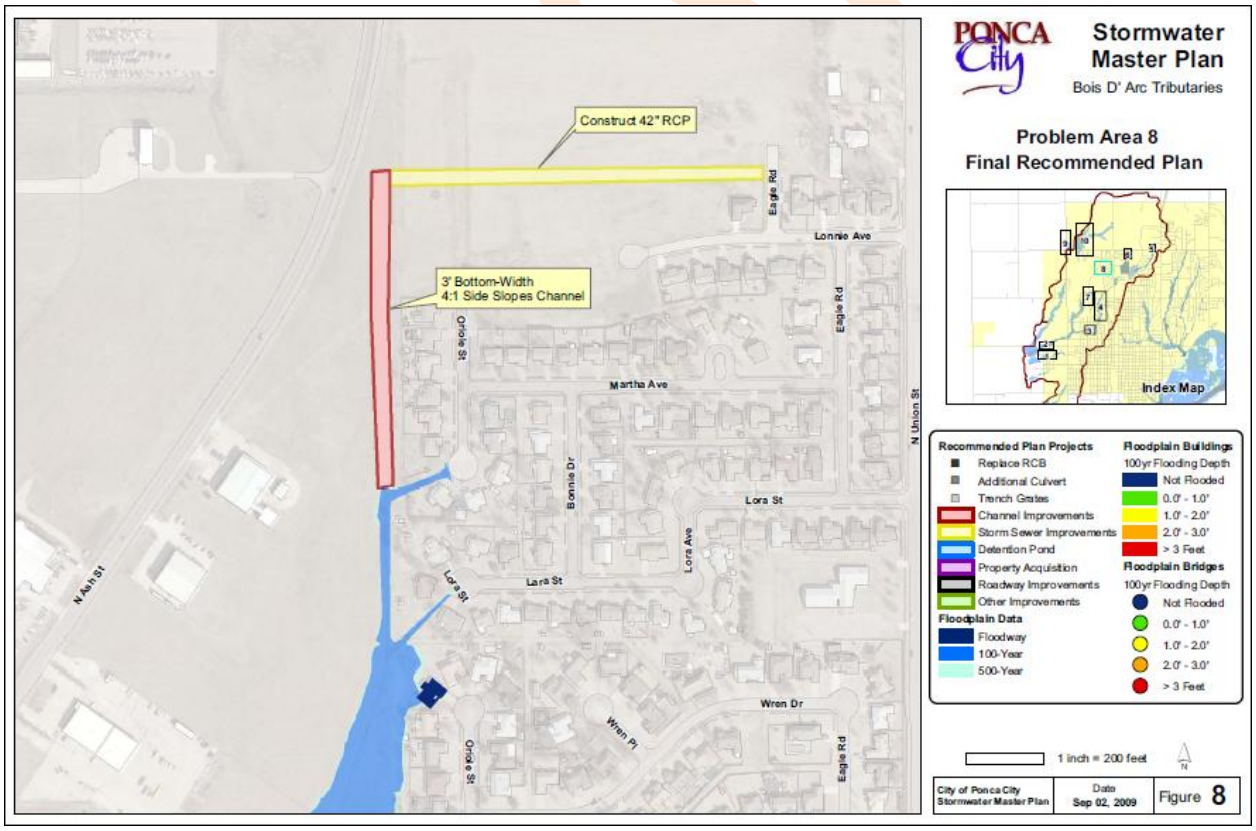
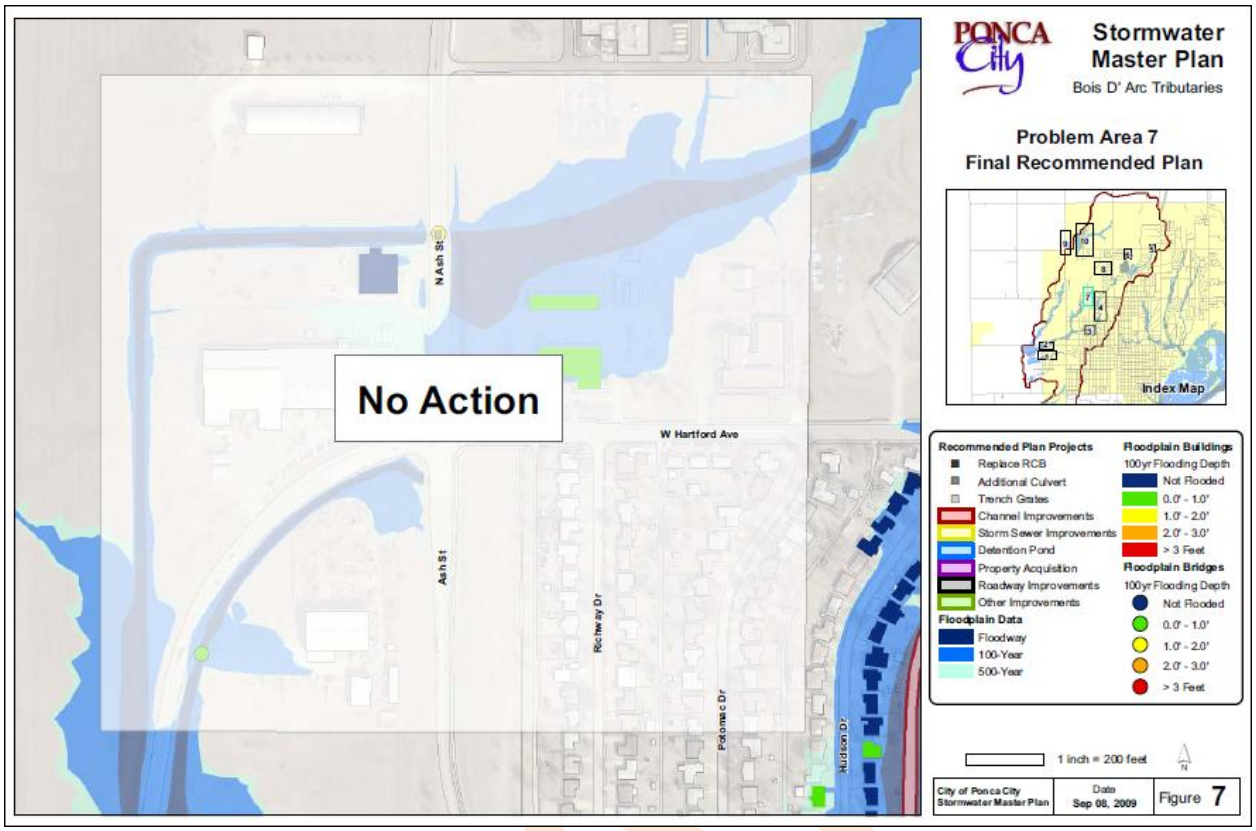


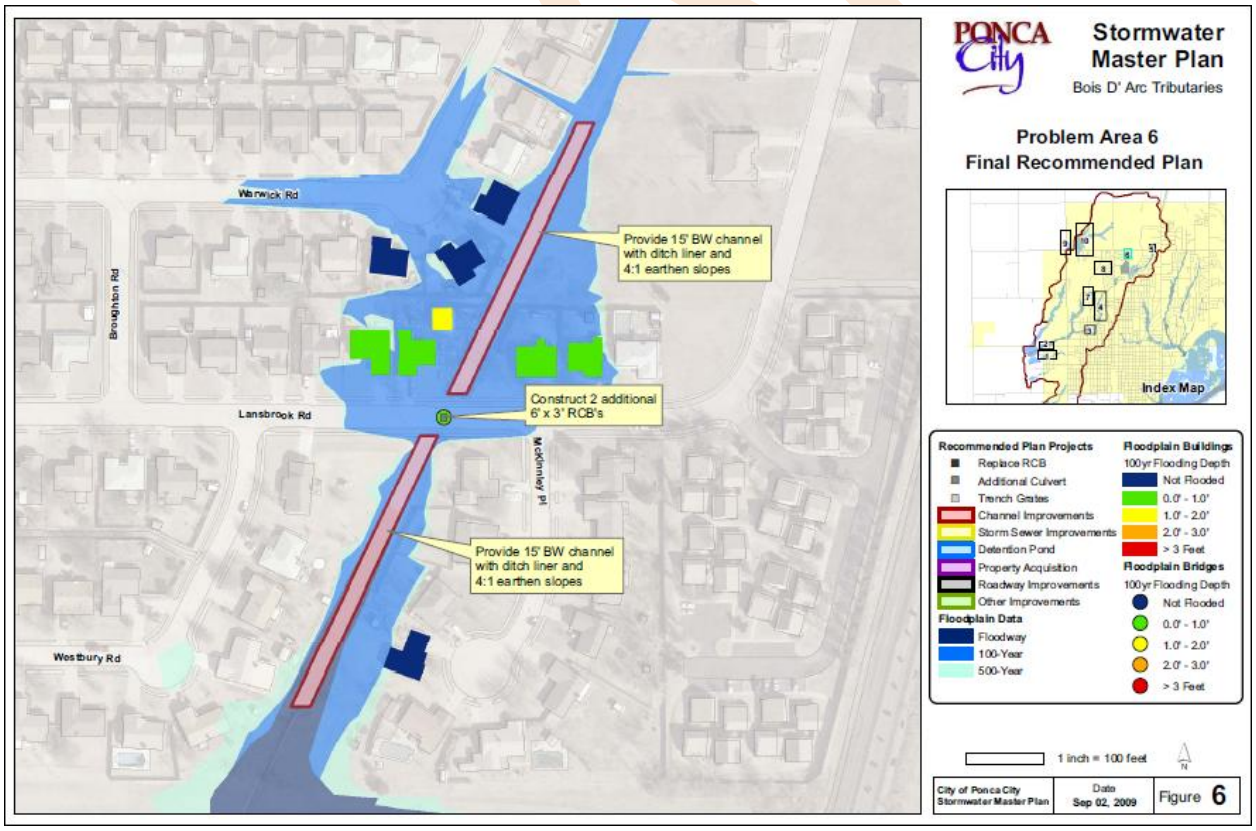
Figure 26: Ponca City FIRM Maps 40071C0415D (Map)

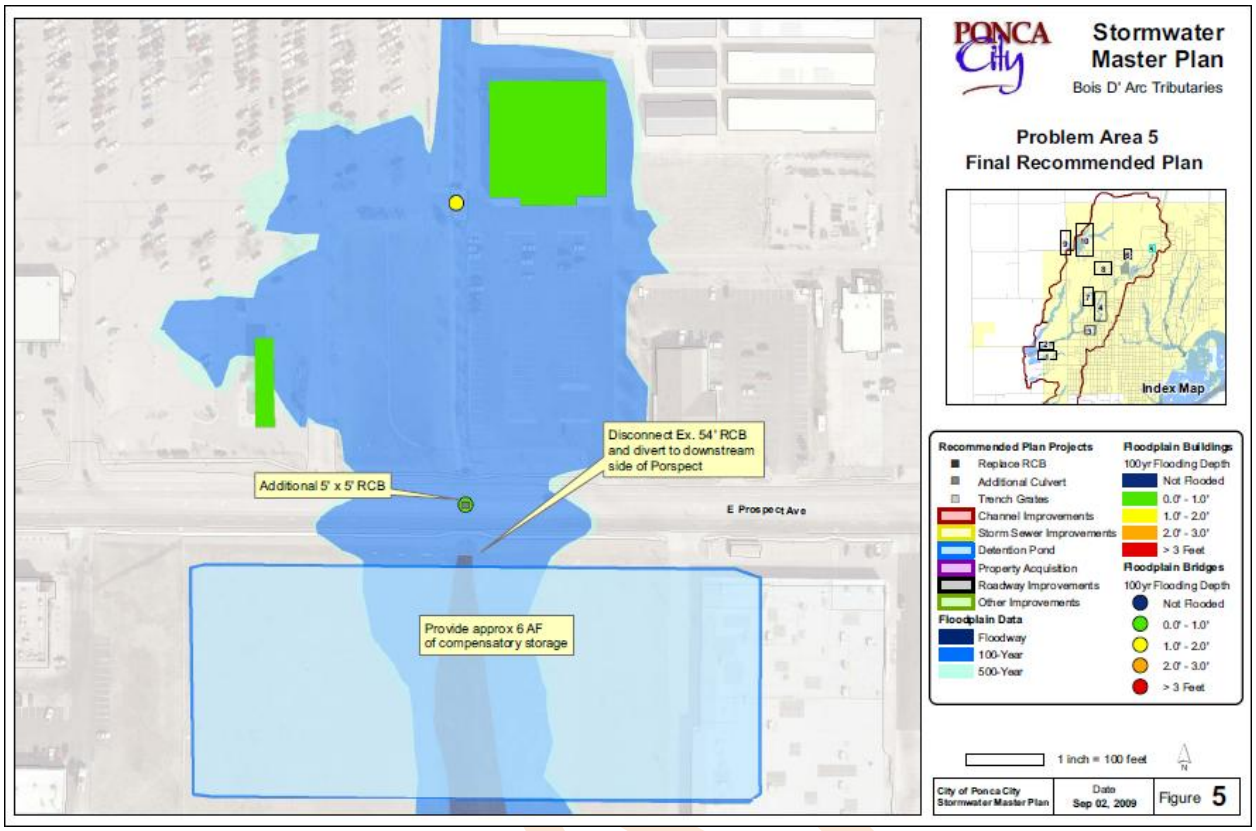


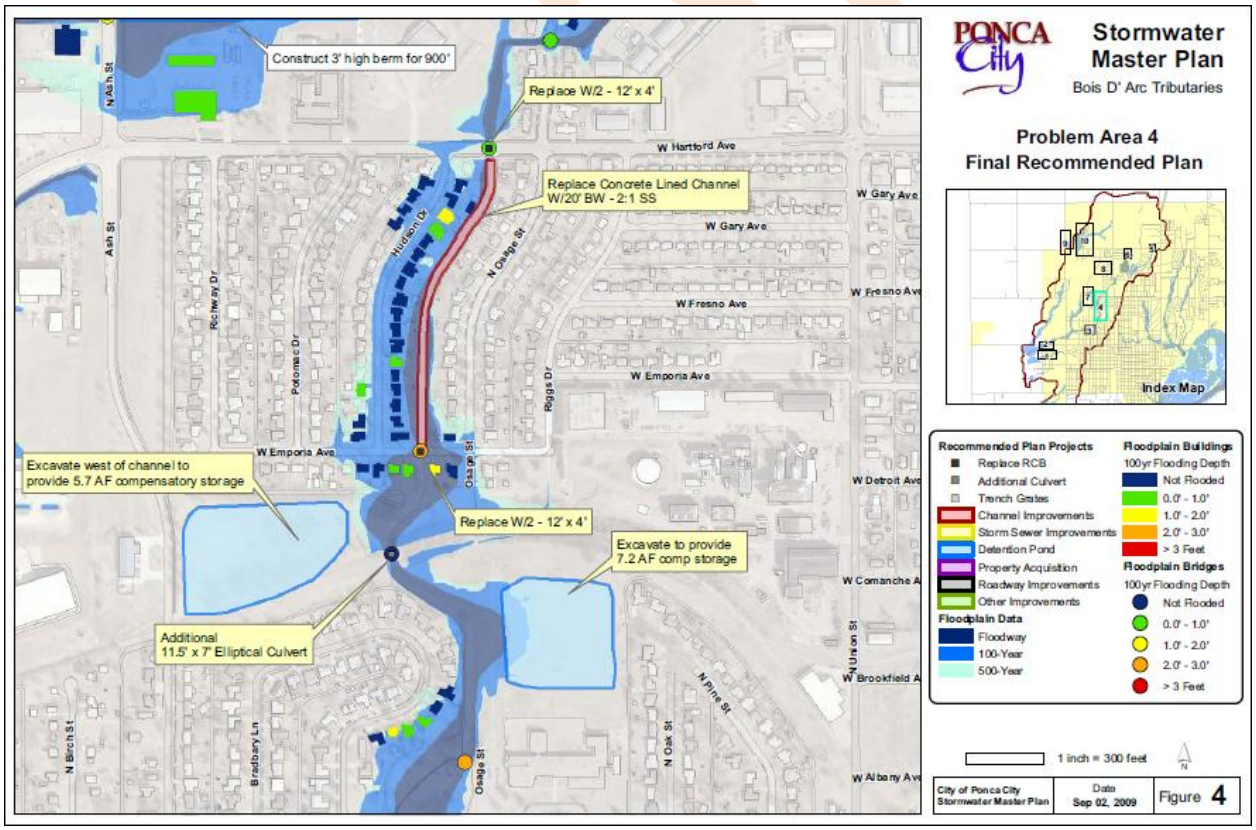

Stormwater Master Plan
Bois D' Arc Tributaries
Problem Area 9
Final Recommended Plan
Index Map
Construct 10' BW, 4:1 side slope ditch from the runway outlet to Waverly and downstream from Waverly
Clean out Culvert
N3310 Rd
E0190 Rd
Waverly St
Recommended Plan Projects
Replace RCB
Additional Culvert
Trench Grates
Channel Improvements
Storm Sewer Improvements
Detention Pond
Property Acquisition
Roadway Improvements
Other Improvements
Floodplain Data
Floodway
100-Year
500-Year
Floodplain Buildings
100yr Flooding Depth
Not Flooded
0.0' - 1.0'
1.0' - 2.0'
2.0' - 3.0'
> 3 Feet
Floodplain Bridges
1 inch = 200 feet
City of Ponca City Stormwater Master Plan
Date Sep 02, 2009
Figure 9

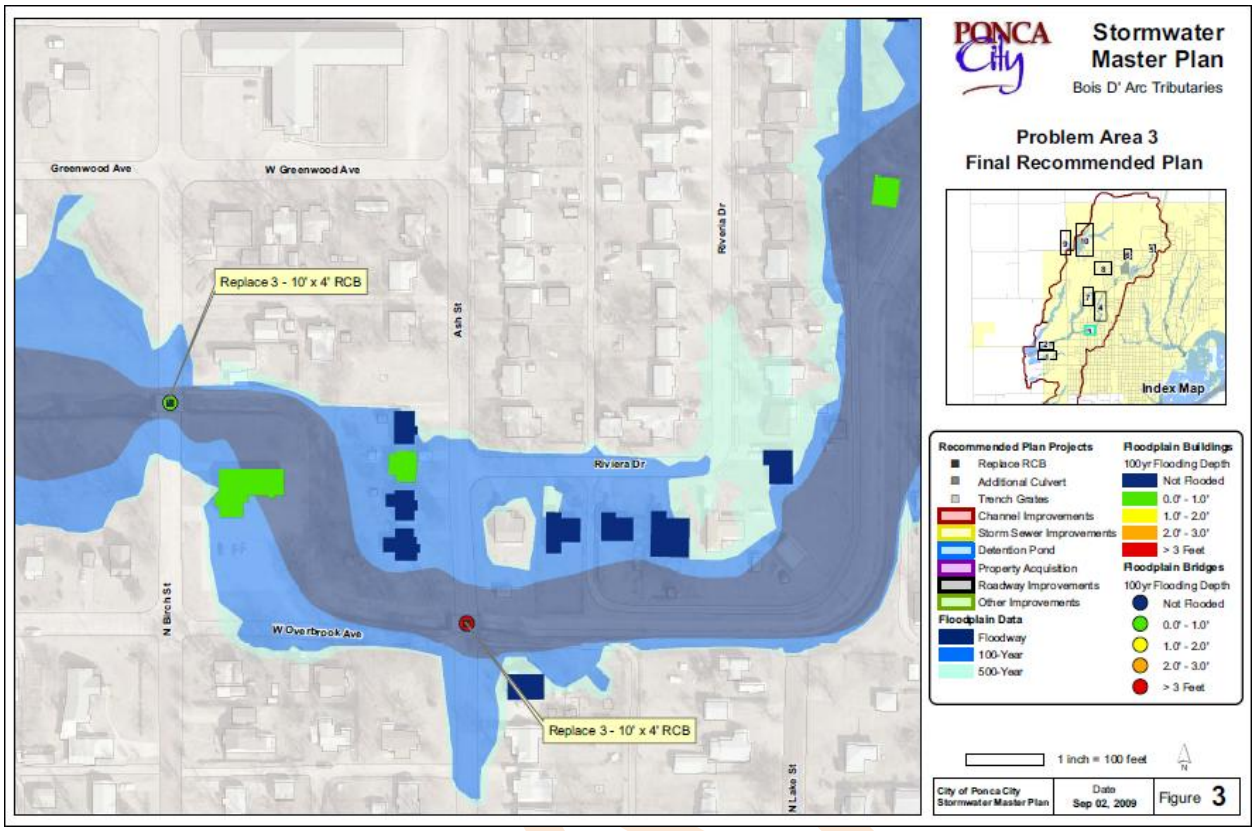

Stormwater Master Plan
Bois D' Arc Tributaries
Problem Area 8
Final Recommended Plan
Index Map
Construct 42" RCP
3' Bottom-Width 4:1 Side Slopes Channel
Eagle Rd
Lonnie Ave
Oriole St
Martha Ave
N Union St
Bonnie Dr
Lora St
Lora Ave
Lara St
N Main St
Wren Dr
Wren Pl
Recommended Plan Projects
Replace RCB
Additional Culvert
Trench Grates
Channel Improvements
Storm Sewer Improvements
Detention Pond
Property Acquisition
Roadway Improvements
Other Improvements
Floodplain Data
Floodway
100-Year
500-Year
Floodplain Buildings
100yr Flooding Depth
Not Flooded
0.0' - 1.0'
1.0' - 2.0'
2.0' - 3.0'
> 3 Feet
Floodplain Bridges
1 inch = 200 feet
City of Ponca City Stormwater Master Plan
Date Sep 02, 2009
Figure 8

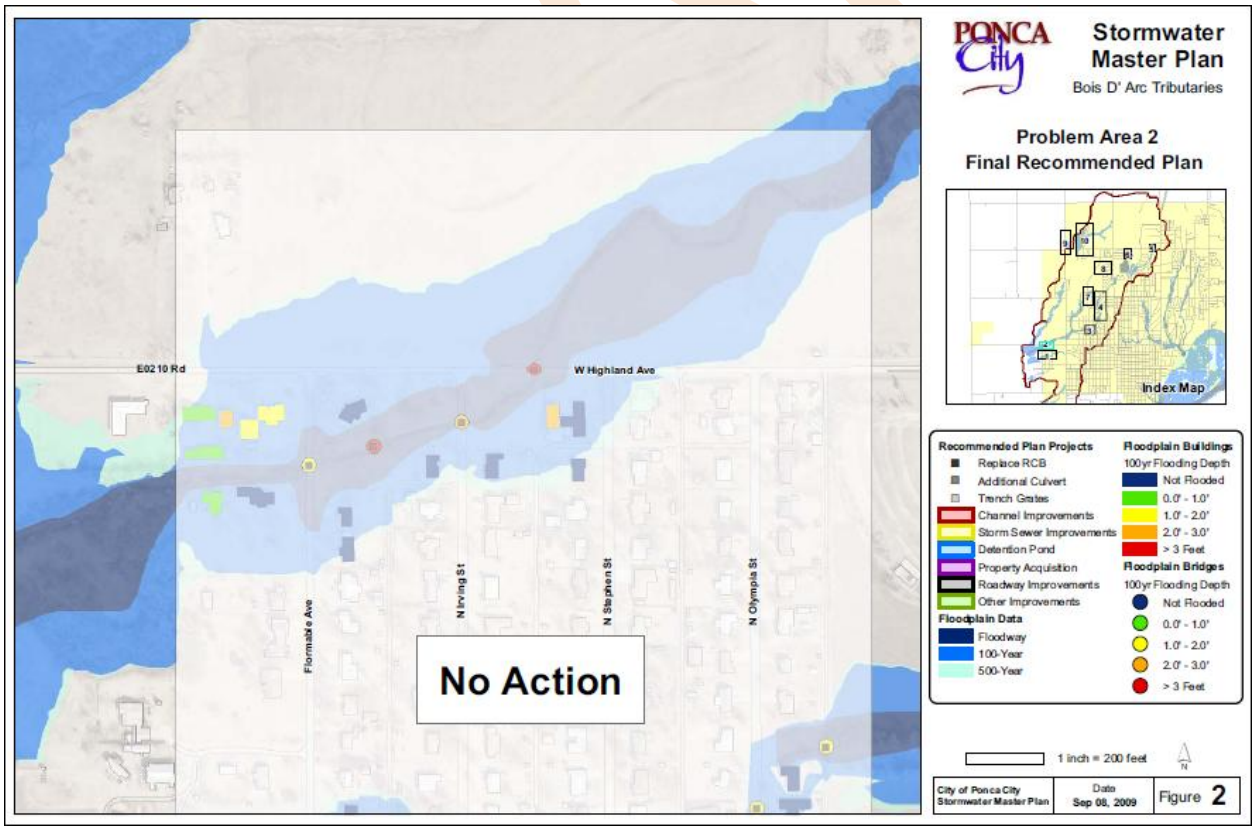

PONCA City
Stormwater Master Plan
Bois D' Arc Tributaries
Problem Area 7
Final Recommended Plan
Index Map
No Action
W Hartford Ave
N Ash St
Ash St
Richway Dr
Potomac Dr
Hudson Dr
Recommended Plan Projects
Replace RCB
Additional Culvert
Trench Grates
Channel Improvements
Storm Sewer Improvements
Detention Pond
Property Acquisition
Roadway Improvements
Other Improvements
Floodplain Data
Floodway
100-Year
500-Year
Floodplain Buildings
100yr Flooding Depth
Not Flooded
0.0' - 1.0'
1.0' - 2.0'
2.0' - 3.0'
> 3 Feet
Floodplain Bridges
100yr Flooding Depth
Not Flooded
0.0' - 1.0'
1.0' - 2.0'
2.0' - 3.0'
> 3 Feet
1 inch = 200 feet
City of Ponca City Stormwater Master Plan
Date Sep 08, 2009
Figure 7

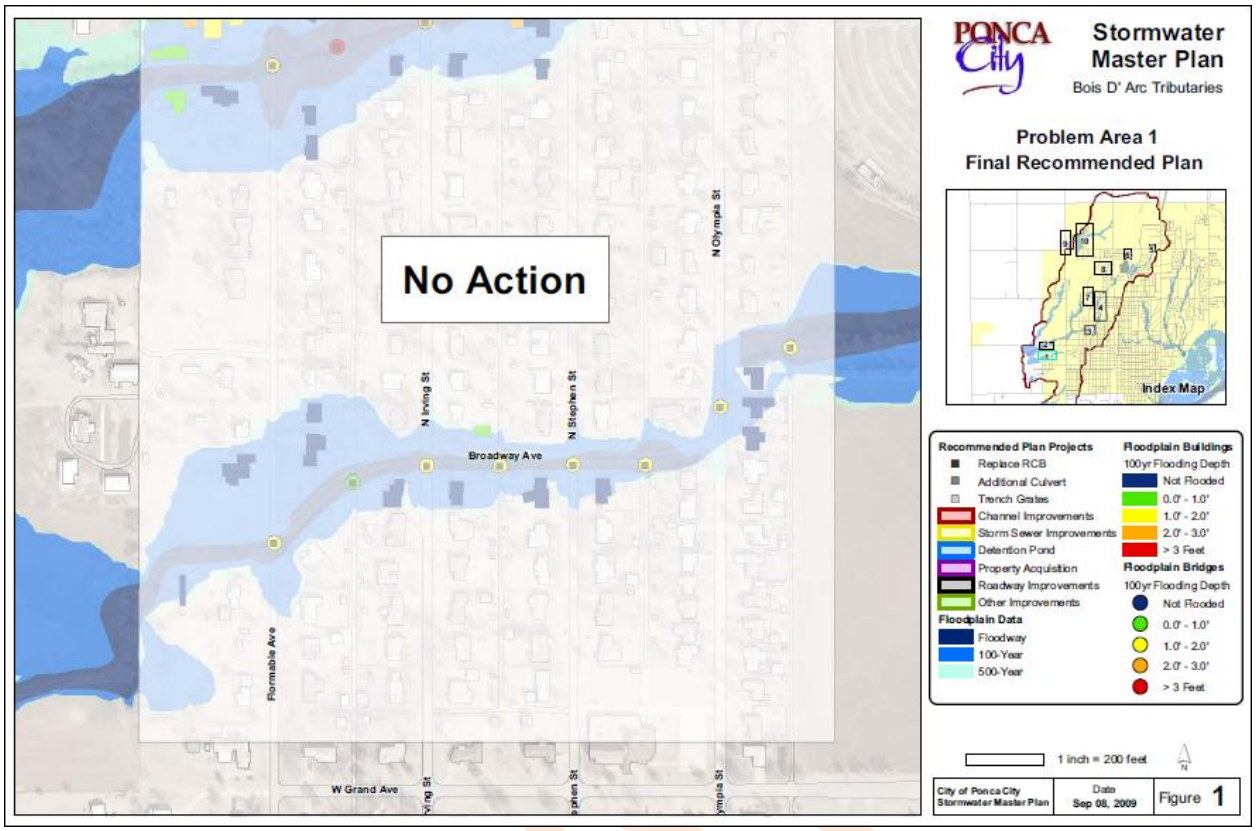

PONCA City
Stormwater Master Plan
Bois D' Arc Tributaries
Problem Area 6
Final Recommended Plan
Index Map
Warwick Rd
Broughton Rd
Lansbrook Rd
Wadsworth Pl
Westbury Rd
Provide 15' BW channel with ditch liner and 4:1 earthen slopes
Construct 2 additional 6' x 3' RCB's
Provide 15' BW channel with ditch liner and 4:1 earthen slopes
Recommended Plan Projects
Replace RCB
Additional Culvert
Trench Grates
Channel Improvements
Storm Sewer Improvements
Detention Pond
Property Acquisition
Roadway Improvements
Other Improvements
Floodplain Data
Floodway
100-Year
500-Year
Floodplain Buildings
100yr Flooding Depth
Not Flooded
0.0' - 1.0'
1.0' - 2.0'
2.0' - 3.0'
> 3 Feet
Floodplain Bridges
100yr Flooding Depth
Not Flooded
0.0' - 1.0'
1.0' - 2.0'
2.0' - 3.0'
> 3 Feet
1 inch = 100 feet
City of Ponca City Stormwater Master Plan
Date Sep 02, 2009
Figure 6


PONCA City
Stormwater Master Plan
Bois D' Arc Tributaries
Problem Area 5
Final Recommended Plan
Index Map
Disconnect Ex. 54" RCB and divert to downstream side of Porspect
Additional 5' x 5' RCB
E Prospect Ave
Provide approx 6 AF of compensatory storage
Recommended Plan Projects
Replace RCB
Additional Culvert
Trench Grates
Channel Improvements
Storm Sewer Improvements
Detention Pond
Property Acquisition
Roadway Improvements
Other Improvements
Floodplain Data
Floodway
100-Year
500-Year
Floodplain Buildings
100yr Flooding Depth
Not Flooded
0.0' - 1.0'
1.0' - 2.0'
2.0' - 3.0'
> 3 Feet
Floodplain Bridges
100yr Flooding Depth
Not Flooded
0.0' - 1.0'
1.0' - 2.0'
2.0' - 3.0'
> 3 Feet
1 inch = 100 feet
City of Ponca City Stormwater Master Plan
Date Sep 02, 2009
Figure 5


PONCA City
Stormwater Master Plan
Bois D' Arc Tributaries
Problem Area 4
Final Recommended Plan
Index Map
Construct 3' high berm for 900'
Replace W/2 - 12' x 4'
W Hartford Ave
Replace Concrete Lined Channel W/20' BW - 2:1 SS
W Gary Ave
W Fresno Ave
W Emporia Ave
Excavate west of channel to provide 5.7 AF compensatory storage
Replace W/2 - 12' x 4'
Excavate to provide 7.2 AF comp storage
Additional 11.5' x 7' Elliptical Culvert
W Detroit Ave
W Comanche Ave
W Brookfield Ave
W Albany Ave
N Ash St
N Birch St
N Oak St
N Pine St
N Union St
N Osage St
Osage St
Hudson Dr
Richway Dr
Potomac Dr
Riggs Dr
Bradbury Ln
Recommended Plan Projects
Replace RCB
Additional Culvert
Trench Grates
Channel Improvements
Storm Sewer Improvements
Detention Pond
Property Acquisition
Roadway Improvements
Other Improvements
Floodplain Data
Floodway
100-Year
500-Year
Floodplain Buildings
100yr Flooding Depth
Not Flooded
0.0' - 1.0'
1.0' - 2.0'
2.0' - 3.0'
> 3 Feet
Floodplain Bridges
100yr Flooding Depth
Not Flooded
0.0' - 1.0'
1.0' - 2.0'
2.0' - 3.0'
> 3 Feet
1 inch = 300 feet
City of Ponca City Stormwater Master Plan
Date Sep 02, 2009
Figure 4


Stormwater Master Plan
Bois D' Arc Tributaries
Problem Area 3
Final Recommended Plan
Greenwood Ave
W Greenwood Ave
Riviera Dr
Ash St
Replace 3 - 10' x 4' RCB
Riviera Dr
N Birch St
W Overbrook Ave
Replace 3 - 10' x 4' RCB
N Lake St
Index Map
Recommended Plan Projects
Replace RCB
Additional Culvert
Trench Grates
Channel Improvements
Storm Sewer Improvements
Detention Pond
Property Acquisition
Roadway Improvements
Other Improvements
Floodplain Data
Floodway
100-Year
500-Year
Floodplain Buildings
100yr Flooding Depth
Not Flooded
0.0' - 1.0'
1.0' - 2.0'
2.0' - 3.0'
> 3 Feet
Floodplain Bridges
100yr Flooding Depth
Not Flooded
0.0' - 1.0'
1.0' - 2.0'
2.0' - 3.0'
> 3 Feet
1 inch = 100 feet
City of Ponca City Stormwater Master Plan
Date Sep 02, 2009
Figure 3


Stormwater Master Plan
Bois D' Arc Tributaries
Problem Area 2
Final Recommended Plan
E0210 Rd
W Highland Ave
N Irving St
N Stephen St
N Olympia St
Flomaste Ave
No Action
Index Map
Recommended Plan Projects
Replace RCB
Additional Culvert
Trench Grates
Channel Improvements
Storm Sewer Improvements
Detention Pond
Property Acquisition
Roadway Improvements
Other Improvements
Floodplain Data
Floodway
100-Year
500-Year
Floodplain Buildings
100yr Flooding Depth
Not Flooded
0.0' - 1.0'
1.0' - 2.0'
2.0' - 3.0'
> 3 Feet
Floodplain Bridges
100yr Flooding Depth
Not Flooded
0.0' - 1.0'
1.0' - 2.0'
2.0' - 3.0'
> 3 Feet
1 inch = 200 feet
City of Ponca City Stormwater Master Plan
Date Sep 08, 2009
Figure 2


No Action
N Olympia St
N Irving St
N Stephen St
Broadway Ave
Formable Ave
W Grand Ave
PONCA City
Stormwater Master Plan
Bois D' Arc Tributaries
Problem Area 1
Final Recommended Plan
Index Map
Recommended Plan Projects
Replace RCB
Additional Culvert
Trench Grates
Channel Improvements
Storm Sewer Improvements
Detention Pond
Property Acquisition
Roadway Improvements
Other Improvements
Floodplain Data
Floodway
100-Year
500-Year
Floodplain Buildings
100yr Flooding Depth
Not Flooded
0.0' - 1.0'
1.0' - 2.0'
2.0' - 3.0'
> 3 Feet
Floodplain Bridges
100yr Flooding Depth
Not Flooded
0.0' - 1.0'
1.0' - 2.0'
2.0' - 3.0'
> 3 Feet
1 inch = 200 feet
N
City of Ponca City Stormwater Master Plan
Date
Sep 08, 2009
Figure 1

DRAFT

Hail

(The Ponca City and participating entities are equally at risk for this hazard.)

Description

Hail is more or less spherical balls of ice which fall from spring and summer thunderstorms. Hail forms as the result of small frozen raindrops being continuously recycled through multiple up and downdrafts. They continuously accumulate new layers of ice until they become so heavy that they can no longer be supported. Hail is not to be confused with sleet or frozen raindrops, which falls during winter storms.

Hail forms in strong thunderstorm clouds, particularly those with intense updrafts, high liquid water content, great vertical extent, large water droplets, and where a good portion of the cloud layer is below freezing (< 32 °F (0 °C)). The growth rate is maximized at about -13 °C (9 °F), and becomes vanishingly small much below -30 °C (-22 °F) as supercooled water droplets become rare. For this reason, hail is most common in midlatitudes during early summer where surface temperatures are warm enough to promote the instability associated with strong thunderstorms, but the upper atmosphere is still cool enough to support ice. Accordingly, hail is actually less common in the tropics despite a much higher frequency of thunderstorms than in the midlatitudes because the atmosphere over the tropics tends to be warmer over a much greater depth. Also, entrainment of dry air into strong thunderstorms over continents can increase the frequency of hail by promoting evaporational cooling which lowers the freezing level of thunderstorm clouds giving hail a larger volume to grow before falling to the earth.

Location

Each time a thunderstorm approaches Ponca City; hail poses a hazard to the entire Ponca City population. There is no way to predict where hail will fall; however, it can produce damage no matter where it lands.

Extent

The extent of damage from hail can be devastating in monetary damages to Ponca City and participating entities. Hail can pose a threat to all lives, structures, personal property, and most commonly, farmers' crops.

Rarely, massive hailstones have been known to cause concussions or fatal head trauma. Vehicles outside could be damaged and could cause a problem with emergency responders. Since a majority of the area in Ponca City is primarily agricultural, hail could be devastating to all farmers.

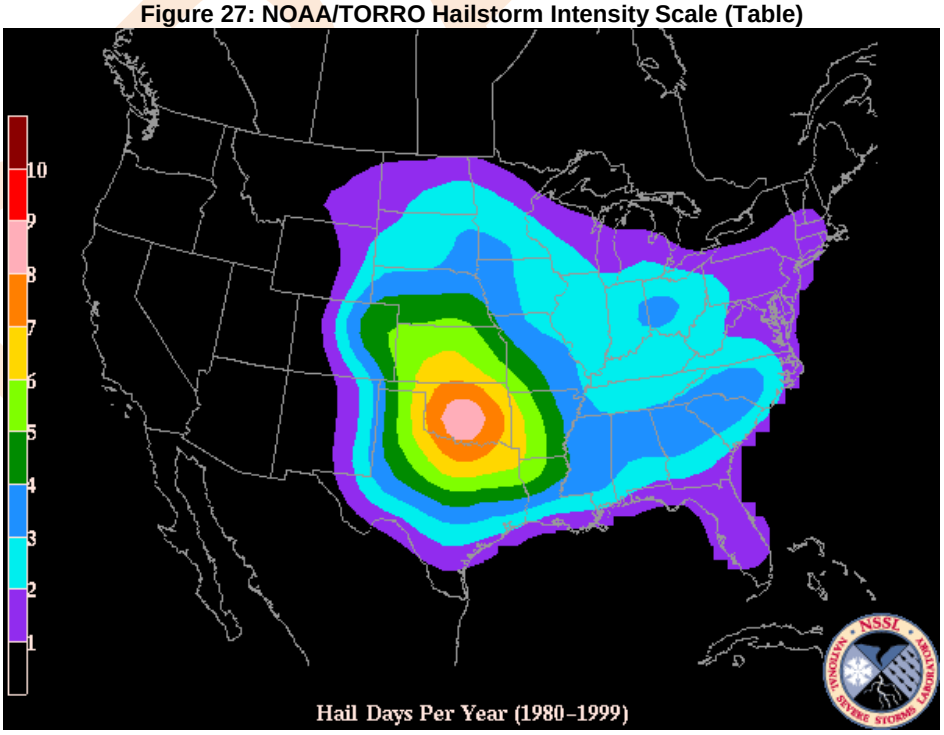
If there is hail that occurs with a thunderstorm, any hailstones, while most commonly are only a few millimeters in diameter, can sometimes grow to 15 centimeters and weigh more than half a kilogram (1.1 pounds). Pea or golf ball-sized hailstones are not uncommon in severe storms. Hail size is estimated by comparing it to a known object. Most hail storms are made up of a mix of sizes and only the very largest hail stones pose serious risk to people caught outside with no shelter. Ponca City and the Ponca City School District consider any hail storm above H3 or greater to be a "Severe" event.

Combined NOAA/TORRO Hailstorm Intensity Scales

Size Code	Intensity Category	Typical Hail Diameter (inches)	Approximate Size	Typical Damage Impacts
H0	Hard Hail	up to 0.33	Pea	No damage
H1	Potentially Damaging	0.33-0.60	Marble or Mothball	Slight damage to plants, crops
H2	Potentially Damaging	0.60-0.80	Dime or grape	Significant damage to fruit, crops, vegetation
H3	Severe	0.80-1.20	Nickel to Quarter	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	1.2-1.6	Half Dollar to Ping Pong Ball	Widespread glass damage, vehicle bodywork damage
H5	Destructive	1.6-2.0	Silver dollar to Golf Ball	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	2.0-2.4	Lime or Egg	Aircraft bodywork dented, brick walls pitted
H7	Very destructive	2.4-3.0	Tennis ball	Severe roof damage, risk of serious injuries
H8	Very destructive	3.0-3.5	Baseball to Orange	Severe damage to aircraft bodywork
H9	Super Hailstorms	3.5-4.0	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	4+	Softball and up	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Sources: www.noaa.gov and www.torro.org

Figure 27: NOAA/TORRO Hailstorm Intensity Scale (Table)



Previous Occurrences

There have been 98 hail events reported in Kay County since 2005 according to the National Climatic Data Center. NCDC data from 2005 through 2015 can be found in Appendix D.

Various Previous Occurrences for Hail Source: NCDC	
March 23, 2009	Widespread thunderstorms developed during the late afternoon and evening along a dry line. Many of the storms became severe producing large hail. The dry line retreated westward during the early evening, with the cold front overtaking the boundary from north to south. Thunderstorms continued to develop along the cold front and dry line intersection during the evening hours, with severe thunderstorms continuing well into the overnight hours. Monetary damages were estimated for some of the events, and not available for others.
May 26, 2008	During the morning hours of the 26th, a cold front moved into southwest Oklahoma, with a dry line extending south of the front into the eastern Texas panhandle. An outflow boundary was located from central Oklahoma, south into north-central and northeastern Oklahoma. Thunderstorms developed over the Texas panhandle during the afternoon east of the dry line and moved east into western Oklahoma. Other thunderstorms developed along and north of the outflow boundary in north-central Oklahoma. Thunderstorms became more widespread by evening, as the cold front continued moving southeast. Large hail from golf ball to even softball size, damaging winds to 70 mph, and flooding rains were reported with the severe thunderstorms. Some wind damage was also reported, but there were no injuries. The thunderstorms persisted well into the overnight hours. The thunderstorms finally moved east during the mid-morning hours of the 17th, but left behind several boundaries that helped with severe thunderstorms later in the afternoon. Monetary damages were estimated.
April 25, 2009	Thunderstorms developed ahead of a dry line, and then ahead of a cold front by late afternoon. Very large hail up to baseball size was reported at several locations. Later in the evening, the low-level jet developed, increasing wind shear and making the environment more conducive for tornadoes. Low-level rotation became more common with the thunderstorms, with a couple of storms over north central Oklahoma producing tornadoes. Damage was reported in the northern Enid and Hillsdale areas, but no significant injuries were reported. The storms moved northeast into Oklahoma after midnight.

Probability of Future Events

Using NCDC data since 2005 It is **Highly Likely** that a thunderstorm will produce hail in Ponca City within the next three years, it is also **Highly-Likely** for Ponca City School District #71. See Hazard Probability Matrix for the risk of the communities in the city on page 37.

Vulnerability

Hail can cause vulnerability to the entire population of Ponca City. Even relatively small hail can shred plants and vegetations to ribbons in a matter of minutes. Other things most commonly damaged by hail are vehicles, roofs of buildings and homes, and landscaping. Hail has also caused injury to humans and animals, with occasional fatalities. See Types and Numbers by Hazard on page 120.

Impact

Hail causes considerable damage to U.S. crops and property, inflicts injuries to humans and farm animals, with occasional fatalities. The damaging aspects of hail storms include the hailstone sizes (average and maximum), number of hailstones per unit area, and associated winds, and hail risk is a combination of these factors plus the frequency of hail at a point or over an area. Crop hail losses nationally in recent years are estimated at $1.3 billion annually, and since the Ponca City area is primarily agricultural this could prove devastating.

Unique and Varied Risk

A thunderstorm that produces hail does not pose a unique or varied risk to Ponca City simply because storms do not follow a pattern, and it cannot be predicted where one would strike each time. The CPRI Index for Hail is 3.35.

DRAFT

High Wind

(The Ponca City and participating entities are equally at risk for this hazard.)

Description

A sustained wind of forty mph or greater and / or gust greater than fifty-eight mph is considered high winds.

While high winds are commonly associated with severe thunderstorms, hurricanes and nor'easters, they may also occur as a result of differences in air pressures, such as when a cold front passes across the area.

High winds can cause downed trees and power lines, flying debris and building collapses, which may lead to power outages, transportation disruptions, damage to buildings and vehicles, and serious injury.

High winds reduce roadway capacity by obstructing lanes or roads with drifting snow and wind-blown debris, such as tree limbs. Wind-blown snow, dust and smoke can impact mobility by reducing visibility distance. High winds can also impact the stability of vehicles, particularly high-profile vehicles.

Damage from severe thunderstorm winds account for half of all severe reports in the lower 48 states and is more common than damage from tornadoes. Wind speeds can reach up to 100 mph and can produce a damage path extending for hundreds of miles. These winds are often called "straight-line" winds to differentiate the damage they cause from tornado damage. Strong thunderstorm winds can come from a number of different processes. Damaging winds are classified as those exceeding 50-60mph.

Since most thunderstorms produce some straight-line winds as a result of outflow generated by the thunderstorm downdraft, anyone living in thunderstorm-prone areas of the world is at risk for experiencing this phenomenon.

Types of damaging winds

Straight-line wind - a term used to define any thunderstorm wind that is not associated with rotation, and is used mainly to differentiate from tornadic winds. A straight-line wind can occur without the presence of a thunderstorm.

Downdrafts – a small-scale column of air that rapidly sinks toward the ground; A downburst is a result of a strong downdraft.

Downbursts – a strong downdraft with horizontal dimensions larger

than 4 km (2.5 mi) resulting in an outward burst or damaging winds on or near the ground. Downburst winds may begin as a microburst and spread out over a wider area, sometimes producing damage similar to a strong tornado. Although usually associated with thunderstorms, downbursts can occur with showers too weak to produce thunder.

Microbursts – a small concentrated downburst that produces an outward burst of damaging winds at the surface. Microbursts are generally small (less than 4km across) and short-lived, lasting only 5-10 minutes, with maximum wind speeds up to 168 mph. There are two kinds of microbursts: *wet and dry*. A wet microburst is accompanied by heavy precipitation at the surface. Dry microbursts, common in places like the high plains and the intermountain west, occur with little or no precipitation reaching the ground.

Gust front – a gust front is the leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. Sometimes the winds push up air above them, forming a shelf cloud or detached roll cloud.

Derecho – a derecho is a widespread thunderstorm wind event caused when new thunderstorms form along the leading edge of an outflow boundary (a surface boundary formed by the horizontal spreading of thunderstorm-cooled air). The thunderstorms feed on this boundary and continue to reproduce themselves. Derechos typically occur in the summer months when complexes of thunderstorms form over the plains and northern plains states. Usually these thunderstorms produce heavy rain and severe wind reports as they rumble across several states during the night. The word "derecho" is of Spanish origin and means "straight ahead". They are particularly dangerous because the damaging winds can last a long time and can cover such a large area.

Bow Echo – a radar echo which is linear but bent outward in a bow shape. Damaging straight-line winds often occur near the "crest" or center of a bow echo. Bow echoes can be over 300km in length, last for several hours, and produce extensive swaths of wind damage at the ground.

Location

Strong winds are associated with thunderstorms and they cannot be predicted to a specific area within Ponca City. The entire city would be susceptible to high winds however when a thunderstorm arrives, residents should listen to all weather broadcast for specific areas of concern for storm conditions.

Extent

Ponca City and participating entities consider Force #9 at 41-47 mph on the Beaufort Wind Scale to be severe winds. According to the Beaufort Wind Scale, this force can cause slight structure and roof damage. To small communities, this can be challenging for available emergency service providers and financial restoration.

Beaufort Wind Scale
Developed in 1805 by Sir Francis Beaufort of England

Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects	
			On Water	On Land
0	Less than 1	Calm	Sea surface smooth and mirror-like	Calm, smoke rises vertically
1	1-3	Light Air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Small waves 1-4 ft. becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Moderate waves 4-8 ft taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger waves 8-13 ft, whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Sea heaps up, waves 13-20 ft, white foam streaks off breakers	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Moderately high (13-20 ft) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Whole trees in motion, resistance felt walking against wind
9	41-47	Strong Gale	High waves (20 ft), sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Very high waves (20-30 ft) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	Exceptionally high (30-45 ft) waves, foam patches cover sea, visibility more reduced	
12	64+	Hurricane	Air filled with foam, waves over 45 ft, sea completely white with driving spray, visibility greatly reduced	

Figure 28: Beaufort Wind Scale (Table)

DRAFT

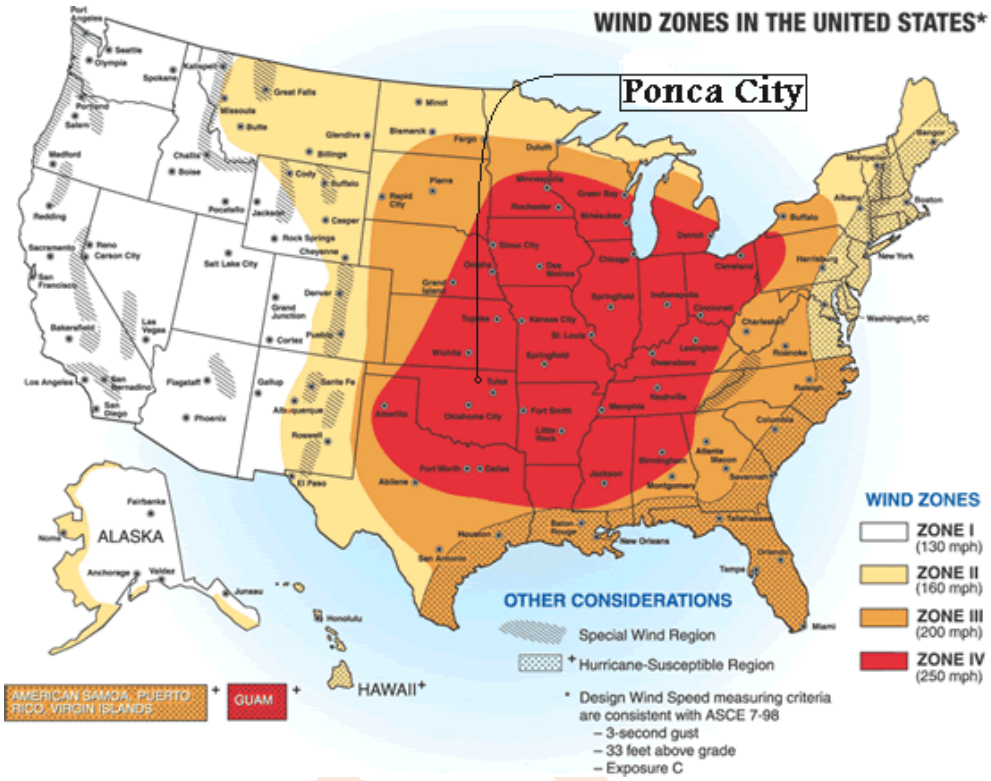


Figure 29: United States Wind Zone (Map)

Previous Occurrences

There have been 7 high wind incidents reported for Ponca City from 2005 to 2015 to the National Climatic Data Center; however each time a thunderstorm occurs in the Ponca City area, there is potential for high winds. Even though there have been no extensive damages reported, due to insurance premiums, many homeowners do not report each time they receive minor damages. Ponca City is located in Zone IV of the United States Wind Zone map. NCDC data from 2005 through 2015 can be found in Appendix D.

Various Previous Occurrences for High Winds Source: NCDC	
June 01, 2008	Power lines were downed in various locations around the city, causing widespread power outages. Some power poles were downed as well. Monetary damages were estimated. Showers and thunderstorms developed over parts of Oklahoma during the overnight hours, before moving southeast into north central Oklahoma. The thunderstorms developed into a MCS, with strong winds and hail. The thunderstorms moved southeast through the morning, before moving into eastern Oklahoma by the afternoon. Some damage was reported with the thunderstorm winds. Monetary damages were estimated.
August 09, 2007	A cluster of showers and thunderstorms developed over parts of central and south central Oklahoma during the late evening hours of the 8th and early morning hours of the 9th. These thunderstorms produced an outflow boundary that pushed south into northern Oklahoma. Thunderstorms developed along the boundary, with some briefly becoming severe. The main impacts were strong winds and large hail, although the slow movement of the storms contributed to very heavy rainfall. Monetary damages were estimated.

High Wind Incidents in Ponca City	
Community	**Incidents**
Ponca City	7
Total	7

Probability of Future Events

Based on NCDC data from 2005 to 2015 it is **Likely** that Ponca City will experience a thunderstorm involving high winds, it is also **Likely** for Ponca City School District #71. There have been 7 thunderstorm events in the county since 2005 and are capable of producing high winds each time that they enter the City of Ponca City. Winds produced by Violent Storms and Hurricane Force winds result in structural damage and widespread interruption of electrical utilities and those are expected to occur every year See Hazard Probability Matrix for the risk of all the communities in the city on page 37.

Vulnerability

Damaging wind events can develop with little or no advanced warning. People outside may not have access to warning information, so individuals attending outdoor sporting events, water and other recreational activities, such as boating and camping are very susceptible. See Types and Numbers by Hazard on page 120.

Impact

Impacts such as power outages or damage to trees, roofs, windows or cars can also be used to indicate that a high wind event has occurred. Gale force winds cause limbs and blowing debris to cause localized interruption of electrical utilities. High winds reduce roadway capacity by obstructing lanes or roads with drifting snow and wind-blown debris, such as tree limbs. Wind-blown snow, dust and smoke can impact mobility by reducing visibility distance. High winds can also impact the stability of vehicles, particularly high-profile vehicles. Winds produced by Violent Storms and Hurricane Force winds result in structural damage and widespread interruption of electrical utilities.

Unique and Varied Risk

High winds do not pose a unique and varied risk to Ponca City due to the inability to determine where the next hazard would occur. Thunderstorms produce high winds and they do not follow a pattern. The CPRI Index for High Wind is 3.0.

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Lightning

(The Ponca City and participating entities are equally at risk for this hazard.)

Description

Lightning is an atmospheric discharge of electricity, which usually, but not always, occurs during rain storms, and frequently during volcanic eruptions or dust storms.

An initial bipolar discharge, or path of ionized air, starts from a negatively charged region in the thundercloud. The discharge ionized channels are called leaders. The negative charged leaders, called a "stepped leader", proceed generally downward in a large number of quick jumps, each up to 50 meters long. Along the way, the stepped leader may branch into a number of paths as it continues to descend. The progression of stepped leaders takes a comparatively long time (hundreds of milliseconds) to approach the ground. This initial phase involves a relatively small electric current (tens or hundreds of amperes), and the leader is almost invisible compared to the subsequent lightning channel. When the downward leader is quite close to the ground, one or more smaller discharges (called positive streamers) arise from nearby, usually tall, grounded objects due to the intense electric field created by the approaching leaders.

As one of the rising streamers meets a stepped leader, the circuit is closed, and the main lightning stroke (often referred to as the *return stroke*) follows with much higher current. The main stroke travels at about 0.1 *c*(30 million meters/second or 100 million feet/second) and the peak current lasts for tens of microseconds or so. After the peak, the current typically decays over tens or hundreds of microseconds.

An average bolt of negative lightning carries a current of 30-to-50 kiloamperes (kA), although some bolts can be up to 120kA, and transfers a charge of 5 coulombs and 500 megajoules (enough to light a 100 watt light bulb for 2 months). However, it has been observed from experiments that different locations in the US have different potentials (voltages) and currents, in an average lightning strike for that area. For example, Florida, with the largest number of recorded strikes in a given period, has a very sandy ground saturated with salt water, and is surrounded by water. California, on the other hand, has fewer lightning strikes (being dryer). Arizona, which has very dry, sandy soil and a very dry air, has cloud bases as high as 6,000-7,000 feet above ground level, and gets very long, thin, purplish discharges, which crackle; while Oklahoma, with cloud bases about 1,500-2,000 feet above ground level and fairly soft, clay-rich soil, has big, blue-white explosive lightning strikes, that are very hot (high current) and cause sudden, explosive noise when the discharge comes. Potentially, the difference in each case may consist of differences in voltage levels between clouds and ground.

Each year, lightning kills about 50 – 100 people nationally, mostly during the spring/ summer season. Typical thunderstorms can last anywhere from 30 minutes to 1 hour. Most lightning strikes occur in the afternoon - 70% occur between noon and 6:00 pm. This is because as air temperatures warm, evaporation increases and supports conditions for the creation of a thunderstorm. Thunderstorms reach their peak in July.

Men are hit by lightning four times more often than women. Men account for 84% of lightning fatalities and 82% of injuries. However, the actual number of deaths and injuries due to lightning

have decreased over the last 35 years. This is attributed to improved forecasts and warnings, better lightning awareness, more substantial buildings, socioeconomic changes, and improved medical care.

In the United States, the National Weather Service recorded 3,239 deaths and 9,818 injuries due to lightning strikes between 1959 and 1994. Only 20% of lightning strikes cause immediate death. Seventy percent of lightning strike victims that survive, experience residual effects, most commonly affecting the brain. Lightning strike victims have typically been walking in an open field or swimming before they are struck. Other lightning victims have been holding metal objects such as golf clubs, fishing poles, hayforks, or umbrellas.

Damage to property from direct or indirect lightning can take the form of an explosion, a burn, or destruction. Damage to property has increased over the last 35 years, probably due to increased spread of the population. The National Weather Service recorded 19.814 incidents of property damage between 1959 and 1994. Yearly losses are estimated at $35 million by the National Weather Service. This amount is compiled from newspaper reports, but many strikes are not reported. The National Lightning Safety Institute estimates damages at $4 to $5 billion. This information is compiled from insurance reports and other sources that keep track of weather damages.

Location

Lightning falls under the secondary hazards from a thunderstorm and would affect the entire community of Ponca City.

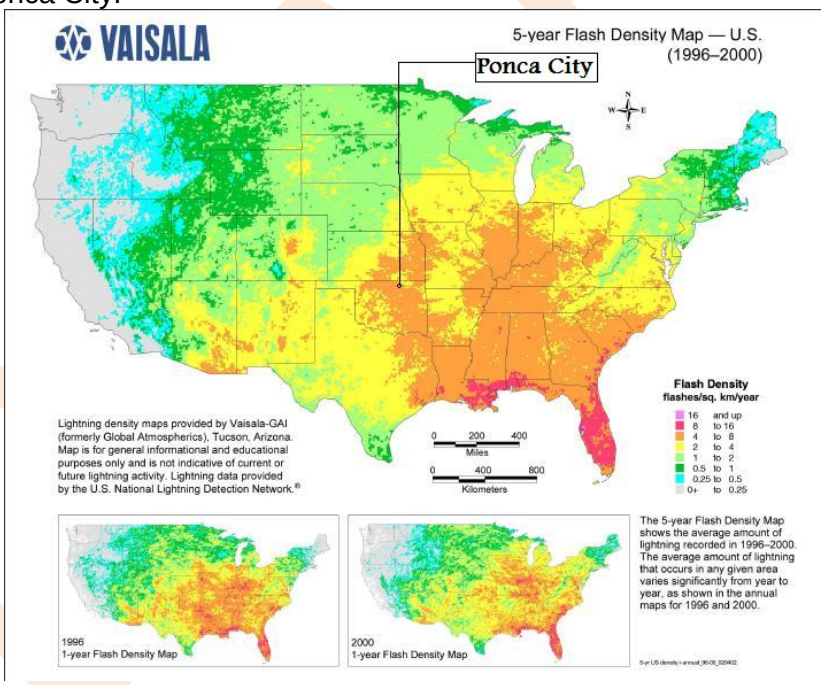

Figure 30: VAISALA Lightning Scale (Table)

Lightning flash density for Ponca City is 4 to 8 flashes per square km per year according to the Vaisala chart above. The Vaisala Figure 27 does provide some helpful information, but the map does not provide sufficiently high resolution for the City of Ponca City.

Consequently, the City of Ponca City depended on the United States Precision Lightning Network to determine the historical number of cloud-to-ground strikes only for a 10-mile radius around the geographic center of the City of Ponca City. The cloud-to-ground lightning stroke data used in this investigation were from the United States Precision Lightning Network (USPLN). This network consists of 98 lightning sensors deployed across the 48 contiguous U.S. and Puerto Rico. The network is specifically designed to identify specific lightning strokes based upon the inherent lightning signal waveforms associated with a lightning stroke event. The USPLN exhibits a lightning detection efficiency of 95% with a mean location accuracy of 250 m. A full description of the USPLN can be found at **http://www.uspln.com**. In order to perform this analysis the services of Weather Decisions Technologies, Inc. was consulted and the lightning strike analysis was performed by E. DeWayne Mitchell, Sr .Meteorologist. The results of their detailed high resolution analysis specific to Ponca City is briefly discussed under **Previous Occurrences** below. And their complete report is included in Appendix D.

Extent

Ponca City and participating entities considers any lightning event severe, due to the fact that it only takes one bolt at the precise time to cause a fatality, injuries, fire or disruption in electronic services.

If you are:	Then:
In a forest	Seek shelter in a low area under a thick growth of small trees
In an open area	Go to a low place such as a ravine or valley. Be alert for flash floods
On open water	Get to land and find shelter immediately
Anywhere you feel your hair stand on end (which indicates that lightning is about to strike)	Squat low to the ground on the balls of your feet. Place your hands over your ears and your head between your knees. Make yourself the smallest target possible and minimize your contact to the ground. DO NOT lie flat on the ground.

Figure 31: Lightning Awareness Scale (Table)

Previous Occurrences

According to reports from the WDT (Weather Decision Technologies) there was an average of 55 Lightning strokes from 2005-2009

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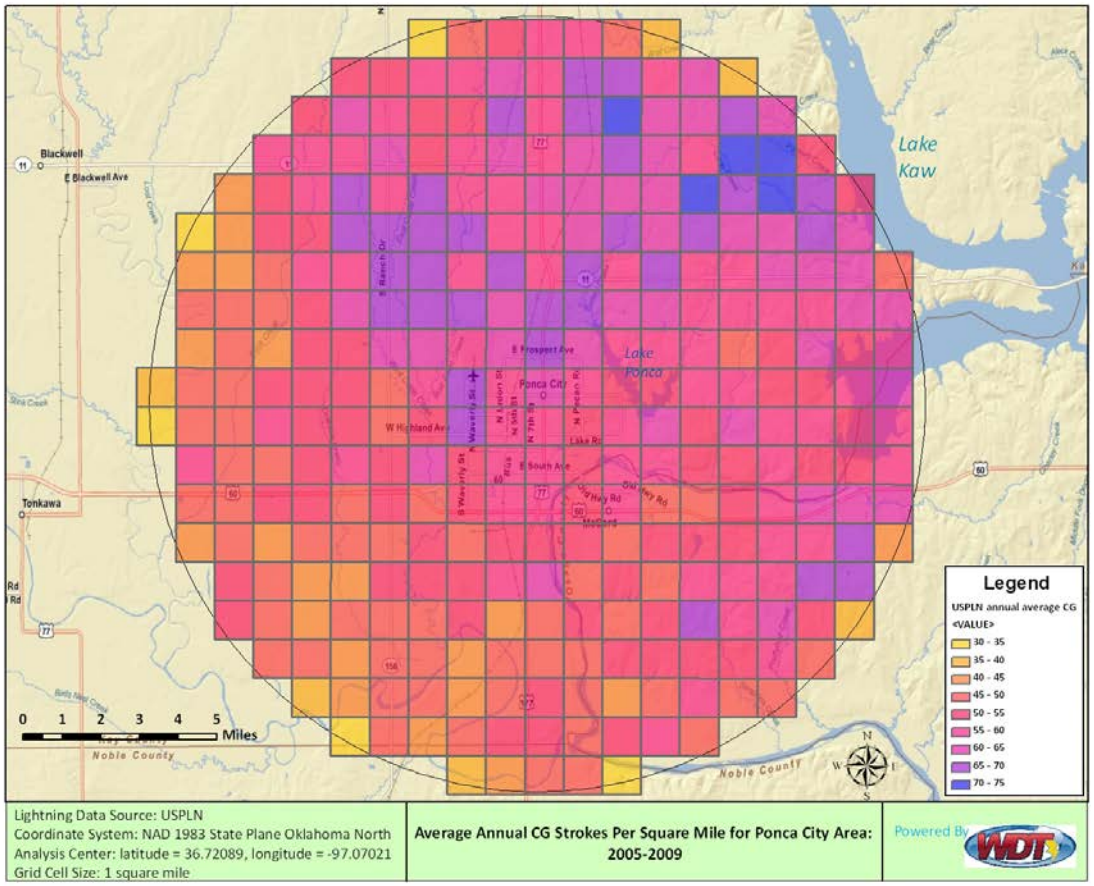

Probability of Future Events

The NCDC only lists one event in the last 10 years and the WDT listed 55 events from 2005 to 2009; therefore, the previous data from the WDT will be used to determine probability of future events. It is **Highly Likely** that Ponca City and the Ponca City School District #71 will have lightning events in the next 10 years. See Hazard Probability Matrix for the risk of all the communities in the city on page 37.

Vulnerability

Cloud-to-ground lightning can kill or injure people by direct or indirect means. The lightning current can branch off to a person from a tree, fence, pole, or other tall object. It is sometimes not known if people are killed by a direct or indirect strike. In addition, flashes may conduct their current through the ground to a person after the flash strikes a nearby tree, antenna, or other tall object. The current also may travel through power or telephone lines or plumbing pipes to a person who is in contact with an electric appliance, telephone, or plumbing fixture. Similarly, objects can be directly struck and this impact may result in an explosion, burn or total destruction. Or, the damage may be indirect when the current passes through or near it. Sometimes, a current may enter a building and transfer through wires or plumbing and damage everything in its path. In urban areas, it may strike a pole or tree and the current then travels to several nearby houses and other structures and enter them through wiring or plumbing.

Lightning striking the water can penetrate down and kill fish nearby which could cause damage to the ecosystem in the lake.

Anyone outside during a thunderstorm is in danger from lightning - especially citizens in a pool or on the lake. Lightning can also cause fires particularly to structures or grassy areas if dry. The odds of being struck in your lifetime (estimated to be 80 years) are 1 in 3000. See Types and Numbers by Hazard on page 118

Impact

Lightning - the most dangerous and most frequently encountered weather hazard most people experience each year - is the second most frequent weather-related killer in the United States. Most casualties result from inappropriate behavior during thunderstorms, particularly when people are caught outdoors during recreation or organized sports.

Unique and Varied Risk

As with thunderstorms, hail and high winds it is impossible to predict the path of lightning and therefore this hazard does not fall under the unique and varied risk. Using the WDT data the CPRI Index for Lightning is 3.3.

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THUNDERSTORMS

(The Ponca City and participating entities are equally at risk for this hazard.)

Description

A thunderstorm is a form of weather characterized by the presence of lightning and its attendant thunder produced from a cumulonimbus cloud. Thunderstorms are usually accompanied by heavy rainfall and potential strong winds, hail and tornadoes. In the winter months, snowfall can occasionally take place in a thunderstorm.

Thunderstorms form when significant condensation producing a wide range of water droplets and ice crystals, which occurs in an atmosphere that is unstable and supports deep, rapid upward motion. This often occurs in the presence of three conditions: sufficient moisture accumulated in the lower atmosphere, reflected by high temperatures; a significant fall in air temperature with increasing height, known as a steep adiabatic lapse rate; and a force such as mechanical convergence along a cold front to focus the lift.

An average thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. At any given moment, there are roughly 2,000 thunderstorms in progress around the world. It is estimated that there are 100,000 thunderstorms each year. About 10% of these storms reach severe levels.

Thunderstorms have a life cycle of three stages: The developing stage, the mature stage and the dissipating stage.

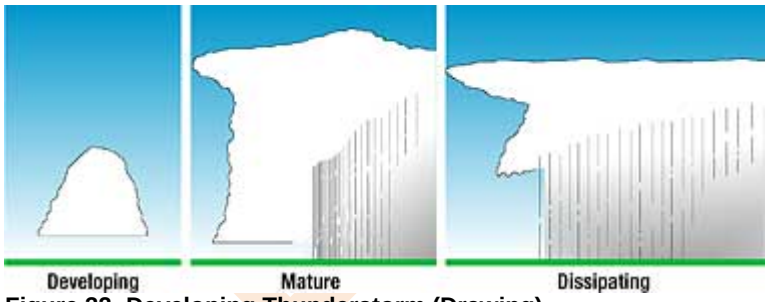


Figure 32: Developing Thunderstorm (Drawing)

All thunderstorms are considered dangerous and every thunderstorm produces lightning. Although most victims struck by lightning will survive, those survivors often report a variety of long-term, debilitating symptoms. Flash flooding can also occur from thunderstorms and is responsible for more than 140 fatalities annually – with the most thunderstorm-associated hazard recorded deaths.

Dry thunderstorms that do not produce rain reaching the ground are most prevalent in the western United States. Falling raindrops evaporate, but lightning can still reach the ground causing injuries, death and wildfires.

There are four main types of thunderstorms: **single cell**, **multicell**, **squall line** and **supercell**. Which type forms depends on the instability and relative wind conditions at different layers of the atmosphere.

Single cell storms form when the atmosphere is unstable, but there is little or no wind shear, meaning precipitation falls back down through the updraft that led to it, cooling it and eventually destroys it. These storms are short lived, and last for less than an hour after becoming strong enough to produce lightning. Days with suitable weather conditions often see the repeated forming and dissipation of such storms, leading them to be known as "pulse" storms.

Multicell storms are groups of cells in different stages of development which have merged into a larger system. The cloud becomes divided into updraft and downdrafts regions separated by a gust front. The gust front may extend for several miles ahead of the storm, bringing with it increases in wind speed and atmospheric pressure, decreases in temperature, and shifts in wind direction. The storm itself will have different portions sequentially going through the various thunderstorm stages. In many cases the immature cells develop along a *flanking line*, resulting in what is known as a line multicell.

Squall line or multicell line storms are formed as an organized line or lines of multicell storms frequently with a gust front. They often arise from convective updrafts in or near mountain ranges and linear weather boundaries, usually strong cold fronts or troughs of low pressure. Squall lines tend to be hundreds of miles long, sometimes stretching across the Midwestern United States, covering five states at a time. These lines can move swiftly and in some parts of the line, bow echoes can form, bringing with it high winds, dangerous lightning, and possibly tornadoes. Heavy rain, hail and damaging winds such as derechos can occur in a squall line.

Supercell storms are large, severe quasi-steady-state storms which feature wind speed and direction that vary with height, separate downdrafts and updrafts and a strong, rotating updraft. These storms normally have such powerful updrafts that the top of the cloud can reach miles into the air and can be 15 miles wide. These storms produce destructive tornadoes, sometimes F3 or greater, extremely large hailstones (4 inch—10 cm diameter), straight-line winds in excess of 80 mph (130 km/h), and flash floods. In fact, most tornadoes occur from this kind of thunderstorm.

Climate studies show that precipitation rates have been increasing over the last several decades. The reason for this is explained as follows.

"Warming, especially in the northern half of the conterminous United States is related to a reduction in spring snow-cover extent, an earlier snow retreat, and earlier onset of spring and summer-like weather conditions. This in turn results in an increase in the frequency of cumulonimbus clouds which relates to the general increase in thunderstorm activity over most of the contiguous United States and in a nationwide increase in very heavy precipitation." (Contemporary Changes of the Hydrological Cycle over the Contiguous United States: Trends Derived from In Situ Observations, *Journal of Hydrometeorology*, Volume 5, 2004, page 80.)

If this trend continues, it is likely that the frequency of thunderstorms will increase along with associated hazards such as flash floods, hail, lightning and wind.

Location

Thunderstorms could impinge on entire communities in Ponca City. A thunderstorm is mobile and will vary each time one is predicted. Due to the fact that Ponca City has several small communities, thunderstorms will more than likely produce rain, wind or hail across an entire community instead of missing certain areas as is common in more populated cities.

Extent

A thunderstorm can cause significant damage to the small communities of Ponca City. Devastating effects from a thunderstorm can cause havoc when there are so few emergency personnel to respond to any damaged areas and conduct rescue efforts. The local and rural fire departments currently do not have the necessary equipment needed for a disaster event with wide spread damage. Ponca City and the Ponca City School District consider any thunder storm that produces hail of H3 magnitude or higher, an EF2 tornado, or winds speeds >41mph to be a "severe" event.

Previous Occurrences

According to the National Climatic Data Center there have been 132 reported thunderstorms in Kay County since 2005. NCDC data from 2005 through 2015 can be found in Appendix D.

Various Previous Occurrences for Thunderstorms **Source: NCDC**	
June 01, 2008	Power lines were downed in various locations around the city, causing widespread power outages. Some power poles were downed as well. Monetary damages were estimated. Showers and thunderstorms developed over parts of Oklahoma during the overnight hours, before moving southeast into north central Oklahoma. The thunderstorms developed into a MCS, with strong winds and hail. The thunderstorms moved southeast through the morning, before moving into eastern Oklahoma by the afternoon. Some damage was reported with the thunderstorm winds. Monetary damages were estimated.
August 09, 2007	A cluster of showers and thunderstorms developed over parts of central and south central Oklahoma during the late evening hours of the 8th and early morning hours of the 9th. These thunderstorms produced an outflow boundary that pushed south into northern Oklahoma. Thunderstorms developed along the boundary, with some briefly becoming severe. The main impacts were strong winds and large hail, although the slow movement of the storms contributed to very heavy rainfall. Monetary damages were estimated.

Thunderstorm Incidents in Kay County	
Community	**Incidents**
Kay County	132
Total	132

Probability of Future Events

The probability of a thunderstorm entering into Ponca City and participating entities and causing some sort of turmoil is **Highly Likely**. There have been 132 reported thunderstorm events in the city since 2005; it is also **Highly-Likely** for the Ponca City School District #71. See Hazard Probability Matrix for the risk of all the communities in the city on page 37.

Vulnerability

A thunderstorm can produce rain, winds, lightning, hail, and tornadoes, and can cause death, injuries and property damage. Each secondary hazard will be addressed in the following pages. A structure that is already unstable from age or susceptible building materials may be at more risk or damaged from winds or tornadoes. Lives could be threatened from flooding, high winds, lightning, hail and tornadoes. Lightning can ignite fires, and there may not be enough emergency personnel to respond when they are already involved with other affects of the thunderstorm. See Types and Numbers by Hazard on page 120.

Impact

Many hazardous weather events are associated with thunderstorms. Lightning is responsible for many fires around the world each year, as well as causing deaths when people are struck. Under the right conditions, rainfall from thunderstorms causes flash flooding, which can change small creeks into raging torrents in a matter of minutes, washing away large boulders and most man-made structures. Hail up to the size of softballs damages cars, windows, roofs and kills wildlife caught out in the open. Strong (up to more than 120 mph) straight-line winds associated with thunderstorms knock down trees and power lines. Tornadoes (with winds up to about 300 mph) can be fatal and destroy all but the best-built man-made structures. From wreaking havoc on airline schedules to threatening outdoor sporting events, thunderstorms have a big effect on our society. Severe events could wreak havoc on Ponca City and Ponca City Schools by causing substantial damage to structures rendering them unusable for the population, schools could see closures do to damages to buildings, traffic could be impacted due to fallen debris blocking roads, homes could be destroyed causing citizens to relocate or seek temporary housing, these are just some of the impacts that could be felt in the event of a severe thunderstorm.

Unique and Varied Risk

Thunderstorms do not pose a unique and varied risk simply because they do not follow a pattern and each thunderstorm will be different as it moves through Ponca City communities. There are so many types of thunderstorms that no one can predict which type will affect Ponca City and participating entities. The CPRI Index for Thunderstorm is 3.5.

DRAFT

Tornadoes

(The Ponca City and participating entities are equally at risk for this hazard.)

Description

Tornadoes are nature's most violent storms. Spawned from powerful thunderstorms, tornadoes can cause fatalities and devastate a neighborhood in seconds. A tornado appears as a rotating, funnel-shaped cloud that extends from a thunderstorm to the ground with whirling winds that can reach 300 miles per hour. Damage paths can be in excess of one mile wide and 50 miles long. Every state is at some risk from this hazard.

Some tornadoes are clearly visible, while rain or nearby low-hanging clouds obscure others. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible.

Before a tornado hits, the wind may die down and the air may become very still. A cloud of debris can mark the location of a tornado even if a funnel is not visible. Tornadoes generally occur near the trailing edge of a thunderstorm. It is not uncommon to see clear, sunlit skies behind a tornado.

The following are facts about tornadoes:

- They may strike quickly, with little or no warning.
- They may appear nearly transparent until dust and debris are picked up or a cloud forms in the funnel.
- The average tornado moves 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 stationary to 70 MPH.

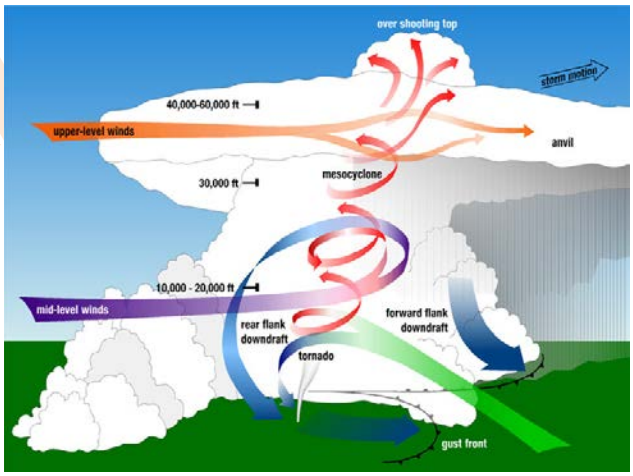


Figure 33: Tornado Diagram (Drawing)

- Waterspouts are tornadoes that form over water.
- Tornadoes are most frequently reported east of the Rocky Mountains during spring and summer months.
- Peak tornado season in the southern states is March through May; in the northern states, it is late spring through early summer.
- Tornadoes are most likely to occur between 3 p.m. and 9 p.m., but can occur at any time.

Location

A tornado could affect any area within the Kay County area, and therefore Ponca City is susceptible to this hazard. Ponca City is situated in the highest risk area of the United States, known as “tornado alley” - and the community is to be expected to experience a tornado.

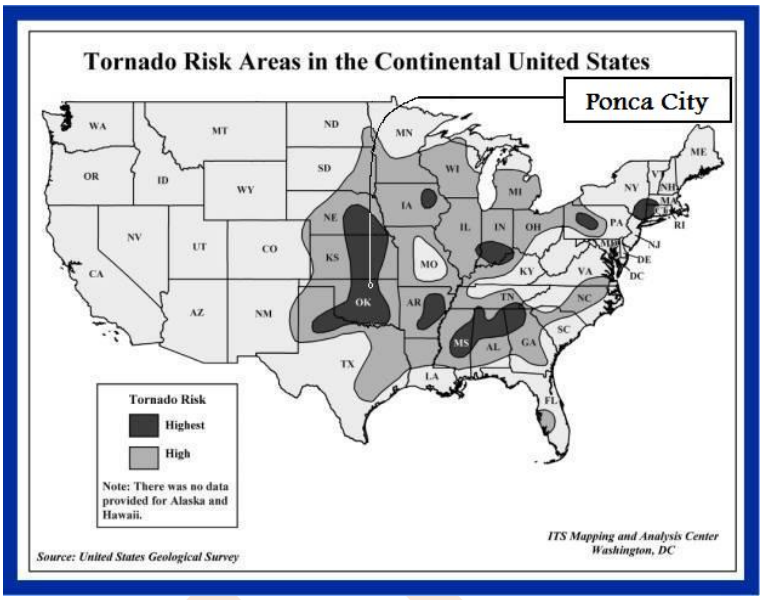


Figure 34: Tornado Risk Area (Map)

Extent

A tornado is devastating to any community, especially those small towns, such as those in Ponca City, when the loss of any resident or monetary damages could be distressing. Ponca City and the Ponca City School District consider any tornado of EF2 magnitude or greater to be a “severe” event within the community.

Tornadoes are measured by intensity according to the following method:

THE FUJITA SCALE			
F-Scale Number	**Intensity Phrase**	**Wind Speed**	**Type of Damage**
F0	Gale tornado	40-72 mph	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards
F1	Moderate Tornado	73-112 mph	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant tornado	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	Severe tornado	158-206	Roof and some walls torn off well constructed houses; trains overturned; most fore trees uprooted
F4	Devastating tornado	207-260 mph	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	Incredible tornado	261-318 mph	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel reinforced concrete structures badly damaged.

Figure 35: Fajita Scale (Table)

DRAFT

Enhanced Fujita (EF) Scale		
Enhanced Fujita Category	**Wind Speed (mph)**	**Potential Damage**
EF0	65-85	**Light damage.** Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1	86-110	**Moderate damage.** Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	**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	136-165	**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	166-200	**Devastating damage.** Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	>200	**Incredible damage.** Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yd); high-rise buildings have significant structural deformation; incredible phenomena will occur.
source: http://en.wikipedia.org/wiki/Enhanced_Fujita_Scale		

The **Enhanced Fujita Scale**, or **EF Scale**, is the scale for rating the strength of tornadoes in the United States estimated via the damage they cause. Implemented in place of the Fujita scale, it was used starting February 1, 2007. The scale has the same basic design as the original Fujita scale, six categories from zero to five representing increasing degrees of damage. It was revised to reflect better examinations of tornado damage surveys, so as to align wind speeds more closely with associated storm damage. The new scale takes into account how most structures are designed, and is thought to be a much more accurate representation of the surface wind speeds in the most violent tornadoes.

Source: http://en.wikipedia.org/wiki/Enhanced_Fujita_Scale

Previous Occurrences

The NCDC has 9 reported tornadoes in Kay County since 2005. The historical tornado information for Kay County for Kay County is also included in Appendix D and was evaluated in detail. The results of the evaluation are shown in the table below. In order to calculate the "Number of Tornadoes in Ponca City" shown below the area of Ponca City was divided by the area of Kay County for the entire 58.33 years of record. The FEMA BCA default values for the average length of path of tornado damage on the ground were reviewed and appear accurate; however, the longest dimension of the City of Ponca City is only 5.88 miles and F2 through F5 tornados have a much longer path on the ground than 5.88 miles, so the damage path on the ground was reduced to 5.88 miles to apply to the City Limits of Ponca City. The width of damage default BCA values were reviewed and were determined to be appropriate to estimate the width of tornado damage. The "Area of Damage in 1 Tornado, square miles" was multiplied by the "Number of Tornados in Ponca City" and the product was divided by the 58.33 years of record to calculate the "Average Chance of Occurrence in any Single Year." NCDC data from 2005 through 2015 can be found in Appendix D.

Probability of Future Events

The City of Ponca City has one recorded tornado event that has occurred since 2005; however, Kay County has 9 recorded tornado events since 1950; therefore, the planning committee has determined the risk for the city would be much greater than the data for the city indicates. Due to the large number of tornados in the county and the extreme difference between data for the city and the county. The planning committee finds it more logical and safer for the community to use the county data over the information for the city for this hazard.

According to the past history using county data for the probability method, tornadoes are **Likely** to strike the City of Ponca City using NCDC historical data since 2005; it is also **Likely** for the Ponca City School District #71. See Hazard Probability Matrix for the risk of all the communities in the city on page 37.

Vulnerability

Although tornadoes strike at random, making all buildings vulnerable, three types of structures are more likely to suffer damage:

- Mobile homes
- Homes on crawlspaces (more susceptible to lift)
- Buildings with large spans, such as airplane hangars, gymnasiums and factories

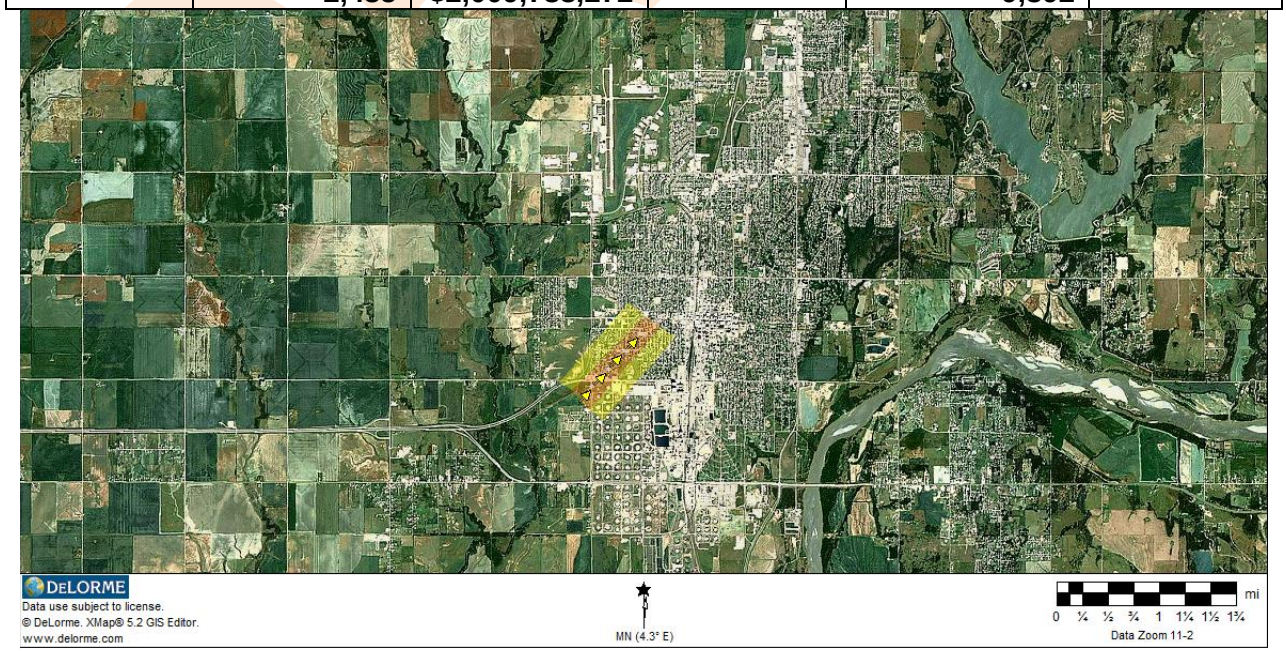
Structures within the direct path of a tornado vortex are often reduced to rubble. However, structures adjacent to the tornadoes path are often severely damaged by high winds flowing into the tornado vortex, known as inflow winds or by debris. The buildings adjacent to the tornado path can be significantly impacted depending on the design and materials used in the building construction. See Types and Numbers by Hazard on page 118.

Impact

Tornadoes can leave a wide swath of devastation in their paths. Weak tornadoes typically break trees, cause damage to houses, and may knock over barns. Strong tornadoes are capable of

demolishing houses from their foundations, leaving only scattered debris in the vicinity. Urban tornadoes can leave shattered glass from windows in storefronts and office buildings, along with extensive structural damage to large buildings, such as schools, shopping centers, and warehouses, in their wake. The extent of damage depends not only on wind speed, but also on the mass and surface area of the object being struck. Objects with an extensive surface area are particularly subject to damage when hit head on by tornadic winds. Even a massive locomotive can be toppled, and automobiles can easily be picked up and battered. Mobile homes are very vulnerable and are no match for a tornado. Secondary impacts of tornado damage result from damage to infrastructure. Downed power and communications transmission lines, coupled with disruptions to surface transportation, create difficulties in reporting and responding to emergencies. As a result of the damages to homes residents my have to move, buy a generator, find a new job or live in a tent for a while. Tornado casualties are common. Over 90 percent of tornado casualties are bodily injuries. Casualties are most frequently associated with the collapse of buildings, being struck by flying objects, or trying to escape the tornado in a car. A compilation of tornado-related fatalities nationwide from 1985 through 1997 revealed that 38 percent of all fatalities occurred in mobile homes, 27 percent in permanent houses, and 11 percent in automobiles. The following map is a scenario of a 1 mile long and quarter mile wide F-3 tornado going through the downtown of Ponca City, OK. The center of the path is the severe damage zone that could cause total or one hundred percent devastation. The outer sections to the side of the severe damage zone are the moderate damage zones that would see damage from flying debris and heavy winds. The moderate damage zone would have some destruction; however, it would be repairable and not a total loss. This zone would cause minimal damage to approximately fifty percent damage to the property and structures in this area.

Estimated Types and Numbers of Existing Structures Affected by an F-3 Tornado Ponca city					
Type of Structure	**Number of Structures**	**Severe Damages**	**Moderate Damage**	**Population in Hazard Area**	**Total Damages**
Residential	**2,127**	$127,632,000	$25,526,400	5,184	$153,158,400
Commercial	**293**	**$1,770,517,000**	**$345,070,850**	**3,016**	**$2,115,587,850**
School Dist.	**4**	**$45,365,379**	**$9,073,076**	**1,183**	**$54,438,455**
Government (City)	**11**	**$66,268,892**	**$13,252,650**	**273**	**$79,521,542**
TOTAL	**2,435**	**$2,009,783,272**	**$401,956,654**	**9,392**	**$2,411,739,926**



Tornado Direction Severe Damage Moderate Damage

Unique and Varied Risk

A unique and varied risk cannot be given to this hazard due to the fact that tornadoes have unpredictable pathways. Residents should follow all directions given in the event of a tornado to reduce their risk. The CPRI Index for Tornado is 3.65.

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WILDFIRES

(The Ponca City and participating entities are not equally at risk for this hazard.)

Description

Wildfires are unplanned fires that start in an open space like a plant covered hillside or forest. The fires can be fueled several different ways: dead or dry vegetation may catch fire naturally (e.g. lightning) or, more commonly by human activities. The spread of wildfires depends on the available fuel and oxygen, the weather conditions at the time (including temperature, humidity, wind speed, and direction), and the slope of the ground.

Wildfire is a serious and growing hazard over much of the United States, posing a great threat to life and property, particularly when it moves from forest or rangeland into developed areas. However, wildfire is also a natural process, and its suppression is now recognized to have created a larger fire hazard, as live and dead vegetation accumulates in areas where fire has been prevented.

According to FEMA, there are three types of wildfires that may occur:

1. **"Surface fire"** is the most common type and burns along the floor of a forest, moving slowly and killing or damaging trees.
2. **"Ground fire"** is usually started by lightning and burns on or below the forest floor in the human layer down to the mineral soil.
3. **"Crown fires"** spread rapidly by wind and move quickly by jumping along the tops of trees.

The threat of wildland fires for people living near wildland areas or using recreational facilities in wilderness areas is real. Dry conditions at various times of the year and in various parts of the United States greatly increase the potential for wildland fires.

Advance planning and knowing how to protect buildings in these areas can lessen the devastation of a wildland fire.

Location

Ponca City is a rural area and is encompassed with agriculture and farmlands, therefore, Ponca City is susceptible to wildfires and the urban areas are susceptible where the urban area meets the rural areas on the outskirts of the communities

Extent

A wildfire can cause a significant amount of damage to Ponca City given that the entire city is encompassed with agriculture and farmlands. These farmlands have a greater chance of burning from lightning, human error or dry conditions. If a wildfire did occur, the monetary damages could be devastating and the possibility of that wildfire reaching the urban areas within Ponca City is highly likely.

The Keetch-Byram Drought Index (KBDI) is basically a mathematical system for relating current and recent weather conditions to potential or expected fire behavior. This system was originally developed for the southeastern United States and is based primarily on recent rainfall patterns.

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The KBDI is the most widely used drought index system by fire managers in the south. It is also one of the only drought index systems specifically developed to equate the effects of drought with potential fire activities.

The result of this system is a drought index number ranging from 0 to 800 that accurately describes the amount of moisture that is **missing**. A rating of zero defines the point where there is no moisture deficiency and 800 is the maximum drought possible.

These numbers correlate with potential fire behavior as follows:

0 - 200 Soil and fuel moisture are high. Most fuels will not readily ignite or burn. However, with sufficient sunlight and wind, cured grasses and some light surface fuels will burn in spots and patches.

200 - 400 Fires more readily burn and will carry across an area with no gaps. Heavier fuels will still not readily ignite and burn. Also, expect smoldering and the resulting smoke to carry into and possibly through the night.

400 - 600 Fire intensity begins to significantly increase. Fires will readily burn in all directions exposing mineral soils in some locations. Larger fuels may burn or smolder for several days creating possible smoke and control problems.

600 - 800 Fires will burn to mineral soil. Stumps will burn to the end of underground roots and spotting will be a major problem. Fires will burn thorough the night and heavier fuels will actively burn and contribute to fire intensity.
Source: http://www.wfas.us/content/view/32/49/

The index contains five ratings - low, medium, high, very high and extreme. Fires are more likely to occur on higher index days, and fires that occur on those days are more likely to be intense and grow rapidly. Fire danger indexes do not predict how a specific fire will behave; however, they do give an indication of potential fire activity. The following chart lists index ratings and fire danger descriptions.

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Fire Danger Rating System		
Rating	**basic description**	**detailed description**
CLASS 1: Low Danger (L) COLOR CODE: **Green**	fires not easily started	Fuels do not ignite readily from small firebrands. Fires in open or cured grassland may burn freely a few hours after rain, but wood fires spread slowly by creeping or smoldering and burn in irregular fingers. There is little danger of spotting.
CLASS 2: Moderate Danger (M) COLOR CODE: **Blue**	fires start easily and spread at a moderate rate	Fires can start from most accidental causes. Fires in open cured grassland will burn briskly and spread rapidly on windy days. Woods fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel – especially draped fuel -- may burn hot. Short-distance spotting may occur, but is not persistent. Fires are not likely to become serious and control is relatively easy.
CLASS 3: High Danger (H) COLOR CODE: **Yellow**	fires start easily and spread at a rapid rate	All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High intensity burning may develop on slopes or in concentrations of fine fuel. Fires may become serious and their control difficult, unless they are hit hard and fast while small.
CLASS 4: Very High Danger (VH) COLOR CODE: **Orange**	fires start very easily and spread at a vary fast rate	Fires start easily from all causes and immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high-intensity characteristics - such as long-distance spotting - and fire whirlwinds, when they burn into heavier fuels. Direct attack at the head of such fires is rarely possible after they have been burning more than a few minutes.
CLASS 5: Extreme (E) COLOR CODE: **Red**	fire situation is explosive and can result in extensive property damage	Fires under extreme conditions start quickly, spread furiously and burn intensely. All fires are potentially serious. Development into high-intensity burning will usually be faster and occur from smaller fires than in the Very High Danger class (4). Direct attack is rarely possible and may be dangerous, except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions, the only effective and safe control action is on the flanks, until the weather changes or the fuel supply lessens.
source: http://www.wfas.net/content/view/34/51/		

Figure 36: Fire Danger Index Rating (Table)

The NWS also issues Fire Weather Forecasts and Red Flag Warnings that refer to weather conditions that could sustain extensive rural fire activity. These forecasts and warnings are used to alert land management agencies and land users when dangerous burning conditions exist. Ponca City considers a “Class 3” severe for the city.

Previous Occurrences

Based on reports from the NCDC there have been 0 events from 2005 to 2015. A NCDC report from 2005 through 2015 can be found in Appendix D.

Probability of Future Events

It is determined that the possibility of a future wildfire is **Unlikely** within the next three years in Ponca City, it is also **Unlikely** for Ponca City School District #71. See Hazard Probability Matrix for the risk of all the communities in the city on page 37.

Vulnerability

All farmlands and urban areas are at risk from a wildfire due to the possibility of fire to structures and crops. Any buildings in the path of a wildfire will be at risk. Emergency response teams are also threatened in the event of a wildfire from heat exhaustion, injuries and being trapped in the wildfire path. See Types and Numbers by Hazard on page 119.

Impact

Local economic impacts from catastrophic wildfires include disruptions to both consumption and production of local goods and services. Immediate effects may include decreased recreation / tourism and timber harvest in the fire region, as well as disruptions from evacuations and transportation delays. Increased use of local goods and services for fire protection also impacts local economies. Other effects include direct property losses (in the form of buildings, timber, livestock, and other capital), damage to human health, and possible changes in the long-term structure of the local economy. There are many secondary effects to wildfire. All vegetation may be destroyed as well as the organic material in the soil may be burned away or may decompose into water repellent substances that prevent water from absorbing into the soil. In effect, normal rainfall after a wildfire may result in unusual erosion or flooding from burned areas; depending on the topography of the burned area, heavy rain can produce destructive debris flows.

Wildfires also have an effect on water supplies. The loss of ground-surface cover, such as pine needles and small branches, and the chemical transformation of burned soils make watersheds more susceptible to erosion from rainstorms.

Ponca City depends on the local and rural fire departments to battle the wildfires within the city. With the limited number of full time and voluntary fireman and equipment a large wildfire could put a strain on manpower, equipment and the local budgets for the communities. Most of the rural fire departments are not capable of fighting a large wildfire due to the fact that their equipment is limited and out of date.

Unique and Varied Risk

Wildfires do fall under the unique and varied risk where the grasslands meet up with urban areas. The map below shows where the urban interface meets up with the city wildlands. The CPRI Index for Wildfire is 2.0.

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Wildfire Maps

Ponca City

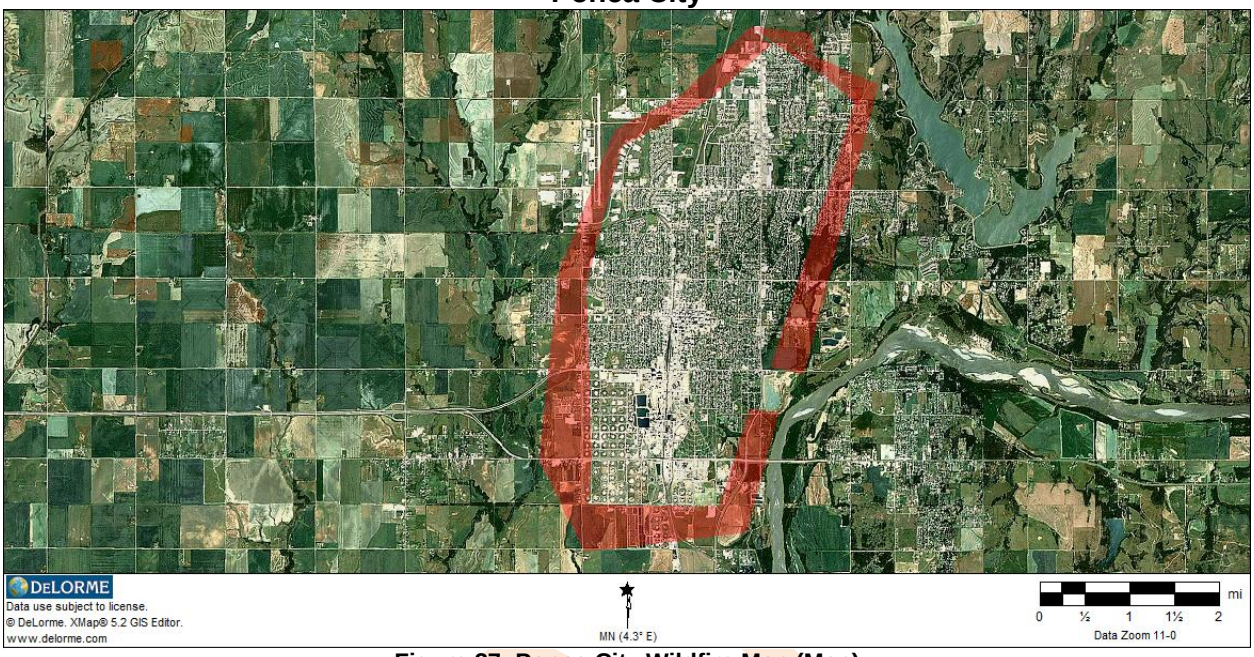

Figure 37: Ponca City Wildfire Map (Map)

Areas highlighted in red show where the Wildland meets with the urban interface.

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Winter Storms

(The Ponca City and participating entities are equally at risk for this hazard.)

Description

Heavy snowfall and extreme cold can immobilize an entire region. Even areas that normally experience mild winters can be hit with a major snowstorm or extreme cold. Winter storms can result in flooding, storm surge, closed highways, blocked roads, downed power lines and hypothermia.

Winter weather kills hundreds of people in the U.S. each year, primarily due to traffic accidents, fires from improper use of heaters, overexertion, and exposure. Additionally, threats such as hypothermia and frostbite can lead to loss of fingers and toes or cause permanent injury to vital organs.

Sometimes winter storms are 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.

Extreme cold often accompanies a winter storm or is left in its wake. Prolonged exposure to the cold can cause frostbite or hypothermia and become life-threatening. Infants and elderly people are most susceptible. What constitutes extreme cold and its effect varies across different areas of the United States. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." Freezing temperatures can cause severe damage to citrus fruit crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat. Long cold spells can cause rivers to freeze, and ice jams may form that lead to flooding.

Heavy accumulations of ice 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 extensive damage. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

Heavy snow can immobilize a region and paralyze a city, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow and ice can collapse buildings and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. The cost of snow removal, repairing damages, and loss of business can have large economic impacts on Ponca City and the participating communities.

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Winter Precipitation

FLURRIES	Light snow falling for short durations. No accumulation or light dusting is all that is expected.
SHOWERS	Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
SQUALLS	Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant. Snow squalls are best known in the Great Lakes region.
BLOWING SNOW	Wind-driven snow that reduces visibility and causes significant drifting. Blowing snow may be snow that is falling and/or loose snow on the ground picked up by the wind
BLIZZARD	Winds over 35 mph with snow and blowing snow reducing visibility to near zero.
SLEET	Sleet is rain drops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects. However, it can accumulate like snow and cause a hazard to motorists.
FREEZING RAIN	Rain that falls onto a surface with a temperature below freezing is considered freezing rain. This causes it to freeze to surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Even small accumulations of ice can cause a significant hazard.

Location

Ponca City and participating entities are equally at risk for the hazard of winter storms; however some structures maybe affected differently depending on age and composition type.

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Extent

The table below gives a range of physical intensities from winter storms along with the potential effect on the City of Ponca City

Level 1 – Nuisance Event No Major Impact	Little snow/ice accumulation. Roads not hazardous	Little to no effect on the City of Ponca City.
Level 2 – Minor Event Caution Advised	Dusting to 2 inches of snow. No measurable ice. Winter Weather Advisory	Untreated roadways may become hazardous and slick. Livestock may need additional supplemental feed.
Level 3 – Major Event **Isolated Emergency Conditions In the City of Ponca City**	Significant Snow Accumulations 2-8 inches. Ice Accumulations of ¼ to ½ inch. Reduced visibility. Wind causing drifting snow. Winter Storm Warning	Widespread hazardous road conditions. Travel discouraged. Areas isolated because of drifting snow. Isolated power outages because of down power lines from ice accumulation. Tree damage. Livestock loss potential increases, supplemental feed necessary.
Level 4 – Extreme Event **The City of Ponca City Under Full State of Emergency**	Crippling Event. Snow accumulations over 8 inches. Winds over 35 mph. Drifting snow, little to no visibility. Ice Accumulations of more than ½ inch. Blizzard Warning	Road conditions hazardous to impassable. People and livestock isolated. Widespread power and utility outages. Infrastructure damage. High potential for loss of livestock. Structures threatened from accumulating snow and ice. Communications infrastructure lost from ice accumulation. May be a long lasting event.

Wind chill is used to describe the relative discomfort and danger to people from the combination of cold temperatures and wind. The wind chill chart below from the National Weather Service shows the wind chill derived from both wind speed and temperature. The City of Ponca City Can experience wind chills of -29 degrees several times per year.

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Wind Chill Chart

Wind (mph)	Temperature (°F)																	
Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph) *Effective 11/01/01*

Figure 38: Wind Chill Chart (Table)

Previous Occurrences

13 reports of winter storms have been reported for Ponca City from 2005 to 2015 by the National Climatic Data Center. There have not been any specific reports given for each community; however, winter storms affecting the county would also have an effect on the communities within the county.

Various Previous Occurrences for Winter Storm Source: NCDC	
December 27, 2008	Two inches of snow accumulation were reported in Cherokee, and 1.5 inches was reported near Helena. Light snow developed over northern Oklahoma on the 27th. The snow lasted through the morning, with most areas reporting one to three inches of snow accumulation.
December 15, 2008 To December 16, 2008	One inch of snow was measured in Ponca City. A few minor accidents were reported, although no injuries were reported. Monetary damages were not given. Light wintry precipitation developed early on the 15th as moist air overspread cold surface temperatures. Very light freezing rain, sleet, and snow were reported across the area, and this quickly translated into travel problems. Numerous accidents were reported, several with injuries and even fatalities.

Winter Storms Incidents in Kay County	
Community	**Incidents**
Kay County	13
Total	13

Probability of Future Events

With the 13 reported winter storms in Ponca City since 2005 by the NCDC, it is predicted that a future event is **Highly Likely** to occur in the next three years in Ponca City, it is also **Highly-Likely** for Ponca City School District #71. Data from the NCDC was reported for the county only

and is considered a data limitation. See Hazard Probability Matrix for the risk of all the communities in the city on page 37.

Vulnerability

The elderly, homeless, and lower income population, with lack of heating equipment and limited finances for sufficient utilities, are vulnerable to the cold. Extreme cold can cause animals and people, especially young children and outdoor workforce exposed to winter elements to suffer from frostbite and hyperthermia – sometimes even death. Since 44% of the population of Ponca City is under 18 and over 65, the likelihood of someone succumbing to the elements is high.

The *Wind Chill* temperature is simply a measure of how cold the wind makes real air temperature feel to the human body. Since wind can dramatically accelerate heat loss from the body, a blustery 30° day would feel just as cold as a calm day with 0° temperatures. The index was created in 1870, and on November 1, 2001, the National Weather Service released a more scientifically accurate equation, which we use today. Here is a chart for calculating wind chill. (Please note that it is not applicable in calm winds or when the temperature is over 50°). See Types and Numbers by Hazard on page 120.

Impact

A Severe Winter Storm can impact our lives in the following ways:

- Highways closed or difficult to travel on
- Airport closings - business and pleasure trips cancelled or delayed
- Commuter trains and buses delayed
- Mail delayed
- Difficulty in obtaining medical care (unable to get to hospital – ambulances blocked by snow covered roads)
- Shipment of food and other goods delayed
- Schools closed, Businesses closed
- Stores lose business because patrons unable to get there
- Power and communication disrupted because of downed lines
- Fire and police delayed in responding to emergencies
- Cars hard to start - need assistance (often extra costs)
- Increased auto accidents
- Large costs to state, county and local highway departments for snow removal

Since 2005, the County has experienced many winter storms of varied intensities that consisted of snow and/or ice. Snow blocked and ice covered roads not only make travel dangerous, but the removal and clearing of snow and ice can be costly. Downed electrical lines and the resulting loss of power to homes, businesses, and water systems can also increase potential dollar losses during winter storm events. An estimated twenty percent calculation was used for the county since there is no specific data for the city of Ponca City for this hazard.

Unique and Varied Risk

This hazard does not fall in the category of unique and varied risk due to the fact that the entire county and communities within the county are at risk; however as stated before, some structures may be affected differently depending on age and composition type. The CPRI Index for Winter Storms is 3.1.

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Identifying Assets

The Ponca City Hazard Mitigation Plan identifies critical facilities located within the community and the hazard events that pose a threat. A critical facility is defined as a facility that is essential to the community such as: emergency services, education facilities, products and services, or financial means to the area and is vital to the structure and stability of the community.

The PCHMPC determined the critical facilities to be included in the assessment. These facilities were determined by utilizing FEMA guidelines to estimate losses using a truncated inventory with cost estimates of residential properties and critical facilities to provide a broad view of the extent of damages that could occur in the community.

Critical Facilities

Critical Facilities for the city of Ponca City		
Facility	**Value of Structure**	**People in Structures**
AT&T Communications Center	$3,640,000.00	N/A
23 Miles 69KV Transmission Line	$15,000,000.00	N/A
Baughman, Toni Child Care Home	$74,652.00	N/A
Broadway Plaza Assisted Living	$5,726,080.00	N/A
Brumley, Kimberly Child Care Home	$45,025.00	N/A
City Hall & Administration Bldg	$12,448,000.00	N/A
Conoco Philips Refinery	$8,713,600,000.00	N/A
Dan Moran Baseball Complex	$466,800.00	N/A
Denny, Laura Child Care Home	$89,159.00	N/A
PC Fire Department (4)	$5,407,100.00	N/A
Golden Villa Senior Center	$124,480.00	N/A
Hutchins Memorial Auditorium	$7,002,000.00	N/A
Kay County Health Department	$746,880.00	N/A
KIXR Radio Station	$100,000.00	N/A
KLVV Radio Station	$100,000.00	N/A
KPNC Radio Station	$100,000.00	N/A
KLOR Radio Station	$100,000.00	N/A
Marland Mansion & Estate	$60,000,000.00	N/A
Marland's Grand Home	$5,000,000.00	N/A
Mothers day out/Methodist	$1,269,696.00	N/A
Northern Oklahoma Youth Services	$1,200,000.00	N/A
Water Treatment Equip. Yard	$245,848.00	N/A
OMPA Electric Power Generating Plant	$98,000,000.00	N/A
Opportunity Center, the	$5,034,300.00	N/A
P.C. Schools Ag Building	$311,200.00	N/A
P.C. Alternative School	$799,784.00	N/A
P.C. Briar Ridge Lift Station	$250,000.00	N/A
P.C. EMA/Police Dept.	$2,519,164.00	N/A
P.C. Energy-Dan Moran Substation	$2,000,000.00	N/A
P.C. Energy-Diesel Plant Substation	$4,000,000.00	N/A
P.C. Energy-Gonterman Substation	$2,000,000.00	N/A
P.C. Energy-Huffy Substation	$2,000,000.00	N/A
P.C. Energy-McCord Substation	$2,000,000.00	N/A
P.C. Energy-Northeast Substation	$2,000,000.00	N/A
P.C. Energy-Northwest Substation	$2,000,000.00	N/A
P.C. Energy-Pecan Park Substation	$2,000,000.00	N/A
P.C. Energy-WWTP Substation	$2,000,000.00	N/A
P.C. Kygar Booster Pump Station	$95,000.00	N/A
P.C. Lake sewage Lift Station	$300,000.00	N/A
P.C. Golf course sewage lift station	$250,000.00	N/A
P.C. Industrial. Park Pump Station & Water Tank	$2,700,000.00	N/A
P.C. Police Training Center & Firing Range	$175,000.00	N/A
Peters, Judy Child CareHome	$16,833.00	N/A
Pioneer Technology Center	$30,200,000.00	N/A
Ponca City Aquatic & Family Center - YMCA	$20,910,410.00	N/A
Ponca City Energy	$34,232,000.00	N/A
P.C. Kids Inc. Ball Field	$311,200.00	N/A
Ponca City Medical Center	$79,128,824.00	N/A

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Ponca City News	$1,720,936.00	N/A
Ponca City Nursing Home	$4,045,600.00	N/A
Ponca City Park Department	$1,363,056.00	N/A
Ponca City Public Library	$5,600,000.00	N/A
Ponca City Regional Airport	$11,825,600.00	N/A
Ponca City Soccer Complex	$311,200.00	N/A
Ponca City Street Department	$505,129.29	N/A
P.C. Traffic Engineering & Motor Pool	$1,245,889.00	N/A
P.C. Solid Waste Department	$612,534.96	N/A
P.C. Motor Pool Facility	$612,534.96	N/A
P.C. Medical Center	$79,128,824.00	N/A
P.C. underground water tank & pump station	$2,500,000.00	N/A
P.C. Water & Sewage Distribution Barn	$100,000.00	N/A
P.C. Water Tower(2)	$1,700,000.00	N/A
P.C. Water Treatment Equip. Yard	$245,848.00	N/A
P.C. Water Treatment Plant	$23,450,000.00	N/A
Regional Medical Laboratory	$2,545,273.00	N/A
Renaissance Assisted Living	$1,420,000.00	N/A
Senior Citizen's Center	$720,000.00	
Shawn Manor Nursing Home	$1,968,028.00	N/A
St. Mary's Childcare	$584,433.60	N/A
Standing Bear Museum & Education Center	$2,000,000.00	N/A
Sterling House	$4,379,362.00	N/A
WBBZ Radio Station	$933,600.00	N/A
Westminster Village Inc.	$2,746,931.00	N/A
Willow Creek Assisted Living	$1,608,479.67	N/A
Willow Springs Softball Park	$311,200.00	N/A
YMCA of Ponca City	$3,750,000.00	N/A
Water Treatment Plant	$23,450,000.00	N/A
Raw Water Supply Total	$3,800,000.00	N/A
Water Distribution	$7,415,000.00	N/A
Wastewater Treatment Plant	$26,006,000.00	N/A
Wastewater Collection	$4,880,000.00	N/A
Wentz Camp Lift Station	$300,000.00	N/A
TOTAL	**$9,351,504,892.48**	N/A

Figure 39: Ponca City Critical Facilities (Table)

Critical Facilities for School District #71 Ponca City			
Facility	**Structure Value**	**People in Structure**	
Garfield Elementary	$6,379,600.00	5157 Students	760 Staff
Child Development Center	$1,182,560.00		
Country School Day	$311,200.00		
East Middle School	$112,032,000.00		
First Baptist Day School	$1,089,200.00		
First Lutheran School	$1,711,600.00		
Kid's Care Learning Center	$466,800.00		
Liberty Elementary School	$3,890,000.00		
Lincoln Elementary School	$3,578,800.00		
Lutheran School	$1,711,600.00		
Miss Nann's Christian School	$298,752.00		
Ponca City Head Start	$838,684.00		
Ponca City High School	$32,676,000.00		
Roosevelt Elementary School	$3,833,050.00		
St. Mary's Catholic School	$1,682,440.56		
Tammy's Playskool & Learning	$171,160.00		
Trout Elementary School	$32,867,543.60		
Union Elementary School	$4,571,839.20		
Unity Recreation Center	$1,175,000.00		
University Learning Center	$9,300,000.00		
Washington Elementary School	$2,226,138.00		
West Middle School	$5,971,928.00		
Woodlands Elementary School	$4,668,000.00		
TOTAL	**$232,633,895.36**	**5917**	

Figure 40: Ponca City Public School District Critical Facilities (Table)

Estimated Types and Numbers of Existing Structures Affected by Hazards Ponca City					
Type of Structure	**Number of Structures**	**Value of Structures**	**Number of Structures in Hazard Area**	**Value of Structures in Hazard Area**	**Number of People in Hazard Area**
Residential	10,440	$626,400,000	2,074	$124,440,000	5,022
Government	55	$331,344,462	11	$2,170,786,671	9
Commercial	1,463	$8,852,585,000	293	$33,356,400	3,016
Education	21	$226,826,895	4	$54,438,455	1,031
TOTAL	**11,979**	**$10,037,156,357**	**2,382**	**$2,383,021,526**	**9,078**

Figure 41: Types and Numbers of Existing Structures in Hazard Area (Table)

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Types and Numbers by Hazard

Estimated Types and Numbers of Existing Structures Affected by an F-3 Tornado Scenario					
Community	**Structures Damaged**	**Severe Damages**	**Moderate Damage**	**Population in Hazard Area**	**Total Damages**
Ponca City	2,074	**$124,440,000**	**$25,526,400**	5,022	**$149,966,400**
Ponca City Public School District #71	**4**	**$46,526,779**	**$9,305,356**	**1,183**	**$55,832,135**

Tornado

In an effort to estimate potential dollar losses to the City in the event of a F3 tornado, this plan included GIS modeling which created such a scenario through Ponca City. Using the GIS software and census data a map was created to illustrate the pathway of a F3 tornado through the town. An estimated loss table was created to show damages in the severe damage zones and moderate damage zones.

The center of the path is the severe damage zone that could cause total or one hundred percent devastation. The outer sections to the side of the severe damage zone are the moderate damage zones that would see damage from flying debris and heavy winds. The moderate damage zone would have some destruction; however, it would be repairable and not a total loss. This zone would cause minimal damage to approximately fifty percent damage to the property and structures in this area.

An additional note, this scenario does not take into account the potential loss to farms or businesses. Should they sustain damage in a tornado event the potential dollar losses could increase by 15% to 25% of the total dollar loss depending upon the path.

Estimated Types and Numbers of Existing Structures Affected by Dam Failure				
Community	**Structures**	**Damages**	**Population in Hazard Area**	**Total Damages**
Ponca City	**140**	**$8,400,000**	**600**	**$8,400,000**
Ponca City Public School District #71	**1**	**$11,361,695**	**296**	**$11,361,695**

Dam Failure

The Lake Ponca, Kaw Lake Dam, and Cremers Park Regional Detention Pond Dams are rated as the only high risk dams in the city. the Ponca and Kaw Lake dams are located to the east of the city and the Cremers Park Regional Detention pond dam is located in the northern section of the city. There are approximately 141 downstream properties and structures at risk in the area of Ponca City. There are some elderly and low to moderate income families within the area. The residential structures are brick and mortar, stone, and wood construction. Most are owner occupied with some lease or rental properties in the location. There would also be vulnerability to roads, bridges, environmental, vital services and traffic. The principal threat would be flood inundation to residential houses, farmland, crops, and livestock downstream in Ponca City; however, there is a greater threat to McCord downstream from the dam breach at Ponca Lake.
Calculations of roughly 1.25% were utilized to compute estimated losses for dam failure in Ponca City.

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Estimated Types and Numbers of Existing Structures Affected by Flooding				
Community	**Structures**	**Damages**	**Population in Hazard Area**	**Total Damages**
Ponca City (20%)	2,074	**$124,440,000**	5,022	**$124,440,000**
Ponca City Public School District #71 (10%)	**2**	**$9,305,356**	**592**	**$9,305,356**

Flooding

Ponca City is susceptible to flooding due to the flash flood events, watersheds and tributaries. However, flooding is a unique and varied risk for those areas located in the 100 to 500 year floodplain. It is estimated that twenty percent for the City of Ponca City since it is at a greater risk from flood events. Properties located in or near the floodplains are the most vulnerable to flood events in the communities. The City of Ponca City has some businesses, critical facilities, elderly, and low income families located in the hazard area. The types of residential structures include brick and mortar, wood, and modular homes.

Estimated Types and Numbers of Existing Structures Affected by Wildfire				
Community	**Structures**	**Damages**	**Population in Hazard Area**	**Total Damages**
Ponca City	2,074	**$124,440,000**	5,022	**$124,440,000**
Ponca City Public School District #71	**4**	**$46,526,779**	**1,183**	**$46,526,779**

Wildfire

All farmlands and urban areas are at risk from a wildfire due to the possibility of fire to structures and crops. Any buildings in the path of a wildfire will be at risk. Emergency response teams are also threatened in the event of a wildfire from heat exhaustion, injuries and being trapped in the wildfire path. Approximately twenty percent of the population and structures in Ponca City are at risk from a wildfire event. These communities mainly have residential properties at risk that include brick and mortar, wood, and some prefabricated mobile homes. The structures that are on the outskirts where the grasslands meet up with the urban interface are at the greatest risk; however, much depends on the emergency personnel and their ability to extinguish the fires. A wildfire has a greater ability to roll through a smaller community with a lesser amount of area to pose as a fire break in those communities. In these areas critical facilities, nursing homes, schools, businesses, and all residents are at risk. The wildfire table uses a twenty percent calculation for the city of Ponca City

Estimated Types and Numbers of Existing Structures Affected by Drought, Earthquake, Flooding, Hail, High Wind, Thunderstorm, and Winter Storm (20% calculation)				
Community	**Structures**	**Damages**	**Population in Hazard Area**	**Total Damages**
Ponca City	2,074	**$124,440,000**	5,022	**$124,440,000**
Ponca City Public School District #71	**4**	**$46,526,779**	**1,183**	**$46,526,779**

Drought

The hazard of drought does not pose a risk to the community's structures; however, it does pose an immediate threat to the farming communities. This can be extremely costly to the communities of Ponca City in regards to financial losses. It is estimated that twenty percent of the population and the communities would suffer from these damages.

Earthquake

There have been recorded events of an earthquake in Ponca City with a reading of above a magnitude of 3 on the Richter Scale. There are no past damages recorded, therefore potential dollar loss was estimated on a twenty percent calculation in the event that an incident was to occur. Older homes and structures would be more vulnerable to this hazard if a low to moderate earthquake were to occur.

Hailstorms

Ponca City is subject to hail events with every thunderstorm. Structures themselves are not necessarily at risk, however, roofs, shingles, vehicles, citizens, crops, and livestock are at risk from this hazard. Anything outdoors is a target for this hazard. Income level, age groups, or health is not a factor with this hazard. Every community is at risk from a hail event and damages. The twenty percent calculation was used to determine possible damages for this hazard.

High Wind

As was documented under the hazard assessments, Ponca City had 7 high wind events recorded by the NCDC since 2005. All residents, structures, buildings, critical facilities, all income levels and age groups are at risk for thunderstorms. Older buildings and wood framed houses are more susceptible from this hazard. Power lines, street lights and signs, and other free standing structures are at risk as well. It is determined that any given thunderstorm could cause approximately twenty percent damage to the city of Ponca City with this hazard. The twenty percent calculation was used to determine damages for this hazard.

Thunderstorms

As was documented under the hazard assessments, Ponca City had 132 thunderstorm events recorded by the NCDC since 2005. All residents, structures, buildings, critical facilities, all income levels and age groups are at risk for thunderstorms. Older buildings and wood framed houses are more susceptible from this hazard. Power lines, street lights and signs, and other free standing structures are at risk as well. It is determined that any given thunderstorm could cause approximately twenty percent damage to the community with this hazard. The twenty percent calculation was used to determine damages for this hazard.

Winter Storm

Since 2005, the County has experienced many winter storms of varied intensities that consisted of snow and/or ice. Snow blocked and ice covered roads not only make travel dangerous, but the removal and clearing of snow and ice can be costly. Downed electrical lines and the resulting loss of power to homes, businesses, and water systems can also increase potential dollar losses during winter storm events. An estimated twenty percent calculation was used for the county since there is no specific data for the city of Ponca City for this hazard.

Extreme Heat, and Lightning

These hazards pose more of a risk to people than property; however, lightning can cause damage to equipment and structures but the greatest threat is to the citizens of the communities. These hazards affect the individuals that are exposed to the element.

Extreme Heat data specific to potential dollar loss resulting from this hazard was not available; therefore estimates for potential loss cannot be derived at this time. Such loss is likely to include livestock and crop damage, which would be identified mostly with drought, rather than events of extreme heat. Extreme heat is dangerous for those individuals at sporting events, outside workers, the sick, elderly, and those that cannot afford the luxury of air-conditioning.

Lightning

Is a totally unpredictable hazard that can occur at any place in the community. An electrical storm can cause an incredible amount of damage if it strikes in the right places such as power plants, hospitals, or other major facilities. Due to the fact that most lightning strikes go unreported and lightning poses more of a hazard to individuals that are outdoors. An accurate damage estimate is not available for this hazard.

DEVELOPMENT TRENDS

Currently most of the development in Ponca City is residential, with a large amount of permits being issued for storm shelters and carports, with the Northeast side of the city seeing the most permits issued. Also, there is currently a project underway for the Ponca City Schools with new locker rooms being built for the baseball team.

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CHAPTER 5
MITIGATION STRATEGIES

Update Revisions for Chapter Since Last FEMA Approval	
Section	Description
Chapter 5	• Updated the Goals and Objectives, Mitigation Strategies, and STAPLEE

Description and Analysis

This section of the Ponca City Hazard Mitigation Plan identifies the goals and alternative mitigation actions that the community considered when putting the mitigation strategy together. In the hazard mitigation planning process, these terms have the following meaning:

- **Goals** are general guidelines explaining what the stakeholders and community want to achieve. Goals are usually expressed as broad policy statements representing desired long-term results and can include objectives that are more detailed.

- **Actions** provide a more detailed description of specific work tasks to help a community achieve the goals and objectives. For each goal and objective, there were a range of mitigation actions considered by the Ponca City Hazard Mitigation Planning Committee. (Source: FEMA How to Guide 386 -1)

The Ponca City Hazard Mitigation Planning Committee established the goals for this planning effort. The goals were developed to reflect existing community priorities consistent with current planning efforts and in consideration of the impact of each natural hazard which affects the Ponca City. The PCHMPC reviewed "Mitigation Ideas" and "Mitigation Planning" prepared by FEMA, that provided useful information in determining mitigation items specific for the Ponca City and participating entities. Continuous efforts and concerns of the PCHMPC were to reduce vulnerability and to have a knowledgeable level of understanding in regards to hazards and emergency response capabilities of the Ponca City and the participating entities.

The Ponca City Hazard Mitigation Planning Committee decided that the goals needed to achieve a complete and resourceful plan are as follows:

- Strive to achieve the goals discussed by the PCHMPC members

- To implement mitigation actions determined by the PCHMPC; these actions are a full range of potential mitigation measures that were identified from the "Risk Assessment" with their capabilities to implement the actions as assessed.

- Continue to review and update the mitigation actions as appropriate to the Ponca City community, city community leaders, Ponca City and the Ponca City Public School Districts.

- After a disaster or hazard event, the PCHMPC will review mitigation actions already in place and determine their effectiveness.

- After a disaster or hazard event, the PCHMPC will evaluate what mitigation items could have reduced the impact of the hazard and determine if it is feasible to implement such action.

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Goals

The Ponca City and participating entities overall priority and responsibility is to reduce or eliminate loss of life or injuries and reduce the affects to the city, school district and individually owned property during a natural or manmade hazard event.

Goals & Objectives	
All Hazards	**Goals**
	1. To protect the life, health and safety of residents
	2. To reduce damages from all natural hazards
	3. To maintain municipal and emergency services
	Objectives
	1. To have mitigation efforts to protect the citizens in Ponca City
	2. To have mitigation measures that will protect the properties of the City, Schools and residents from disasters
	3. To have mitigation efforts in place to maintain municipal services to the community
Dam Failure	**Goals**
	1. Reduce the affects of dam failure in Ponca City
	2. Provide early warning in case of water breach
	Objectives
	1. To identify a secondary water supply from nearby lakes or aquifers. The main threat to the community of Ponca City would be a depleted potable water supply.
	2. To purchase and install an early warning notification system at Ponca City Lakes. There is very little downstream threat to people or property from the Ponca City Lakes; however, there would be a threat to recreational campers, visitors and anglers.
Drought	**Goals**
	1. Assist in developing farm ponds to reduce the affects of drought
	2. Notify and educate the public about the effects of drought
	3. Assist in developing an irrigation program
	Objectives
	1. To identify a water source to be utilized by the local fire department, farmers and ranchers. The water source would provide for firefighting, irrigation and livestock.
	2. Inform the public on how to reduce the affects of drought by conserving water
	3. Coordinate with state and federal agencies to develop a volunteer irrigation program for farmers
Earthquake	**Goals**
	1. Inform the public on the risks of an earthquake
	2. Change building codes
	Objectives
	1. Use informational packets to inform the public
	2. Develop building codes to secure structures for earthquake
Extreme Heat	**Goals**
	1. Set up cool and warming zones for extreme heat and winter storms
	2. Inform the public on the risks of extreme heat.
	3. Develop out door water sources
	Objectives
	1. Set up cool and warming zones in the community and schools that the public can go to when they need to cool down from extreme heat and warm up during the winter weather
	2. Inform the public on extreme heat risks and how to identify when some one is in danger from the heat event by presentations and leaflets at the city and the school facilities
	3. Develop outdoor water sources, so the public has access to drinking water while outdoors. Outdoor water sources will be placed at recreational areas and some areas around the community
Flooding	**Goals**
	1. Protect health and welfare of the community and reduce damages from flooding
	2. Maintain drainage system
	3. Maintain compliance in the NFIP
	4. Enhance the environment in the floodplain
	Objectives
	1.There are very few areas that flood within Ponca City; however, there are some low lying areas and a few residential houses that are at risk. Drainage efforts need to be made in those areas
	2. Watersheds flood on occasion; however, keeping the areas clear of debris will reduce the risk of flooding around the community
	3. Maintaining compliance in the NFIP is one of the best ways to ensure that houses and structures are not developed in the flood plain
	4. Removing the debris and clutter from the watersheds will enhance the environment and eliminate the debris from flowing down stream
Thunderstorms	**Goals**

• **Lightning** • **Hail** • **High winds**	
	1. Identify construction practices that can reduce the impact of thunderstorms
	2. Provide sheltering options from the impact of thunderstorms
	3. Educate the public regarding the risks of thunderstorms
	4. Reduce damage to structures from lightning, hail, and high winds
	Objectives
	1. Identify and promote construction practices to residents, area contractors and real estate agencies to better secure the structures from thunderstorms.
	2. Provide public awareness for shelter locations and create a database to identify local shelters for search and rescue operations after a disaster
	3. Inform the public through literature handouts and presentations about the risks of severe weather events.
	4. Inform the public and local contractors of construction techniques and items to protect structures from thunderstorms.
Tornado	**Goals**
	1. Protect life and safety of property of residents and businesses in the community
	2. Minimize community impact
	3. Improve protection of infrastructure
	4. Identify residential and public shelters in the community
	Objectives
	1.Protect life and residential / business property in the community by providing informational packets for suggested measures to strengthen their structures and actions to take in the event of a tornado
	2.Minimize community impact by promoting shelters, school shelters, and public awareness
	3. Provide information to residents and local contractors for ways to strengthen structures from tornados
	4. Develop a database of all residential and public safe rooms in the community to assist with search and rescue efforts
Wildfire	**Goals**
	1. Inform the public about the risk of wildfires
	2. Assist with developing farm ponds
	3. Become a Firewise community
	4. Equip the Ponca City fire departments with adequate trucks, machinery and equipment
	Objectives
	1. Inform the public through presentations and literature distributed at city buildings and school facilities
	2. Assist local farmers to develop needed farm ponds for watering animals and for use on fighting wildfires
	3. Contact the State Forestry Service to develop a Firewise Plan for the community
	4. Obtain fire trucks, equipment and machinery for wildfires.
Winter Storms	**Goals**
	1. Educate the public regarding the risks of winter storms
	2. Coordinate staging areas for snow and ice removal
	3. Provide backup generators for critical facilities
	4 Strengthen power lines to reduce outages around the community
	Objectives
	1. Educate the public and students through presentations and literature handouts to inform them about actions to take in the event of a winter storm
	2. Provide staging areas around the city for snow removal equipment and sand
	3. Provide backup generators for critical facilities in the event of a power outage during a winter storm event
	4 Strengthen power lines to reduce outages around the community with twisted pair wiring

Figure 42: Goals and Objectives (Table)

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Strategies

Six Categories of Mitigation Actions	
CATEGORY	**DESCRIPTION**
Prevention	Prevention actions are intended to address future development. These actions are: ➢ Sustain a hazard risk to prevent it from becoming a greater risk ➢ Ensure that future development does not increase hazard losses ➢ Guide future development away from hazards, while maintaining other community goals such as economic development and quality of life Community can achieve significant progress toward hazard resistance through prevention actions. Prevention actions are particularly effective in areas that have not been developed or where capital investment has not been substantial. **Examples** ▪ Planning and zoning (floodplain regulations) ▪ Open space preservation (parks and recreational areas) ▪ Land development regulations ▪ Storm water management (clear ditches / develop larger retention basins) ▪ Capital improvements planning ▪ Maintain building codes enforcement
Property Protection	Property protection actions are measures that: ➢ Modify existing buildings subject to hazard risk, or their surroundings ➢ Directly protect people and property at risk ➢ Can be inexpensive actions where they are implemented or cost-shared with property owners **Examples** ▪ Acquisition - Public procurement and management of lands that are vulnerable to damage from hazards ▪ Relocation - Permanent evacuation of hazard-prone areas through movement to safer areas ▪ Flood-proofing - modifying a flood-prone structure to reduce future flood damages
Public Education and Awareness	Public education and awareness actions inform and remind individuals about hazardous areas and the actions they can take to avoid potential damage and injury. They are directed toward property owners, potential property owners, business owners, students, staff, and visitors. **Examples** ▪ Providing hazard maps and other hazard information ▪ Information posted on websites or other public sites ▪ Outreach programs that provide hazard and mitigation information to the public ▪ Provide business owners with mitigation information for employees and customers ▪ Mass literature mail-outs ▪ Notice to residents and property owners in hazard-prone areas ▪ Displays in high traffic facilities such as public buildings and restaurants ▪ Newspapers, radio / TV spots and interviews ▪ Public access TV channel announcements ▪ Videotape / property owner handbook ▪ Presentations at meetings (neighborhood, community and civic groups) ▪ Real estate disclosure ▪ Information in public library ▪ Student and adult education
Natural Resource Protection	Natural resources protection actions reduce the intensity of hazard effects and improve the quality of the environment and wildlife habitats. They are usually implemented by parks, recreation or conservation agencies or organizations

	Examples ▪ Erosion and sediment control ▪ Wetlands protection ▪ Environmental restoration
Emergency Services Protection	Emergency services protect people before and after a hazard event. Most counties and many cities have emergency management offices to coordinate warning, response, and recovery during a disaster. Actions taken to ensure the continuity of emergency services are considered to be mitigation. **Examples** ▪ Warning systems ▪ Protection of critical facilities ▪ Protection of infrastructure such as roads and bridges for emergency response
Structural Projects	These are actions that: ➢ Directly protect people at risk ➢ Involve construction of manmade structures to control hazards **Examples** ▪ Reservoirs ▪ Levees and floodwalls ▪ Diversions ▪ Channel modifications ▪ Storm sewers

Figure 43: Six Categories of Mitigation Actions (Table)

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The City of Ponca City has been active in utilizing the opportunities provided by the current Ponca City Hazard Mitigation Plan. The City has been active participating in mitigation activities throughout the community. The City has utilized resources provided by FEMA, State of Oklahoma, City and community funds to see that these actions are taking place to better protect the community from hazards that were identified in the planning process of the hazard mitigation plan. Below is a list of the mitigation activities that the community has completed, started, currently applied for, or has applied for and been rejected for funding.

Mitigation Project	Amount	App sent	Funded	NOI Submitted
Safe Room Grant	$648,000	☐	☒	☐
Weather Radios	$155,000	☒	☐	☐
Public Safe room	$420,950	☒	☐	☐
Acquisition of Repetitive Loss Properties	$400,000	☒	☐	☐
Replacement of 4" Waster Mains/ Downtown/ Critical facilities	$536,989	☐	☐	☒
Generator/Public Safety Ctr	$36,180	☒	☐	☐
Electric Lines / GIS	$2,000,000	☐	☐	☒
Env. Health / Safety Plan	$75,000	☐	☐	☒
Update / Mitigation Plan and Elevation Certificates	$120,000	☐	☒	☐
EOC Renovations	$61,800	☐	☐	☒
SCADA Monitoring	$465,000	☐	☐	☒
Early Flood Warning System	$60,788	☐	☐	☒
Safe Room Grant (Residential)	$576,000	☐	☐	☒
Planimetric Data & Aerial Photography	$150,000	☐	☒	☐
System Construct (Workflow Analysis, Hardware Upgrade, And Training	$250,000	☐	☒	☐
ESRI ELA (Phase 1)	$185,000	☐	☒	☐
911 System Integration	$250,000	☐	☒	☐
Fire Department Software Integration	$40,000	☐	☒	☐
Pictometry Photography	$120,000	☐	☒	☐
Cityworks ELA (Phase 1)	$195,000	☐	☒	☐
Outage Reporting System	$150,000	☐	☒	☐
Outage Call Handling	$75,000	☐	☒	☐
Distribution Reclosing & Control	$375,000	☐	☒	☐
Storm Water Application	$35,000	☐	☒	☐
Modeling for Dam Failures	$25,000	☐	☒	☐
Flood Prone Inventory	$25,000	☐	☒	☐
Critical Facility Mapping	$25,000	☐	☒	☐
Correction Street Address Attributes	$50,000	☐	☒	☐
Addressing & Mapping Critical Structures	$25,000	☐	☒	☐
Mapping of Damaged Items	$25,000	☐	☒	☐
Fy-08 Community Development Block Grant	$126,843	☐	☐	☒

Mitigation Actions

Mitigation Action Items in red proposed to be removed

Figure 44: Start of Mitigation Actions (Table)

Ponca City	**Mitigation Action Item**
Action # 1	**Action:** Public Education for drought, dam failure, earthquake, extreme heat, thunderstorms, tornadoes, wildfires, winter storms
Hazards Addressed:	☒ Dam Failure ☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Inform the public with hazard information on drought, dam failure, earthquakes, extreme heat, thunderstorms, tornadoes, wildfire, and winter storms in hazard awareness literature and presentations. This information will explain what to do, where to go in the event of a hazard and tell how to minimize their risks. Each person can help in the efforts to reduce the risks of all hazards if they know what to expect. The literature will be distributed throughout the city and school facilities and presentations will be given to school children in class. Create a Ponca City Outreach Program based upon the Community Rating System program.
Lead:	Hazard Mitigation Committee, Emergency Manager
Schedule:	1-3 years
Cost:	$1,000 annually
Budget:	HMGP Grant, PDM Grant, city budget, and other possible grant funding
Action Item for: ☒ Ponca City ☒ Ponca City Public School District #71	

Ponca City	**Mitigation Action Item**
Action # 2	**Action:** Detention Ponds for farmers within city limits
Hazards Addressed:	☒ Dam Failure ☒ Drought ☐ Earthquake ☒ Extreme Heat ☒ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Assist local farmers in building detention ponds to help retain water for times of drought. The ponds could be used for irrigation, stock and to help fight wildfires by submerging suction pumps to battle fires.
Lead:	Hazard Mitigation Committee, Emergency Manager
Schedule:	3-5 years
Cost:	Staff time
Budget:	HMGP Grant, PDM Grant, city budget, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 3	**Action**: Multi-Purpose Public Address and Warning System
Hazards Addressed:	☒ Dam Failure☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Inform the public with combination warning sirens/public address system when a thunderstorm threatens the community. Currently all community is in need of multi-purpose warning system. The public address system would allow the community to announce any hazard event that is threatening the community. Establish permanent Staff Gauges in streams and develop rating curves for each Staff Gauge, and establish high resolution technology for early flash flood warning by way of radar technology.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	1-3 years
Cost:	$40,000 per system
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 4	**Action:** NOAA Weather Radio Program
Hazards Addressed:	☒ Dam Failure☒ Drought ☐ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☐ Wildfire ☒ Winter Storm
Description:	Provide a NOAA Weather Radio to students and residents in the city to warn them of weather events (including lightning and hail events). The program would allow residents to purchase the radios at a reduced price.
Lead:	Hazard Mitigation Committee, Emergency Manager and School Administrators
Schedule:	1-3 years
Cost:	No cost to, city, or schools. Residents will cover the 25% match.
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☒ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 5	**Action:** Community Storm Shelters and Hazard Supply Staging Areas
Hazards Addressed:	☒ Dam Failure☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Build community storm shelters and hazard supply staging areas around the city and school district to be prepared for all hazard events. The staging areas will contain equipment and supplies for all hazards. For example, medical supplies, sand, sand bags, pumps, bottled water, blankets, heaters, refrigeration units, generators, etc…
Lead:	Hazard Mitigation Committee, Emergency Manager
Schedule:	1-3 years
Cost:	$200,000 to $500,000 per shelter
Budget:	HMGP Grant, PDM Grant, city budget, and other possible grant funding
Action Item for: ☒ Ponca City ☒ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 6	**Action:** Emergency Operations Center/911 Call Center/Community Shelter
Hazards Addressed:	☒ Dam Failure☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Build an Emergency Operations Center/911 Call Center/Community Storm Shelter. Currently, the communities EOC is not sheltered and is vulnerable to hazards.
Lead:	Hazard Mitigation Committee, Emergency Manager
Schedule:	1 – 5 years
Cost:	$200,000 to $500,000 per shelter
Budget:	HMGP Grant, PDM Grant, city budget, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 7	**Action:** Watershed, Lake, and River Warning Devices
Hazards Addressed:	☒ Dam Failure ☒ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☐ Wildfire ☒ Winter Storm
Description:	Install electronic water level warning devices at key areas upstream and danger levels to notify the emergency management departments of possible impending flood from the watersheds, lakes, and rivers.
Lead:	Hazard Mitigation Committee, Emergency Manager
Schedule:	3-5 years
Cost:	$500 per device
Budget:	HMGP Grant, PDM Grant, city budget, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 8	**Action:** Drainage and Storm Water Management Program
Hazards Addressed:	☒ Dam Failure ☒ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☐ Wildfire ☒ Winter Storm
Description:	Have a program to reduce or eliminate the floodplain from the areas around watersheds, lakes, and rivers that is shown on the FIRM Maps. This program would concrete the drainage area and direct the waterflow down stream to detention ponds. This could reduce or eliminate flooding to some residents that are in or near the floodplains by watersheds, lakes, and rivers.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	$3,000,000 plus
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 9	**Action:** Continue Participation in the National Flood Insurance Program
Hazards Addressed:	☒ Dam Failure ☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☐ Wildfire ☒ Winter Storm
Description:	Continued participation in the NFIP for the community will insure that individuals are not building in the flood hazard areas within the city.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	1-3 years
Cost:	Staff time
Budget:	City budget
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 10	**Action:** Debris Removal Program
Hazards Addressed:	☒ Dam Failure ☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Have a community wide drainage and stormwater cleanup days to remove all trash and debris from local drainage ways. This would involve the local churches, businesses, high schools, boy scouts, girl scouts and City Staff throughout the city
Lead:	Hazard Mitigation Committee, Emergency Managers, and REC's
Schedule:	1-3 years
Cost:	Staff Time and Equipment Usage
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☒ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 11	**Action:** Dredge the watersheds, lakes, and rivers.
Hazards Addressed:	☒ Dam Failure☒ Drought ☐ Earthquake ☒ Extreme Heat ☒ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☐ Wildfire ☒ Winter Storm
Description:	Dredge the lakes, watersheds and river channels located near the city to allow a larger capacity of water and water flow during heavy snows and thunderstorms.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	$1,000,000 plus
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 12	**Action:** Construct Flood Walls/levies
Hazards Addressed:	☒ Dam Failure☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☐ Wildfire ☒ Winter Storm
Description:	Construct flood walls/levies in the community where flooding is prevalent to reduce the flooding within the community.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	$1,000,000 plus
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 13	**Action:** Tree Trimming and Branch Removal Program
Hazards Addressed:	☒ Dam Failure ☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Have a communitywide tree-trimming program to cut down branches and trees away from power lines and drainage areas. This will reduce the chances of downed power lines during severe storms and reduce debris during flood events. The cost and time will be served by community volunteers, city staff and local electrical companies.
Lead:	Hazard Mitigation Committee, Emergency Managers, and REC's
Schedule:	1-3 years
Cost:	Staff time and equipment usage
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 14	**Action:** Backup Generator for Critical Facilities
Hazards Addressed:	☒ Dam Failure ☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Purchase backup generators for City Halls, Emergency Operations Centers, the Police Departments, the Fire Departments, Community Centers, and school districts as well as two portable units for locations as needed throughout the city. These generators will be useful for severe weather events when the community loses power. It is vital that critical facilities keep power or have backup capabilities during weather events.
Lead:	Hazard Mitigation Committee, Emergency Managers, School Districts and REC's
Schedule:	1-3 years
Cost:	$10,000 to $15,000 per unit
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☒ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 15	**Action:** Individual Backup Generator Program
Hazards Addressed:	☒ Dam Failure☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Provide a reimbursement program for local residents to purchase generators needed at their homes or businesses. Currently FEMA does not offer this program; however, if this program should be incorporated as a FEMA eligible project or other grant funds, this would be a good program for the local citizens.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	No cost to the city, or schools. Residents will cover the 25% match.
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for:	☒ Ponca City ☐ Ponca City Public School District #71

Ponca City	Mitigation Action Item
Action # 16	**Action:** Hazard Event Database
Hazards Addressed:	☒ Dam Failure☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Have all emergency services departments report all hazard related incidents to the city emergency management department to keep an updated Hazard Event Database for proper tracking and reporting procedures. Currently, each department keeps track of their own information and does not have a primary reporting database to correlate all hazard events.
Lead:	Hazard Mitigation Committee, Emergency Managers, School Districts, and REC's
Schedule:	1-3 years
Cost:	$5,000
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City Public School District #71

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Ponca City	Mitigation Action Item
Action # 17	**Action:** Mitigation Tabletop Exercises
Hazards Addressed:	☒ Dam Failure☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	A "What If" mitigation activity during HMPC meetings. For example, during the meeting have "What If" exercises to see what kind of mitigation items are in place and what if a hazard event took place, what would the outcome be and what other mitigation items would be needed to reduce the effects of the hazards.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	1-3 years
Cost:	Staff time
Budget:	City, and School budgets
Action Item for: ☒ Ponca City ☒ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 18	**Action:** Emergency Exercise Training
Hazards Addressed:	☒ Dam Failure☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Have a community-wide emergency exercises to put efforts at work prior to the real event. This will help determine "hands on" what mitigation items are needed and what could make the event go smoother in response to the hazard.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	1-3 years
Cost:	Staff time
Budget:	City, and School budgets
Action Item for: ☒ Ponca City ☒ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 19	**Action:** City, School, and Business Systems Backup
Hazards Addressed:	☒ Dam Failure☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	In the computer age, we now have the technology to back up all data in our computer systems. Computer system backups are available; however, the city, schools and businesses need to back up their systems online or at a secondary server location to be able to retrieve their data if their buildings and computer systems were destroyed.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	1-3 years
Cost:	$5,000
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☒ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 20	**Action:** Emergency Responder Volunteer Program
Hazards Addressed:	☒ Dam Failure☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Develop database and setup voluntary emergency responders in the event of a disaster to respond and assist in search and rescue, evacuations, debris removal, and other emergency services that could be too large for a community to handle at the onset of the event.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	1-3 years
Cost:	Staff Time
Budget:	City Staff Time
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 21	**Action:** Emergency Management Mobile Unit
Hazards Addressed:	☒ Dam Failure☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Purchase an EM Mobile Unit to serve as a command post during a hazard event. This unit will allow the city emergency managers to have an onsite location for the disaster area and be available for first response capability.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	$50,000 per unit
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 22	**Action:** Residential Assessment Team
Hazards Addressed:	☒ Dam Failure☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Develop a residential assessment team to evaluate residential homes for disaster prevention. They would evaluate and suggest conditions and items that could reduce the effects of hazard events. For example, suggest hurricane straps on a house to reduce the risk of losing their roof in high winds or a tornado. The team will be a group of volunteers, city staff that will go to locations with a checklist and inform the residents of things they could do to reduce their risks.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	Staff Time
Budget:	City budget
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 23	**Action:** Secondary Water Sources
Hazards Addressed:	☒ Dam Failure ☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Run a water line to a secondary water source for times of drought to provide water to the public and for fire protection in the community.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	$500,000 per line
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 24	**Action:** Remote Weather Cameras
Hazards Addressed:	☒ Dam Failure ☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Purchase remote weather cameras to view incoming weather events around the city. The weather cameras can also serve useful for wildfire that could threaten the outskirts of the community.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	$15,000 per system
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 25	**Action:** Amend Building Codes for Earthquake, High Winds, and Tornados
Hazards Addressed:	☐ Dam Failure ☐ Drought ☒ Earthquake ☐ Extreme Heat ☐ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☐ Wildfire ☐ Winter Storm
Description:	Amend city building codes to strengthen structures on new and existing buildings to reduce the effects of earthquake, high wind, and tornados.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	Staff Time
Budget:	City budget
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 26	**Action:** Above Ground Gas Pumps With Backup Generators for City Vehicles
Hazards Addressed:	☒ Dam Failure ☐ Drought ☒ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Above ground gas pumps for city vehicles in times of disasters with a backup generator. The gas pumps are for city use only. It was found to be a necessity during the January 2007 ice storm for several jurisdictions that ran out of gas because fuel trucks could not travel to the locations; however, there was still a demand for fuel. This could be developed at areas with controlled access.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	$15,000 per setup
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 27	**Action:** Cool/Warming Zones for Extreme Heat and Winter Storms
Hazards Addressed:	☐ Dam Failure ☐ Drought ☐ Earthquake ☒ Extreme Heat ☐ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☐ Wildfire ☒ Winter Storm
Description:	Set up cool/heat zones at the city, and school district where children and families can remove themselves from the cold or heat.
Lead:	Hazard Mitigation Committee, Emergency Managers and School Districts
Schedule:	3-5 years
Cost:	$2,000 per setup
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 28	**Action:** Outdoor Drinking Sources for Extreme Heat
Hazards Addressed:	☐ Dam Failure ☐ Drought ☐ Earthquake ☒ Extreme Heat ☐ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☐ Wildfire ☐ Winter Storm
Description:	Set up outdoor drinking sources at the parks, schools and in the community where children and adults can re-hydrate themselves.
Lead:	Hazard Mitigation Committee, Emergency Managers, School Districts
Schedule:	3-5 years
Cost:	$500 per fountain
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 29	**Action:** Fan and Air Conditioner Program for the Poor and the Elderly
Hazards Addressed:	☐ Dam Failure ☐ Drought ☐ Earthquake ☒ Extreme Heat ☐ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☐ Wildfire ☐ Winter Storm
Description:	Provide Fans and Air Conditioners for the poor and the elderly throughout the community. Hold fund-raiser programs at the City, Schools, and local churches to obtain the necessary equipment.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	Staff Time
Budget:	Donations
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 30	**Action:** Covered Walkways for Thunderstorms
Hazards Addressed:	☐ Dam Failure ☐ Drought ☐ Earthquake ☒ Extreme Heat ☐ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☐ Wildfire ☒ Winter Storm
Description:	Provide covered sidewalks at city streets and school walkways to reduce the risk of severe thunderstorms and winter storms to the public, and shield students and citizens from hail.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	$30,000 plus per community
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 31	**Action:** Surge Protector Program
Hazards Addressed:	☒ Dam Failure ☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Provide a surge protector program to reduce the risk of electrical surges from hazard events, such as, severe thunderstorms with lightning, extreme heat, winter storms and other hazards that may cause loss of power or power surges that can damage computers, televisions, and other electronic equipment that are vulnerable. The program would allow residents to purchase surge protectors at a reduced price.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	No cost to city, or schools. Residents will cover the 25% match.
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 32	**Action:** Equipment and Furniture Strap Program
Hazards Addressed:	☒ Dam Failure ☐ Drought ☒ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☐ Wildfire ☐ Winter Storm
Description:	Strap and bolt down large equipment and furniture at the city and school facilities to reduce the risk of debris during severe hazard events.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	$5,000 per community
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☒ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 33	**Action:** Protective Window Film
Hazards Addressed:	☐ Dam Failure ☐ Drought ☒ Earthquake ☐ Extreme Heat ☐ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☐ Wildfire ☐ Winter Storm
Description:	Purchase protective window film for all city and school building windows to reduce the risk of airborne debris injuries during extreme hazard events.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	$5,000 per community
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☒ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 34	**Action:** Lightning Detection Systems
Hazards Addressed:	☐ Dam Failure ☐ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☐ Wildfire ☐ Winter Storm
Description:	Purchase lightning detection systems to provide warnings at city parks, camp grounds, and school recreation areas. The lightning detection system can detect lightning up to 10 miles away and could be beneficial in notifying children and adults in recreational areas of the possible danger.
Lead:	Hazard Mitigation Committee, Emergency Managers, School Districts
Schedule:	3-5 years
Cost:	$5,000 per unit
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☒ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 35	**Action:** Pumper Trucks and Fire Equipment
Hazards Addressed:	☐ Dam Failure ☐ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☒ Wildfire ☐ Winter Storm
Description:	Pumper trucks and fire equipment were found to be a necessity during the wildfires that occurred in 2006. At least one new pumper truck with equipment are needed at each fire station to battle wildfires efficiently; however the city has limited funding available for the purchase of these items.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	$40,000 per unit
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 36	**Action:** Individual Safe Room Program
Hazards Addressed:	☐ Dam Failure ☐ Drought ☒ Earthquake ☐ Extreme Heat ☐ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☐ Wildfire ☐ Winter Storm
Description:	The city would like to offer an individual safe room program with FEMA funding. The city would manage the grant program and reimburse individuals that have a safe room built. The safe room program would be on a 75% to 25% match. FEMA would cover 75% and the homeowner would cover the other 25%.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	Staff Time
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 37	**Action:** Promote Hurricane Straps to Contractors and Homeowners
Hazards Addressed:	☐ Dam Failure ☐ Drought ☒ Earthquake ☐ Extreme Heat ☐ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☐ Wildfire ☐ Winter Storm
Description:	Promote hurricane straps to local contractors and homeowners to reduce the risk of high wind and tornado damages to rooftops. Possibly conduct a program with local hardware stores to sell hurricane straps at a reduced price to homeowners and contractors to help with costs on new and existing homes.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	Staff Time
Budget:	City budget
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 38	**Action:** Storm Shelter/Safe Room Database
Hazards Addressed:	☒ Dam Failure ☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Develop a citywide storm shelter and safe room database with latitude and longitude of each individual safe room in the community. This will help locate safe rooms and citizens after a disaster.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	$5,000
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 39	**Action:** Blanket, Heater, and Coat Program
Hazards Addressed:	☐ Dam Failure ☐ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☐ Wildfire ☒ Winter Storm
Description:	Have a communitywide Blanket, Heater and Coat Program to donate items to the poor and the elderly for wintertime. Establish donation banks located throughout the city, community churches and at the schools.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	Donations
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 40	**Action:** Bury Electrical Lines Program
Hazards Addressed:	☒ Dam Failure ☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Change ordinances to bury electrical lines from the transformer to the house on any new construction. This will reduce the amount of downed powerlines during a hazard event. Also, bury electrical cables on existing houses through grant programs that may become available. Residential neighborhood conversion west of 14th St. from low reliability overhead electric to underground electrical supply.
Lead:	Hazard Mitigation Committee, Emergency Managers, and REC's
Schedule:	1-3 years
Cost:	Staff Time
Budget:	City budget
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 41	**Action:** Become a Firewise Community
Hazards Addressed:	☐ Dam Failure ☒ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☒ Wildfire ☐ Winter Storm
Description:	Become a Firewise Community by having each community have a Firewise Plan. Work with the State Forestry Service to meet the criteria in becoming a Firewise community.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	$10,000 plus
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 42	**Action:** Waterline Insulation Program
Hazards Addressed:	☐ Dam Failure ☐ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☐ Wildfire ☒ Winter Storm
Description:	Have a Waterline Insulation Program where the poor or elderly could have their waterlines insulated to reduce the risk of pipe breaks during the winter months. Work with hardware stores, churches and large businesses to donate pipe insulation wrap. The program would also request volunteer labor from high school students, churches, local businesses and City staff to install the insulation for local residents in need.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	Volunteer Labor
Budget:	Staff Time and Volunteer Labor
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 43	**Action:** Storm Spotter Programs
Hazards Addressed:	☒ Dam Failure ☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☐ Wildfire ☐ Winter Storm
Description:	Work with the National Weather Service to hold storm spotter training seminar in the community or a nearby area to train interested individuals. If possible, offer this training as an elective in high schools for seniors or to any local citizen. This would place more storm spotters in the community to keep a lookout for severe weather headed for the community.
Lead:	Hazard Mitigation Committee, Emergency Managers, School Districts
Schedule:	3-5 years
Cost:	Staff Time
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☒ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 44	**Action:** Voluntary Snow Shoveling Programs
Hazards Addressed:	☐ Dam Failure ☐ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☐ Wildfire ☒ Winter Storm
Description:	Request volunteers from local churches, boy scouts, girl scouts, city staff, and high school students that would shovel snow for the physically handicapped and the elderly in the community. This would help these citizens from having to get out in the cold weather and reduce the chances for them to slip and fall on the ice or snow.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	Staff Time
Budget:	City, and School District budgets
Action Item for: ☒ Ponca City ☒ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 45	**Action:** Snow Fences
Hazards Addressed:	☐ Dam Failure ☐ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☐ Wildfire ☒ Winter Storm
Description:	Construct snow fences along the highways to reduce the risk of blowing snow build up on the roads. This would reduce the risk of traffic problems for emergency service vehicles the community and highway travel.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	$100,000 Citywide
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 46	**Action:** Promote Drought Insurance to Farmers
Hazards Addressed:	☐ Dam Failure ☒ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☐ Wildfire ☐ Winter Storm
Description:	Conduct presentations and provide handouts to local farmers to explain the benefits to having drought insurance. Have local insurance companies conduct the presentations and provide the handouts for the program.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	Volunteers and Staff Time
Budget:	City budgets
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 47	**Action**: Volunteer Irrigation Program
Hazards Addressed:	☐ Dam Failure ☒ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☒ Wildfire ☐ Winter Storm
Description:	Create a list of farmers willing to assist other farmers in developing irrigation lanes in their crop fields. Some local farmers do not use irrigation lanes on their farmland. Irrigation lanes will help hold water in the fields and keep moisture in the crops to reduce wildfires. Also, have agricultural professors provide information on irrigation techniques that may help the farmers in the community.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	Staff Time and Volunteer Time
Budget:	City budgets
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 48	**Action:** Evergreen Removal Program
Hazards Addressed:	☐ Dam Failure ☒ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☒ Wildfire ☐ Winter Storm
Description:	Have the rural and city fire departments work with local farmers and land owners to remove wild evergreen trees from their fields. Evergreens are high fire fuels and this program would reduce the risk of wildfires spreading. Evergreens also consume a lot of water and removing these trees would leave water available for other plant life.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	1-3 years
Cost:	$10,000 a year for Ponca City
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 49	**Action:** Suggested Vegetation Program
Hazards Addressed:	☐ Dam Failure ☒ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☒ Wildfire ☐ Winter Storm
Description:	Have the rural and local fire departments work with the State Forestry Service, Oklahoma State University Extension Office, local farmers, land owners, and home owners to suggest low fuel vegetation seeding to decrease the risk of wildfires in the areas surrounding the outskirts of the community.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	3-5 years
Cost:	Staff Time
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 50	**Action:** Perimeter Wildfire Zone Ordinance
Hazards Addressed:	☐ Dam Failure ☐ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☒ Wildfire ☐ Winter Storm
Description:	Have local landowners, where farmland meets the urban interface, to have a plowed or rocked zone from the grassland to the area meeting the local community whether it is a fence line or roadway. A suggested 20-30 feet plowed area would be recommended to slow or stop wildfires from entering the community.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	1-3 years
Cost:	Staff Time
Budget:	City budgets
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 51	**Action:** Control Burns
Hazards Addressed:	☐ Dam Failure ☒ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☒ Wildfire ☐ Winter Storm
Description:	Have the rural and local fire departments, State Forestry Service, and area farmers conduct controlled burns on highly vegetative fields to reduce the threat of wildfires.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	1-3 years
Cost:	$10,000 per year citywide
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 52	**Action:** Storm Shelter Beacon Program
Hazards Addressed:	☒ Dam Failure ☐ Drought ☒ Earthquake ☐ Extreme Heat ☐ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☐ Wildfire ☐ Winter Storm
Description:	Purchase storm shelter beacons through grant programs and donations to provide a distress signal when people are trapped in area shelters after a disaster. This would be similar to the devices put on emergency rafts from ships that notify the United States Coast Guard when activated and provides a GPS coordinate to the rescuers.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	5 years or when funding becomes available
Cost:	$100.00 per unit
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

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Ponca City	Mitigation Action Item
Action # 53	**Action:** Reverse 911 System
Hazards Addressed:	☒ Dam Failure ☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Purchase a reverse 911 system for the community. This will allow the Emergency Management Director to send out messages regarding in hazard event that may pose a threat to the community.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	1-3 years or when funding becomes available
Cost:	$50,000 per system
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71	

Ponca City	Mitigation Action Item
Action # 54	**Action:** Repetitive Loss Properties Acquisition
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☐ Tornado ☐ Wildfire ☒ Winter Storm
Description:	Purchase, raze, and maintain repetitive loss structures as open space or up to 10 properties.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$1,200,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 56	**Action:** Construct Separate Waterline From Well Field
Hazards Addressed:	☒ Drought ☐ Earthquake ☒ Extreme Heat ☐ Flood ☐ Severe Thunderstorms ☐ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Provide a safe water redundant water supply in the event of a disruption to the surface water supply by constructing 27,500 feet of raw 36" waterline with flow metering and isolation valves, and also constructing 12,800 feet of 8" raw water line from the wells to the 36" lines.
Lead:	City of Ponca City Water Department
Schedule:	3 years or when funding becomes available
Cost:	$7,000,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

Ponca City	Mitigation Action Item
Action # 55	**Action:** Replace Water Lines
Hazards Addressed:	☒ Drought ☐ Earthquake ☒ Extreme Heat ☐ Flood ☐ Severe Thunderstorms ☐ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Replace existing out of date 4" water line with 6" and 8" line and replace of existing 8" line with new 12" line. Also replace old small diameter water main with 950 feet of new 12" water main to improve fire fighting water supply for the hospital and medical complexes in the area and add new 8" water lines in the downtown area to improve fire hydrant capacity.
Lead:	City of Ponca City Water Department
Schedule:	3 years or when funding becomes available
Cost:	$2,325,250
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 57	**Action:** SCADA Control for Water Wells
Hazards Addressed:	☒ Drought ☐ Earthquake ☒ Extreme Heat ☐ Flood ☐ Severe Thunderstorms ☐ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Provide individual flow monitoring and remote control to enable the WTP operators to remotely observer the performance of each well and control them remotely.
Lead:	City of Ponca City Water Department
Schedule:	3 years or when funding becomes available
Cost:	$450,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

Ponca City	Mitigation Action Item
Action # 58	**Action:** Chlorine Scrubber for WTP
Hazards Addressed:	☒ Drought ☐ Earthquake ☒ Extreme Heat ☐ Flood ☐ Severe Thunderstorms ☐ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Construct a chlorine scrubber system to protect the operators and nearby residential communities.
Lead:	City of Ponca City Water Department
Schedule:	3 years or when funding becomes available
Cost:	$250,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 59	**Action:** Community Shelters for Residents and Pets
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☐ Severe Thunderstorms ☒ Tornado ☐ Wildfire ☐ Winter Storm
Description:	Construct shelter for the Ponca City Aquatic & Family Center – YMCA to provide a safe place for surrounding neighborhoods, and construct fenced areas to provide temporary shelter for pets displaced by disasters.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$540,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

Ponca City	Mitigation Action Item
Action # 60	**Action:** Enter CRS Program
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☐ Severe Thunderstorms ☐ Tornado ☐ Wildfire ☐ Winter Storm
Description:	Enter CRS program to help reduce flood damages through mitigation efforts established in the CRS program.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	N/A
Budget:	N/A
Action Item for:	☒ Ponca City ☒ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 61	**Action:** Upgrade And Revise Subdivision Ordinance
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☐ Severe Thunderstorms ☐ Tornado ☐ Wildfire ☐ Winter Storm
Description:	The current ordinance is limited in it's area of applicability. A new, revised ordinance will include additional Higher Regulatory Standards to prevent flooding damages.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	N/A
Budget:	N/A
Action Item for:	☒ Ponca City ☒ Ponca City School District

Ponca City	Mitigation Action Item
Action # 62	**Action:** Aerial Photography And Mapping
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☐ Severe Thunderstorms ☒ Tornado ☐ Wildfire ☐ Winter Storm
Description:	Update existing photos from 2004 to help with emergency response and rescue missions in the event of a disaster.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$175,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 63	**Action:** 2 Additional Weather Stations
Hazards Addressed:	☒ Drought ☐ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Establish 2 additional weather stations in the Ponca City area.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$70,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

Ponca City	Mitigation Action Item
Action # 64	**Action:** Elevation Survey of Critical Facilities
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☐ Tornado ☐ Wildfire ☒ Winter Storm
Description:	Determine the suitability for occupancy of critical facilities during flood events by way of building surveys.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$600/survey (Example)
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 65	**Action:** South Ave. Overpass Emergency Flood Pumping System
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☐ Tornado ☐ Wildfire ☐ Winter Storm
Description:	Construct emergency flood water pump system beneath the overpass on South Ave. immediately north of the Conoco-Phillips Refinery Complex to help emergency responders access the western part of the city.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$300,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 66	**Action:** Improvements to Arkansas River Flooding Problem Areas
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☐ Tornado ☐ Wildfire ☒ Winter Storm
Description:	Construct drainage systems improvements along the Arkansas river, specifically the more problematic areas, to reduce damages to houses and structures.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$8,318,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

Ponca City	Mitigation Action Item
Action # 67	**Action:** Improvements to Bois d'Arc Creek Flooding Problem Areas
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☐ Tornado ☐ Wildfire ☒ Winter Storm
Description:	Construct drainage systems improvements along the Bois d'Arc Creek, specifically the more problematic areas, to reduce damages to houses and structures.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$1,626,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 68	**Action:** Underground Electric Service for 2nd Feed to Water Treatment Plant and Back feed to Pecan Park Substation
Hazards Addressed:	☐ Drought ☒ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	The Ponca City Water Plant is currently provided electrical power from the Pecan Park Electrical Substation. This project would construct an underground electric service wiring and transfer switch so in the event of electric failure to the Water Treatment Plant, electrical power supply can be switched to receive power from the Gonterman Electrical Substation.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$1,650,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

Ponca City	Mitigation Action Item
Action # 69	**Action:** 1000 MCM underground electric supply lines along Hartford Ave. from Highland to Hartford Ave.
Hazards Addressed:	☐ Drought ☒ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	The existing electrical service in this area that includes critical medical and emergency medical facilities is lower reliability overhead conductors. This project is to replace the overhead conductors with much more reliable underground electrical service.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$550,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 70	**Action:** Battery Backup for Traffic Signals on Arterial Streets.
Hazards Addressed:	☐ Drought ☒ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	This is to provide battery back-up for traffic signals controlling traffic flow along arterial streets in the of power failure to traffic signals.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$190,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

Ponca City	Mitigation Action Item
Action # 71	**Action:** Conversion of Traffic Signal to communication with Traffic Engineering by Ponca City Wi-Fi Internet Service
Hazards Addressed:	☐ Drought ☒ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Existing traffic signal control and communication systems communicate by low reliability overhead communications cables which will be replaced so that communication will be performed by more reliable wireless communications.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$190,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 72	**Action:** Tubgrinder for Solid Waste
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	A Tub Grinder for the Solid Waste Division to expedite disposal of debris generated by disasters.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$300,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

Ponca City	Mitigation Action Item
Action # 73	**Action:** Rolloff Trash Container with Crane Attachment for Solid Waste Division
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	A Rolloff Trash Container with Crane Attachment for the Solid Waste Division to expedite clearing of obstructions and transport of debris for proper landfilling.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$300,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 74	**Action:** Skid-Steer Loader with Loading Claw Attachment
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Skid-Steer Loader with Claws to clear debris generated by disaster and supplement loading operations of solid waste transport containers..
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$100,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

Ponca City	Mitigation Action Item
Action # 75	**Action:** Prepare Regional Water Resources Development Plan
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Kaw Reservoir is owned and operated by the US Army Corps of Engineers and is a source of significant water resources. Ponca City is currently depending on wells that will meet winter water demands, but are inadequate alone to meet year round demands, thus surface water from Lake Ponca must also be used. Lake Ponca, the raw water intake structure, and raw water supply line were constructed over 70 years ago and have exceeded their service life. In addition, siltation has occurred over time resulting in a reduction of the raw water supply available from Lake Ponca. This study is to determine the feasibility of use of Kaw Reservoir water, the items to be addressed to make this a feasible alternative, and the cost-effectiveness of the water supply.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$150,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 76	**Action:** 911 System Integration
Hazards Addressed:	☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Combine the 911 system with any GIS data gathered to help emergency responders reduce response time.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$250,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

Ponca City	Mitigation Action Item
Action # 77	**Action:** Outage Reporting System
Hazards Addressed:	☐ Drought ☒ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Combine the Electric SCADA with GIS data which would help reduce response time during outages.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$150,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 78	**Action:** ESRI ELA (Phase 1)
Hazards Addressed:	☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Improve maintenance and management of the GIS data on an enterprise level. This would allow the city to phase in proposed components in key departments to broaden the data management at the point of creation and allow for direct management by key personnel. This would enhance the City's capabilities of maintaining relevant data at all times within the GIS, which would increase readiness during times of emergency management.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$185,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

Ponca City	Mitigation Action Item
Action # 79	**Action:** Evaluation and Design of Land-Based Rocket Launched Cloud Seeding System to Reduce Size of Hailstones
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☐ Severe Thunderstorms ☐ Tornado ☐ Wildfire ☐ Winter Storm ☒ Hail
Description:	Evaluate and if a reasonable probability of success is determined then design a ground based rocket launched and aiming system to perform cloud seeding to reduce the size of hailstones.
Lead:	City of Ponca City
Schedule:	1-3 years or when funding becomes available
Cost:	$100,000
Budget:	PDM or HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☐ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 80	**Action:** Engineering Inspection and Testing of Electrical Main Service Entrances, Grounding System, and Lightning of 29 Public Buildings to improve Lightning Protection
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☒ Severe Thunderstorms ☐ Tornado ☐ Wildfire ☐ Winter Storm ☒ Lightning
Description:	For existing Public Buildings not constructed under recent National Electrical Code examine and test the performance of the grounding system, electrical surge protection and lightning arrestor systems to reduce the risk for lightning strikes or lightning induces electrical surges.
Lead:	City of Ponca City and Ponca City Schools
Schedule:	3 years or when funding becomes available
Cost:	$ 30,000
Budget:	PDM or HMGP Grant, city budget, school budget and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

Ponca City	Mitigation Action Item
Action # 81	**Action:** Construction to correct defects in Electrical Surge and Electrical Service Entrance into Public Buildings to improve lightning protection and lightning induced electrical surges
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☒ Severe Thunderstorms ☐ Tornado ☐ Wildfire ☐ Winter Storm ☒ Lightning
Description:	Action #80 includes an engineering evaluation of 29 public buildings which are also critical facilities to determine deficiencies that should be corrected to mitigate the lightning hazard or electrical surges induced by lightning. The 29 public buildings are older buildings that were constructed prior to the most recent National Electrical Code as upgraded for Ponca City enhanced grounding requirements. Normally such buildings would not require retrofitting to current code.
Lead:	City of Ponca City and Ponca City Schools for School Property
Schedule:	3 years or when funding becomes available
Cost:	$ 250,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 82	**Action:** Engineering Inspection and Testing of Grounding System, and Lightning Protection of Public Owned Communication and Water Towers to improve Lightning Protection
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☒ Severe Thunderstorms ☐ Tornado ☐ Wildfire ☐ Winter Storm ☒ Lightning
Description:	Evaluate and testing the grounding system, lightning protection and lightning induced electrical surges for publically owned communication towers and SCADA control ed water towers.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$50,000
Budget:	PDM, HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☐ Ponca City School District

Ponca City	Mitigation Action Item
Action # 83	**Action:** Construction to correct defects in communication and water tower grounding systems and installation of lightning arrestors and electrical surge surge protection for lightning induced electrical surges
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☒ Severe Thunderstorms ☐ Tornado ☐ Wildfire ☐ Winter Storm ☒ Lightning
Description:	Action #82 includes an engineering evaluation of publicly owned communication towers and water towers with SCADA systems. This is to perform the construction and installation of devices to mitigate the lightning hazard.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$ 75,000
Budget:	PDM, HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☐ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 84	**Action:** Lightning Detection and Warning System
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☒ Severe Thunderstorms ☐ Tornado ☐ Wildfire ☐ Winter Storm ☒ Lightning
Description:	This is an automatic system of lightning detectors to monitor for lightning strikes. The older versions alarmed when lightning strikes occur within 10 miles of a monitor. This would reduce the alarm radius to 6 miles and network together for triangulation of dectection by 2 monitors (the 2nd monitor could remain with the 10 mile range) to eliminate the past problems of nuisance alarms which rendered the lightniong detection and alarm systems unreliable. .
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$100,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

Ponca City	Mitigation Action Item
Action # 85	**Action:** Storage Facilities for street/road salt storage
Hazards Addressed:	☐ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☒ Severe Thunderstorms ☐ Tornado ☐ Wildfire ☒ Winter Storm
Description:	This is to provide a corrosion resistant road salt storage facility to store road salt until needed for winter storms.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$ 75,000
Budget:	PDM, HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☐ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 86	**Action:** Construct emergency storage facilities and facilities to stabilize reactive spills collected by City emergency responders during disaster and emergency events
Hazards Addressed:	☐ Drought ☒ Earthquake ☐ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☒ Tornado ☒ Wildfire ☐ Winter Storm
Description:	This is to provide emergency response holding and stabilization facilities to hold and test hazardous substances released by spills during emergencies that cannot be immediately transported and disposed of. These facilities will consist of a raw spill corrosive resistant holding tank for emergency responders to temporarily store wastes until testing is performed to determine the proper and legal method of disposal. An oil-water separator to separate and store the oil float, a basin to allow for pH adjustment of reactive materials, and a 2nd holding tank for retaining separated or pH adjusted materials until further testing and ultimate disposal can be performed. .
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$ 400,000
Budget:	PDM, HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☐ Ponca City School District

Ponca City	Mitigation Action Item
Action # 87	**Action:** Sun Shading Panels to protect equipment sensitive to Extreme Heat
Hazards Addressed:	☐ Drought ☐ Earthquake ☒ Extreme Heat ☐ Flood ☐ Severe Thunderstorms ☐ Tornado ☐ Wildfire ☐ Winter Storm
Description:	The dates and times of extreme heat events have been and are expected to remain very predictable. Consequently, positions of screening critical equipment from direct sunlight can be performed in order to mitigate the possible equipment failures due to Extreme Heat. By having critical equipment in the shade during Extreme Heat events instead of also heated by direct sunlight could be equivalent to 5-15 degree lower ambient temperature.
Lead:	City of Ponca City
Schedule:	3 years or when funding becomes available
Cost:	$ 125,000
Budget:	PDM, HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☐ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 88	**Action:** Upgrade Fire Department radio system to become Project 25 compliant.
Hazards Addressed:	☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Replace existing obsolete radio communications infrastructure with industry standard Project 25 compliant radio equipment. System will consist of 35 mobile radios; 35 portable radios; 8 base radio units; 2 trunked repeater systems; and associated antennas and interconnecting equipment.
Lead:	Ponca City Fire Department
Schedule:	3 years or when funding becomes available
Cost:	$500,000
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

Ponca City	Mitigation Action Item
Action # 89	**Action:** Federal Commander Digital System
Hazards Addressed:	☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunderstorms ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Siren control units, and antennas for each siren, FSK encoder, software and training. This system will continually monitor siren status and provide immediate notification of siren failure, making the outdoor warning system a more reliable method of public warning.
Lead:	Ponca City Fire Department
Schedule:	3 years or when funding becomes available
Cost:	$84,813.15
Budget:	HMGP Grant, city budget, and other possible grant funding
Action Item for:	☒ Ponca City ☒ Ponca City School District

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Ponca City	Mitigation Action Item
Action # 90	**Action:** E-911 Consoles
Hazards Addressed:	☒ Dam Failure☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Update E-911 Center work consoles to provide enhanced response environment.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	1-3 years
Cost:	$105,000.00
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71 ☐ All	

Ponca City	Mitigation Action Item
Action # 91	**Action:** E-911 Lighting
Hazards Addressed:	☐ Dam Failure☐ Drought ☐ Earthquake ☐ Extreme Heat ☐ Flood ☐ Severe Thunder Storms (hail, high wind, lightning) ☐ Tornado ☐ Wildfire ☐ Winter Storm
Description:	Update lighting in E-911 Center to indirect lighting to improve emergency response. Poor lighting causes screen glare.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	1-3 years
Cost:	$2,000.00
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☐ Ponca City ☐ Ponca City Public School District #71 ☐ All	

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Ponca City	Mitigation Action Item
Action # 92	**Action:** E-911 Radios
Hazards Addressed:	☒ Dam Failure☒ Drought ☒ Earthquake ☒ Extreme Heat ☒ Flood ☒ Severe Thunder Storms (hail, high wind, lightning) ☒ Tornado ☒ Wildfire ☒ Winter Storm
Description:	Update obsolete radios in E-911 Center to enhance emergency communication capabilities.
Lead:	Hazard Mitigation Committee, Emergency Managers
Schedule:	1-3 years
Cost:	$40,000.00
Budget:	HMGP Grant, PDM Grant, city budgets, and other possible grant funding
Action Item for: ☒ Ponca City ☐ Ponca City Public School District #71 ☐ All	

Proposed Action Items to be Added

Description	Lead City Department	Schedule	Target Hazards	Feasible	Cost Effective	Eligible	Reasonable
Install warning sirens at high hazard dam inundation areas	Emergency Management	5 years	Dam Break	Yes	Maybe	Maybe	Yes
Development 10-year Rehabilitation Plan for Lake Ponca Dam	Environmental Services	3 years	Dam Break	Yes	Maybe	No	Yes
Acquisition and Demolition of flood-prone buildings	Development Services	3 years	Flood	Yes	Maybe	Maybe	Yes
Structural or physical improvements to buildings to reduce the potential for flood damage	Development Services	3 years	Flood	Yes	Maybe	Maybe	Yes
Improvements to power transmission system to reduce potential for damage during natural disasters	Ponca City Energy	5 years	Various	Yes	Maybe	No	Yes
Improvements to water treatment plant and distribution system to reduce potential for damage during natural disasters	Environmental Services	5 years	Various	Yes	Maybe	No	Yes
Improvements to waste water treatment plant and conyence system to reduce potential for damage during natural disasters	Environmental Services	5 years	Various	Yes	Maybe	No	Yes

Improvements to critical facilities to reduce potential for damage and increase personnel protection during natural disasters	Emergency Management	5 years	Various	Yes	Maybe	No	Yes
Construction regional detention facilities to decrease flood potential	Development Services	5 years	Flood	Yes	Maybe	No	Yes
Development of a city disaster resiliency plan	Emergency Management	5 years	All	Yes	Maybe	Maybe	Yes
Windproof all doors and windows at all school buildings.	School Superintendent	5 Years	High Wind Tornado	Yes	Yes	Maybe	Yes
Acquire equipment to improve City's ability to transport and process debris	Solid Waste	5 years	Various	Maybe	Maybe	No	Yes

Figure 45: End of Mitigation Actions (Tables)

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The PCHMPC used the STAPLEE method to prioritize mitigation items for the Ponca City and participating entities mitigation plan. The committee members used a scoring system under each category for social, technical, administrative, political, legal, economical, and environmental concerns. Ponca City and participating entities will take these into consideration when selecting mitigation items for the community; however the city and school district may chose lower ranking items due to funding, political pressures and public input. All proposed mitigation actions and projects were accepted and included as acceptable mitigation items.

Evaluation Category	Sources of Information
Social	Members of Ponca City and participating entities were members of the Ponca City Hazard Mitigation Planning Committee and had input throughout the planning process. Many small town political leaders are also business or professional persons. Existing community plans were used for information wherever possible. Members of the community were contacted and invited to attend all PCHMPC meetings.
Technical	The following Persons/Agencies were consulted as to the technical feasibility of the various projects: Community officials, Soil Conservation Service, and Oklahoma Health Departments, Oklahoma Water Resource Board, Oklahoma Division of Emergency Management and Oklahoma Forestry Service.
Administrative	Staffing for proper implementation of the plan currently will rely on existing members of the various agencies involved. City, and school department heads have been consulted on various mitigation items that pertain to their departments. Department heads will be responsible for the implementation of any mitigation items that pertain to their field of expertise and will include them in their department's budget.
Political	The City, and school district were part of the planning committee. Representatives of each of the facilities were present during the planning committee meetings and were consulted on all aspects of the Plan.
Legal	Members of the PCHMPC discussed legal issues with the city, and school officials, and it appears that no significant legal issues were involved in the projects that were selected by the PCHMPC.
Economic	Economic issues are of great concern and were thoroughly discussed by the PCHMPC. All entities felt that the projects selected would have a positive effect on the community; however funding for all projects is not available at this time. Each mitigation item will have to be addressed when funding becomes available or possible grant sources open. It was determined that the projects would be beneficial to the community when and if funding were made available to start the mitigation projects. All involved believed that the mitigation items will help the community be better prepared for a disaster. Funding for the various projects was the major concern as local budgets were not capable of fulfilling the needs, due to the low economic funding. Grant funds will be relied on heavily for completion of most of the mitigation items. A cost – benefit review was conducted on each action item to maximize benefits
Environmental	Oklahoma Department of Environmental Quality, Oklahoma Forestry Service, and the Oklahoma Water Resources Board were utilized in regards to the environmental impact of the various projects, and the PCHMPC felt that there would be no negative impact with any of the mitigation action items.
Hazards Mitigated	This provides additional points for mitigation items that can mitigate several hazards and those mitigation items that address more than one hazard receive an additional point per hazard.
Special Needs	This allows the community to place a special interest in certain mitigation items that the community feels will help the community mitigate hazards that pose a risk to the community. The community can add up to 10 additional points to show the interest in the community for this mitigation item.
Communities Served	This allows mitigation items that serve more than one community to receive additional points for each community that it serves.

Figure 46: STAPLEE (Table)

Scoring: 1 Poor, 2 Fair, 3 Good, and 4 Excellent
Hazards Mitigated: Up to the total number of hazards.
Special Needs: Up to 10 additional points
Communities Served: Up to number of communities served.

Item #	Action Item	Social	Technical	Admin	Political	Legal	Economic	Environ	Hazards Mitigated	Special Needs Pts	Communities Serv.	Total
1	Public Awareness for all hazards	4	4	4	4	4	4	4	12		2	44
2	Farm Detention Ponds	4	4	4	4	4	4	4	6		1	25
3	Multi-Purpose Warning Notification System	4	4	3	3	4	3	4	12		1	37
4	NOAA Weather Radio Program	4	4	4	4	4	4	4	7	5	2	47
5	Storm Shelters/ Hazardous Supply	4	4	4	4	4	2	4	12	10	2	38
6	Multi-Purpose EOC	4	4	3	3	4	1	4	12		1	35
7	River Warning Devices	4	4	4	4	4	3	4	7		1	34
8	Drainage & Storm Water Mgmt	4	3	2	2	4	1	4	8		1	28
9	Continue NFIP Compliance	4	4	4	4	4	4	4	7		1	56
10	Debris Removal Program	4	4	4	4	4	4	4	12		2	40
11	River, Lake, and Watershed Dredging	2	4	2	2	4	1	4	5		1	24
12	Flood Walls	3	3	1	2	4	1	4	7		1	25
13	Tree Trimming Program	4	4	4	4	4	4	4	9		1	37
14	Backup Generators for Critical Facilities	4	4	3	3	4	2	4	12	5	2	36
15	Individual Generator Program	4	4	4	4	4	4	4	12		1	40
16	Hazard Event Database	4	4	4	4	4	3	4	12		2	39
17	Mitigation Tabletop Exercises	4	4	4	4	4	4	4	12		2	40
18	Emergency Exercise	4	4	4	4	4	3	4	12		2	39
19	City, School, Business Data Backup	4	4	3	3	3	3	4	12		2	36
20	Emergency Responder Volunteer Program	4	4	4	4	4	4	4	12		1	40
21	EM Mobile Unit	4	4	2	4	4	2	4	12		1	36
22	Residential Assessment Team	4	4	4	4	4	4	4	12		1	40
23	Secondary Water Source	3	3	1	2	4	1	4	12	3	1	30
24	Weather Cameras	4	4	2	4	4	2	4	9		1	33
25	Amend Building Codes	4	4	3	3	4	3	4	6		1	31
26	Above Ground Gas Pumps	3	4	3	3	4	3	4	10		1	34
27	Cool/Warming Zones	4	4	3	3	4	3	4	2		1	27
28	Outdoor Drinking Sources	4	4	3	3	4	3	4	2		1	27
29	Fan & AC Programs	4	4	3	4	4	3	4	1		1	27
30	Covered Walkways	3	4	3	2	4	1	4	3	3	1	24
31	Surge Protector Program	4	4	3	3	4	3	4	12		1	37
32	Furniture & Equipment Straps	4	4	3	3	4	3	4	8		2	33
33	Protective Window Film	4	4	3	4	4	3	4	6		2	32
34	Lightning Detection Systems	4	4	4	4	4	3	4	4	3	2	31
35	Pumper-Trucks and Fire Equipment	4	4	2	3	4	2	4	1		1	24
36	Individual Safe Room Program	4	4	4	4	4	3	4	6	7	1	54

37	Hurricane Straps	4	4	4	4	4	4	4	6		1	34
38	Shelter Database	3	4	4	4	3	4	4	12	3	1	38
39	Blanket, Heater, Coat Program	4	4	4	4	4	4	4	1		1	29
40	Bury Electrical Lines	2	2	3	3	4	3	4	12	5	1	33
41	Firewise Community	4	4	4	4	4	3	4	2		1	29
42	Waterline Insulation Program	4	4	4	4	4	4	4	1		2	29
43	Storm Spotter Programs	4	4	4	4	4	3	4	7		2	34
44	Snow Shoveling Program	4	4	4	4	4	4	4	1		2	29
45	Snow Fences	2	4	2	2	4	1	4	1		1	20
46	Promote Drought Farm Insurance	4	4	4	4	4	4	4	1		1	29
47	Volunteer Irrigation Program	4	4	4	4	4	3	4	2		1	29
48	Evergreen Removal	4	4	4	4	4	3	4	2		1	29
49	Suggested Vegetation Program	4	4	4	4	4	4	4	2		1	30
50	Voluntary Perimeter Fire Zone	3	4	3	3	4	3	4	1		1	25
51	Control Burn Program	4	4	4	4	3	3	4	2		1	28
52	Storm Shelter Beacon Program	4	4	4	4	4	4	4	7		1	35
53	Reverse 911 & Call Center	4	3	3	3	4	2	4	12		1	35
54	Property Acquisition	3	3	1	2	4	1	4	1	10	2	19
55	Replace Waterlines	4	4	4	4	4	4	4	4		2	32
56	Well Field Waterline	4	4	4	3	4	2	4	4	5	2	29
57	SCADA Control For Water Wells	4	4	4	4	4	1	4	4	5	2	29
58	Chlorine Scrubber	4	4	4	4	4	2	4	4	5	2	30
59	Community Shelters For Res./Pets	4	4	4	4	4	3	4	1	10	2	28
60	Enter CRS Program	4	4	4	4	4	4	4	1		2	29
61	Upgrade And Revise Subdivision Ordinance	3	4	4	3	4	4	4	2		2	28
62	Aerial Photography And Mapping	4	4	4	4	4	3	4	10		2	37
63	2 Additional Weather Stations	4	4	4	4	4	3	4	6		2	33
64	Elevation Survey of Crit. Facilities	4	4	4	4	4	3	4	2	3	1	29
65	Overpass Flood Pumping System	4	4	4	4	4	2	4	6	10	1	32
66	Improve Arkansas River Flood Areas	4	4	4	4	4	1	4	6		2	31
67	Improve Bois d'Arc Creek Flood Areas	4	4	4	4	4	1	4	6		2	31
68	Underground 2nd Feed For WTP	4	4	4	4	4	1	4	9	10	1	34
69	1000 MCM Electric Lines	4	4	4	4	4	2	4	9		1	35
70	Battery Backup For Traffic Signals	4	4	4	4	4	2	4	9		1	35
71	Convert Traffic Signals To Wi-Fi	4	2	4	4	4	2	4	9		2	33
72	Tubgrinder For Solid Waste	4	4	4	4	4	2	3	9		2	34
73	Rolloff Trash Container With Crane	4	4	4	4	4	2	3	8		1	33
74	Skid-Steer Loader With Loading Claw	4	4	4	4	4	3	4	8	5	1	35
75	Prepare Regional Water Resource Plan	4	4	4	4	4	2	4	8		1	34
76	911 System Intergration	4	4	4	4	4	2	4	8		2	34
77	Outage Reporting System	4	4	4	4	4	2	4	12		2	38
78	ESRI ELA (Phase 1)	4	4	4	4	4	2	4	10		2	36
79	Cloud Seeding to reduce Hailstone Size	2	2	2	2	2	2	2	1		2	17

80	Engr. Eval of Building Grounds & Lightning	4	4	4	4	4	4	4	2	3	2	28
81	Const. of Building Grounds & Lightning Prot.	4	4	4	4	4	4	2	2		2	26
82	Engr. Eval of Comm. & Water Tower for Lightning	4	4	4	4	4	4	4	2	3	2	28
83	Ground & Lightning Protect for Comm & Water Towers	4	4	4	4	4	4	4	2		2	28
84	Lightning Detection & Warning System	4	4	4	4	4	4	3	12	3	2	37
85	Road Salt Storage Facility	4	4	4	4	4	4	4	1	5	2	27
86	Haz Spill Storage and Stabilization Facilities	4	4	4	4	4	3	1	1		2	23
87	Sun Screening of Equip at Risk during Extreme Heat	4	4	4	4	4	4	3	1		2	26
88	Fire Department Radio Upgrade	4	4	4	4	4	4	1	12		2	39
89	Federal Commander Digital System	4	3	4	4	4	4	3	12		2	40
90	E-911 Consoles	4	4	4	4	4	4	2	12		2	40
91	E-911 Lighting	4	4	4	4	4	4	4	12		2	42
92	E-911 Radios	4	4	4	4	4	4	3	12		2	41

Figure 47: Mitigation Actions Priority Ranking (Table)

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Item #	Action Item	Social	Technical	Admin	Political	Legal	Economic	Environ	Hazards Mitigated	Special Needs Pts	Communities Serv.	Total
36	Individual Safe Room Program	4	4	4	4	4	3	4	6	7	1	61
9	Continue NFIP Compliance	4	4	4	4	4	4	4	7		1	56
4	NOAA Weather Radio Program	4	4	4	4	4	4	4	7	5	2	52
5	Storm Shelters/ Hazardous Supply	4	4	4	4	4	2	4	12	10	2	48
1	Public Awareness for all hazards	4	4	4	4	4	4	4	12		2	44
68	Underground 2nd Feed For WTP	4	4	4	4	4	1	4	9	10	1	44
91	E-911 Lighting	4	4	4	4	4	4	4	12		2	42
65	Overpass Flood Pumping System	4	4	4	4	4	2	4	6	10	1	42
92	E-911 Radios	4	4	4	4	4	4	3	12		2	41
38	Shelter Database	3	4	4	4	3	4	4	12	3	1	41
14	Backup Generators for Critical Facilities	4	4	3	3	4	2	4	12	5	2	41
10	Debris Removal Program	4	4	4	4	4	4	4	12		2	40
15	Individual Generator Program	4	4	4	4	4	4	4	12		1	40
17	Mitigation Tabletop Exercises	4	4	4	4	4	4	4	12		2	40
20	Emergency Responder Volunteer Program	4	4	4	4	4	4	4	12		1	40
22	Residential Assessment Team	4	4	4	4	4	4	4	12		1	40
89	Federal Commander Digital System	4	3	4	4	4	4	3	12		2	40
90	E-911 Consoles	4	4	4	4	4	4	2	12		2	40
84	Lightning Detection & Warning System	4	4	4	4	4	4	3	12	3	2	40
74	Skid-Steer Loader With Loading Claw	4	4	4	4	4	3	4	8	5	1	40
16	Hazard Event Database	4	4	4	4	4	3	4	12		2	39
18	Emergency Exercise	4	4	4	4	4	3	4	12		2	39
88	Fire Department Radio Upgrade	4	4	4	4	4	4	1	12		2	39
77	Outage Reporting System	4	4	4	4	4	2	4	12		2	38
40	Bury Electrical Lines	2	2	3	3	4	3	4	12	5	1	38
59	Community Shelters For Res./Pets	4	4	4	4	4	3	4	1	10	2	38
3	Multi-Purpose Warning Notification System	4	4	3	3	4	3	4	12		1	37
13	Tree Trimming Program	4	4	4	4	4	4	4	9		1	37
31	Surge Protector Program	4	4	3	3	4	3	4	12		1	37
62	Aerial Photography And Mapping	4	4	4	4	4	3	4	10		2	37
4	City, School, Business Data Backup	4	4	3	3	3	3	4	12		2	36
21	EM Mobile Unit	4	4	2	4	4	2	4	12		1	36
78	ESRI ELA (Phase 1)	4	4	4	4	4	2	4	10		2	36
6	Multi-Purpose EOC	4	4	3	3	4	1	4	12		1	35
52	Storm Shelter Beacon Program	4	4	4	4	4	4	4	7		1	35

53	Reverse 911 & Call Center	4	3	3	3	4	2	4	12		1	35
69	1000 MCM Electric Lines	4	4	4	4	4	2	4	9		1	35
70	Battery Backup For Traffic Signals	4	4	4	4	4	2	4	9		1	35
58	Chlorine Scrubber	4	4	4	4	4	2	4	4	5	2	35
7	River Warning Devices	4	4	4	4	4	3	4	7		1	34
26	Above Ground Gas Pumps	3	4	3	3	4	3	4	10		1	34
37	Hurricane Straps	4	4	4	4	4	4	4	6		1	34
43	Storm Spotter Programs	4	4	4	4	4	3	4	7		2	34
72	Tubgrinder For Solid Waste	4	4	4	4	4	2	3	9		2	34
75	Prepare Regional Water Resource Plan	4	4	4	4	4	2	4	8		1	34
76	911 System Intergration	4	4	4	4	4	2	4	8		2	34
34	Lightning Detection Systems	4	4	4	4	4	3	4	4	3	2	34
56	Well Field Waterline	4	4	4	3	4	2	4	4	5	2	34
57	SCADA Control For Water Wells	4	4	4	4	4	1	4	4	5	2	34
24	Weather Cameras	4	4	2	4	4	2	4	9		1	33
32	Furniture & Equipment Straps	4	4	3	3	4	3	4	8		2	33
63	2 Additional Weather Stations	4	4	4	4	4	3	4	6		2	33
71	Convert Traffic Signals To Wi-Fi	4	2	4	4	4	2	4	9		2	33
73	Rolloff Trash Container With Crane	4	4	4	4	4	2	3	8		1	33
23	Secondary Water Source	3	3	1	2	4	1	4	12	3	1	33
33	Protective Window Film	4	4	3	4	4	3	4	6		2	32
55	Replace Waterlines	4	4	4	4	4	4	4	4		2	32
64	Elevation Survey of Crit. Facilities	4	4	4	4	4	3	4	2	3	1	32
85	Road Salt Storage Facility	4	4	4	4	4	4	4	1	5	2	32
25	Amend Building Codes	4	4	3	3	4	3	4	6		1	31
66	Improve Arkansas River Flood Areas	4	4	4	4	4	1	4	6		2	31
67	Improve Bois d'Arc Creek Flood Areas	4	4	4	4	4	1	4	6		2	31
80	Engr. Eval of Building Grounds & Lightning	4	4	4	4	4	4	4	2	3	2	31
82	Engr. Eval of Comm. & Water Tower for Lightning	4	4	4	4	4	4	4	2	3	2	31
49	Suggested Vegetation Program	4	4	4	4	4	4	4	2		1	30
39	Blanket, Heater, Coat Program	4	4	4	4	4	4	4	1		1	29
41	Firewise Community	4	4	4	4	4	3	4	2		1	29
42	Waterline Insulation Program	4	4	4	4	4	4	4	1		2	29
44	Snow Shoveling Program	4	4	4	4	4	4	4	1		2	29
46	Promote Drought Farm Insurance	4	4	4	4	4	4	4	1		1	29
47	Volunteer Irrigation Program	4	4	4	4	4	3	4	2		1	29
48	Evergreen Removal	4	4	4	4	4	3	4	2		1	29
60	Enter CRS Program	4	4	4	4	4	4	4	1		2	29
54	Property Acquisition	3	3	1	2	4	1	4	1	10	2	29
8	Drainage & Storm Water Mgmt	4	3	2	2	4	1	4	8		1	28
51	Control Burn Program	4	4	4	4	3	3	4	2		1	28
61	Upgrade And Revise Subdivision Ordinance	3	4	4	3	4	4	4	2		2	28

83	Ground & Lightning Protect for Comm & Water Towers	4	4	4	4	4	4	4	2		2	28
27	Cool/Warming Zones	4	4	3	3	4	3	4	2		1	27
28	Outdoor Drinking Sources	4	4	3	3	4	3	4	2		1	27
29	Fan & AC Programs	4	4	3	4	4	3	4	1		1	27
30	Covered Walkways	3	4	3	2	4	1	4	3	3	1	27
81	Const. of Building Grounds & Lightning Prot.	4	4	4	4	4	4	2	2		2	26
87	Sun Screening of Equip at Risk during Extreme Heat	4	4	4	4	4	4	3	1		2	26
2	Farm Detention Ponds	4	4	4	4	4	4	4	6		1	25
12	Flood Walls	3	3	1	2	4	1	4	7		1	25
50	Voluntary Perimeter Fire Zone	3	4	3	3	4	3	4	1		1	25
11	River, Lake, and Watershed Dredging	2	4	2	2	4	1	4	5		1	24
35	Pumper-Trucks and Fire Equipment	4	4	2	3	4	2	4	1		1	24
86	Haz Spill Storage and Stabilization Facilities	4	4	4	4	4	3	1	1		2	23
45	Snow Fences	2	4	2	2	4	1	4	1		1	20
79	Cloud Seeding to reduce Hailstone Size	2	2	2	2	2	2	2	1		2	17

CHAPTER 6

PLAN MAINTENANCE

Update Revisions for Chapter Since Last FEMA Approval	
Section	Description
Chapter 6	• No significant changes were made throughout the chapter

Monitor, Evaluate and Update

The Ponca City Hazard Mitigation Plan will be kept on record at the Ponca City Emergency Management Office, Ponca City City hall, and Ponca City Public School Districts Administration Offices. Any interested party may request a copy of the plan to review at these locations.

The Ponca City Hazard Mitigation Planning Committee (PCHMPC) will review the hazard mitigation plan every year and update the plan during that time if needed. The Chairpersons for the PCHMPC will be responsible to assemble the committee each January monitoring, evaluation, and the review and update of the plan. If the committee updates the plan, the committee chairpersons will notify the Ponca City Commissioners, and the Ponca City Public School Superintendents in writing of any and all changes. Their written response to the update will be kept in the appendix with the revisions.

The Ponca City Hazard Mitigation Plan will be officially reviewed and updated no later than every five years after FEMA approval. Once updated, the PCHMPC will submit the plan to Oklahoma Division of Emergency Management and FEMA for their review and approval. The PCHMPC will correct any revisions required and resubmit them to Oklahoma Division of Emergency Management and FEMA for their approval. When the plan update has been approved, the PCHMPC will send the plan to the Ponca City Commissioners, participating city councils, Ponca City Public School District's Boards of Education, the participating rural electric cooperatives for adoption.

During the evaluation process the planning committee will concentrate on the following elements:

- Do goals and objectives address current and expected conditions?
- Have the nature, magnitude, and/or type of risks changed?
- Are there implementation problems?
- Are current resources appropriate to implement the plan?
- Were the outcomes as expected?
- Did the plan partners participate as originally planned?

Procedures and Techniques

Evaluate the effectiveness of the planning process.

1. Reconvene the planning Team.
2. Review the planning process.
    a. Building the Planning Team
    b. Engaging the Public.
    c. Data Gathering and analysis.
    d. Coordinating with other Agencies.

Evaluate the effectiveness of the actions.

1. What were the results of the implemented actions? Did the results achieve the goals/objectives outlined in the plan? Did the actions have the intended results?
2. Were the actions cost-effective? Did (or would) the project result in the reduction of potential losses?
3. Document actions which were slow to get started or not implemented.

Determined why the actions worked (or did not work).

1. Lack of available resources.
2. The political or popular support for or against the actions.
3. The availability of funds.
4. The workloads of the responsible parties.
5. The actual time necessary to implement the actions.

Incorporation of Other Planning Mechanisms

The following process is how the local governing body has and will incorporate or incorperated the requirements in other plans, when appropriate:

1. The Ponca City Hazard Mitigation Planning Committee (PCHMPC) worked with the Chief administrative officials of the Capital Improvement Planning, Emergency Operation Planning, Stormwater Master Planning, transportation planning, Water Master Planning, Comprehensive Planning and the Zoning Committee departments to integrate the adopted hazard mitigation goals and actions.
2. Appropriate work plans, policies or procedures from each department included hazard mitigation concepts and activities to help integrate into the daily operations.
3. The PCHMPC and the department heads from each entity met on an annual basis to review and update the mitigation sections in their plans.
4. Each department submitted quarterly reports to the chairperson of the PCHMPC to inform them of mitigation efforts.
5. The chairperson of the PCHMPC was the designated person responsible to see that the annual meetings were scheduled and the quarterly reports were submitted.

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These changes included how major development projects and subdivision reviews were addressed in hazard prone areas and ensured that hazard mitigation concerns were considered in the approval of major capital improvement projects. Each department head assigned a person in their division to act as the Hazard Mitigation Liaison Officers to the PCHMPC.

6. Each department included a line item in their budget for mitigation. This line item was also included as a funding source; whether it was a revolving fund, private organizations, Federal/State grant programs, etc… These department heads were directed to submit quarterly reports to the PCHMPC on the progress of implementing these actions or progress of locating additional funding sources to fund the desired projects.
   - A hazard mitigation element was added to all the comprehensive plans that are now in place and new plans that are implemented into the local government.
   - Mitigation measures were addressed in these plans for new and existing structures to see if hazards can be mitigated prior to or during the building process.
   - Regulatory mechanisms that are in place will implement mitigation goals and objectives to their zoning and development ordinances.

   With the occurrence of future natural disasters, additional mitigation projects may be developed and added to the plan.

Each department looked into the uses of other financial sources to implement these measures. Other funding sources considered should be fees, taxes, bonds, loans to finance projects, and other sources.

Continued Public Involvement

The Ponca City and the Ponca City Public School District has limited resources for public involvement. Ponca City will post meetings and agendas on the city information board in front of the Ponca City Court House. This is the normal procedure for the city to notify the public of any and all upcoming events. The Ponca City Public School District will post meetings and agendas at the public notice boards in the High Schools, Middle Schools and Elementary Schools. This is the normal procedure for the Ponca City Public School District to post any and all upcoming events. Both the Ponca City and Ponca City Public School District will invite the public to the meetings and ask for their input and present any mitigation suggestions they may have to the Ponca City Hazard Mitigation Planning Committee.

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