

## Special Topics

## Washington County Disaster Resiliency Assessment

The purpose of this section is to assess at the county level key components of disaster resiliency. Housing location and quality as well as planning activities can help reduce impacts from disaster events and allow for faster recovery. Disasters can include tornadoes, extreme weather, high winds, as well as man-made events. These events may largely be inevitable, but the ability to reduce damage and casualties as well as recovery can be improved with good planning.

### C.0 Comprehensive Plans & Hazard Mitigation Plans

There are 6 cities and towns within the county. Two key cities within the county, Bartlesville and Dewey. Towns include Copan, Ocheleta, Ramona and Vera.

**Comprehensive plans** are the guiding documents for cities of various sizes to address key aspects of their community from land use, transportation, environment, housing, and economic development. City of Bartlesville has a Comprehensive Land Use Plan for the Bartlesville Metropolitan Area.

City of Bartlesville has also prepared a Floodplain Management Plan, a Stormwater Master Plan, a Flood Mitigation Assistance Plan, a City-wide Master Drainage Plan, and completed a Stream Gauge Feasibility Study.

City of Dewey has a draft comprehensive plan that has not yet been adopted.

The following is language in the plans that addresses land use decisions that reduce placing housing and businesses within historical areas of risk (e.g. flooding) and other supporting actions to increase disaster resiliency.

#### **City of Bartlesville Comprehensive Plan Elements addressing housing and community resiliency:**

##### *Land use Objectives*

- To protect the public from the dangers of flooding by limiting development in flood-prone areas to those uses which will not present a threat to life or property in the event of a major flood.
- To protect the health of residents living in neighborhoods which are part of the National Zinc Overlay District by managing the soil caps which have been constructed in the area to prevent their loss or assure replacement if disrupted.

##### *Land Use Policies*

- Policy LU-6.3: The FEMA National Floodplain Standards and Regulations and other flood prevention and control regulations as adopted by the City of Bartlesville and Washington County should be enforced.
- Policy LU-7.1: Institutional controls for the regulation of soil disturbance activities within this overlay district should be adopted and implemented to maintain protective soil caps and ensure proper handling and disposal of contaminated soils.
- Policy LU7.2: The rezoning and redevelopment of incompatible commercially zoned and/or developed properties within residential neighborhoods lying within this overlay district should be encouraged.

### *Community Facilities Policies*

- Policy CF-8.7: As stated in the Future Parks Plan, major flood-prone areas of the City should be utilized as park land and should be designed to detain storm water run-off and used for recreational purposes where appropriate.

### **Emergency Operation Plan**

City of Bartlesville and Washington County have met all the conditions for compliance with the National Incident Management System (NIMS) as set forth in Homeland Security Presidential Direction #5 (HSPD-5). The NIMS incorporates a system called Incident Command System (ICS) that provides a common language, common management protocols, and scalable incident response chains-of-command that can be applied to any emergency response.

- **Emergency Operations Center** – Washington County Emergency Management (WCEM) in coordination with the City of Bartlesville has established emergency operations and procedures. WCEM is responsible for the Emergency Operations Center (EOC) and the coordination of disaster emergency response activities within the community. WCEM is a volunteer organization made up of 54 professional and volunteer staff trained to respond to a variety of technological and natural disasters. The Emergency Management Office is also active in training Community Emergency Response Team (CERT) members.
- **Storm Ready** – The Emergency Management Office participates in the National Weather Service accredited program *Storm Ready*. Requirements for the program include an established 24-hour warning point and functioning emergency operations center, multiple means of both, receiving severe weather forecasts and providing warnings to alert the public, systems to monitor local weather conditions, promotion of public safety information, and a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises.
- **Hazard Analysis** – Washington County Emergency Management has prepared a Hazard Analysis for eight potential disasters. The document coordinates the City's response to an emergency or disaster. This Multi-Hazard Mitigation Plan updates Bartlesville's portion of the Washington County Emergency Management Plan.
- **Enhanced 9-1-1** – Washington County has also implemented an Enhanced 9-1-1 Emergency Telephone System (E-911). The system enables the 9-1-1 emergency dispatcher to have information on the telephone customer's name from which the call was made, the physical address of the location including the community, and the emergency services recommended for dispatch to the location. The County and Bartlesville have developed Geographical Information Systems (GIS) compatible between two jurisdictions to aid in wireless 9-1-1.
- **Weather Radios** – WCEMA has acquired over 200 NOAA weather radios that were placed in City and County buildings including schools, licensed daycare, and licensed long term care facilities as well as all medical facilities and churches in Washington County. The radios allow Washington County to retain its *Storm Ready* certification.
- **Warning Siren** – The warning siren coverage for the City of Bartlesville includes 36 sirens strategically placed throughout the community and is illustrated in Figure 2-3 and listed in Table 2-7. A Warning Siren Study Grant Application was completed and approved by the Bartlesville City Council and submitted to ODEM to review upgrades to the existing warning siren coverage in Bartlesville.

- **National Zinc Overlay District** – Historic smelter operations at the National Zinc facility on the west side of Bartlesville caused soils adjacent to the facility to be contaminated with lead, arsenic, cadmium and other metals. The top two feet of soil in those areas have been removed and replaced with clean soil. A soil disturbance activity permit is required prior to exaction activities, rezoning or change of land use, development or subdivision of land, or for the use of any land that involves children’s use of the site with this district.

### **Emergency Operation Center**

During major emergencies, Bartlesville’s City government will be moved to the Emergency Operation Center (EOC), located at 3931 SE Adams Rd. Bartlesville’s backup EOC is at the Police Department or the mobile trailer unit may be utilized. The EOC is equipped with a communications center with all the necessary communications equipment. An emergency generator with fuel for a substantial period is available. At the time that the HMP was approved (2011), the City of Bartlesville was in the initial stages looking at building an index of citizen storm shelters, so that in the aftermath of a disaster that spreads debris over shelters, emergency rescue teams will know where to begin looking for survivors. Since that time, a storm shelter program has been established. See Section C.2.1.2. for more information on the storm shelter program.

The other key plan for a city to manage, mitigate, and plan for recovery related to disasters are county or city Hazard Mitigation Plans and/or Emergency Management Plans.

City of Bartlesville has a Hazard Mitigation Plan (HMP) that provides guidance related to major risks that impact the area and methods to address and mitigate those risks. The existing HMP was completed with coordination from Bartlesville Public Schools. City of Bartlesville is in the process of updating their HMP in coordination with Washington County. This assessment is based on the City of Bartlesville HMP, and the joint City of Bartlesville/Washington County HMP is not expected to be complete until December 2015. City of Dewey has an expired Hazard Mitigation Plan. Rather than renew the HMP, City of Dewey will be included within the Washington County HMP. Other communities involved in the update process include Copan, Ocheleta, Ramona and Vera. School districts involved in the plan update include Copan Public Schools, Dewey Public Schools, and Caney Valley Public Schools.

### **C.2.1.1. Historical Data on Natural Disasters and Other Hazards**

The City of Bartlesville Multi-Jurisdictional Multi-Hazard Mitigation 2011 Plan Update had two key goals:

#### *Bartlesville’s Goal*

- To improve the safety and well-being of the people residing and working in the City of Bartlesville by reducing the potential of deaths, injuries, property damage, environment
- and other losses from natural hazards, and to do this in a manner that creates a disaster-resistant community, enhances economic development opportunities and
- advances community goals and quality of life resulting in a more livable, viable, and sustainable community.

*Bartlesville Public Schools' Goal*

To improve the safety and well-being of the Students, Faculty, and Staff of the Bartlesville Public School System by reducing the potential of deaths, injuries, property damage, education interruption and other losses from natural hazards, and to do this in a manner that creates a disaster-resistant school system that advances the schools goals and quality of education resulting in a more viable, and sustainable school system.

The following are high priority mitigation measures defined by the Bartlesville Hazard Mitigation Technical Advisory and Citizens Advisory Committees:

<b>Prioritized Mitigation Measures</b>		
<b>Rank</b>	<b>Lead/Responsible Department</b>	<b>Mitigation Strategy</b>
1	Emergency Management	Develop an All-Hazard Public Information, Education and Awareness Program.
2	Emergency Management	Educate the public on the importance of a family disaster plan and supply kit.
3	City Manager	Develop distribution centers in local libraries and City hall where information and safety guidance on natural and man-made hazards can be provided to citizens.
4	City Manager	Distribute a Family Emergency Preparedness Guide to all families.
5	Emergency Management	Develop an inventory and database of Special Needs Populations requiring special assistance during disasters.
6	Chief Building Official	Train/Educate builders, developers, architects and engineers in techniques of disaster-resistant homebuilding, such as the Fortified Home standards developed by the Institute for Business & Home Safety (IBHS), the Blueprint for Safety guidelines developed by the Federal Alliance for Safe Homes (FLASH).
7	Chief Building Official	Educate builders on appropriate foundation types for soils with different degrees of shrink-swell potential. For example, using "post-tensioned slab-on-grade" or "drilled pier" vs. standard "slab-on-grade" or "wall-on-grade" foundations.
8	City Manager	Establish an administrative procedure or change City codes for requiring builders to check for expansive soils when they apply for permits for new residential construction and for using foundations that mitigate expansive soil damages when in a moderate or high-risk area.
9	Parks Department	Provide lighting sensing and warning systems for outdoor systems for outdoor sports areas, pools, golf courses, play grounds, schools, ball fields, and parks.
10	Emergency Management	Develop an Emergency Back-up Generator Hazard Mitigation Plan Annex for the community, assessing generator needs for critical facilities, both public and private. Assessment should include generator needs, costs of installation for pads/transfer panels only,

		or for complete generator assembly installation.
11	City Manager	Based on the results of the Emergency Back-Up Generator Hazard Mitigation Plan Annex, provide wiring and transfer switches to accommodate emergency generators during disaster power outages for Critical Facilities including Emergency Operations Centers, City Hall, Dispatch, Police, Fire, Community Centers used for emergency shelters during disasters, life stations, water treatment plants, and community medical facilities.
12	City Manager	Provide Critical Facilities (City Hall, Emergency Operations Center, 911 Dispatch, Police Station, Fire Stations, and other essential Critical Facilities) with generator pad, wiring/transfer switches and Emergency Back-Up Generators, or reliable contracts to provide Back-Up Generators.
13	City Manager	Identify and encourage Private Critical Facilities (Financial Institutions, Long Term Care Facilities, Designated/Potential Community Emergency Shelters, etc.) to have generator pad, wiring/transfer switches and Emergency Back-Up Generators, or reliable contracts to provide Back-Up Generators.
14	City Manager	Adopt an Ordinance requiring generator pad and wiring/transfer switches for Elder Care Facilities and Nursing Homes, to accommodate Emergency Back-Up Generators in the event of prolonged power outages.
15	City Manager	Identify and/or encourage Key Important Private Service Facilities (gas stations, convenience stores, etc.) to have wiring/transfer switches and Emergency Back-Up Generators installed, or reliable contracts for the provision of Back-Up Generators, in the event of disasters or power outages.
16	City Manager/ Emergency Management	Provide new/retrofit Critical Facilities and Safe Rooms that will withstand hazards and ensure continuity of government and First Responders, including City Hall, Police, Fire, Emergency Operations Center, and 911 Center/Dispatching. Identify and/or encourage Key Important Private Service Facilities (gas stations, convenience stores, Wal-Mart, etc.) to have wiring/transfer switches and/or Emergency Back-Up Generators, or Reliable Contracts to provide Back-Up Generators.
17	City Manager/Chief Building Official	Educate residents, building professionals and Safe room vendors on the ICC/NSSA “Standard for the Design and Construction of Storm Shelters” and consider incorporating into current regulatory measures.
18	Superintendent, Bartlesville Public Schools	Install Safe Rooms in schools
19	City Manager/ Flood Plain Manager	Continue compliance with, and participation in the National Flood Insurance Program (NFIP) and Community Rating System (CRS).
20	City Manager/ Flood	Acquire and remove flood plain and repetitive loss properties where

	Plain Manager	the community's repetitive loss and Flood & Drainage annex to the Hazard Mitigation Plan identify acquisition as the most cost-effective and desirable mitigation measure.
21	City Manager	When replaced, install Break/Shatter Resistant Glass in government offices critical facilities.
22	Superintendent, Bartlesville Public Schools	When replaced, install Break/Shatter Resistant Glass in Schools.
23	City Manager	Provide surge and lightning protection for computer-reliant critical facilities (e.g. 911 Center, EOC, police stations, fire stations, water/wastewater treatment plant and public works buildings).
24	City Manager	Educate the public, and encourage the utility companies to provide information to their clients on Whole House Surge and Lightning Protection.
25	Emergency Management	Continue upgrading and maintaining community-wide outdoor omnidirectional voice/siren warning systems for new and developing areas.
26	Emergency Management	Develop Warning and Evacuation Plans for populations along Caney River, downstream from High Hazard Dams (Hulah & Copan).
27	Emergency Management	Install a mass Emergency Telephone Communication System, such as Reverse 911 or Black Board Connect, for mass call-outs to targeted areas of the community for emergency notification and/or information.
28	City Manager/ Emergency Management	Develop Memorandums of Understanding (MOUs) with private sector gasoline service facilities, in times of emergency of power outages, to provide fuel and give priority to Emergency/Critical Vehicles (government, police, fire, ambulance, etc.)
29	City Manager/ Public Works/ Emergency Management	Develop/Review/Update the debris management plan.
30	City Manager/ Emergency Management	Adopt an ordinance requiring registration of Safe Rooms, and create a data base and GIS (lat/long) map to locate Safe Rooms in the event of a disaster.*

\* It should be noted that since the HMP was approved in 2011, the City of Bartlesville and Washington County EMS have developed a Storm Shelter Program where residents can voluntarily register storm shelters. Registration can be done with a smart phone through an automated system.

At the time of this report, the Washington County and the City of Bartlesville were in the process of updating the HMP.

Historical natural disasters in Washington County are documented in City of Bartlesville Multi-Jurisdictional Multi-Hazard Mitigation 2011 Plan Update (HMP 2011). Thirteen natural disasters since 2001 have been formally declared disaster area by the President. Typical hazard disasters in the region include flooding, severe storms, wildfires, severe winter storms, and tornadoes. (HMP 2011).

<i>Hazard</i>	<i>How Identified</i>	<i>Why Identified</i>
<b>Floods</b>	Review of FEMA floodplain maps Buildings in the floodplains Historical floods and damages (detailed in Chapter 4)	<ul style="list-style-type: none"> <li>• 472 structures located in floodplain</li> <li>• Flash floods can occur with little or no warning and account for most flood deaths</li> <li>• Over \$80 million of property at risk</li> </ul>
<b>Hailstorms</b>	Review of data from National Climatic Data Center	<ul style="list-style-type: none"> <li>• 21 hail damage events in the Bartlesville area between 1989 and 2008</li> <li>• Over \$3 Million in reported property damage</li> </ul>
<b>High Winds</b>	National Weather Service data Loss information provided by national insurance companies	<ul style="list-style-type: none"> <li>• 28 high wind related events in Bartlesville since 1999</li> <li>• Several events exceeded 70 mph</li> <li>• \$531,000 in reported structure damages</li> </ul>
<b>Lightning</b>	National Climatic Data Center information and statistics	<ul style="list-style-type: none"> <li>• Oklahoma has had 540 incidents resulting in 13 deaths, 87 injuries, and \$33.68 Mil between 1989 and 2008</li> <li>• 2 lightning events in the Bartlesville area between 1989 and 2008 resulting in \$65,000 in damages</li> </ul>
<b>Severe Winter Storms</b>	Review of past disaster declarations Input from Washington County Emergency Management Input from Bartlesville Department of Public Works Input from area utility companies	<ul style="list-style-type: none"> <li>• Severe winter storms are an annual event in the Bartlesville area and can produce both wide-spread economic disruption and massive public utility outages.</li> <li>• Washington County has had 22 major winter storm events in the last 10 years.</li> <li>• \$51.5 Million in reported damages during those 22 events</li> </ul>
<b>Tornadoes</b>	Review of recent disaster declarations Input from Emergency Manager Review of data from the National Climatic Data Center	<ul style="list-style-type: none"> <li>• Bartlesville is located in "Tornado Alley"</li> <li>• An average of 52 tornadoes per year strike Oklahoma</li> <li>• Recent disaster events and damage</li> <li>• Oklahoma City tornado of 1999 killed 42 people and destroyed 899 buildings</li> <li>• All citizens and buildings are at risk</li> </ul>
<b>Wildfires</b>	Input from Bartlesville Fire Department Input from surrounding county & community fire departments Input from State Fire Marshal Input from Oklahoma State University Rangeland Conservation	<ul style="list-style-type: none"> <li>• Fires of the urban/rural interface threaten Bartlesville properties</li> <li>• Several miles of Bartlesville's perimeter and a number of identified critical facilities are exposed and vulnerable to wildfires</li> <li>• 562 grass and crop fires in Bartlesville area between 1999-2003 resulted in over \$22,050 in damage</li> </ul>



Hazard	Description
Dam & Levee Failures	<p>The Federal Emergency Management Agency (FEMA) defines a dam as "a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water." A dam failure is the collapse, breach, or other failure of such a structure resulting in downstream flooding.</p> <p>Bartlesville is exposed to risk of flooding from failure of four high-hazard upstream dams – Bardew, Copan, Hulah, and Hudson – with the greatest threats coming from Hulah and Copan. However, the Corps of Engineers believes that the chances of a dam failure are very small as the Hulah &amp; Copan dams are classified as high risk and inspected annually.</p> <p>Even though there is a low likelihood of a major dam or levee failure, if it were to occur the impact would be devastating. Therefore, Bartlesville and Bartlesville Public Schools are at high risk from dam failure, and have a low probability that a dam failure event will occur.</p>
Transportation	<p>Transportation is the physical movement of an object through components of a system and its subsystems. Transportation includes the use of aviation, highway, railroad, pipeline, and marine systems to convey movement of objects and people.</p> <p>Bartlesville and Bartlesville Public Schools are at high risk from transportation events, and have a high probability that a transportation event will occur.</p>

**Table 4-1: Summary of Damages, 1995-2009**

Hazard	Events	Years	Events/Year	Total Property Damage (Recorded)	Property Damage/Event	Property Damage/Year	Injuries	Injuries/Event	Injuries/Year	Deaths	Deaths/Event	Deaths/Year
Floods	23	15	1.53	\$1,115,000.00	\$48,478.26	\$74,333.33	0	0	0	0	0	0
Tornadoes	4	15	0.27	\$1,701,000.00	\$425,250.00	\$113,400.00	3	0.75	0.2	0	0	0
High Winds	32	15	2.13	\$698,000.00	\$18,625.00	\$39,733.33	0	0	0	0	0	0
Lightning	1	15	0.07	\$15,000.00	\$15,000.00	\$1,000.00	0	0	0	0	0	0
Hail	45	15	3.00	\$3,025,000.00	\$67,222.22	\$201,866.67	0	0	0	0	0	0
Winter Storms	29	15	1.93	\$6,152,000.00	\$1,776,586.21	\$3,434,733.33	0	0	0	0	0	0
Extreme Heat	3	15	3.30	\$0.00	\$0.00	\$0.00	0	0	0	0	0	0
Drought	2	15	3.30	\$0.00	\$0.00	\$0.00	0	0	0	0	0	0
Expansive Soils	Data Unavailable											
Urban Fires <sup>1</sup>	233	5	46.6	\$8,100,000.00	\$26,180.26	\$1,220,000.00	5	0.02	1	1	0.004	0.2
Wildfires <sup>1</sup>	435	5	87	\$15,351.00	\$35.29	\$3,070.20	Data Unavailable					
Earthquakes <sup>2</sup>	0	15	0	\$0.00	\$0.00	\$0.00	0	0	0	0	0	0
HazMat Events <sup>3</sup>	5	15	0	Data Unavailable								
Dam Failures	0	15	0	Data Unavailable								
Transportation <sup>4</sup>	6	10	0.6	Data Unavailable								

<sup>1</sup> Based on a 5-year time period from 2004-2008. Source: OK Fire Marshall's Office

<sup>2</sup> Source: Oklahoma Geological Survey Earthquake Catalog

<sup>3</sup> Source: National Response Center

<sup>4</sup> Based on a 10-year time period from 1999-2008. Source: National Response Center

**Table 4-2: City of Bartlesville Hazard Risk Analysis**

Type of Hazard	Occurrence		Vulnerability				Mitigation Activities	Resources		Total
	Historical	Probability	Human	Property	Infra structure	Business		Internal	External	
Winter / Ice Storm	5	5	2	3	5	5	3	3	3	5.7
High Wind Events	5	5	2	4	3	4	2	2	3	5.4
Flooding	5	5	3	3	3	2	3	3	3	4.8
Hail	5	5	1	5	1	2	2	2	2	4.7
Expansive Soils	5	5	1	4	2	1	2	2	2	4.4
Tornadoes	2	2	3	5	5	4	2	2	3	4.3
Heat, Extreme	3	5	4	1	3	2	3	3	2	4.2
Dam Failure	1	1	5	5	5	5	3	3	2	4.2
Transportation	5	5	2	1	2	1	2	2	2	4.0
HazMat - Fixed Site	5	5	2	1	2	1	3	2	2	3.9
Wildfires	5	5	1	1	1	1	3	4	3	3.1
Urban (Structure) Fires	5	5	1	1	1	1	4	4	4	2.9
Drought	2	3	1	1	2	3	4	3	2	2.3
Lightning	2	2	1	2	2	2	3	4	4	1.7
Earthquake	0	1	1	1	1	1	1	2	2	0.8

**Table 4-3: Summary of Hazard Risk Analysis Ranking Criteria**

Summary:	<p>This tool looks at an organization's or a community's vulnerability to the effects of various hazards. Using a scale of 0 to 5, the probability of occurrence and the impact potential are measured against mitigation activities and the resources available to respond to the hazard. The total is based on a formula that weighs risk heavily but provides credit for mitigation and response and recovery resources.</p> <p>The highest score possible is 7.8. The lower the total score, the lower the overall risk from the Hazard.</p>	
Instructions:	<p>Score each hazard based on a scale of 0 to 5 with 5 being the highest. Ratings values: 1 = Low : 2-3 = Moderate : 4-5 = High</p>	
Historical Occurrence:	<p>This is based on the number of occurrence in the last 20 years. Maximum is 5; if a new hazard, use 0.</p>	
Probability:	<p>Score 0 if non-existent, 1 if less than 1%, 2 if less than 5%, 3 if less than 10%, 4 if less than 20%, and 5 if greater than 20%. Probability is the likelihood an event will occur. History and probability are similar, but hazards that are newly developing, hazards where the likelihood has increased or decreased based upon new developments or activities, or hazards that have a lack of historical information may need to be considered individually.</p>	
Impact:	<p>Based on "worst-case scenario" - greatest possible impact should worst-case event occur. Maximum threat is the worst-case scenario of a hazard. Its impact is expressed in terms of human casualties, property loss, and business interruption/loss revenue issues. Secondary events need to be factored in where necessary. Assume maximum population when appropriate (for example, industrial park during peak work hours).</p>	
Internal/ External Resources:	<p>Based on the resources available to the community internally, or to Mutual Aid agreements or other understandings with neighboring jurisdictions. May also include private resources available, such as corporate firefighting/hazmat teams or medical resources.</p>	
Analysis Results:	<p><b>Extreme Risk: Greater than 6.0</b></p>	<p><b>Moderate Risk: 2.5 to 4.0</b></p>
	<p><b>High Risk: 4.0 to 6.0</b></p>	<p><b>Low Risk: Less than 2.5</b></p>

### Dam Failure Risks

**Historical Context:** “There are 30 dams in Washington County of which Bardew and Copan are designated by the Oklahoma Water Resources Board (OWRB) as high hazard as well as Hulah and Hudson of Osage County. These dams pose a potential threat to Bartlesville Public Schools and the City of Bartlesville where 70.9% of Washington County population resides” (City of Bartlesville HMP 2011).

The 4 dams assessed as part of the HMP included Bardew Dam, Hudson Lake Dam, Copan Lake Dam, and Hulah Lake Dam (City of Bartlesville HMP 2011).

**Bardew Dam:** Located 4.5 miles north of Bartlesville, built in 1938. A breach of this dam is noted to potentially inundate local areas east of the dam and the Caney River floodplain but would not impact citizens.

**Hudson Lake Dam:** Located 6 miles NW of Bartlesville in Osage County, built in 1949. A breach of this dam is noted to potentially inundate Bartlesville including the Bartlesville Airport and areas along State Highway 123 and U.S. 60.

**Copan Lake Dam:** Located 9 miles north of Bartlesville in Washington County, built in 1983. A breach of this dam is noted to potentially inundate Bartlesville including areas along Interstate 75, State Highway 123 and U.S. 60 which could potentially impact 4,800 people.

**Hulah Lake Dam:** Located 13 miles NW of Bartlesville in Osage County, built in 1951. A breach of this dam is noted to potentially inundate Bartlesville including areas along Interstate 75, State Highway 123 and U.S. 60 which could potentially impact 5,900 people.

There has not been a historical dam breach in Washington County. As noted in the Flood section, “the worst flood in Bartlesville’s history occurred in 1986 when over 25 inches of rain fell over a week’s time necessitating the opening of floodgates for the Hulah and Copan dams. The releases from these floodgates resulted in the Caney River cresting at 17 feet above flood stage and flooded half of the City of Bartlesville in what was deemed the equivalent to the 500-year flood. The flooding resulted in a Presidential Disaster Declaration for Washington County.” (City of Bartlesville HMP 2011)

#### **Mitigation Strategy / Recommendations from HMP:**

##### **HMP 5.2, Dam and Levee Break –**

**Objective 2. Preventive Measures.** Expand mapping, regulations, and loss-prevention programs in areas with high risks, including extension of flood insurance regulations behind high-risk levees; updated risk mapping downstream of high-risk dams; and pre-disaster evacuation and hazard-mitigation programs.

### Drought

**Historical Context:** Six major drought events have occurred in Oklahoma over the past 50 years. Bartlesville has experienced 3 drought events times from 2004 through 2011 which resulted in crop damage and wildfire. Property and crop damage due to drought in Oklahoma

between 2000 and 2007 reached \$594 million (\$32.5 million to property and \$561.6 million to crops). (City of Bartlesville HMP 2011)

**Mitigation Strategy / Recommendations from HMP:** Agriculture is usual the first economic sector to be affected by drought. Economic damage due to crop loss and wildfire remain a significant threat to Washington County. Water rationing and clearing brush away from structures will minimize losses. (City of Bartlesville HMP 2011)

**HMP 5.2, Drought – Goal:** To reduce the impact of drought on property, infrastructure, natural resources and local government response functions.

**Objective 1. Public Information and Education.** Improve public awareness of drought and measures by which people can protect themselves, their property, and their community.

### Earthquake

**Historical Context:** “The earliest documented earthquake in what is now Oklahoma occurred in “Indian Territory” in 1882. Other significant Oklahoma earthquakes include an earthquake near El Reno in 1952 (5.7 magnitude), in Seminole County in 1969 (4.6 magnitude), in Ada in 1997 (4.4 magnitude), near Lawton in 1998 (4.2 magnitude), and near Lawton in 2002 (3.8 magnitude).” (City of Bartlesville HMP) Though not included in the Bartlesville HMP, the largest earthquake experienced in Oklahoma occurred near Sparks in 2011 (as the HMP was published in 2011). Washington County has not experienced any reported earthquakes from 1977 through 2005.

Concerns about fracking or fluid injection as part of the process for extraction of oil/ natural gas continues to factor into discussions for risk assessment for building codes and mitigation.

**Mitigation Strategy / Recommendations from HMP:** Washington County does not consider earthquakes to be a significant threat.

**HMP 5.2, Earthquake – Goal:** To reduce injury, loss of life, and damage to property, equipment and infrastructure caused by earthquakes

### Expansive Soils

**Historical Context:** damage to structures due to expansive soils can be expected following periods of extended drought. Damage from expansive soils is difficult to track. No damage information is available.

**Mitigation Strategy / Recommendations from HMP:** “A prolonged period of drought could significantly speed and intensify infrastructure deterioration. For example, aging gas and water pipelines, especially when originally constructed in wet soil, can rupture during periods of extended drought. Likewise, damage to structures can be expected during and following any period of extended drought especially when structures are built during a drought followed by soaking rains that cause swelling of clays ” (City of Bartlesville HMP 2011)

**HMP 5.2, Expansive Soil – Goal:** To reduce the damage and economic losses caused by expansive soils on property and local infrastructure.

### Extreme Heat

**Historical Context:** The average high temperature in Bartlesville for July is 93.6 degrees with an average afternoon humidity of 56%. This calculates to a heat index of 106 degrees putting the area in the Danger category on the National Weather Service (NWS) Heat Index sale. The City of Bartlesville and Washington County experienced **3 extreme heat** events from 2001 through 2007.

Date	Location	General Description of Incident
07/06/01	Western and Central Oklahoma including	Extreme Heat – Extended period of excessive heat caused 8 deaths across Oklahoma including 1 death in Bartlesville.
07/06 - 08/06	Oklahoma	Extreme Heat - Temperatures reached above 100 F starting in mid-July and continued through the middle of August. Many locations reached 105 F or greater with higher heat index values. The heat caused 10 deaths across the area during this time period.
08/07	Eastern Oklahoma	Extreme Heat - High heat and high humidity resulted in daytime heat index values from 105 F to 113 F across much of Eastern Oklahoma. In Bartlesville, 2 deaths occurred as a result of the heat. Bartlesville EMS treated 200 other people for heat related illnesses, many of whom were in attendance at a PGA Championship.

**Mitigation Strategy / Recommendations from HMP:** Vulnerable populations include disabled, elderly, the ill and lower incomes where electricity (fans) and air conditioning is not affordable.

**HMP 5.2, Extreme Heat – Goal:** To reduce heat-related illnesses, loss of life, and exacerbation of other hazards such as drought and expansive soils caused by heat conditions.

**Objective 1. Public Information and Education.** Improve public awareness of extreme heat hazards and measures by which people can protect themselves, their property and their community.

**Objective 2. Preventive Measures.** Identify and protect people and critical infrastructure that are vulnerable to extreme heat conditions.

**Object 5. Emergency Services.** Ensure that a Heat Emergency Action Plan is followed and that heat alerts are issued in a timely manner. Establish or expand emergency services protocols that adequately address response scenarios in the event of extreme heat.

#### Flood

**Historical Context:** Flooding can be connected to development being permitted too close to stream, rivers and floodplains. Flooding can also have devastating impacts to property owners without flood insurance. The primary threat for flooding is for properties located along the Caney River.

**Table 4–8: Floods in Oklahoma and Washington County from 1995-2009**

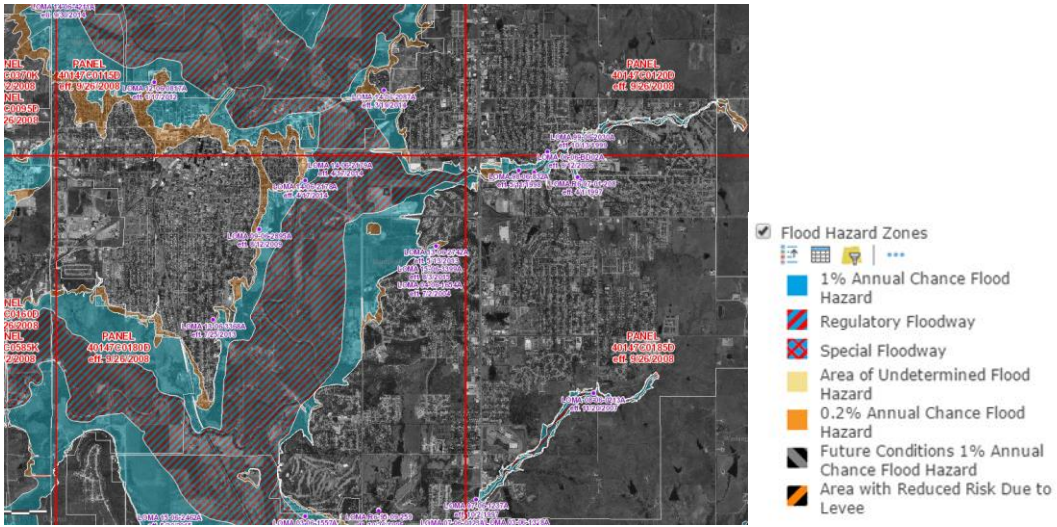
Oklahoma	Events	Deaths	Injuries	Damage Events	Property Damage
Bartlesville*	23	0	0	5	\$1,115,000
Washington County	39	0	0	10	\$1,268,000
Oklahoma	1,971	25	25	355	\$79.67 Million

\* Information in NCDC does not allow for damages to a community to be separated from the county report. The dollar damages for the events that affected Bartlesville were for all areas affected by those events.

Date	Location	General Description of Incident
1941	Bartlesville	Flood – Three significant floods in 1941 following a 5-year drought
06/12/51, 06/25/51	Bartlesville	Flood - Gates at Hulah Dam in Copan, OK closed to prevent further flooding of Bartlesville along the Caney River.
1974	Bartlesville	Flood - Damage to more than 400 homes in Bartlesville. \$275,000 damages were estimated.
10/05/86	Bartlesville	Flood - Worse flood in Bartlesville’s history due to 25 inches of rain in one week. Caney River rose more than 30 feet above normal and 17 feet above flood stage at Bartlesville. Fifty percent of Bartlesville was under water cutting off the east and west sides from each other. The President declared it a disaster area.
07/01/07	Washington County	Flood - Caney River rose to 8.45 feet above flood stage by 07/02/07. 2500-3000 residents displaced across the county. Estimated \$400,000 in damages to government infrastructure and a total damages estimated at \$1 million. This event led to 60 counties being included in a FEMA Disaster Declaration.

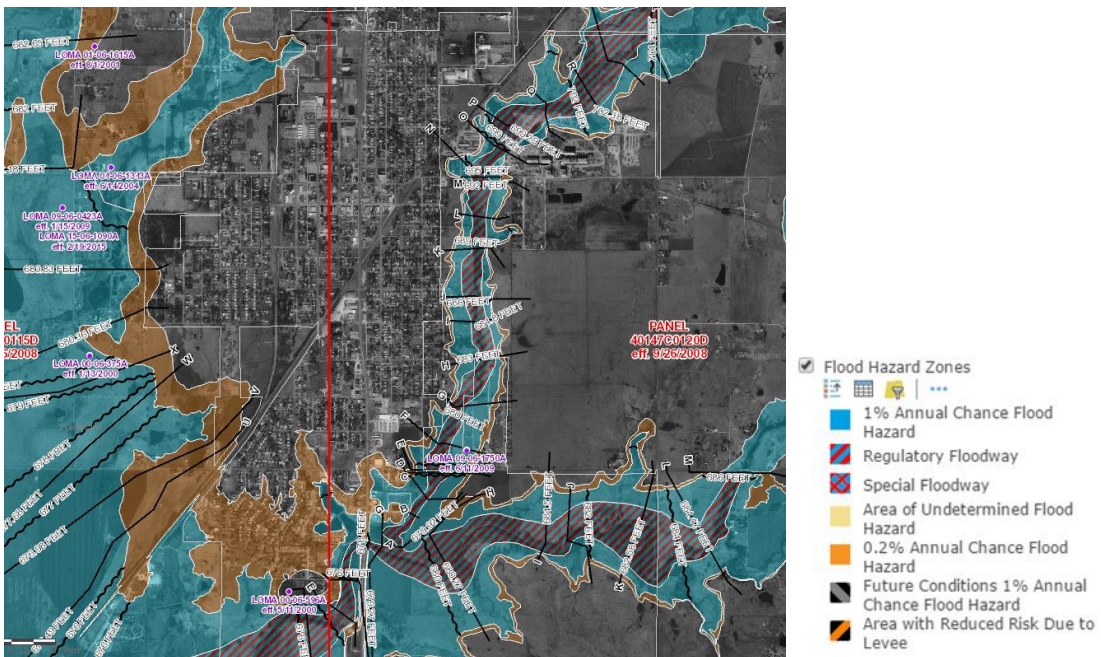
(City of Bartlesville HMP 2011)

Bartlesville



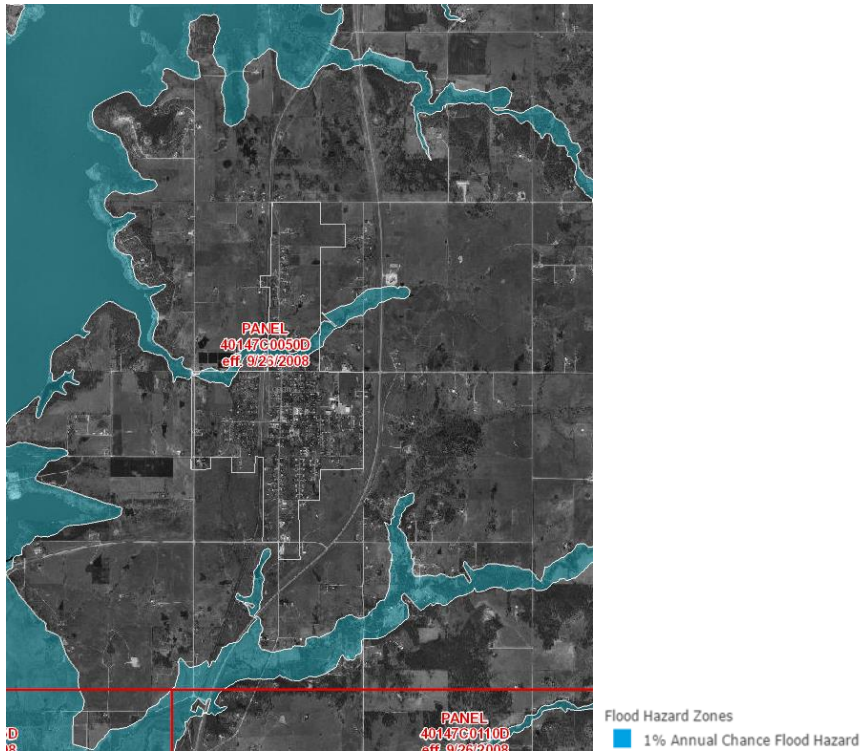
FEMA's National Flood Hazard Layer <http://fema.maps.arcgis.com/>

Dewey



FEMA's National Flood Hazard Layer <http://fema.maps.arcgis.com/>

Copan



FEMA's National Flood Hazard Layer <http://fema.maps.arcgis.com/>

Ramona



FEMA's National Flood Hazard Layer <http://fema.maps.arcgis.com/>



## Ocheleta



FEMA's National Flood Hazard Layer <http://fema.maps.arcgis.com/>

**Mitigation Strategy / Recommendations from HMP:** As stated in the Bartlesville Future Parks Plan, major flood-prone areas should be utilized as park land and should be designed to detain storm water run-off and used for recreational purposes.

**HMP 5.2, Flood - Goal:** To reduce injuries and loss of life; trauma; damage to property, equipment and infrastructure; community disruption; and economic, environmental, and other losses caused by floods and flash floods.

**Objective 3. Structural Projects.** Obtain funding for an implement projects that can reduce flood and drainage hazards, with consideration for comprehensive solutions in accord with watershed-wide management plans.

**Objective 4. Property Protection.** Identify and protect people, structures, critical facilities, and critical infrastructure that are vulnerable to flood and flash flood hazards.

## Hail

**Historical Context:** "Washington County has reported 137 severe hail events (hail one inch or larger) from 1995 through 2009, with \$3.3 million in reported damage. Based on data from the National Climatic Data Center, 45 of these events were reported for the Bartlesville jurisdiction, with \$3 million in reported damages."

**Table 4–26: Reported Casualties and Damages Caused by Hail from 1995 to 2009**

Location	Events	Deaths	Injuries	Damage Events	Property Damages
Bartlesville	45	0	0	3	\$3,025,000
Washington County	137	0	0	7	\$3,110,000
Oklahoma	6,019	0	2	236	\$154.5 Million

Date	Location	General Description of Event
11/10/95	2 miles south of Bartlesville	1.00" - Monetary damages unavailable
5/08/00	Bartlesville	1.75" - Golf ball to softball size hail damaged roofs, windows, and cars. \$2 million in damages was reported
5/20/01	Bartlesville	1.75" - \$1 million in damages
4/06/06	Bartlesville	1.75" - \$25,000 in damages
5/31/08	Bartlesville	1.00" HAIL – Severe thunderstorms occurred primarily over northeast Oklahoma bringing 1.00-inch hail to Bartlesville. Monetary damages unavailable

(City of Bartlesville HMP 2011)

**Mitigation Strategy / Recommendations from HMP:**

**HMP 5.2, Hail – Goal:** To reduce the high costs of property and infrastructure damage caused by hailstorms.

**Objective 4. Property Protection.** Identify, fund, and implement projects to protect people and public and private property from losses in hail events, including critical infrastructure such as utilities and public vehicles.

Hazardous Materials, Fixed Site Incidents

**Historical Context:** “From January 1, 1998 to December 31, 2008, there were 19 fixed-site incidents in Washington County reported to the National Response Center. Of those the great majority were harmless (but reportable) releases of materials used in manufacturing, such as nitrogen oxide, hydrogen sulfide, anhydrous ammonia, sulfur dioxide and sulfuric acid.” (City of Bartlesville HMP 2011) Five of these incidents occurred in Bartlesville.

**Table 4-51: Fixed Site Hazardous Materials in the Bartlesville Area**

Incident Date	Description	Type	Cause	Location	Material Name
12/20/97	Unknown Sheen Sighting, Sheen Size: 1/2 Mile of a Creek /Rainbow Colored Sheen	Unknown Sheen	Unknown	Rd 2100 & Rd 4020 Intersection	Unknown Oil
06/14/00	Valve on Reactor Malfunctioned & caused Release	Fixed	Equipment Failure	Us Hwy 60 & Ok Hwy 123	Methyl Mercaptan
08/23/02	Caller reported release of crude oil from pump jack due to Unknown causes	Fixed	Unknown	Dry Creek Bed 4231 Nebraska St	Oil: Crude
09/11/02	Caller reporting release of crude oil from wellhead at location. Vegetation impacted at scene. Caller also reports exposed electrical wiring (220 volts) on ground to pump. Gasket failed & rags used to patch.	Fixed	Equipment Failure	Rural Area 3101 Minnesota Rd	Salt
09/11/02	Caller reporting release of crude oil from wellhead at location. Vegetation impacted at scene. Caller reports exposed electrical wiring (220 volts) on ground to pump. Gasket failed & rags used to patch.	Fixed	Equipment Failure	Rural Area 3101 Minnesota Rd	Oil: Crude

Source: National Response Center

High winds

**Historical Context:** 32 High Wind events have caused damage since 1995.

Date	Location	General Description of Event
<b>4/11/01</b>	Bartlesville	<b>61 knots</b> Thunderstorm winds blew out windows in an office building and ripped a piece of tin off the roof of another building.
<b>6/4/02</b>		<b>70 knots</b> Thunderstorm winds estimated at 70 mph blew down power lines and trees.
<b>5/16/03</b>	Bartlesville	<b>80 knots</b> Thunderstorm winds estimated at 80 mph associated with a line of thunderstorms referred to as a bow echo did serious damage to homes and businesses, especially I the Oak Park neighborhood. Light to moderate damage was reported for 129 homes.
<b>6/25/03</b>	Bartlesville	<b>70 knots</b> Thunderstorm winds estimated at



		70 mph blew trees and power lines down resulting in power outages.
<b>8/5/03</b>	Bartlesville area	<b>80 knots</b> Thunderstorm winds estimated at 80 mph did considerable damage in the Bartlesville area. Numerous tree limbs and power lines were blown down.
<b>6/4/05</b>		<b>70 knots</b> A heat burst produced wind gusts up to 70 mph which resulted in downed trees, large tree limbs and power lines.
<b>5/9/09</b>	Bartlesville Airport, Washington County	<b>100 knots</b> A 100 mph wind gust was recorded west of the Bartlesville Airport in Washington County.

(City of Bartlesville HMP 2011)

**Table 4-19: High Wind Events in Bartlesville from 1995 thru 2009**

From NOAA National Climatic Data Center <http://www4.ncdc.noaa.gov/cgi-win/wwwcgi.dll?wwevent-storms>

Location	Events	Deaths	Injuries	Damage Events	Property Damages
Bartlesville	32	0	0	13	\$596,000
Washington County	118	0	0	39	\$903,000
Oklahoma	9,174	8	196	2,525	\$959,603,000

**Mitigation Strategy / Recommendations from HMP:**

**HMP 5.2, High Wind – Goal:** To reduce injuries and loss of life; trauma; damage to property, equipment and infrastructure; community disruption; and economic, environmental and other losses caused by high winds.

**Objective 3. Structural Projects.** Provide fortified buildings for critical public facilities and vulnerable populations, including children; offer training and incentives to encourage people of means to build stronger structures in new and retrofit building projects.

Lightning

**Historical Context:** “Washington County has reported 1 lightning event between 1999 and 2008 that resulted in \$15,000 in damages. This event occurred 7 miles east of Bartlesville and burned down a hay bar. However, it is highly likely there were many more unreported incidents producing damage. This data fails to demonstrate that Washington County can anticipate significant lightning strikes each year with damages and potential injuries.”

Date	Location	General Description of Event
<b>Between 1999</b>	Washington County	Lighting event occurred 7 miles east of



<b>and 2009</b>	Bartlesville and burned a hay barn; Damage:\$15,000
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City of Bartlesville HMP 2011

**Mitigation Strategy / Recommendations from HMP:**

**HMP 5.2, Lightning – Goal:** To reduce injuries, loss of life, and damage to property, equipment and infrastructure caused by lightning strikes.

**Objective 3. Structural Projects.** Provide for necessary construction, renovation, retrofitting or refurbishment of city infrastructure to protect vulnerable populations from the effects of lightning strikes.

**Tornado**

**Historical Context:** Washington County has experienced 9 tornados since 1950. The May 3, 1999 tornado was one of the costliest natural disasters in US history and ranks among the deadliest in Oklahoma history with May 20, 2013 becoming equal or more devastating.

Date	Location	General Description of Event
4/19/03	Dewey-Copan- Washington County	F2 tornado

**Table 4–15: Tornadoes in Oklahoma and Washington County from 1995 thru 2009**  
From NOAA National Climatic Data Center <http://www4.ncdc.noaa.gov/cgi-win/wwwcgi.dll?wwevent~storms>

Location	Events	Deaths	Injuries	Damage Events	Property Damages
Washington County – F0	3	0	0	1	\$1,000
Washington County – F1	0	0	0	0	\$0
Washington County – F2	1	0	3	1	\$1,700,000
Washington County – F3	0	0	0	0	\$0
Washington County – F4	0	0	0	0	\$0
Washington County – F5	0	0	0	0	\$0
Oklahoma – F0	589	0	14	136	\$3,672,000
Oklahoma – F1	268	0	40	229	\$50,104,000
Oklahoma – F2	93	5	88	81	\$92,723,000
Oklahoma – F3	27	5	116	26	\$403,211,000
Oklahoma – F4	7	29	514	7	\$650,500,000
Oklahoma – F5	2	23	332	2	\$540,000,000

Note: Since the starting point or ending point of many of the tornadoes in the area are not observed, it is not possible to accurately isolate whether tornadoes did or did not occur within the City Limits.

**Mitigation Strategy / Recommendations from HMP:**

**HMP5.2, Tornado - Goal:** To reduce injuries and loss of life; trauma; damage to property, equipment and infrastructure; community disruption; and economic,



environmental and other losses caused by tornadoes.

**Objective 2. Preventive Measures.** Prevent or reduce tornado losses by strengthening buildings and by publicizing, training, and creating market options for fortified new construction, retrofits, code changes and code-plus innovations.

**Objective 3. Structural Projects.** Provide safe tornado shelters, SafeRooms, and fortified buildings for vulnerable populations, including children; offer training and incentives to encourage people of means to include shelters and SafeRooms in new and retrofit building projects.

**Objective 4. Property Protection.** Identify and protect people, structures, and critical infrastructure that are vulnerable to tornado hazards, with emphasis on critical facilities.

Transportation

**Historical Context:** The City of Bartlesville has had six reported mobile hazardous materials events from 1999 to 2008 and two non-fatal aircraft incidents.

**May 2001:** “A tanker truck carrying 10 cylinders of hydrogen gas was pushed off the road when a vehicle traveling alongside the tanker lost control and forced both vehicles into a roadside ditch. The collision broke a seal on one of the cylinders causing an initial explosion and claimed the life of the tanker driver. High winds caused the fire to spread into a grass fire. (City of Bartlesville HMP 2011)

**Table 4-64: Mobile or pipeline hazardous materials events 1999-2008**

Description	Type	Cause	Date	Location	Suspected Responsible Company	Material
Caller stated 2 men releasing materials into air from air conditioners.	Storage Tank	Dumping	6/10/06	Empty Lot, Marante & Adeline Street		Refrigerant Gases
Caller stated unknown oil running through his creek from unknown source.	Pipeline	Unknown	10/20/04	402951 W. 2300 Rd		Unknown Oil
Caller reported release of natural gas from pipeline leading to commercial facility. Employee used lighter to check water meter. Flash of gas caused employee burns.	Pipeline	Operator Error	12/31/02	United Linen Company, 122 S. Park	Kansas Gas Service	
Material released from oil field storage tank after it was overfilled due operator error.	Storage Tank	Operator Error	5/15/02	¼ Mile East of Hwy 75 on County Rd 1200	Unknown	Crude Oil
Caller reporting release of material from storage tank on oil drilling lease.	Storage Tank	Unknown	5/3/02	1.5 MI North of Cnty Rd 1100 on Cnty Rd 4020	JE Energy	Crude Oil
Private residence exploded due to leak in 2" NG main line. Line underground approx 10' from home.	Pipeline	Explosion	10/15/00	1120 S Dewey	ONG	Natural Gas

**Mitigation Strategy / Recommendations from HMP:**

**HMP 5.2, Transportation Incidents.**

**Objective 5. Emergency Services.** Establish or expand emergency services protocols that adequately address HazMat and Search and Rescue response.



Urban (Structure) Fires

**Historical Context:** “From 2004 to 2008, Bartlesville had **233 structure fires** that resulted in the loss of **\$6.1 million** and **6 casualties** (2 injuries and 1 death for civilians, and 3 injuries for fire service).

**Table 4–44: City of Bartlesville Urban Fire Damages, Injuries & Deaths 2004-2008**  
 Source: Oklahoma State Fire Marshal / All Damages listed in 1000's of Dollars

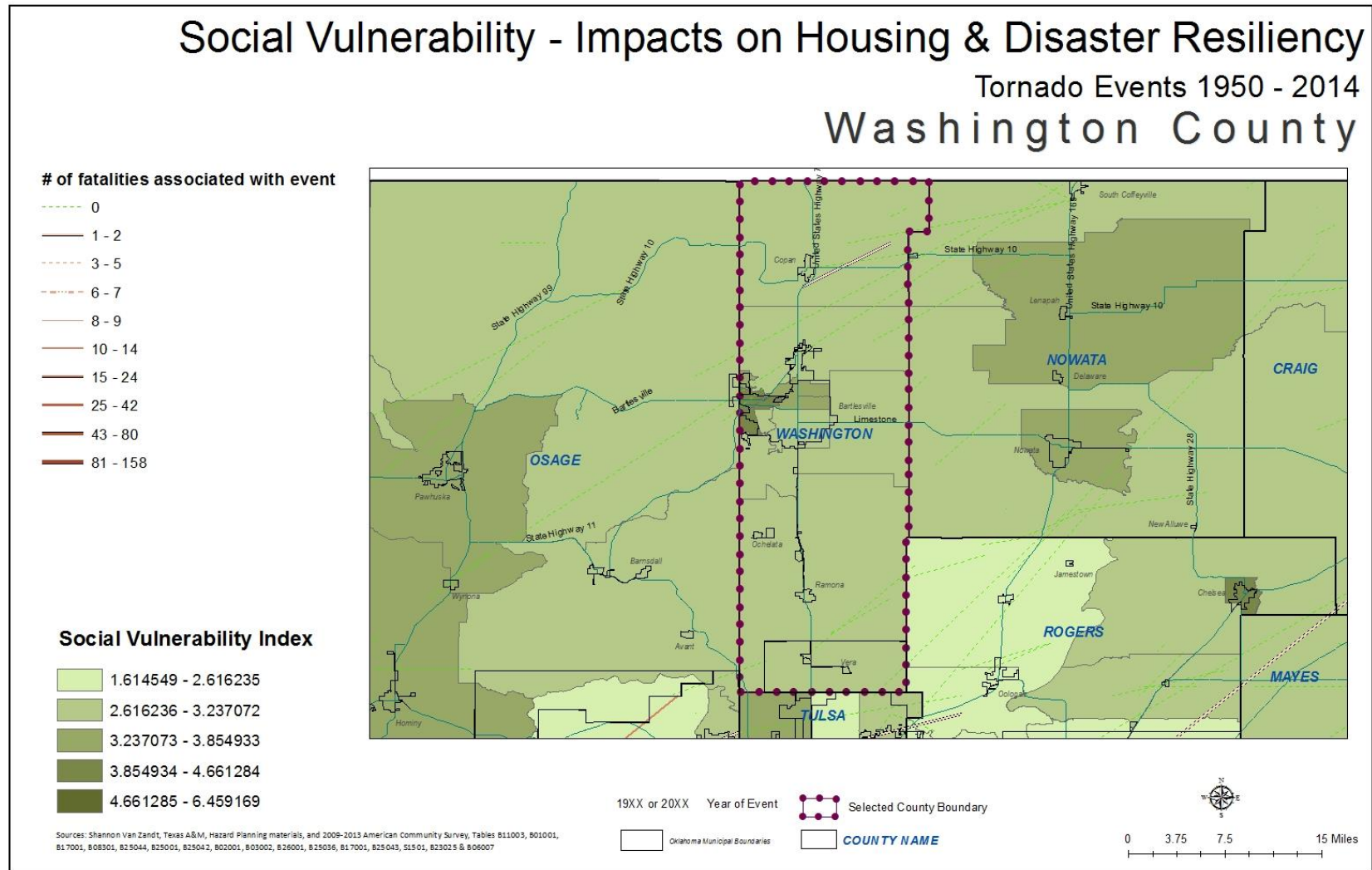
Type of Structure	2004		2005		2006		2007		2008		Total	
	#	Damage	#	Damage	#	Damage	#	Damage	#	Damage	#	Damage
Single Family	33	\$871.00	53	\$733.00	10	\$285.00	46	\$1,143.00	25	\$529.00	167	\$3,561.00
Apartments	1	\$0.00	4	\$0.00	2	\$2.20	5	\$71.40	3	\$0.20	15	\$73.80
Mobile Homes	2	\$2.00	2	\$3.00	0	\$0.00	2	\$55.00	1	\$0.00	7	\$60.00
Other Residential	0	\$0.00	0	\$0.00	3	\$121.40	1	\$0.00	3	\$13.00	7	\$134.40
Commercial/Office	1	\$0.00	5	\$138.00	0	\$0.00	2	\$21.50	4	\$1,967.00	12	\$2,126.50
Warehouse	3	\$22.00	8	\$42.90	1	\$31.00	3	\$18.50	5	\$14.50	20	\$128.90
Industrial	1	\$1.00	3	\$0.20	1	\$28.80	0	\$0.00	0	\$0.00	5	\$30.00
<b>Total</b>	<b>41</b>	<b>\$896.00</b>	<b>75</b>	<b>\$917.10</b>	<b>17</b>	<b>\$468.40</b>	<b>59</b>	<b>\$1,309.40</b>	<b>41</b>	<b>\$2,523.70</b>	<b>233</b>	<b>\$6,114.60</b>
Casualty	2004		2005		2006		2007		2008		Total	
Civilian Injuries	0		0		0		2		0		2	
Civilian Deaths	0		0		0		1		0		1	
Firefighter Injuries	0		0		0		3		0		3	
Firefighter Deaths	0		0		0		0		0		0	
<b>Total Injuries</b>	<b>0</b>		<b>0</b>		<b>0</b>		<b>5</b>		<b>0</b>		<b>5</b>	
<b>Total Deaths</b>	<b>0</b>		<b>0</b>		<b>0</b>		<b>1</b>		<b>0</b>		<b>1</b>	

**Mitigation Strategy / Recommendations from HMP:**

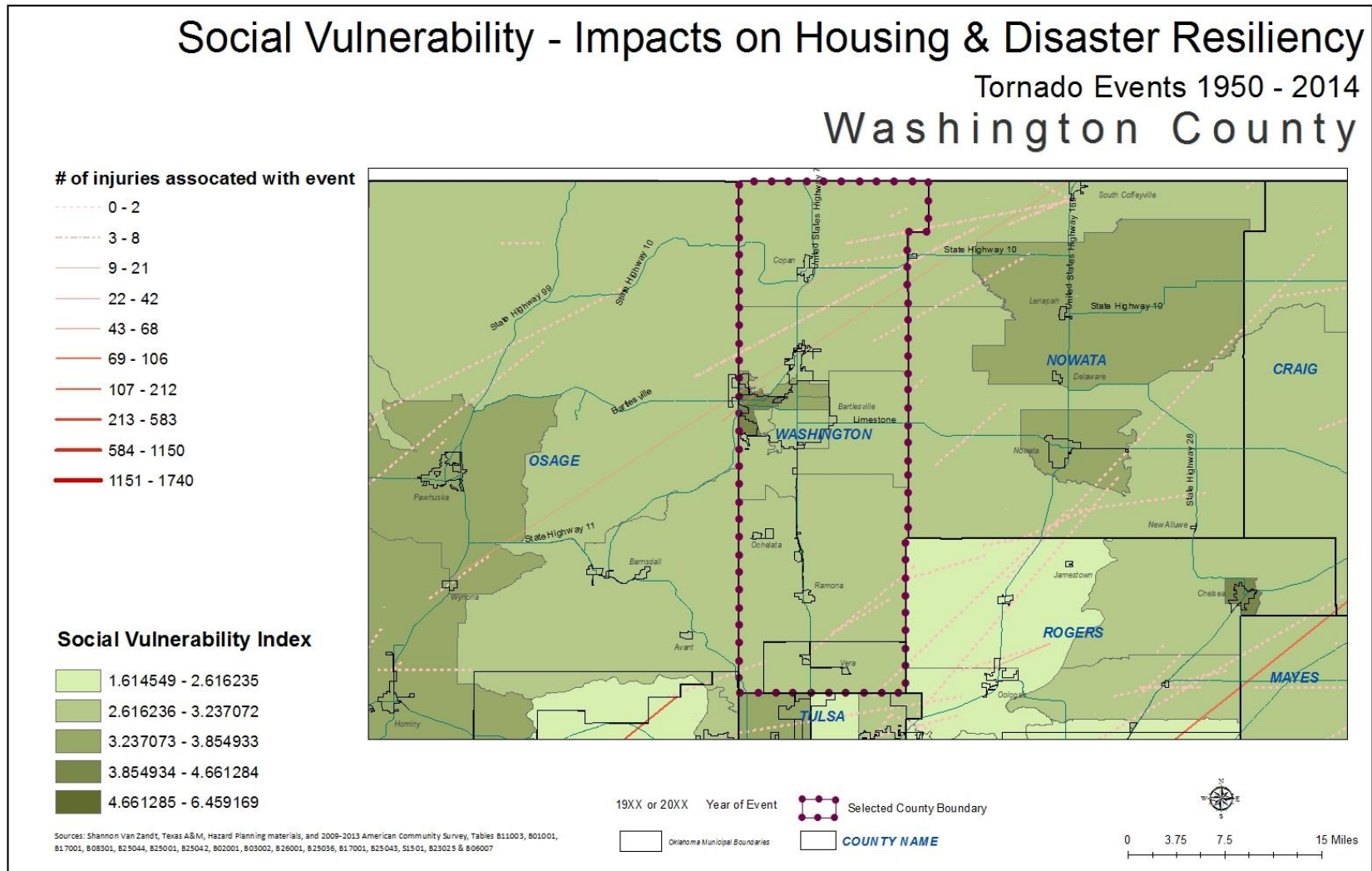
**HMP 5.2, Urban Fires – Goal:** To reduce injuries, loss of life, and damage to property, equipment and infrastructure caused by urban structure fires.

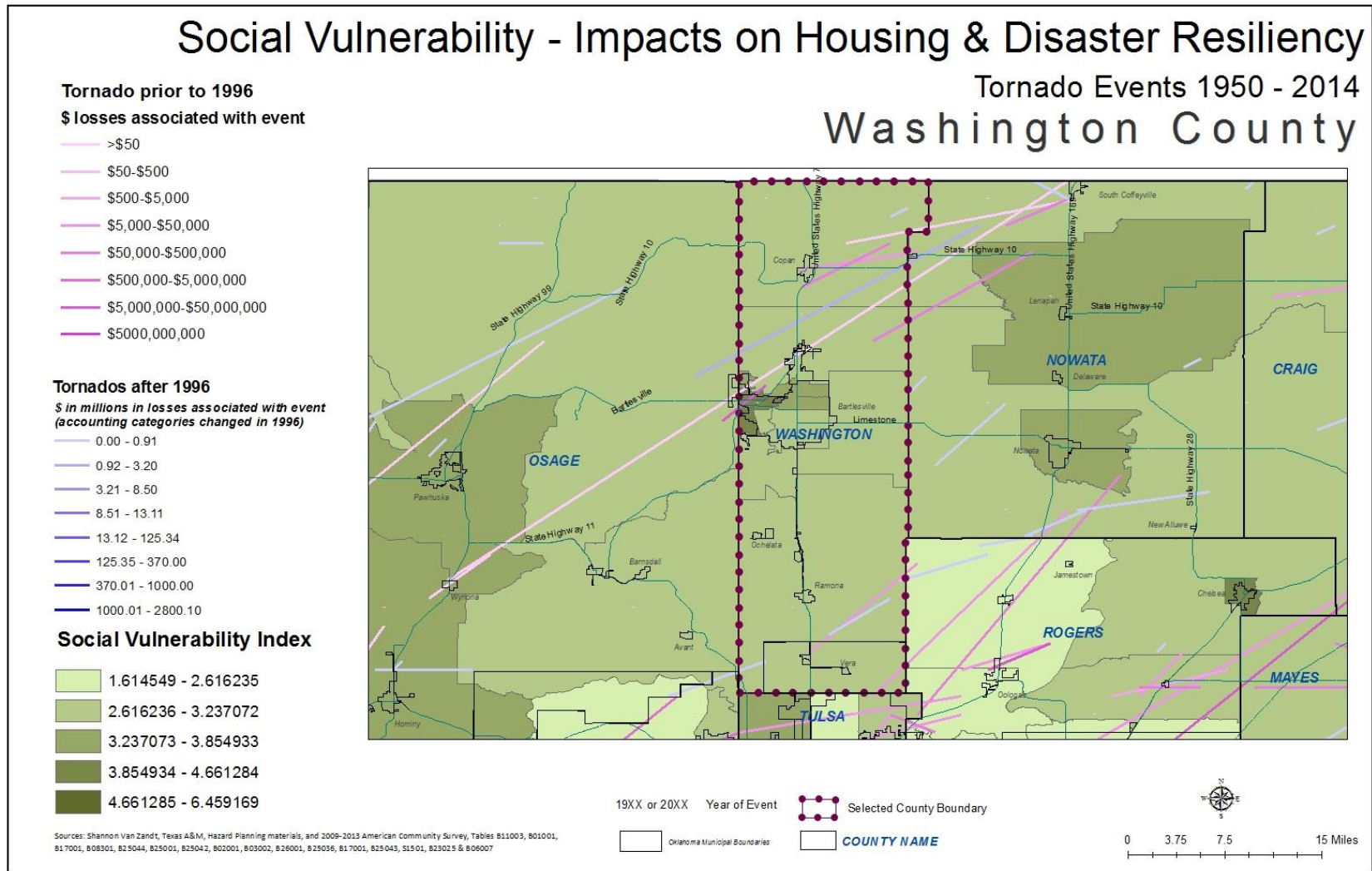
**Objective 2. Preventive Measures.** Identify and protect populations, structures, and critical infrastructure particularly vulnerable to urban fires.

For all the county profiles for this study we are providing maps of the historic tornados mapped over the developed social vulnerability index. This is in addition to the data prepared and summarized from the HMP in this section.









Wildfires

**Historical Context:** “Between 2004 and 2008, the Bartlesville Fire Department made a total of **435 runs** related to grass and crop fires that caused **\$15,351 in damage**. In 2008, Washington County fire agencies made 199 wildland fire runs with a reported 10,727 acres affected.

**Table 4–48: City of Bartlesville Grass and Crop Fires, 2004-2008**

Year	Runs	Acres Burned	Damages
2004	104	0	\$4,750
2005	133	0	\$0
2006	63	39	\$10,600
2007	55	75	\$0
2008	80	556	\$1
<b>Total</b>	<b>435</b>	<b>670</b>	<b>\$15,351</b>
<b>Average</b>	<b>87</b>	<b>134</b>	<b>\$3,070</b>

**Mitigation Strategy / Recommendations from HMP:**

**HMP 5.2, Wildfire – Goal:** To reduce injuries, loss of life, and damage to property, equipment and infrastructure caused by wildfires.

Winter Storms

**Historical Context:** “The eastern portion of Oklahoma experienced two major winter storm events in 2007. The first occurred in January, hitting Muskogee and surrounding counties the hardest. The second came in December of the same year wreaking havoc across Oklahoma but greatly impacting the Bartlesville area. Both of these events resulted in an Emergency Declaration issued by the governor of Oklahoma for all 77 counties. The major effect was widespread and prolonged power outages.”

**Table 4–30: Snow and Ice Events from 1995 thru 2009**

Location	Events	Deaths	Injuries	Damage Events	Property Damages
Washington County	29	0	0	3	\$51,521,000
Oklahoma	365	2	7	67	\$732,234,000

The National Weather Service does not isolate damages with enough specificity to determine only the City of Bartlesville damages.

Date	Location	General Description of Event
12/09/07	Central to Northeastern Oklahoma (including Bartlesville)	<b>Ice Storm</b> - caused power outages to 260,000+ homes across the state; 29 deaths statewide; 750-800 power poles broken; 150 transmission poles broken; Tulsa International Airport closed to incoming/departing flights for 24+ hours; Bartlesville Hospital, along with many other critical facilities



		throughout the state, forced to rely on emergency generators. 78% of the Bartlesville customer base was without power. This storm was considered the worst in recent history from the standpoint of number of outages.
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(City of Bartlesville HMP 2011)

**Table 4–31: Bartlesville Recovery Rates during the December 2007 Winter Storm**

Interruption Start Date	Total Customers Restored	Total Customers Still Out as of 23:59 Hrs
12/09/2007	13,946	11,048
12/10/2007	17,365	7,167
12/11/2007	6,449	2,318
12/12/2007	1,751	973
12/13/2007	2,454	1,030
12/14/2007	909	121
12/15/2007	19	102
12/16/2007	1	101
12/17/2007	1	100
12/18/2007	98	2
12/20/2007	1	1
12/28/2007	1	0
Total Restored	42,995	

**Table 4–32: Major Bartlesville Power Outages, 2003-2008**

Interruption Start Date	Total Customer Affected	Total Customer Hours Interrupted	Avg Customer Hrs Interrupted	Nature Of Outage Event
05/16/2003	3,382	21,225.45	6.28	Thunderstorms, High Winds
08/05/2003	10,592	99,595.08	9.40	Thunderstorms, High Winds
08/06/2003	4,882	39,757.28	8.14	Thunderstorms, High Winds
07/04/2004	4,433	10,869.60	2.45	Thunderstorms, High Winds
05/09/2006	2,711	7,342.23	2.71	Thunderstorms, High Winds
11/30/2006	11,238	24,761.37	2.20	Thunderstorms, High Winds
05/06/2007	3,403	6,974.38	2.05	Thunderstorms
12/09/2007	24,994	416,666.18	16.67	Ice Storm
12/10/2007	13,484	87,648.85	6.50	Ice Storm

Source: AEP/PSO

**Mitigation Strategy / Recommendations from HMP:**

**HMP 5.2, Winter Storms – Goal:** To reduce injuries and loss of life; trauma; loss of critical utilities; damage to property, equipment and infrastructure; community disruption; and economic, environmental and other losses caused by winter storms. Winter hazards can



include extreme temperatures, ice and snow, high winds, and cascading hazards such as loss of utilities.

**Objective 2. Preventive Measures.** Identify costs and benefits of loss-prevention programs such as burying power lines to reduce utility outages or building snow-load roofs, with consideration for uncalculated benefits such as averting environmental and business losses.

**Objective 3. Structural Projects.** Identify, fund, and implement measures, such as winterization retrofits to homes, critical facilities, transportation systems and infrastructure, to avert or reduce losses from winter storms. Provide additional protection, such as generators and emergency shelters, for agencies and facilities that serve vulnerable populations.

**Objective 5. Emergency Services.** Identify and expand emergency services for people at high risk in winter storms, such as the homeless, elderly, disabled, and oxygen-dependent people.

### **C.2.1.2; C.2.1.6; C.2.1.7;C.2.1.8 Shelters from Disaster Event**

Most jurisdictions have elected to not have public shelters in order to discourage people from leaving safe places and ultimately be caught on the road trying to reach a public shelter.

- The Town of Copan recently constructed a public storm shelter on Weldon Avenue in 2015.

Washington County keeps an online form for registering locations of private shelters:

<http://form.jotform.us/form/50278836611155>

Washington County implemented a storm shelter program that has been in place for about three years. About two years ago, EMS started a rigorous promotional campaign, and presented information to civic groups and to church groups. Additionally, the IT Department in Bartlesville developed a “Collector App” for locating storm shelters. It was a joint effort that included Fire, EMS, the City of Bartlesville GIS Department, and the County 911 coordinator. With the Collector App, rather than inputting the GPS location, the system is entirely automated. Using a smart phone, a person can click on the location and the information is automatically entered. Even residents can register the location of their storm shelters but using their smart phones.

To date, there are around 400 registered storm shelters in Washington County. Registration is voluntary. There are no government operated storm shelters in Bartlesville or in unincorporated areas of the county; thus, there are no public shelters for those who live in multifamily dwellings or in mobile homes. Some churches open to the public.

There is a tunnel that goes under the railroad tracks at the west side of downtown Bartlesville that leads to the Conoco Phillips buildings. Entry to the tunnel is to the west of the railroad tracks. Some residents will go to the tunnel during storms but since Conoco and Phillips separated into two companies in 2012, that access has been limited as part of the tunnel access was closed off as Conoco and Phillips employees do not have access to all buildings any longer. Phillips has not restricted people from coming to the tunnel but because of liability issues, they prefer that people do not come to the tunnel during a storm. EMS also prefers that people shelter in place rather than drive to the tunnel.

### **C.2.1.3 Public Policy and Governance to Build Disaster Resiliency**

Building Codes for Bartlesville follow the standard 2009 International Building Codes and the 2011 National Electric Code. County resolutions are reviewed and coordinated with the Hazard Mitigation Plan. Fire Department ISO ratings are set within the Hazard Mitigation Plan.

Site Plan review requirements are included for hazards/risks in Bartlesville. Floodplain related provisions are included in the Zoning Ordinance and Subdivision Regulations.

Washington County Hazard Mitigation Planning Team includes representation by: Washington County, City of Bartlesville, Bartlesville Public Schools, City of Dewey, Towns of Copan, Ramona, Ocheleta, and Vera, Dewey Public Schools, Copan Public Schools, Caney Valley Public Schools.

### **C.2.1.4 Local Emergency Response Agency Structure**

Washington County and the City of Bartlesville Emergency Operation Plan clearly identifies that local resilience to risks starts with prepared individuals. The EOP for the City of Bartlesville has a detailed list of task assignments and responsibilities. The tasks outlined include for example “access control of restricted areas, assisting in damage assessment, disseminate warnings throughout the County, food and water supply inspection, rescue operations, medical first response, and recovery services. Clear roles are assigned in primary and assisting roles.

### **C.2.1.5 Threat & Hazard Warning Systems**

Warning systems may be activated from any level of government by agencies having responsibility to notify the public of imminent danger. At the local level, these warnings are channeled through the Emergency Management Director in order to assign responsibility and ensure control of the warning process.

#### **Bartlesville Emergency Notification and Warning Systems**

##### *NOAA Weather Radios*

As of June 2010, over 200 NOAA weather radios were placed in City and County buildings including schools, licensed daycare, and licensed long term care facilities as well as all medical facilities and churches in Washington County. Emergency warnings are received and disseminated through the National Warning System (NAWAS). Bartlesville’s EOC has the capability of overriding local radio and television stations, including cable channels.

Member’s of Bartlesville’s deaf and hard-of-hearing community are served by the Oklahoma Weather Alert Remote Notification (OK-WARN) program that uses pagers and/or E-mail addresses. The State Department of Rehabilitation Services can provide free NOAA weather radios specially adapted to the needs of the deaf and hard-of-hearing community with such accessories as strobes and pillow shakers.

*Flood Alert System*

The City of Bartlesville submitted an application to the Oklahoma Department of Emergency Management requesting grant money to identify the need for stream gauges on creeks and rivers to provide better warning of impending flood waters and rising creeks.

*Warning Systems*

The City of Bartlesville submitted a grant application to evaluate the warning siren system and make recommendations for adding new warning tones to include several thunderstorms and floods.

Bartlesville has dense outdoor warning system (36 sirens) and mass notification, including social media outlets. Twenty-six of the sirens have the capability to not only sound a siren tone and several other tones, but also provide live or pre-recorded voice..Twenty-eight of the sirens operate from battery power, so commercial power outages do not affect the operation of most of our system. Bartlesville

Public Schools utilize mass calling/texting/and email system with some outdoor warning sirens. All Bartlesville Schools have NOAA weather radios.

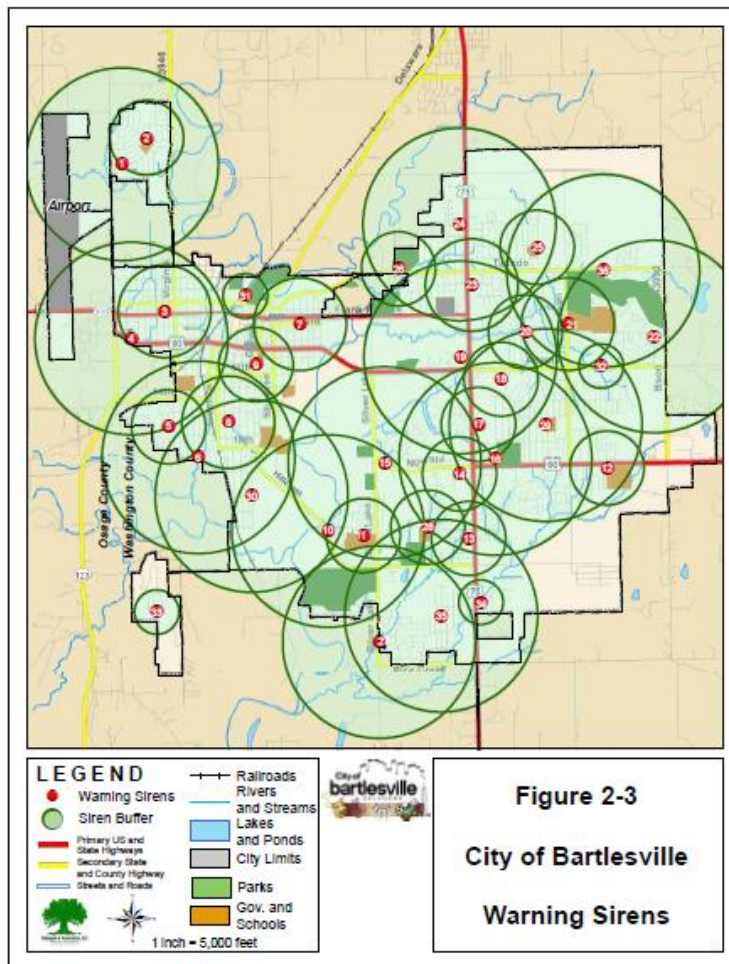


Table 2-7: Warning Sirens in Bartlesville

Siren ID	Location	Type	Radius FT
1	Mistotow Ln and Oak Park Rd	200 IDC	5200
2	Brentwood Rd and Lahoma Rd	2T22	2000
3	Frank Phillips Blvd and Penn Ave	Thunder Bot	2500
4	Adams Blvd and Sunset Blvd	200 IDC	5200
5	Rogers and 15th St	2T22	2000
6	Maize and 18th St	200 IDC	5200
7	Chickasaw Ave and 3rd St	Thunder Bot	2500
8	Johnstone Ave and 16th St	Thunder Bot	2500
9	Cherokee Ave and 9th St	2T22	2000
10	Hillcrest Dr north of Skyline Dr	200 IDC	5200
11	Silverlake Rd	SD-10	2000
12	Nowata Rd	SD-10	2000
13	Harvey Rd and Washington Blvd	SD-10	2000
14	Limestone Park on Nowata Rd	2T22	2000
15	Nowata Rd and Oakdale Dr	200 IDC	5200
16	Sheridan Rd and Swan Dr	200 IDC	5200
17	Washington Blvd @ Sooner Motel	SD-10	2000
18	Parking lot of the Elks Club	SD-10	2000
19	Adams Blvd and Washington Blvd	200 IDC	5200
20	Frank Phillips Blvd and Brookline	2T22	2000
21	Madison Blvd and Brookline Dr	Thunder Bot	2500
22	Baylor Dr and Quail Ridge Rd	200 IDC	5200
23	Washington Blvd and Kentucky Ave	Thunder Bot	2500
24	Nebraska St and Cholwell Ave	200 IDC	5200
25	Spruce Ave and Ohio St	2T22	2000
26	Young St north of Tuxedo Blvd	2T22	2000
27	Silver Lake Rd and Georgetown Dr	200 IDC	5200
28	Wayside Dr and Jefferson Pl	2T22	2000
29	On Harmed north of David Drive	200 IDC	5200
30	Southview Ave and 21st St	200 IDC	5200
31	Hensley Blvd and Johnstone Ave	Modular	1200
32	Adams Blvd @ Revere Way	Modular	1200
33	Circle Mountain SE of Centre Rd	Modular	1200
34	Washington Blvd and Southport	Modular	1200
35	Kington Dr	200 IDC	5200
36	Tuxedo Blvd West of Martin Ln	200 IDC	5200



**Social Vulnerability**

Based on the research work done by the Texas A&M University

Hazard Reduction and Recovery Center, an added component is being included in this section. Social vulnerability can place households at a further disadvantage during and after a disaster. This analysis is assessing for the county the levels of social vulnerability based on demographic indicators to highlight 'hotspots' or counties that have higher social vulnerability. That combined with Hazard Mitigation Plans – or lack thereof – can highlight places where additional work is needed to reduce impacts on households.

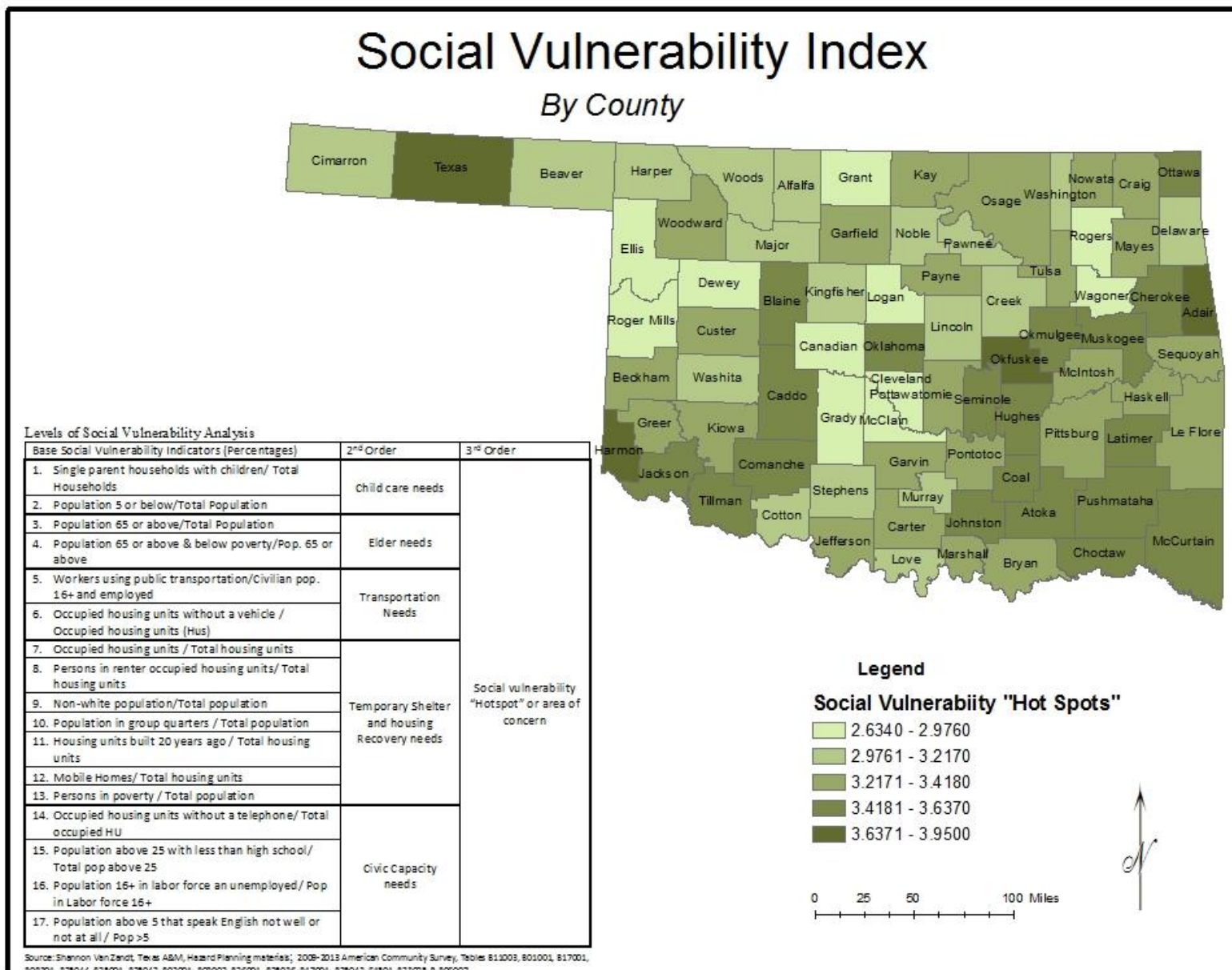
**Social Vulnerability Analysis - Washington County**

Base Social Vulnerability Indicators (%)		2nd Order	3rd Order
1.) Single Parent Households	14.62%	0.211	<b>3.217 Social Vulnerability 'Hotspot' or Area of Concern</b>
2.) Population Under 5	6.45%	(Child Care Needs)	
3.) Population 65 or Above	17.95%	0.255	
4.) Population 65 or Above & Below Poverty Rate	7.55%	(Elder Needs)	
5.) Workers Using Public Transportation	0.32%	0.056	
6.) Occupied Housing Units w/o Vehicle	5.26%	(Transportation Needs)	
7.) Housing Unit Occupancy Rate	90.79%	2.482 (Temporary Shelter and Housing Recovery Needs)	
8.) Rental Occupancy Rate	27.13%		
9.) Non-White Population	24.87%		
10.) Population in Group Quarters	1.44%		
11.) Housing Units Built Prior to 1990	82.21%		
12.) Mobile Homes, RVs, Vans, etc.	7.06%		
13.) Poverty Rate	14.76%	0.213 (Civic Capacity Needs)	
14.) Housing Units Lacking Telephones	2.34%		
15.) Age 25+ With Less Than High School Diploma	10.60%		
16.) Unemployment Rate	6.95%		
17.) Age 5+ Which Cannot Speak English Well or Not At All	1.41%		

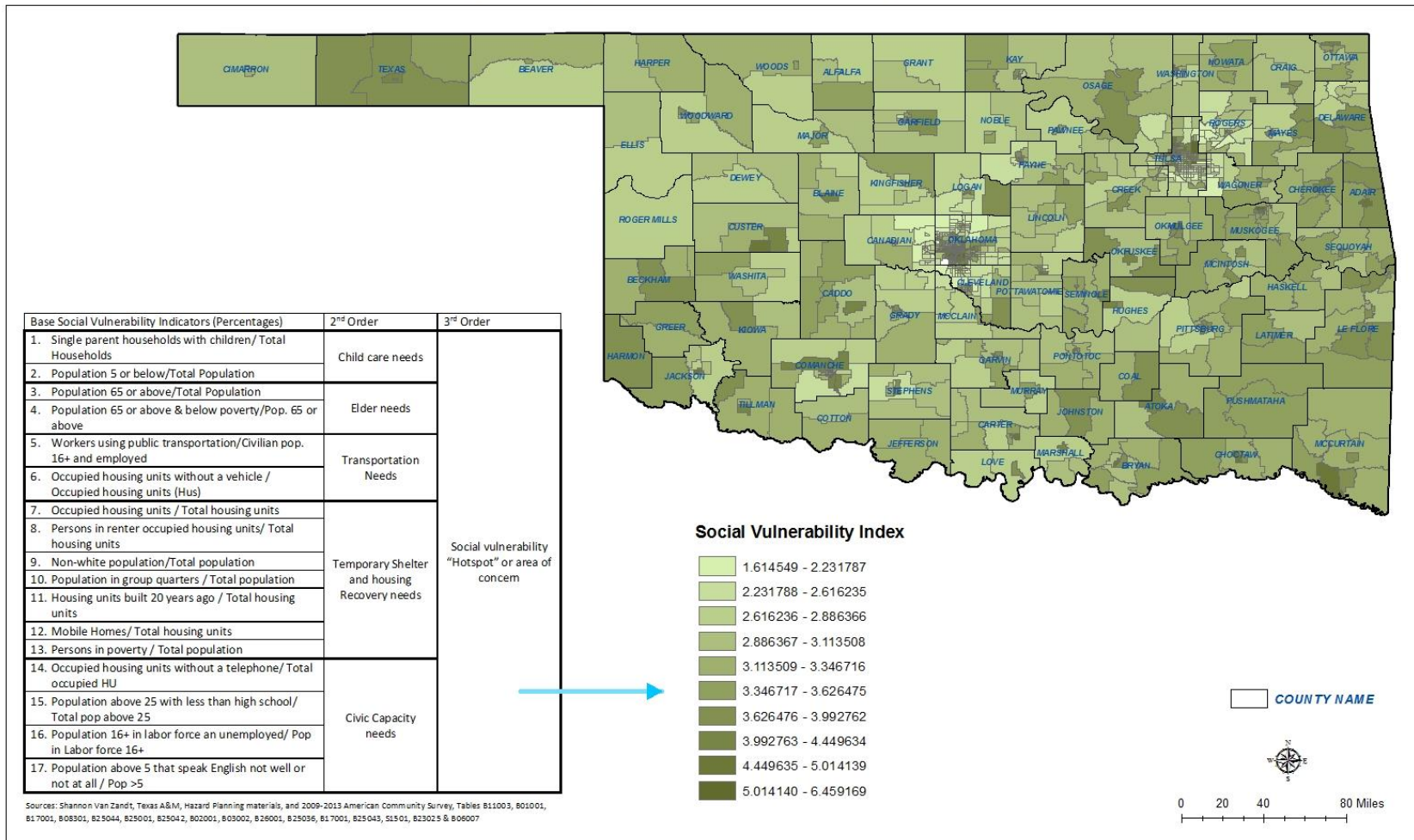
Sources: Shannon Van Zandt, Texas A&M, Hazard Planning materials, and 2009-2013 American Community Survey, Tables B11003, B01001, B17001, B08301, B25044, B25001, B25042, B02001, B03002, B26001, B25036, B17001, B25043, S1501, B23025 & B06007







# Social Vulnerability - Impacts on Housing & Disaster Resiliency



# Social Vulnerability - Impacts on Housing & Disaster Resiliency

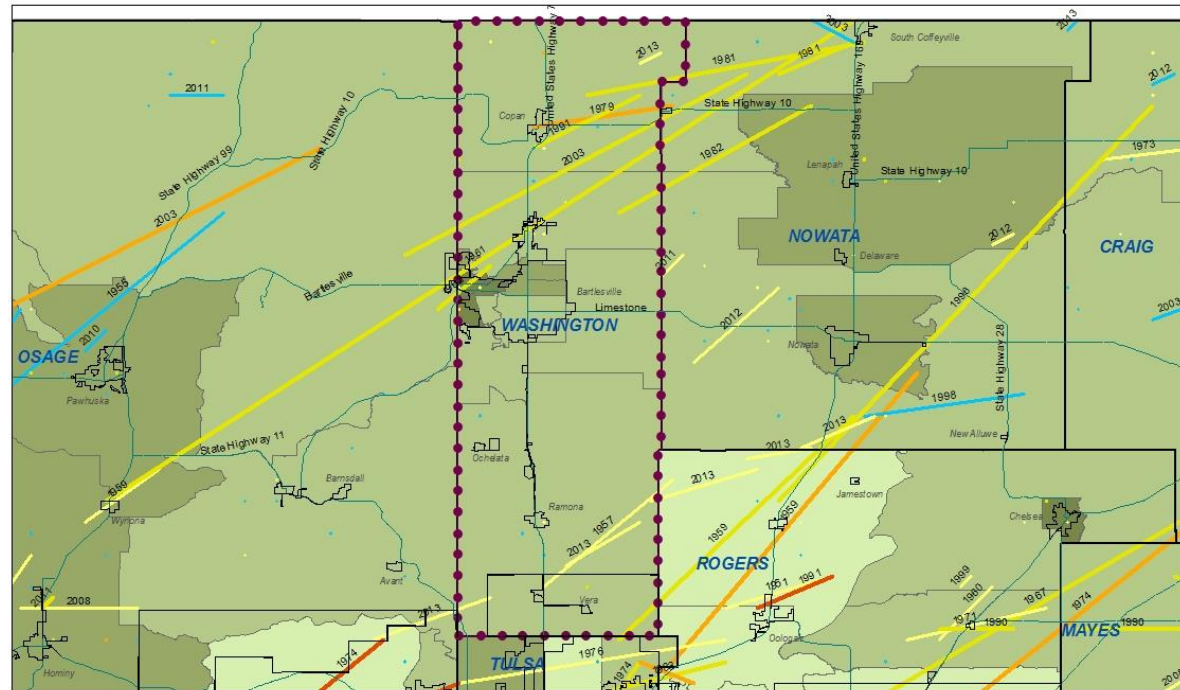
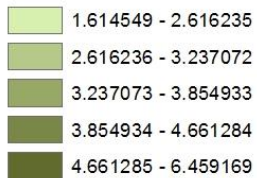
## Tornado Events 1950 - 2014

### Washington County

**Tornado Magnitude**

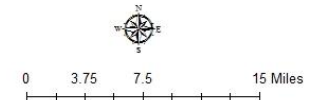


**Social Vulnerability Index**



Sources: Shannon Van Zandt, Texas A&M, Hazard Planning materials, and 2009-2013 American Community Survey, Tables B11003, B01001, B17001, B08301, B25044, B25001, B25042, B02001, B03002, B26001, B25036, B17001, B25043, S1501, B23025 & B06007

19XX or 20XX Year of Event  
 Selected County Boundary  
 Oklahoma Municipal Boundaries  
 COUNTY NAME



Social vulnerability combined with the devastating impacts of a natural or man-made disaster can compound a household's ability to recover and in fact can place those individuals at an even greater gap or disadvantage prior to the event (Shannon Van Zandt, Texas A&M, Hazard Planning).

This county falls below the state score per this index for social vulnerability when comparing as a county to other counties in the state. The area most vulnerable by census tract is in the populated area of Bartlesville.

**Recommendations for this county:**

- Continue to update and maintain the county HMP and include attention to areas within the county that in addition to physical vulnerability may have compounding social vulnerability factors.
- Efforts to strengthen building codes related to tornadoes and natural disasters should be considered.
- Planning for shelters from disaster events for multifamily, HUD and LIHTC units, in addition to all housing in the community should be incorporated with any effort to increase housing.