

Carlton Landing	Carlton Landing has identified a drainage issue. When it rains, the streets and sidewalks don't drain as they're supposed to.	Drainage issues can cause water to build up and damage roads or impede traffic.
	Several roads have been washed out by heavy rains and flooded waterways. Others flood frequently to the point of being closed until the water has dried up because they're too low.	Flooded roadways pose a danger to travelers. Although the county has tried to purchase barricades and signs, they don't have enough for the amount of roads affected and sometimes travelers ignore these warnings. It also poses an inconvenience to bus routes and citizens who live in the area.
	The city only has one access point.	If that access point were to flood, the city would be completely cut off.
Town of Crowder	The tin horns and culverts in this jurisdiction aren't large enough to handle the current intake.	When the intake is higher than the system can handle, the roads flood. Flooded roadways pose a danger to travelers.. It also poses an inconvenience to bus routes and citizens who live in the area.
	Several roads have been washed out by heavy rains and flooded waterways. Others flood frequently to the point of being closed until the water has dried up because they're too low.	Flooded roadways pose a danger to travelers.. It also poses an inconvenience to bus routes and citizens who live in the area.
Town of Indianola	The jurisdiction has identified a lack of education for citizens as a vulnerability.	A lack of education can make citizens unnecessarily vulnerable to this hazard.
Town of Kiowa	Several roads have been washed out by heavy rains and flooded waterways. Others flood frequently to the point of being closed until the water has dried up because they're too low.	Flooded roadways pose a danger to travelers. It also poses an inconvenience to bus routes and citizens who live in the area.
	The ditches and culverts in this jurisdiction aren't large enough to handle the current intake.	When the intake is higher than the system can handle, the roads flood.

		Flooded roadways pose a danger to travelers. It also poses an inconvenience to bus routes and citizens who live in the area.
Town of Pittsburg	The sewer pump house and pump experience frequent flooding.	This can disrupt the flow of the system and delay services to citizens.
	The ditches and culverts in this jurisdiction aren't large enough to handle the current intake.	When the intake is higher than the system can handle, the roads flood. Flooded roadways pose a danger to travelers. It also poses an inconvenience to bus routes and citizens who live in the area.
Town of Quinton	Several roads have been washed out by heavy rains and flooded waterways. Others flood frequently to the point of being closed until the water has dried up because they're too low.	Flooded roadways pose a danger to travelers. It also poses an inconvenience to bus routes and citizens who live in the area.
Town of Savanna	Several roads have been washed out by heavy rains and flooded waterways. Others flood frequently to the point of being closed until the water has dried up because they're too low.	Flooded roadways pose a danger to travelers. It also poses an inconvenience to bus routes and citizens who live in the area.
City of Haileyville	The WPA ditches in the jurisdiction are full of debris.	If they don't drain properly, it causes backups that create health hazards and additional flooding.
	There are several old culverts and bridges that become useless when it floods.	Flooded roadways pose a danger to travelers. It also poses an inconvenience to bus routes and citizens who live in the area.
City of Hartshorne	Several roads have been washed out by heavy rains and flooded waterways. Others flood frequently to the point of being closed until the water has dried up because they're too low.	Flooded roadways pose a danger to travelers. It also poses an inconvenience to bus routes and citizens who live in the area.
	The ditches and culverts in this jurisdiction aren't large enough to handle the current intake.	When the intake is higher than the system can handle, the roads flood. Flooded roadways pose a

		danger to travelers. It also poses an inconvenience to bus routes and citizens who live in the area.
City of Krebs	The ditches and culverts in this jurisdiction aren't large enough to handle the current intake.	If they don't drain properly, it causes backups that create health hazards and additional flooding.
	Several roads have been washed out by heavy rains and flooded waterways. Others flood frequently to the point of being closed until the water has dried up because they're too low.	When the intake is higher than the system can handle, the roads flood. Flooded roadways pose a danger to travelers. It also poses an inconvenience to bus routes and citizens who live in the area.
City of McAlester	The entire drainage system for the city has issues when it rains.	When the intake is higher than the system can handle, the roads flood. Flooded roadways pose a danger to travelers. It also poses an inconvenience to bus routes and citizens who live in the area.
McAlester Public Schools	Water congregates in front of the building. Pump at Will Rogers	This causes unnecessary flooding that causes wear on the sidewalks and van stand stagnant, creating a health hazard.
Quinton Public Schools	The school's ball complex floods.	When the ball complex floods, they can't have games.
Crowder Public Schools	Drainage near the school gets backed up easily.	When the intake is higher than the system can handle, roads and sidewalks flood, making them unusable.
Haileyville Public Schools	The guttering at the school isn't able to keep up with typical rainfall.	When the intake is higher than the system can handle, roads and sidewalks flood, making them unusable.
Frink-Chambers Public Schools	Drainage near the school gets backed up easily.	When the intake is higher than the system can handle, roads and

		sidewalks flood, making them unusable.
Tannehill Public Schools	Drainage near the school gets backed up easily.	When the intake is higher than the system can handle, roads and sidewalks flood, making them unusable.
Krebs Public Schools	The guttering at the school isn't able to keep up with typical rainfall.	When the intake is higher than the system can handle, roads and sidewalks flood, making them unusable.
Haywood Public Schools	The guttering at the school isn't able to keep up with typical rainfall.	When the intake is higher than the system can handle, roads and sidewalks flood, making them unusable.
	Drainage near the school gets backed up easily.	When the intake is higher than the system can handle, roads and sidewalks flood, making them unusable.
Savanna Public Schools	Drainage near the school gets backed up easily.	When the intake is higher than the system can handle, roads and sidewalks flood, making them unusable.
Canadian Public Schools	The guttering at the school isn't able to keep up with typical rainfall.	When the intake is higher than the system can handle, roads and sidewalks flood, making them unusable.
Pittsburg Public Schools	The guttering at the school isn't able to keep up with typical rainfall.	When the intake is higher than the system can handle, roads and sidewalks flood, making them unusable.
Hartshorne Public Schools	The guttering at the school isn't able to keep up with typical rainfall.	When the intake is higher than the system can handle, roads and sidewalks flood, making them unusable.
Indianola Public Schools	Drainage near the school gets backed up easily.	When the intake is higher than the system can handle, roads and sidewalks flood, making them unusable.

Kiowa Public Schools	The bus routes tend to flood.	When roads on bus routes flood, it creates a time and resource hardship on the school. It can also prevent kids from receiving education.
Carlton Landing Academy	Drainage near the school gets backed up easily.	When the intake is higher than the system can handle, roads and sidewalks flood, making them unusable.

3.4.3 Winter Storm

Description

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 the surface and can accumulate like snow and become a hazard to motorists.

Ice storms are extended freezing rain events, lasting several hours to sometimes 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.

A severe winter storm in Pittsburg County is defined as a storm that drops four or more inches of snow during a 12-hour period, or six or more inches during a 24-hour span.

Location

Winter storms affect the entire Planning Area.

Previous Occurrences

There were 12 of winter storms recorded in the Planning Area between 2009 and 2019. Occurrence data from the National Oceanic and Atmospheric Administration (NOAA) website is located below.

Figure 3-15

Winter Storm Previous Occurrences
2010-2020

From the NOAA National Centers for Environmental Information
<https://www.ncdc.noaa.gov/stormevents>

Date	Jurisdiction	Narrative
01/29/2010	Pittsburg County	Four inches of snow fell across the northern portion of the county.
02/01/2011	Pittsburg County	Four to six inches of snow fell across much of the county.
02/04/2011	Pittsburg County	Four to five inches of snow fell across the county.
02/09/2011	Pittsburg County	Four inches of snow fell across the northern portion of the county.
12/25/2012	Pittsburg County	A strong storm system translated from the Pacific Northwest across the Southern Rockies and into the Southern Plains from the 23rd through the 25th. Rain began across southeastern Oklahoma during the early morning hours of the 25th as this system approached and then transitioned to light freezing rain and a little sleet. The precipitation changed over to snow during the early afternoon of the 25th and fell heavily for several hours before tapering off late in the evening. A swath of heavy snow occurred across much of central and southern Oklahoma with four to eight inches occurring across southeastern and east central Oklahoma.
12/05/2013	Pittsburg County	Arctic air spread across eastern Oklahoma on the 4th as a strong storm system developed across the western United States. Several upper level disturbances moved through the south central part of the country on the 5th through the 6th, resulting in widespread wintry precipitation across the region beginning during the morning hours of the 5th. The precipitation fell as mainly freezing rain across southeastern Oklahoma and as snow and sleet across northeastern Oklahoma. The precipitation changed to all snow by the time it ended on the 6th. By the end of the storm, portions of southeastern Oklahoma received over an inch of ice. Power outages were widespread across Choctaw, Pushmataha, and Le Flore Counties, some of which lasted for up to two weeks in remote areas.

12/20/2013	Pittsburg County	<p>Arctic air spread across all of eastern Oklahoma on the 20th as a strong storm system developed into the Southern Rockies. Precipitation began to increase across northeastern Oklahoma during the evening hours of the 20th and continued through the 21st. Warm air overriding the shallow cold air near the ground resulted in freezing rain. Much of eastern Oklahoma north of a McAlester to Stillwell line received between a quarter and a half inch of ice with locally near three quarters of an inch in some areas of northeastern Oklahoma. Scattered to numerous power outages and widespread tree damage occurred across the region. The freezing rain changed to snow during the evening of the 21st with very light accumulations across portions of northeastern Oklahoma. The ice and snow resulted in slick and hazardous roads. The ice finally melted off trees and power lines on the 24th, when temperatures climbed above freezing for the first time since the storm.</p>
02/02/2014	Pittsburg County	<p>A strong upper level disturbance moved into the Southern Plains from the southwest on February 2nd. Arctic air was already in place across eastern Oklahoma ahead of this system. Precipitation developed during the morning hours and continued into the late afternoon and evening hours. Light freezing rain and sleet fell across portions of southeastern Oklahoma early in the event, otherwise the precipitation fell as snow across the area. Portions of southeastern Oklahoma received between one half and one and a half inches of sleet with up to two tenths of an inch of ice. Four to seven inches of snow occurred across much of east central and northeastern Oklahoma during this event. Roads were snow and ice covered, resulting in numerous automobile accidents.</p>

03/02/2014	Pittsburg County	Arctic air surged south into eastern Oklahoma late on March 1st ahead of a strong upper level disturbance that moved from the Southern Rockies into the Southern Plains. Precipitation developed over the region as this system approached during the late evening of the 1st. Periods of light freezing rain and sleet occurred across much of the area through the morning of the 2nd. Thunderstorms developed over the shallow cold air near the ground and resulted in heavy sleet across a lot of the region through late afternoon. Snow developed into the area during the evening of the 2nd as the strong upper level disturbance finally translated across the area. The precipitation ended during the early morning hours of the 3rd. Several inches of snow and sleet covered much of the region and resulted in travel difficulties.
02/15/2015	Pittsburg County	An arctic cold front moved through eastern Oklahoma late on the 14th and early on the 15th. A strong upper level disturbance moved into the Southern Plains late on the 15th, resulting in widespread precipitation developing across the region as warm and moist air was lifted over the low level cold air. A brief period of light rain quickly changed to freezing rain and sleet over much of northeastern Oklahoma. Some convection embedded in the precipitation resulted in rapid accumulations of sleet over a light accumulation of glaze. Some areas received between half an inch and an inch of sleet before precipitation changed over to snow during the early morning hours of the 16th. Much of the region received between three and six inches of sleet and snow. The rain gradually changed over to sleet over east central and southeastern Oklahoma during the late evening of the 15th. Sleet accumulations across this region were also in the half inch to nearly two inch amounts, with some embedded convection responsible for rapid accumulations.
02/23/2015	Pittsburg County	An upper level disturbance moved through the Southern Plains on the 23rd, resulting in widespread precipitation development. Arctic air had already settled into the area, which supported a widespread snowfall. Some portions of east central Oklahoma received between four and five inches of snow during the event.

02/27/2015	Pittsburg County	A series of upper level disturbances moved through the Southern Plains on the 27th and 28th, ahead of a strong low pressure system located over the southwestern United States. Arctic air was already in place ahead of these disturbances, resulting in widespread snow across the region. A swath of snow in the four to five inch category occurred across northeastern Oklahoma and another occurred across portions of southeastern Oklahoma.
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Probability of Future Events

The probability of winter storm events is high for the Planning Area.

Extent

The extent of a winter storm in Oklahoma can vary greatly and is influenced by a variety of factors. The local weather conditions can influence the extent of a storm as can the way ice and snow accumulate. Even a relatively minor winter storm, with ice buildup on elevated roadways and bridges, can become dangerous, impacting the mobility of the public, power company officials, first responders, and emergency management officials due to slick, hazardous and/or impassible roads. Any amount of ice on roads has the ability to negatively affect the Planning Area and the public.

Ice damage to trees and power lines can cause electricity to be out for days, if not weeks, thus greatly expanding the extent of this natural hazard. Power outages caused by the effects of winter storm also creates a health concern of food borne illness in facilities that serve or store food and threaten life sustaining machinery the Planning Area and hospitals rely on. The local jurisdictions within the Planning Area have identified generators to mitigate the issues power outages bring.

All jurisdictions within the Planning Area use the Sperry-Piltz Ice Accumulation (SPIA) Index to measure the extent of winter storms. In the past, all jurisdictions have seen up to a 4 on the scale. They expect to see the same measure of storms in the future. The Planning Area starts to see the effects of winter storms when the scale rises to a one. Anything after that number can potentially start to exhaust the local jurisdictions' resources.

The extent of the impact of a winter storm can be lessened by the identification of at-risk populations, by weather warnings and notifications, by the establishment of warming rooms and utility bill assistance programs, road condition alerts, ensuring there are backup electric power generation for critical facilities, and so forth.

Figure 3-16
Sperry-Piltz ice Accumulation (SPIA) Index

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. Travel 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 line 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.)

Impact and Vulnerability

The impacts of this hazard can affect a region for weeks. Houses are damaged from the weight of the ice, roads buckle and or become slick and hazardous, electrical poles and lines break, and people lose their electricity and heat, water lines freeze and burst due to the cold weather and people and livestock have no water. Winter storms impact the environment by destroying vegetation with secondary impacts of flooding causing possible water and soil contamination. Possible impacts to first responders include hypothermia, contact with damaged powerlines, hazardous roadways, injuries, and fatalities.

In the event of a winter storm, services to the public could be delayed, leading to a lack of confidence in the local jurisdictions' ability to govern. In the event facilities or access to facilities is compromised, the local jurisdictions' Continuity of Operations needs to be activated. This would insure minimal disruption to public services. At this time, only Pittsburg County and the City of McAlester have a Continuity of Operations Plan to enact. All other participating jurisdictions do not have a plan, and this is considered a vulnerability.

While winter storms occur nearly every year, the public isn't accustomed to driving in the conditions this hazard creates. Every time there is a winter storm, first responders become inundated with traffic accidents and house fire calls. All jurisdictions have identified a need to educate the public on how to handle these conditions and how to keep warm without endangering lives and property.

School districts typically must close schools during winter storm events to keep kids from being out in these conditions. While they may see impacts to buildings and power, they have only identified a need for education to students to show how severe the effects of this hazard can be to those who are not prepared and how to be more prepared.

Figure 3-17

Winter Storm Vulnerabilities		
Jurisdiction	Vulnerabilities Needs Narration and MI	Impact Needs Narration
Pittsburg County	There are several critical facilities within the jurisdiction that are lacking generators, including the County Courthouse, several fire departments, and others.	Without generators, critical facilities can't guarantee they will be able to function during winter storms. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Alderson	The Alderson Fire Department lacks a generator.	Without generators, critical facilities can't guarantee they will be able to function during winter storms. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Ashland	The Ashland Fire Department lacks a generator.	Without generators, critical facilities can't guarantee they will be able to function during winter storms. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Canadian	The Town of Canadian lacks generators at the Town Hall, Lift Station, and several others identified critical facilities.	Without generators, critical facilities can't guarantee they will be able to function during winter storms. If these facilities are unable to stay open, essential services to the public could be delayed.
Carlton Landing	The jurisdiction only has one access route to it.	During winter storms, the jurisdiction only has one way in and out. If that way was to be blocked, they would be cut off.

	The Carlton Landing Fire Department and one of their lift stations lack generators.	Without generators, critical facilities can't guarantee they will be able to function during winter storms. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Crowder	The Crowder Fire Department and Senior Center lack generators.	Without generators, critical facilities can't guarantee they will be able to function during winter storms. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Indianola	The Indianola Fire Department lacks a generator.	Without generators, critical facilities can't guarantee they will be able to function during winter storms. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Kiowa	The jurisdiction has access to a mass notification system but doesn't have enough employees trained in it or policies and procedures in place to know when to use it.	Unreliable messaging could confuse citizens and make cause a delay in preparedness for impending storms.
Town of Pittsburg	All of the identified critical facilities for the Town of Pittsburg lack generators.	Without generators, critical facilities can't guarantee they will be able to function during winter storms. If these facilities are unable to stay open, essential services to the public could be delayed.

Town of Quinton	Quinton's town hall and fire department lack generators.	Without generators, critical facilities can't guarantee they will be able to function during winter storms. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Savanna	All but two of Savanna's identified critical facilities lack generators.	Without generators, critical facilities can't guarantee they will be able to function during winter storms. If these facilities are unable to stay open, essential services to the public could be delayed.
City of Haileyville	None of this jurisdiction's critical facilities have generators.	Without generators, critical facilities can't guarantee they will be able to function during winter storms. If these facilities are unable to stay open, essential services to the public could be delayed.
	The jurisdiction has access to a mass notification system but doesn't have enough employees trained in it or policies and procedures in place to know when to use it.	Unreliable messaging could confuse citizens and make cause a delay in preparedness for impending storms.
City of Hartshorne	The City Hall does not have a generator.	Without generators, critical facilities can't guarantee they will be able to function during winter storms. If these facilities are unable to stay open, essential services to the public could be delayed.
City of Krebs	The jurisdiction doesn't think their citizens understand the hazard or are prepared to handle it when it happens.	A lack of education can cause preventable injuries and impede preparedness.

City of McAlester	There are several critical facilities within the jurisdiction that are lacking generators.	Without generators, critical facilities can't guarantee they will be able to function during winter storms. If these facilities are unable to stay open, essential services to the public could be delayed.
	The city doesn't have enough resources to keep the roads in good condition.	If the roads are impassible, it can cause accidents and creates a time and economic hardship for the city.
McAlester Public Schools	The school district does not have an emergency generator.	Should an outage occur during school hours, the buildings need to be functional to safely accommodate and keep kids warm until the event or the school day is over to prevent injury or sickness.
Quinton Public Schools	The school district does not have an emergency generator.	Should an outage occur during school hours, the buildings need to be functional to safely accommodate and keep kids warm until the event or the school day is over to prevent injury or sickness.
Crowder Public Schools	The school district does not have an emergency generator.	Should an outage occur during school hours, the buildings need to be functional to safely accommodate and keep kids warm until the event or the school day is over to prevent injury or sickness.
Haileyville Public Schools	The school district does not have an emergency generator.	Should an outage occur during school hours, the buildings need to be functional to safely accommodate and keep kids warm until the event or the school day is over to prevent injury or sickness.

Frink-Chambers Public Schools	The school district does not have an emergency generator.	Should an outage occur during school hours, the buildings need to be functional to safely accommodate and keep kids warm until the event or the school day is over to prevent injury or sickness.
Tannehill Public Schools	The school district does not have an emergency generator.	Should an outage occur during school hours, the buildings need to be functional to safely accommodate and keep kids warm until the event or the school day is over to prevent injury or sickness.
	The jurisdiction has access to a mass notification system but doesn't have enough employees trained in it or policies and procedures in place to know when to use it.	Unreliable messaging could confuse citizens and make cause a delay in preparedness for impending storms.
Krebs Public Schools	The school district doesn't have confidence in the student's current knowledge level about winter storm preparedness.	A lack of education can cause preventable injuries and impede preparedness.
Haywood Public Schools	The school district doesn't have confidence in the student's current knowledge level about winter storm preparedness.	A lack of education can cause preventable injuries and impede preparedness.
Savanna Public Schools	The school district doesn't have confidence in the student's current knowledge level about winter storm preparedness.	A lack of education can cause preventable injuries and impede preparedness.
Canadian Public Schools	The school district doesn't have confidence in the student's current knowledge level about winter storm preparedness.	A lack of education can cause preventable injuries and impede preparedness.
Pittsburg Public Schools	The school district doesn't have confidence in the student's current knowledge level about winter storm preparedness.	A lack of education can cause preventable injuries and impede preparedness.
Hartshorne Public Schools	The school district does not have an emergency generator.	Should an outage occur during school hours, the buildings need to be functional to safely accommodate and keep kids warm until the event or the school day is over to prevent injury or sickness.

Indianola Public Schools	The school district doesn't have confidence in the student's current knowledge level about winter storm preparedness.	A lack of education can cause preventable injuries and impede preparedness.
Kiowa Public Schools	The school district doesn't have confidence in the student's current knowledge level about winter storm preparedness.	A lack of education can cause preventable injuries and impede preparedness.
Carlton Landing Academy	The school district does not have an emergency generator.	Should an outage occur during school hours, the buildings need to be functional to safely accommodate and keep kids warm until the event or the school day is over to prevent injury or sickness.

3.4.4 Wildfire

Description

A wildfire is described as a fire that is uncontrolled in a rural or wilderness area. The typical time for wildfires to occur in Oklahoma is in the late fall through winter and into early spring, which coincides with dormant vegetation and the time when the state receives little to no regular precipitation. A wildfire often goes unnoticed until it grows in size and is harder to control. These fires can be started through a variety of different ways including arson, a campfire not put out thoroughly, a tossed cigarette, burning debris, or lightning. The three different classes of wildfires are surface fires, ground fires, and crown fires.

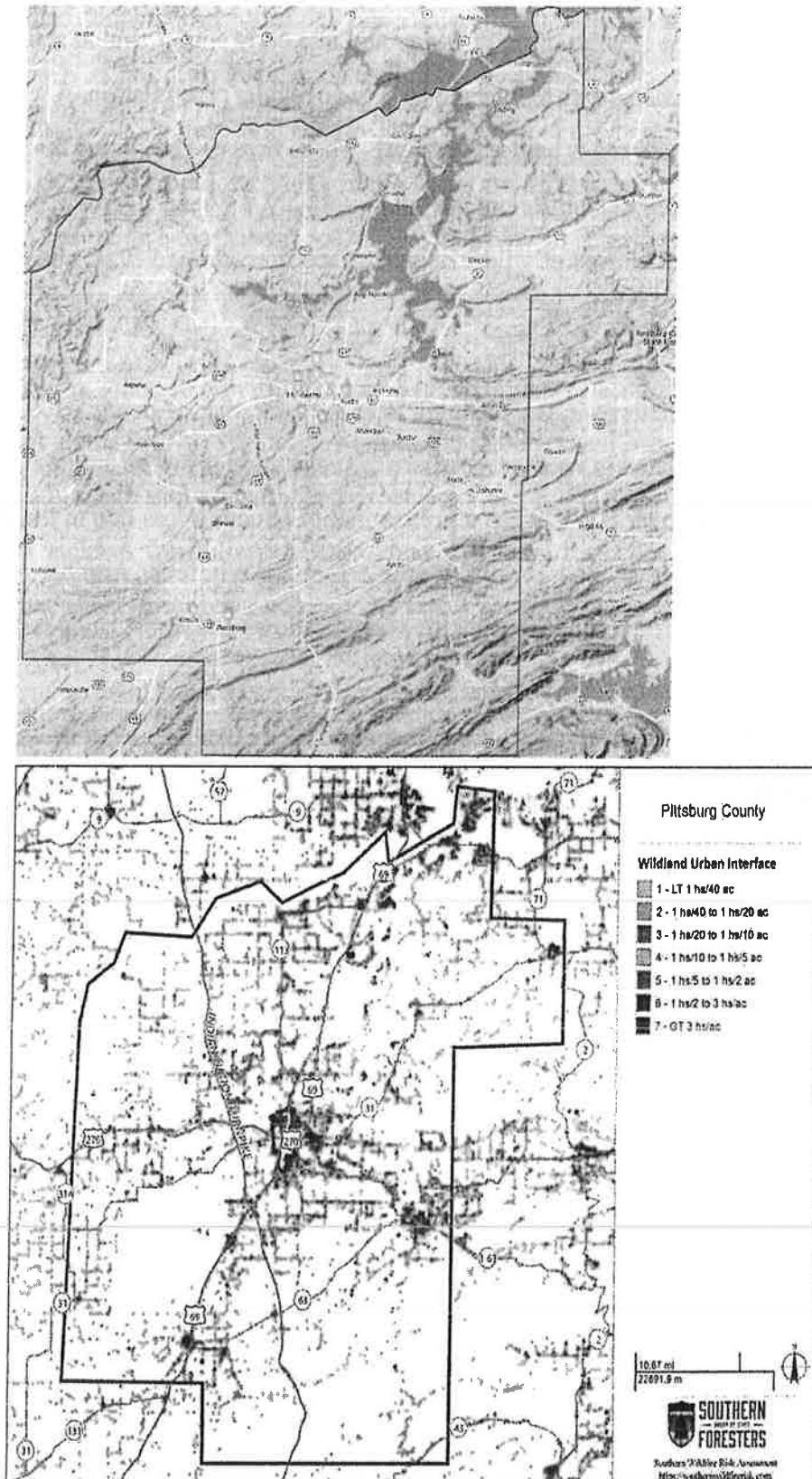
Location

While Pittsburg County and all jurisdictions in the planning area have the risk of being affected by wildfires, the highest risk areas are located in rural areas where the vegetation provides ample fuel for fires. The northern end of the county near HWY 9 has a greater risk of structure loss due to the close proximity of a large parcel of underdeveloped land with ample fuel for wildfires. Another at risk location within the county is near the Town of Pittsburg where hay meadows and forest lands surround Pittsburg Public Schools.

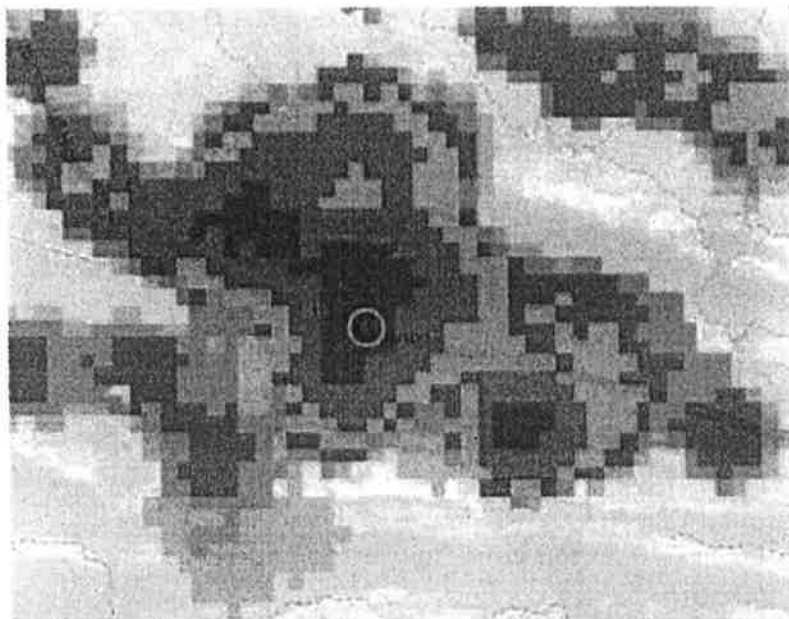
The Wildland Urban Interface (WUI) Map depicts where humans and their structures meet or intermix with wildland fuel. For the Planning Area, it is estimated that 83.9% of the population lives within the WUI. Figure 3-18 shows where these areas are located.

Figure 3-18

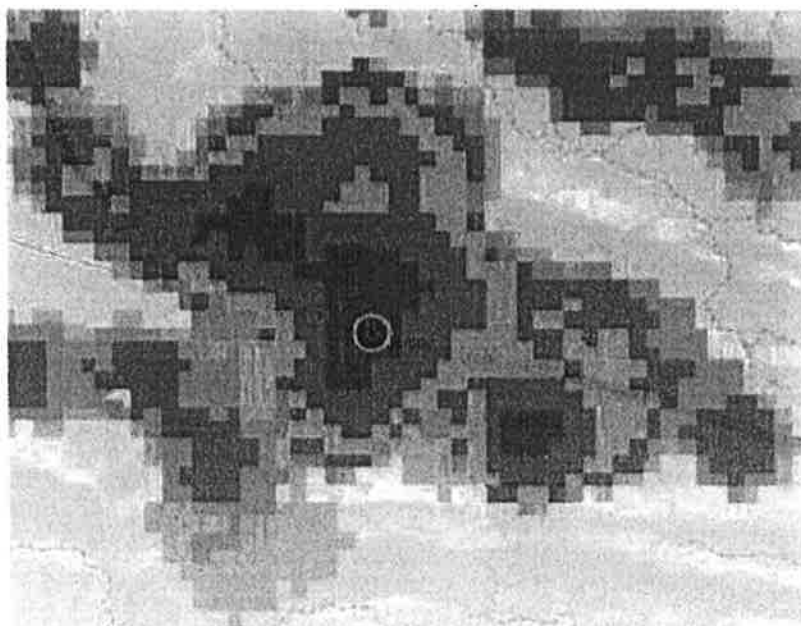
Map of Planning Area and Wildfire Urban Interface Map



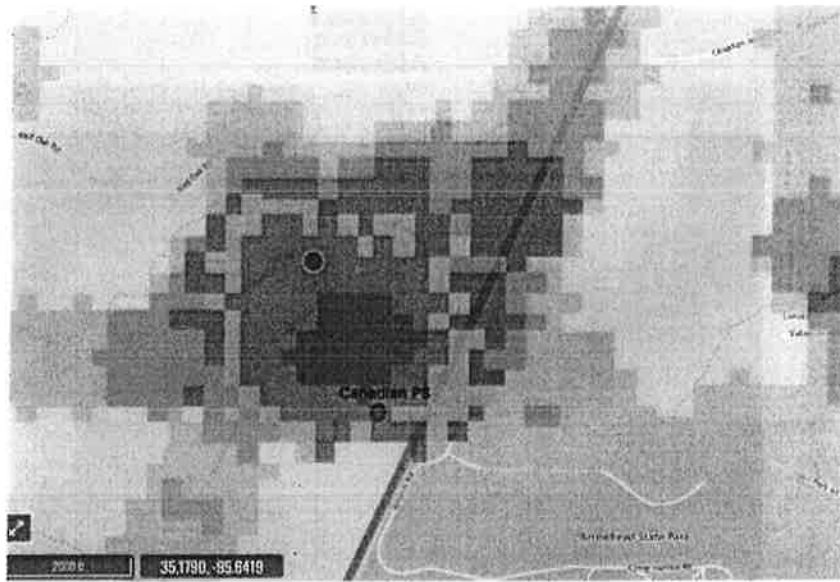
Alderson



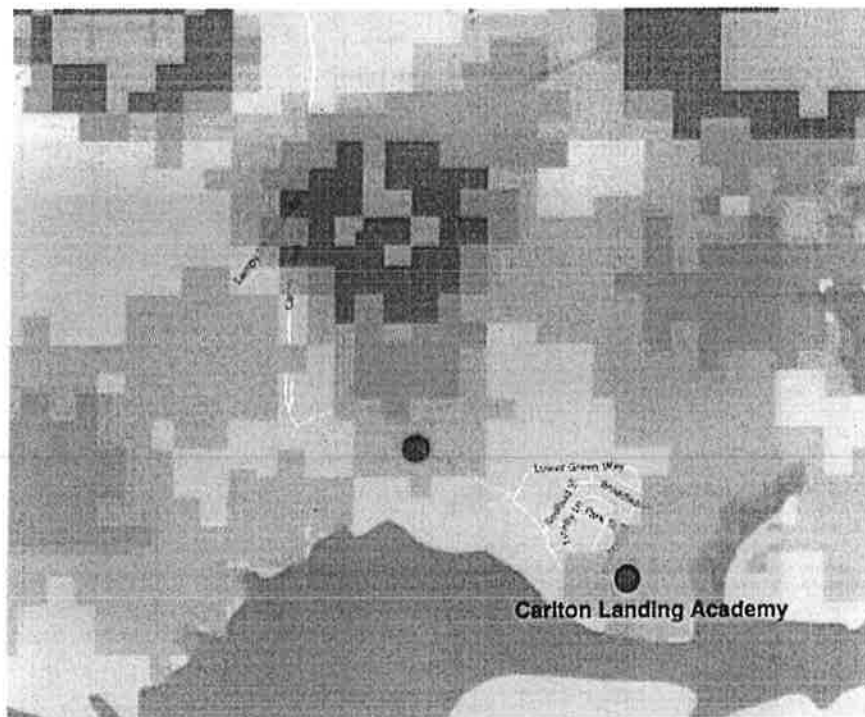
Ashland



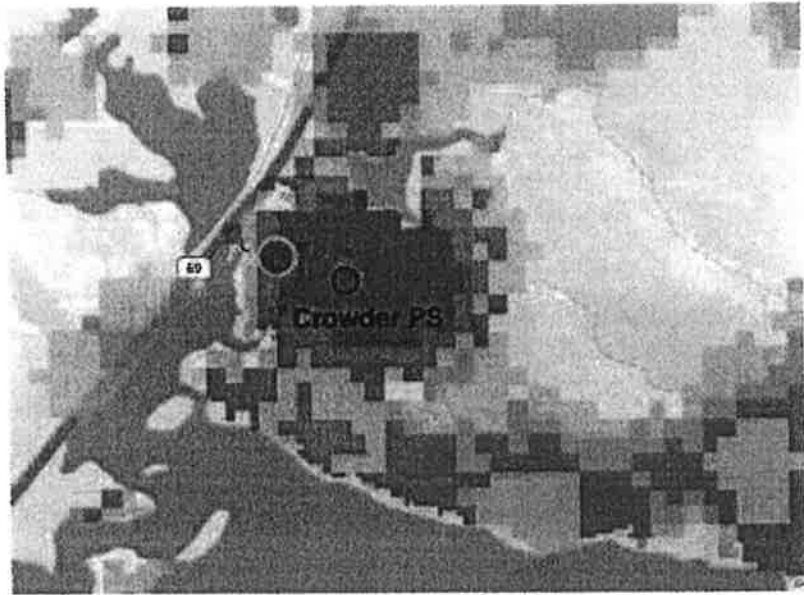
Canadian/Canadian PS



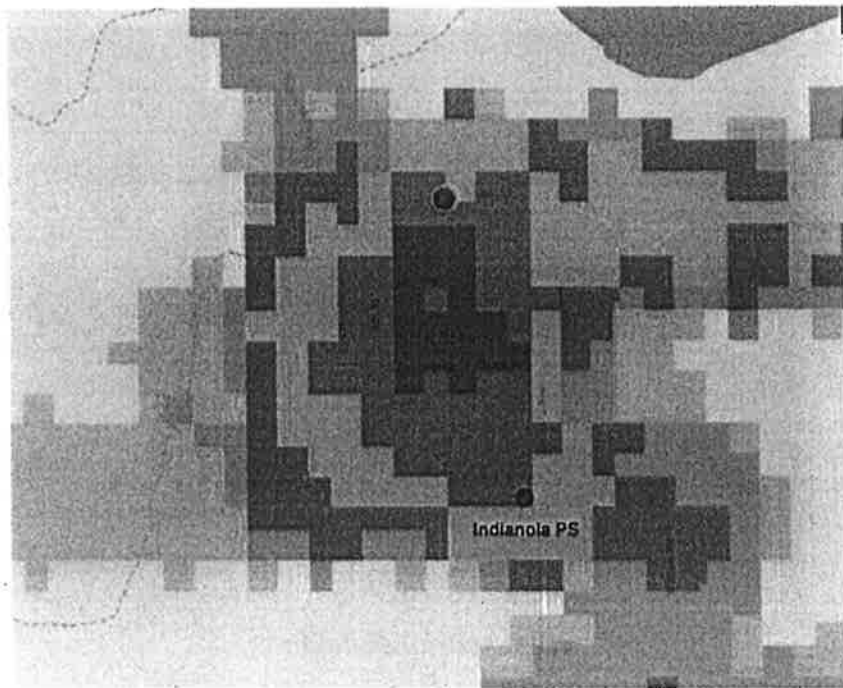
Carlton Landing/Carlton Landing Academy



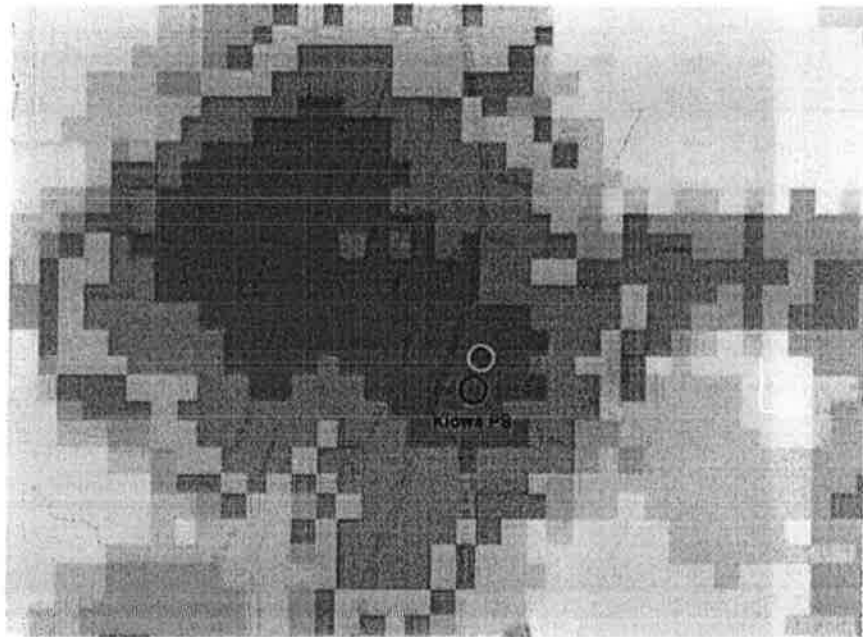
Crowder/Crowder PS



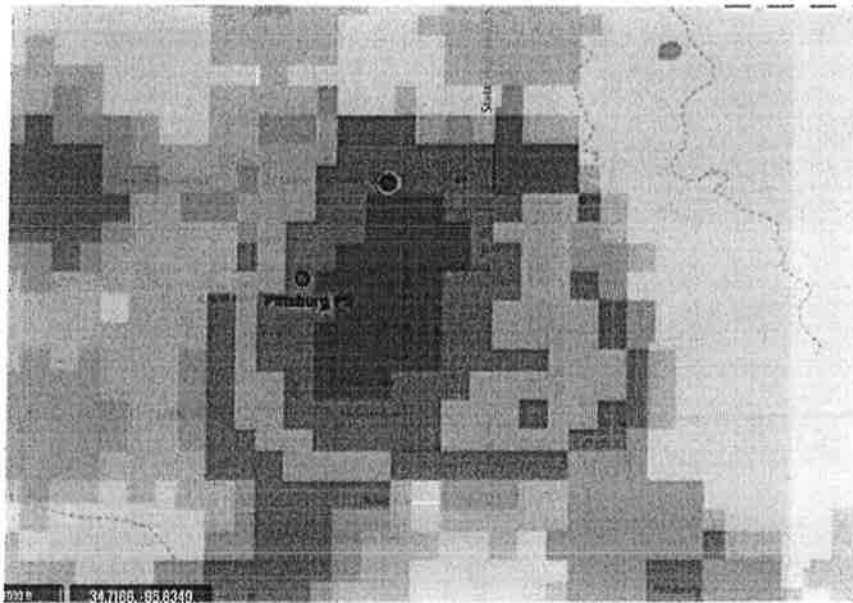
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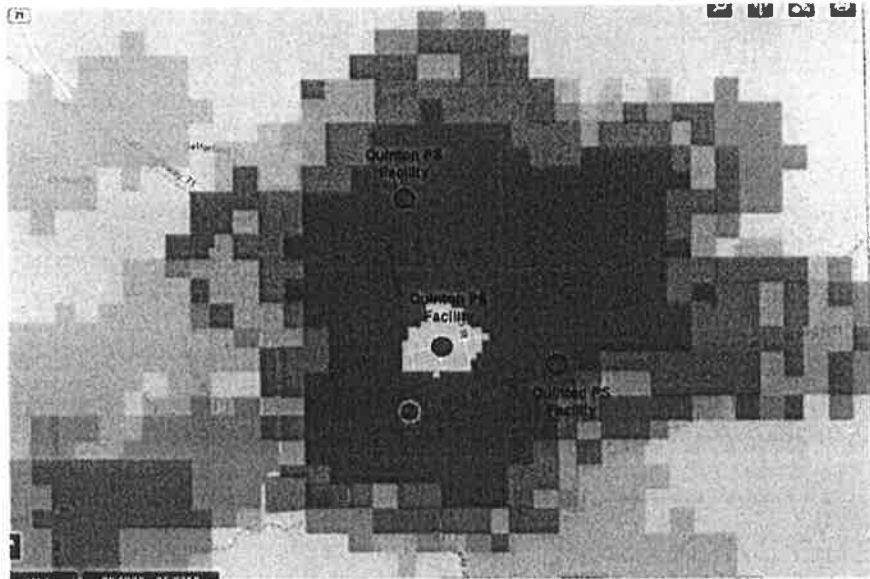
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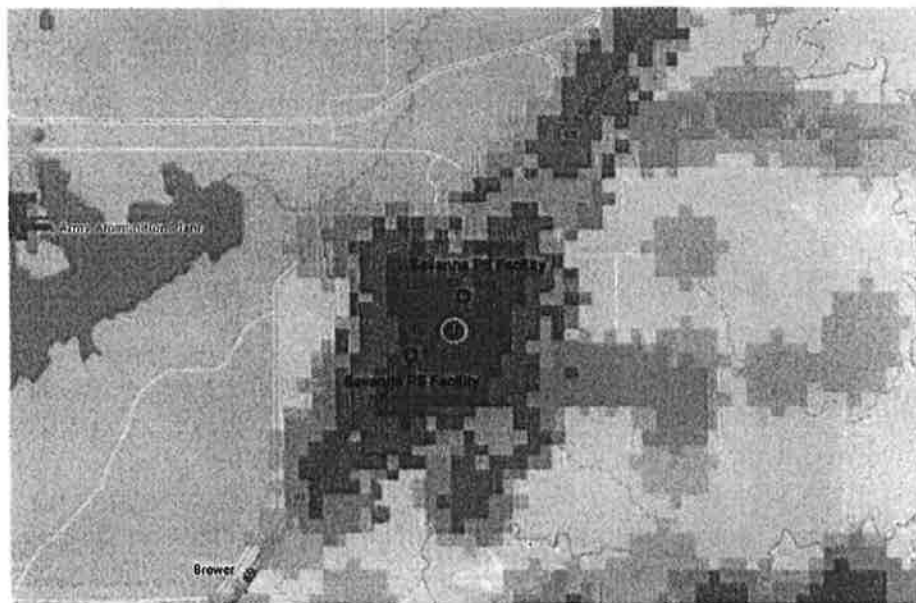
Pittsburg/Pittsburg PS



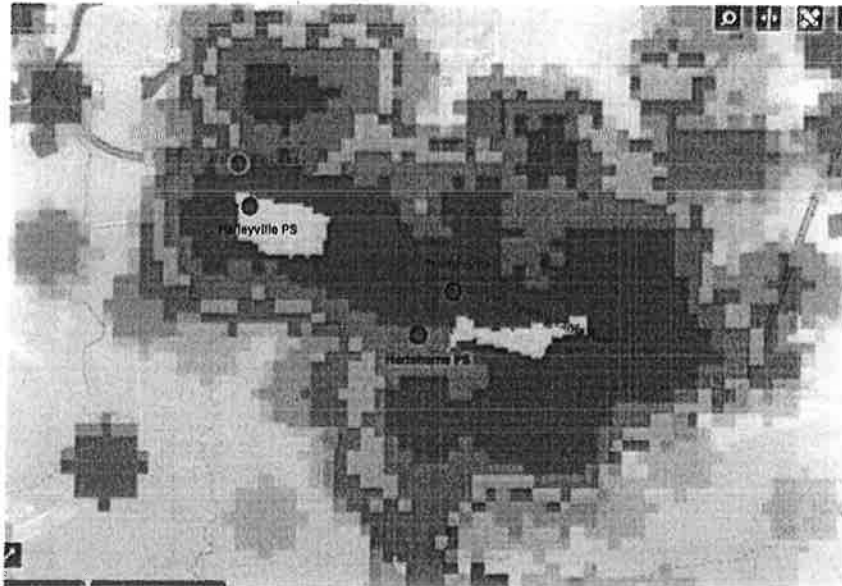
Quinton/Quinton PS



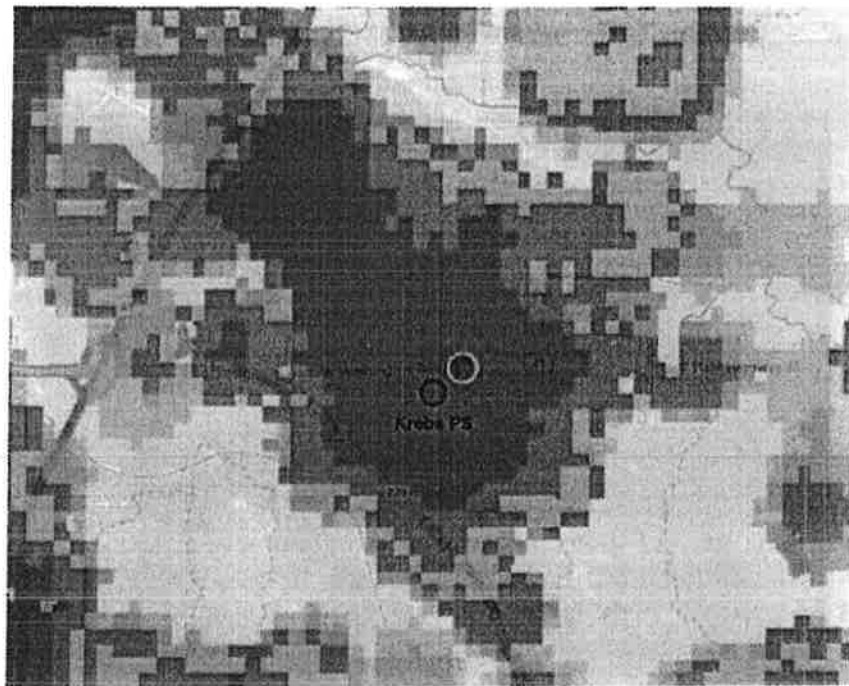
Savanna/Savanna PS



**Haileyville/Haileyville PS
Hartshorne/Hartshorne PS**



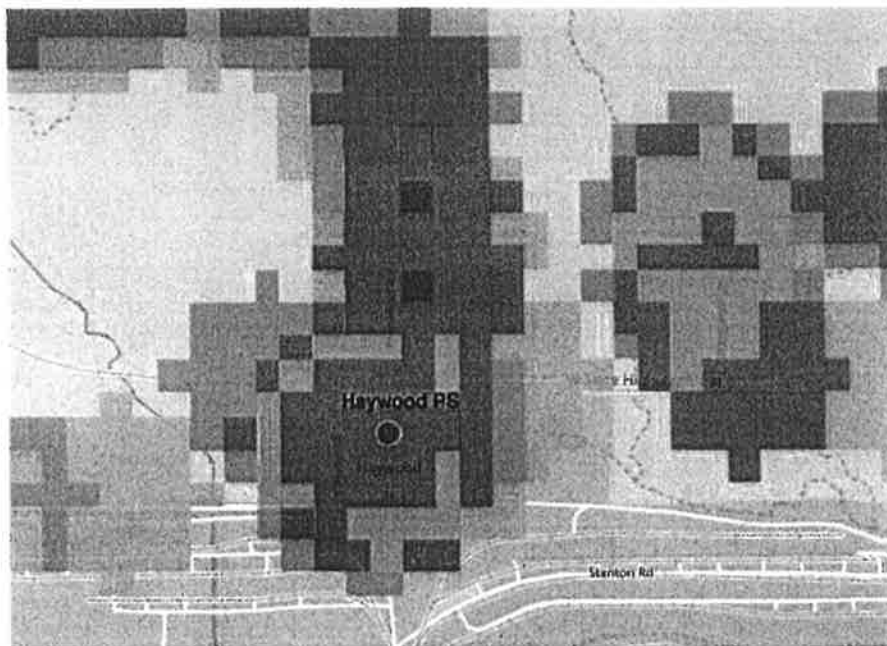
Krebs/Krebs PS



McAlester/McAlester PS/Frink-Chambers PS/Tannehill PS



Haywood PS



Previous Occurrences

The Planning Area has experienced nearly 900 wildfire events between 2010 and 2020. Unfortunately, this data is spread across multiple departments with different record keeping systems.

Probability of Future Events

The probability of future events within the Planning Area is high due to previous occurrences.

The WUI Risk (Figures 3-17 and 3-18) represents a rating of the potential impact of a wildfire on people in their homes. The scale starts at -1 Minor Impacts and ends with -9 Major Impacts. The data from Figures 3-19 and 3-20 shows the Planning Area sees the entire scale but has a majority impact of -2.

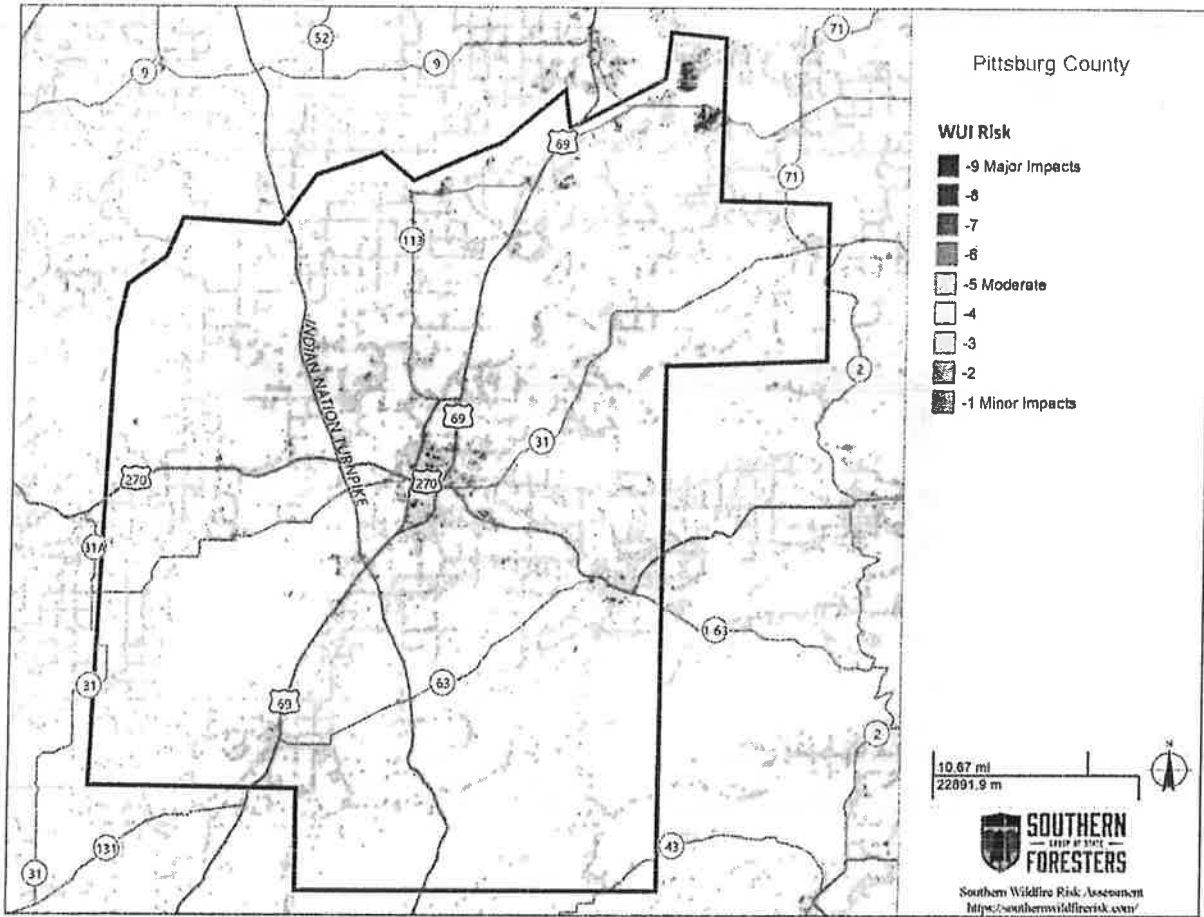
Figure 3-19

WUI Risk

Class	Acres	Percent
-9 Major Impacts	12	0.0%
-8	1,035	0.5%
-7	3,657	1.7%
-6	3,647	1.7%
-5 Moderate	25,139	11.6%
-4	22,446	10.4%
-3	17,174	7.9%
-2	110,413	51.0%
-1 Minor Impacts	33,083	15.3%
Total	216,606	100.0%

Figure 3-20

WUI Risk

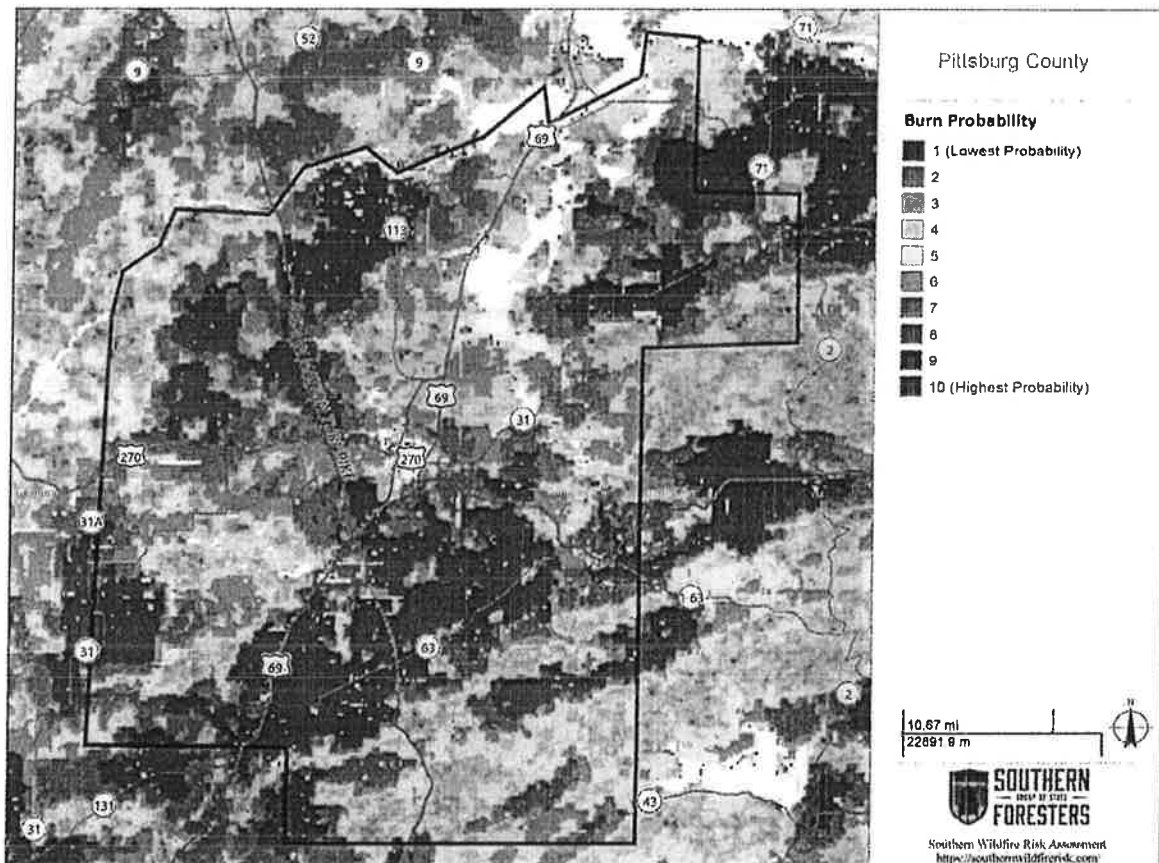


The Burn Probability Map shows the probability of an area burning given current landscape conditions, percentile weather, historical ignition patterns, and historical fire prevention and suppression efforts. Figures 3-21 and 3-22 show where these probabilities are the greatest. The scale shows 1 as the lowest probability and 10 as the highest probability. The Planning Area only sees 1-8 on the scale.

Figure 3-21
Burn Probability

Class	Acres	Percent
1	1,099	0.1 %
2	5,476	0.7 %
3	38,045	4.8 %
4	84,684	10.7 %
5	159,387	20.2 %
6	134,366	17.0 %
7	162,738	20.6 %
8	205,197	25.9 %
9	0	0.0 %
10	0	0.0 %
Total	790,992	100.0 %

Figure 3-22
Burn Probability



Extent

The Burning Index is a short-term response to meteorological factors. The burning index includes real-time observations of temperature, relative humidity, wind speed and solar radiation. It applies those factors to a vegetation model, which includes the “relative greenness,” (a satellite-derived measure of the health of the vegetation), and fuel models for native vegetation. This vegetation model is comprised of 1-kilometer grids across Oklahoma. The model uses these inputs to produce four indices: Spread Component, Energy Release Component, Ignition Component, and Burning Index. Burning Index is a synthesis of the Spread and Energy Release components and infers fire line intensity and flame length. The higher the number, the more difficult it is to fight a wildfire. The Planning Area starts to see the affects and stress on resources at a Fire Line Intensity of >100 but has seen and expects to continue seeing the full range of the scale.

Figure 3-23
The Burning Index

Flame Length (ft)	Fire Line Intensity (BTU/ft/s)	Interpretations
4 (BI < 40)	<100	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold fire.
4-8 (BI 40-80)	100-500	Fires are too intense for direct attack on the head by persons using hand tools. Hand line cannot hold fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8-11 (BI 80-110)	500-1,000	Fires may present serious control problems; torching out, crowning, and spotting. Control efforts at fire head will probably be ineffective.
>11 (BI >110)	>1,000	Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective.

Impact and Vulnerability

Possible environmental impacts of wildfires are loss of plant and animal life and the disruption of the natural balance of the ecosystem, chemicals, and other hazardous substances. Environmental impact after a wildfire is considered high.

Impacts to responders include severe burns, heat exhaustion, smoke inhalation, other injuries and fatalities. Roads that become impassable due to smoke or other circumstances related to the hazard create a health risk, financial, and time hardship to the local governments, the public, the school districts and others that must find alternative routes around affected areas.

Smoke from fires can cover roadways, leaving them impassible. Additionally, services to the public could be delayed, leading to a lack of confidence in the jurisdictions' ability to govern. In the event facilities or access to facilities are limited, the local jurisdiction's Continuity of Operations/Government Plan may be activated ensuring minimal disruption to essential services. At this time, only Pittsburg County and the City of McAlester have a Continuity of Operations Plan to enact. All other participating jurisdictions do not have a plan, and this is considered a vulnerability.

Farmers and ranchers who also reside in rural or unincorporated parts of the Planning Area rely on crops and livestock for financial support. Wildfires can burn several hundreds of acres before being stopped, posing a financial and health risk to these citizens.

Figure 3-24

Wildfire Vulnerabilities

Jurisdiction	Vulnerabilities	Impact
Pittsburg County	The county doesn't put out enough wildfire awareness or education.	A lack of education can cause preventable incidents that could put several people, homes, livestock, and other structures in danger.
Town of Alderson	The jurisdiction doesn't have the proper equipment to keep the city clear from potential fire hazards such as overgrown brush.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
Town of Ashland	The Town of Ashland doesn't have the proper equipment to keep the city clear from potential fire hazards such as overgrown brush.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
Town of Canadian	The jurisdiction doesn't put out enough wildfire awareness or education.	A lack of education can cause preventable incidents that could put several people, homes, livestock, and other structures in danger.
	The Town of Canadian doesn't participate in any kind of debris removal or fuel reduction programs.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
Carlton Landing	The jurisdiction only has one access point.	If the access point were to be compromised by a wildfire, the citizens would be cut off.
Town of Crowder	The Town of Crowder doesn't have the proper equipment to keep the city clear from potential fire hazards such as overgrown brush.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
Town of Indianola	The jurisdiction doesn't have enough fire hydrants or other water sources.	If a wildfire were to happen, the jurisdiction wouldn't have the resources to contain it or put it out completely which would put citizens, homes, livestock, and other buildings in danger.

Town of Kiowa	The jurisdiction doesn't have enough fire hydrants or other water sources.	If a wildfire were to happen, the jurisdiction wouldn't have the resources to contain it or put it out completely which would put citizens, homes, livestock, and other buildings in danger.
	The jurisdiction doesn't have the proper equipment to keep the city clear from potential fire hazards such as overgrown brush.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
Town of Pittsburg	The jurisdiction doesn't have a clear or consistent system for keeping the town clear of potential fire fuels.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
Town of Quinton	The jurisdiction doesn't put out enough wildfire awareness or education.	A lack of education can cause preventable incidents that could put several people, homes, livestock, and other structures in danger.
Town of Savanna	The jurisdiction doesn't put out enough wildfire awareness or education.	A lack of education can cause preventable incidents that could put several people, homes, livestock, and other structures in danger.
City of Haileyville	The jurisdiction doesn't put out enough wildfire awareness or education.	A lack of education can cause preventable incidents that could put several people, homes, livestock, and other structures in danger.
	The City of Haileyville has several overgrown areas that have increased the jurisdiction fire risk.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
City of Hartshorne	The jurisdiction doesn't participate in any fire fuel reduction programs and doesn't have any clear procedures for clearing debris.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
City of Krebs	The jurisdiction doesn't put out enough wildfire awareness or education.	A lack of education can cause preventable incidents that could put several people, homes, livestock, and other structures in danger.

	The jurisdiction doesn't have a system to clean potential fire fuels from the area.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
City of McAlester	The city doesn't have the proper equipment to keep the city clear from potential fire hazards such as overgrown brush or to put out fires once they start.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
McAlester Public Schools	McAlester Public Schools doesn't participate in any kind of fire prevention program and believes that's a deficiency for the school district.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
Quinton Public Schools	The jurisdiction doesn't have a system to clean potential fire fuels from the grounds.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
Crowder Public Schools	The school district doesn't think they put out enough wildfire awareness or education.	A lack of education can cause preventable incidents that could put several people, homes, livestock, and other structures in danger.
Haileyville Public Schools	Haileyville Public Schools doesn't participate in any kind of fire prevention program and believes that's a deficiency for the school district.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
Frink-Chambers Public Schools	Frink-Chambers Public Schools doesn't participate in any kind of fire prevention program and believes that's a deficiency for the school district.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
Tannehill Public Schools	Tannehill Public Schools doesn't participate in any kind of fire prevention program and believes that's a deficiency for the school district.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
	The school district doesn't think they put out enough wildfire awareness or education.	A lack of education can cause preventable incidents that could put several people, homes, livestock, and other structures in danger.
	There isn't a system or program in place to clear potential fire fuels.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.

Krebs Public Schools	The jurisdiction doesn't participate in any fire fuel reduction programs and doesn't have any clear procedures for clearing debris.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
Haywood Public Schools	The school district doesn't think they put out enough wildfire awareness or education.	A lack of education can cause preventable incidents that could put several people, homes, livestock, and other structures in danger.
Savanna Public Schools	The school district doesn't think they put out enough wildfire awareness or education.	A lack of education can cause preventable incidents that could put several people, homes, livestock, and other structures in danger.
	Savanna Public Schools doesn't participate in any kind of fire prevention program and believes that's a deficiency for the school district.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
Canadian Public Schools	Canadian Public Schools doesn't participate in any kind of fire prevention program and believes that's a deficiency for the school district.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
Pittsburg Public Schools	The school district doesn't think they put out enough wildfire awareness or education.	A lack of education can cause preventable incidents that could put several people, homes, livestock, and other structures in danger.
Hartshorne Public Schools	Hartshorne Public Schools doesn't participate in any kind of fire prevention program and believes that's a deficiency for the school district.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.
Indianola Public Schools	The school district doesn't think they put out enough wildfire awareness or education.	A lack of education can cause preventable incidents that could put several people, homes, livestock, and other structures in danger.

Kiowa Public Schools	The school district doesn't think they put out enough wildfire awareness or education.	A lack of education can cause preventable incidents that could put several people, homes, livestock, and other structures in danger.
Carlton Landing Academy	The jurisdiction doesn't have a system to clean potential fire fuels from the grounds.	Overgrown brush and other potential fire fuels increases the probability of a wildfire event.

3.4.5 Lightning

Description

Lightning is generated by the buildup of charged ions in a thundercloud. When the buildup interacts with the best conducting object or surface on the ground, the result is a discharge of a lightning bolt. Thunder is the sound of the shock wave produced by the rapid heating and cooling of the air near the lightning bolt. The air in the channel of a lightning strike reaches temperatures higher than 50,000 Fahrenheit.

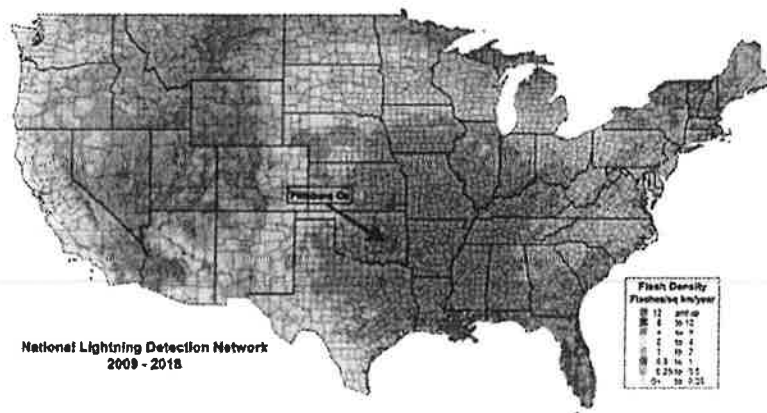
Location

The entire Planning Area is at risk to lightning, though outdoor events are considered the most at risk to this hazard.

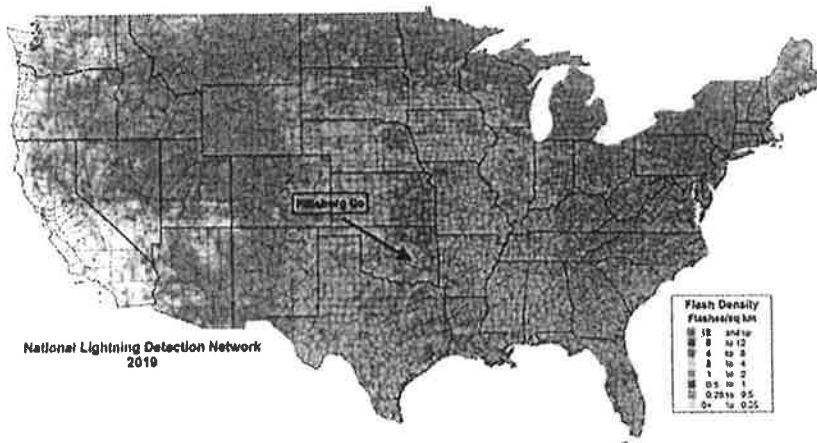
Previous Occurrences

According to Vaisala Lightning Report data, the Planning Area has received 2 - 12 Cloud-to-Ground Lightning flashes per year, per square kilometer between 2009-2020.

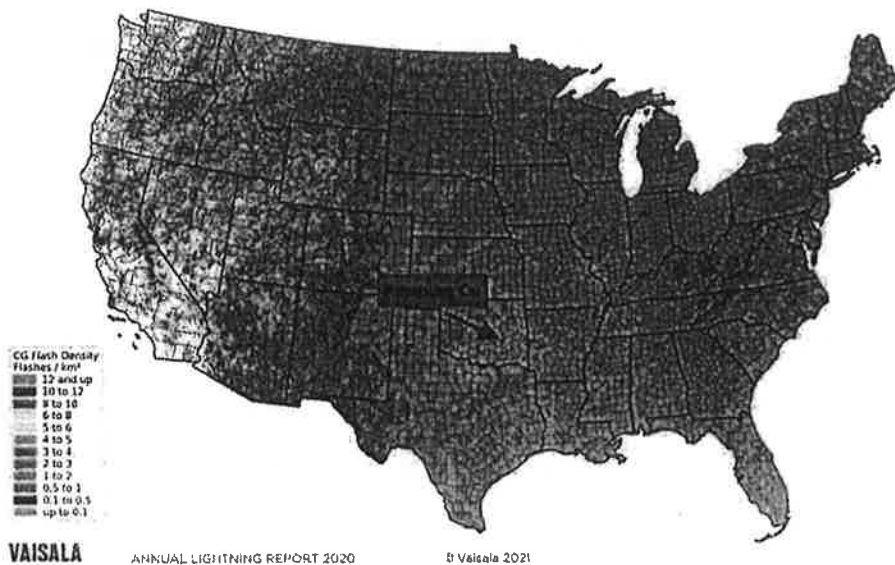
U.S. Cloud-to-Ground Lightning Flash Density Map 2009-2018



U.S. Cloud-to-Ground Flash Density in 2019



U.S. cloud-to-ground flash density in 2020



Probability of Future Events

The probability of future events is considered high.

Extent

There are two different types of lightning—sheet lightning and cloud-to-ground lightning. Cloud-to-ground lightning begins with a step like series of negative or positive charges and then races downward from a storm cloud toward Earth. There is both positive and negative charged cloud-to-ground lightning.

Positive cloud-to-ground lightning flashes make up about 5-10% of all cloud-to-ground lightning. These flashes typically originate in the upper portion of thunderstorms. Due to the location of this type of lightning, it's usually observed approximately 10 or more miles from where it is currently striking along earth's surface. These flashes occur away from the main point of precipitation meaning it has a higher probability of creating wildfires and extra fire danger than negative cloud-to-ground lightning.

The Planning Area uses the Vaisala Lightning Report data to categorizes Lightning extent, and data maps are provided in the Previous Occurrence section. The Planning Area can expect to receive 2 - 12 Cloud-to-Ground Lightning flashes per year, per square kilometer.

Impact and Vulnerability

The impact of lightning occurs during cloud to ground lightning. None of the participating jurisdictions or school districts have ever reported damage to facilities from this hazard but recognizes the potential for future impacts. The main concern for all jurisdictions and school districts is outdoor events. If lightning were to strike during an outdoor event, the potential for loss of life and property is high. Because of this, school districts have guidelines to follow in case of a lightning event that would delay all outdoor activities until it's safe to continue.

Possible environmental impacts from lightning include loss of plant and animal life, wildfires, and disruption of the natural balance of the ecosystem, chemicals, and other hazardous substances. Environmental impact after a lightning event is considered high.

Another large concern are the fishing tournaments held on Lake Eufala. Portions of the lake are located in the Town of Crowder, Town of Canadian, and the County. When the participants are on the lake and away from the shore, they could easily be caught out in the weather and be at risk to lightning. Additionally, some participants come from out of state and aren't familiar with the jurisdictions' hazards, leaving them especially vulnerable.

**Figure 3-26
Lightning Vulnerabilities**

Jurisdiction	Vulnerabilities	Impact
Pittsburg County	The County stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.
	The jurisdiction has several buildings without lightning rods or some other form of lightning protection.	A direct lightning strike can damage or even catch a building on fire, endangering those inside.
	There are several critical facilities within the jurisdiction that are lacking generators, including the County Courthouse, several fire departments, and others.	Without generators, critical facilities can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Alderson	The Alderson Fire Department lacks a generator.	Without generators, critical facilities can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Ashland	The Ashland Fire Department lacks a generator.	Without generators, critical facilities can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Canadian	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.

	The jurisdiction doesn't have a lightning detection or warning system.	Citizens participating in outdoor activities are severely vulnerable to lightning. If struck, lightning can injure or even kill citizens.
	The Town of Canadian lacks generators at the Town Hall, Lift Station, and several others identified critical facilities.	Without generators, critical facilities can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, essential services to the public could be delayed.
Carlton Landing	The Carlton Landing Fire Department and one of their lift stations lack generators.	Without generators, critical facilities can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, essential services to the public could be delayed.
	The jurisdiction has several buildings without lightning rods or some other form of lightning protection.	A direct lightning strike can damage or even catch a building on fire, endangering those inside.
	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.
Town of Crowder	The Crowder Fire Department and Senior Citizen Center lack generators.	Without generators, critical facilities can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, essential services to the public could be delayed.
	The jurisdiction doesn't have a lightning detection or warning system.	Citizens participating in outdoor activities are severely vulnerable to lightning. If struck, lightning can injure or even kill citizens.

	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.
Town of Indianola	The Indianola Fire Department lacks a generator.	Without generators, critical facilities can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Kiowa	The jurisdiction has access to a mass notification system but doesn't have enough employees trained in it or policies and procedures in place to know when to use it.	Unreliable messaging could confuse citizens and make cause a delay in preparedness for impending storms.
	The jurisdiction is worried about citizens not understanding or taking the threat of lightning seriously.	While lightning is a common occurrence in the jurisdiction, it can be deadly.
	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.
Town of Pittsburg	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.
	All of the identified critical facilities for the Town of Pittsburg lack generators.	Without generators, critical facilities can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, essential services to the public could be delayed.
	The jurisdiction has several buildings without lightning rods or some other form of lightning protection.	A direct lightning strike can damage or even catch a building on fire, endangering those inside.

Town of Quinton	Quinton's town hall and fire department lack generators.	Without generators, critical facilities can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Savanna	All but two of Savanna's identified critical facilities lack generators.	Without generators, critical facilities can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, essential services to the public could be delayed.
City of Haileyville	The jurisdiction has access to a mass notification system but doesn't have enough employees trained in it or policies and procedures in place to know when to use it.	Unreliable messaging could confuse citizens and make cause a delay in preparedness for impending storms.
	None of this jurisdiction's critical facilities have generators.	Without generators, critical facilities can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, essential services to the public could be delayed.
	The jurisdiction doesn't have a lightning detection or warning system.	Citizens participating in outdoor activities are severely vulnerable to lightning. If struck, lightning can injure or even kill citizens.
	The jurisdiction is worried about citizens not understanding or taking the threat of lightning seriously.	While lightning is a common occurrence in the jurisdiction, it can be deadly.
City of Hartshorne	The jurisdiction has several buildings without lightning rods or some other form of lightning protection.	A direct lightning strike can damage or even catch a building on fire, endangering those inside.
	The school doesn't have a lightning detection or warning system.	Citizens participating in outdoor activities are severely vulnerable to lightning. If struck, lightning can injure or even kill citizens.

	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.
	The City Hall does not have a generator.	Without generators, critical facilities can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, essential services to the public could be delayed.
City of Krebs	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.
	The jurisdiction doesn't have a lightning detection or warning system.	Citizens participating in outdoor activities are severely vulnerable to lightning. If struck, lightning can injure or even kill citizens.
	The jurisdiction has several buildings without lightning rods or some other form of lightning protection.	A direct lightning strike can damage or even catch a building on fire, endangering those inside.
City of McAlester	The jurisdiction has several buildings without lightning rods or some other form of lightning protection.	A direct lightning strike can damage or even catch a building on fire, endangering those inside.
	The jurisdiction doesn't have a lightning detection or warning system.	Citizens participating in outdoor activities are severely vulnerable to lightning. If struck, lightning can injure or even kill citizens.
	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.

	There are several critical facilities within the jurisdiction that are lacking generators.	Without generators, critical facilities can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, essential services to the public could be delayed.
McAlester Public Schools	The school district does not have an emergency generator.	Without generators, the schools can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, parents may have to miss work.
	The school doesn't have a lightning detection or warning system.	Kids participating in sports or other outdoor activities are left vulnerable without proper warning. A lightning strike has the ability to kill or severely harm children.
	The school stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.
Quinton Public Schools	The school doesn't have a lightning detection or warning system.	Kids participating in sports or other outdoor activities are left vulnerable without proper warning. A lightning strike has the ability to kill or severely harm children.
	The school has several buildings without lightning rods or some other form of lightning protection.	A direct lightning strike can damage or even catch a building on fire, endangering those inside.
	The school district does not have an emergency generator.	Without generators, the schools can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, parents may have to miss work.

Crowder Public Schools	The school doesn't have a lightning detection or warning system.	Kids participating in sports or other outdoor activities are left vulnerable without proper warning. A lightning strike has the ability to kill or severely harm children.
	The school has several buildings without lightning rods or some other form of lightning protection.	A direct lightning strike can damage or even catch a building on fire, endangering those inside.
	The school stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.
Haileyville Public Schools	The school doesn't have a lightning detection or warning system.	Kids participating in sports or other outdoor activities are left vulnerable without proper warning. A lightning strike has the ability to kill or severely harm children.
Frink-Chambers Public Schools	The school doesn't have a lightning detection or warning system.	Kids participating in sports or other outdoor activities are left vulnerable without proper warning. A lightning strike has the ability to kill or severely harm children.
	The school has several buildings without lightning rods or some other form of lightning protection.	A direct lightning strike can damage or even catch a building on fire, endangering those inside.
	The school stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.
	The school district does not have an emergency generator.	Without generators, the schools can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, parents may have to miss work.

Tannehill Public Schools	The school has several buildings without lightning rods or some other form of lightning protection.	A direct lightning strike can damage or even catch a building on fire, endangering those inside.
	The school doesn't have a lightning detection or warning system.	Kids participating in sports or other outdoor activities are left vulnerable without proper warning. A lightning strike has the ability to kill or severely harm children.
	The school district does not have an emergency generator.	Without generators, the schools can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, parents may have to miss work.
Krebs Public Schools	The school doesn't have a lightning detection or warning system.	Kids participating in sports or other outdoor activities are left vulnerable without proper warning. A lightning strike has the ability to kill or severely harm children.
	The school has several buildings without lightning rods or some other form of lightning protection.	A direct lightning strike can damage or even catch a building on fire, endangering those inside.
Haywood Public Schools	The school stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.
	The school has several buildings without lightning rods or some other form of lightning protection.	A direct lightning strike can damage or even catch a building on fire, endangering those inside.
	The school doesn't have a lightning detection or warning system.	Kids participating in sports or other outdoor activities are left vulnerable without proper warning. A lightning strike has the ability to kill or severely harm children.

Savanna Public Schools	The school is worried about students and families not understanding or taking the threat of lightning seriously.	While lightning is a common occurrence in the jurisdiction, it can be deadly.
	The school doesn't have a lightning detection or warning system.	Kids participating in sports or other outdoor activities are left vulnerable without proper warning. A lightning strike has the ability to kill or severely harm children.
	The school has several buildings without lightning rods or some other form of lightning protection.	A direct lightning strike can damage or even catch a building on fire, endangering those inside.
	The school is worried about students and families not understanding or taking the threat of lightning seriously.	While lightning is a common occurrence in the jurisdiction, it can be deadly.
	The school stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.
Canadian Public Schools	The school is worried about students and families not understanding or taking the threat of lightning seriously.	While lightning is a common occurrence in the jurisdiction, it can be deadly.
Pittsburg Public Schools	The school doesn't have a lightning detection or warning system.	Kids participating in sports or other outdoor activities are left vulnerable without proper warning. A lightning strike has the ability to kill or severely harm children.
	The school has several buildings without lightning rods or some other form of lightning protection.	A direct lightning strike can damage or even catch a building on fire, endangering those inside.
	The school stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.

Hartshorne Public Schools	The school doesn't have a lightning detection or warning system.	Kids participating in sports or other outdoor activities are left vulnerable without proper warning. A lightning strike has the ability to kill or severely harm children.
	The school stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.
	The school has several buildings without lightning rods or some other form of lightning protection.	A direct lightning strike can damage or even catch a building on fire, endangering those inside.
	The school district does not have an emergency generator.	Without generators, the schools can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, parents may have to miss work.
Indianola Public Schools	The school doesn't have a lightning detection or warning system.	Kids participating in sports or other outdoor activities are left vulnerable without proper warning. A lightning strike has the ability to kill or severely harm children.
	The school stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.
Kiowa Public Schools	The school doesn't have a lightning detection or warning system.	Kids participating in sports or other outdoor activities are left vulnerable without proper warning. A lightning strike has the ability to kill or severely harm children.

<p>Carlton Landing Academy</p>	<p>The school district does not have an emergency generator.</p>	<p>Without generators, the schools can't guarantee they will be able to function during lightning events. If these facilities are unable to stay open, parents may have to miss work.</p>
	<p>The school has several buildings without lightning rods or some other form of lightning protection.</p>	<p>A direct lightning strike can damage or even catch a building on fire, endangering those inside.</p>
	<p>The school stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.</p>	<p>Equipment and vehicles left out in the elements are vulnerable to lightning strikes. A lightning strike can cause equipment failure.</p>

3.4.6 Hail

Description

Hail is an outgrowth of a severe thunderstorm in which balls or irregularly shaped lumps of ice fall with rain. Extreme temperature changes from the ground upward into the jet stream produce strong updraft winds that cause hail formation.

The size of hailstones is a direct function of the severity and size of a storm. High velocity updraft winds keep hail in suspension in thunderclouds. The greater the intensity of heating at the Earth's surface, the stronger the updraft will be. Higher temperatures relative to elevation result in increased suspension time, allowing hailstorms to grow in size.

Location

The entire Planning Area is at risk to Hail events, though outdoor event areas are considered at a higher risk.

Previous Occurrences

Figure 3-27		
Hail Previous Occurrences		
2010-2020		
From the NOAA National Centers for Environmental Information https://www.ncdc.noaa.gov/stormevents		
Date	Jurisdiction	Narrative
05/10/2010	McAlester	Severe thunderstorms developed along and ahead of a dry line over central Oklahoma during the afternoon hours. Very unstable air along with very strong low level wind shear resulted in a number of supercell thunderstorms. These storms produced numerous tornadoes, very large hail, and damaging wind gusts as they moved eastward across eastern Oklahoma during the evening hours.
05/19/2010	Pittsburg County	Severe thunderstorms developed over eastern Oklahoma along and ahead of a northward lifting warm front during the evening of May 19th. The storms produced several tornadoes, along with large hail, damaging winds, and flash flooding.
05/26/2010	Hartshorne	Isolated severe thunderstorms developed in the vicinity of a weak surface boundary that pushed into eastern Oklahoma on the 26th.

06/14/2010	Pittsburg County	Widespread showers and thunderstorms affected much of eastern Oklahoma in response to a stalled frontal boundary and a very moist and unstable atmosphere in place over the area. Strong to severe thunderstorms developed across portions of east-central and southeast Oklahoma where large hail and damaging winds occurred, while heavy rain producing showers and thunderstorms resulted in flash flooding and river flooding for portions of northeast Oklahoma.
03/25/2011	Savanna	Scattered severe thunderstorms developed during the early morning hours over eastern Oklahoma, to the north of a stationary frontal boundary that was located over northern Texas and northern Louisiana.
03/25/2011	Pittsburg County	Scattered severe thunderstorms developed during the early morning hours over eastern Oklahoma, to the north of a stationary frontal boundary that was located over northern Texas and northern Louisiana. The hail from this storm was measured at 2 inches.
04/14/2011	Savanna	Low pressure was centered over southern Kansas during the early afternoon of the 14th with a sharp dryline extending from the low pressure system through central Oklahoma. A moist and very unstable air mass was in place across eastern Oklahoma ahead of the dryline. Severe thunderstorms developed along the dryline during the afternoon and moved into eastern Oklahoma during the early evening hours. Large hail up to grapefruit size, damaging wind gusts, and numerous tornadoes occurred as the storms moved through the region.
04/14/2011	Krebs	Low pressure was centered over southern Kansas during the early afternoon of the 14th with a sharp dryline extending from the low pressure system through central Oklahoma. A moist and very unstable air mass was in place across eastern Oklahoma ahead of the dryline. Severe thunderstorms developed along the dryline during the afternoon and moved into eastern Oklahoma during the early evening hours. Large hail up to grapefruit size, damaging wind gusts, and numerous tornadoes occurred as the storms moved through the region.
04/25/2011	Kiowa	Periods of showers and thunderstorms resulted in widespread heavy rainfall on the 25th with a frontal boundary extending through eastern Oklahoma and an upper level disturbance approaching the region. These showers and thunderstorms only compounded the already serious flood situation across much of the area. Severe thunderstorms also produced large hail and damaging wind gusts.

04/25/2011	Pittsburg County	Periods of showers and thunderstorms resulted in widespread heavy rainfall on the 25th with a frontal boundary extending through eastern Oklahoma and an upper level disturbance approaching the region. These showers and thunderstorms only compounded the already serious flood situation across much of the area. Severe thunderstorms also produced large hail and damaging wind gusts.
04/26/2011	Pittsburg County	On the afternoon of the 26th, a frontal boundary began to lift north out of Texas with surface low pressure developing on the front over southeastern Oklahoma. Severe thunderstorms developed within the moist and unstable air mass near and north of the frontal boundary, producing large hail up to golfball size and a brief tornado.
05/12/2011	Pittsburg County	A cold front moved into and across the region during the afternoon and evening of the 12th. A warm, moist, and unstable air mass existed over eastern Oklahoma ahead of the front. Thunderstorms developed along and ahead of the front during the afternoon and continued to affect eastern Oklahoma through the evening. The stronger storms produced large hail up to baseball size and damaging wind gusts.
05/12/2011	Ashland	A cold front moved into and across the region during the afternoon and evening of the 12th. A warm, moist, and unstable air mass existed over eastern Oklahoma ahead of the front. Thunderstorms developed along and ahead of the front during the afternoon and continued to affect eastern Oklahoma through the evening. The stronger storms produced large hail up to baseball size and damaging wind gusts.
05/22/2011	McAlester	A very moist and very unstable air mass developed across eastern Oklahoma on the afternoon and evening of the 22nd as a dry line moved into the area from the west. Severe thunderstorms, including supercells, developed ahead of the dry line and moved across the area producing tornadoes, large hail up to softball size, and damaging wind gusts.
05/24/2011	Pittsburg County	Severe thunderstorms developed along a dry line over central Oklahoma during the afternoon hours. Very unstable air and strong wind shear east of the dry line supported supercell thunderstorm structures, which persisted as the storms moved into eastern Oklahoma during the evening hours. These severe storms produced tornadoes, large hail to golfball size, and very strong damaging downburst wind across much of eastern Oklahoma.

02/01/2012	Pittsburg County	During the mid to late morning on the 1st, a cold front pushed into southeastern Oklahoma where temperatures were unseasonably warm and deep low level moisture was in place. Thunderstorms occurred in association with this boundary, some of which produced large hail.
05/29/2012	Pittsburg County	Numerous thunderstorms developed along a cold front moving through eastern Oklahoma on the evening of the 29th. These thunderstorms resulted in damaging winds and large hail.
08/07/2012	Quinton	A weak surface boundary provided the focus for afternoon thunderstorm development across southeast Oklahoma on the 7th. The stronger storms produced damaging wind and some hail.
09/26/2012	Crowder	Scattered thunderstorms developed near an outflow boundary across east-central Oklahoma during the early afternoon hours of the 26th. These storms drifted south and east during the afternoon. Several of the storms became supercellular, producing large hail, damaging wind, and some flash flooding.
09/26/2012	McAlester	Scattered thunderstorms developed near an outflow boundary across east-central Oklahoma during the early afternoon hours of the 26th. These storms drifted south and east during the afternoon. Several of the storms became supercellular, producing large hail, damaging wind, and some flash flooding.
09/26/2012	McAlester	Scattered thunderstorms developed near an outflow boundary across east-central Oklahoma during the early afternoon hours of the 26th. These storms drifted south and east during the afternoon. Several of the storms became supercellular, producing large hail, damaging wind, and some flash flooding.
12/19/2012	McAlester	A line of severe thunderstorms developed over eastern Oklahoma during the early evening hours of the 19th as a cold front moved into the region from the west. The thunderstorms moved rapidly eastward, producing damaging wind and large hail across mainly southeastern Oklahoma.
03/30/2013	Ashland	Thunderstorms developed across southeastern Kansas and eastern Oklahoma during the evening hours of the 30th. The combination of instability and wind shear across the area resulted in supercell storm structures as these storms evolved. The storms moved east-southeast across much of eastern Oklahoma during the evening producing large hail

		up to three inches in diameter, damaging wind gusts, and two tornadoes.
03/30/2013	Ashland	Thunderstorms developed across southeastern Kansas and eastern Oklahoma during the evening hours of the 30th. The combination of instability and wind shear across the area resulted in supercell storm structures as these storms evolved. The storms moved east-southeast across much of eastern Oklahoma during the evening producing large hail up to three inches in diameter, damaging wind gusts, and two tornadoes.
07/14/2013	McAlester	Thunderstorms developed during the afternoon hours of the 14th along weak surface boundaries that were in place across the area. Large hail and damaging winds occurred with the stronger storms.
07/14/2013	McAlester	Thunderstorms developed during the afternoon hours of the 14th along weak surface boundaries that were in place across the area. Large hail and damaging winds occurred with the stronger storms.
07/14/2013	Pittsburg County	Thunderstorms developed during the afternoon hours of the 14th along weak surface boundaries that were in place across the area. Large hail and damaging winds occurred with the stronger storms.
07/14/2013	Pittsburg County	Thunderstorms developed during the afternoon hours of the 14th along weak surface boundaries that were in place across the area. Large hail and damaging winds occurred with the stronger storms.
04/13/2014	McAlester	A strong cold front and dry line moved into eastern Oklahoma during the early afternoon hours of the 13th. Severe thunderstorms formed on these boundaries and moved eastward during the afternoon and evening hours. Large hail up to golfball size and damaging wind gusts up to around 80 mph occurred as the storms moved through the region.
04/24/2014	McAlester	Thunderstorms developed along a cold front as it moved into the region during the afternoon of the 24th. The stronger storms produced large hail and damaging wind.
03/25/2015	McAlester	Severe thunderstorms developed during the afternoon hours to the east of a surface low pressure system located over southwestern Oklahoma and near a stationary frontal boundary that was draped across northeastern Oklahoma. Several of these storms developed supercell characteristics due to a very unstable air mass that was in place over the region coupled with strong vertical wind shear. These

		<p>supercells produced several tornadoes, including a strong tornado that resulted in a fatality in Sand Springs. The storms also produced hail up to softball size and wind gusts to around 90 mph. The storms evolved into a line during the evening hours and moved swiftly across eastern Oklahoma producing wind damage and hail to golfball size. Locally heavy rainfall as a result of storms moving repeatedly across the same locations resulted in flash flooding. Two flash flood fatalities occurred in Muskogee County when a vehicle was driven into flood waters and was swept off the road.</p>
04/19/2015	Kiowa	<p>Thunderstorms developed during the mid afternoon of the 19th in response to a strong cold front moving through the region. Large hail up to golfball size occurred with these thunderstorms as they swept across the area.</p>
06/29/2015	Pittsburg County	<p>Scattered thunderstorms developed during the evening hours of June 29th, along a slow-moving cold front that was moving through southeastern Oklahoma. The atmosphere ahead of the front was very unstable, resulting in some severe thunderstorms that produced large hail up to tennis ball size.</p>
06/29/2015	Pittsburg	<p>Scattered thunderstorms developed during the evening hours of June 29th, along a slow-moving cold front that was moving through southeastern Oklahoma. The atmosphere ahead of the front was very unstable, resulting in some severe thunderstorms that produced large hail up to tennis ball size.</p>
06/29/2015	Kiowa	<p>Scattered thunderstorms developed during the evening hours of June 29th, along a slow-moving cold front that was moving through southeastern Oklahoma. The atmosphere ahead of the front was very unstable, resulting in some severe thunderstorms that produced large hail up to tennis ball size.</p>
06/29/2015	Kiowa	<p>Tennis ball size hail damaged homes and vehicles.</p>
03/13/2016	Canadian	<p>Thunderstorms developed across southeastern Oklahoma during the afternoon of March 13th, ahead of a strong upper level disturbance that approached the area from the west. The strongest storms produced large hail.</p>
05/09/2016	Haileyville	<p>Severe thunderstorms developed along and ahead of a dry line across central Oklahoma during the afternoon of May 9th. The storms moved across eastern Oklahoma during the evening hours. Prior to the storms moving into the area, the atmosphere ahead of the dry line in eastern Oklahoma had become very unstable. This instability, combined with very</p>

		strong wind shear associated with a strong trough of low pressure that moved into the Southern Plains from the Southern Rockies, resulted in the development of supercell thunderstorms. One of these supercells produced multiple tornadoes as it tracked along and near an outflow boundary from morning thunderstorms, which had settled across southeastern Oklahoma by the afternoon. One of the tornadoes was long-lived and damaging. In addition to the tornadoes in southeastern Oklahoma, the severe thunderstorms produced hail up to golfball size and damaging wind gusts across other portions of eastern Oklahoma.
09/14/2016	Haileyville	Thunderstorms developed across southeastern Oklahoma on the 14th, along and ahead of a slow moving cold front. The strongest storms produced large hail.
03/01/2017	McAlester	Strong to severe thunderstorms developed over northeastern Oklahoma during the late evening hours of February 28th along and ahead of a cold front that moved into the area. The thunderstorms organized into lines as they moved across eastern Oklahoma during the early morning hours of March 1st. The strongest storms produced hail up to golfball size and damaging wind gusts.
03/01/2017	McAlester	Strong to severe thunderstorms developed over northeastern Oklahoma during the late evening hours of February 28th along and ahead of a cold front that moved into the area. The thunderstorms organized into lines as they moved across eastern Oklahoma during the early morning hours of March 1st. The strongest storms produced hail up to golfball size and damaging wind gusts.
03/01/2017	McAlester	Strong to severe thunderstorms developed over northeastern Oklahoma during the late evening hours of February 28th along and ahead of a cold front that moved into the area. The thunderstorms organized into lines as they moved across eastern Oklahoma during the early morning hours of March 1st. The strongest storms produced hail up to golfball size and damaging wind gusts.
03/26/2017	McAlester	Strong to severe thunderstorms developed across central Oklahoma during the late afternoon hours of the 26th, as a dry line moved into the area from the west. These storms moved into eastern Oklahoma during the evening hours, producing hail up to golfball size and damaging wind.
04/26/2017	Pittsburg	Severe thunderstorms developed along and ahead of a cold front that moved into eastern Oklahoma during the evening of the 25th. The storms moved eastward across the area through the early morning hours of the 26th, resulting in three tornadoes, hail up to baseball size, and damaging

		wind. Locally heavy rainfall of three to four inches resulted in flash flooding.
04/29/2017	Haileyville	Strong to severe thunderstorms developed during the late evening hours of the 28th over portions of eastern Oklahoma, along and north of a warm front that had moved into the area during the day. These storms produced a strong tornado, hail up to baseball size, damaging wind, and locally heavy rainfall through the early morning hours of the 29th. Another round of severe weather developed during the afternoon hours of the 29th, as a cold front moved into the area from the north. These storms produced a tornado, hail up to golf ball size, damaging wind, and locally heavy rainfall.
06/30/2017	Pittsburg County	Strong to severe thunderstorms developed during the evening hours of the 30th, along a cold front that stretched from southwestern Oklahoma into east-central Oklahoma. The strongest storms produced hail up to quarter size and damaging wind gusts.
04/13/2018	Savanna	Severe thunderstorms developed over eastern Oklahoma during the early afternoon hours of the 13th as a cold front moved into the area. The strongest storms produced large hail up to quarter size and damaging wind gusts as they moved east across the area through the early evening hours.
05/15/2018	McAlester	Thunderstorms developed across southeastern Kansas during the evening of the 14th along a nearly stationary frontal boundary. The storms moved southeast across portions of northeastern Oklahoma during the late evening. The strongest storms produced damaging wind and large hail up to quarter size. The frontal boundary across southeastern Kansas began to move southward as a cold front during the early morning hours of the 15th. Thunderstorms formed along this boundary during the early afternoon as it moved into southeastern Oklahoma. The strongest storm produced large hail up to quarter size.
06/24/2018	Pittsburg County	Severe thunderstorms developed along a warm front that stretched across east central Oklahoma during the evening of the 23rd. These storms moved slowly across portions of eastern Oklahoma through the early morning hours of the 24th. The strongest storms produced hail up to two inches in diameter and damaging wind gusts. Other thunderstorms developed over eastern Colorado and northwestern Kansas during the afternoon of the 23rd. These storms became organized and moved southeast across southwestern Kansas and northwestern Oklahoma during the evening of the 23rd and early morning hours of

		the 24th. They moved into eastern Oklahoma during the morning of the 24th, producing widespread damaging wind and some large hail up to half dollar size.
06/24/2018	Krebs	Severe thunderstorms developed along a warm front that stretched across east central Oklahoma during the evening of the 23rd. These storms moved slowly across portions of eastern Oklahoma through the early morning hours of the 24th. The strongest storms produced hail up to two inches in diameter and damaging wind gusts. Other thunderstorms developed over eastern Colorado and northwestern Kansas during the afternoon of the 23rd. These storms became organized and moved southeast across southwestern Kansas and northwestern Oklahoma during the evening of the 23rd and early morning hours of the 24th. They moved into eastern Oklahoma during the morning of the 24th, producing widespread damaging wind and some large hail up to half dollar size.
06/24/2018	Pittsburg County	Severe thunderstorms developed along a warm front that stretched across east central Oklahoma during the evening of the 23rd. These storms moved slowly across portions of eastern Oklahoma through the early morning hours of the 24th. The strongest storms produced hail up to two inches in diameter and damaging wind gusts. Other thunderstorms developed over eastern Colorado and northwestern Kansas during the afternoon of the 23rd. These storms became organized and moved southeast across southwestern Kansas and northwestern Oklahoma during the evening of the 23rd and early morning hours of the 24th. They moved into eastern Oklahoma during the morning of the 24th, producing widespread damaging wind and some large hail up to half dollar size.
06/24/2018	Savanna	Severe thunderstorms developed along a warm front that stretched across east central Oklahoma during the evening of the 23rd. These storms moved slowly across portions of eastern Oklahoma through the early morning hours of the 24th. The strongest storms produced hail up to two inches in diameter and damaging wind gusts. Other thunderstorms developed over eastern Colorado and northwestern Kansas during the afternoon of the 23rd. These storms became organized and moved southeast across southwestern Kansas and northwestern Oklahoma during the evening of the 23rd and early morning hours of the 24th. They moved into eastern Oklahoma during the morning of the 24th, producing widespread damaging wind and some large hail up to half dollar size.
04/24/2020	Indianola	Strong to severe thunderstorms developed across eastern Oklahoma during the afternoon of the 24th, as an upper level disturbance and associated surface low pressure

		system translated across the region from the west. The strongest thunderstorms produced hail up to ping pong ball size and damaging wind gusts as they moved east across the area.
04/24/2020	McAlester	Strong to severe thunderstorms developed across eastern Oklahoma during the afternoon of the 24th, as an upper level disturbance and associated surface low pressure system translated across the region from the west. The strongest thunderstorms produced hail up to ping pong ball size and damaging wind gusts as they moved east across the area.
04/24/2020	Crowder	Strong to severe thunderstorms developed across eastern Oklahoma during the afternoon of the 24th, as an upper level disturbance and associated surface low pressure system translated across the region from the west. The strongest thunderstorms produced hail up to ping pong ball size and damaging wind gusts as they moved east across the area.
04/24/2020	McAlester	Strong to severe thunderstorms developed across eastern Oklahoma during the afternoon of the 24th, as an upper level disturbance and associated surface low pressure system translated across the region from the west. The strongest thunderstorms produced hail up to ping pong ball size and damaging wind gusts as they moved east across the area.
04/24/2020	Hartshorne	Strong to severe thunderstorms developed across eastern Oklahoma during the afternoon of the 24th, as an upper level disturbance and associated surface low pressure system translated across the region from the west. The strongest thunderstorms produced hail up to ping pong ball size and damaging wind gusts as they moved east across the area.
04/28/2020	McAlester	A broken line of severe thunderstorms developed across northeastern Oklahoma during the late afternoon hours of the 28th, as a cold front moved into the area. The line of thunderstorms moved southeast across eastern Oklahoma through the evening hours. Very strong instability and strong deep layer shear developed across eastern Oklahoma ahead of the thunderstorms. These conditions promoted the development of supercell thunderstorms within the line, as well as ahead of the line in southeastern Oklahoma. The strongest storms produced hail up to two inches in diameter, damaging wind gusts, and a tornado. Locally heavy rainfall also resulted in some flash flooding.
04/28/2020	Pittsburg County	Large hail damaged vehicles and the roofs of homes.

04/28/2020	Haileyville	Golf ball size hail damaged vehicles and the roofs of homes.
04/28/2020	Haileyville	Large hail damaged vehicles and the roofs of homes.
04/28/2020	Pittsburg County	Golf ball size hail damaged vehicles and the roofs of homes.
04/28/2020	Pittsburg County	A broken line of severe thunderstorms developed across northeastern Oklahoma during the late afternoon hours of the 28th, as a cold front moved into the area. The line of thunderstorms moved southeast across eastern Oklahoma through the evening hours. Very strong instability and strong deep layer shear developed across eastern Oklahoma ahead of the thunderstorms. These conditions promoted the development of supercell thunderstorms within the line, as well as ahead of the line in southeastern Oklahoma. The strongest storms produced hail up to two inches in diameter, damaging wind gusts, and a tornado. Locally heavy rainfall also resulted in some flash flooding.
04/28/2020	McAlester	A broken line of severe thunderstorms developed across northeastern Oklahoma during the late afternoon hours of the 28th, as a cold front moved into the area. The line of thunderstorms moved southeast across eastern Oklahoma through the evening hours. Very strong instability and strong deep layer shear developed across eastern Oklahoma ahead of the thunderstorms. These conditions promoted the development of supercell thunderstorms within the line, as well as ahead of the line in southeastern Oklahoma. The strongest storms produced hail up to two inches in diameter, damaging wind gusts, and a tornado. Locally heavy rainfall also resulted in some flash flooding.
04/28/2020	Pittsburg County	Golfball size hail damaged vehicles and the roofs of homes.
04/28/2020	Pittsburg County	Golfball size hail damaged vehicles and the roofs of homes.
07/30/2020	Kiowa	Thunderstorms developed across southeastern Oklahoma during the early evening of the 30th, as a cold front moved into the region. The atmosphere had become very unstable ahead of the front, allowing some of the storms to become severe with large hail up to quarter size and damaging wind.
11/24/2020	Pittsburg County	Golf ball size hail damaged vehicles and homes.
11/24/2020	Pittsburg County	Strong to severe thunderstorms developed across western and central Oklahoma during the afternoon of the 24th, along and ahead of an approaching cold front. The thunderstorms intensified as they moved eastward and

		across eastern Oklahoma during the late afternoon and evening hours. The strongest storms produced large hail up to golf ball size, damaging wind gusts, and two tornadoes.
11/24/2020	McAlester	Strong to severe thunderstorms developed across western and central Oklahoma during the afternoon of the 24th, along and ahead of an approaching cold front. The thunderstorms intensified as they moved eastward and across eastern Oklahoma during the late afternoon and evening hours. The strongest storms produced large hail up to golf ball size, damaging wind gusts, and two tornadoes.

Probability of Future Events

The probability of future events is high in the Planning Area.

Extent

The local jurisdictions within the Planning Area have many assets vulnerable to the impacts of hail. Some of those vulnerabilities include facilities, vehicles, agriculture, and the public. The impacts of hail at any size can cause impacts to the Planning Area, but the Planning Area has seen and expects to continue to see up to an H4. Anything above H1 could start to affect the local jurisdictions' ability to function and cause severe damages.

Figure 3-28

Hail size and diameter in relation to TORRO Hailstorm Intensity Scale.		
Size code	Maximum Diameter	Description
H0	5-9	Pea
H1	10-15	Mothball
H2	16-20	Grape
H3	21-30	Walnut
H4	31-40	Pigeon's egg > squash ball
H5	41-50	Golf ball > Pullet's egg

Impact and Vulnerability

The impact of this hazard is mainly financial resulting in repairs to cars, roofs, walls, and windows. County, city, town, and school vehicles are particularly vulnerable to this threat.

Hail can also cause considerable damage to crops, buildings, and vehicles, and occasionally death to farm animals. Hail can also strip leaves and small limbs from non-evergreen trees. While large hail poses a threat to people caught outside in a storm, it seldom causes loss of human life.

Costs and losses to agricultural and livestock producers:

- *Reduced yields and crop loss*
- *Injuries or loss of livestock*
- *Damage to barns and other farm buildings*
- *Damage to trees resulting in increased susceptibility to disease*

Urban, residential, and commercial

- *Damage to buildings, possibly critical facilities*
- *Roofs*
- *Windows*
- *Damage to automobiles, trucks, airplanes, etc.*

Disruptions to local utilities and services

- *Power*
- *Communications*
- *Transportation*

Additional vulnerabilities are difficult to evaluate since hail occurs in random locations and creates relatively narrow paths of destruction.

Possible environmental impacts from hail are damaged plants, trees, and crops.

In the event of a hail event, services to the public could be delayed, leading to a lack of confidence in the local jurisdictions' ability to govern. In the event facilities or access to facilities is compromised, the local jurisdictions' Continuity of Operations needs to be activated. This would insure minimal disruption to public services. At this time, only Pittsburg County and the City of McAlester have this capability. All other participating jurisdictions have defined this as a deficiency.

Another large concern are the fishing tournaments held on Lake Eufala. Portions of the lake are located in the Town of Crowder, Town of Canadian, and the County. When the participants are on the lake and away from the shore, they could easily be caught out in the weather and be at risk to hail. Additionally, some participants come from out of state and aren't familiar with the jurisdictions' hazards, leaving them especially vulnerable.

Figure 3-29

Hail Vulnerabilities

Jurisdiction	Vulnerabilities MI	Impact MI
Pittsburg County	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to hail. Hail can dent, damage, and destroy vehicles and equipment.
	There are several critical facilities within the jurisdiction that are lacking generators, including the County Courthouse, several fire departments, and others.	Without generators, critical facilities can't guarantee they will be able to function during thunderstorms. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Alderson	The Alderson Fire Department lacks a generator.	Without generators, critical facilities can't guarantee they will be able to function if a hail event causes a disruption to the power supply. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Ashland	The Ashland Fire Department lacks a generator.	Without generators, critical facilities can't guarantee they will be able to function if a hail event causes a disruption to the power supply. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Canadian	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to hail. Hail can dent, damage, and destroy vehicles and equipment.

	The Town of Canadian lacks generators at the Town Hall, Lift Station, and several others identified critical facilities.	Without generators, critical facilities can't guarantee they will be able to function during thunderstorms. If these facilities are unable to stay open, essential services to the public could be delayed.
Carlton Landing	The Carlton Landing Fire Department and one of their lift stations lack generators.	Without generators, critical facilities can't guarantee they will be able to function if a hail event causes a disruption to the power supply. If these facilities are unable to stay open, essential services to the public could be delayed.
	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to hail. Hail can dent, damage, and destroy vehicles and equipment.
	The jurisdiction is concerned about the debris a major hail storm can leave behind.	Debris left behind by storms can cause build up that can become fire hazards.
Town of Crowder	The Crowder Fire Department and Senior Citizen Center lack generators.	Without generators, critical facilities can't guarantee they will be able to function if a hail event causes a disruption to the power supply. If these facilities are unable to stay open, essential services to the public could be delayed.
	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to hail. Hail can dent, damage, and destroy vehicles and equipment.

Town of Indianola	The Indianola Fire Department lacks a generator.	Without generators, critical facilities can't guarantee they will be able to function if a hail event causes a disruption to the power supply. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Kiowa	The jurisdiction has access to a mass notification system but doesn't have enough employees trained in it or policies and procedures in place to know when to use it.	Unreliable messaging could confuse citizens and make cause a delay in preparedness for impending storms.
	The jurisdiction is worried about citizens not understanding or taking the threat of hail seriously.	While hail is a common occurrence in the jurisdiction, it can be deadly.
	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to hail. Hail can dent, damage, and destroy vehicles and equipment.
Town of Pittsburg	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to hail. Hail can dent, damage, and destroy vehicles and equipment.
	All of the identified critical facilities for the Town of Pittsburg lack generators.	Without generators, critical facilities can't guarantee they will be able to function if a hail event causes a disruption to the power supply. If these facilities are unable to stay open, essential services to the public could be delayed.
Town of Quinton	Quinton's town hall and fire department lack generators.	Without generators, critical facilities can't guarantee they will be able to function if a hail event causes a disruption to the power supply. If these facilities are unable to stay open, essential services to the public could be delayed.

Town of Savanna	All but two of Savanna's identified critical facilities lack generators.	Without generators, critical facilities can't guarantee they will be able to function if a hail event causes a disruption to the power supply. If these facilities are unable to stay open, essential services to the public could be delayed.
City of Haileyville	None of this jurisdiction's critical facilities have generators.	Without generators, critical facilities can't guarantee they will be able to function if a hail event causes a disruption to the power supply. If these facilities are unable to stay open, essential services to the public could be delayed.
	The jurisdiction is worried about citizens not understanding or taking the threat of hail seriously.	While hail is a common occurrence in the jurisdiction, it can be deadly.
City of Hartshorne	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to hail. Hail can dent, damage, and destroy vehicles and equipment.
	The City Hall does not have a generator.	Without generators, critical facilities can't guarantee they will be able to function if a hail event causes a disruption to the power supply. If these facilities are unable to stay open, essential services to the public could be delayed.
City of Krebs	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to hail. Hail can dent, damage, and destroy vehicles and equipment.

City of McAlester	The city has several walkways between critical buildings that are uncovered. They see this as a weakness in regards to this hazard.	Uncovered walkways leave necessary foot traffic vulnerable to hail. Should a citizen or city worker be struck by a significant hail event, they may receive serious injuries or even death.
	The jurisdiction stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to hail. Hail can dent, damage, and destroy vehicles and equipment.
	There are several critical facilities within the jurisdiction that are lacking generators.	Without generators, critical facilities can't guarantee they will be able to function if a hail event causes a disruption to the power supply. If these facilities are unable to stay open, essential services to the public could be delayed.
McAlester Public Schools	The school district does not have an emergency generator.	Without generators, critical facilities can't guarantee they will be able to function if a hail event causes a disruption to the power supply. If these facilities are unable to stay open, parents may have to miss work.
	The school has several walkways between buildings that are uncovered. They see this as a weakness in regards to this hazard.	Students using the walkways who are caught in the storm are left vulnerable to this hazard. If they were struck by hail, they may sustain serious injuries or even death.
	The school district stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to hail. Hail can dent, damage, and destroy vehicles and equipment.
Quinton Public Schools	The school has several walkways between buildings that are uncovered. They see this as a weakness in regards to this hazard.	Students using the walkways who are caught in the storm are left vulnerable to this hazard. If they were struck by hail, they may sustain serious injuries or even death.

	The school district does not have an emergency generator.	Without generators, school facilities can't guarantee they will be able to function if a hail event causes a disruption to the power supply. If these facilities are unable to stay open, parents may have to miss work.
Crowder Public Schools	The school district stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to hail. Hail can dent, damage, and destroy vehicles and equipment.
	The school has several walkways between buildings that are uncovered. They see this as a weakness in regards to this hazard.	Students using the walkways who are caught in the storm are left vulnerable to this hazard. If they were struck by hail, they may sustain serious injuries or even death.
Haileyville Public Schools	The school has several walkways between buildings that are uncovered. They see this as a weakness in regards to this hazard.	Students using the walkways who are caught in the storm are left vulnerable to this hazard. If they were struck by hail, they may sustain serious injuries or even death.
Frink-Chambers Public Schools	The school district stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to hail. Hail can dent, damage, and destroy vehicles and equipment.
	The school district does not have an emergency generator.	Without generators, school facilities can't guarantee they will be able to function if a hail event causes a disruption to the power supply. If these facilities are unable to stay open, parents may have to miss work.

Tannehill Public Schools	The school district does not have an emergency generator.	Without generators, critical facilities can't guarantee they will be able to function if a hail event causes a disruption to the power supply. If these facilities are unable to stay open, parents may have to miss work.
Krebs Public Schools	The school district doesn't have adequate covered parking for their busses.	Vehicles left out in the elements are vulnerable to hail. Hail can dent, damage, and destroy vehicles and equipment.
Haywood Public Schools	The school district stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to hail. Hail can dent, damage, and destroy vehicles and equipment.
Savanna Public Schools	The school district believes they have a deficit in educating students about this hazard.	A lack of education can cause preventable injuries and impede preparedness.
	The school has several walkways between buildings that are uncovered. They see this as a weakness in regards to this hazard.	Students using the walkways who are caught in the storm are left vulnerable to this hazard. If they were struck by hail, they may sustain serious injuries or even death.
	The school district stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to hail. Hail can dent, damage, and destroy vehicles and equipment.
Canadian Public Schools	The school district stores a large portion of equipment and vehicles uncovered outside that is considered vulnerable to this hazard.	Equipment and vehicles left out in the elements are vulnerable to hail. Hail can dent, damage, and destroy vehicles and equipment.