

ABSTRACT

The purpose of Hazard Mitigation Planning is to improve the health, safety and welfare of the citizens of Blaine County through development of effective strategies that can be implemented to mitigate the negative effects of known natural hazards.

BLAINE COUNTY OK

HAZARD MITIGATION PLAN UPDATE 2022

This project is a result of the combined efforts of the Citizens of Blaine County, Blaine County Emergency Management, the Blaine County Commissioners, the Oklahoma Department of Emergency Management (OEM), the Federal Emergency Management Agency (FEMA) and the Oklahoma Economic Development Authority (OEDA) working together to produce this 5-year plan update.

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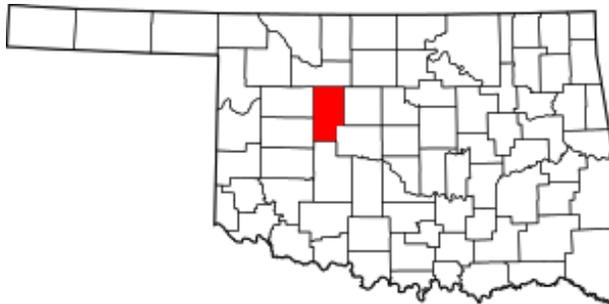
Introduction

A Brief History

The following information is drawn from the Encyclopedia of Oklahoma History and Culture, and authored by Linda D Wilson.

Located in west-central Oklahoma, Blaine County is bordered by Dewey and Custer Counties on the West, Kingfisher and Canadian Counties to the East, Major County on the North, with Canadian and Caddo Counties to the South.

Blaine County's prehistory is represented by seventy-eight archaeological sites. Eight sites date to the Archaic period (6000 B.C. to A.D. 1), three to the Woodland period (A.D. 1 to 1000), and sixty-seven to the Plains Village era (A.D. 1000 to 1500). Artifacts recovered from the site designated as 34BL46 include two points that probably date to the late Archaic or Woodland periods and pottery shards indicative of the early Plains Village era.



After the Louisiana Purchase (1803), which included present Oklahoma, explorers and traders traversed the region. Before the Civil War Jesse Chisholm had established a salt works in present Blaine County in order to trade with the Plains Indians.

The area was originally the part of Indian Territory where the Creek and Seminole were settled in the 1820s and 1830s. After a complicated history of forced Native American relocation and changing laws, the land was opened to non-native settlers on August 8, 1901. Following the Civil War the Reconstruction Treaties of 1866 required the Five Tribes to cede part of their lands.

Blaine County was one of several counties created by the Land Run of 1892. According to Michael H. Reggio, "Cheyenne-Arapaho Opening," in the Encyclopedia of Oklahoma History and Culture, the land run was held after giving members of the tribe allotments of 160 acres each.

Early settlers opened towns and farmed the sandy-loam soil. They grew wheat, corn, cotton, oats, broomcorn, sorghum, hay, and Irish potatoes. Cotton gins, mills, and grain elevators soon appeared in the towns of Geary, Greenfield, Hitchcock, Okeene, and Watonga. The outcropping of gypsum attracted at least six plaster mills, and a plant was established at Southard in 1905. The county courthouse was constructed in Watonga in 1906.

Cattle drives from Texas to Kansas followed the Caldwell Trail, situated west of Cantonment. A military road connected Fort Reno and Cantonment. The Southern Stage Company and the Concord Stage served the citizens until railroads were built in the early 1900s (Wilson, UNK).

Towns

The following information is also from the Encyclopedia of Oklahoma History and Culture, authored by Don Foster.

The Town of Canton got its name from “Cantonment,” a nearby military post that was established in 1879. October 1923, the North Canadian River overflowed in one of the worst floods that Canton had experienced. In 1938 the US Congress authorized Canton Lake project for flood control. The US Army Corps of Engineers completed Canton Dam in 1948, after World War II. In the late 1960s, the Canton Chamber of Commerce inaugurated the Walleye Rodeo, a fishing derby that established Canton Lake’s claim as “the Walleye Capital of Oklahoma.” The local economy is based on oil production and US Gypsum plant nearby at Southard.

The City of Geary is the second largest city and named for Edmund Guerrier, a scout and an interpreter for the U.S. Army. He was of French and Cheyenne descent. Because his name was difficult for people to pronounce, the town became Geary. It was labeled a “first class city” because of its population over 2,000 (as was the requirement), but by statehood the population decreased significantly. Jesse Chisholm’s final resting place was nearby and his grave was designated a historic site in 1971. He was instrumental in establishing peaceful trade relations. Major employers include First Choice Home Medical Inc., Geary Public Schools, and the Town of Geary.

The Town of Greenfield was established at noon on April 19, 1892 and was named for its first postmaster William Henry Greenfield. The town provided a trade center for the surrounding agricultural area. Their school held their last commencement in May 1991.

The Town of Hitchcock. In early days it was the busiest trade center in the county. It was named for Ethan Allen Hitchcock, the secretary of the interior. It held the title of “largest wagon wheat market in the world.” In the early 1900s, before statehood, a devastating fire came through the town, from which it never really recovered. By the 1930s the town had creameries, several mills, a cotton gin, and a blacksmith/machine shop.

The Town of Longdale was named for Lucious Walter Long. He and his wife, Carrie Millerman, wanted to name it Longview but decided against it because they didn’t want it confused with Fairview. She became the first teacher in their school. After the students moved into their permanent schoolhouse, the Works Progress Administration (WPA) built a gym and two additional classrooms in the 1930s. Later they consolidated with Canton Schools.

The Town of Okeene was originally pronounced in three syllables, O-Kee-Ne, for its Cherokee and Cheyenne roots. For such a small town, it has three major industries: Okeene Milling Company (producer of flour and feed), Seaboard Farms (milled feed to hog farms), and Mountain Country Foods (pet food manufacturer). Its hospital and clinic serve their community and surrounding towns. Annual events include the Annual Rattlesnake Round-up during the third weekend in May.

The City of Watonga is the county seat and is named for Arapaho Chief Wa-ton-gha, whose name means Black Coyote. It is also the home of the annual Watonga Cheese Festival every fall. Notable citizens include Theresa Hunt Tyler, the town’s first dentist at a time when few women practiced that profession, and native son Clarence Nash provided the voice of Walt Disney’s cartoon character Donald Duck. Major employers include Feather Warrior Casino, Roman Nose State Park, and Wheeler Brothers Grain Company (Foster, 1985).

CHAPTER ONE: BLAINE COUNTY

1.1 Overview of the Planning Area

Blaine County lies in west central Oklahoma. Elevations range from about 1,900 feet in the western part of the county to 1,100 feet in the northeastern part. Watonga, located near the center of the county has an elevation of about 1,500 feet.

The Cimarron River crosses the northeastern corner of the County. The North Canadian River bisects Blaine County from northwest to southeast. The South Canadian River crosses the southwest corner and southern portion. Canton Lake, a federal reservoir, is located on the North Canadian River in the northwest corner of Blaine County. Rivers drain generally west to east as part of the greater Arkansas River Basin, ultimately flowing into the Mississippi River.

Demographics

According to the US Census Bureau American Community Survey (ACS), the 2020 population of Blaine County was 9,521. The racial categories are 84.9% white, 12.7% Native American and 4.4% African American; 12.2% identify as Hispanic of any race.

US Census Topic	Blaine Co	State of Oklahoma
Median income	\$49,638	\$53,840
Median age	42.7	36.7
Age 65 and over	18.3%	15.7%

Population density

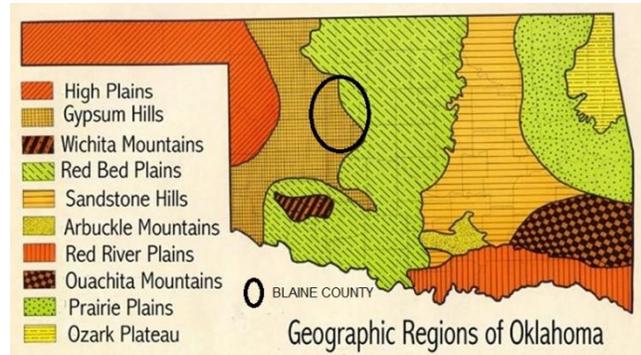
According to the U.S. Census Bureau, the county has a total area of 939 square miles, of which 928 square miles is land and 10 square miles (1.1%) is water. That gives us a population density of 10.26 persons per square mile. However, since 3,895 people live in population clusters that cover about 15 square miles, the rural population density is about 6 people per square mile. With an average of 2.4 people per household, that indicates there are about 2 occupied houses per square mile in rural areas, which seems consistent with observations in the field.

Housing	Number of DUs	Percent
Total dwelling units (DUs)	5,204	100%
Occupied	3,940	76%
Vacant	1,264	24%

In 2010 Census records indicate a Blaine County population of 11,972. By 2020 that number was estimated to be 9,521, a loss of almost 20% of residents. See analysis in Appendix A.

Geography and Ecosystem

Blaine County lies in the Red Bed Plains and the Gypsum Hills Geographic regions. It is in the southern part of the tall-grass prairie of the Central Lowland Geologic region and the Central Great Plains Ecological region, a significant wheat producing area of Oklahoma.



Economy

The economy is based on crop and livestock agriculture and mineral resource extraction. The most commonly produced crops are wheat and hay. In recent decades, cotton has become more prevalent. Poultry and cattle are the top two livestock produced (Blaine County, 2017).

Important mineral resources are oil, natural gas and gypsum. Tourism is also important in Blaine County with recreational facilities located at Roman Nose State Park & Golf Course and Canton Lake.

1.2 Participating Jurisdictions

Participating jurisdictions for this plan are Blaine County, the Cities of Geary and Watonga, the Towns of Canton, Greenfield, Hitchcock, Longdale and Okeene, four Public School Districts: Canton, Geary, Okeene and Watonga. See Municipal descriptions in the Introduction to this document.

The point of contact for the 2022 Blaine County Hazard Mitigation Plan Update (HMPU) is Blaine County Emergency Manager Jim Shelton at blainecountyem@gmail.com

Other places in Blaine County are Eagle City, Hydro and Southard.

Type	Jurisdiction	Population (ACS 2020)
County	Blaine County	9,521
City of	Geary	895
City of	Watonga	2,867
Town of	Canton	464
Town of	Greenfield	114
Town of	Hitchcock	102
Town of	Longdale	186
Town of	Okeene	998
PSD	Canton Schools	-
PSD	Geary Schools	-
PSD	Okeene Schools	-
PSD	Watonga Schools	-

CHAPTER TWO: PLANNING PROCESS

2.1 Planning Process

The Blaine County HMPU was developed through a series of public meetings held throughout the planning process. Planning staff conducted research on hazard data, documented the needs and goals of the community and organized the material into this report. The Blaine County Hazard Mitigation Planning Committee (HMPC) was formed to provide guidance and oversight during the preparation of this Plan.

Stakeholders on the HMPC include County Commissioners, representatives from local government, state government, local business/industries and school superintendents as well as individual members of the public. Capability and Risk assessments were completed.

All meetings were held in accordance with Oklahoma Open Meeting law. Public opinion surveys and personal conversations were also used to solicit comments during the planning process. This public participation provided valuable insight on the challenges and needs of each jurisdiction.

Staff then conducted research on potential mitigation activities by reviewing the previous Blaine County HMP, FEMA approved mitigation actions, the State of Oklahoma Hazard Mitigation Plan and other Planning documents as shown in a table below. This work resulted in a second set of meetings that offered the opportunity for all jurisdictions to discuss the items that had been included in the previous plan, which items had been completed and which should be carried forward to the Update. Options for other mitigation activities were presented by planning staff. Local preferences for mitigation actions were compared to FEMA guidelines and participants offered comments on their preferred action items.

When the Draft Plan Update was complete, we provided a paper copy to each jurisdiction for a final review during a 15-day public comment period. Digital copies were also provided to all jurisdictions. Additional digital copies were sent by email to adjacent jurisdictions and other individuals. A press release was published and the draft was posted on the Blaine County and OEDA websites. Comments were received and incorporated into the document. The BCHMPU was submitted to the Oklahoma Department of Emergency Management (OEM) for review, who then referred it to FEMA.

2.2 Planning Committee Members

The Hazard Mitigation Planning Committee (HMPC) was directly involved in the development of the Hazard Mitigation Plan Update.

Planning Committee members for plan development and review

Blaine County	Contribution to Plan	How contacted
Jim Shelton	Provided many hours of assistance to Planning staff	Personal contact
Blaine County EM	Provided travel hours and travel mileage	Phone, email
	Reproduced documents	
	Provided storage for planning records	
	Planning Team Chairman	
	Coordinated grant administration and OEM	
	Conducted HMPC public meetings and public hearings	
	Provided local knowledge of hazard history	

	Assisted with Capability & Risk assessment	
	Assembled public comments from school district staff	
	Contributed info on past mitigation strategies & effort	
	Assisted with development of mitigation actions	
	Reviewed draft plans	
	Contributed to plan revisions	
Brandon Schultz		Personal contact
County Commissioner	Meeting attendance	
	Assisted with Capability & Risk assessment	
	Provided information on Blaine County	
	Provided current & future development trends	
	Contributed info on past mitigation strategies & effort	
	Reviewed draft plan	
Jennifer Haigler		Personal contact
County Clerk	Meeting attendance	
	Assisted with Capability & Risk assessment	
	Provided local knowledge and comments	
	Reviewed draft plan	
City of Geary		
Bobby Allen	Provided information on City of Geary	Personal contact
Mayor	Meetings	Phone, email
	Mitigation strategies needed	
	Assisted with Capability & Risk assessment	
	Reviewed draft plan	
	Contributed to plan revisions	
City of Watonga		
Carriebeth Little	Provided information on City of Watonga	Personal contact
City Manager	Mitigation strategies needed	Phone, email
	Assisted with Capability & Risk assessment	
	Reviewed draft plan	
Town of Canton		
Toni Goforth	Meetings	Personal contact
Asst Town Clerk	Provided information about Town of Canton	Phone, email
	Capability Assessment	
	Hazard risk assessment/Mitigation strategies needed	
	Reviewed draft plan	
	Made comments on Draft Plan	
Town of Greenfield		
Kenny Scheihing	Meetings	Personal contact
Town Manager	Provided information about Town of Greenfield	Phone, email
	Capability Assessment	
	Hazard risk assessment/Mitigation strategies needed	
	Reviewed draft plan	
	Contributed comments	
Town of Hitchcock	Contribution to Plan	
Perry Scheffler	Provided information about Town of Hitchcock	Personal contact
Town Manager	Meetings	Phone, email
	Capability Assessment	
	Hazard risk assessment/Mitigation strategies needed	
	Reviewed draft plan	

Town of Longdale	Contribution to Plan	
JW Sizemore	Provided information about Town of Hitchcock	Personal contact
	Capability Assessment	Phone, email
	Hazard risk assessment/Mitigation strategies needed	
	Reviewed draft plan	
Town of Okeene	Contribution to Plan	
Susan Rauh	Provided information about the Town of Okeene	Personal contact
City Clerk	Meeting	Phone, email
	Assisted with Capability & Risk assessment	
	Provided information	
	Reviewed draft plan	
Canton School District	Contribution to Plan	
Carl Baker	Meetings	Personal contact
Superintendent	Assisted with Capability & Risk assessment	Phone, email
	Provided information	
	Reviewed draft plan	
	Contributed comments	
Geary School District	Contribution to Plan	
Sean Buchanan	Meetings	Personal contact
Superintendent	Assisted with Capability & Risk assessment	Phone, email
	Provided information	
	Reviewed draft plan	
	Contributed comments	
Okeene School District	Contribution to Plan	
Mike Jinkins	Assisted with Capability & Risk assessment	Personal contact
Superintendent	Provided information	Phone, email
	Reviewed draft plan	
Watonga School District	Contribution to Plan	
Kyle Hilterbran	Assisted with Capability & Risk assessment	Personal contact
Superintendent	Provided information	Phone, email
	Reviewed draft plan	

2.3 Other Participating Stakeholders

This is a record of other stakeholders; organizations and agencies that made contributions to the BCHMPU. Each of these participants provided information, comments or helped with hazard assessments.

Neighboring Communities, Businesses, Non-Profit Agencies Contacted

Entity	Contact Person	How Contacted
OK Economic Development Authority	Gail Thomas, Planner	Personal Contact
Northern Oklahoma Development Authority	Patti Hobbs, Planning	Personal Contact
American Red Cross	Celeste Carpenter, H Hammonds	Personal Contact
Oklahoma Health Department	Local Em Response Coordinator	Personal Contact
Alfalfa County Emergency Manager	Shana Smallwood	Phone, email
Grant County Emergency Manager	Brandon Fetters & M Wheeler	Phone, email
Kingfisher County Emergency Manager	Steve Loftis	Phone, email

Major County Emergency Manager	Tresa Lackey, B Thompson, B Case	Phone, email
Woods County Emergency Manager	Ethan Feidler	Phone, email

State and Federal Agencies Contacted

Entity	Contact Person	How Contacted
National Weather Service (NWS)	Rick Smith	Email
Oklahoma Water Resources Board	Julie Cunningham	Phone
Oklahoma State NFIP – Coordinator	Yohanes Sugeng	Personal Contact
Oklahoma Dept Emergency Management	Matthew Rollins, Lynn Gould	Email, Meetings
Oklahoma Forestry Services – Fire Wise	Drew Daily	Email
Oklahoma State Fire Marshall – NFIRS	Madelyn Brandon & A Aguilar	Email
U.S. Army Corps of Engineers – EM	Bill Smiley, Carrie Stark	Email
USDA-NRCS – Resource Soil Scientist	Phillip Martin	Email

2.4 Public Involvement

The public was involved in all stages of the planning process. The public was invited to attend the Commissioner, Town Board and HMPC meetings. Public meetings were posted at the County Courthouse, Town Administration buildings and the NODA and/or OEDA office. Public comments were requested by use of flyers, personal interviews and distribution of a survey. Public feedback was incorporated into the plan by incorporating public concerns into the vulnerability and impact sections for each hazard in Section 3.4.1 through 3.4.10, and each of those concerns were considered during the development of the mitigation action items.

Activity	Entity	Date	Comments
Citizen Interviews	NODA, OEDA, BCEM	Initiated 5/01/2019	Throughout planning process
Survey distributed	Planner, jurisdictions	Initiated 5/01/2019	Throughout planning process
Information session	LEPC	5/1/2019	Presented info to HMPG
Working session	HM Planning Committee	6/12/2019	Review previous action items, risk assessment
Working session	HMPC	7/10/2019	Mitigation strategies, review doc
Working session	HMPC	8/28/2019	Data & Document review
Discuss vulnerability and impacts, preferred action items	Blaine County	11/1/ to 11/11/2022	Draft & Edit Actions
Discuss vulnerability and impacts, preferred action items	City of Geary	11/1/ to 11/11/2023	Draft & Edit Actions
Discuss vulnerability and impacts, preferred action items	City of Watonga	11/1/ to 11/11/2024	Draft & Edit Actions

Discuss vulnerability and impacts, preferred action items	Town of Canton	11/1/ to 11/11/2025	Draft & Edit Actions
Discuss vulnerability and impacts, preferred action items	Town of Greenfield	11/1/ to 11/11/2026	Draft & Edit Actions
Discuss vulnerability and impacts, preferred action items	Town of Hitchcock	11/1/ to 11/11/2027	Draft & Edit Actions
Discuss vulnerability and impacts, preferred action items	Town of Longdale	11/1/ to 11/11/2028	Draft & Edit Actions
Discuss vulnerability and impacts, preferred action items	Town of Hitchcock	11/1/ to 11/11/2029	Draft & Edit Actions
Discuss vulnerability and impacts, preferred action items	Canton PSD	11/1/ to 11/11/2030	Draft & Edit Actions
Discuss vulnerability and impacts, preferred action items	Geary PSD	11/1/ to 11/11/2031	Draft & Edit Actions
Discuss vulnerability and impacts, preferred action items	Okeene PSD	11/1/ to 11/11/2032	Draft & Edit Actions
Discuss vulnerability and impacts, preferred action items	Watonga PSD	11/1/ to 11/11/2033	Draft & Edit Actions
Website	OEDA, Blaine County	11/14/2022	Draft Plan posted
Start 15 day comment period	Blaine County	11/14/2022	Post Notices
Press release	Watonga Republican	Sent 11/14/2022	Local newspaper
Press release	Geary Star	Sent 11/14/2023	Local newspaper
Final Draft Review	Blaine County	11/14/2022	Sent to County Commissioners
Final Draft Review	Cities & Towns	11/14/2022	Sent to City Councils and Town Boards
Final Draft Review	All PSDs	11/14/2022	Superintendents
Final Draft Review	OEM	11/14/2022	OEM Review Team
FEMA Approval date	FEMA		Approved for adoption
Adopt Final Plan	Blaine County		Commissioner's Mtg
Adopt Final Plan	City of Geary		City Council Meeting
Adopt Final Plan	City of Watonga		City Council Meeting
Adopt Final Plan	Town of Canton		Town Board Meeting
Adopt Final Plan	Town of Greenfield		Town Board Meeting

Adopt Final Plan	Town of Hitchcock		Town Board Meeting
Adopt Final Plan	Town of Longdale		Town Board Meeting
Adopt Final Plan	Town of Okeene		Town Board Meeting
Adopt Final Plan	Canton PSD		School Board Meeting
Adopt Final Plan	Geary PSD		School Board Meeting
Adopt Final Plan	Okeene PSD		School Board Meeting
Adopt Final Plan	Watonga PSD		School Board Meeting
Copy to local Libraries: Geary, Okeene, Watonga			Copies of the 2022 BCHMPU

2.5 Plans, Documents and Literature Reviewed

During development of the Blaine County Hazard Mitigation Plan Update, several existing plans and documents were reviewed. Data and information from these documents was incorporated into the plan. Of particular importance was disaster history and strategies recommended to mitigate the effects of such disasters. Location of critical infrastructure was reviewed and updated.

Literature and Resources

Agency/Document	Relevant Info Incorporated into Plan
US Census Bureau Population Data	Demographic, economic, housing data, ACS 2020
National Climatological Data Center (NCDC)	Storm history, Climate data 2000-2022
OWRB Watershed Region Report	Watershed and Groundwater information, 2020
OWRB Comprehensive Water Plan 2012	Water demand Forecast 2012
OK State University Extension Service	Drought & Impact on Ag Water Resources Feb 2018
Oklahoma Conservation Commission	Watershed Fact Sheet; Blaine County 2020
US Dept of Environmental Quality (DEQ)	Hazardous waste permit sites 2020
US Dept of Environmental Quality (DEQ)	WaterWeb, Impaired waters 2020
US Dept of Environmental Quality (DEQ)	NPDES Discharge sites 2020
US Dept of Environmental Quality (DEQ)	Brownfields 2020
FEMA Map Service Center	Flood data, maps, NFIP information 2021
NRCS, Watonga office	Flood data, information; Red Cedar information
US Geological Survey	Data on seismic activity 2000-2021
State University Agricultural Extension Service	Drought, Land management
State Department of Transportation	Disaster history, roads and bridges
Natural Resource Conservation Service	Management After Wildfire 2006

Plans Reviewed

During development of this update of the BCHMP, other State and regional plans were reviewed for information on known hazards and mitigation activities in Oklahoma. A list of those plans is shown in the table below. Information from those Plans was incorporated into this plan.

State of Oklahoma	Hazard Mitigation Plan 2019
Blaine County Oklahoma	Emergency Operations Plan
Blaine County OK	Hazard Mitigation Plan 2011 (Previous HMP)
Beaver County OK	Hazard Mitigation Plan 2022
Cheyenne and Arapaho Tribes	Hazard Mitigation Plan 2022

Canadian County OK	Hazard Mitigation Plan 2013
Canton Public School District	Emergency Operations Plan
Geary Public School District	Emergency Operations Plan
Okeene Public School District	Emergency Operations Plan
Watonga Public School District	Emergency Operations Plan

2.6 Continued Public Involvement

The Blaine County Emergency Manager with the assistance of NODA/OEDA and the planning committee will conduct an annual review of the Plan. The plan will be updated every five years. The public will be able to directly comment on and provide feedback about the Plan by contacting the Blaine County Emergency Manager. Public meetings will be publicized and open for public comment.

After the Hazard Mitigation Plan Update is adopted, a copy of the plan will be placed at the Blaine County Court House and made available to the public. Copies of the plan will be distributed to each City/Town Hall, Emergency Management Director, School Superintendent and local Library. The public will be invited to become involved in fund raising for specific Hazard Mitigation activities and educational opportunities over the life of the plan.

2.7 Plan Update Review

The Blaine County Emergency Management Director will be responsible for monitoring, evaluating, and updating all components of the HMPU. These procedures will follow hazard mitigation planning requirements as outlined in 44 CFR. The plan will be monitored, evaluated and updated by the Blaine County Emergency Manager with the assistance of the Hazard Mitigation Planning Committee (HMPC) over a five-year period. The Emergency Manager will be the lead contact for calls and scheduling of meetings.

Monitoring - tracking the implementation of the plan over time

Evaluating - assessing the effectiveness of the plan in achieving its stated purpose and goals

Updating - reviewing and revising the plan at least once every five years

Monitor. The Blaine County Emergency Manager (BCEM) will maintain contact with a representative of each jurisdiction who will monitor the progress of the mitigation actions on an annual basis. Each jurisdiction will provide a list of completed action items. The BCEM will provide a report to the LCG each year. The BCEM will monitor all aspects of the HM Plan, to include the following actions:

- ✓ Monitor the hazard analysis for changes and additions; record new data as events occur
- ✓ Monitor objectives and determine if they continue to meet hazardous conditions
- ✓ Monitor the implementation of the plan's action items; document completion of action items
- ✓ Determine if there are implementation problems, such as financial, technical, political, legal, or issues of coordination with other agencies

Evaluate. The BCEM will review the Hazard Mitigation Plan annually to ensure progress on mitigation objectives. Post disaster reviews will be used to evaluate the effectiveness of stated

objectives as implemented. These findings will be documented by the Blaine Co EM. The planning committee members will meet annually to discuss post disaster reviews, and to:

- ✓ Evaluate the risk assessment to ensure the hazards, vulnerabilities and impacts originally addressed are still valid
- ✓ Evaluate the goals and the mitigation strategies to ensure they continue to address the priorities of each participating jurisdiction

Update. Two years before this plan expires, the plan update process will begin with the Blaine County Emergency Manager and the Hazard Mitigation Planning Committee (HMPC). The emergency manager and the planning committee will reconvene plan development meetings for the Blaine County Hazard Mitigation Plan Update, to discuss the progress made on this plan, update the capability and risk assessments, and revise the objectives and strategies as needed. A draft plan will be submitted to Oklahoma Emergency Management for review twelve months before the current plan expiration. Any revisions will be incorporated into the document as necessary, and the plan resubmitted to FEMA for approval. Once approved, participating jurisdictions will adopt the plan by resolution.

CHAPTER 3: HAZARD IDENTIFICATION AND RISK ASSESSMENT

3.1 List of Identified Hazards included and excluded

Hazards that were considered for this update are listed below in alphabetical order and are prioritized in Chapter 4, Mitigation Strategies. The hazards included are consistent with those addressed in the Oklahoma State Hazard Mitigation Plan with the exception of Landslide and Land Subsidence.

Hazards not addressed. Landslides are not known to have happened in the Planning Area to date. Due to topography and development patterns of existing structures and infrastructure, there is no known risk of damage or injury from landslide in the county. Land subsidence is primarily a concern in Eastern Oklahoma; areas associated with historic mining activity. No underground mining activity is known to have occurred in Blaine County (OKHMP, 2019). The Emergency Manager and Planning Committee will review plan on a yearly basis to evaluate any new hazards and/or new action items.

Planning Committee members and other stakeholders discussed the frequency and severity of past disasters and completed the Hazard Vulnerability Assessment. Presidential disaster declarations, fire data, weather events, climate history, flood conditions, soil types and geological records were evaluated and that data was recorded in this plan. Public comments and surveys were used to identify known risks and set the priorities of the community. The hazards listed below are applicable to all jurisdictions of Blaine County.

Dam Failure	Hail
Drought	High wind
Earthquake	Lightning
Expansive soils	Tornado
Extreme heat	Wildfire
Flood	Winter storm

3.2 Disaster History

There were nine Federally-declared disasters in Blaine County during the years 2012 through 2021. One was a wildfire, five were severe winter storms, three involved flooding, one tornado, one storm with high winds and two were related to the COVID-19 pandemic.

EVENT	DATE/TIME	TYPE	DESCRIPTION
2998	2012-08-03	Fire	GEARY FIRE
4109	2013-04-08	Severe Storm(s)	SEVERE WINTER STORM AND SNOWSTORM
4247	2015-12-29	Severe Ice Storm	SEVERE WINTER STORMS AND FLOODING
4256	2016-02-10	Severe Storm(s)	SEVERE WINTER STORMS AND FLOODING
4299	2017-02-10	Severe Storm(s)	SEVERE WINTER STORM
4438	2019-06-01	Severe Storm(s)	SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, AND FLOODING
3462	2020-03-13	Biological	COVID-19 PANDEMIC
4530	2020-04-05	Biological	COVID-19 PANDEMIC
4587	2021-07-30	Severe Storm(s)	SEVERE WINTER STORM

3.3 Hazard Probability Rating

To determine the probability of future hazard events, the number of events of each type was documented and divided by the number of years being considered. In this case, the storm and event data was drawn from the National Center for Climate Data (NCDC), a division of the National Oceanic and Atmospheric Administration (NOAA).

Probability was determined by calculating the:

Total number of events/Total number of years = Probability % of event occurring each year

Based on the above calculation, probability is quantified as follows:

High = > 80%

Medium = 30 - 79%

Low = 10 - 29%

Very Low = < 10%

HAZARD	EVENTS/TIME	PROBABILITY RATING
Dam Failure	0 events/10 years = 0 %	Very Low
Drought	43.5 months/120 months = 36%	Medium
Earthquake	24 events/10 years = >100%	High
Expansive soils	0 events/10 years = 0 %	Very Low
Extreme heat	655 days/920 days = 71%	Medium
Flood	7 events/10 years = 70%	Medium
Hail	28 events/10 years = >100%	High
High wind	22 events/10 years = >100%	High
Lightning	4-5 per sqkm per yr/10 yr = >100%	High
Tornado	5 events/10 years = 50%	Medium
Wildfire	Several per year = >100%	High
Winter storm	16 events/10 years = >100%	High

3.4 Profiled Hazards

Each hazard listed in the plan has been profiled individually, and includes the following sections: Description, Location, Extent, Previous Occurrences, Probability of Future Events, Vulnerability and Impact.

3.4.1 Dam Failure

A dam is an artificial barrier usually constructed across a stream channel to impound water. Timber, rock, concrete, earth, steel, or a combination of these materials may be used to build the dam. A dam that impounds water in the upstream area is referred to as a reservoir. The amount of water impounded is measured in acre-feet. An acre-foot is the volume of water that covers an acre of land to a depth of one foot. As a function of upstream topography, even a very small dam may impound or detain many acre-feet of water.

A dam failure is an uncontrolled release of water from a reservoir through a dam as a result of structural failures or deficiencies in the dam. Two factors influence the potential severity of a

full or partial dam failure: the amount of water impounded, and the density, type, and value of development and infrastructure located downstream.

Dams can fail by several different means. Three general failure models include:

- Natural disaster related failure, such as when the dam is overtopped by floodwaters, which creates a breach through the embankment
- Intrinsic structural failure, (including foundation problems) either under sunny-day circumstances or during high reservoir levels
- Failure resulting from an act of terrorism or sabotage

Location:

The Canton Lake Dam is the largest dam and the only high hazard dam in the Planning Area. There is one other significant dam located at the West Blaine Recycle Facility and 24 private dams throughout the county.

According to the USACE Tulsa Districts Canton Lake Dam Emergency Action Plan, in the remote event of a dam failure, the largest impact would be to Oklahoma City. Other impacted areas would be the towns of Canton, Watonga, Greenfield, Calumet, El Reno, and Shawnee. There is also flood risk associated with the dam due to normal operation of the dam which could include large releases through the gated spillway during a large flood.

Extent

The extent and severity of dam failure is directly proportional to the capacity of the dam/levee, the water height at time of breach, and the type of property at risk downstream from the dam/levee. The Planning Area uses the Oklahoma Dam Classification Chart below to categorize the extent and also takes into consideration the Emergency Action Plan (EAP) from the Army Corp of Engineers (USACE), Tulsa District.

From the EAP: Risk Characterization Summary. USACE completed a risk assessment in 2017 and classified the risk associated with the dam as very low. Although extremely unlikely, the primary risks to the integrity of the dam are the potential for (1) mechanical or electrical issues causing gate failure, (2) instability of the concrete portion of the dam, and (3) a large earthquake resulting in damage to the earthen embankment. In the remote event of a dam failure, the largest impacts would be to Oklahoma City. Other impacted areas would be the towns of Canton, Watonga, Greenfield, Calumet, El Reno, and Shawnee. There is also flood risk associated with the dam due to normal operation of the dam which could include large releases through the gated spillway during a large flood.

Risk Management Measures. Construction remediation efforts were completed within the last 10 years to improve the safety of the structure which contributed to the very low risk rating. This work included construction of an auxiliary spillway, anchoring the primary spillway to ensure its stability, and widening the earthen dam and constructing a new drainage system to collect water seeping beneath the dam (Canton Dam EAP, 2022)

While the EAP categorizes the risk of dam failure as Low, if it were ever to fail, the USACE Dam Safety Program classifies the Hazard Potential Classification as High (Canton Dam, 2022).

Oklahoma Dam Classification Chart

Hazard-Potential Classification	Risk Involved with Dam Failure	Inspection Frequency
High	probable loss of human life	annually, by a registered professional engineer
Significant	no probable loss of human life but can cause economic loss or disruption of lifeline facilities	every three years by a registered professional engineer
Low	no probable loss of human life and low economic loss	every five years

Previous Occurrences

There has been no dam failure during the study period 2012-2021, or previously. In May of 1951, Canton Lake filled to capacity after several days of heavy rain, forcing the US Army Corps of Engineers to release 80,000 cfs into the North Canadian River.

Probability of Future Events

The probability of future events is 0 events in 10 years = Very Low probability.

Vulnerability and Impact

The designation of “high-hazard” simply reflects a dam’s potential for doing damage downstream if it were to fail and does not mean that a dam is in need of repair. The areas impacted (swash zones) are delineated using dam breach analysis. According to the US Army Corps of Engineers, only high hazard dams have swash zone determinations.

There are approximately 20 small, privately-owned earthen dams constructed in rural areas throughout the county. Three of these are used for flood control; the others are used for fire protection, recreation, and as stock or small farm ponds. Little to no population and property improvements are located in the flood prone areas near or below these structures. Should there be a complete loss of structure, only rural portions of the County with little or no population would be affected. See maps, below.

The comments below are quoted from the 2022 Cheyenne Arapahoe Hazard Mitigation Plan.

The City of Canton is at about the same elevation as the dam and could be inundated with major flooding and possible loss of life.

Highway 58A crosses the dam and would be washed out in the event of a dam failure. Highways 51 and 58 would be inundated or washed out making those highways un-navigable. Many county roads, (E0640, E0650, E660, E670, E680, E690, N2470, N2480, N2490, N2500, N2510, N2520) could be inundated and some destroyed. The loss of these highways and county roads would not only cause commuters hardships in finding alternate

routes, extra fuel costs and extended driving times, Highways 51 and 58 are major north-south and east-west commercial vehicle routes that would create havoc on deliveries to and from local communities. Emergency services would be greatly delayed by the loss of these transportation routes. Traffic would be forced to divert around the inundation waters.

Numerous residences and some businesses in Canton are within the area of inundation where possible loss of life could occur with residences and businesses being destroyed or flooded leading to possible rescue situations and relocation for residents until houses and businesses can be repaired or rebuilt.

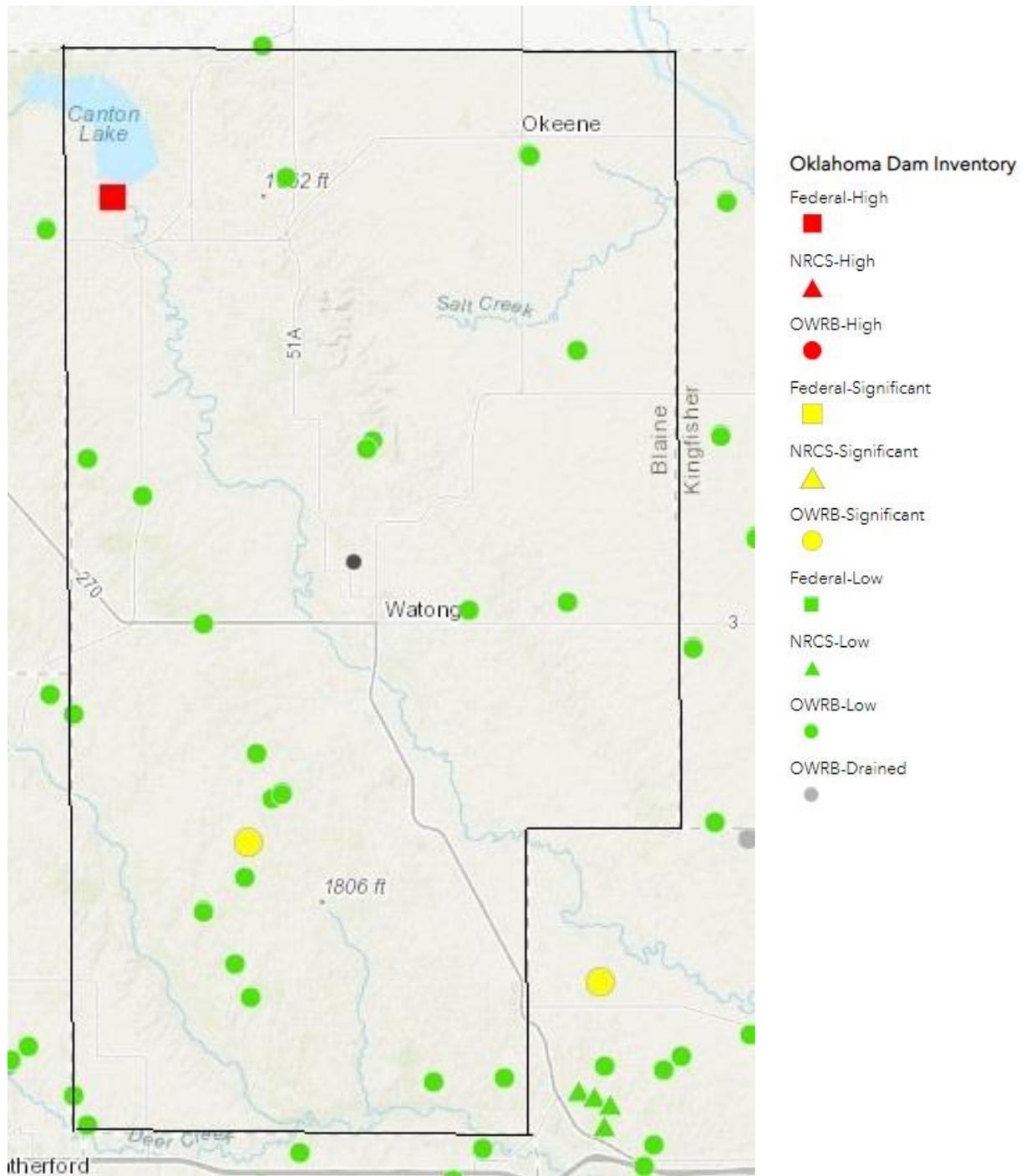
Farmers and ranchers would lose crops and livestock costing them their livelihood and causing a large economic blow to the local economies.

The loss of Canton Lake would be a devastating loss to a large area of Oklahoma as Canton Lake is a major water supply for a large part of the state. Many businesses and residences rely on water supplied from Canton Lake. The cost of rebuilding the dam could be enormous but the loss of the water provided by the lake would create a major hardship and added expense to all that rely on it. Canton Lake is used extensively for recreation and the loss of Canton dam would be a big loss for the local economy and the businesses that support it (Cheyenne and Arapaho Tribes Hazard Mitigation Plan 2022).

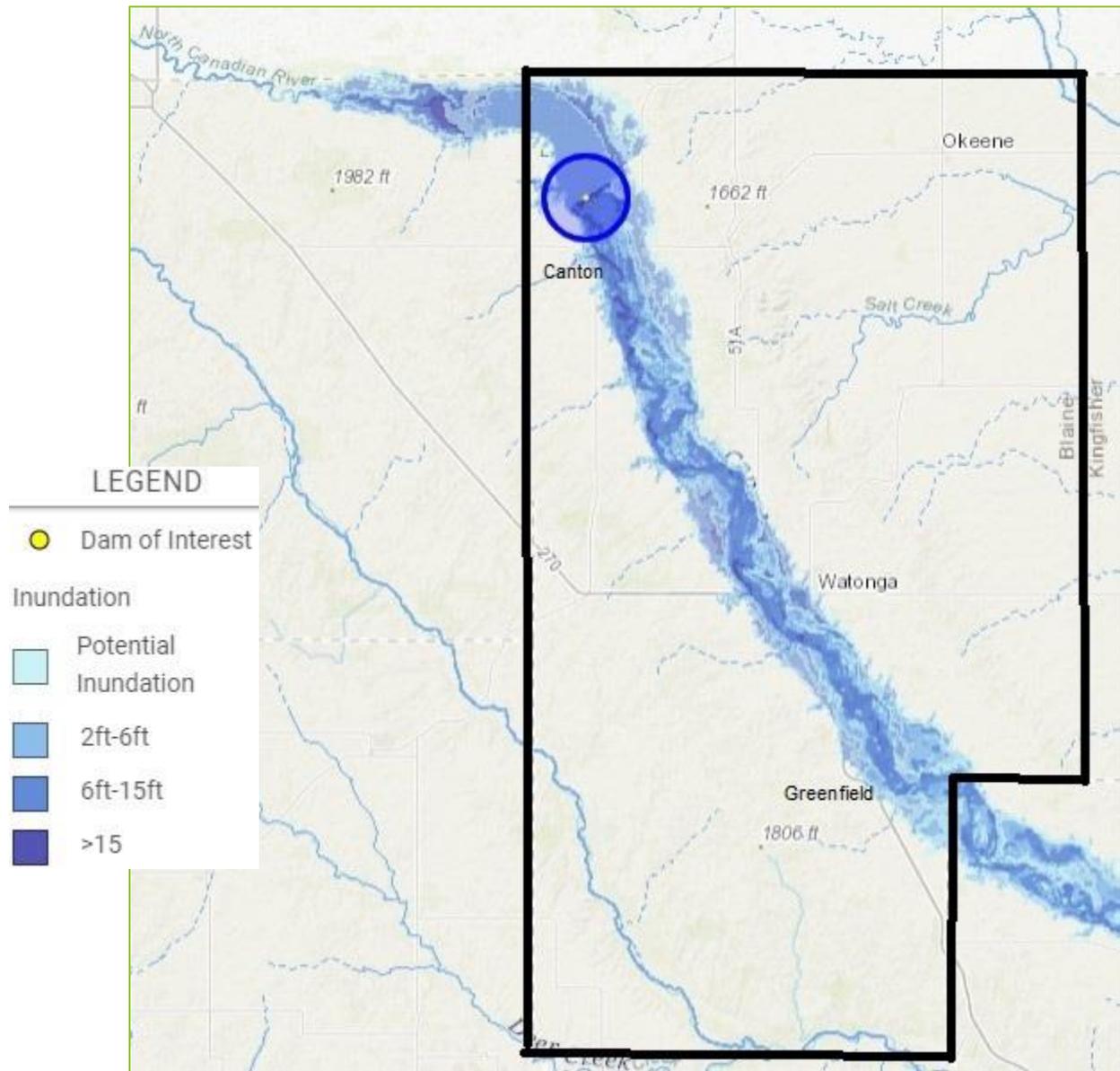
The Canton Dam is under the control of the US Army Corps of Engineers. USACE has recently performed maintenance activity on the dam and a Report was issued in April of 2022. The reader is referred to that report, the USACE Canton Emergency Action Plan 2022.

Chance of dam failure is very low. The Town of Canton believes that the dam is secure.

DAM FAILURE
Critical facilities in the Inundation zone
Town of Canton
Critical facilities in the Town of Canton are in the inundation zone. The sewer lagoon lies SE of the town, near the Canadian River. Depending on the volume of water released, all public infrastructure, medical facilities and housing is at risk.



Canton Dam Inundation Zone



3.4.2 Drought

A drought is a period of drier-than-normal conditions. If dry weather persists and water supply problems develop, the dr period can become a drought.

The Oklahoma State Extension website states that “Drought is different from other natural hazards such as flood or wildfire, where negative impacts are felt very quickly. Drought follows a slow and accumulating process . . . This characteristic makes drought preparedness very challenging (OKState 2018).” The article points out three types of drought, Meteorological, Agricultural and Hydrological. Together, these contribute to social (economic) effects of drought.

Meteorological drought is lower precipitation than is typical for a specific area, and precedes the other types. The terms Agricultural drought and Hydrological drought are most pertinent to this assessment. Agricultural drought depends not only on precipitation, but soil conditions, groundwater or surface water as well. Crops are also more susceptible to insufficient moisture at certain stages of development. Hydrological drought refers to the impact of precipitation deficiency on water levels in streams, lakes, reservoirs and groundwater. This is a long-term type of drought that can have an impact on wells and public water supplies.

Location

The entire Planning Area is affected by Drought.

Extent

The planning area uses the Palmer Drought Severity Index (PDSI) to classify a deficiency or excess of precipitation. Values in Blaine County may fall at any point on the scale. All participating jurisdictions have experienced drought conditions ranging from 0 to <-4.0 on the scale, and may expect such conditions to occur in the future.

Palmer Drought Severity Index		
	< -4.0	Extreme Drought
	-3.99 to -3.0	Severe Drought
	-2.99 to -2.0	Moderate Drought
	-1.99 to -1.0	Mild Drought
	-0.99 to -0.5	Incipient Drought
	-0.49 to 0.49	Near Normal
	0.5 to 0.99	Incipient Moist Spell
	1.0 to 1.99	Moist Spell
	2.0 to 2.99	Unusual Moist Spell
	3.0 to 3.99	Very Moist Spell
	> 4.0	Extreme Moist Spell

Previous Occurrences

The National Oceanic and Atmospheric Administration (NOAA) storm events database shows 43.5 months of drought during the 10 year period from January 2012 - December 2021.

Drought 2012 – 2021	Number of months	Classification
7/01/2012 – 4/30/2013	10	D3 Extreme
5/01/2013 – 8/31/2013	4	D1 Moderate
9/01/2013 – 10/31/2013	2	DO Abnormally dry
3/01/2014 – 3/31/2015	13	D2 Severe
4/01/2015 – 5/31/2015	2	D3 Extreme
1/1/2017 – 1/31/2017	1	D2 Severe
8/01/2017 - 8/8/2017	0.5	D3 Extreme
1/01/2018 - 9/30/2018	10	D2 Severe to D3 Extreme
9/15/2021 - 9/30/2021	0.5	D1 Moderate
12/16/2021 - 12/31/2021	0.5	D1 Moderate
TOTAL	43.5	Months of drought

The drought that began 12/16/2021 continued for another 5.5 months until 5/15/2022.

Probability of Future Events

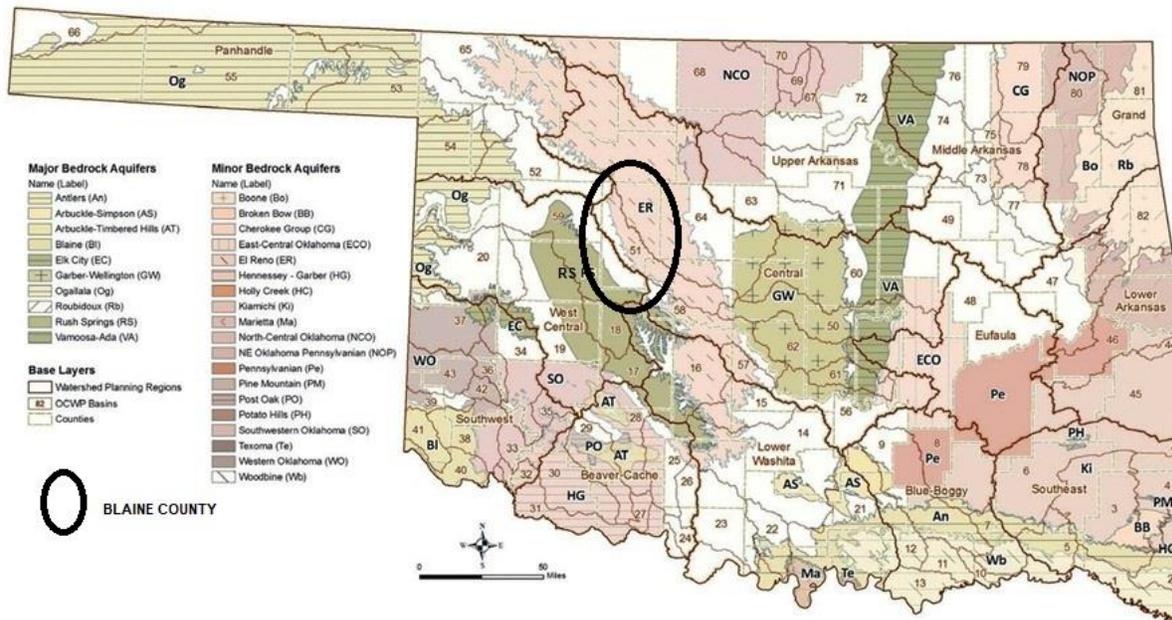
Over a 120 month period, there were 43.5 months of drought = 36 % probability.

Water supply in Blaine County

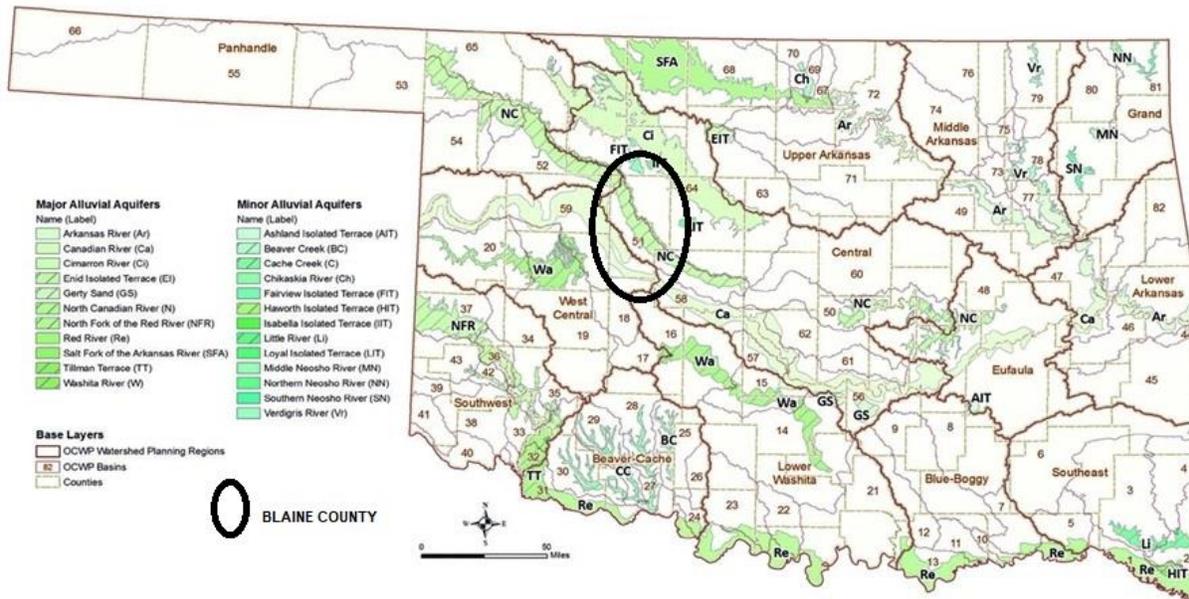
Municipal and rural water supply is sourced from bedrock and alluvial aquifers in the county.

See illustration below.

BEDROCK AQUIFERS



ALLUVIAL AQUIFERS



Map source: Rush Springs Report

<https://www.owrb.ok.gov/reports/studies/RushSprings2015.pdf>

According to the Rush Springs Report, monitoring shows that several planning basins overlying the Rush Springs aquifer, including the El Reno bedrock aquifer in Blaine County, will experience significant groundwater depletion by 2060. Depletion is detected when dissolved solids begin to increase, indicating a change from fresh water to more brackish conditions (OWRB, 2015).

Blaine County Municipal Water supply wells	
Geary	4 wells drinking water with a RO system, 1 well for bulk water; El Reno Aquifer
Watonga	5 wells; El Reno Aquifer
Canton	2 primary wells; El Reno Aquifer
Greenfield	Purchase water from the City of Geary
Hitchcock	1 well; Alluvial aquifer. Backup emergency water from North Blaine Water
Longdale	1 well; Alluvial
Okeene	3 wells; Alluvial

Vulnerability and Impact

DROUGHT

Blaine County	
Vulnerability	Drought reduces the availability of precipitation for bedrock aquifer recharge. The El Reno Aquifer is a regional groundwater supply and cannot be placed under local control. Agricultural irrigation is common throughout the region
Impact	Depletion of the El Reno Aquifer is a hazard to the long term sustainability of agriculture, business and public health in Blaine County
Vulnerability	Drought causes a reduction in quantity and quality of water supply from alluvial wells
Impact	Depletion of alluvial groundwater is intensified, reducing the supply of fresh water for agricultural production, industry and municipal uses
Vulnerability	During drought, surface water is reduced, therefore water supplies for rural residents, crops and livestock are drawn more heavily from wells and aquifers
Impact	Reduced vegetation for grazing and/or hay production impacts livestock production
Impact	Environmental impacts of drought include direct damage to plant and animal species, loss of wildlife habitat (wetlands, lakes, and vegetation) and biodiversity
Impact	Loss of agricultural production and economic stress can result in reduced tax revenues to support local government
Vulnerability	Risk of wildfire increases with drought and low humidity
Impact	There is an increased risk of wildfire at the same time as a reduced availability of water for fire suppression
All Cities and Towns	
Vulnerability	The population relies on municipal water supply; lack of rainfall intensifies depletion of water supply sources
Impact	Quantity and quality of municipal water supply may be reduced
Vulnerability	Many people who live in local towns are employed in the agriculture industry and therefore are vulnerable to loss of production income that comes with drought
Impact	Drought has a negative impact on agricultural production and jobs, retail trade serving agricultural families, and the personal and business tax base
Vulnerability	Fire danger is intensified during periods of drought
Impact	Drought brings an increased threat of fire, while less surface water is available for fire suppression
Town of Canton	
Vulnerability	Prolonged drought reduces water levels in Canton Lake
Impact	In addition to agricultural impacts of drought, the Canton economy is centered on Tourism at Canton Lake. When water levels are low, recreational activity is reduced, impacting jobs, the economy and tax base of the town

Canton, Geary, Okeene and Watonga Public School Districts	
Vulnerability	Schools depend on the municipal water supplies that are affected by drought
Impact	Quantity and quality of potable water may be reduced
Impact	Water rationing may prohibit watering the athletic field increasing the chance of injury to student athletes
Vulnerability	Schools are dependent on tax revenue from agricultural production
Impact	Economic stress results in reduced tax revenues for funding schools

3.4.3. Earthquake

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

Most earthquakes occur as the result of slowly accumulating pressure that causes the ground to slip abruptly along a geological fault plane on or near a plate boundary. The resulting waves of vibration within the earth create ground motion at the surface that vibrates in a very complex manner.

Location

Earthquakes are a hazard for the entire Planning Area.

Extent

The affected jurisdictions use a Modified Mercalli Scale to determine severity. The Planning Area can expect any of the range levels, but magnitudes lower than a 4.0 typically occur.

Modified Mercalli Scale with Richter Magnitude Approximations

Mag	Mercalli	Description	Earthquake Effects
2	I	Instrumental	Not felt except by a very few under especially favorable conditions
	II	Feeble	Felt only by a few persons at rest, especially on upper floors of buildings.
3	III	Slight	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	Moderate	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.
4	V	Rather Strong	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.

5	VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
	VII	Very Strong	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.
6	VII	Destructive	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.
7	IX	Ruinous	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	Disastrous	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
8	XI	Very Disastrous	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
	XII	Catastrophic	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Source: <http://earthquake.usgs.gov/learn/topics/mercalli.php>

Previous Occurrences

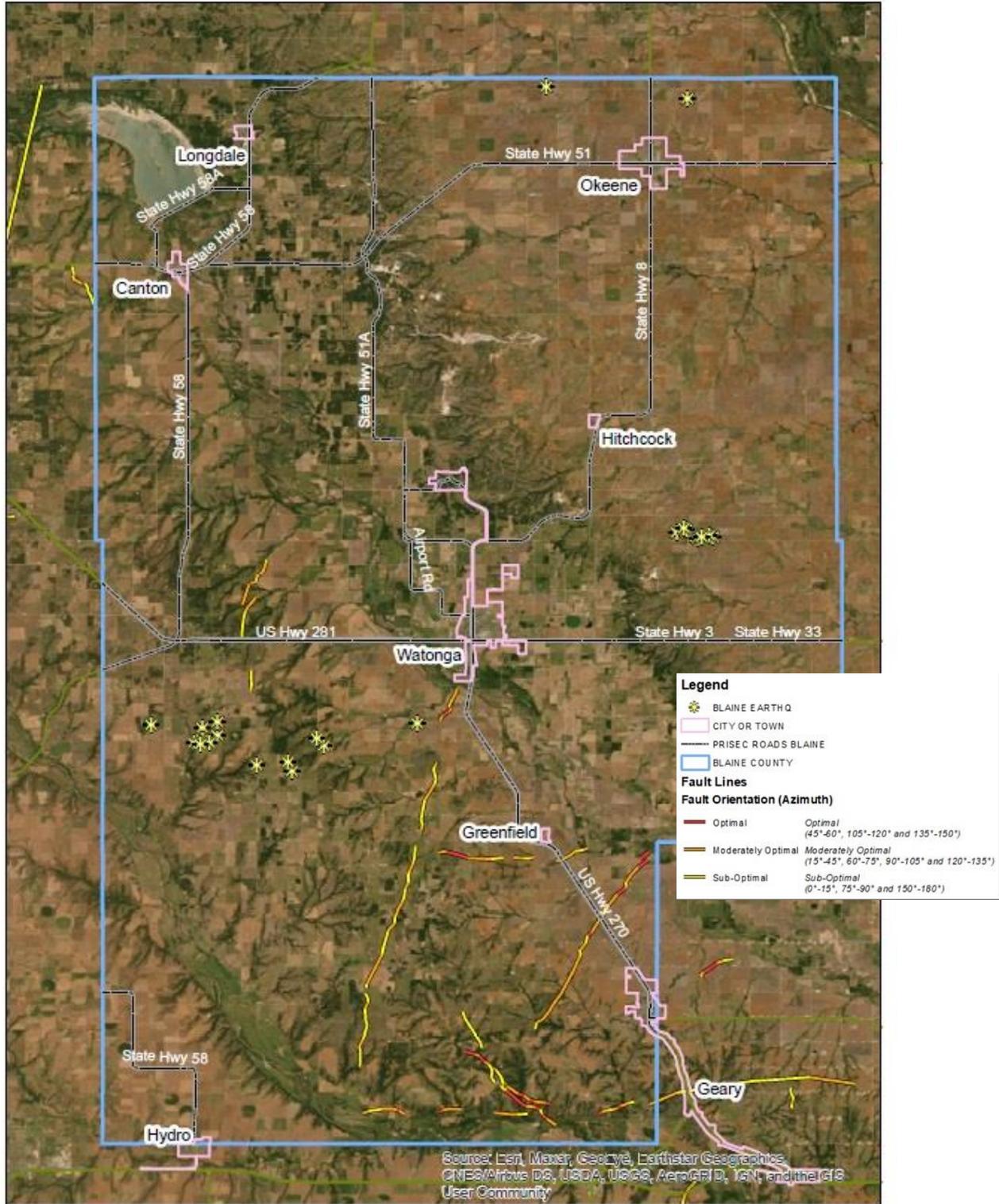
During the study period 2012-2021 there were 24 earthquake events recorded by USGS, downloaded from ArcGIS Online 10/31/2022. The 2019 to 2021 events are not included in that dataset. No earthquakes over 3 magnitude are locally known to have occurred during that period.

BLAINE EARTHQ

time	latitude	longitude	depth	mag	magType	place
11/30/2015 10:50:33 AM	35.7853	-98.509	0.111	2.5	ml	10km SW of Watonga, Oklahoma
11/30/2015 4:23:13 PM	35.781	-98.505	0	2.5	ml	10km SW of Watonga, Oklahoma
11/30/2015 10:54:39 PM	35.77	-98.5436	4.026	2.7	ml	14km SW of Watonga, Oklahoma
9/25/2016 5:34:53 PM	35.7711	-98.5255	5.417	2.5	ml	13km SW of Watonga, Oklahoma
11/22/2016 10:46:19 PM	35.7929	-98.6042	4.6	2.9	ml	14km ENE of Thomas, Oklahoma
1/24/2017 6:16:25 PM	35.7665	-98.5232	4.614	2.6	ml	13km SW of Watonga, Oklahoma
3/5/2017 11:33:34 AM	35.901	-98.2881	5	2.9	ml	12km ENE of Watonga, Oklahoma
3/5/2017 12:09:16 PM	35.8996	-98.2899	5	3.2	ml	12km ENE of Watonga, Oklahoma
3/8/2017 9:48:56 AM	35.9008	-98.2811	5.598	2.6	ml	13km ENE of Watonga, Oklahoma
3/9/2017 4:41:39 AM	35.903	-98.294	6.491	2.7	ml	12km ENE of Watonga, Oklahoma
3/15/2017 7:14:35 PM	35.9008	-98.2878	6.871	3.4	ml	12km ENE of Watonga, Oklahoma
3/23/2017 5:28:46 PM	35.9016	-98.2833	5.204	2.8	ml	13km ENE of Watonga, Oklahoma
3/26/2017 5:15:56 PM	35.9058	-98.2977	6.5	2.5	ml	12km ENE of Watonga, Oklahoma
3/30/2017 8:24:52 PM	35.9053	-98.2964	5.868	2.7	ml	12km ENE of Watonga, Oklahoma
5/1/2017 3:17:50 PM	35.9032	-98.3019	6.903	2.9	ml	11km ENE of Watonga, Oklahoma
8/25/2017 6:48:31 PM	35.782	-98.5707	5	2.5	mb_lg	15km WSW of Watonga, Oklahoma
8/26/2017 5:26:48 AM	35.7823	-98.5797	5	2.8	mb_lg	15km ENE of Thomas, Oklahoma
8/27/2017 12:22:39 AM	35.7947	-98.5661	8.65	2.8	mb_lg	14km WSW of Watonga, Oklahoma
8/27/2017 5:43:44 PM	35.7845	-98.5747	4.983	2.8	ml	16km WSW of Watonga, Oklahoma
8/27/2017 9:24:43 PM	35.7871	-98.566	8.47	3.5	mb_lg	15km WSW of Watonga, Oklahoma
1/3/2018 4:00:30 AM	36.1603	-98.377	5.667	3.4	ml	7km NW of Okeene, Oklahoma
1/6/2018 5:02:11 PM	36.1534	-98.2957	6.8	2.6	ml	4km NNE of Okeene, Oklahoma
2/18/2018 4:44:49 AM	35.7914	-98.5748	2.281	3.2	ml	15km WSW of Watonga, Oklahoma
4/17/2018 8:57:59 AM	35.7812	-98.576	2.863	3.1	ml	16km WSW of Watonga, Oklahoma

Map for Earthquakes that occurred from 2000-2018 appears on the following page. Earthquakes do not appear to be closely correlated with fault lines (USGS 2018).

BLAINE COUNTY OK EARTHQUAKES 2000 - 2018



Probability

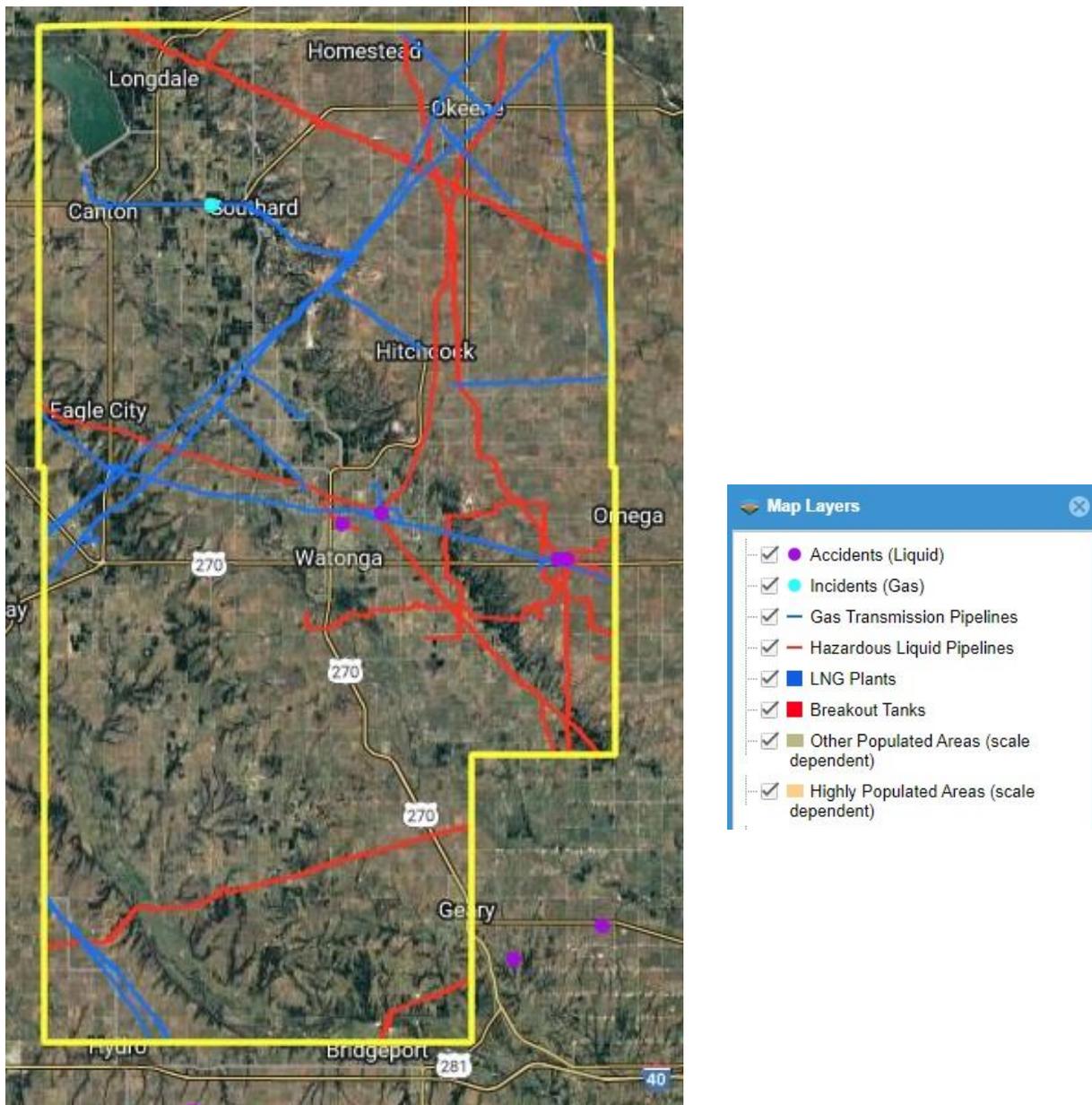
During the study period of 2012 through 2021, 24 earthquakes occurred in Blaine County. That indicates a probability of 2.4 events per year = High probability.

Vulnerability and Impact

Special consideration: Pipelines, Canton Dam

Oklahoma is rich in natural resources and pipelines are ever present. These underground lines would be impacted by ground shifting, causing the release of hazardous material. See Pipeline map below.

As noted above in Section 3.4.1 (page 12), a large earthquake could potentially result in in damage to the earthen embankment of Canton Dam.



EARTHQUAKE

Blaine County	
Vulnerability	The Blaine County Courthouse, constructed in 1906 in Watonga, is listed in the National Register of Historic Places (NR 84002972)
Impact	Older buildings were not constructed to withstand earthquake
Vulnerability	About 65% of agricultural and residential buildings in the county were built prior to 1980 and therefore constructed prior to the adoption of modern building codes. Only 11% of residential buildings were constructed since 2000.
Impact	Due to date of construction and obsolete building practices, older agricultural and residential structures are more susceptible to damage from shaking
Vulnerability	Because the perceived risk of earthquake is low, buildings were not designed to be resistant to shaking; shelves and cabinetry are not earthquake resistant
Impact	People or livestock indoors or near buildings may be harmed by falling debris in older buildings not built to modern codes
Vulnerability	Fixed infrastructure is vulnerable to earthquake damage, including public utilities, roads, bridges. Most roads and bridges throughout the county are aging structures that suffer from deferred maintenance
Impact	Aging roads and bridges may become cracked or unstable. Utility infrastructure is damaged by earth movements
Vulnerability	Pipelines run across the County in all directions (See map above), owned by a variety of companies and subject to frequent changes in ownership
Impact	Both active and inactive pipelines can contain hazardous material. There is no local control of these lines and the potential for damage in the event of an earthquake is unknown
Impact	In the event of a break in a pipeline, there is a danger of airborne noxious gases or explosion
Vulnerability	"Tank batteries" for oil storage are scattered throughout the rural landscape. These containers become corroded due to weather over time, weakening the structures
Impact	Outdoor oil storage facilities may be damaged by earthquake, causing environmental hazards from spilled contents
City of Geary	
Vulnerability	Geary has public water and sewer infrastructure that can be damaged by ground shifting
Impact	Older infrastructure can be damaged by shaking
Vulnerability	The town has a concentration of residential and business buildings 90% of which were built before 1980
Impact	Structures may be damaged; people indoors or near buildings may be harmed by falling debris

City of Watonga	
Vulnerability	Watonga has a concentration of older residential and business buildings that could be damaged in the event of an earthquake; of 1,125 houses, 92% of houses were built before 1990 and only 3% were built since 2000.
Impact	Structures may be damaged; people indoors or near buildings may be harmed by falling debris; roads and bridges may be cracked, infrastructure can be damaged by shaking
Vulnerability	The town has aging water and sewer lines
Impact	Underground service lines may be disturbed, causing interruption of water and sewer service; streets and bridges may be cracked
Town of Canton	
Vulnerability	Canton has a concentration of older residential and business buildings that could be damaged in the event of an earthquake. Of 209 occupied houses in Canton, 94% were built prior to 1980 and before the adoption of modern building codes
Impact	Structures may be damaged; people indoors or near buildings may be harmed by falling debris
Vulnerability	The town has aging water and sewer lines
Impact	Underground service lines may be disturbed, causing interruption of water and sewer service; streets and bridges may be cracked
Greenfield	
Vulnerability	Greenfield has older residential and business buildings that could be damaged in the event of an earthquake. Of 72 occupied houses in Greenfield, 71% were built prior to 1980 and before the adoption of modern building codes
Impact	Due to date of construction and obsolete building practices, older structures are more susceptible to damage from shaking
Vulnerability	An aging concrete grain elevator stands in the center of town
Impact	Grain elevators are critically important to the agricultural economy. If the elevator were damaged, storage and shipment of grain will be disrupted
Hitchcock	
Vulnerability	Hitchcock has a concentration of older residential and business buildings that could be damaged in the event of an earthquake. Of 29 occupied houses in Hitchcock, all were built prior to 1970 and before the adoption of modern building codes
Impact	Due to date of construction and obsolete building practices, older structures are more susceptible to damage from shaking
Vulnerability	An aging concrete grain elevator stands at the North end of town
Impact	Grain elevators are critically important to the agricultural economy. If the elevator were damaged, storage and shipment of Ag products will be disrupted
Longdale	
Vulnerability	Longdale has a concentration of older residential and business buildings that could be damaged in the event of an earthquake. Of 105 occupied houses in Longdale, 68% were built prior to 1980 and before the adoption of modern building codes

Impact	Due to date of construction and obsolete building practices, older structures are more susceptible to damage from shaking
Okeene	
Vulnerability	Okeene has older residential and business buildings that could be damaged in the event of an earthquake. Of 415 occupied houses, 83% were built prior to 1980
Impact	Due to date of construction and obsolete building practices, older structures are more susceptible to damage from shaking
Vulnerability	There are several historic buildings in the downtown area
Impact	Older buildings can be damaged by shaking. Damage to historic buildings is a loss to the entire community
Vulnerability	A concrete grain elevator stands in the center of town
Impact	Grain elevators are critically important to the agricultural economy. If the elevator were damaged, storage and shipment of grain will be disrupted
Canton, Geary, Okeene, Watonga School Districts	
NOTES	Canton Schools were constructed mostly since 1980. Geary School buildings and accessory structures were mostly built in the 1950's. Okeene a mix of buildings built before 1980 Watonga a mix of buildings built from 1950s to 1990
Vulnerability	Older structures may be more vulnerable to earthquake damage, staff and children are concentrated in these buildings
Vulnerability	Shelves or cabinets are not adequately secured with tie downs; windows are not coated with shatterproof film
Impact	During an earthquake, buildings and other structures can be damaged by shaking; windows may shatter, shelves can collapse or spill contents, posing a risk to health and life.
Vulnerability	The Emergency Operations Plans do not include earthquake safety protocol
Impact	Students and staff could benefit from education about the potential for earthquake to occur, and the related safety protocol, increasing their ability to protect themselves adequately in an earthquake event

3.4.4 Expansive Soils

Expansive or swelling soils are soils that expand when subjected to moisture. These swelling soils typically contain clay materials that attract and absorb water. Another category of expansive soil known as swelling bedrock contains a special type of mineral called clay stone.

When water is added to these expansive clays, the water molecules are pulled into gaps between the clay plates. As more water is absorbed, the plates are forced further apart, leading to an increase in soil pressure or an expansion of the soil's volume. Soils containing expansive clay become very sticky when wet and are usually characterized by surface cracks or a "popcorn" texture when dry. Therefore, the presence of surface cracks is usually an indication of an expansive soil.

Changes in soil volume present a hazard primarily to structures built on top of expansive soils. The most extensive damage occurs to highways and streets. The effect of expansive soil is most prevalent in regions of moderate to high precipitation, where prolonged periods of drought are followed by long periods of rainfall. Expansive soils can be recognized by visual inspection in the field or by conducting laboratory analysis of the soil.

Location

The entire Planning Area is affected by Expansive Soils.

Extent

The Planning Area uses a soil rating system based on the Linear Extensibility Map below. Most of the Planning area carries a low rating but Okeene, Hitchcock, and the unincorporated area in the NE portion of the County can see a high rating. Some areas along the SW riparian zone of the Canadian River have a high potential for shrink/swell of soils.

The effects of expansive soils are most prevalent in regions of moderate to high precipitation, where prolonged periods of drought are followed by long periods of rainfall. Other cases of damage result from increases in moisture volume from such sources as broken or leaking water and sewer lines. Dry clays are capable of absorbing water and will increase in volume in an amount proportional to the amount of water absorbed. Areas capable of these changes in soil volume present a hazard to buildings, slabs, concrete, asphalt and other structures built over them and to the pipelines buried in them.

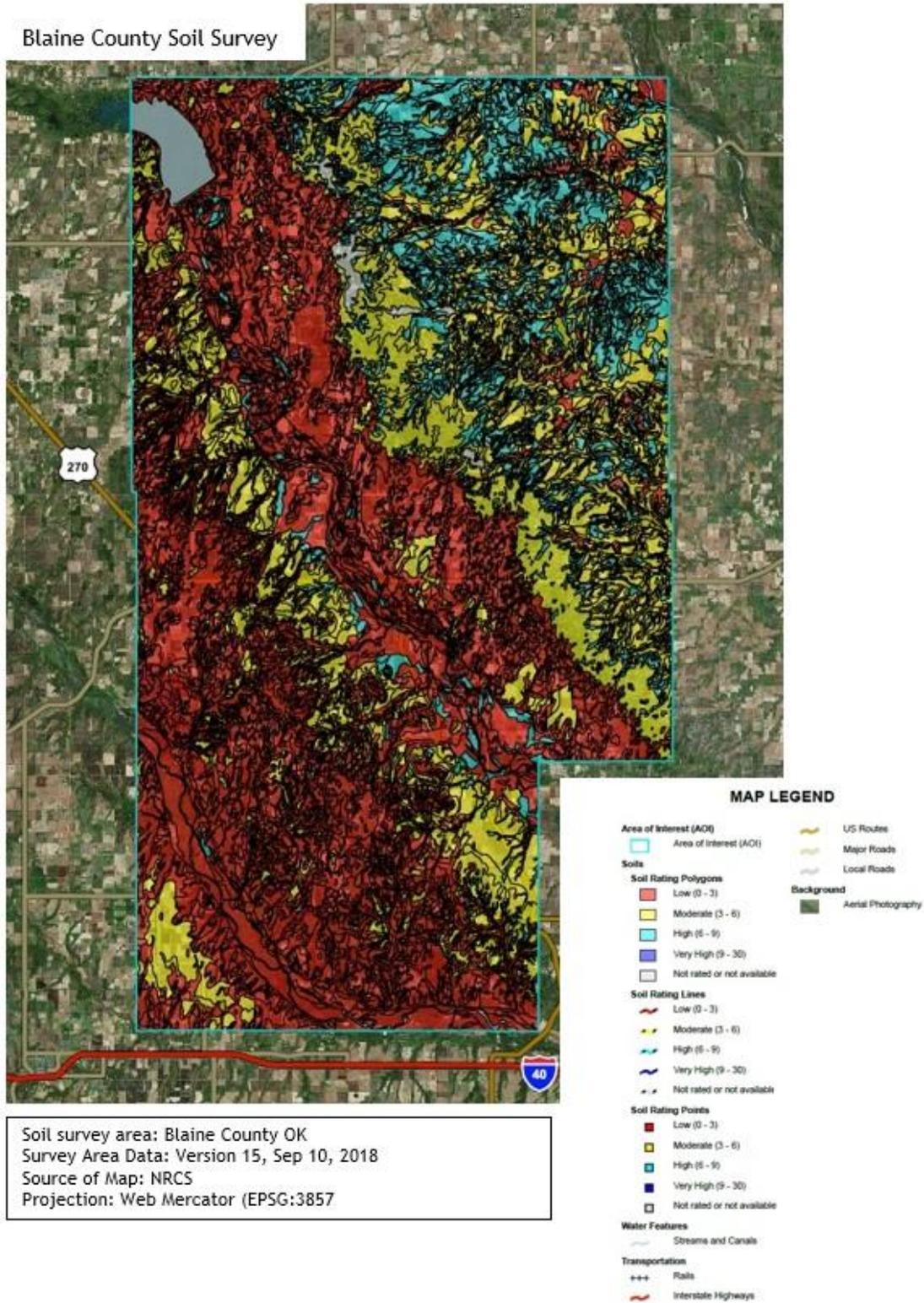
Houses and one-story commercial buildings are more apt to be damaged by the expansion of swelling clays than are multi-story buildings, which are usually heavy enough to counter swelling pressures. However, if constructed on wet clay, multi-story buildings may also be damaged by clay shrinkage when moisture levels are substantially reduced.

According to the NRCS soils database, 45.7% of Blaine County's land acres soils contain shrink-swell properties, and 13.8% are 6.0-8.9 percent linear extensibility (high to very high shrink-swell potential). When the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots.

Previous Occurrences

Since this hazard develops gradually and seldom presents an immediate threat to life, problems may not be recognized as being related to expansive soils or may be considered only nuisances

and therefore never repaired or reported. No records of specific incidences of structure damage due to expansive soils in the Planning Area were found in the years of 2012 - 2021.



Probability of Future Events

The potential for damage from expansive soil events in Blaine County is unlikely but could occur under the right soil and weather conditions. Zero incidents reported indicates that the likelihood of loss due to expansive soils within the Planning area is Very Low: 0 events/10 years = 0 % probability.

Vulnerability and Impact

FEMA’s Multi Hazard Identification and Risk Assessment points out that the best way to mitigate structural damage from expansive soils is to avoid building on them. However, when structures are already in place, property maintenance to prevent excessive moisture from entering the soil near foundations should be implemented by owners of buildings in areas of expansive soils. This includes proper grading and keeping gutters/downspouts clear of debris and not allowing stormwater discharge adjacent to the foundation. In addition, inspection of the property after heavy rainfall to address drainage issues should also be put into practice.

According to the 2019 Oklahoma State Hazard Mitigation Plan, no history of damage is available because there are no reported losses which identify the presence of expansive soils as the direct cause. Damage develops gradually and it is difficult to attribute dollar amounts to this hazard.

A structure is affected by expanding and/or shrinking soils causing uneven settlement of the soil. Extensive damage can occur to buildings and other structures, such as highways, streets and sidewalks. Even trees can be impacted.

The greatest damage occurs when structures are constructed when clays are dry (such as during a drought) and subsequent soaking rains swell the clay.

As noted above, many pipelines are present in the planning area. Expansive soils can cause damage to underground lines, increasing the risk of oil and gas spillage/leakage. No incidents of pipeline damage from this hazard have been recorded.

In nearby Canadian County, it was noted in the 2013 Hazard Mitigation Plan that during periods of drought there are more water line breaks, which appears to be caused by the shrinkage of clays in the soil where older lines are buried (Soils, 2013).

Blaine County; All jurisdictions	
Vulnerability	Pipelines are present throughout the county
Impact	Pipelines can be disturbed by expansive soils, leaks can occur
Vulnerability	Aging roads, bridges are in place throughout the county. Municipal and Rural water lines are present throughout the county
Impact	Infrastructure is impacted by shrink/swell action of expansive soils
Vulnerability	Building foundations and basements are vulnerable to the effects of shrink and swell of soils
Impact	Older buildings and structures are more likely to show evidence of cracks and instability with the passage of time
Vulnerability	Periods of drought are common in the planning area (shrinking soils)
Impact	Structures built during drought are more vulnerable to damage from expansive soils when heavy rains come and soil swells

3.4.5 Extreme Heat

Summertime temperatures routinely climb above the 100° mark, which can create very uncomfortable conditions when combined with high humidity. Temperatures that hover 10° or more above the average high temperature for an area, and last for several days or longer, is one measure of extreme heat. In addition, humid conditions can persist and air quality can deteriorate during the summer when a dome of high atmospheric pressure creates a temperature inversion that traps a stagnant air mass near the ground.

Location

Extreme heat events affect the entire planning area. Urbanized areas with more concrete and asphalt tend to have somewhat higher temperatures than open and vegetated areas, therefore it could be expected that the City of Watonga may record a slightly higher temperature than the less populated parts of the county.

Extent

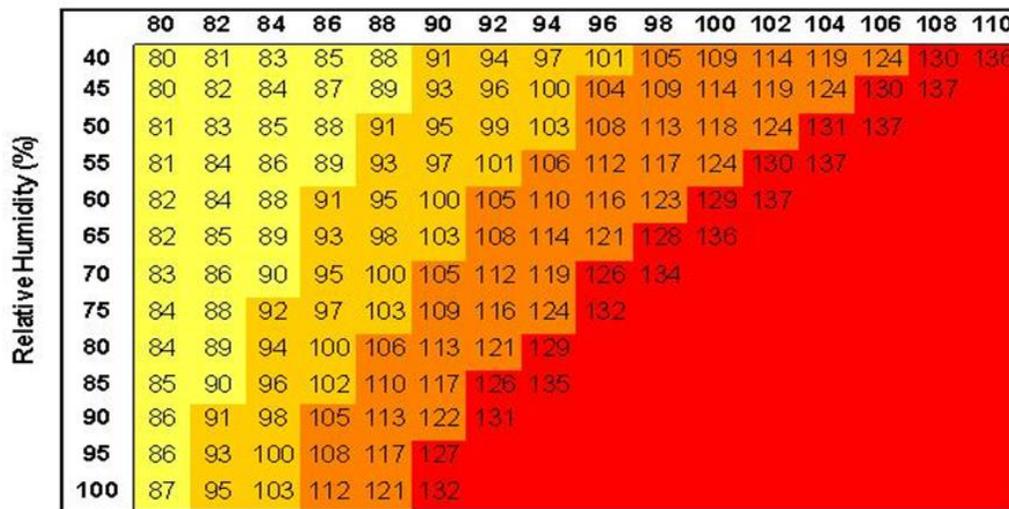
The planning area uses the Heat Index Chart to categorize Extreme Heat, and values that fall anywhere on the Index may be expected to occur.

Temperature and Humidity. Extreme heat conditions in Blaine County are a function of heat and humidity; illustrated below using a Heat Index Chart. A status of Extreme Caution can occur at temperatures as low as 82 degrees Fahrenheit when humidity is at 90% and may be expected to reach Extreme Danger when temperatures reach 90 with high humidity. At temperatures of 98 degrees and above, humidity as low as 40% creates a dangerous situation. Oklahoma humidity is typically between 43% and 83% during summer days (Climate, 2020).

The combined effects of rising temperatures and humidity present a situation where humans and animals may experience heat disorders which, at extreme levels can be fatal.

HEAT INDEX CHART

Temperature (°F)



Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution Extreme Caution Danger Extreme Danger

Previous Occurrences

Referring to the heat chart, one way to identify periods of extreme heat is to record the number of days in the danger and extreme danger categories when temperatures reached 90 degrees or more and humidity is greater than 70%. At temperatures over 100, 65% humidity creates extreme danger. When temperature or humidity exceeds those levels, conditions always pose a danger of heat disorders to unsheltered people or animals.

According to the National Weather Service, over the period 2012 through 2021, temperatures reached greater than 90 degrees on about 71.2% of summer days, while more than 82.5% of all summer days reached over 70% humidity (June, July and August = 920 days). These days overlap in that nearly all days over 90 degrees also reach humidity of 70% or greater.

Of 920 summer days from 2012 through 2021, 542 reached temperatures in the 90's, and another 113 saw temperatures of 100 degrees or more, for a total of 655 days over 90 degrees (NOAA, 2022).

“Danger and Extreme Danger”

Blaine County Heat data	Days over 90F	Days over 70% Humidity	Days exceeding 90 degrees and greater than 70% humidity
Summer days	655 of 920	759 of 920	654 of 920
10 year average	71.2%	82.5 %	71%

Included in the above figures are twelve percent of those summer days that exceed 100 degrees, as illustrated below. Virtually all summer days that reach temperatures of 100 degrees are days of “Extreme Danger.”

“Extreme Danger”

Blaine County Heat data	Days over 100F	Days over 65% Humidity	Days exceeding 100 degrees and greater than 65% humidity
Summer days	113 of 920	906 of 920	113 of 920
10 year average	12.28%	98.47%	12.28%

Probability

Seventy-one percent of summer days in Blaine County pose a danger to public health; 655/920 = 71% Medium probability.

Vulnerability and Impact

Extreme heat events affect all jurisdictions. Humans, crops and livestock suffer injury or death from extreme heat. In extreme heat situations local emergency responders accompany fire departments on calls, in the event they are needed to treat fire fighters for heat disorders. Over time, infrastructure such as roads, bridges and electrical lines are damaged due to expansion and contraction during extreme temperatures. Children and elderly or disabled persons are especially vulnerable to heat stress.

EXTREME HEAT	
Blaine Co 2020 ACS Census 5-year estimate Pop 9,521	
Vulnerability	The county is a rural area and there are many low income and elderly individuals. Of all people in the county, 11.5% are below the poverty level; 9.5% of people age 65 and over are in poverty. Some people cannot afford to buy or operate air conditioners all summer, and at times there are breakdowns or power loss
Impact	There is a danger of heat exhaustion for all people and especially vulnerable low income elderly who do not have the ability to withstand extreme heat events
Vulnerability	County workers, Emergency personnel and other people working outdoors must sometimes work in extreme conditions
Impact	Fire fighters and people working outdoors need to be cooled down periodically to avoid heat disorders
Vulnerability	Extreme heat conditions directly affect agricultural production of crops and livestock by causing severe heat stress
Impact	Loss of production in crops and heat disorders in livestock have a negative economic impact on the county and reduces tax revenue
Vulnerability	Blaine County has aging infrastructure that is more vulnerable to expansion and contraction due to extreme temperatures
Impact	Older infrastructure is weakened by extreme temperature effects of expansion and shrinkage over decades
City of Geary Pop 895	
Vulnerability	In Geary, 16.2% of people are below the poverty level. 14.7% are over age 65
Impact	Low income households may not have air conditioning, and elderly people are more vulnerable to heat stress
Vulnerability	The Town has older infrastructure which is more vulnerable to a cycle of temperature extremes
Impact	Extreme heat expansion causes stress on infrastructure over a period of decades
Vulnerability	Emergency personnel and other people working outdoors must sometimes work in extreme conditions
Impact	Extreme temperatures can cause heat disorders in emergency response personnel and people working outdoors
City of Watonga Pop 2,867	
Vulnerability	8.2% of the population is below poverty level and 21.2% of residents are over age 65
Impact	Low income households may not have air conditioning, and elderly people are more vulnerable to heat stress
Vulnerability	The town has older infrastructure that is vulnerable to a cycle of temperature extremes
Impact	Extreme temperatures cause damage to infrastructure in freeze/thaw cycles over decades

Vulnerability	Emergency personnel and other people must work outdoors in extreme conditions
Impact	Extreme temperatures cause heat disorders in emergency response personnel and people working outdoors
Town of Canton Pop 464	
Vulnerability	The town has older infrastructure that is vulnerable to a cycle of temperature extremes
Impact	Heat stress causes damage to aging infrastructure
Vulnerability	Outdoor workers and emergency personnel may be working in extreme conditions
Impact	Extreme temperatures cause heat disorders in emergency response personnel and people working outdoors
Town of Greenfield Pop 176	
Vulnerability	In Greenfield 36.4% of residents are living below the poverty level
Impact	Low income residents struggle to pay for operation, maintenance or repair of AC units
Vulnerability	Of 72 DUs, only 5 were built in the last 25 years. Almost 30% of dwellings are mobile homes.
Impact	Older structures, especially mobile homes, are more expensive to cool during periods of extreme heat
Vulnerability	Greenfield is a very small town with few public spaces or services available
Impact	There are few places away from home where one can find shelter from the heat
Vulnerability	Aging infrastructure is more vulnerable to shrink/swell from extreme temperatures, while the small population means very little tax revenue for repairs and modernization
Impact	Funding for repair and maintenance of infrastructure is a constant challenge for the Town
Town of Hitchcock Pop 56	
Vulnerability	In Hitchcock, 17.9% of the population lives in poverty
Vulnerability	28 of the 29 houses were built prior to 1939, one house was built in the 1960's
Impact	Impoverished people in old or dilapidated housing have difficulty keeping temperatures at a safe level
Impact	Residents pay more for AC if older homes have not been retrofitted with sufficient insulation
Vulnerability	Hitchcock is a very small town with few public spaces or services
Impact	Residents have few options for alternative shelter during the heat of the day
Town of Longdale Pop 217	
Vulnerability	In Longdale, 41.9% of pop is below poverty and 31% of those over 65 are in poverty
Impact	Low income elderly people are more vulnerable to heat stress and less likely to have access to alternative shelter
Vulnerability	Of 105 houses, 40% are mobile homes. 76% of all housing was built prior to 2000; 62% was built prior to 1980
Impact	It is usually more difficult and more expensive to regulate the temperature of older homes, especially older mobile homes
Town of Okeene Pop 998	
Vulnerability	27.5% of all residents are below poverty level and 19% of pop is over age 65
Impact	Low income households may not be able to maintain cooling units, and elderly people are more vulnerable to heat stress

Vulnerability	Okeene lacks a city pool or splash park for relief from midday heat
Impact	The lack of community cooling options impacts economically-challenged residents who do not have the ability to adequately cool homes during extreme heat events
Canton, Geary, Okeene and Watonga School Districts	
Vulnerability	Due to the climate in western Oklahoma, most school buildings and buses must have adequate air-conditioning
Impact	There are increased cooling costs to maintain air-conditioned areas during times of excessive heat; schools may have to close when AC systems are overwhelmed
Vulnerability	Children and staff are vulnerable to heat stress. Although most extreme heat events occur during summer months when school is not in session, extreme heat does occur on school days and during summer activities
Impact	Staff and students can be negatively impacted by extreme heat, indoors and outdoors
Vulnerability	Staff is not trained in extreme heat safety protocols; Emergency Operations Plans do not address extreme heat hazards
Impact	Safety protocols and staff training for extreme heat events is needed to protect staff and student health, especially for student athletes

3.4.6 Flood

River flooding is when a river rises to its flood stage and spills over the banks. The amount of flooding is usually a function of the amount of precipitation in an area, the amount of time it takes for rainfall to accumulate, previous saturation of local soils, and the terrain around the river system. A river located in a broad, flat floodplain will often overflow to create shallow and persistent floodwaters in an area that do not recede for extended periods of time. The excess water can be from snowmelt or rainfall far upstream. Flood effects can be local, impacting a neighborhood or community. They can also be very large, affecting entire river basins and multiple states.

Base flood. The terms “base flood,” “100 year flood,” and “one-percent annual chance flood” are often used interchangeably. The boundary of the Base Flood (1% flood) is intended to be equivalent to the Flood Hazard Boundary (NFIP, 2022)

Flash Flood. “Flash flood” is a flood caused by heavy or excessive rainfall in a short period of time, generally less than 6 hours. Flash flooding occurs when excessive rainfall temporarily exceeds the design capabilities of drainage facilities, and is not identified on flood hazard maps.

Overland flow. Overland flows occur when soils cannot absorb water, such as when rain or meltwater flows over saturated soils, or as a result of rain intensity that is too high for vegetation and soils to absorb.

NFIP. The National Flood Insurance Program (NFIP) provides flood insurance to property owners, renters and businesses. Private insurance companies do not cover flood. The NFIP works with communities to adopt and enforce floodplain management regulations that help mitigate flooding effects. Flood insurance is available to anyone living in one of the 23,000 participating NFIP communities. Homes and businesses in high-risk flood areas with mortgages from government-backed lenders are required to have flood insurance (NFIP, 2022).

Location

Flood hazard affects all jurisdictions in the Planning Area.

The usual areas for Base flood to occur is in the flood plains of the Cimarron, North Canadian and Canadian Rivers and other low-lying areas and smaller tributaries in Blaine County.

Flash flood affects all jurisdictions. Flooding within the municipalities is usually street flooding in areas where poor drainage exists.

Overland flow is a problem in areas where the grade of land does not properly direct water away from structures. This can happen anywhere over time due to erosion or settling of soil, and care must be taken to maintain adjacent grade near buildings.

Repetitive loss structures. One purpose of the NFIP is to identify locations where losses occur repeatedly, and to mitigate those losses. None of the participating jurisdictions in the planning area has identified or reported repetitive loss structures.

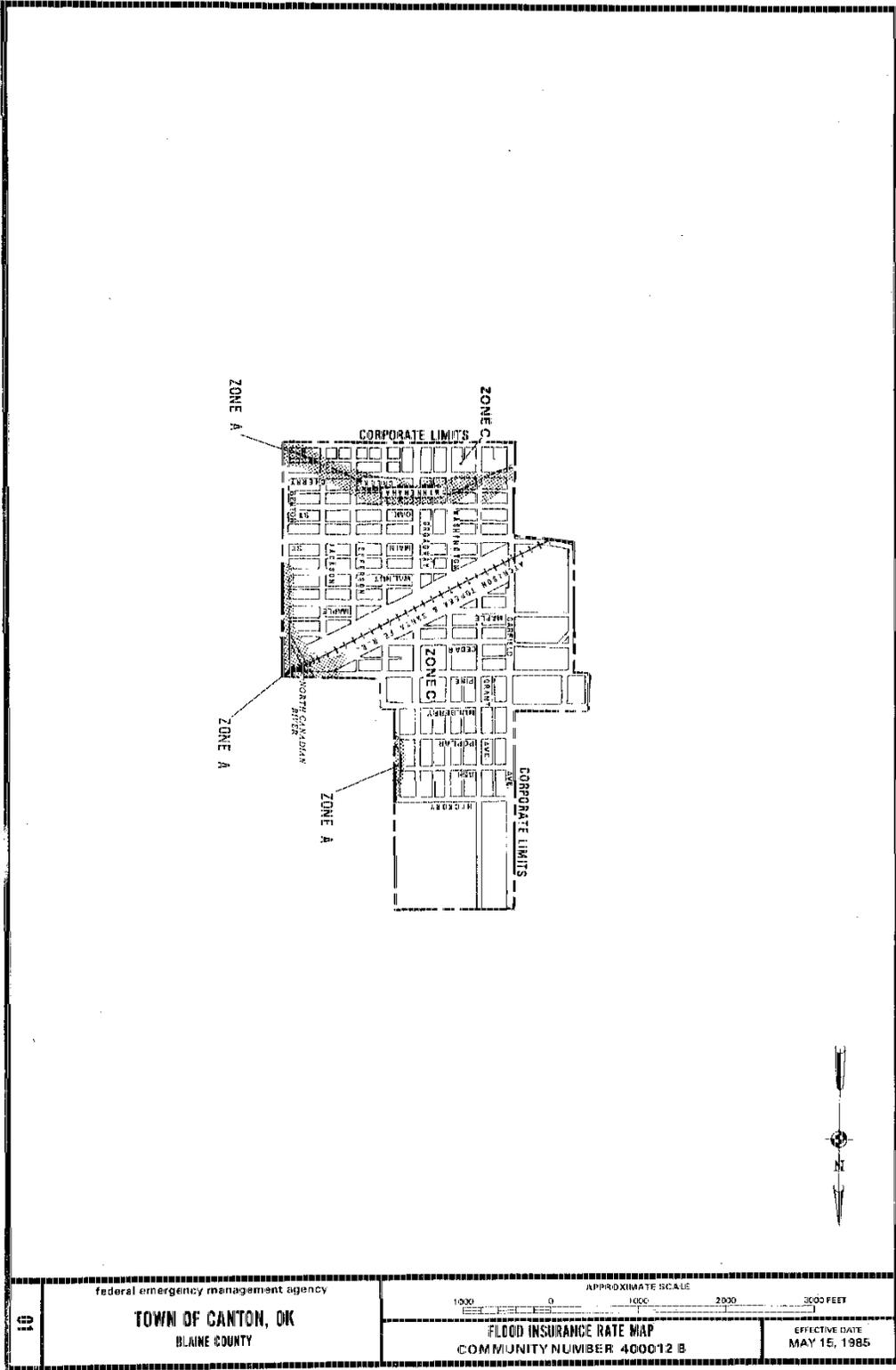
Extent

FIRM Maps for the Town of Canton, City of Geary, Town of Greenfield, Town of Okeene, City of Watonga are replicated below, showing the location of the Special Flood Hazard Area (SFHA) for a Base Flood, which has a 1% chance of occurring in any given year.

The Town of Canton, City of Geary, Town of Okeene and City of Watonga, participate in the NFIP. The Town of Greenfield does not participate in NFIP. The Towns of Hitchcock and Longdale have not been mapped.

The Town of Greenfield is a very small town. There are only 3 homes in the SFHA, and those property owners do not choose to purchase flood insurance. They have been told of the flood risk and advised that if the property were to be sold, there may be a lender requirement for flood insurance on the property.

Note: Town maps are replicated below. FIRM maps for Unincorporated areas of Blaine County are in Appendix B



NOTE: The City of Geary is depicted on FIRM Panels 40017C0025H, 40017C0175H and 40017C0200H. Because of an annexation, the City extends SE to Interstate HWY 40.

The SFHA is south of the Town proper and crosses the annexed portion of the City. Below is the FP as shown on the digital version of the area.

Legend

 CITY OF GEARY

Map is not for official use

 FIRM Panel

Special Flood Hazard Area

FLD_ZONE, ZONE_SUBTY

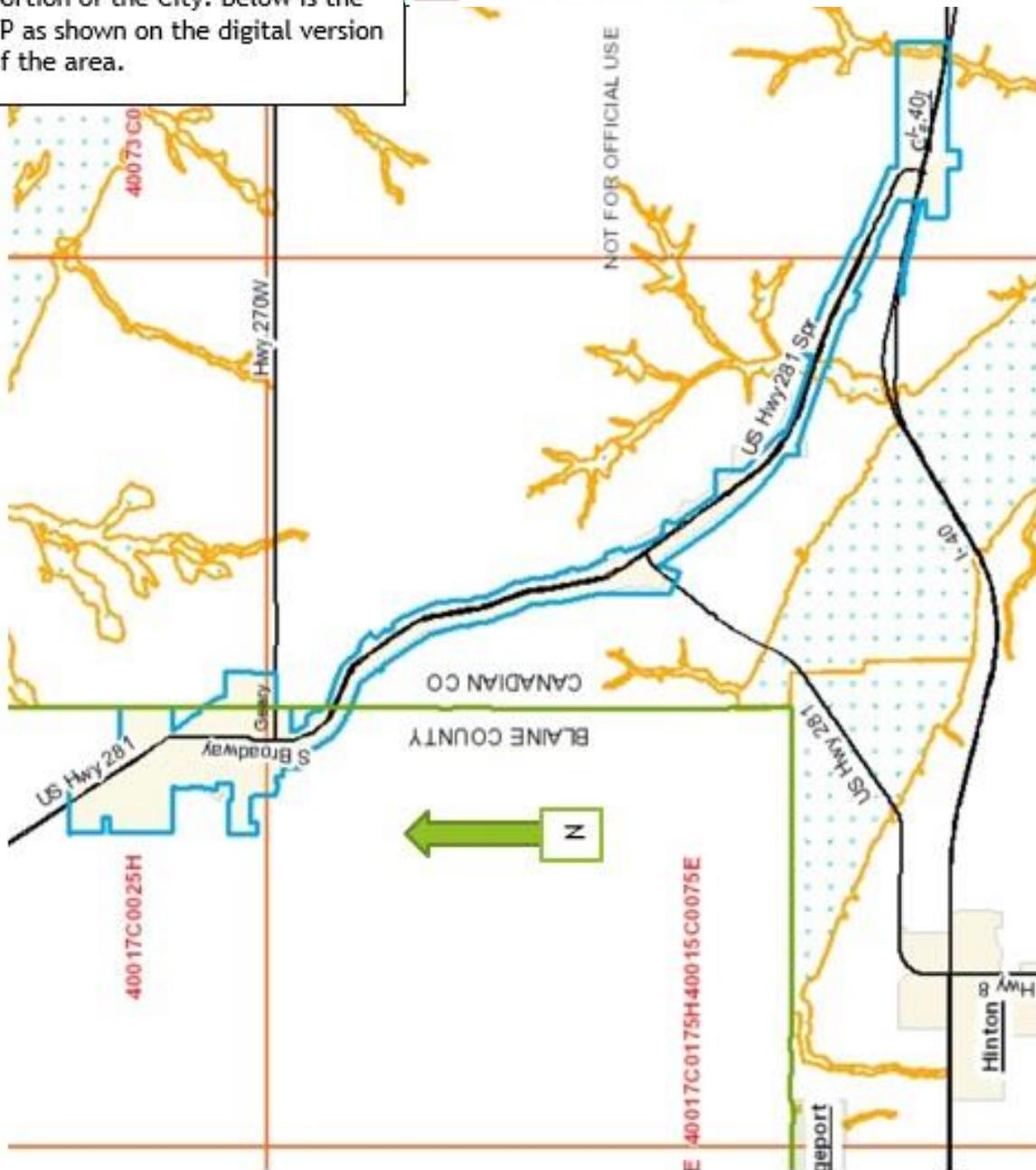
 A - 1% annual chance of flooding; base flood elevations not determined

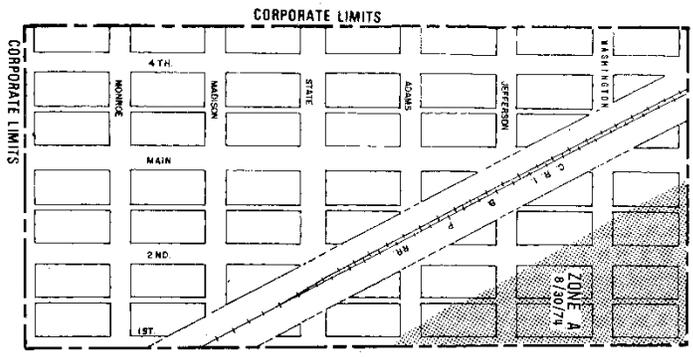
 AE - 1% annual chance of flooding; base flood elevations determined

 AE, Floodway - AE zone with development regulations

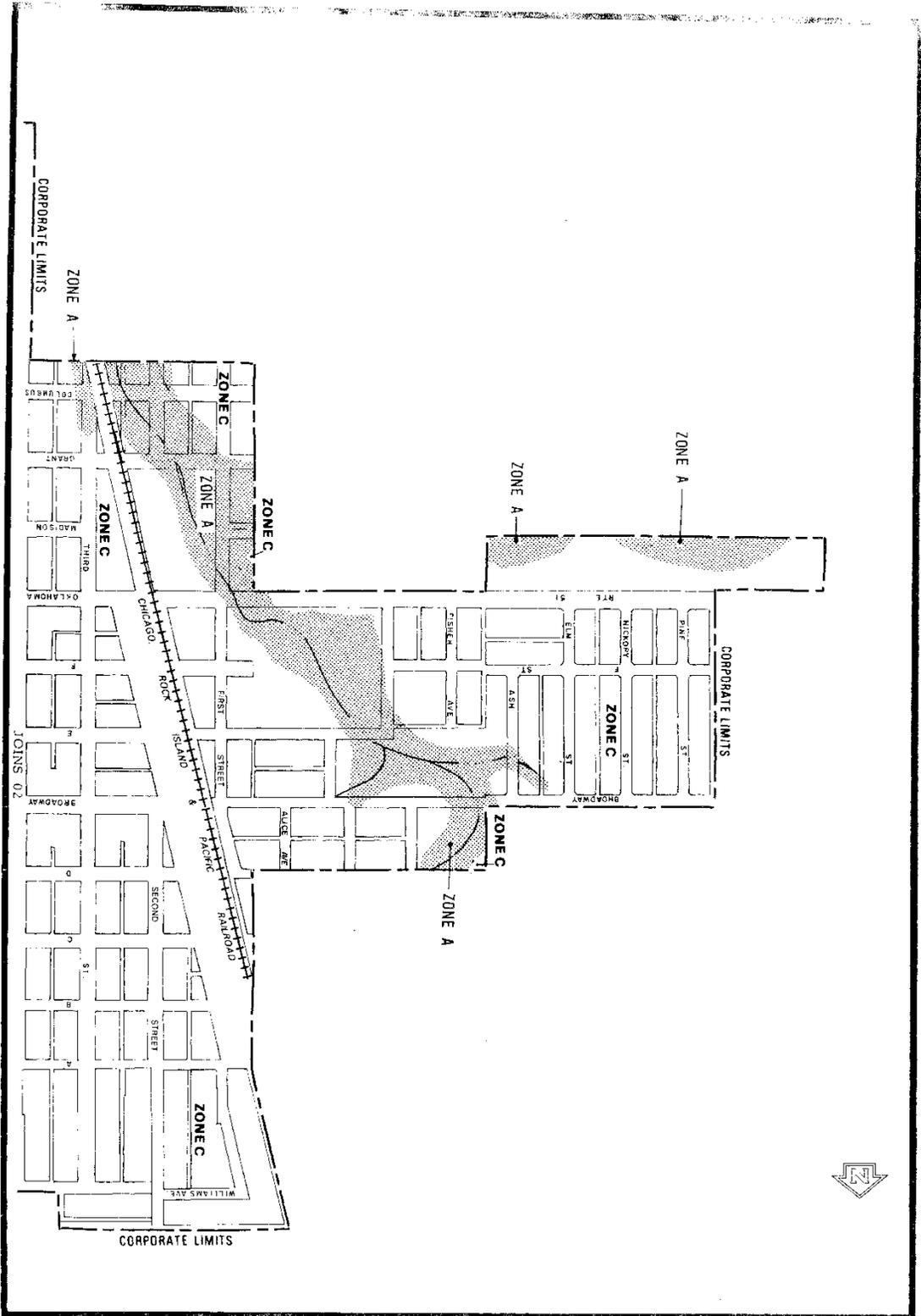
 AH/AO - 1% chance of flooding; between 1 and 3 feet of ponding or sheet flow

 X - 0.2% annual chance of flooding





01	DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT Federal Insurance Administration	APPROXIMATE SCALE	
	TOWN OF GREENFIELD, OK (BLAINE CO.)	250 0 500 1000 1500 FEET	MAP REVISED 2/20/76
		FIA FLOOD HAZARD BOUNDARY MAP No. H 01	

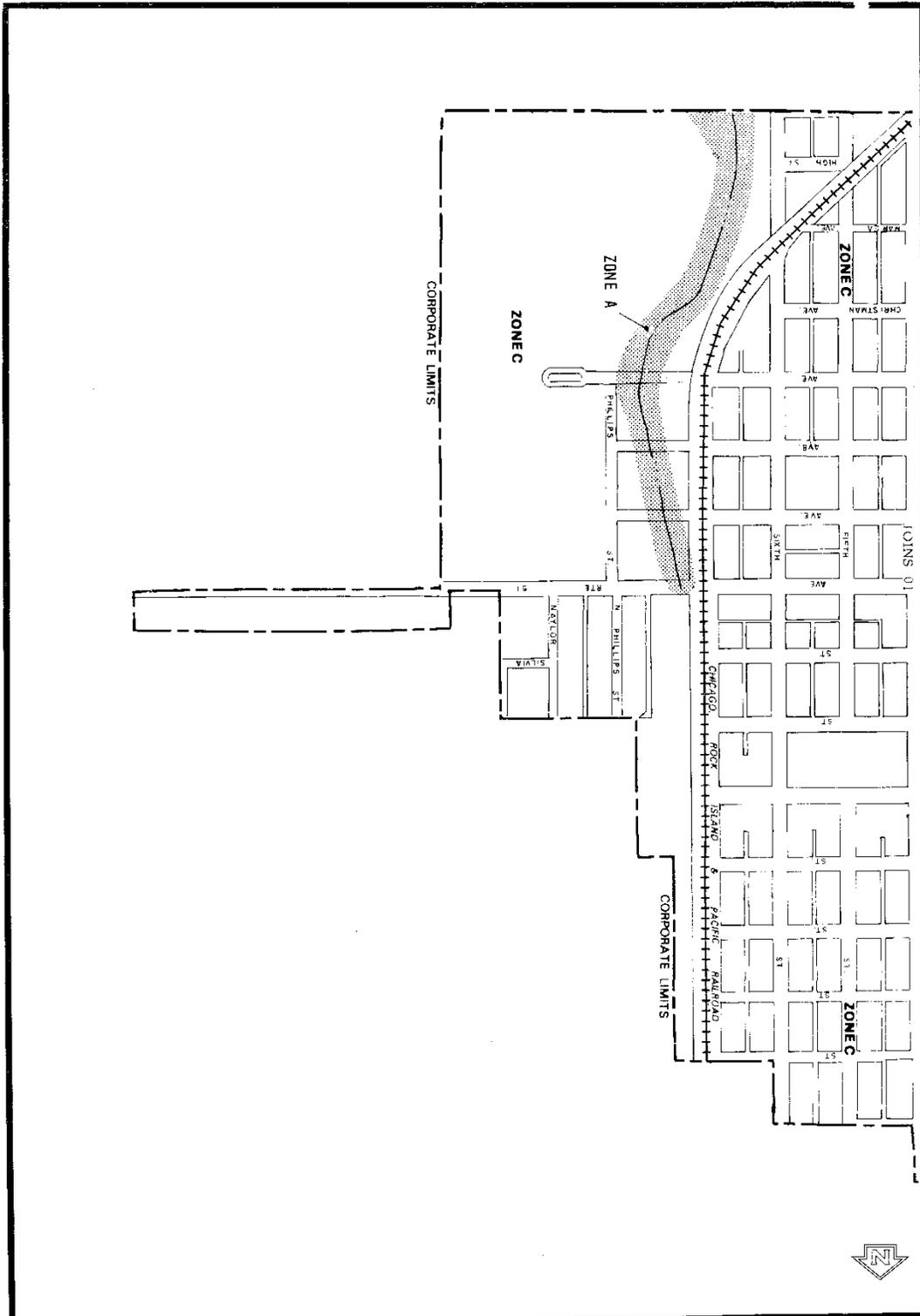


federal emergency management agency
TOWN OF OKEENE, OK
 BLAINE COUNTY

APPROXIMATE SCALE
 0 500 1000 1500 FEET
FLOOD INSURANCE RATE MAP
 COMMUNITY NUMBER 400015

EFFECTIVE DATE
 NOVEMBER 15, 1985

01



02	federal emergency management agency	APPROXIMATE SCALE	
	TOWN OF OKEENE, OK BLAINE COUNTY		EFFECTIVE DATE
		FLOOD INSURANCE RATE MAP COMMUNITY NUMBER 400015	NOVEMBER 15, 1985

Probability

Seven events are recorded in the NOAA storm database for the years 2012-2021. That gives a likelihood of 7/10= 70% Medium probability.

Vulnerability and Impact

When Blaine County receives rainfall of 2 inches or more in less than one hour street flooding typically occurs. Rainfall in one day of 4 inches or more has the potential to cause a flood event in Blaine County. Heavy precipitation over several weeks can result in soils becoming over-saturated causing water to stand in low-lying areas.

FLOOD	
Blaine County	
Vulnerability	Blaine County has many older roads and bridges still in use that were not constructed to modern standards and lack adequate flood capacity or erosion control features
Impact	Erosion due to flood weakens road and bridge infrastructure; excess storm water causes erosion and floods roads when water volume overwhelms the capacity of drainage ditches
Vulnerability	Low population and modest economic activity limit the tax revenue available for maintenance each year
Impact	Some county roads are subject to water over the road at times of flooding, posing a threat to human life
Vulnerability	Ditches have the capacity to hold low level floods but ponding persists and infiltration is slow due to the high concentration of clay in the soils and compaction of soils in ditches
Impact	Standing water becomes stagnant over a period of time and poses a health risk from breeding mosquitos and other life
City of Geary and Watonga; Towns of Canton, Greenfield and Okeene	
Vulnerability	Residential and commercial structures are at risk from rising flood water associated with local rivers; overland sheet flow also occurs
Impact	Flooding from any source damages residential and commercial structures
Vulnerability	Most streets are not designed with underground storm drains; existing drainage and storage structures reach capacity quickly and overflow
Impact	Storm water causes erosion and floods the streets when water volume overwhelms the capacity of drainage ditches
Impact	Erosion due to flood weakens street and bridge infrastructure
Vulnerability	Where ponding occurs, infiltration is slow due to the presence of clay minerals in soils and compaction of soils in ditches
Impact	Standing water becomes stagnant over a period of time and poses a health risk from breeding mosquitos and other life
Towns of Hitchcock and Longdale	
Vulnerability	During times of larger rainfall events, streets lack adequate drainage and storage capacity
Impact	Storm water may overwhelm the capacity of drainage systems

Canto, Geary, Okeene, Watonga School Districts	
Vulnerability	While school district structures are not located in flood hazard areas, there is a risk of damage from overland flow around school structures
Impact	Overland sheet flow causes erosion near buildings or parking areas
Vulnerability	Water over local roads poses a hazard to bus transportation
Impact	Transportation to school is disrupted when water floods the roads

3.4.5 Hail

Hail is a form of precipitation that consists of solid lumps of ice, which are individually called hailstones. Hail formation requires an atmospheric environment of strong, upward moving air, called an updraft, within the subfreezing region of a thunderstorm cloud. Large hail stones greater than an inch in diameter (quarter size), can result from a severe thunderstorm and require a very powerful updraft to form. Most large hail is the product of supercell thunderstorms, which have a sustained rotating updraft that moves growing hailstones through the height of the cloud before falling to the ground.

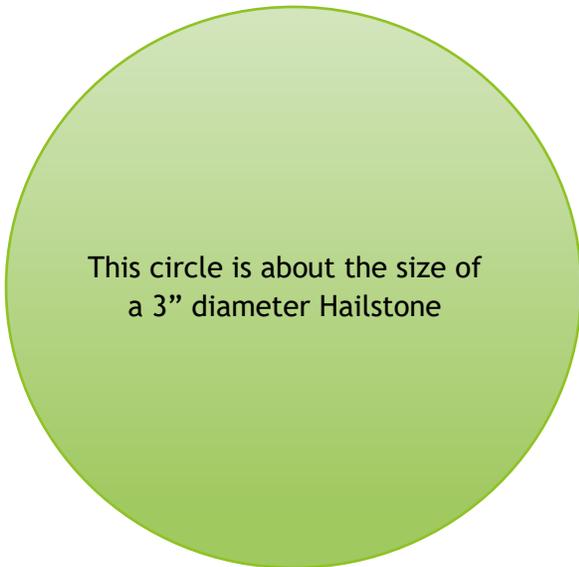
Another factor that affects the amount of damage that can result from hail is the speed at which it falls. Velocity is affected by the height of a falling object due to the constant acceleration of gravity. For small hailstones produced at lower atmospheric heights, the expected fall speed is between 9 and 25 mph. For hailstones that fall in a severe thunderstorm (1 inch to 1.75-inch in diameter), the expected fall speed is between 25 and 40 mph.

In the strongest, upper level supercells which produce some of the largest hail, the expected fall speed can reach between 44 and 72 mph or more. While there is a degree of uncertainty in these estimates due to variability in a hailstone’s shape, degree of melting, fall orientation, and environmental conditions such as wind (NOAA, 2020), a 3 inch hailstone falling at 70 mph certainly has the potential to cause serious damage or death.

Location

Hail affects all jurisdictions in the planning area.

HAIL DIAMETER SCALE	
Diameter (Inches)	Description
1/4"	Pea
1/2"	Small Marble
3/4"	Penny or Large Marble
7/8"	Nickel
1"	Quarter
1 1/4"	Half Dollar
1 1/2"	Walnut or Ping Pong Ball
1 3/4"	Golf Ball
2"	Hen’s Egg
2 1/2"	Tennis Ball
2 3/4"	Baseball
3"	Teacup Size
4"	Grapefruit
4 1/2"	Softball



Extent

The planning area uses the Hail Diameter Scale to categorize Hail events. Hailstones of any size described on the chart can be expected to occur.

Previous Occurrences

There were 28 hail storms recorded by NOAA during the 10 year period January 2012 through December 2021. Most hail recorded was between ¾ inch and 1 inch diameter. Ninety-six percent (96%) of all hail reported measured 2" or less. Records show one storm in 2012 produced hailstones up to 3 inches across.

Probability of Future Events

Hail falls in the planning area an average of two or three times each year. The probability of a hail event is greater than 100%; High probability.

Vulnerability and Impact

Injury to people or animals, damage to crops and structures varies with the size and velocity of hailstones and the duration of the event.

The cost of damages to buildings and infrastructure must be borne by owners or insurance companies. Disruption of the economic purpose of affected structures is a cost which may be difficult to quantify and absorb.

HAIL REPORTS 2012-2020	
Size (inches)	# of Reports
.75	1
.88	3
1.0	10
1.25	3
1.5	2
1.75	6
2.0	2
3.0	1

HAIL	
Blaine County	
Vulnerability	Rural residential and agricultural structures of all vintage and a variety of construction materials are scattered throughout the county. Some of those are more vulnerable due to age of construction, siding materials or the type and age of roof
Impact	Roofs, siding and windows on residential and business are damaged
Vulnerability	Due to the relatively mild winters, personal vehicles, farm equipment and larger trucks are often stored outdoors
Impact	Damage to vehicles ranges from minor dents to total loss of value
Vulnerability	Hail events cause crop damage that ranges from minor to total loss Livestock frequently graze open land, away from roofed structures

Impact	The economic impacts of crop loss affect families quality of life and reduces tax revenues for local services Unsheltered livestock are stressed or injured
Vulnerability	Infrastructure such as electrical power lines, transformers and associated equipment is exposed to the weather
Impact	Utility equipment is damaged by large hail, causing loss of power
Cities and Towns	
Vulnerability	Structures date from 1887 to 2021; older roofs are more vulnerable to damage from hail. Among towns, 10% to 30% of people are below the poverty level; 61% of households are below median income.
Impact	Roofs, siding, windows and appurtenances on residential and commercial structures suffer damage from hail events. Lower income families may not be able to maintain structures in good repair or purchase better quality materials. Poor quality roofing and siding is more easily damaged, and trees are less likely to be maintained
Vulnerability	Due to the relatively mild winters, personal vehicles, equipment, trucks and RVs are often stored outdoors
Impact	Damage to structures and vehicles ranges from minor cosmetic damage to total loss of value
Vulnerability	Municipal utility services such as electric power and communication systems vulnerable to hail are exposed to weather
Impact	Large hail can impact trees and power lines. Damage to electrical infrastructure from tree damage and hail causes loss of power, and secondary effects such as impaired emergency communication and failure of home medical equipment
School Districts	
Vulnerability	Buildings, buses and other vehicles, outdoor structures are exposed to the weather
Impact	Hail damages roofs, siding, windows and appurtenances, vehicles stored outside. Lighting and scoreboards on athletic fields are damaged by hail
Vulnerability	Outdoor activities and sports events draw large crowds
Impact	People who are caught outdoors in a hail event may be injured

3.4.6 High Winds

High winds can result from thunderstorms, strong cold front passages, or gradient winds between high and low pressure. Damaging winds are often called “straight-line” winds to differentiate the damage they cause from tornado damage. Downdraft winds are a small-scale column of air that rapidly sinks toward the ground, usually accompanied by precipitation as in a shower or thunderstorm. A downburst is the result of a strong downdraft associated with a thunderstorm that causes damaging winds near the ground. For wind speed definitions, see Chart below.

Location

High winds affect the entire planning area. Western Oklahoma is perceived by most people to be very windy under typical conditions. Average wind speed in Blaine County is estimated to be about 16.6 mph according to the website USA.com (Wind, 2021). Weather patterns and low relief topography pose little resistance to wind in the region.

Extent

The Planning Area uses the Beaufort Wind Scale to categorize High Wind. According to the Beaufort Wind Chart (below), the Planning Area can expect any range or Beaufort Number from 0 - 12.

Beaufort Number	MPH		Terminology	Description
	Range	Average		
0	0	0	Calm	Calm. Smoke rises vertically.
1	1 - 3	2	Light air	Wind motion visible in smoke.
2	4 - 7	6	Light breeze	Wind felt on exposed skin. Leaves rustle
3	8 - 12	11	Gentle breeze	Leaves and smaller twigs in constant motion.
4	13 - 18	15	Moderate breeze	Dust and loose paper is raised. Small branches begin to move.
5	19 - 24	22	Fresh breeze	Smaller trees sway.
6	25 - 31	27	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult.
7	32 - 38	35	Near gale	Whole trees in motion. Some difficulty when walking into the wind.
8	39 - 46	42	Gale	Twigs broken from trees. Can veer on road.
9	47 - 54	50	Severe gale	Light structure damage.
10	55 - 63	60	Storm	Trees uprooted. Considerable structural damage.
11	64 - 73	70	Violent storm	Widespread structural damage.
12	74 - 95	90	Hurricane	Considerable and widespread damage to structures.

Previous Occurrences

According to the NCDC storm database From January 2012 to December 2021, records indicate 22 high wind events in the Planning Area.

Date	Event	MPH	Measured by:
2/1/2012	Drought & High wind	40-60	Other Federal Agency
5/18/2013	Thunderstorm Wind	51	Mesonet
6/5/2013	Thunderstorm Wind	55	Mesonet
7/29/2013	Thunderstorm Wind	52	Mesonet
6/23/2014	Thunderstorm Wind	52	Public
5/26/2015	Thunderstorm Wind	61	Amateur Radio
7/4/2015	Thunderstorm Wind	52	Public
12/27/2015	Ice Storm & High Wind	40-60	Utility Company
6/28/2016	Thunderstorm Wind	52	Amateur Radio
8/7/2016	Thunderstorm Wind	63	Emergency Manager
8/25/2016	Thunderstorm Wind	52	Law Enforcement
9/17/2016	Thunderstorm Wind	52	Emergency Manager
10/6/2016	Thunderstorm Wind	55	Broadcast Media
12/25/2016	High Wind	50	Mesonet
4/29/2017	Thunderstorm Wind	61	Storm Chaser
6/14/2017	Thunderstorm Wind	51	Mesonet
6/25/2018	Thunderstorm Wind	54	Mesonet
3/13/2019	High Wind	52	Mesonet
6/4/2020	Thunderstorm Wind	52	Emergency Manager
7/10/2020	Thunderstorm Wind	51	AWOS
7/11/2020	Thunderstorm Wind	51	AWOS
9/7/2021	Thunderstorm Wind	61	Broadcast Media

Probability

Twenty-two events in 10 year period indicates a High probability that a high wind event will occur in any given year.

Vulnerability and Impact

The quality and age of building materials affect the resilience of structures during high winds.

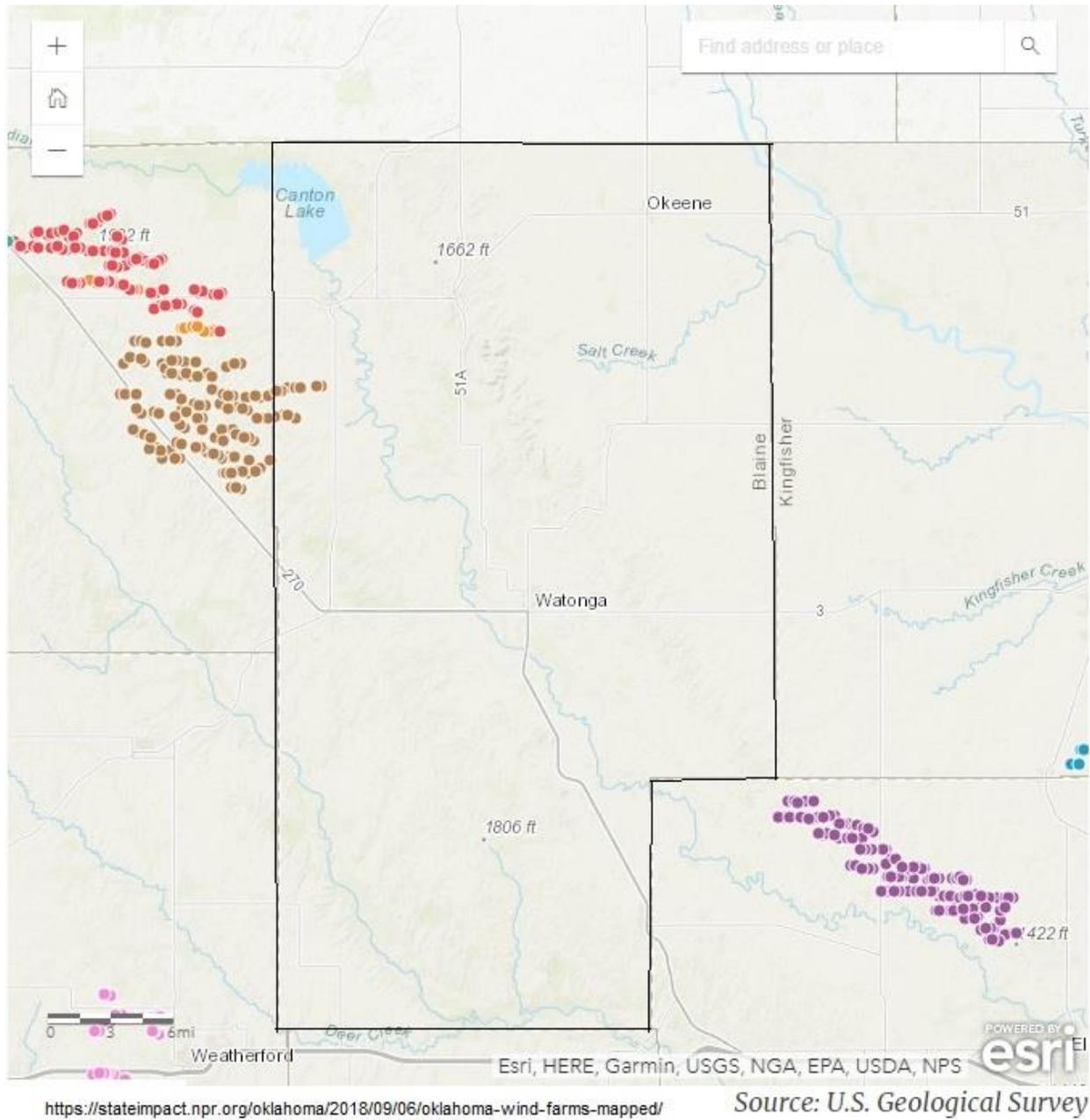
HIGH WIND	
Blaine County	
Vulnerability	Buildings, especially roofs are vulnerable to the effect of high wind. Depending on wind speed, debris of various material and weight is torn apart and carried aloft
Impact	People and livestock are impacted by airborne debris Eye injuries occur from debris in the air
Vulnerability	Utility infrastructure; above ground power lines and poles are vulnerable to high wind. Trees are uprooted or broken, limbs take down utility lines

Impact	Power outages cause secondary impacts such as endangering the health of people who may be dependent on power for medical devices
Impact	When electrical lines fall, it may be necessary to close roads until power companies can ensure public safety
Vulnerability	Semi-trucks and other high profile vehicles travel local highways to facilitate economic activity
Vulnerability	Because of the high number of jobs in natural resources and construction that require crews to be able move from one location to another for relatively short periods of time, there are many high-profile, lightweight RV's and campers utilized as living space in the county
Impact	Sustained winds of 30 mph or gusts of 45 mph or more make it difficult to drive high profile vehicles such as semi-trucks and RVs (NWS, 2020). Parked vehicles can be overturned at higher wind speeds depending on the weight of the load
Vulnerability	Wind increases the danger that fire will spread
Impact	Sparks become wildfires very quickly
City of Geary and Watonga	
Vulnerability	Residential, commercial and governmental buildings and utility infrastructure are exposed to damaging wind events.
Impact	Roofs are damaged by loss of shingles or other roofing material
Vulnerability	Trees are uprooted or broken
Impact	Uprooted or broken trees pull down power lines and block streets
Vulnerability	There are RV parks in Geary and Watonga, and private campers are stored outdoors in residential neighborhoods
Impact	RV's and campers are blown over and damaged by windblown debris
Vulnerability	There are 24 mobile homes in the City of Geary, and 62 in Watonga, while 95% of all housing in those cities was built before 2000
Impact	Mobile homes are less able than traditional homes to withstand the effects of high winds, especially those built prior to modern standards
Vulnerability	Many homes have satellite antennas or other appurtenances attached to walls or roofs which can become detached
Impact	Wind driven projectiles cause injury to people or animals, destroy windows and result in other property damage
Vulnerability	Wind delivers additional oxygen to fires
Impact	Wind increases fire intensity and spread
Towns of Canton, Greenfield, Hitchcock Longdale, Okeene	
Housing built before 2000	Canton = 96% Greenfield = 89% Hitchcock = 100% (only one built since 1940) Longdale = 82% (38% of housing is mobile homes) Okeene = 99%
Vulnerability	Residential, commercial and governmental buildings and utility infrastructure are exposed to extreme wind events

Impact	Older homes were built before modern building codes and some suffer from deferred maintenance. Roofs, siding and appurtenances are damaged by loss of material
Vulnerability	Where vacant lots are unkempt, some of the trees that grow there are less resilient species such as cottonwood, mulberry or poplar
Impact	Uprooted or broken trees pull down power lines, damage adjacent structures and block streets. On neglected lots, they become a nuisance and fire hazard
Vulnerability	Winds increase the possibility that fires will spread
Impact	Wind delivers additional oxygen to fires, increasing fire intensity and spread
Canton, Geary, Okeene, Watonga School Districts	
Vulnerability	School building windows have shatterproof film on them to protect them from flying debris during a high wind event
Impact	Students and staff are at higher risk of injury should flying debris impact classroom windows
Vulnerability	The schools are dependent on the municipal power system. These systems use above-ground power lines, which are susceptible to high wind damage
Impact	Power outages interrupt school operations and result in a loss of refrigerated food
Vulnerability	Debris of various weight and material is carried aloft
Impact	Wind-blown debris causes injury and property damage. Windows are broken
Vulnerability	High winds can move high profile vehicles such as school buses
Impact	High winds create dangerous conditions for transport of students

NOTE: Because of the consistent winds in western Oklahoma, there are wind farms in Blaine County. These turbines are regulated to shut down in extreme conditions. Map below.

Wind farms in and near Blaine County



NOTE: No legend is available for this interactive map. Visit the website to click on individual sites for detailed information <https://stateimpact.npr.org/oklahoma/2018/09/06/oklahoma-wind-farms-mapped/>

3.4.7 Lightning

Lightning is associated with thunderstorms. According to the National Weather Service, a thunderstorm is defined as a rain-bearing cloud that produces lightning. Lightning is a discharge of intense atmospheric electricity, accompanied by a vivid flash of light, from one cloud to another or from a cloud to the ground. Lightning is formed by the separation of positive and negative charges that occur when ice crystals collide high up in a thunderstorm cloud. As lightning passes through the atmosphere the air immediately surrounding it is heated, causing the air to expand rapidly. The resulting sound wave produces thunder.

Lightning often strikes outside of the heavy rain in the thunderstorm and may occur as far as 10 miles away from any rainfall. “Dry” thunderstorms that do not produce rain that reaches the ground are most prevalent in the western United States. Falling raindrops evaporate, but lightning can still reach the ground and can start wildfires. “Heat lightning” is actually lightning from a thunderstorm too far away for thunder to be heard.

All thunderstorms are dangerous. Every thunderstorm produces lightning. In the United States, an average of 300 people are injured and 80 people are killed each year by lightning (NWS, 2021).

According to the National Weather Service (NWS), cloud-to-ground (CG) lightning is the most damaging and dangerous form of lightning. Most flashes originate near the lower-negative charge center and deliver negative charge to Earth. However, an appreciable minority of flashes carry positive charge to Earth. These positive flashes often occur during the dissipating stage of a thunderstorm’s life.

Positive lightning makes up less than 5% of all strikes. However, despite a significantly lower rate of occurrence, positive lightning is particularly dangerous for several reasons.

Since it originates in the upper levels of a storm, the amount of air it must burn through to reach the ground is usually much greater. Therefore, electric fields associated with positive Cloud-to-Ground (CG) strikes are typically much stronger than those associated with negative strikes. The flash duration is also longer with peak charge and potential up to ten times greater as compared to negative CG strikes; as much as 300,000 amperes and one billion volts . . . Also, positive flashes are believed to be responsible for a large percentage of forest fires and power line damage. Thus, positive lightning is much more lethal and causes greater damage than negative lightning (NWS, 2021).

Location

All jurisdictions in the planning area are subject to Lightning hazard.

Extent

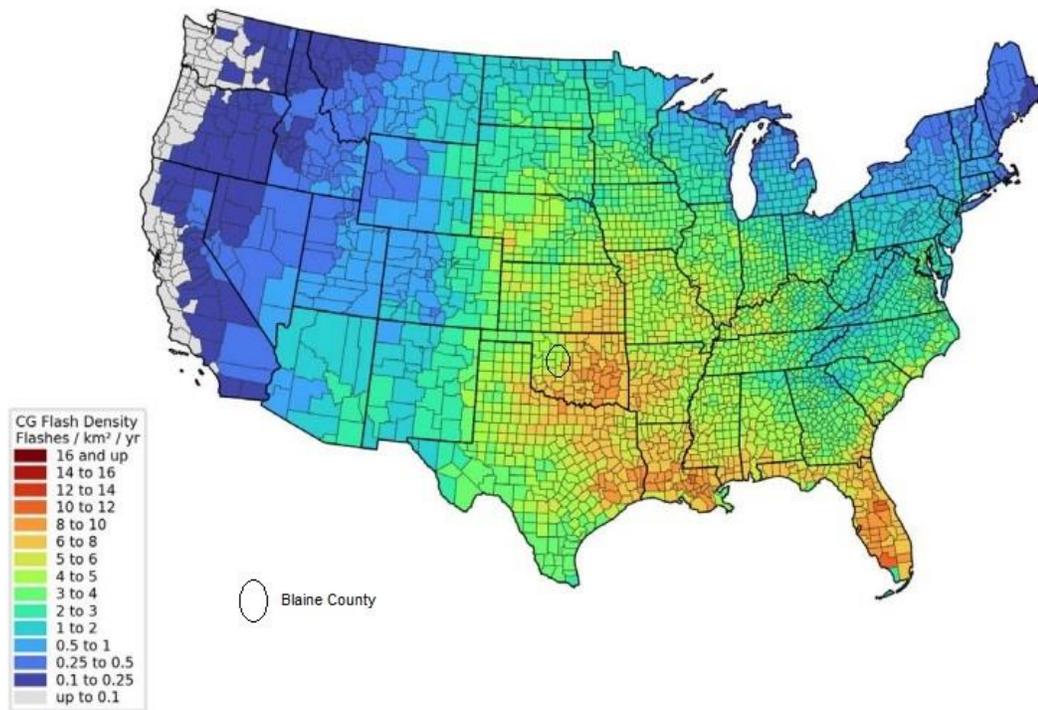
The Vaisala Flash Density scale is used to measure lightning in Blaine County. Evaluating lightning density gives an accurate picture of how much lightning occurs in states or counties of various sizes. Density is stated as cloud-to-ground (CTG) strikes per square km per year (Vaisalia, 2019). Lightning occurs frequently throughout the entire planning area each year. Lightning flash density values from 0 to 12 on the Vaisala maps scale can be expected to occur.

Previous Occurrences

For the period January 2012 through December 2021, there were 18 Thunderstorms recorded in the NOAA storm data record for Blaine County. During that decade, lightning events have damaged structures, electrical infrastructure and caused loss of power. The financial impact has not been tracked.

The 2015-2021 Vaisala Cloud-to-Ground Flash Density Map below shows that annual counts for cloud-to-ground lightning strike density in Blaine County 2015 through 2021 indicate an average frequency of about 4-5 flashes per square/km per year.

Cloud-to-ground flash density 2015-2020 per county



VAISALA

2021 ANNUAL LIGHTNING REPORT

© Vaisala 2022

Probability of Future Events

The NOAA storm data records that were evaluated covered 10 years; 2012 through 2021. Thunderstorm probability is about 2 storms per year. Lightning occurs at a frequency of 4-5 cloud to ground strikes per square kilometer every year. That results in a probability of greater than 100% that lightning hazard will occur in a given year; High probability.

Vulnerability and Impacts

Throughout the planning area, property, life and health are negatively impacted by lightning strike events. Direct impacts are those which result from physical proximity to a lightning strike, damaged communication equipment, or ignition of flammable material. Indirect impacts are those which occur as a secondary effect of a strike, such as when a breakdown in communication disrupts the emergency response system.

Tank Batteries

In rural areas, tank batteries are hit with some regularity. A tank battery is a group of containers used to store crude oil, located near production sites. When hit by lightning they can release a significant amount of hazardous material. Tank batteries are protected with lightning suppression devices, but according to some oil industry safety companies, existing industry standards have not kept pace with the advances in oil field technology. As a result, lightning & static related issues will continue to plague the industry. A contributing factor is the age of a tank battery installation, when corrosion reduces the protective effects of grounding devices over time (PetroG, 2015).

Blaine County OK

Tank Battery Fire caused by lightning strike extinguished with Novacool 0.5%, a bio-degradable firefighting foam.

Blaine County Training provided the footage. Hitchcock Volunteer Fire Dept was on scene.

Posted on YouTube Jun 12, 2020



Trees

Certain types of trees are more likely to be struck by lightning due to high starch or moisture content, including Ash, Maple, Oak, Pine and Poplar. When lightning hits a tree, the electrical current moves down the branches and trunk and heats the water within the tree into steam. This steam causes the affected areas to explode and often the tree will instantly splinter. Lightning-damaged trees are a liability in the landscape because they are more likely to drop branches or fall (Rawson, 2018).

Weedy, non-native, invasive and prolific, Red Cedar trees are especially hazardous due to high combustibility.

Red Cedar Trees have a high resin content.

“The sap is combustible; it’s almost like a car bomb going off if they get on fire.. they explode.. and a lit ember can go as far as a mile and a half to start another fire we have to deal with,” said Brian Maughan, Oklahoma County Commissioner.

Ok Energy Today 2022



LIGHTNING	
Blaine County	
Vulnerability	Blaine County is an agricultural community where people commonly work with machinery outdoors and animals graze on open land. Both are at risk for bodily injury or loss of life due to lightning strikes
Impact	People or animals struck by lightning need immediate lifesaving medical attention; the low density of the rural population means that Emergency responders may have to travel some distance in response to life-threatening events
Vulnerability	Lightning suppression devices are not installed on all county buildings. Many privately owned agricultural buildings are not equipped with lightning suppression devices.
Impact	Unprotected combustible structures ignite when struck by lightning
Vulnerability	Oil storage tanks are sited on rural parcels around the county. Known as "tank batteries" these structures are vulnerable to lightning strikes due to weathering of suppression devices
Impact	When tank batteries are hit by lightning, they burst into flame, destroying property, releasing hazardous material & contributing to the incidence of wildfire
Vulnerability	Most utility infrastructure is above ground and exposed to weather events which cause power outages
Impact	Power outages put health and life at risk for people who are dependent on electrical power to operate medical devices and ruins refrigerated food supplies
All Jurisdictions	
Vulnerability	There is a history of frequent periods of drought in western Oklahoma, which makes conditions so dry that lightning strikes are more hazardous
Impact	Lightning strikes start fires more readily during drought conditions when any spark can ignite ready tinder
Vulnerability	Invasive Red Cedar is present throughout the planning area

Impact	Red Cedar is very combustible and tends to take over neglected areas
Vulnerability	Most residential, commercial and municipal structures lack lightning suppression devices
Impact	Electronics inside buildings are destroyed by the power surge of a lightning strike passing through the electrical grid, which can disable critical communication systems
Vulnerability	Utility infrastructure is exposed to weather and components are vulnerable to lightning damage, particularly electrical transformers or substations
Impact	Power loss puts the health of individuals at risk when home medical equipment is reliant on electricity or extreme temperatures threaten health (See also Sec 5.3)

People have to remain aware of lightning hazard when using outdoor recreational facilities such as golf courses and swimming pools.

Golf Courses	
Okeene Golf Course	401 South Phillips Street Okeene, OK
Roman Nose Park Golf Course	Oklahoma 8A Watonga, OK
Watonga Golf Club	861 Airport Road Watonga, OK
Fairview Golf Course	N 2470 Rd, Longdale, OK (operated from Fairview OK)
Swimming Pools	
Canton Swimming Pool	N Armor, Canton, OK
Geary Swimming Pool	W Embree Dr, Geary, OK
Okeene Swimming Pool	309 S Phillips St, Okeene, OK
Roman Nose Park	Watonga, OK 73772

City of Geary, City of Watonga, Town of Okeene	
Vulnerability	People working outdoors or using outdoor recreation areas such as the municipal golf course, swimming pool and local parks are exposed to lightning
Impact	Staff at the golf course and the municipal pool must rely on anecdotal information and personal experience to determine when facility visitors must seek shelter from lightning
Town of Canton	
Vulnerability	People working outdoors or using outdoor recreation areas such as the municipal swimming pool and local parks are exposed to lightning
Impact	Staff must maintain awareness and authority to protect people from risk of lightning
Canton, Geary, Okeene, Watonga School Districts	
Vulnerability	School buildings, play yards and sports stadiums are among areas where lightning can be a danger to people and property
Impact	Electronic scoreboards can be struck; metal bleachers exposed to lightning place people at additional risk
Vulnerability	Staff, parents and students don't have a clearly articulated plan for dealing with lightning
Impact	Misunderstandings occur among parties when lightning strike protocols for safety are unclear

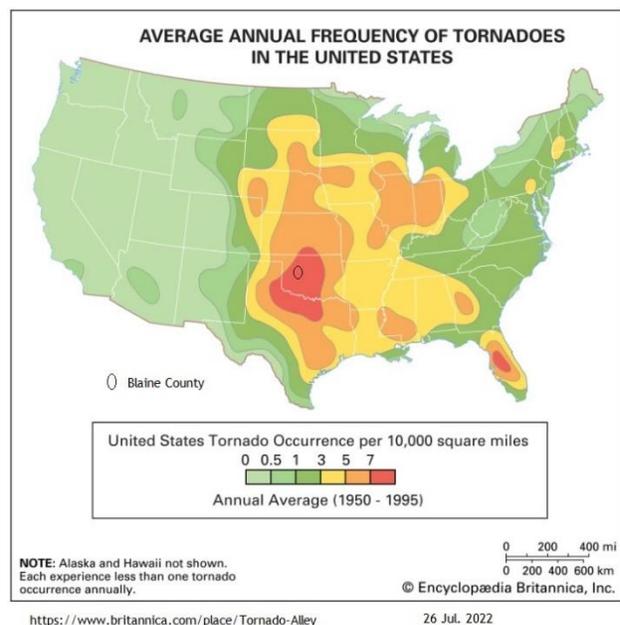
3.4.8 Tornado

Tornadoes are violently rotating columns of air that reach from the bottom of a cumulonimbus cloud to the ground. Tornadoes are found in severe thunderstorms, but not all severe thunderstorms produce tornadoes. While all tornadoes touch both the ground and the bottom of a cloud, it is possible for only part of the tornado to be visible.

A tornado may be on the ground for only a few seconds, or last for over an hour. They can appear in a variety of shapes and sizes, ranging from thin, rope-like circulations to large, wedge-shapes greater than one mile in width. However, a tornado's size is not necessarily related to its wind speed. The strongest tornadoes can have wind speeds in excess of 200 mph. In NW Oklahoma, most tornadoes occur between 3PM and 9PM, during the months of March through May, but may occur anytime the necessary atmospheric conditions of wind shear, lift, instability, and moisture are present.

Blaine County lies in a weather area often referred to as Tornado Alley, characterized by interaction between cold, dry air from Canada, warm to hot, dry air from Mexico and the Southwestern U.S., and warm, moist air from the Gulf of Mexico. Meteorologically, the region is ideally situated for the formation of supercell thunderstorms, often the producers of violent (EF-2 or greater) tornadoes (NOAA, 2022).

The interactions among these three contrasting air currents produces severe weather with a frequency virtually unseen anywhere else on our planet. An average of 62 tornadoes strike the state each year - one of the highest rates in the world by square mile of land area. (US Tornado Climatology, 2010).



Location

Blaine County has a history of tornado activity. Tornadoes affect the entire planning area.

Extent

The scale of intensity for tornadoes in Blaine County is measured by the Enhanced Fujita Scale as illustrated below. The Planning area can expect tornadoes of any magnitude on the scale to occur.

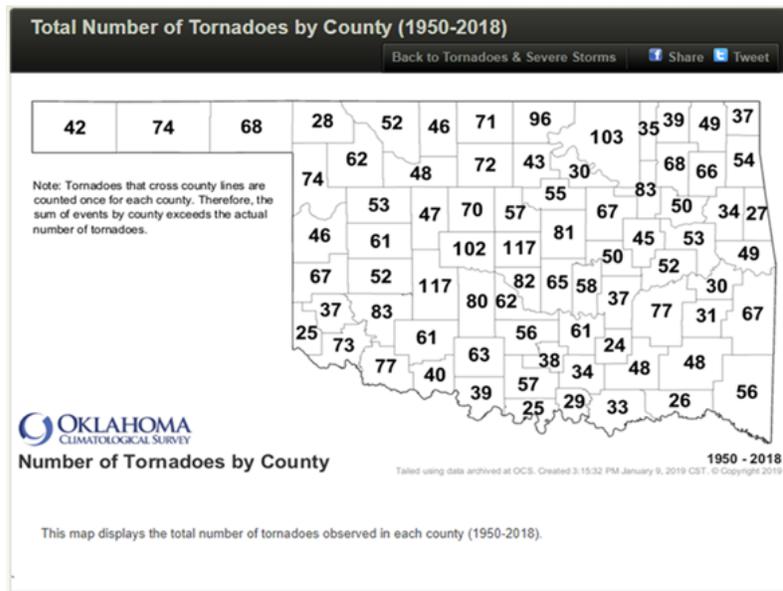
The Enhanced Fujita Scale or EF Scale (which became the standard in 2007) is used to assign a tornado a 'rating' based on estimated wind speeds and related damage. When tornado-related damage is surveyed, it is compared to a list of Damage Indicators (DIs) and Degrees of Damage (DoD) which help estimate better the range of wind speeds the tornado likely produced. From that, a rating (from EF0 to EF5) is assigned.

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

Previous Occurrences

Between 1950 and 2018, 68 tornadoes were recorded in Blaine County, with many more occurring in adjacent counties. In regard to the graphic shown to the right, it should be noted that tornadoes that cross county lines are counted as an event for each county. NOAA storm records from 2011 through 2020 below, show ten Tornado events in Blaine County (NOAA, 2021).

During the study period 2012 through 2021, there are five instances of tornado reported for Blaine County in the NOAA storm database.



NOTE: The classification of tornadoes in Blaine County should be viewed with the caveat that tornadoes are rated on the EF Scale by evaluating the amount of damage to structures directly in the path. In low-density rural areas where few structures are present, a severe storm may bypass most homes, barns or buildings. Therefore, some tornadoes may not be assigned an EF Score if they have passed mostly through open range.

Tornado outbreaks are when more than one tornado occurs over a short period in a region.

Location	Date	Time	Event	Mag	Reported by
OKEENE	5/29/2012	1703	Tornado outbreak	UNK	NWS Employee
GEARY	5/31/2013	1620	Tornado outbreak	UNK	Other Federal Agency
GREENFIELD	4/18/2015	1445	Tornado outbreak	UNK	Storm Chaser
GREENFIELD	5/18/2017	1533	Tornado	EFO	Emergency Manager
LONGDALE	5/18/2019	1726	Tornado outbreak	UNK	Trained Spotter

Probability of Future Events

Over the period 2012-2021, five tornadoes were recorded in Blaine County, resulting in a 50% probability of a tornado in any year, Medium probability.

Vulnerability and Impact

The entire planning area is vulnerable to tornado hazard. Damage is caused by a combination of wind speed and debris carried by the wind. People, animals and every type of structure, farm, business, residential and public buildings are vulnerable to tornado damage, as are critical facilities, recreation areas, vehicles, crops, livestock and trees. High profile vehicles, campers, carports and mobile homes that are not properly anchored to the ground become unstable at wind speeds over 40 mph. Anchored mobile homes can be seriously damaged when tornadic winds gust over 80 mph.

Indirect effects. While structural damage is common, secondary impacts of tornado events can be equally serious, particularly the loss of power. Municipal wells and lift stations for sewage removal are powered by electricity. Communication equipment can be damaged, making the delivery of emergency services more difficult. Cellphone and radio towers are exposed to wind, rain and flying debris.

Power outages can take time to repair, putting health at risk for individuals dependent on medical devices. Food storage or buying a gallon of gas becomes a challenge during loss of electrical power. Post-storm impacts include the loss of the economic use of damaged buildings or equipment and the cost to repair.

One study showed that 50 percent of tornado-related injuries are suffered during rescue attempts, cleanup, and other post-tornado activities. Nearly a third of injuries resulted from stepping on nails. Because tornadoes often damage power lines, gas lines, or electrical systems, there is always a risk of fire, electrocution, or an explosion (CDC, 2012).

TORNADO	
Blaine County	
Vulnerability	People, animals and every type of structure, farm, business and residential buildings are vulnerable to tornado damage
Vulnerability	80% of homes in the county were built before 1980, 60% prior to 1960
Impact	Older structures and homes were not built in accordance with formal building codes, therefore the ability to withstand storms is unknown
Vulnerability	Most homes do not have tornado shelters on the property
Impact	People are forced to seek shelter in structures that were not designed to withstand tornadoes
Vulnerability	There are several RV parks in the county, including at Canton Lake, at Roman Nose State Park and off Highway 270 west of Watonga 15.3 percent of dwellings in Blaine County are Mobile homes
Impact	Unanchored RV's or mobile homes suffer damage at wind speeds over 40 mph; anchored mobile homes can be seriously damaged when tornadic winds gust over 80 mph (F0)

Vulnerability	Electric utility infrastructure is above ground
Impact	Downed power lines and wind-blown debris pose a danger to people and livestock; local roads and highways may have to be closed due to fallen power lines
Vulnerability	Trees on private property are not properly maintained
Impact	Trees are damaged when tornadic winds occur
All Cities and Towns	
Vulnerability	Most residential sites do not have private storm shelters
Impact	People are forced to seek shelter in structures that were not designed to withstand tornadoes, or travel to a public shelter
Vulnerability	Older residential structures in the towns are in various states of disrepair
Impact	Structures in poor repair are less resistant to the effects of tornadic winds
Vulnerability	There are RV parks in most towns, and RVs are stored outdoors on private property. Some dwelling structures are mobile homes
Impact	Unanchored RV's or mobile homes suffer damage at wind speeds over 40 mph; even anchored mobile homes can be seriously damaged when tornadic winds gust over 80 mph (EF1)
Vulnerability	Trees on private property suffer from deferred maintenance. Trees that are not properly cared for will lose branches or be uprooted more quickly than a well maintained tree
Impact	Trees that lose limbs cause injuries to people, damage structures and utility lines
Vulnerability	Electric utility infrastructure is above ground
Impact	Downed power lines and wind-blown debris pose a danger to people and livestock; local roads and highways may have to be closed due to fallen power lines
Geary, Okeene, Watonga	
Vulnerability	There are nursing homes in Geary and Okeene, and hospitals in Okeene and Watonga. One nursing home on the north side of the Town of Hydro, OK is in Blaine County. Nursing homes and hospitals are vulnerable due to the unpredictability of a tornado route and the difficulty of evacuating patients and staff that may be in the path of danger
Impact	In addition to the physical risk to people, post-storm impacts include the loss of the economic use of damaged buildings or equipment and the cost to repair

Canton, Geary, Okeene, Watonga School Districts	
Canton	Has a safe room
Geary	Does not have a safe room
Okeene	Has a safe room
Watonga	Has a safe room
Vulnerability	School buildings and sports facilities are vulnerable due to the unpredictability of a tornado path
Impact	People are always at risk when a tornado is present
Vulnerability	Children are separated from their families while at school
Impact	Staff caring for children separated from family face challenges of communication, safe reunification and authorization for medical care

3.4.9 Wildfire

Wildfire is an uncontrolled fire in a rural or wilderness area. The majority of wildfires occur when precipitation is low. A wildfire often begins unnoticed and can spread quickly, lighting brush, trees, and structures. There are three different classes of wildfires. A *surface fire* is common in grasslands, or areas with open vegetation, and can spread quickly. A *ground fire* is a dense, very hot fire that has a thick fuel source and significantly damages the soil health where it occurs. *Crown fires* are those that move by jumping along the tops of trees. Wildfires often begin unnoticed, but are usually signaled by dense smoke that fills the area for miles around.

Location

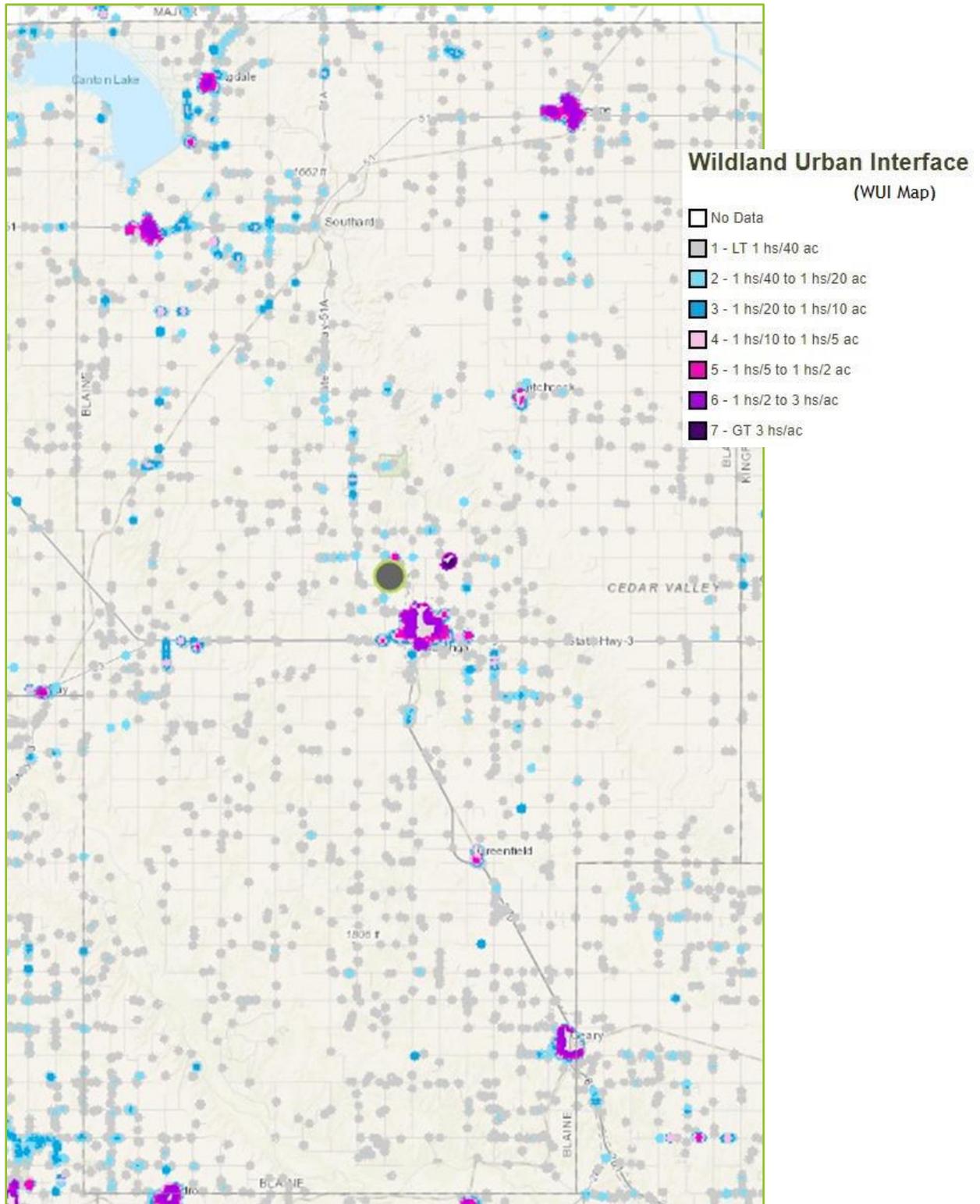
All participating jurisdictions are at risk from the danger of wildfire. Agricultural crops and rangeland are present throughout the planning area, and surround all jurisdictions. Areas with Red Cedar trees are especially flammable. Masses of dry, windblown plant materials build up in fence rows, brushy places and abandoned farmsteads, creating a tinderbox for sparks.

The Planning Area has eight volunteer fire departments. They are Canton, Eagle City, Geary, Greenfield, Hitchcock, Longdale, Okeene and Watonga Fire Departments.

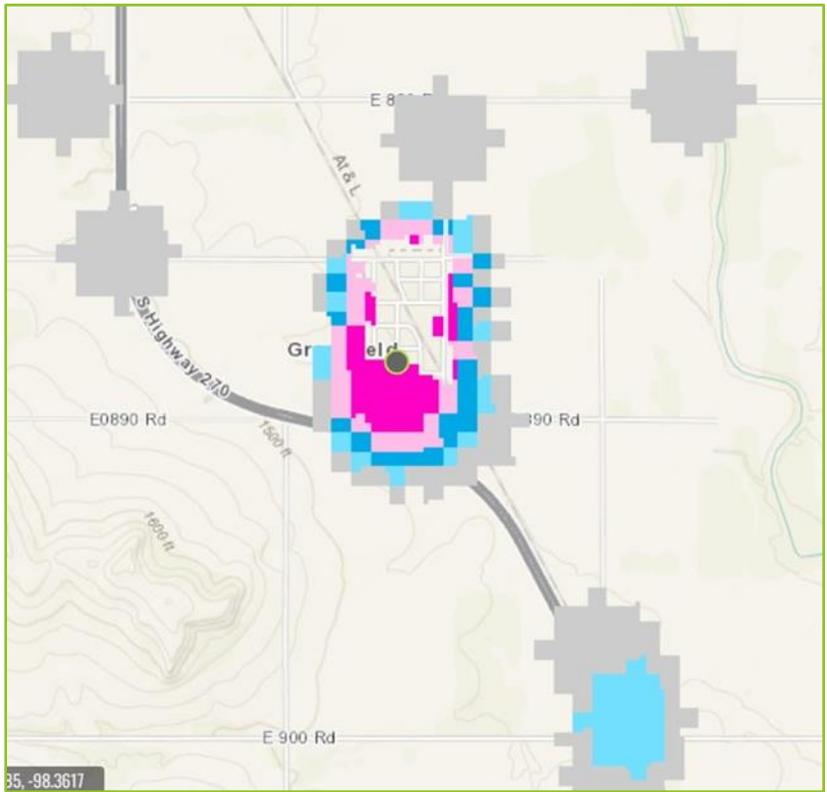
A fire that starts as a rural wildfire can quickly become a threat to rural structures and towns. The Wildland/Urban interface is illustrated in the map below (WUI, 2020). Brightly colored areas indicate residential clusters. Intensity of color indicates greater density of residential structures.

Wildland Urban Interface Maps

Blaine County



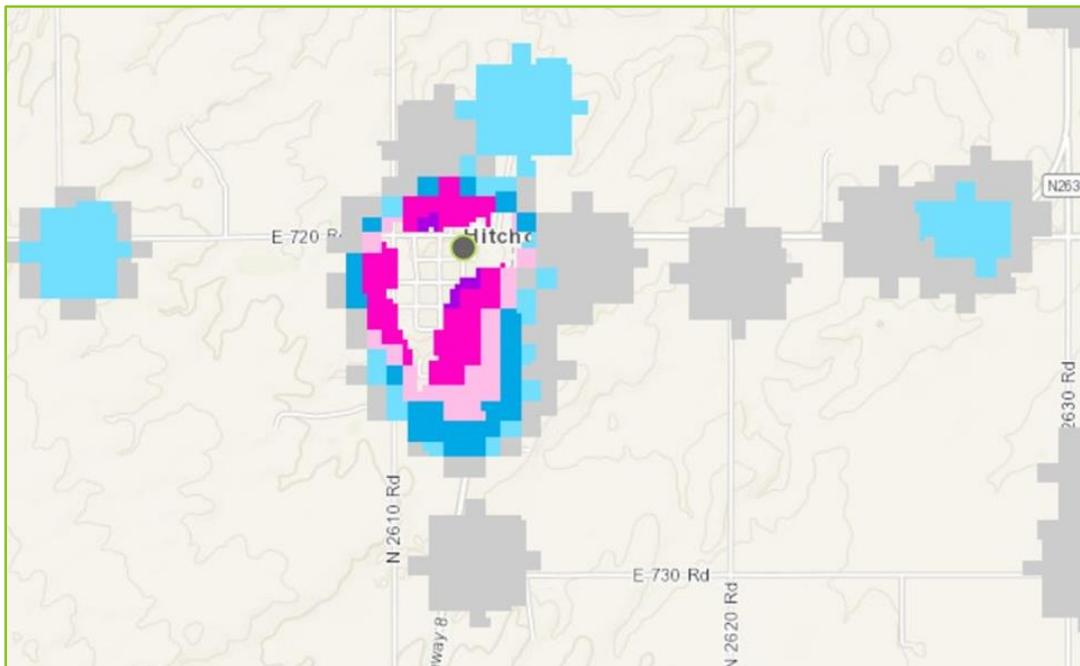
Town of Greenfield



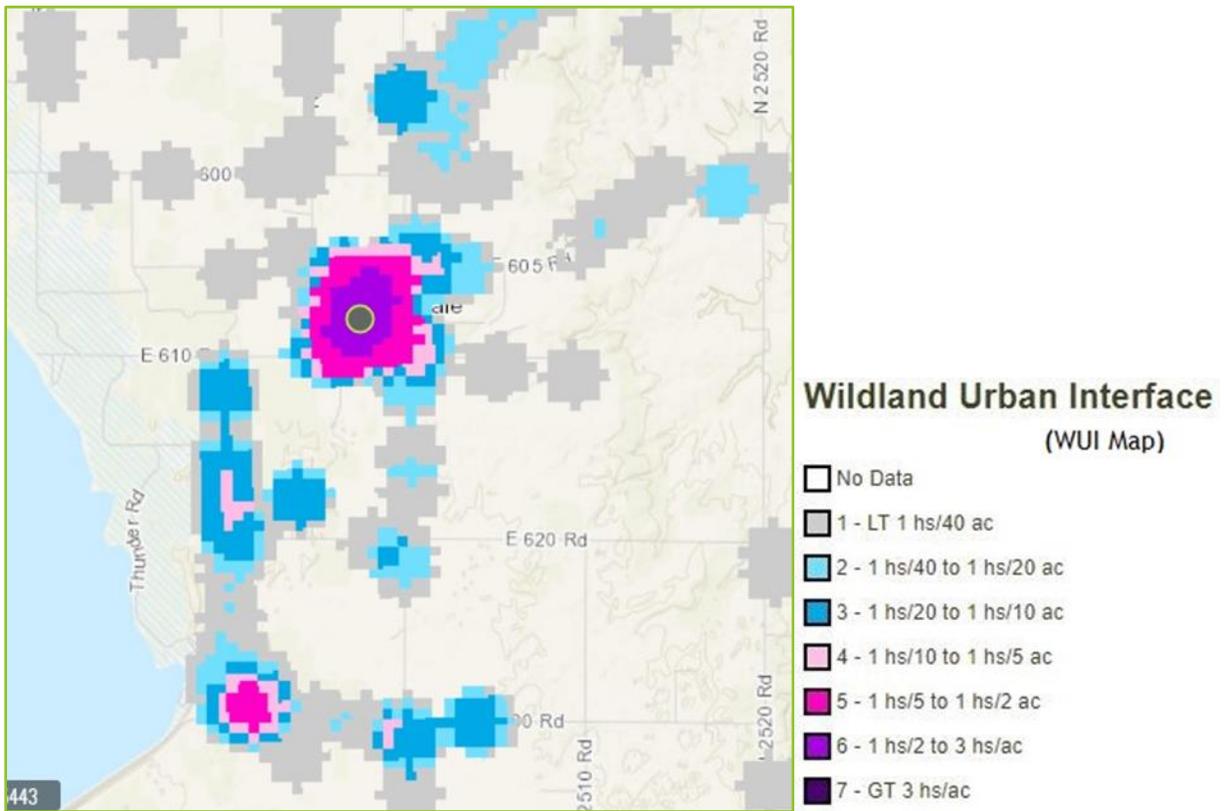
Wildland Urban Interface
(WUI Map)

- No Data
- 1 - LT 1 hs/40 ac
- 2 - 1 hs/40 to 1 hs/20 ac
- 3 - 1 hs/20 to 1 hs/10 ac
- 4 - 1 hs/10 to 1 hs/5 ac
- 5 - 1 hs/5 to 1 hs/2 ac
- 6 - 1 hs/2 to 3 hs/ac
- 7 - GT 3 hs/ac

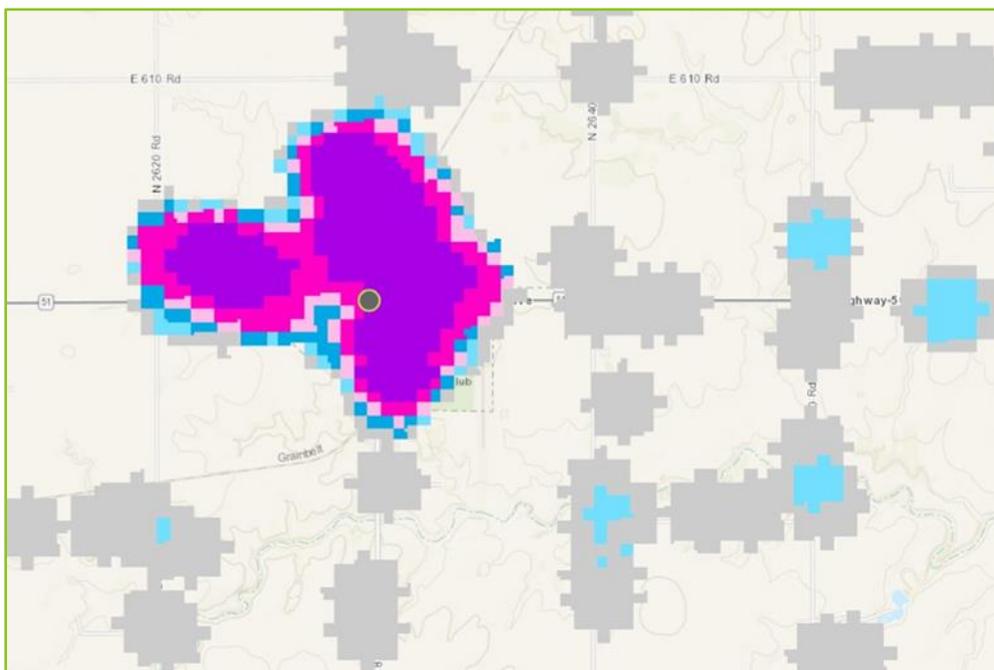
Town of Hitchcock



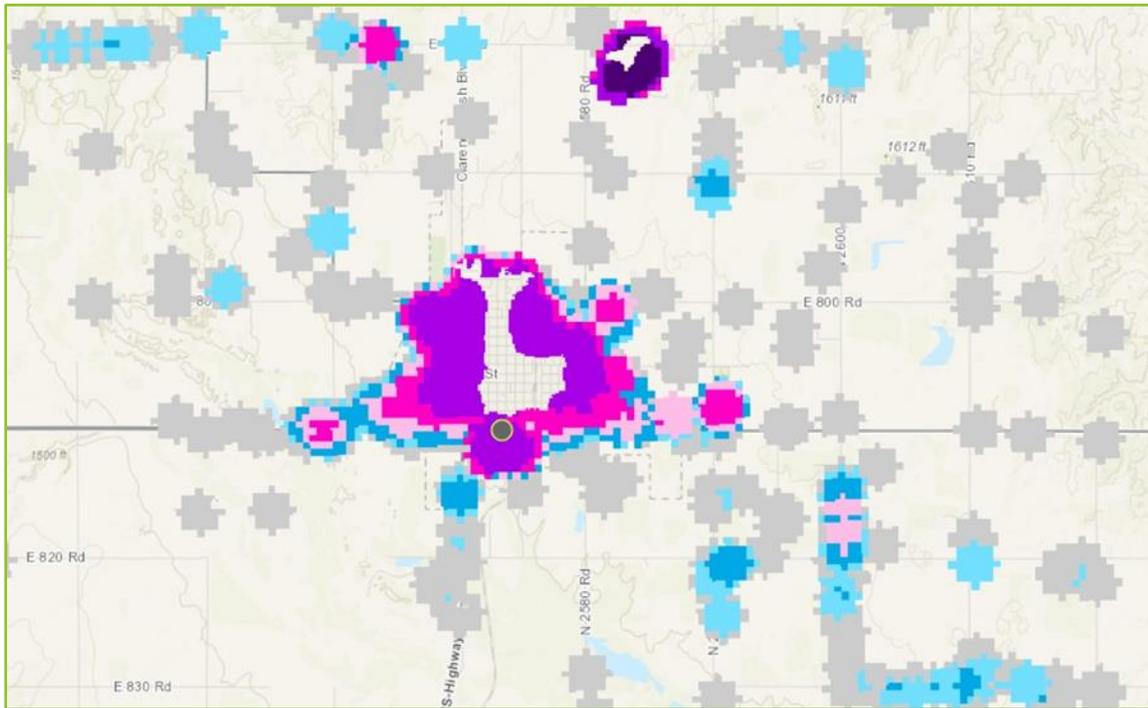
Town of Longdale



Town of Okeene



City of Watonga



Extent

Spreading surface fires in brush, crops or grass are the most common wildfires in Blaine County. Relative humidity has an effect on the potential for wildfire events. During times of high humidity, prescribed burns can be used safely to control vegetation and improve pasture. When humidity is low, the danger of wildfire increases rapidly.

The Keetch-Byram Drought Index and the Fire Danger Rating System are used to classify the danger of wildfires, based on the amount of soil moisture and humidity present at a given time. The planning area can expect any value on these scales to occur.

The Keetch-Byram Drought Index with Fire Danger Rating Data	
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 through the night and heavier fuels will actively burn and contribute to fire intensity

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 very 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/		

Previous Occurrences

Incidents of fire response are recorded by the Oklahoma Department of Forestry. Small, localized wildfires occur every year and are logged with all fire calls by local fire departments. The state does not track these small fires but does identify large fires when they require a coordinated response. These are recorded in the NOAA Storm data records.

Blaine County has had only one incidence of wildfire recorded in that database in the last ten years (NOAA, 2021), a wildfire outbreak associated with drought.

BEGIN_DATE	EVENT_TYPE	EPISODE_ID	REPORTED	EVENT_NARRATIVE	EPISODE_NARRATIVE
2/1/2012	Drought	60539	Other Federal Agency	D2 (severe) drought	The drought status changed little through the month. High winds that brought in very dry surface relative humidity dried out some of the near surface moisture, which caused a few wildfires to break out.

Other wildfires were recorded by the Oklahoma Department of Emergency Management (OEM).

- August 9, 2012 the Blaine County/Spur Fire burned 978 acres. More than 111,600 acres burned in fires across the state (OEM)

Local fire departments respond to calls for wildfire assistance from adjacent counties. Two examples are below:

- April 12, 2018 widespread fires were fought all over western Oklahoma. On April 20, 2018, OEM reported that a State of Emergency “remains in effect” for 52 Oklahoma counties (including Blaine) due to ongoing wildfires and critical fire weather conditions
- Blaine County was included in a State of Emergency declared for 22 Oklahoma counties due to ongoing wildfires and critical fire weather conditions that began March 7, 2017. Starbuck Fire (Beaver and Harper County) - 715,484 acres total in Oklahoma and Kansas Selman Fire (Harper and Woodward County) - 47,289 acres 283 Fire (Harper County) - 71,168 acres

Burn bans to prevent fire are frequently in effect.

Total fire calls of all type as reported by local Volunteer Fire Departments are shown in the table below. These records provide an incomplete record since not all FDs report all their calls.

Year	# of Runs	Acres Burned	Cost of Loss Reported	Fire Departments with Missing Data
2012	75	11,979	\$450,750.00	Hitchcock
2013	66	448	\$3,500.00	Hitchcock
2014	154	191	\$63,570.00	
2015	95	9,737	\$91,000.00	
2016	112	3,077	\$76,500.00	Canton, Eagle City, Hitchcock
2017	130	2,296	\$81,815.00	
2018	127	4,065,127	\$7,700.00	Canton, Eagle City, Greenfield, Longdale
2019	102	665	\$59,890.00	Canton, Eagle City, Greenfield
2020	93	1,614	\$66,040.00	Canton, Eagle City, Greenfield
2021	-	-	-	Not reported at this time

Probability of Future Events

Over the last ten years (2012 - 2021) there have been two severe wildfires, the 2012 Geary Fire, and the Rhea Fire in 2018, the most destructive. Many smaller wildfires occur every year and the probability that a wildfire will occur during any year is greater than 100%; High probability.

Vulnerability and Impact

The entire planning area is vulnerable to wildfires, especially during times of low precipitation. Periods of drought and low humidity together with ever-present winds create extremely volatile conditions where any spark is blown to life.

Some parts of the Planning Area experience a higher risk of wildfires due to pastureland or crops adjacent to the municipal boundary. There is heightened risk just before, during and after harvest when the crop plants are at their driest.

Nearly all firefighters in the region are volunteers. Any fire can become a wildfire when response teams are too far away. Therefore, it is necessary to support the many small but well trained Volunteer Fire Departments to improve response capability and reduce the potential for injury, loss of life and property.

Eastern Red Cedar is a highly flammable and invasive tree species that occurs throughout Blaine County. While some Red Cedar trees were native to NW Oklahoma, they were controlled by regular prairie fires. After 1900, the land was converted to agriculture and fire was suppressed. During the Oklahoma Dust Bowl in the 1930's many more of these trees were planted to form windbreaks. Today, Red Cedar is considered a noxious weed; it spreads readily and takes root in old shelterbelts, fence lines, and abandoned farmsteads. The Russian thistle is another noxious weed. Mature plants break off at ground level, creating windblown tumbleweeds that collect in fencerows or any brushy area, providing very dry tinder.

After the threat to humans, impacts of wildfires on livestock are especially tragic. Cattle moving away from a fire become trapped in fencing. After the 2018 Rhea Fire, hundreds of animals had to be shot to end their suffering; the carcasses bulldozed into burial pits.

WILDFIRE	
Blaine County	
Vulnerability	Highly invasive and flammable Red Cedar grows in shelterbelts, abandoned farmsteads, fencerows and on fallow land. Due to the nearly constant vigorous wind, tumbleweeds and dry brush collect in masses along fences and fill abandoned farmyards
Impact	The environmental conditions create a situation where any spark can ignite dry grass or tinder and quickly become a wildfire. For example, spot welding of fences is one example of a typical cause of wildfire throughout western Oklahoma
Vulnerability	Extended periods of drought are common in the planning area; drought with low humidity increases the danger of wildfire
Impact	Loss of life and property damage is the impact of wildfire. People must be safely evacuated. One severe impact is when livestock becomes trapped by fencing and cannot escape the fire

Impact	The loss of crops, livestock, agricultural buildings and residential structures carries a tremendous economic cost both in terms of initial losses and continuing until items can be rebuilt or replaced
Vulnerability	Above ground utility infrastructure is located throughout the county and electric power lines often run along fencerows where flammable vegetation collects
Impact	Power lines are burned or left hanging when the poles burn off at ground level
Vulnerability	838 people over age 75 live in Blaine County
Impact	Older people may not be able to drive to safety. The low density of the population means these residents are spread widely across the landscape, complicating evacuation efforts
City of Geary and Watonga, Towns of Canton, Greenfield, Hitchcock, Longdale, Okeene	
Vulnerability	Range or cropland is adjacent to municipal boundary; large fires can encircle a town
Impact	Citizens do not always know which direction they should travel to evacuate safely
Vulnerability	Fire causes loss of life and destruction of property
Impact	Residents and business owners may be forced to abandon valuable property and are sometimes reluctant to move to safety
Vulnerability	Many elderly people live alone in town
Impact	Elderly people may not be able to drive themselves to safety
Vulnerability	There are nursing homes in Geary and Okeene, and hospitals in Okeene and Watonga. One nursing home on the north side of the Town of Hydro, OK is in Blaine County. Nursing homes and hospitals are vulnerable due to the difficulty of evacuating patients and staff that may be in the path of danger
Impact	Infirm people are more difficult to evacuate. People with limited mobility such as hospital or nursing home patients suffer added stressors to health during evacuation
Canton, Geary, Okeene, Watonga School Districts	
Vulnerability	Firebreaks are not always sufficient near school properties
Impact	Wildfires can approach too near school structures, buffer zones are needed
Vulnerability	Large quantities of smoke and ash are released into the atmosphere
Impact	Smoke and ash cause respiratory issues for children
Vulnerability	In the Public School Emergency Operation Plans, the protocol for fire is focused on evacuation from structural fires, while protocols for evacuation during wildfires are not specifically addressed
Impact	When children must be evacuated from town during school days or school events, while they are separated from their families, the lack of emergency protocols increases the likelihood for confusion about evacuation destinations and procedures
Impact	Misunderstandings and communication failures can occur among administration, staff, students, and parents when children are evacuated from a school facility, and especially if the town itself must be evacuated

3.4.10 Winter storm

Winter Storm can refer to a combination of winter precipitation, including snow, sleet and freezing rain. A severe winter storm can range from freezing rain or sleet to moderate snow over a few hours, or to blizzard conditions and extremely cold temperatures that last several days.

Blowing snow is wind-driven snow that reduces visibility and causes significant drifting. Blizzards occur when falling and blowing snow combine with winds of 35 mph or greater, reducing visibility to near zero.

Freezing rain is precipitation that falls, as liquid, into a layer of freezing air near the surface. When the precipitation makes contact with the surface, it forms into a coating or glaze of ice and even a small accumulation can cause a significant hazard.

Sleet is frozen precipitation that has melted by falling through a warm layer of the atmosphere and then refreezes into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and can accumulate like snow and become a hazard to motorists.

Ice storms are extended freezing rain events, lasting from several hours to days, when the freezing rain accumulates on surfaces and damages trees, utility lines, and roads. Ice loads on overhead power lines, combined with windy conditions, may cause the lines to “gallop.” This forceful motion often causes the lines to break away from the connectors and poles, resulting in widespread power failure.

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 from the National Weather Service shows the apparent temperature derived from both wind speed and temperature.

Location

The entire planning area is at risk from winter storms several times each year. Ice and freezing rain, snowfall, cold temperatures and wind pose a hazard to all residents and structures.

Extent

The Sperry-Piltz Ice Accumulation Index is used to categorize ice damage, as shown in the table below. Ice accumulation can be expected to occur at any level on the Sperry-Piltz Index. While serious winter weather events are not unusual, most storms in Blaine County are short-lived. It is unusual for snowfall to remain on the ground more than a few days (OKHMP, 2019).

The planning area also uses the National Weather Service (NWS) Windchill Chart to evaluate the potential for injury or loss of life due to low temperatures. Due to the unpredictable nature of winter storms, the planning area can experience a wide variety of temperatures referenced on the Windchill Chart (below). It is expected that temperatures of -20 or warmer can occur, with potential wind speeds at any level on the NWS chart, below.

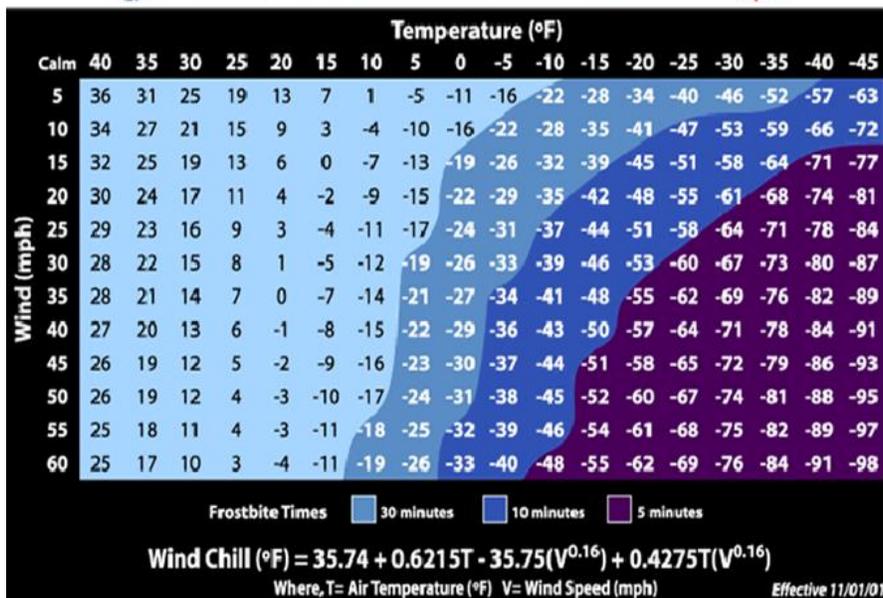
The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

ICE DAMAGE INDEX	DAMAGE AND IMPACT DESCRIPTIONS
0	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
2	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
3	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
4	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
5	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)



NWS Windchill Chart



Previous Occurrences

During the years 2012 and 2021, sixteen winter weather events are recorded for Blaine County in the NOAA data.

Winter Weather Events Table

BEGIN_DATE	EVENT_TYPE	SOURCE	EVENT_NARRATIVE
2/12/2013	Heavy Snow	Public	Areas around Fay saw 6 inches of snow, while Watonga picked up 4 inches.
12/25/2012	Winter Weather	Public	Two and a half inches of snow fell in western Blaine County.
2/21/2013	Winter Weather	Public	The second in a series of winter storms impacted portions of northern and western Oklahoma late on the 20th. Watonga measured 2.5 inches of snow, while areas northwest of Geary saw up to 3.7 inches of snowfall.
2/25/2013	Blizzard	COOP	Northern and western parts of the county began to see rain and snow during the late evening of the 24th. Snow became heavy and was accompanied by strong and gusty north winds by late morning on the 25. This lasted well into the evening. Snowfall totals varied greatly across the county, ranging from over a foot south of Eagle City, to around 7 or 8 inches at Watonga.
4/10/2013	Winter Weather	COOP	Up to a quarter inch of ice accumulated on elevated surfaces. No accumulation on roads, bridges, or sidewalks.
12/5/2013	Winter Weather	Public	Wintry precipitation came in all forms. Freezing rain, sleet and snow developed during the afternoon of the 5th. This transitioned to mainly snow by the evening hours. Very light snow continued into the morning of the 6th. By the time the storm had ended, areas around Watonga had picked up 1 inch of snow.
2/4/2014	Heavy Snow	Public	Moderate to heavy precipitation fell within a very deep sub-freezing air mass. By the time the storm ended, 4 inches of snow had fallen north of Watonga and 5 inches had fallen in Longdale.
3/4/2015	Winter Weather	Fire Dept	Snow and sleet fell, with significant impacts to travel. Light snow accumulations of around an inch fell in Watonga.
11/27/2015	Ice Storm	Em Manager	A four day event from the 26th through the 29th, shifted from rain to freezing rain. Freezing rain continued into early Sunday morning as temperatures continued to hover in the 20s to lower 30s. Damage estimates are from local power cooperatives
12/27/2015	Ice Storm	Utility Co	The 27th saw precipitation transition to sleet and freezing rain. Combined with high winds, this caused extensive damage to trees and power lines. By the 28th, all of the precipitation had turned to snow. Damage estimates reported by local power companies.
1/6/2017	Heavy Snow	Public	Public report of 5.5 inches.

10/26/2020	Ice Storm	Public	Ice accreted 0.60 - 1.25 across the county. Extreme freezing rain accumulations of at least 1.5 inches were reported in west-central Oklahoma over a 3 day period. Partial damage estimates reached \$104,000.
12/13/2020	Heavy Snow	Public	A general 3 to 5 inches fell across the county, with a maximum of 5 inches reported 1 N of Watonga.
1/1/2021	Heavy Snow	Public	Heavy snow fell during the early morning hours with a general 4 to 6 inches falling across the county. A maximum of 6 inches was measured in Watonga.
2/14/2021	Heavy Snow	Public	Reports from across the county ranged from 4 to 6 inches, with a maximum of 6 inches reported in Greenfield.
2/14-16/2021	Cold/Wind Chill	Mesonet	Below zero wind-chills were recorded for an extended period, with the coldest readings recorded on the morning of the 15th, when wind chills of -20 to -35 degrees were measured.

Probability of Future Events

Sixteen winter storms recorded over a 10 year period indicates a probability that such a storm is likely to occur more than once a year; 100% = High probability.

Vulnerability and Impact

Above ground electric utility infrastructure is vulnerable to ice, wind and snow, leading to loss of power. Ice accumulation causes tree damage and broken limbs which bring down power lines. Trees with weak branches include volunteer species such as Cottonwood, Elm, Poplar and Mulberry (Miller, 2021). Vacant lots in the planning area have such weedy trees.

Power loss during times of extreme temperatures has secondary impacts, especially for those who rely on electricity for medical support equipment. See Sec 5.3, Power Failure.

WINTER STORM	
Blaine County	
Vulnerability	The County maintains 1602 miles of roadways. Due to the temperate climate, Blaine County does not often need heavy plows and trucks to remove snow. Therefore, the County is less equipped to deal with a severe winter storm event than a similar municipality at a more northerly latitude. There may be an extended time period before secondary roads are fully cleared
Impact	Utility crews encounter difficulty reaching downed power lines in remote locations when roads are impassable
Vulnerability	Poor road conditions cause motorists to become stranded
Impact	Vehicle accidents due to heavy snow or icy roads and bridges put humans at risk of exposure to extreme temperatures, endangering health & life
Vulnerability	Groceries or medical services may be many miles away from rural homes
Impact	Access to essential supplies and medical services is disrupted, endangering health

Vulnerability	Many people in Blaine County work outdoors engaged in agriculture, natural resource extraction or construction. Humans, crops and livestock are vulnerable to extreme temperatures, making these outdoor activities more dangerous
Impact	Farm workers, utility crews and rescue personnel are exposed to extreme conditions, risking injury and loss of life
Impact	Economic losses to business and the tax base are incurred when agricultural production is impacted
Vulnerability	Due to older and above-ground electrical utilities, power outages occur when there is ice accumulation and wind.
Impact	Utility infrastructure is damaged by ice accumulation and wind. Power disruptions can endanger the health of people who rely on home medical equipment
Vulnerability	Few households have backup power generator systems in place
Impact	When power fails and roads cannot immediately be cleared, people can be isolated at home without heat or access to supplies or medical care
Impact	People are exposed to dangerously low temperatures in their homes and may resort to unsafe use of alternative heat sources including those that emit carbon monoxide
All Cities and Towns	
Vulnerability	Power outages occur due to ice accumulation and high winds
Impact	People are exposed to dangerously low temperatures in their own homes and may resort to unsafe use of alternative heat sources
Vulnerability	Travel conditions deteriorate
Impact	People are at risk of exposure in case of vehicle breakdown or accidents
Vulnerability	The temperate climate means the towns are not equipped for heavy duty snow removal
Impact	It can take street crews several days to clear all town streets
Vulnerability	Trees are damaged by the weight of ice loads
Impact	Falling tree limbs cause damage to structures and bring down power lines
Town of Canton	
Vulnerability	Power outages occur due to ice accumulation, storms and high winds
Impact	The Fire Dept, Police Dept and Town Hall are impacted by power outages
Towns of Greenfield & Hitchcock	
Vulnerability	Groceries or medical services are not available in the towns of Greenfield or Hitchcock; the nearest supplies are 8 to 12 miles away
Impact	Access to essential supplies and medical services is disrupted, endangering health
Town of Hitchcock	
Vulnerability	Hitchcock has a shelter to protect people during extreme weather events, however:
Impact	The community shelter does not have a generator for use during power outages

Canton, Geary, Okeene, Watonga School Districts	
Vulnerability	Travel conditions deteriorate
Impact	School staff, children and caregivers must travel in hazardous conditions to reach school or home, risking exposure
Vulnerability	The community does not have many heavy trucks or snow plows; secondary roads cannot be cleared immediately
Impact	While poor road conditions persist, schools are subject to cancellation or delay
Vulnerability	Above ground electric utilities are exposed to weather
Impact	Power outages frequently occur. When there is a loss of power, school must be cancelled. Power outages result in loss of refrigerated food in cafeteria

Chapter 4 Mitigation Strategy

4.1 Capabilities Assessment

The ability of a community to respond and recover from disasters is a function of the capabilities and resources available. Some of these capabilities include the skills of staff and employees; others are met by contracting for services on an as-needed basis.

In addition to staff skills, abilities and services, each incorporated municipality has the authority to impose regulations on land development, manage floodplains, and may be a provider of critical utilities or functions such as water, sewer, and electric services and waste collection.

For a good portion of each year, schools are responsible for nearly every child in a community and employ many other local people. Schools, therefore have a special interest in ensuring public safety from hazardous events. Other educational opportunities offered to a community can enhance the efficacy of pre-disaster planning and post-disaster management.

The tables below provide a summary of the administrative and technical capabilities currently in place in each participating jurisdiction. A mark (X) indicates that the jurisdiction was reported to have the authority to implement the specified regulatory tool and that the tool is currently in place.

4.1.1 Existing Institutions, Plans, and Ordinances

Jurisdiction	Building Code	Zoning Ordinance	Subdivision Ordinance	Special Purpose Ordinance	Growth Management Ordinance	Site Plan Review Requirements	Comprehensive Plan	Capital Improvement Plan	Economic Development Plan	Emergency Response Plan	Post-Disaster Recovery Plan
Blaine County	X									X	
Canton	X							2010			
Geary	X	X									
Greenfield	X							2020			
Hitchcock	X							2016			
Longdale	X							2007			
Okeene	X	X						2008			
Watonga	X	X						2022			

4.1.2 Administrative and Technical Capability

Jurisdiction	Planner or Engineer with knowledge of land development and management practices	Engineer or professional trained in construction practices related to buildings and fire	Planner or Engineer with an understanding of natural and/or human caused hazards	Floodplain Manager	Surveyors	Staff with education or expertise to assess the communities vulnerability to hazards	Personnel skilled in GIS and/or HAZUS	Scientists familiar with the hazards of the community	Emergency Manager	Grant writers
Blaine County	H		H	X	H		C		X	H/C
Canton	H		H		H		C		X	H/C
Geary	H		H	X	H		C		X	H/C
Greenfield	H		H		H		C		X	H/C
Hitchcock	H		H		H		C		X	H/C
Longdale	H		H		H		C		X	H/C
Okeene	H		H		H		C		X	H/C
Watonga	H		H	X	H		C		X	H/C
H = Hired by Project						C = Local COG				

4.1.3 Financial Capabilities

Jurisdiction	Capital Improvements Project Funding	Authority to levy taxes for specific purposes	Water, Sewer, Gas, or Electric service Fees	Incur fees for new development	Incur debt through general obligation funds and/or special tax bonds	CDBG Grant	Federal funding programs	State funding programs
Blaine County	X	X			X	X	X	X
Canton	X	X	X	X	X	X	X	X
Geary	X	X	X	X	X	X	X	X
Greenfield	X	X	X	X	X	X	X	X
Hitchcock	X	X	X	X	X	X	X	X
Longdale	X	X	X	X	X	X	X	X
Okeene	X	X	X	X	X	X	X	X
Watonga	X	X	X	X	X	X	X	X
Canton Schools		X			X		X	X
Geary Schools		X			X		X	X
Okeene Schools		X			X		X	X
Watonga Schools		X			X		X	X

4.1.4 Education and Outreach Capabilities

Jurisdiction	Local citizen groups/Non-profit organizations willing to assist with mitigation activities	Ongoing public education or information programs	Natural disaster or safety related programs	Storm Ready Certification	Firewise Communities Certification	Public-Private partnership initiatives addressing disaster-related issues
Blaine County		X	X			X
Canton						
Geary						
Greenfield						
Hitchcock						
Longdale						
Okeene						
Watonga						X
Canton Schools			X			
Geary Schools			X			
Okeene Schools			X			
Watonga Schools			X			

4.1.5 School District Capability Assessment

Question	Canton PSD	Geary PSD	Okeene PSD	Watonga PSD
Has your District had positive response to Bond issues in the past?	Yes	No		
Is your District growing or declining in population?	Steady	Steady		
Has the District taken measures to protect students from hazard events?	Drills/Built Safe Room	Drills		
List any hazard events that have damaged your school in the last 10 years		Lights blown down at FB Field		

4.1.6 Other School District Capability

Does the School District have:	Canton PSD	Geary PSD	Okeene PSD	Watonga PSD
Capital Improvement Plan	No	No	No	No
Emergency Management Plan (EOP)	Yes	Yes		

Budget to raise funds for mitigation (bonds)	Yes	No		
Public/Private partnerships, Corp donations	No	No		
Designated emergency manager	Yes	Yes		
PTO/PTA	Yes	No		
Lightning evaluation training for staff	Yes	No		
Post disaster recovery plan	No	Yes		

4.2 NFIP Participation

The Town of Canton, City of Geary, Town of Okeene and City of Watonga participate in the National Flood Insurance Program. The Town of Greenfield has chosen not to participate. The Towns of Hitchcock and Longdale do not have FIRM maps. FIRM maps for cities and towns can be viewed in Section 3.4.6, above. Maps for the unincorporated portions of Blaine County are in Appendix B of this document. For official maps, see your local Floodplain Administrator or go to the website FEMA Map Service Center.

4.3 Mitigation Goals

The purpose of mitigation is to save lives and reduce property damage. Mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event. In setting Goals, the planning team was guided by the State of Oklahoma Hazard Mitigation Plan (OKHMP, 2019). These were found to be appropriate for Blaine County.

Blaine County	Hazard Mitigation Goals
Goal 1	To protect life (reduce effects of hazards on people and livestock)
Goal 2	To protect property (reduce property damage)
Goal 3	To protect the environment (avoid environmental damage)
Goal 4	To increase public preparedness for disasters (prevention and safety)

4.4 Development of Action Steps

Mitigation can protect critical community facilities, reduce exposure to liability, and minimize disruption of community services. Examples of mitigation actions include land use planning, adoption of building codes, acquisition and demolition of structures in hazard-prone areas, or ensuring that appropriate shelters are available. Mitigation actions should be cost-effective and environmentally sound.

There are five mitigation action types:

- Local Plans and Regulations: Using authorities, policies, and codes to influence development

- Structure/Infrastructure Projects: Modifying or removing infrastructure to mitigate hazard
- Natural System Protection: Minimizing damage by preserving natural system functions
- Education and Awareness Programs: Informing citizens on how to mitigate hazards
- 5% Projects: Actions not quantifiable by a Benefit Cost Analysis, (i.e., sirens, generators, etc.)

Priorities

One method of prioritizing mitigation activities is to analyze each potential action by evaluating the “Social, Technical, Administrative, Political, Legal, Economic, and Environmental” (STAPLEE) effects of a proposed activity. This methodology was used to examine opportunities (benefits) and constraints (costs) of implementing each action from the perspective of all seven of the STAPLEE criteria.

STAPLEE Method of Mitigation Action Evaluation	
Category	Evaluation
Social	Community acceptance, Effect on segments of the population, educational
Technical	Technical feasibility, Long term solution, Secondary impacts
Administrative	Staffing, Funding available, Maintenance & operations
Political	Political support, Local leadership support, Public support
Legal	Jurisdictional authority, potential legal challenge
Economic	Benefits outweigh costs, contributes to economic goals, outside funding required
Environmental	Effect on land, water, species, consistent with sound environmental goals

Each of the STAPLEE categories were considered when developing action steps and that evaluation is recorded in the Action Tables below, labeled “Mitigation Action Evaluation.” The priorities of the community as stated during public meetings and by survey were compared with the STAPLEE categories of potential benefit as a means of measuring the qualitative benefit to the community, and a score of 1 to 7 was assigned to indicate the number of potential benefits represented by an Action.

Preference was also given to the hazards viewed by the public as presenting the most frequent problems and the most severe consequences. For example, planning committee discussions and community survey comments indicated the most common problem was power outages. Top hazard concerns were drought, tornado, wildfire, winter storm and high wind. Hail was frequently mentioned as a damaging event. Earthquake was uniformly the hazard of least concern.

4.5 Action Plan

Public comments indicate that the community would prefer to have a limited number of Action Items, because it may be more likely that fewer, targeted action items can be accomplished during the five year period, rather than trying to choose from an overwhelming number of potential activities. Therefore, we edited the ideas down to 19 specific suggestions. When progress on this plan is evaluated for a subsequent update, additional Action Items can be recommended for implementation.

Action Item 1	Help fund the installation of handicap accessible public shelters and/or safe rooms
Action Description	Apply for OEM/FEMA shelter grants, Safe Schools 101
Hazard(s) Addressed	Dam Failure, Extreme Heat, Tornado, High Wind, Winter storm
Jurisdiction(s)	All jurisdictions
Responsible Party	County EM, City & Town Administrators, Superintendent of Schools
Supports	Goals # 1, 4
Mitigation Type	Structure and Infrastructure Projects
STAPLEE Score	7: S,T,A,P,L,Ec,Env
Implementation Timeline	12-60 months
Cost	Staff time; grant matching funds up to 25% of total project cost
Potential Funding Sources	HM Grants, Community Budget, REAP funds

Action Item 2	Equip key buildings and shelters for generators, by either hard-wiring to accept generators or install fixed generators
Action Description	Provide safe shelter for residents during storms or power outages
Hazard(s) Addressed	Dam Failure, High Wind, Lightning, Tornado, Winter storm
Jurisdiction(s)	All jurisdictions
Responsible Party	County EM, City & Town Administrators, Superintendent of Schools
Supports	Goals # 1, 4
Mitigation Type	Structure and Infrastructure Projects
STAPLEE Score	S, A, P, Ec
Implementation Timeline	12-24 months
Cost	\$2,000
Potential Funding Sources	HMGP, Community Budget, REAP funds

Action Item 3	Install safety film, or movable shutters, to protect vulnerable windows in schools and city, town, and county offices
Action Description	Protect windows from breakage and reduce effects of extreme heat
Hazard(s) Addressed	EH, EQ, HW
Jurisdiction	All jurisdictions
Responsible Party	County EM, City & Town Administrators, Superintendent of Schools
Supports	Goals # 1,2,4
Mitigation Type	Structure and Infrastructure Projects
STAPLEE Score	S, T, A, Env
Implementation Timeline	12-24 months
Cost	\$1,000 - \$50,000
Potential Funding Sources	Annual budgets

Action Item 4	Install hurricane clips or reinforcement ties to protect vulnerable roofs and appurtenances from wind
Action Description	Assess and reinforce anchoring of roofs, satellite dishes, other appurtenances
Hazard(s) Addressed	HW
Jurisdiction	All jurisdictions
Responsible Party	County EM, City & Town Administrators, Superintendent of Schools
Supports	Goals # 2,4
Mitigation Type	Structure and Infrastructure Projects
STAPLEE Score	3: T,A,Ec
Implementation Timeline	0-36 months
Cost	\$500 - \$10,000
Potential Funding Sources	Annual Budgets, REAP

Action Item 5	Establish a 50 ft firebreak around structures and vulnerable areas
Action Description	With the cooperation of adjacent landowners, use county/city equipment and labor to create buffer zones
Hazard(s) Addressed	Wildfire
Jurisdiction	All jurisdictions
Responsible Party	County EM, City & Town Administrators, Superintendent of Schools
Supports	Goals # 1,2,3,4
Mitigation Type	Structure and Infrastructure Projects
STAPLEE Score	7: S,T,A,P,L,Ec,Env
Implementation Timeline	12-60 months
Cost	Depends on the size of the project
Potential Funding Sources	HMGP, Community Budget, REAP funds, Forestry

Action Item 6	Help fund installation of private storm shelters
Action Description	Assist homeowners to make applications for shelter grants
Hazard(s) Addressed	Tornado
Jurisdiction	Blaine County, Cities and Towns
Responsible Party	County EM, City & Town Administrators
Supports	Goals # 1,4
Mitigation Type	Local Plans and Regulations
STAPLEE Score	7: S,T,A,P,L,Ec,Env
Implementation Timeline	12-60 months
Cost	State grants may be available to cover a portion of the cost
Potential Funding Sources	OEM/FEMA shelter grants, Private funds

Action Item 7	Participate in the Firewise Communities program
Action Description	Adopting a Firewise strategy will enhance wildfire safety
Hazard(s) Addressed	Wildfire
Jurisdiction	Cities & Towns
Responsible Party	City & Town Administrators
Supports	Goals # 1,2,3,4
Mitigation Type	Local Plans and Regulations
STAPLEE Score	7: S,T,A,P,L,Ec,Env
Implementation Timeline	12-60 months
Cost	Staff Time
Potential Funding Sources	Annual budget

Action Item 8	Update and provide continual administration to insure NFIP compliance is maintained
Action Description	Maintain employment of a Certified Floodplain Manager or contract for CFM services
Hazard(s) Addressed	Flood
Jurisdiction	County, Cities & Towns
Responsible Party	County EM, City & Town Administrators
Supports	Goals # 1,2,3,4
Mitigation Type	Local Plans and Regulations
STAPLEE Score	7: S,T,A,P,L,Ec,Env
Implementation Timeline	12-24 months
Cost	Staff salary or contract
Potential Funding Sources	Annual budget

Action Item 9	Provide current floodplain maps and expansive soil maps
Action Description	Make Flood and Soil maps available to the public
Hazard(s) Addressed	Flood
Jurisdiction	County, Cities & Towns
Responsible Party	County EM, City & Town Administrators
Supports	Goals # 2,4
Mitigation Type	Local Plans and Regulations
STAPLEE Score	4: S,T,A,Env
Implementation Timeline	12-36 months
Cost	Negligible
Potential Funding Sources	Staff salary

Action Item 10	Correct flooding problems around Public buildings
Action Description	Adjust grade; build diversions, catch basins & retention ponds
Hazard(s) Addressed	Expansive soils, Flood
Jurisdiction	All Jurisdictions
Responsible Party	County EM, City & Town Administrators, Superintendent of Schools
Supports	Goals # 2,3,4
Mitigation Type	Natural systems
STAPLEE Score	7: S,T,A,P,L,Ec,Env
Implementation Timeline	12-36 months
Cost	\$0-5,000
Potential Funding Sources	Staff labor & equipment, Donations

Action Item 11	Enhance landscaping and design for public buildings using Xeriscape to conserve water
Action Description	Use the landscaping budget to improve design and plantings
Hazard(s) Addressed	Drought, Expansive soils
Jurisdiction	All Jurisdictions
Responsible Party	County EM, City & Town Administrators, Superintendent of Schools
Supports	Goals # 3
Mitigation Type	Natural Systems Protection
STAPLEE Score	4: S,T,Ec,Env
Implementation Timeline	12-60 months
Cost	\$500 - \$10,000
Potential Funding Sources	Annual budget

Action Item 12	Continue practicing fire, tornado, and other hazard drills within the school systems
Action Description	Training students to respond to emergency improves safety
Hazard(s) Addressed	Tornado, Wildfire
Jurisdiction	Schools
Responsible Party	Superintendents of Schools
Supports	Goals # 1, 4
Mitigation Type	Education and Awareness Programs
STAPLEE Score	3: S,T,A
Implementation Timeline	12-60 months
Cost	Negligible
Potential Funding Sources	Staff salary

Action Item 13	Conduct awareness programs for citizens and students to teach emergency preparedness
Action Description	Print brochures, distribute from County, City, Town and Schools
Hazard(s) Addressed	Dam Failure, Extreme Heat, Earthquake, Hail, Flood Tornado, Wildfire, Winter Storm
Jurisdiction	All Jurisdictions
Responsible Party	County EM, City & Town Administrators, Superintendent of Schools
Supports	Goals # 1, 4
Mitigation Type	Education and Awareness Programs
STAPLEE Score	3: S,T,A
Implementation Timeline	12-60 months
Cost	Negligible
Potential Funding Sources	Printing, Staff

Action Item 14	Promote the use of a 50 foot safety perimeter around homes, businesses and schools near the edge of town (wildfire urban interface)
Action Description	Print and distribute a brochure that shows the benefits of a firebreak or buffer zone
Hazard(s) Addressed	Wildfire
Jurisdiction	All Jurisdictions
Responsible Party	County EM, City & Town Administrators, Superintendent of Schools
Supports	Goals # 1, 2, 3, 4
Mitigation Type	Education and Awareness Programs
STAPLEE Score	4: S,T,Ec,Env
Implementation Timeline	12-60 months
Cost	Negligible
Potential Funding Sources	Printing, Staff

Action Item 15	Establish a program to implement a procedure to check on the safety of elderly and/or handicapped residents, before and after a hazard event
Action Description	Create a database of citizens who may be adversely affected by extreme temperatures or other hazard events, recruit volunteers
Hazard(s) Addressed	Dam Failure, Extreme Heat, Tornado, Wildfire, Winter Storm
Jurisdiction	Blaine County, Cities and Towns
Responsible Party	County EM, City & Town Administrators
Supports	Goals # 1, 4
Mitigation Type	Education and Awareness Programs

STAPLEE Score	2: S,A
Implementation Timeline	12-60 months
Cost	Negligible
Potential Funding Sources	Volunteer program

Action Item 16	Continued participation and support of map information services by providing Flood Insurance Rate Map (FIRM) information to the public
Action Description	Improve safety, assist the public, maintain compliance
Hazard(s) Addressed	Flood
Jurisdiction	Blaine County, Cities and Towns
Responsible Party	County EM, Town Administrators
Supports	Goals # 2, 3, 4
Mitigation Type	Education and Awareness Programs
STAPLEE Score	7: S,T,A,P,L,Ec,Env
Implementation Timeline	12-60 months
Cost	Printing & design time
Potential Funding Sources	In-house printing and distribution - Staff

Action Item 17	Conduct a public education campaign to inform the citizens of the benefits of using Xeriscape to conserve water
Action Description	Print a brochure that shows the benefits of Xeriscape & planting ideas
Hazard(s) Addressed	Drought
Jurisdiction	All Jurisdictions
Responsible Party	County EM, City & Town Administrators, Superintendent of Schools
Supports	Goals # 3
Mitigation Type	Education and Awareness Programs
STAPLEE Score	4: S,T,A,Env
Implementation Timeline	12-60 months
Cost	In-house Printing & design
Potential Funding Sources	Printing & Staff

Action Item 18	Distribute NOAA weather radios
Action Description	Distribute NOAA weather radio receivers to individuals, schools, hospital, nursing homes and other public facilities
Hazard(s) Addressed	Dam Failure, Hail, Tornado, Winter storms
Jurisdiction	Blaine County

Responsible Party	County EM
Supports	Goals # 1, 4
Mitigation Type	5% Projects
STAPLEE Score	4: S,T,A,Ec
Implementation Timeline	12-60 months
Cost	\$40 per radio
Potential Funding Sources	Local Emergency management funding; or paid by facility or individual

Action Item 19	Purchase and Install Generators To Power Critical Facilities
Action Description	Purchase generators for critical facilities in all jurisdictions
Hazard(s) Addressed	Dam Failure, Hail, High wind, Lightning, Tornado, Winter storms
Jurisdiction	All Jurisdictions
Responsible Party	County EM, City & Town Administrators, Superintendent of Schools
Supports	Goals # 1, 4
Mitigation Type	5% Projects
STAPLEE Score	4: S,A,P,Ec
Implementation Timeline	12-60 months
Cost	\$5000 - \$10,000
Potential Funding Sources	Staff labor, 5% funding OEM, REAP, Local funding

4.6 Integration of Data, Goals, and Action Items

Each jurisdiction in Blaine County will receive a copy of the 2022 Hazard Mitigation Plan Update so that the data, information, and hazard mitigation goals and actions be incorporated into other planning mechanisms. Regulations be adopted to facilitate implementation of Hazard Mitigation strategies. Hazard mitigation information and actions identified in this update will be incorporated into other plans when adopted or reviewed as follows:

Jurisdiction	Plan	When
Blaine County; Cities of Geary and Watonga, Towns of Canton, greenfield, Hitchcock, Longdale, Okeene	Comprehensive Plans (if adopted)	Annual review, 20 year update
	Blaine County Emergency Management Plan	Annual review, annual update
	Blaine County Post-Disaster Recovery Plan	Annual review, annual update
Cities of Geary and Watonga, Towns of Canton, Greenfield, Hitchcock, Longdale, Okeene	Capital Improvement Plans (if adopted)	Annual review, 5 year update
Canton, Geary, Okeene, Watonga Public School Districts	Emergency Operations Plans	Annual review, annual update
	Post disaster recovery plans (if adopted)	Annual review, annual update

The Blaine County Emergency Management Plan and the Post-Disaster Recovery Plan cover all jurisdictions and are reviewed by the Emergency Management Director on an annual basis.

The Emergency Management Directors for Blaine County, City and Town managers and public works directors review priorities for capital improvements as part of fiscal planning on an annual basis. The action items project list from the Hazard Mitigation Plan will be reviewed during the budget planning process to document progress and ensure on-going prevention, preparedness, response, recovery, and mitigation of identified hazards.

Capital Improvement Plans (CIPs) are reviewed on an annual basis by the City of Watonga, Greenfield, and Hitchcock for fiscal year budgets. The Towns of Canton, Longdale and Okeene are eligible to apply for CIP updates, and it is recommended that they do so to improve capability and hazard resilience. The City of Geary does not have a CIP on record, and they are encouraged to apply to the Oklahoma Department of Commerce for a planning grant for that purpose.

The Canton, Geary, Okeene and Watonga School Districts each have a School Board and a designated Emergency Manager who are responsible for review and update of Emergency

Operations Plans every year. The action items list from the Hazard Mitigation Plan will be reviewed during these plan updates to ensure the school district continues to seek opportunities to accomplish mitigation action items. Each Public School Board has the authority to distribute school funds and issue bonds as they pertain to proposed mitigation action projects. The public votes on bond issues to approve or deny funding.

Incorporation of previous HMP. The Oklahoma State Hazard Mitigation Plan incorporates local plans, including the Blaine County HMP, but local Capital Improvement Plans and School Emergency Operation Plans have been developed independently, and data or goals from the previous Blaine County HMP were not incorporated into those plans during the last 5 years.

Chapter 5 Plan Update and Prioritization Review

5.1 Changes in Jurisdictional Development

Two modest changes in development have occurred in Blaine County since the publication of the previous HMP. Those are: an increase in the number of Tank Batteries which are used as storage for petroleum products, and an increase in the number of wind turbines that have been built. Neither has made a significant change in vulnerability to hazard events in the county; both were addressed in this update as a component of utility infrastructure. No other changes in development have impacted the overall vulnerability of local jurisdictions. Housing and industry are both relatively stable.

5.2 Status of Previous Mitigation Action Items

The table below is a list of hazard mitigation actions that were recommended in the previous plan. Items in yellow will be carried forward in the new plan. While progress has been made on some items, none have been completed. Comments were received that the previous plan had too many suggested action items and the organization of the document made it unwieldy to use. These factors may have negatively impacted the utility of the previous HMP.

The community chose to carry forward items that seemed the most practical, and delete items that are either no longer seen as a priority, or are not really under the jurisdiction of the municipalities. The expressed goal is to produce a plan of action that can be realistically implemented in 5 years, then reevaluate the Action Items again.

Items marked in yellow will be carried forward to the new Action Plan. Some were combined for efficiency. A few items, such as purchase of additional firefighting equipment, were not included because they are not in the category of “Mitigation” under FEMA guidelines.

Actions Recommended in Previous Plan

Item #	Action	Keep in Plan?
1	Continue practicing fire, tornado, and other hazard drills within the school systems.	Yes
2	Analyze retention and flow for drainage improvements and make the necessary adjustments.	No
3	Install amperage meters to divert usage as needed.	No
4	Purchase irrigation adapters so fire trucks to connect to irrigation lines.	No
5	Promote the use of xeriscape plants to minimize the need of frequent watering.	Yes
6	Develop a debris removal program and educate the public on funds available to assist with private property debris removal.	No
7	Promote energy efficiency and the availability of resources for assistance with utility expenses.	No
8	Ensure privately owned dams are complying with relevant inspection/maintenance codes.	No
9	Conduct awareness programs for citizens to teach them tornado safety.	Yes

10	Educate floodplain residents on how to minimize flood damage by conducting workshops/information booths, distributing brochures, etc.	Yes
11	Prepare and/or distribute information to educate the public on how to protect themselves against natural hazards.	Yes
12	Develop a call list and system for contacting elderly, disabled and other citizens needing assistance after a hazard event.	Yes
13	Prepare & distribute info regarding better construction techniques.	No
14	Provide and/or promote locations for "cooling stations" during extreme heat days.	Yes
15	Investigate codes/incentives for new foundations to mitigate expansive soil damage. Pass ordinances establishing building codes to protect from expansive soils.	No
16	Establish an administrative procedure to inform builders to check for expansive soils.	No
17	Promote the benefits of metal roofing and the use of Class 4 impact-resistant shingles.	No
18	Educate public on hazards of cedar trees.	No
19	Develop/implement strategy to inform citizens, developers of dangers, costs related to expansive soils.	No
20	Prepare and/or distribute information regarding the dangers and signs of heat-related and cold-related stresses and inform the public of preventive measures in each case.	No
21	Prepare and/or distribute information on how to conserve water usage.	No
22	Provide informational booths, workshops, etc., on water conservation techniques.	No
23	Obtain equipment to help communicate and track status of storms.	Yes
24	Promote the use of a 50 foot safety perimeter around homes and businesses in the county	Yes
25	Obtain funding to remove or stabilize abandoned, unsafe buildings.	No
26	Educate/install safety film, or movable metal shutters, to protect vulnerable windows in schools and city, town, and county offices.	Yes
27	Establish a program to implement a procedure to check on the safety of elderly and/or handicapped residents.	Yes
28	Educate/install hurricane clips to protect vulnerable facilities in schools and city, town, and county buildings.	Yes
29	Designate shelters for generators to support multiple oxygen (making) machines, equip them by either hard-wiring to accept generators or install fixed generators.	Yes
30	Hard-wire critical facilities to be able to accept a generator backup.	Yes
31	Identify buildings at risk from 100 and 500-year floods.	Yes
32	Limit building in flood zone areas.	Yes
33	Document locations of private storm shelters.	No
34	Upgrade to larger transformers as older ones are replaced.	No
35	Clear limbs and dead trees on utility right of ways.	No
36	Tin horns and culverts that are too small, damaged, and/or have soil eroding from around it need to be replaced with appropriate sizes and properly installed.	No

37	Remove silt and debris from drainage channels, ditches, tin horns, culverts, etc.	No
38	Purchase and install dry hydrants around the county.	No
39	Distribute weather radios	Yes
40	Seek and obtain the use of an approved site for debris disposal.	No
41	Purchase generators	Yes
42	Obtain funding for cedar removal program	No
43	Purchase equipment to fight fires, and deter spread of hazardous materials.	Yes
44	Replace current roofing on schools, city, town, and county-owned buildings with metal roofing (and pitched if possible).	No
45	Implement a warning system to alert residents of possible dam failure and/or maximum spillway discharge.	No
46	Correct flooding problems around county and school buildings which have had flooding issues in the past.	Yes
47	Acquire battery backup and remote activation for existing storm sirens and purchase additional sirens with battery backup and remote activation.	Yes
48	Participate in the Firewise Communities program.	Yes
49	Concrete certain sections of street curves and intersections to eliminate the street damage.	No
50	Seek and obtain equipment to help remove and dispose of debris.	No
51	Purchase new fire-fighting apparatus.	No
52	Update and provide continual administration to insure NFIP compliance is maintained.	Yes
53	Continued participation and support of map information services by providing Flood Insurance Rate Map (FIRM) information to people who inquire, and to make the public aware of this service.	Yes
54	Continued participation and expansion regarding hazard disclosure by working with local real estate agents to advise potential purchasers with regard to flood prone property and the hazards involved.	No
55	Provide dam monitoring equipment	No
56	Help fund the installation of handicap-accessible public shelters and/or safe rooms.	Yes
57	Bury electric lines which are vulnerable to high winds, lightning, ice storms, and wildfires	No
58	Correct and update floodplain maps for Blaine County, cities and towns by working with FEMA as necessary.	Yes
59	Help fund installation of private storm shelters	Yes
60	Replace utilities' pipelines with more flexible pipe.	No

5.3 Changes in Jurisdictional Priorities

Power failure from any hazard has several negative impacts. This problem is viewed as a very high priority. Some impacts that were specially mentioned were:

1. Power loss is a problem for the Town of Greenfield because they have to travel 40 miles to Fairview to pick up the generator to operate the sewer system lift station
2. Power loss has been the biggest hazard problem at Geary Public Schools in recent years because of the loss of food in the cafeteria, causing not only inconvenience and extra expense, but also the work to clean up & discard the ruined items
3. Power outages at Hitchcock sometimes take many days to repair because they are a small remote community reliant on a big power company that serves the City. The Hitchcock water supply is dependent on electrical power

Drought has become a hazard of increased concern to local officials and residents of all jurisdictions in the planning area. Drought not only affects the annual availability of fresh water, it contributes to increased danger of wildfires and intensifies aquifer depletion posing a long-term threat to the agricultural economy and to municipal water supplies.

- ✓ **Wildfires.** The danger of Wildfire is a hazard that becomes an increasing threat when drought becomes more frequent or severe
- ✓ **Aquifer depletion.** The planning team took special note that the problem of aquifer depletion could become severe at some time in the next few decades

In recent decades, the Oklahoma Water Resources Board's Financial Assistance Program has provided billions of dollars in assistance to local water and sewer infrastructure projects, which has increased the drought resistance of local water treatment and distribution systems in towns and cities across the state. Blaine County municipalities are eligible to apply for assistance through that program.

An analysis conducted for the 2012 Update of the Oklahoma Comprehensive Water Plan (OCWP) estimated that Oklahoma faced an \$82 billion need in such financing over the next 50 years (OWRB, 2012). This is an indication that the State recognizes the risk and is motivated to assist communities in mitigation of that long term hazard.

5.4 Conclusion

The Goals and Action Items detailed in this 2022 Hazard Mitigation Plan update are intended to be a guide to officials and residents of Blaine County as they continue to make progress towards becoming a safer community. As new information and new technology become available, this plan will be updated accordingly.

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Appendix A

Population loss

The following information is directly reproduced from an article in the Enid News & Eagle.

Census: Migration from rural Oklahoma to cities continues

By Reese Gorman and Janelle Stecklein CNHI Oklahoma News Aug 13, 2021

OKLAHOMA CITY – Bill Seitter isn't surprised that Blaine County's population dropped 27% – about 3,200 residents – over the past decade. It was the county that lost the highest percentage of its population in the state, according to 2020 U.S. Census figures released this week.

Shortly after the 2010 census, officials decided to shutter the local prison, Diamondback Correctional Center, said Seitter, mayor of Watonga, a setback for the county that recently has been propped up by a vibrant oil and gas economy and new growth in the state's medical marijuana industry.

“So what we see right here in the county seat of Blaine County is things are looking up, things are looking a little better and things are happening around our community,” Seitter said. “There's jobs available and our sales taxes are not decreasing. They're not increasing by a lot, but they're not decreasing either.”

Nearly two-thirds of Oklahoma counties saw their populations decrease over the past decade, losing a combined 69,000 residents, an analysis of Oklahoma's U.S. Census Bureau data shows.

The remaining counties – predominantly urban and suburban – saw their populations grow by about 277,000 people,

But while the state saw a net gain of about 208,000 in the past decade, nearly half of all Oklahoma residents reported living in just four counties – Canadian, Cleveland, Oklahoma, and Tulsa.

Oklahoma's continued migration from rural to urban and suburban communities mirrors an ongoing national trend, said J. Tom Mueller, a research assistant professor with the University of Oklahoma's Department of Geography and Environmental Sustainability.

The article continues; find it at https://www.enidnews.com/news/local_news/census-migration-from-rural-oklahoma-to-cities-continues/article_a9c06d44-fc8b-11eb-8f98-4742e88e6a57.html

Appendix B

FEMA Federal Insurance Rate Maps (FIRMs) are replicated below. Visit the FEMA Map Service Center for official maps.

LEGEND

WATER BODIES

- 1. Lake, Reservoir, Pond, etc.
- 2. Stream, River, etc.
- 3. Canal, etc.
- 4. Wetland, etc.

LAND USE

- 5. Agricultural
- 6. Residential
- 7. Commercial
- 8. Industrial
- 9. Forest
- 10. Pasture
- 11. Open Land
- 12. Water

ROADS

- 13. Interstate
- 14. State
- 15. County
- 16. Local

BOUNDARIES

- 17. Township
- 18. County

OTHER

- 19. Elevation Contour
- 20. Spot Elevation
- 21. Section Number
- 22. Township and Range

NOTES

1. This map is based on the 1980 Census of Population and Housing, Census of Agriculture, and Census of Economic Census of Agriculture.

2. The map is based on the 1980 Census of Population and Housing, Census of Agriculture, and Census of Economic Census of Agriculture.

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FIRM

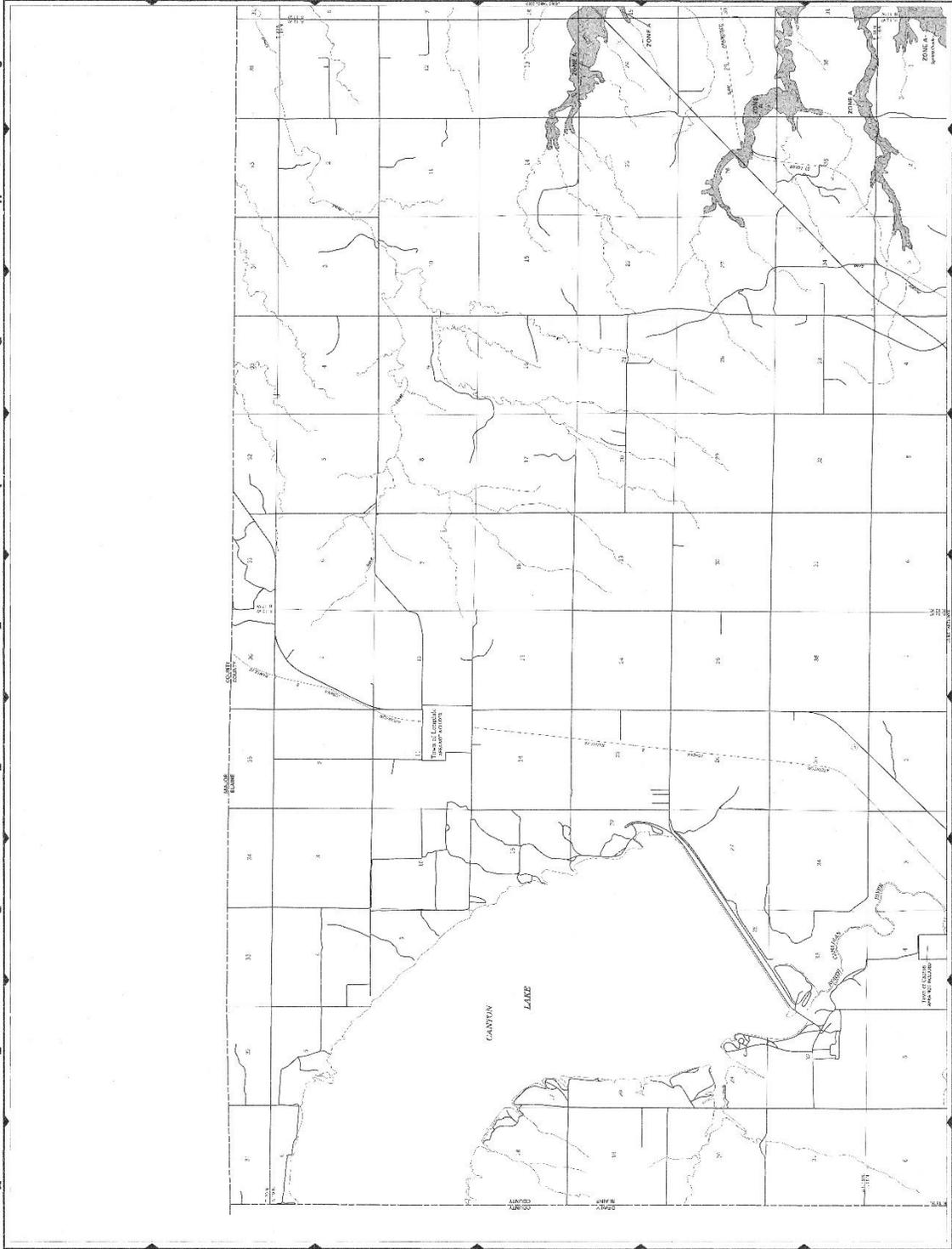
FLOOD INSURANCE RATE MAP

BLAINE COUNTY, OREGON

COMMUNITY PANEL NUMBER 40011 005 A

REVISION DATE: AUGUST 1978

Blaine County Planning Agency





Appendix C

Action Table Summary

ACTION ITEMS SUMMARY

	STRUCTURE INFRASTRUCTURE	HAZARD	JURISDICTION
1	Help fund the installation of handicap-accessible public shelters and/or safe rooms	DF, EH, Torn, HW, WS	ALL JURISDICTIONS
2	Equip key buildings and critical infrastructure for generators, by either hard-wiring to accept generators or install fixed generators	DF, HW, LTNG, TORN, WS (Power loss)	ALL JURISDICTIONS
3	Install safety film, or movable shutters, to protect vulnerable windows in schools and city, town, and county offices from breakage and protect from extreme heat	EH, EQ, HW	ALL JURISDICTIONS
4	Install hurricane clips or reinforcement ties to protect vulnerable roofs and appurtenances from wind	HW	ALL JURISDICTIONS
5	Establish a 50 ft firebreak around structures and vulnerable areas	WF	ALL JURISDICTIONS
	PLANS & REGS		
6	Help fund installation of private storm shelters	Torn	COUNTY & TOWNS
7	Participate in the Firewise Communities program	WF	TOWNS
8	Update and provide continual administration to insure NFIP compliance is maintained	Flood	COUNTY & TOWNS
9	Provide current floodplain maps and expansive soil maps to the public	Flood	COUNTY & TOWNS
	NATURAL SYSTEMS		
10	Correct flooding problems around county, town and school buildings (adjust grade; build diversions, catch basins & retention ponds)	ES, Flood	ALL JURISDICTIONS
11	Enhance landscaping and design for public buildings using Xeriscape to conserve water	DR, ES	ALL JURISDICTIONS
	EDUCATION & AWARENESS		
12	Continue practicing fire, tornado, and other hazard drills within the school systems	Torn, WF	SCHOOLS
13	Conduct awareness programs for citizens and students to teach emergency preparedness	DF, EH, EQ, HAIL, FL, TORN, WF, WS	ALL JURISDICTIONS

14	Promote the use of a 50 foot safety perimeter around homes, businesses and schools near the edge of town (wildfire urban interface)	WF	ALL JURISDICTIONS
15	Establish a program to implement a procedure to check on the safety of elderly and/or handicapped residents, before and after a hazard event	DF, EH, Torn, WF, WS	COUNTY & TOWNS
16	Continued participation and support of map information services by providing Flood Insurance Rate Map (FIRM) information to the public	Flood	COUNTY & TOWNS
17	Conduct a public education campaign to inform the citizens of the benefits of using Xeriscape to conserve water	DR	ALL JURISDICTIONS
	5% PROJECTS		
18	Distribute NOAA weather radios	DF, Hail, HW, Torn, WS	COUNTY
19	Purchase and Install Generators To Power Critical Facilities	DF, Torn, Hail, HW, LT, WS	ALL JURISDICTIONS

HAZARD KEY:
DF= DAM FAILURE
DR= DROUGHT
EH= EXTREME HEAT
EQ= EARTHQUAKE
ES= EXPANSIVE SOILS
FL= FLOOD
HA = HAIL
HW= HIGH WIND
LT= LIGHTNING
TORN= TORNADO
WF= WILDFIRE
WS= WINTER STORM

See full description of how to implement these ideas in the tables in Section 4.5