



Hazard Mitigation Plan

2020 to 2025



Cleveland County

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CHAPTER ONE: INTRODUCTION

1.1 Overview of Planning Area

Cleveland County, Oklahoma, is located in central Oklahoma and the third most populous county in the state, with 255,755 citizens as of the 2010 census. (It is estimated that Cleveland County's population has grown to 279,641 as of 2017.) Cleveland County encompasses a total land area of 558 square miles, and the Oklahoma City Metropolitan Area extends into Cleveland County.

The estimated populations of each jurisdiction are as follows:

The city of Lexington had a population of 2,152 as of the 2010 U.S. Census. (As of 2017, it has a population of 2,151.)

The city of Noble had a population of 6,481 as of the 2010 U.S. Census. (As of 2017, it has a population of 6,738.)

The city of Norman had a population of 110,925 as of the 2010 U.S. Census. (As of 2017, it has a population of 122,843.)

The town of Slaughterville had a population of 4,137 as of the 2010 U.S. Census. (As of 2017, it has a population of 4,299.)

Strategy

The Cleveland County Hazard Mitigation Plan Update 2020-2025 (hereafter CCHMPU) is completed in compliance with the Robert T. Stafford Disaster Relief and Emergency Assistance Act. This plan is updated every five years with FEMA to remain eligible for grant funding applications connected to the Hazard Mitigation Grant Program and also enhance the eligibility for other grant opportunities.

The primary developer for the CCHMPU was the Cleveland County Emergency Management (hereafter referred to as CCEM) Deputy Director. The deputy director referenced the Oklahoma State Hazard Mitigation Plan Update 2014-2019 and the 2019 Oklahoma State Hazard Mitigation Plan Update to ensure consistency in recognizing and addressing the natural hazards that affect Cleveland County. The CCHMPU planning committee affirmed the hazards addressed in this CCHMPU at the initial planning meeting held March 2018. Details on this meeting can be found in Chapter 2.

1.2 Participating Jurisdictions

Participating jurisdictions in the CCHMPU include:

- Cleveland County, unincorporated,
- the City of Lexington,
- the City of Noble,
- the City of Norman,
- the Town of Slaughterville;
- the school districts of Lexington, Little Axe, Noble, Norman, and Robin Hill

NOTE: Unless otherwise noted, “Cleveland County,” refers to all of the jurisdictions participating in this update. When referring to Cleveland County as an unincorporated area or government or geographic area, it will be specified.

McClain, Oklahoma, and Pottawatomie Counties were included as stakeholders since they are neighboring counties.

The City of Moore and Moore Public Schools were previous participants in the CCHMPU 2014-2019, but they have opted to create their own hazard mitigation plan. They are no longer included as a participant in the CCHMPU. Therefore, previous City of Moore Action Items have been removed from this CCHMPU.

The City of Oklahoma City also extends into Cleveland County geographically; however, the City of Oklahoma City has its own hazard mitigation plan and will not participate under the CCHMPU.

CHAPTER TWO: PLANNING PROCESS

2.1 Overview of Planning Process

Cleveland County Emergency Management invited all participating jurisdictions to a kick-off meeting March 7, 2018 and had approximately forty (40) attendees. The CCEM deputy director then met individually with each jurisdiction between March and September 2018. This allowed for each municipality, school district, or educational institution the opportunity to ask questions unique to their jurisdiction. Numerous follow-up phone calls and emails were conducted and sent to retrieve specific information pertaining to each jurisdiction, as well as communications with state and federal agencies to retrieve the most current data possible.

The CCEM deputy director initiated a county-wide survey that each jurisdiction could utilize as they chose. The purpose of the county's hazard mitigation survey was to better understand which hazards were perceived as the most hazardous threats in contrast to which hazards citizens had experienced over the past five (5) years.

The City of Norman wanted more extensive demographic information to use for future projects and Dr. Amy Goodin, a volunteer with the City of Norman Emergency Management, created a separate survey. The results of Norman's survey were compiled by Dr. Goodin and shared with Cleveland County Emergency Management. More detail for both surveys is included under **Section 2.4**.

The CCEM deputy director met with stakeholders and subject matter experts and regularly consulted the state hazard mitigation planner to ensure thorough research and accuracy was achieved throughout the updating process.

2.2 Planning Committee Members

The names of the planning committee members are below:

Name	Title	Jurisdiction Represented	Contribution to Planning Process
George Mauldin	Safety & Emergency Management Director	Cleveland County	Contributor
Lauree Beth Marshall	Deputy Director of Emergency Management	Cleveland County	Coordinated with all jurisdictions, coordinated with OEM, managed and wrote the plan
Gayland Kitch	Emergency Manager	City of Moore	Contributor, proofreader
Debi Wagner	Deputy Emergency Manager	City of Moore	Contributor, proofreader
Marsha Blair	Town Administrator; Floodplain Administrator	Town of Slaughterville	Planning for Town of Slaughterville
David Thompson	Fire Chief and Emergency Manager	Town of Slaughterville	Planning for Town of Slaughterville
David Grizzle	Emergency Management Officer	City of Norman	Contributor for the City of Norman, proofreader
Travis King	Fire Chief, Emergency Management Director	City of Norman	Contributor for the City of Norman
Carrie Evenson	City of Norman Floodplain Manager	City of Norman	Contributor for the City of Norman; Inundation maps for City of Norman
Dr. Amy Goodin	Volunteer with Norman Emergency Management	Volunteer	Survey Volunteer and researcher for the City of Norman
Jerry McConnell	Safety Coordinator	Moore-Norman Technology Center	Contributor for MNTC
Phil Scott	Fire Chief and Emergency Management Coordinator	City of Noble	Contributor for the City of Noble
Terry Ford	Campus Police Officer, Emergency Manager	Noble Public School	Contributor for the Noble Public Schools
Joe Rohr		Noble Public Schools	Contributor for Noble Public Schools
Matthew Stephens	Noble Police Department	Noble Police Department	Contributor for City of Noble
Bob Wade	City Manager	City of Noble	Contributor for City of Noble
Ronnie Fulks	Noble Public Schools	Noble Public Schools	Contributor for Noble Public Schools
Jared Cox	Noble Police Department	City of Noble	Contributor for the City of Noble
Robert Porton	City Planner	City of Noble	Contributor for the City of Noble
	City Manager	City of Lexington	Contributor for the City of Lexington
Travis Ary	Fire Chief, Emergency Manager, Floodplain Manager	City of Lexington	Contributor for the City of Lexington
Kim McClarney	City Clerk	City of Lexington	Contributor for the City of Lexington
Max Punneo	Firefighter	City of Lexington	Contributor for City of Lexington
David Adams	Mayor	City of Lexington	Contributor for the City of Lexington
Deana Allen	Police Chief	City of Lexington	Contributor for the City of Lexington
Janet Green	Town Clerk	Town of Etowah	Contributor for Etowah
James Bachman	Mayor	Town of Etowah	Contributor for Etowah
Justin Milner	Chief Operating Officer	Norman Public Schools	Contributor for Norman Public Schools
Delbert Potts	Maintenance and Operations	Norman Public Schools	Contributor for Norman Public Schools
Tim Gibson	MACU Police/Emergency Manager	MACU	Contributor for Mid-America Christian University
Connie Gall	Facilities	MACU	Contributor for Mid-America Christian University
Brandon Voss	Superintendent	Robin Hills Schools	Contributor for Robin Hill School
Chad Hall	Superintendent	Lexington Public Schools	Contributor for Lexington Public Schools
Harry Grider	Maintenance and Operations	Lexington	Contributor for Lexington Public Schools

Name	Title	Jurisdiction Represented	Contribution to Planning Process
Justin Daniels	Fire Marshal, Emergency Preparedness Manager	University of Oklahoma	Contributor for OU
Dr. Kevin Kloesel	Meteorologist	University of Oklahoma	Contributor for OU, consultant for climatological data
Kevin Leach	Director of Risk Management	University of Oklahoma	Contributor for OU
Rod Cleveland	Commissioner District 1	Cleveland Co.	Contributor for District 1
Darry Stacy	Commissioner District 2	Cleveland Co.	Contributor for District 2
Paul Meyer	Crew Foreman	Cleveland Co.	Contributor for District 2
Harold Haralson	Commissioner District 3	Cleveland Co.	Contributor for District 3
Richey Fink	Crew Foreman	Cleveland Co.	Contributor for District 3
Allen Shetley	Shop Foreman	Cleveland Co.	Contributor for District 3
Brian Tupper	Elementary Principal	Little Axe Schools	Contributor for Little Axe Schools
Jay Thomas	Superintendent	Little Axe Schools	Contributor for Little Axe Schools
Cathey Miller	Deputy to Superintendent	Little Axe Schools	Contributor for Little Axe Schools
Dalton Griffin	Middle School Principal	Little Axe Schools	Contributor for Little Axe Schools
Brad Meyer	Maintenance	Little Axe Schools	Contributor for Little Axe Schools

2.3 Other Stakeholders

These organizations and agencies were contacted and participated in discussions that related to any topics that would have had jurisdictional overlap.

Neighboring Communities, Businesses, and Non-Profit Agencies Contacted

Name	Title	Agency Represented	How Agency Was Invited	Contributions to Plan
Ron Johnson	Emergency Manager	McClain Co.	Email	Contributor
Donnell Weatherall	Deputy Emergency Manager (Former)	McClain Co.	Email	Contributor
Don Lynch	Emergency Manager	City of Shawnee/ Pottawatomie Co	Email	Contributor, Proofreader
Greg Whitworth	Resource Specialist	Oklahoma Co.	Email	Contributor
David Barnes	Emergency Manager	Oklahoma Co.	Email	Contributor
Franklin Barnes	Emergency Manager	City of Oklahoma City	Email	Contributor
Sharon Ray	Administrative Deputy	City of Oklahoma City	Email	Contributor

State and Federal Agencies Contacted

Name	Title	Agency Represented	How Agency Was Invited	Contributions to Plan
Jim Rosser	Hazard Mitigation Planner	State Agency	Email, phone calls	Consultant, Proofreader
Dr. Kevin Kloesel	Meteorologist	Climatological Survey, University of Oklahoma	Phone, Email	Weather Data Consultant
Dr. Netra Regmi	Geologist: Landslides, Hazards	Oklahoma Geological Center	Phone, Email	Geology consultant
Adam Milligan	Safety Coordinator	Bureau of Reclamation	Phone call	Norman Dam inundation maps
Yohannes Sugang	NFIP State Coordinator	Oklahoma Water Resources Board	Phone call, email	Inundation maps for dams in county; NFIP Information
Aaron Milligan	OWRB Floodplain Management	Oklahoma Water Resources Board	Phone call, email	NFIP Information
Dr. Jacob I Walter	Geophysicist and State Seismologist	Oklahoma Geological Survey	Email, Phone	Geology consultant
Sarah Terry Cobo	Public Information Office	Oklahoma Corporation Commission	Phone, Email	Consultant
Steve Alspach	State Soil Scientist	Natural Resources Conservation Services	Phone	Soil consultant
University of Oklahoma	Risk and Hazard Management office	State agency	Phone call, email, meetings	Consultant
Mid-America Christian University	Police Chief/EM	Private Non-Profit	Phone call, email, meetings	Consultant
Moore-Norman Technology Center	Safety and Health Coordinator	State agency	Phone call, email, meetings	Consultant

2.4 Public Involvement

Throughout this process, public involvement was solicited through two (2) online surveys, in addition to the public meetings.

Cleveland County Emergency Management Hazard Mitigation Survey

The CCEM deputy director created and shared a brief survey that each jurisdiction could utilize by adding the link to their city’s utility bills and/or social media sites. The CCEM director solicited public input at the Little Axe Community Festival April 28, 2018 and the deputy director set up a booth at the Cleveland County courthouse for one week (April 23-27, 2018) and asked visitors if they would complete the survey. CCEM promoted the survey on their Facebook page. The purpose of the survey was to have a better idea of what citizens perceived as hazards and how their perception correlated with their personal experience of natural hazards over the past five (5) years.

The Cleveland County Hazard Mitigation Survey had 250 respondents over a three (3) month period. The survey was posted online through Survey Monkey and publicized on the CCEM’s Facebook page and website. The link was also emailed to Cleveland County employees and employees were encouraged to complete and share the survey. The link was made available for participating jurisdictions to share via utility bills, social media, and/or any other means they wanted to solicit public input.

The Cleveland County Survey

Question 1 of the county survey asked “In the last five (5) years, which natural hazards have directly impacted you personally?” With each hazard, respondents could choose between Never, Rarely (once in the past 5 years), Once a year, or More than once a year.

Hazard	Never	Rarely (once in the past 5 years)	Once a year	More than once a year	Total respondents
Tornado	35.68%	44.4%	11.62%	8.71%	241
High Winds	9.92%	32.23%	23.14%	34.71%	242
Lightning/Hail	12.03%	37.34%	21.58%	29.46%	241
Drought	32.89%	26.75%	25%	15.35%	228
Wildfire	66.81%	21.4%	3.93%	7.86%	229
Flooding	48.51%	34.47%	10.64%	8.94%	235
Extreme Heat	29.31%	15.52%	22.41%	33.62%	232
Winter Storm/Ice	12.92%	35.42%	36.25%	15.42%	240
Dam Failure	96.89%	2.67%	0%	0.44%	225

Question 2 asked, “What concerns you most about these hazards and severe weather?” There were 248 respondents to this question and they answered accordingly:

Lack of personal preparedness	Concern that community is not prepared to assist with or handle clean up	Damage or loss of property	Inconvenience	Loss of life	Other	Other (specify)
8.47%	13.71%	44.76%	4.84%	22.58%	0%	5.65%

Question 3 asked, “Do you feel prepared to deal with natural disasters?” There were 249 respondents and they answered as follows:

I am not prepared at all.	I am somewhat prepared.	Yes, I am prepared!
8.03%	59.84%	32.93%

Question 4 asked if respondents would provide their zip code and two hundred forty-five (245) provided it. Of those 245, eight (8) were from outside Cleveland County. The table below specifies the zip codes within Cleveland County and how many responses came from each area.

Zip Code	Respondents	Zip Code	Respondents	Zip Code	Respondents
73019	1	73069	27	73132	1
73020	1	73070	2	73139	2
73026	29	73071	36	73159	1
73051	38	73072	26	73160	11
73068	22	73110	1	73165	2
73170	12	73173	3	Other	8
74857	21	73179	1	Skipped	6

Questions 5 asked, “Would you be interested in attending preparedness related meetings if they were available?” Two hundred forty-eight (248) people responded with sixty-eight percent (68.55%) answering yes, and thirty-one percent (31.45%) answering no.

CCEM concluded these results gave a reasonable representation of the population based on the diversity of zip codes reported. The survey accomplished the goal of CCEM to have a better idea what residents have experienced in contrast to the perception of which hazards have occurred more often in the past 5 years. This initial survey also gave CCEM a baseline to gauge what proved effective in soliciting public input, and have a better idea how to engage residents in the future.

City of Norman Hazard Mitigation Plan Public Input Survey

The City of Norman used the topic of hazard mitigation as the vehicle to assess how public input is collected and assessed the results to see how residents of Norman perceived and received information from the city about natural hazards and preparedness.

Dr. Amy Goodin, a volunteer with the City of Norman Emergency Management and adjunct lecturer at the University of Oklahoma, constructed their survey. She and other volunteers solicited public input at the 2018 Earth Day Festival April 22, 2018, in Norman, OK and shared the survey link on social media and utility bills. Paper surveys were also provided if a respondent preferred to participate via paper survey. Overall, six hundred forty-five (645) respondents participated between April and August 2018. Dr. Goodin and emergency management coordinator, David Grizzle, will use this information as part of a community outreach presentation at the 2019 Southern Political Science Association annual meeting. They will be speaking on the panel: *Hazard Mitigation Planning and Public Input: Moving Beyond the Public Meeting*. To view the complete summary of this survey, go to the Cleveland County Emergency Management website at: https://clevelandcountyok.com/DocumentCenter/View/1942/City-of-Norman_HMP-Survey-Report_Jan-15-2019

2.5 Plans, Documents, and Literature Reviewed

The following documents were used as resources and references for the CCHMPU.

The *CCHMPU 2014-2019* provided the basis for this update, as well as the *Oklahoma State Hazard Mitigation Plan Update 2014-2019* and the *Oklahoma State Hazard Mitigation Plan Update 2019-2024*. The *City of Oklahoma City Hazard Mitigation Plan Update 2017* also provided insight into the areas where Cleveland County and the City of Oklahoma City interface but are within Oklahoma City's jurisdiction.

“Empowering Local Hazard Mitigation Planners: An All-Hazard Community Inventory in a Cleveland County, OK Case Study” by Amber L. Larson provided a third-party assessment of the strengths and weaknesses within the 2014-2019 HMP update. Her assessment provided her opinion on the areas where hazard mitigation plans need to be strengthened in general.

“The Norman Dam and Lake Thunderbird Emergency Action Plan”, and the *“2015 EAP Activation for Hydrologic Incidents After-Action Report”* by the U.S. Department of the Interior Bureau of Reclamation provided insight into the flooding event that prompted the release of water from the Norman Dam in May and June 2015.

The Oklahoma Water Resources Board provided updated maps and breach analyses for Shadow, Sutton, Hall Park, and Summit Lakes. Additionally, the floodplain manager for the City of Norman also provided maps and information related to these lakes.

Additional climatological data was produced and provided by the Southern Climate Impacts Planning Program (SCIPP) via The Simple Planning Tool for Oklahoma Climate Hazards.

Additionally, the Cleveland County Local Emergency Planning Committee (hereafter referred to as the LEPC) meets quarterly. This multi-agency, inter-county planning committee regularly discusses any plans or projects within Cleveland County to encourage and strengthen relationships between jurisdictions. The LEPC is completely separate from the CCHMPU planning committee, and CCEM plays an active role in organizing and supporting this community group. CCEM provided quarterly status updates on how the CCHMPU had progressed.

2.5.1 Literature and Resources Reviewed

Agency/Document	Relevant Information Incorporated into Plan
<i>Empowering Emergency Managers</i> by Amber Larson	Awareness of potential weaknesses in county plans
SCIPP Simple Planning Tool by SCIPP NOAA RISA	Weather related data
A Guide to F-Scale Damage Assessment by U.S. Dept. of Commerce, NOAA, NWS	Context and general information for how F-Scale is assessed
<i>Comprehensive Fault Database and Interpretive Fault Map of Oklahoma</i> by Stephen Marsh and Austin Holland.	Provides comprehensive earthquake data and explanations of how the data was compiled and how it can be used.
<i>Seismicity and tectonic Relationships of the Nemaha Uplift in Oklahoma-Part III</i> by Kenneth V. Luza and James E Lawson, Jr.	Provided context for better understanding why Cleveland Co. does not have as many earthquakes as neighboring counties; provided context for why Oklahoma has as many earthquakes as it does
<i>Nemaha Strike-Slip Fault Zone</i> by William McBee, Jr.	Provides a more clear description of the geology underlying Oklahoma.
Oklahoma Drought Management Plan prepared by the Oklahoma Drought Management Team	Provided context regarding drought management in Oklahoma
<i>Changing Fire Regimes and Management Strategies by Southern Climate Impacts Planning Program</i> by Darrian Bertrand (SCIPP)	Provided a general overview of the threshold conditions that allow for burn days in Nebraska, Oklahoma, Kansas, and Texas
<i>2018 OneYear Seismic Hazard Forecast for the Central and Eastern United States from Induced and Natural Earthquakes</i> by Mark D. Petersen, et. Al	Provided explanations of how seismicity within Oklahoma has changed in since 2015 and detailed explanations of the causes of Oklahoma earthquakes
<i>“Geomorphic and Hydrologic Assessment of Erosion Hazards at the Norman Municipal Landfill, Canadian River Floodplain, Central Oklahoma”</i> by Jennifer A. Curtis and John W. Whitney	provided context into local, historical events within Cleveland County
<i>“Geologic Hazards in Oklahoma”</i> by Kenneth V. Luza and Kenneth S. Johnson	provided context into local, historical events within Cleveland County

2.5.2 Plans Reviewed

Plan Title	Relevant Information Incorporated into Plan
Oklahoma State Hazard Mitigation Plan Update, 2-10-14	General guidance specific to Oklahoma
Oklahoma State Hazard Mitigation Plan Update, 2019	General guidance specific to Oklahoma
The Norman Dam and Lake Thunderbird Emergency Action Plan	Historical and general information
2015 EAP Activation for Hydrologic Incidents After-Action Report	Historical information on flooding and dam management
City of Oklahoma City Hazard Mitigation Plan Update 2017	General information regarding hazards that overlap with their jurisdiction
Oklahoma Drought Management Plan	Overview of the state’s action plan for dealing with widespread drought
Emergency Action Plan—Sutton Wilderness Lake	Information from the City of Norman
Emergency Action Plan—Hall Park Lake	Information from the City of Norman

2.6 Continued Public Involvement

The City of Norman and Cleveland County both created surveys for the purpose of soliciting public input. These surveys were discussed above in Section 2.4. Cleveland County anticipates using similar surveys in the future, and also anticipates that other jurisdictions will solicit public input from online surveys as well.

Participating jurisdictions have also listed various educational programs and booklets related to hazard mitigation and natural hazard awareness as ongoing action projects.

Cleveland County regularly posts information on social media that promotes educational and outreach programs neighboring jurisdictions want to promote.

Regular discussions pertaining to hazard mitigation projects and federal, state, and private grant opportunities already occur, and will continue, between the county and each jurisdiction on a case-by-case basis.

It is the goal of the county to assist all participating jurisdictions with annual updates and meetings to track the progress of relevant projects. However, it will be the responsibility of each jurisdiction to initiate, manage, and provide resources for completing their own specific projects.

Initially, the CCHMPU 2020-2025 will be approved by each jurisdiction according to their individual governing bodies and pending approval by FEMA. Each meeting will be publicized, in compliance with the Oklahoma Open Meetings Act (O.S. 25 § 301-314).

2.7 Plan Update Review: Monitoring, Evaluation, and Implementation

Monitoring: The CCEM Director has appointed the CCEM deputy director as the primary person responsible for overseeing the CCHMPU. The CCHMPU will be monitored by the CCEM deputy director and make annual updates to the CCHMPU. CCEM will continue to coordinate efforts and manage the update process with participating jurisdictions regarding projects that require public input and measuring the success of projects. The timeline below is based on the length of time each part of the process took for the CCHMPU 2020-2025 submission. It is anticipated that this timeline is subject to change; however, this projected timeline is intended to avoid a lapse for the next CCHMPU.

Timeline:

January-June 2020: Approval of the CCHMPU 2020-2025 by FEMA and adoption by participating jurisdictions

April-December 2020: Monitoring of natural hazard events by CCEM

December 2020: CCEM will finalize details of the 2020 events; CCEM deputy director will conduct a county-wide meeting as an annual update

January-December 2021: Monitoring of natural hazard events by CCEM

December 2021: CCEM will finalize details of the 2021 events; CCEM deputy director will conduct a county-wide meeting as an annual update

January-December 2022: Monitoring of natural hazard events by CCEM

December 2022: CCEM will finalize details of the 2022 events; CCEM deputy director will conduct a county-wide meeting as an annual update

January-December 2023: Monitoring of natural hazard events by CCEM

December 2023: CCEM will finalize details of the 2023 events; CCEM deputy director will conduct a county-wide meeting as an annual update. Vote by the CCHMPU planning committee to submit the CCHMPU for approval with OEM and FEMA.

January 2024: Finalize preparation for CCHMPU 2025-2030 submission; continued monitoring of natural hazard events by CCEM

February 2024: Submit CCHMPU 2025-2030 to OEM; continued monitoring and updating of events in Cleveland County.

May 2024: Approval of CCHMPU 2025-2030 by OEM and submission to FEMA.

May-December 2024: Submit CCHMPU 2025-2030 to FEMA; FEMA review process; continued monitoring by CCEM for any and all changes to data.

January-March 2025: Buffer time for FEMA Review and pending adoption by jurisdictions

Evaluation: The CCHMPU will be evaluated by the CCEM deputy director. This evaluation will occur annually, and it will be accomplished during the end-of-year, county-wide meetings, along with solicitation of public input from surveys, comments, and public events, as outlined in the Timeline above. The CCEM deputy director, in conjunction with the respective mitigation action item POCs will:

- Evaluate magnitude of risks and determine if any have changed;
- Evaluate current resources and determine if they are appropriate for implementing mitigation actions;
- Determine if there were technical, political, legal, or coordination issues with implementation problems;
- Evaluate goals, objectives, and current/expected conditions;
- Evaluate participation;
- Evaluate mitigation actions and determine if outcomes occurred as expected:
 - Was the intended purpose of the original mitigation action met?
 - Was the mitigation action met in the proposed timeline?
 - Did the listed agencies participate in the mitigation action?
 - Did the mitigation action stay within the proposed budget?

Updating: The CCEM deputy director will also lead efforts to update with each jurisdiction annually (every 12 months) during a CCHMPU meeting and then follow up with any absent participants either in person, by phone, or email, to proactively update this plan as various projects are completed.

It is presumed that CCEM and the CCHMPU planning committee will hold additional meetings after disasters occur within the geographical area of Cleveland County to address any new hazard mitigation related projects and add them to the CCHMPU.

Any other changes will be added to corresponding sections as they occur. Since natural hazards and their impact be predicted, data related to these natural hazard events will be added on a case-by-case basis as they occur. Natural hazard data will be added to each hazard specific section of this CCHMPU, and research and consultation with state agencies will ensure proper documentation for the CCHMPU.

The CCEM deputy director will submit the CCHMPU to the state and Federal Emergency Management Administration (FEMA) as required every five (5) years.

CHAPTER THREE: HAZARD IDENTIFICATION AND RISK ASSESSMENT

3.1 List of Identified Hazards

The hazards affecting the participating jurisdictions is consistent with the list found in the 2019 Oklahoma State Hazard Mitigation Plan Update (hereafter referred to as the OSHMPU) and the previous CCHMPU 2014-2019.

The OSHMPU includes subsidence/expansive soils and landslides within Oklahoma; however, these hazards have not had any recorded instances of occurring within Cleveland County and were removed as hazards from the 2014-2019 CCHMPU. There has been no change to the likelihood of either of those hazards occurring as the underlying geological layers are imbedded sandstone and shale. According to the Oklahoma Geological Survey, those types of bedrock, coupled with the types of soil found in the geographic area of Cleveland County, are not conducive to shifting, landslides, or subsidence.¹

To date, no disasters have been declared in Oklahoma or in any of the participating jurisdictions due to landslides and/or subsidence.²

This table lists the hazards which affect Cleveland County and participating jurisdictions.

Hazard	Jurisdictions Affected
Dam Failure	Norman, unincorporated Cleveland County*
Drought	All
Earthquake	All
Extreme Heat	All
Flood	All
Hail	All
High Wind	All
Lightning	All
Tornado	All
Wildfire	All
Winter Storm	All

*NOTE: Norman and unincorporated Cleveland County would be the only participants that would experience flooding due to dam failure; therefore, only those two jurisdictions are listed. Should any dam failure flooding extend into the City of Oklahoma City's or Oklahoma County's jurisdiction, it would be addressed by their respective Hazard Mitigation plans.

¹ National Resources Conservation Service. https://www.nrcs.usda.gov/Internet/NRCS_DIAGRAMS/graphics/OK-2012-02-16-11.pdf and

https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/survey/geo/?cid=nrcs142p2_054317

² NRCS Web Soil Survey. <https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>

3.2 Disaster History

Since the last Cleveland County Hazard Mitigation Plan Update, Cleveland County has been part of these federally declared disasters listed in the table below.

Federally-Declared Disaster History from 2013 to 2018

Disaster #	Declaration Date	Incident Type
DR-4117	5-19-2013	Tornadoes and severe thunderstorms
DR-4222	5-25-2015	Severe storms, straight line winds, tornadoes flooding

Cleveland County was included in several statewide declared disasters between 2013-2018; however, only those events which directly affected Cleveland County are listed below.

Disaster #	Declaration Date	Incident Type
	3-3-2017	Wildfire Event

3.3 Hazard Probability Rating

Describe what method was used to determine the probability of future hazard events. Probability means the likelihood of the hazard occurring and may be defined in a variety of terms.

Probability can be determined by calculating the:

$$\frac{\text{Total number of events}}{\text{Total number of years}} = \text{Probability \% of event occurring each year}$$

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

- High = Event has 1 in 1 year chance of occurring 100%
- Medium = Event has 1 in 3 years chance 33%
- Low = Event has 1 in 5 years chance 20%
- Very Low = Event has 1 in 10 years chance 10%

NOTE: It is important to determine what an “Event” means for each hazard, and to define that in the plan when calculating the hazard Probability Rating. This will help ensure the probability rating matches accurately with the Previous Occurrence section. For example, a tornado event is most likely defined as anytime a tornado was documented. This same definition would not be practical for a hazard such as Lightning. In that case, a hazard event might be described as any Lightning occurrence that causes property damage and/or loss of power in the community.

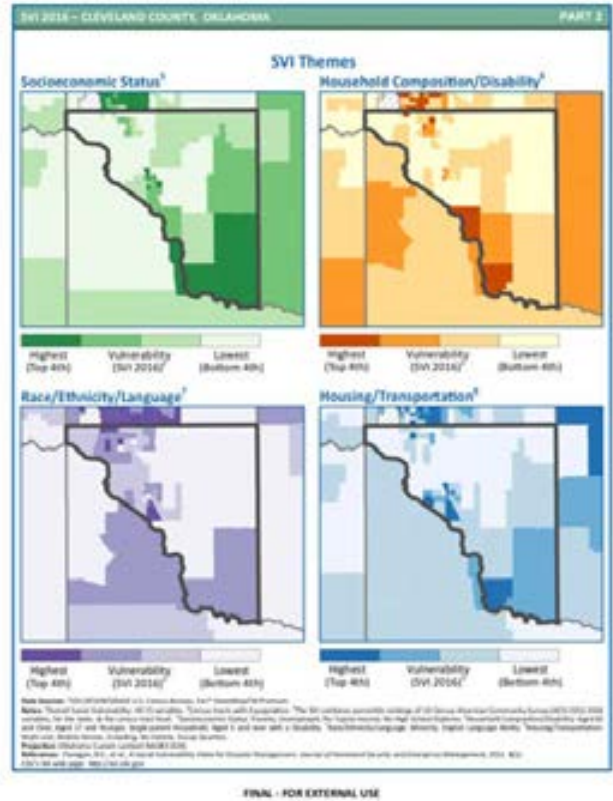
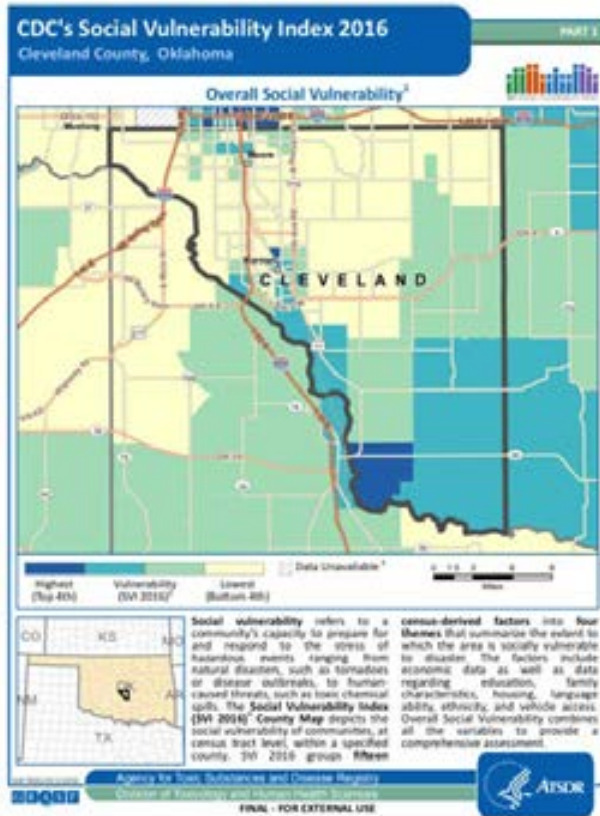
Hazard Rating Matrix:

Hazard	Probability Rating
Dam Failure	Very Low
Drought	High
Earthquake	Very Low
Extreme Heat	High
Flood	High
Hail	High
High Wind	High
Lightning	High
Tornado	High
Wildfire	High
Winter Storm	High

3.4 Profiled Hazards

Hazards impacting Cleveland County and participating jurisdictions are below.

The graphic below shows Cleveland County’s Social Vulnerability as compiled by the Center for Disease Control (CDC). The County Profile shows population statistics for each participating municipality and a summary of the more vulnerable populations (over the age of 65 and individuals living below the Census poverty threshold). Each participating jurisdiction considers these variables when integrating hazard mitigation measures into their planning and budgets.



3.4.1 Dam Failure

Dams are artificial barriers constructed across a stream or channel of water, usually constructed to impound water. Dams that impound water upstream are called reservoirs and the volume of water impounded is measured in acre-feet. An acre-foot is the volume of water that covers an acre of land to a depth of one foot. Two factors influence the potential severity of a full or partial dam failure: the amount of water impounded, and the density, type, and value of development and infrastructure located downstream.

Location

There are five dams classified as high hazard by the Oklahoma Water Resources Board that would impact the Planning Area.

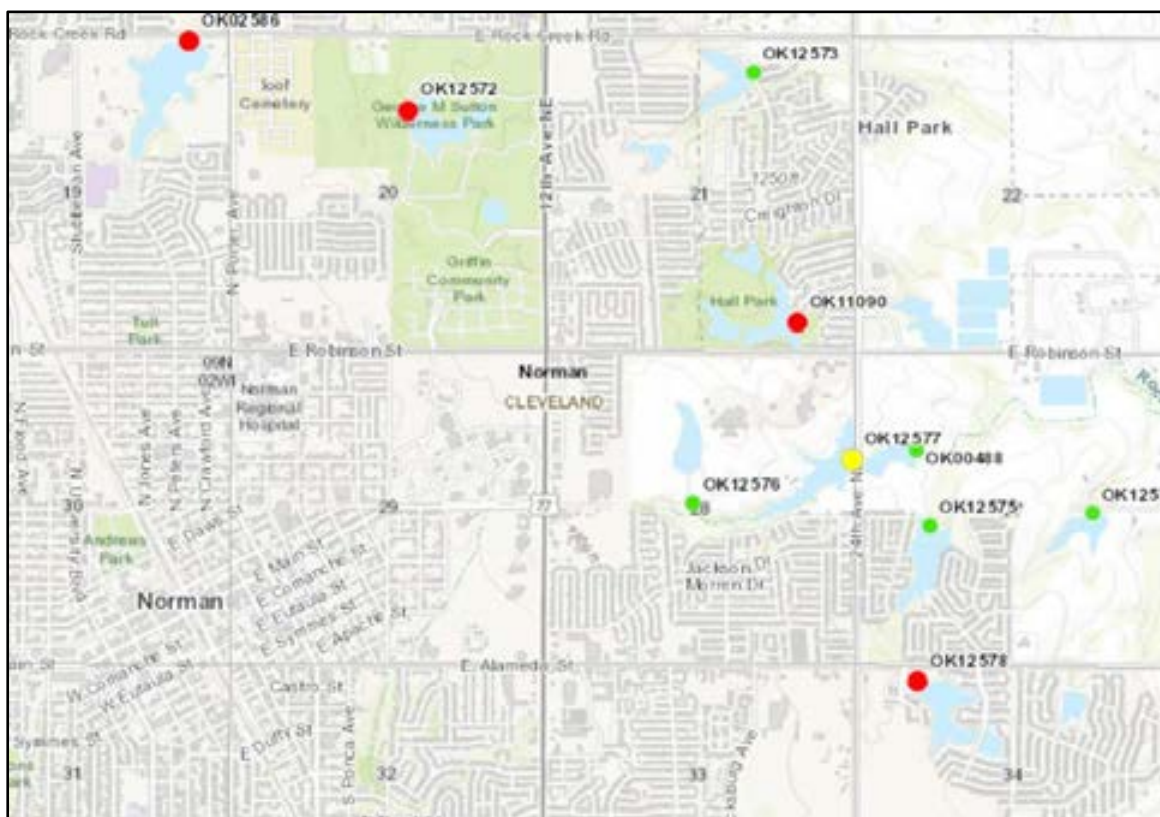
Dam	Dam ID #	Agency Owner	Jurisdiction(s) Affected
Hall Park Lake Dam	OK11090	City of Norman	City of Norman
Sutton Wilderness Lake Dam	OK12572	City of Norman	City of Norman
Summit Lake Dam	OK12578	Privately Owned	City of Norman
Crystal Lake Dam	OK02586	Privately Owned	City of Norman
Lake Stanley Draper Dam	580	City of Oklahoma City	Unincorporated Cleveland Co. & Norman

The CCHMPU 2014-2019 plan included the Shadow Lake Dam. Although this dam is within the geographical area of Cleveland County, the City of Oklahoma City manages this dam and its respective lake. It is listed in the City of Oklahoma City’s Dam Emergency Action Plan. This dam is not being included in the CCHMPU 2020-2020 plan because should a breach occur, none of the inundation area would impact the Planning Area.



This area shows the Lake Stanley Draper Dam location, and shows how the jurisdictions of Oklahoma City, Unincorporated Cleveland County, and the City of Norman would have affected areas if a breach were to occur.

Location map for Sutton Wilderness Lake, Hall Park Lake, Crystal Lake, and Summit Lakes are in the inset below and show where they are within the City of Norman.



Previous Occurrences

There have been no dam failures or breaches of high hazard dams within the participating jurisdictions since the previous update.

Extent

Dam failure varies from a minor seepage to major collapse or breach when a dam can no longer contain the overflow of flood waters. Dam failure would be high due to the potential loss of life and property within the inundation flood path.

<i>Dam Name</i>	<i>Length</i>	<i>Height</i>	<i>Max Capacity</i>	<i>Norm Capacity</i>	<i>Surface Area</i>
Hall Park	600 ft	21 ft	144 acre ft	98 acre ft	17 acre ft
Lake Stanley Draper	7,250 ft	111 ft			
Summit Lake (aka Misty Lake)	810 ft	21 ft	200 acre ft	130 acre ft	18 acre ft
Sutton Wilderness	650ft	22 ft	200 acre ft	117 acre ft	17 acre ft
Crystal Lake	610 ft	15 ft	210 acre ft	1174.5 acre ft	210 acre ft

Hall Park Lake Dam: Six (6) maps are included in the Appendix A. According to the cross sections on the maps provided, the breach time of travel is as follows:

Cross Section Number	Time to Peak (hours)
1	.2 hours
2	.2 hours
3	.3 hours
4	.5 hours
5	.8 hours
6	1.7 hours
7	2.5 hours
8	3.4 hours
9	5.2 hours
10	18.9 hours

Lake Stanley Draper Dam: Inundation maps are not included in this plan. Stanley Draper Lake Dam is located in the southeast area of Oklahoma City. If a breach were to occur, the inundation path would start in Oklahoma City, travel into the northwest corner of Unincorporated Cleveland County, and then into the northwest corner of Norman.

According to a dam analysis study done by the University of Oklahoma, the dam has an elevation of 1,201 ft. and is about 6,900 ft. long. The maximum reservoir capacity for Stanley Draper Lake is 148,000 acre-ft. According to the dam breach analysis report, the breach time of travel is as follows:

Bridge Name	Sunny Day Stage (ft)	Time to Peak (HH:MM)
149 th Street	1,123.14	01:35
164 th	1,107.6	01:50
179 th	1,101.5	01:55
Franklin Road	1,084.63	02:10
Alameda Street	1,062.5	03:10

Summit Lake Dam: Maps are included in the Appendix. According to the dam breach analysis report, “one home north of the development entrance could be affected by a failure....on the fringe area of the flood wave...The effect was determined to be 8 feet +/- 0.5 feet about the lot elevation of 1185 for a time period less than 30 minutes.”

Sutton Wilderness Lake Dam: One (1) map is included in the Appendix. According to the dam breach analysis, “A major flood caused by a sudden breach of the dam is estimated to inundate approximately 127 homes, 0 businesses, and 4 roads/highways.” The travel time of a flood wave is approximately 10-20 minutes. The breach would flow north through a residential area into rural Norman. The maximum discharge would be 1,628.8 feet per second in the event of a dam breach.

Crystal Lake Dam: A high quality digital inundation map was not available during the drafting of this HM Plan, so the Extent of the Crystal Lake Dam failure will be narration-only. Crystal

Lake Dam is located in the northwest area of Norman, between the Max Westheimer Airport and Sutton Wilderness Park Lake. According to the dam breach analysis report, if a breach were to occur the flood inundation would follow a north-northeast path that would travel for 6200 feet and cover approximately 680 acres. The flood wave would progress through the area in 15-20 minutes, with an average wave speed of 6-8 feet per second. In the upper reaches of the breach, where there are approximately 131 residential structures, the peak flow would occur 0-2 minutes after the initiation of the breach. The flood depth max water surface elevation would be 4-5 feet higher than street level. The lower reaches of the inundation area consists of more open land and fewer residential structures.

Probability of Future Events

The probability of dam failure within Cleveland County is very low according to the Hazard Probability Rating.

Vulnerability and Impact

Unincorporated Cleveland County and the City of Norman have the highest vulnerability from a dam breach. Those areas located in the breach zone of a dam failure would be immediately impacted by the force of water that has been released. Residential and commercial structures, transportation routes, infrastructure systems such as water, sewer, electrical and pipelines have the potential to be severely to completely destroyed. Critical facilities and services would be impacted, including firefighting, medical care, and the loss of source water to water districts. These water districts, located away the immediate impact area, would result in loss of service to residential and commercial customers. Many of these customers do not have a secondary source of potable water.

Economic impacts can be direct or indirect. Direct impacts appear immediately following a dam failure event and typically include the need to repair and rebuild structures and infrastructure and reopen businesses. Indirect economic impacts that might be identified during the consequence assessment are unemployment leading to population shifts, difficulty in attracting new businesses to the area, the need for governmental assistance, and lower property tax revenues. Indirect impacts may also include the closure of an industry outside the inundation area that depends on the output of a factory within the inundation area that would be destroyed by the dam failure scenario under consideration. Dam failure has the potential to cause significant and long-term social effects, resulting in changes to the quality of life in the affected community. Social impacts may include a loss in the public's confidence in public officials, difficulty delivering necessary social or medical services to the community, or the loss of connections among community members that provide support and enrichment. A dam failure can also have negative environmental impacts, such as the pollution of surface or groundwater, air, and soil; the release of hazardous materials; or the destruction of environmentally sensitive areas. Long term vulnerabilities to the community, reservoir, such recreation, environment, and cost to rebuild or develop a new source of potable water etc.

3.4.2 Drought

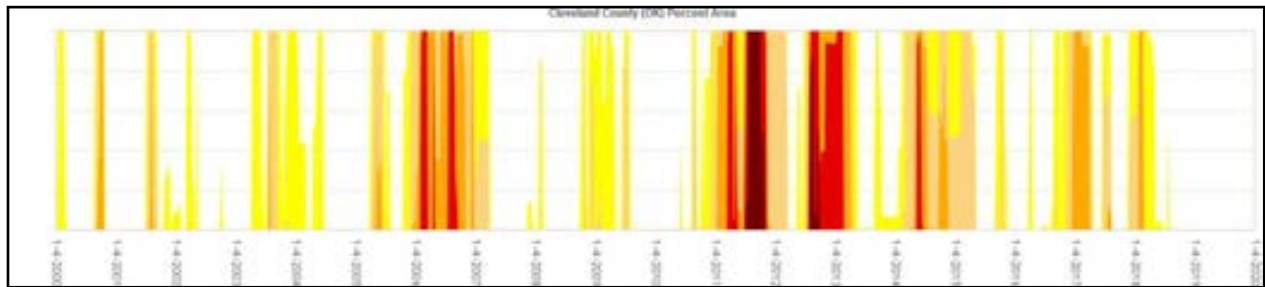
Description: A drought is a period of drier-than-normal conditions. If dry weather persists over the long term, and water supply problems develop, the dry period can become a drought. Drought conditions worsen as temperatures remain high and precipitation levels remain below normal averages, though it should be noted that drought conditions can occur in winter also, not only in summer.

Location

All jurisdictions within Cleveland County experience cycles of drought without exception. Drought is primarily caused by a lack of precipitation. Drought conditions can also be accelerated by above average temperatures; however, drought is as likely to occur in the winter months if snowfall and/or rainfall is below average amounts.

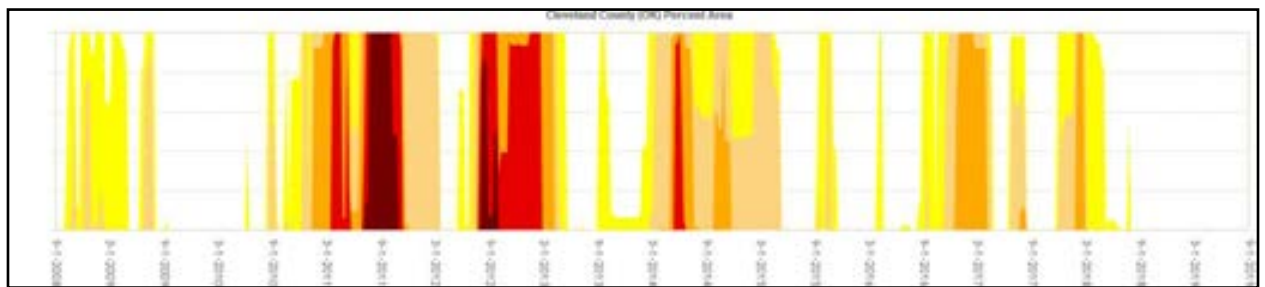
Previous Occurrences

The graph below depicts the varying severities of annual drought cycles within and across Cleveland County since 2000.



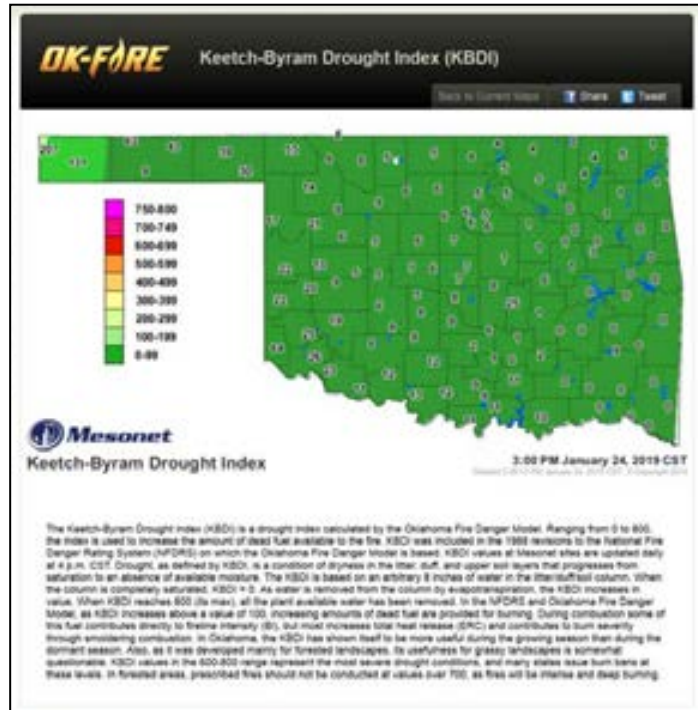
Color code:
 D0-D4 = Yellow (Least severe; abnormally dry)
 D1-D4 = Peach/light orange (Moderate drought)
 D2-D4 = Orange (Severe drought)
 D3-D4 = Red (Extreme drought)
 D4 = Dark red (Exceptional drought, most severe)

This graph shows more detail on the drought cycles since September 2008. As shown in this graph, the most severe drought conditions occurred in mid-August to mid-September 2011, and again from September 2012 to March 2013.



Color code:
 D0-D4 = Yellow (Least severe; abnormally dry)
 D1-D4 = Peach/light orange (Moderate drought)
 D2-D4 = Orange (Severe drought)
 D3-D4 = Red (Extreme drought)
 D4 = Dark red (Exceptional drought, most severe)

At the time of preparing this CCHMPU, all of Oklahoma, including Cleveland County, experienced a period of unseasonably wet conditions, as shown by this Keetch-Byram Drought Index (KBDI) graphic. The KBDI number helps local emergency management, local fire departments, and meteorologists understand how much greenness vegetation across a region has. This is crucial to understanding how drought and wind contribute to wildfires any time of year.³



Extent

The Palmer Drought Severity Index (PDSI) provides a guide for classifying weather conditions, focusing mainly on precipitation, temperature data, and local Available Water Content (AWC) within the soil. The PDSI helps meteorologists, local emergency managers, and fire departments have a better idea on how severe the drought conditions are. The severity of drought directly relates to the possibility of wildfires, which will be discussed later in this plan. (See page 43.)

Cleveland County and participating jurisdictions can experience the full range of drought severity shown on this index.

Palmer Drought Severity Index

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

³ http://www.mesonet.org/index.php/okfire/map/keetch_byram_drought_index_kbdi/current_maps

Probability of Future Events

The probability of a drought impacting all of Cleveland County is high. Since unincorporated southern Cleveland County has more rural areas, the county emergency management department proactively monitors the Keetch-Byram Drought Index (KBDI), particularly when a period of little to no rainfall has occurred. As conditions worsen, communications and coordination with local and volunteer fire departments occur on a regular basis, and as needed, daily or even multiple times a day. Coordination and communications with the Oklahoma Forestry Service, local emergency management, and local fire departments also regularly occurs in such situations.

Vulnerability and Impact

All jurisdictions are equally susceptible to the effects of drought conditions. Most effects are economic rather than loss of life and/or an immediate loss of property; however, as drought severity increases, the likelihood of wildfires in the rural areas brings an increased concern for loss of property and life. This includes losses from agricultural crops and livestock due to lack of water and rainfall.

Agriculture is usually the first sector to be affected by the onset of drought because it relies on precipitation and soil moisture availability during various crop growth stages. During drought events, available water resources deplete at a faster rate, creating serious sustainability issues for the long term.

Extended periods of drought affect the reservoir levels and in extreme cases, municipalities might need to seek alternatives to their water supplies. Drought is typically accompanied by extreme heat which can result in higher mortality rates if the elderly and children do not have access to adequate water supply.

As water levels in lakes and wells decrease, water quality can suffer and increase cost of water treatments and private wells can dry up.

In extreme drought cases where water supplies are severely depleted, the affected population is as follows:

The City of Lexington serves 858 people.

The City of Noble serves 2,200 people.

The City of Norman serves 82,541 people in addition to the University of Oklahoma's population of 22,738, for a total of 105,279 people.

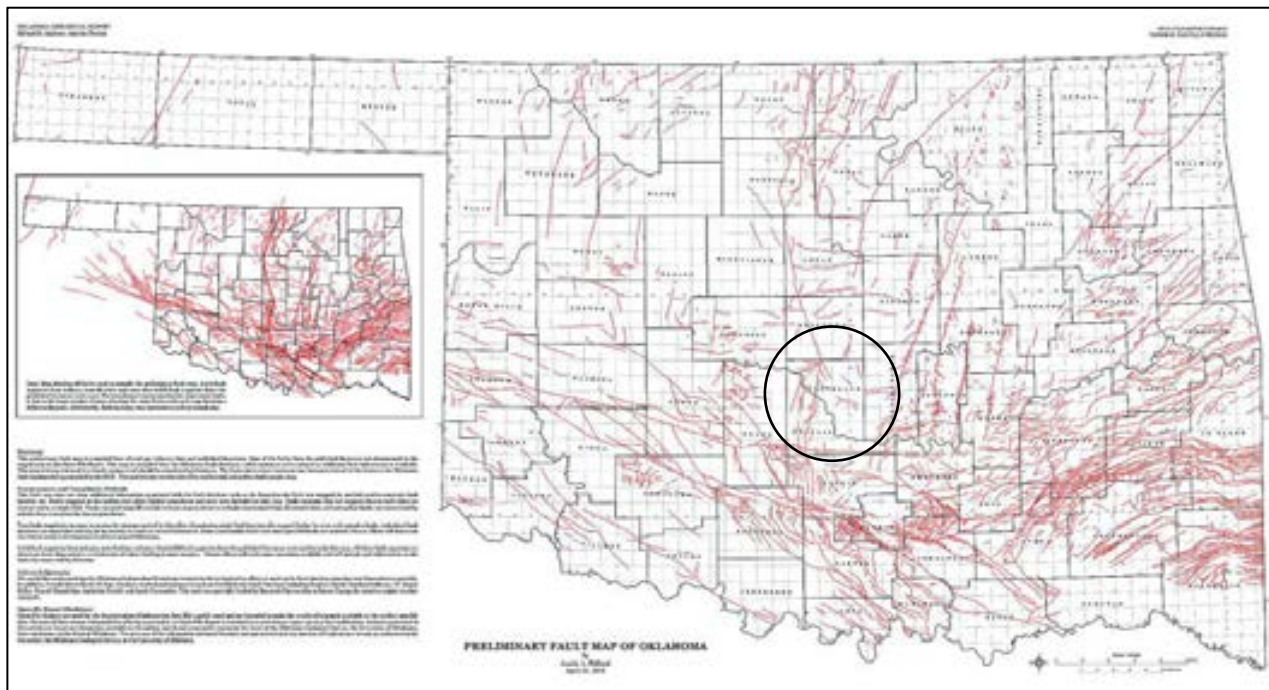
The Town of Slaughterville does not have a municipal water supply and all residents have their own private wells. As of 2018, there is an estimated 4,328 living in Slaughterville.

3.4.3 Earthquake

Description

An earthquake occurs when two blocks of the earth suddenly slip past one another as the result of slowly accumulating pressure underground near a geological fault plane or a plate boundary. The surface where they slip is called the fault or fault plane. The resulting waves of vibration within the earth create ground motion that vibrates at the surface. The location below the earth's surface where the earthquake starts is called the hypocenter, and the location directly above it on the surface of the earth is called the epicenter.

Location



Earthquakes can occur throughout the planning area.

Oklahoma has several fault lines beneath its surface. The Meers Fault is located in southwest Oklahoma.

The Nemaha Ridge zone extends from southeastern Nebraska, through Kansas into central Oklahoma. The Nemaha fault line varies in width from 4 to 15 miles.

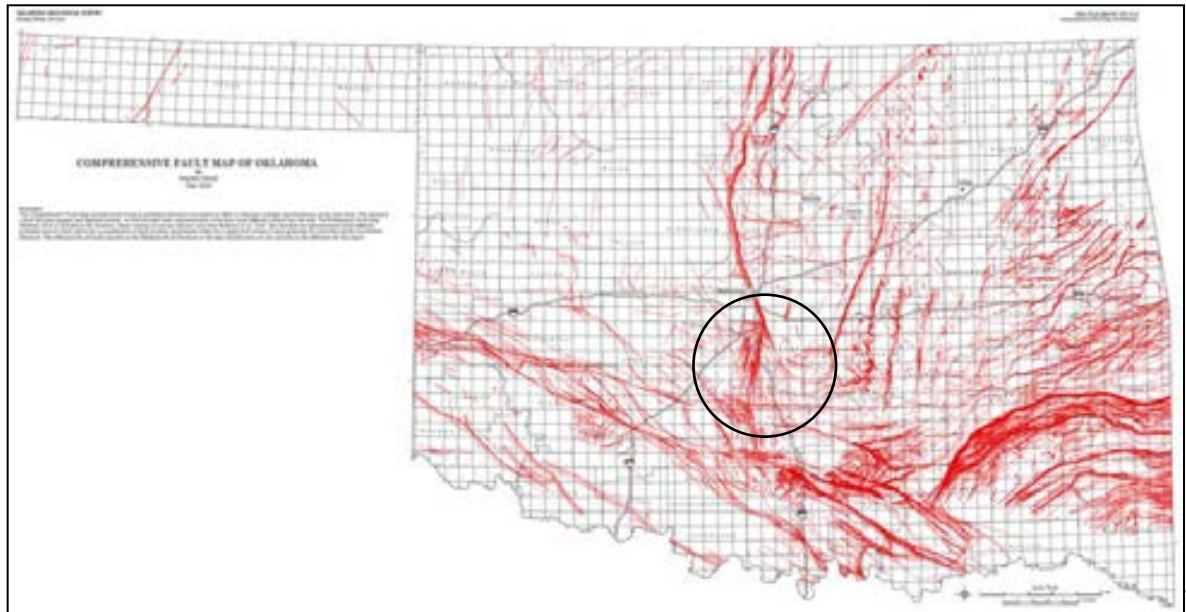
The New Madrid fault zone is centered in Missouri and included several large earthquakes in the early 1800s that were widely felt in the region, including in Oklahoma.⁵

The Wilzetta Fault also lies beneath central Oklahoma. The Wilzetta Fault caused a 5.7 earthquake in November 6, 2011 near Prague, Oklahoma. This particular earthquake was within

⁴Holland, Austin. Preliminary Fault Map of Oklahoma. April 2015 <http://ogs.ou.edu/docs/openfile/OF3-2015.pdf>

⁵Facts about the New Madrid Seismic Zone. Missouri Department of Natural Resources <https://dnr.mo.gov/geology/geosrv/geores/techbulletin1.htm>

close proximity to several wastewater disposal wells. Both state and federal science agencies such as the Oklahoma Geological Survey (OGS) and United States Geological Survey (USGS) have linked large volume wastewater injection wells to an increase in earthquake frequency and an increase in the occurrence of damaging earthquakes from 2008-2015. A significant decrease in earthquake activity since 2015 has been driven by to market forces and regulatory actions within Oklahoma.⁶



Extent

Most earthquakes within Cleveland County are strong enough to be recorded, but generally not felt. The only exception to this is the earthquake recorded October 13, 2010, with its magnitude of 4.4 on the Richter scale*. This table on page 25 provides a comparison and description on the magnitudes of earthquakes.

For hazard mitigation planning purposes, based on the historical magnitudes Cleveland County has experienced listed below, earthquakes between the range of 2-4.4 can be felt by persons indoor and outdoor. It is unlikely that structural damage would occur, though fragile objects could be disturbed or broken.

*The Richter Scale is used as reference for planning purposes since it is a more familiar scale.

⁶ Petersen, Mark D.; Mueller, Charles S.; Moschetti, Morgan P.; Hoover, Susan M.; Rukstales, Kenneth S.; McNamara, Daniel E.; Williams, Robert A.; Shumway, Allison M.; Powers, Peter M.; Earle, Paul S.; Llenos, Andrea L.; Michael, Andrew J.; Rubinstein, Justin L.; Norbeck, Jack H.; Cochran, Elizabeth S. "2018 One-Year Seismic Hazard Forecast for the Central and Eastern United States from Induced and Natural Earthquakes." *Seismic Research Letters*, 89 (3): 1049-1061.

⁷ Marsh, Stephen. Comprehensive Fault Map of Oklahoma. May 2016. <http://ogs.ou.edu/docs/openfile/OF2-2016P1.pdf>

The Richter Scale

Magnitude	Mercalli	Description	Earthquake Effects
2	I	Instrumental	Not felt except by a very few under especially favorable conditions.
	II	Feeble	Felt only by a few persons at rest, especially on upper floors of buildings.
3	III	Slight	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
	IV	Moderate	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
4	V	Rather Strong	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
5	VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
	VII	Very Strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
6	VIII	Destructive	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
7	IX	Ruinous	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
	X	Disastrous	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
8	XI	Very Disastrous	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
	XII	Catastrophic	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

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

Previous Occurrences

In spite of Cleveland County geographically lying within central Oklahoma, Cleveland County has not experienced as many earthquakes recorded within its boundary, as its northern neighboring county, Oklahoma County. According to the Oklahoma Geological Society, twelve (12) earthquakes ranging from 2.2 to 4.4 on the Richter Scale have been recorded between 2008-2019.⁸

Date	Magnitude
10/21/08	2.7
10/13/10	4.4
10/14/10	2
10/18/10	2.4
10/19/10	3.2
5/20/12	2.4
7/16/12	2.3
1/31/14	2.2
2/1/14	2.3
6/8/18	2.4
1/24/19	2.4
1/25/19	2.8

Probability of Future Events

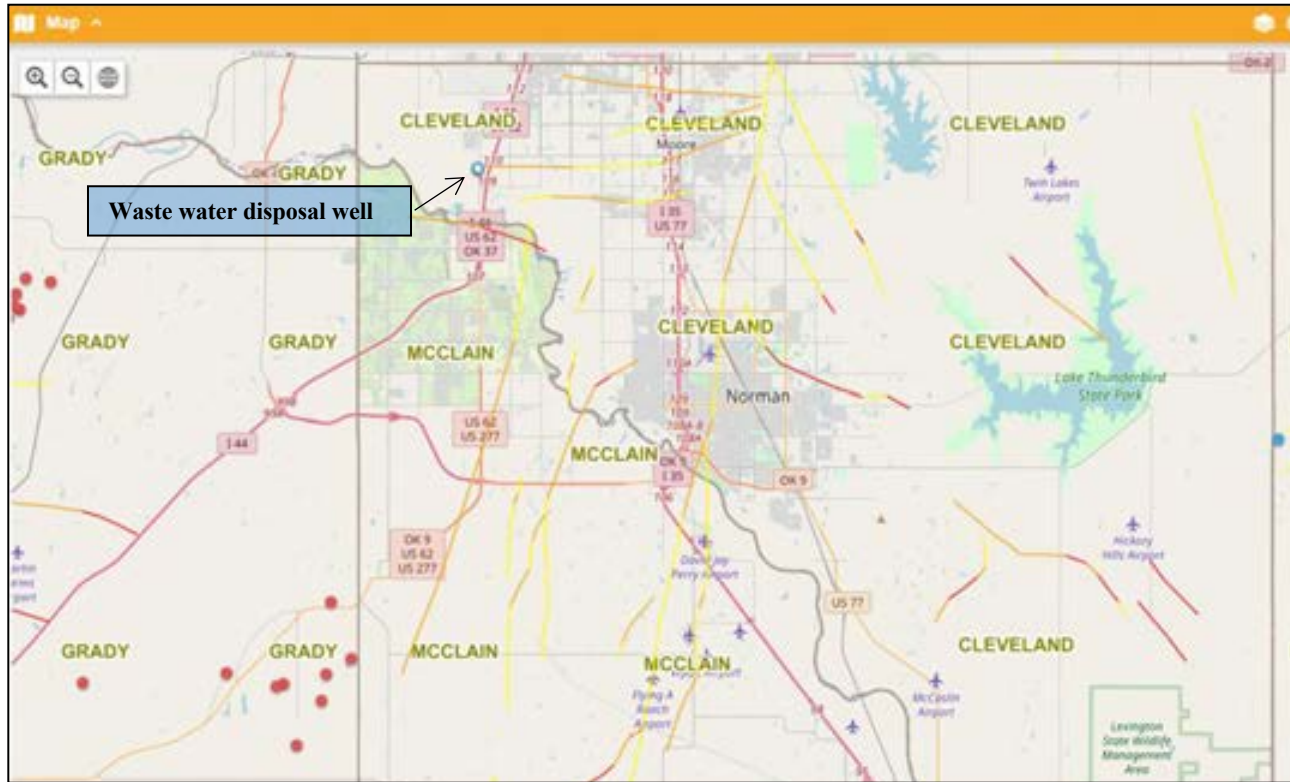
The probability of significant earthquakes that cause minor or major damage to structures is very low, based on the data shown above. There is a moderate risk from induced earthquakes in adjacent counties being strong enough to be felt in Cleveland County geographically.

While oil and gas industry activity within Cleveland County is limited by comparison to other counties, the presence of a fault line increases the long-term potential for earthquakes.

It is not expected that the number of small earthquakes would increase for two reasons: firstly, the lack of water disposal wells within the county, and secondly, due to the composition of the geological surface beneath the participating jurisdictions. The following map shows the location of a waste water disposal well in Cleveland County near the Will Rogers International Airport. See map on the following page.

Another waste water disposal well near Slaughterville has been identified in the course of this update. The Slaughterville town administrator and the Oklahoma Corporation Commission clarified that this commercial disposal well does not inject into the Arbuckle formation and is not included in the OCC's Induced Seismicity Department's classification of hazardous injection wells that have potential to induce earthquakes.

⁸ Oklahoma Geological Survey Earthquake Catalog Download Tool; https://ogsweb.ou.edu/eq_catalog/



9

Vulnerability and Impact

Vulnerabilities to earthquakes include any structure and could potentially damage infrastructure such as roads, bridges, water and sewer lines, electrical networks, and communication networks. These effects are economic, rather than a loss of life.

Extent of the damage correlates to the magnitude of each earthquake. It is expected the damages would continue to range from Instrumental (2) to Rather Strong (4), according to the Richter Scale descriptions on the table on page 30.

If a more significant earthquake were to occur, it would be expected that critical services could be impeded, depending on the location of the epicenter of the earthquake and the participating jurisdictions' proximity to it. If such a severe earthquake were to occur, it could be expected to have an associated loss of life; however, considering the historical data and the geological structures beneath the surface, it is unlikely that an earthquake of such severity would occur.

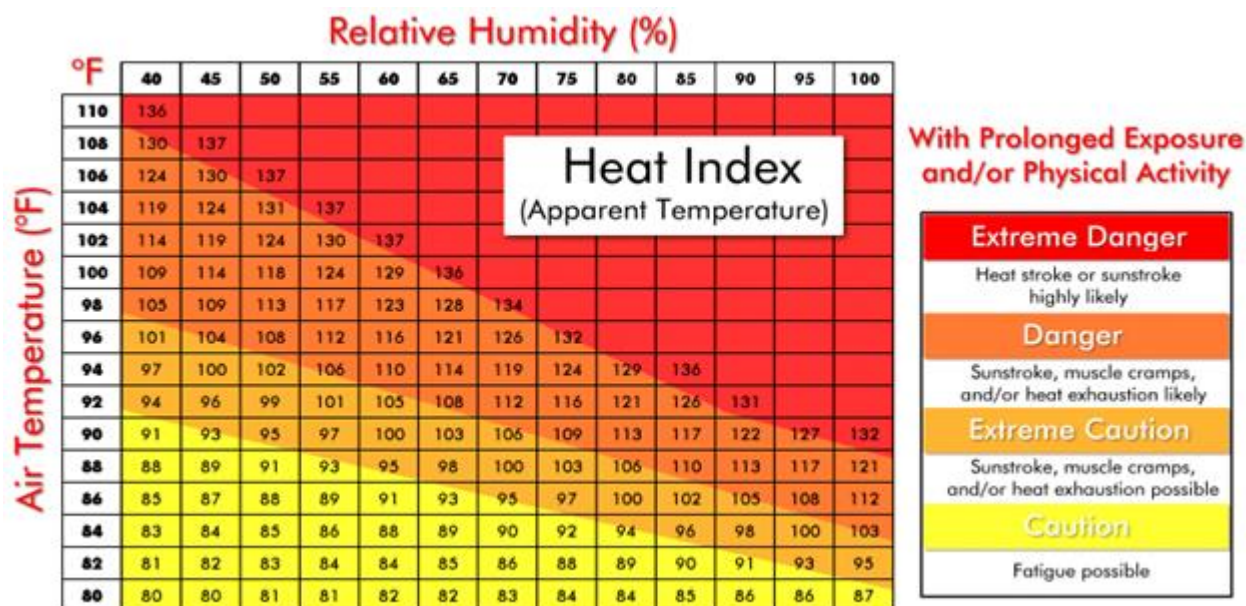
Participating jurisdictions take seismic forces into account and implement changes according to the three-year code cycle, as determined necessary relative to the information provided.

⁹ Courtesy of Oklahoma Corporation Commission.

3.4.4 Extreme Heat

Description

FEMA describes extreme heat as “a long period (2 to 3 days) of high heat and humidity with temperatures above 90 degrees.” (All degrees in this text will be in Fahrenheit.) Heat waves combined with a lack of precipitation create drought and increase the potential for wildfires.



Location

All jurisdictions can be impacted by extreme heat.

Extent

Participating jurisdictions consider a moderate heat index range indicated in the chart below is a minor extent. Anything in the high heat index range is considered a major extent.

The heat index associated protective measures for worksites (following) shows how varying levels of heat and humidity affect humans, and how people who have strenuous outdoor activity need to be more aware of the heat index and monitor symptoms accordingly.

The participating jurisdictions have experienced the range of temperatures shown below, except for the heat index range above 115 degrees F (very high to extreme). However, such heat indices could be reached if the conditions of high temperatures and relative humidity were conducive.

Heat index–associated protective measures for worksites

Heat index	Risk level	Protective measure
Less than 91°F (33°C)	Lower (caution)	Basic health and safety planning
91°F to 103°F (33°C to 39°C)	Moderate	Implement precautions and heighten awareness
103°F to 115°F (39°C to 46°C)	High	Additional precautions to protect workers
Greater than 115°F (46°C)	Very high to extreme	Even more aggressive protective measures

Adapted from OSHA [2012].

Additional information about protective measures mentioned in the above table can be found on OSHA's website.

Note: The presence of a radiant heat source may decrease the accuracy and usefulness of the above heat index.

Previous Occurrences

All participating jurisdictions experience extreme heat periodically. This table below lists the year and number of days each year that the participating jurisdictions experienced **heat indices** over 90 degrees.¹⁰

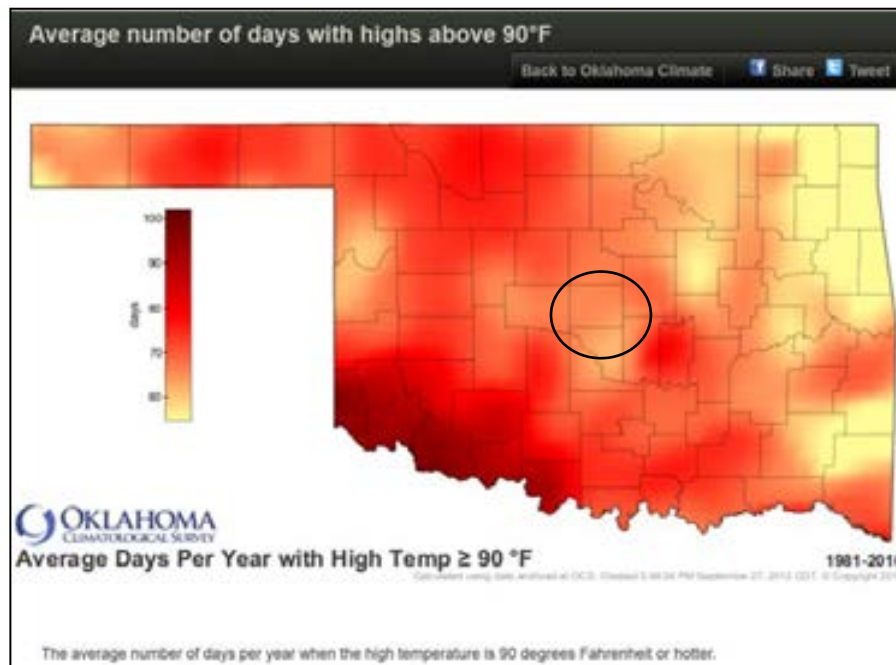
Year	Number of Days of Extreme Heat
2014	80
2015	86
2016	97
2017	77
2018	99
2019 (Up to July 1, 2019)	17

The highest heat index since 2014 occurred July 19, 2018 at 112.64 degrees, with a maximum temperature of 105.15 degrees and maximum relative humidity at 97.13.

¹⁰ Mesonet. https://www.mesonet.org/index.php/weather/daily_data_retrieval

Probability of Future Events

The probability of all jurisdictions experiencing extreme heat is high. As shown in this graphic, the participating jurisdictions average between 60-70 days annually.¹¹ This data provided by the Oklahoma Climatological Survey is the most current data they provide online; the data in the preceding section reflects extreme heat data recorded by the Mesonet since the previous CCHMPU. The frequency and intensity of heatwaves and extreme heat events have increased since the past 50 years, in particular, central Oklahoma has experienced milder winter and spring seasons. It is reasonable to assume that the occurrence and intensity of heat events could remain the same or increase.



Vulnerability and Impact

Anyone within the geographical area of Cleveland County can suffer from heat related illnesses when their bodies do not have the ability to compensate and properly cool itself through sweating. High humidity levels prevent sweat from evaporating efficiently.

The elderly, outdoor workers, the very young, and the chronically ill are most vulnerable to heat-related illnesses; however, even young and healthy individuals can succumb to heat-related illnesses if they lack proper hydration and a chance to cool. Factors that can make heat-related illnesses worse are certain prescription drugs that could inhibit natural cooling abilities, excessive alcohol consumption, and poor circulation. In very extreme cases, loss of life could occur if humans or livestock had no access to water for an extended period of time during periods of extreme heat.

Structural damage is unlikely to occur in extreme heat, though, it is possible for roads and bridges to buckle and expand.

Extreme heat events are one of the leading weather-related causes of death in the United States— from 1999 through 2009, extreme heat exposure caused more than 7,800 deaths.

Heat waves are especially hard on children, the elderly, outdoor workers and athletes, economically disadvantaged groups, and those already suffering from chronic illnesses, often resulting in more trips to the hospital.

¹¹ Oklahoma Climatological Survey.

http://climate.ok.gov/index.php/climate/map/average_number_of_days_with_highs_above_90f/oklahoma_climate

Hotter than average days in the summer increase illness and death by compromising the body's ability to regulate its temperature. This loss of temperature control can result in a cascade of illnesses, including heat cramps, heat exhaustion, heatstroke, and hyperthermia. Even small differences from seasonal average temperatures are associated with increased illness and death. Temperature extremes can also worsen chronic conditions, including cardiovascular, respiratory, and cerebrovascular disease and diabetes-related conditions.

In cities, the "urban heat island" effect can increase temperatures from 1.8 to 5.4°F higher than the less developed areas around them. An increase in warmer nighttime temperatures means that many people are unable to sufficiently cool down at night, which increases their risk of heat-related illnesses. People who live alone or lack air conditioning are at even greater risk. Urban heat islands, combined with an aging population, poor air quality, and growing urbanization are concerns.

Demand for electricity usually increases during heat waves, leading to potential brownouts and blackouts. To meet this demand, utilities sometimes ask urban hospitals to shift to emergency generators to free up electricity. Because many hospital cooling systems are not connected to back-up power generators, brownouts and blackouts can rapidly increase the number of people affected by an extended heat wave, as patients and those seeking refuge from the heat crowd emergency room lobbies.

Some risks associated with extreme heat-related illness and death have decreased in recent decades, possibly due to better weather forecasting, heat early warning systems, and increased access to air conditioning. Deaths and illnesses due to extreme heat events can be prevented, and advances in our understanding of extreme heat risk and our ability to predict it, in addition to capacity building and communication, could continue to decrease risk.

3.4.5 Flood

Description

According to FEMA, flooding is a “general and temporary condition of partial or complete inundation of normally dry land areas from: (1) The overflow of inland or tidal waters; (2) The unusual and rapid accumulation or runoff of surface waters from any source; (3) Mudslides (i.e., mudflows) which are proximately caused by flooding and are akin to a river of liquid and flowing mud on the surfaces of normally dry land areas, as when earth is carried by a current of water and deposited along the path of the current. A flood inundates a floodplain. Most floods fall into three major categories: riverine flooding, coastal flooding, and shallow flooding. Alluvial fan flooding is another type of flooding more common in the mountainous western states.”

The National Flood Insurance Program (hereafter NFIP) defines flood as “an area covered in water or mud that is normally dry.”

All jurisdictions within the geographical area of Cleveland County experience periodic flooding from excessive rainfall. In flood prone areas, flash flooding can easily overwhelm streets and roads where the drainage cannot keep up with the overflow of water. Flooding can also occur on the Canadian River during times of excessive rainfall.

All municipal jurisdictions and Cleveland County are participants of the NFIP. The details of NFIP are discussed in section 4.2.

Location

Special flood hazard areas within the planning area are shown in the maps on pages 119-121 and 141-171 in the Appendix.

All jurisdictions within the geographical area of Cleveland County have identified the flood prone areas within their respective jurisdictions and have plans in place to address the flooding. With extraordinary amounts of rainfall, any area within the geographic area of Cleveland County could become inundated and require attention.

Extent

A floodplain is any land area susceptible to being inundated by floodwaters from any source.¹² Certain locations of the planning area are situated within the 100-year flood zone. An area designated as a 100-year flood zone means there is a 1% chance of that area flooding in any given year, and the area could experience flooding several years in a row.¹³

The locations of these 100-year flood zone (1%) areas are depicted on the FIRM maps located in Appendix A on pages 141-169. In addition to the *1% Chance Floodplain* areas listed, the maps also include data on *Floodway* areas. FEMA defines a floodway as such: A “*Regulatory Floodway*” means the channel of a river or other watercourse and the adjacent land areas that

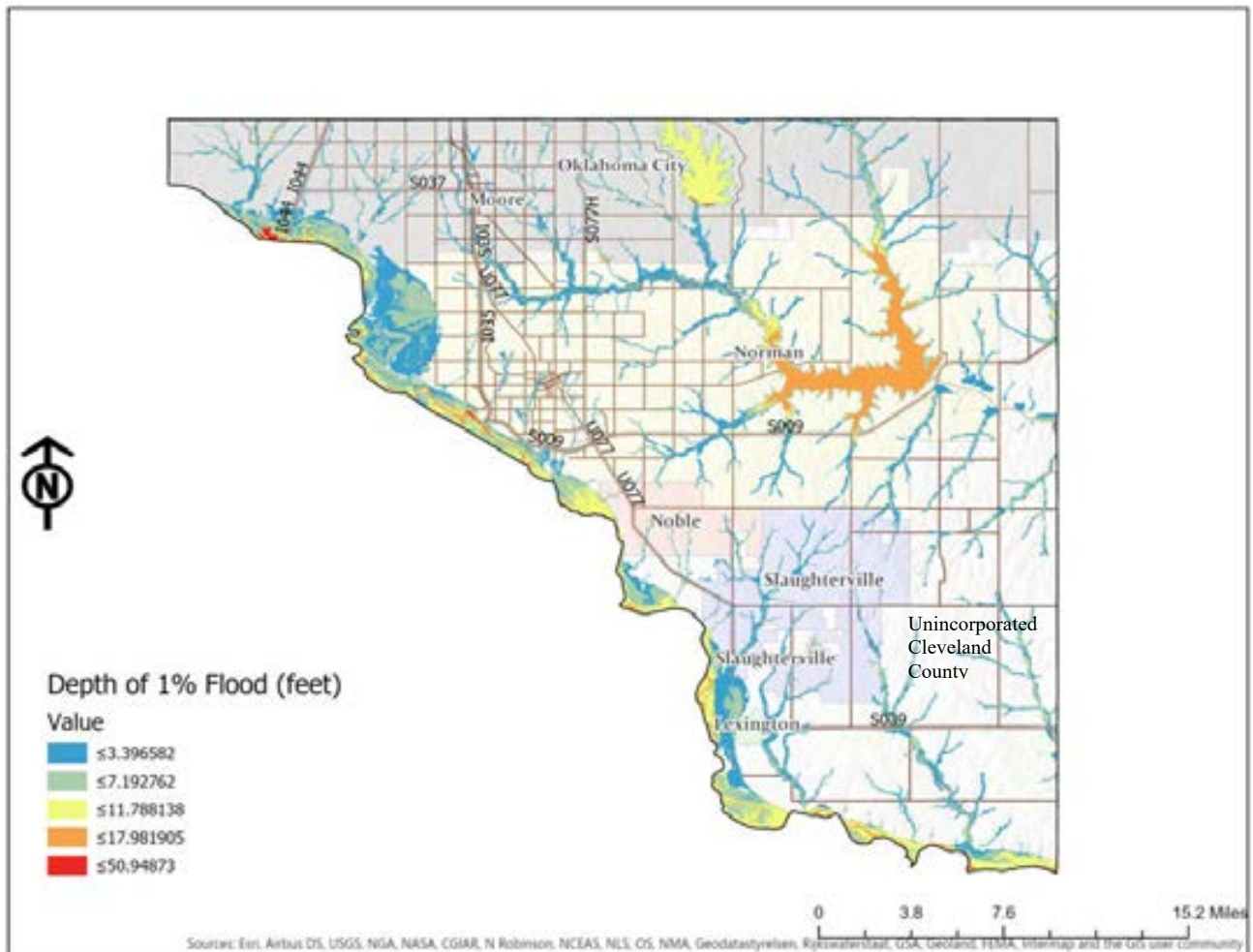
¹² National Floodplain Insurance Program Definitions. <https://www.fema.gov/national-flood-insurance-program/definitions#F>

¹³ Floods: Recurrence intervals and 100-year floods (USGS). <https://water.usgs.gov/edu/100yearflood.html>

must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.”¹⁴

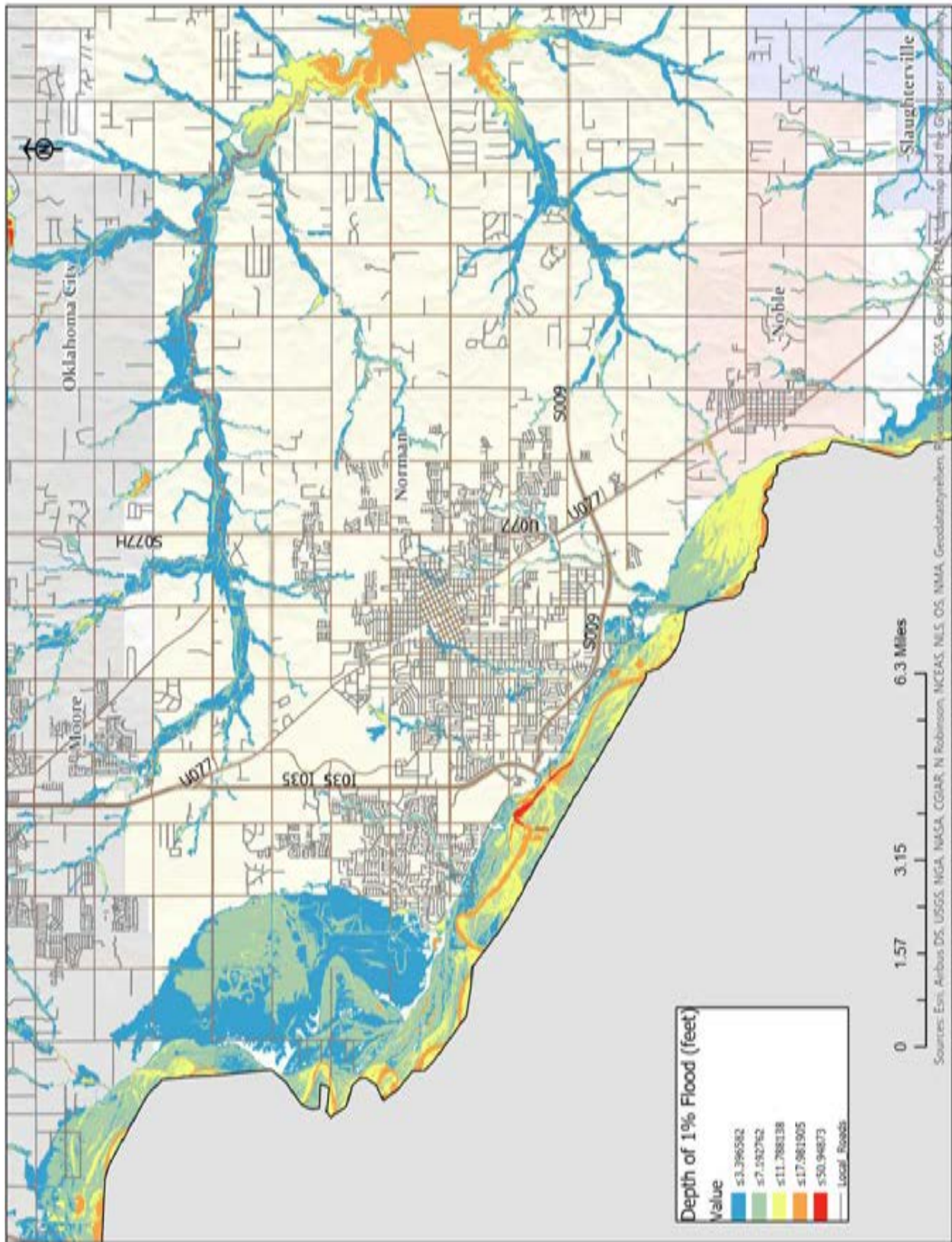
The extent of flooding in the planning area can experience is represented through the flooding depths as shown on the following maps. Each map depicts a measurement scale to explain the possible depth of flooding that would occur in a 1% flood event.

This is an overall map of the county showing the 1% depth of flood areas.

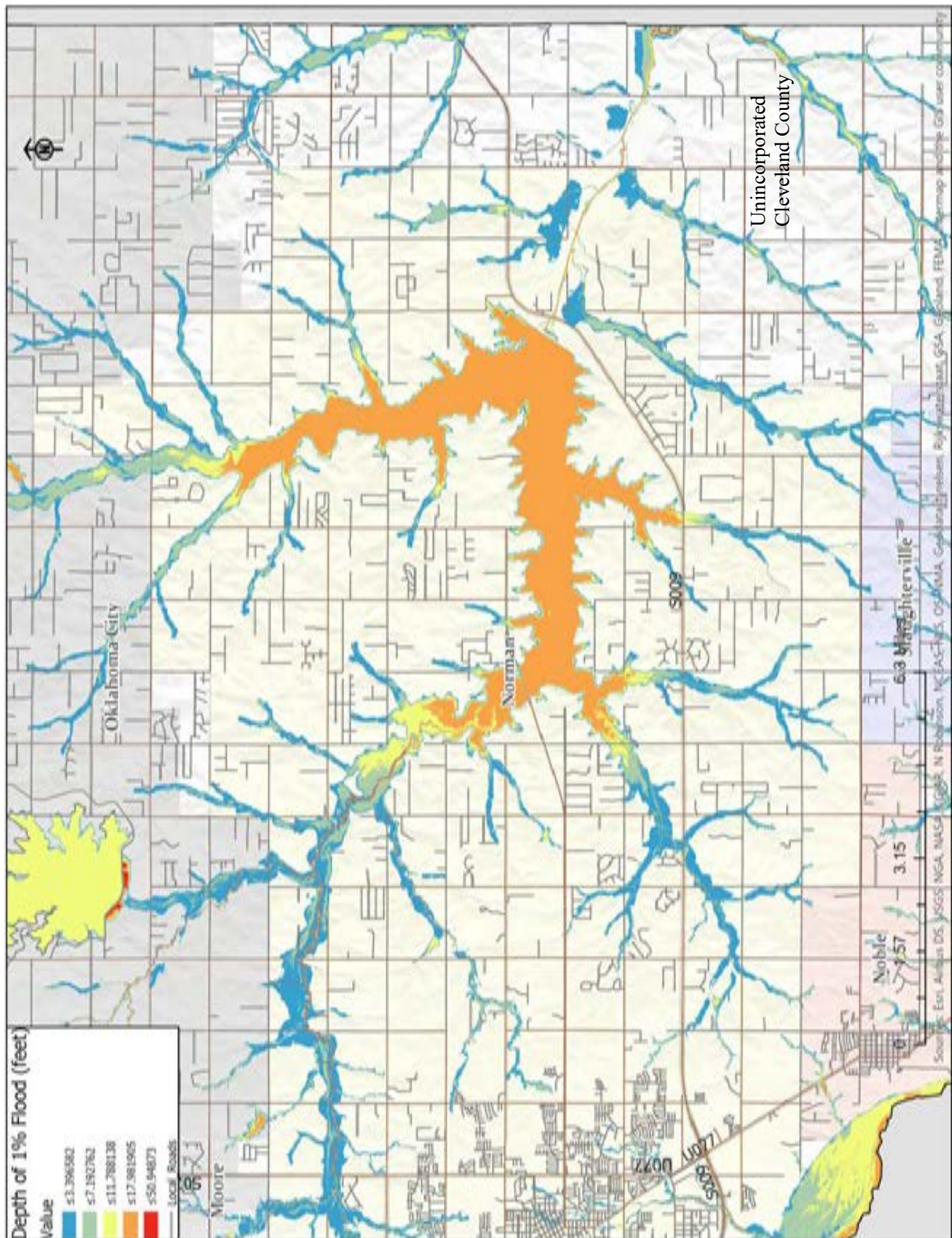


¹⁴ <https://www.fema.gov/floodway>

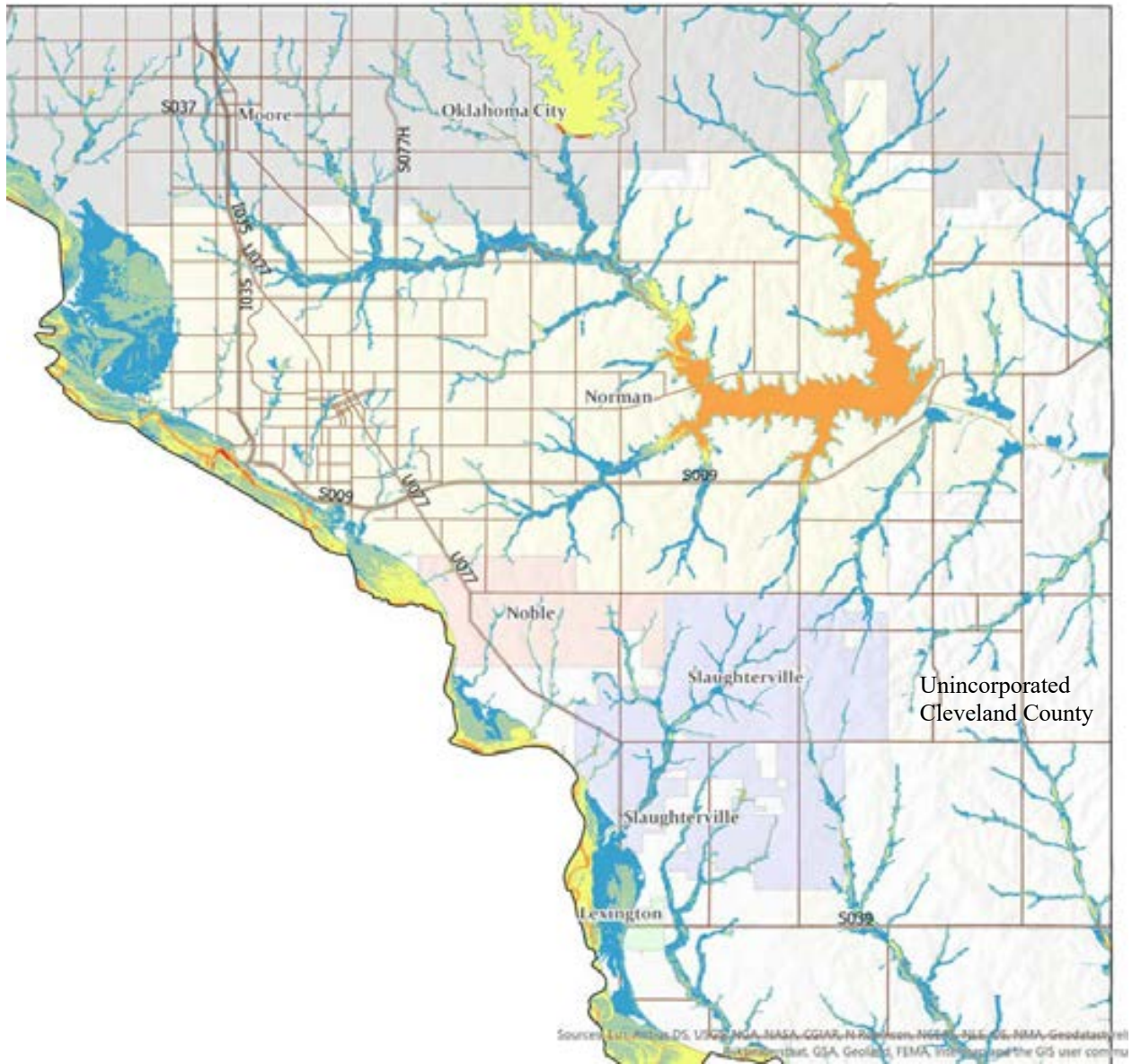
This map shows Norman and the 1% depth of flood areas.



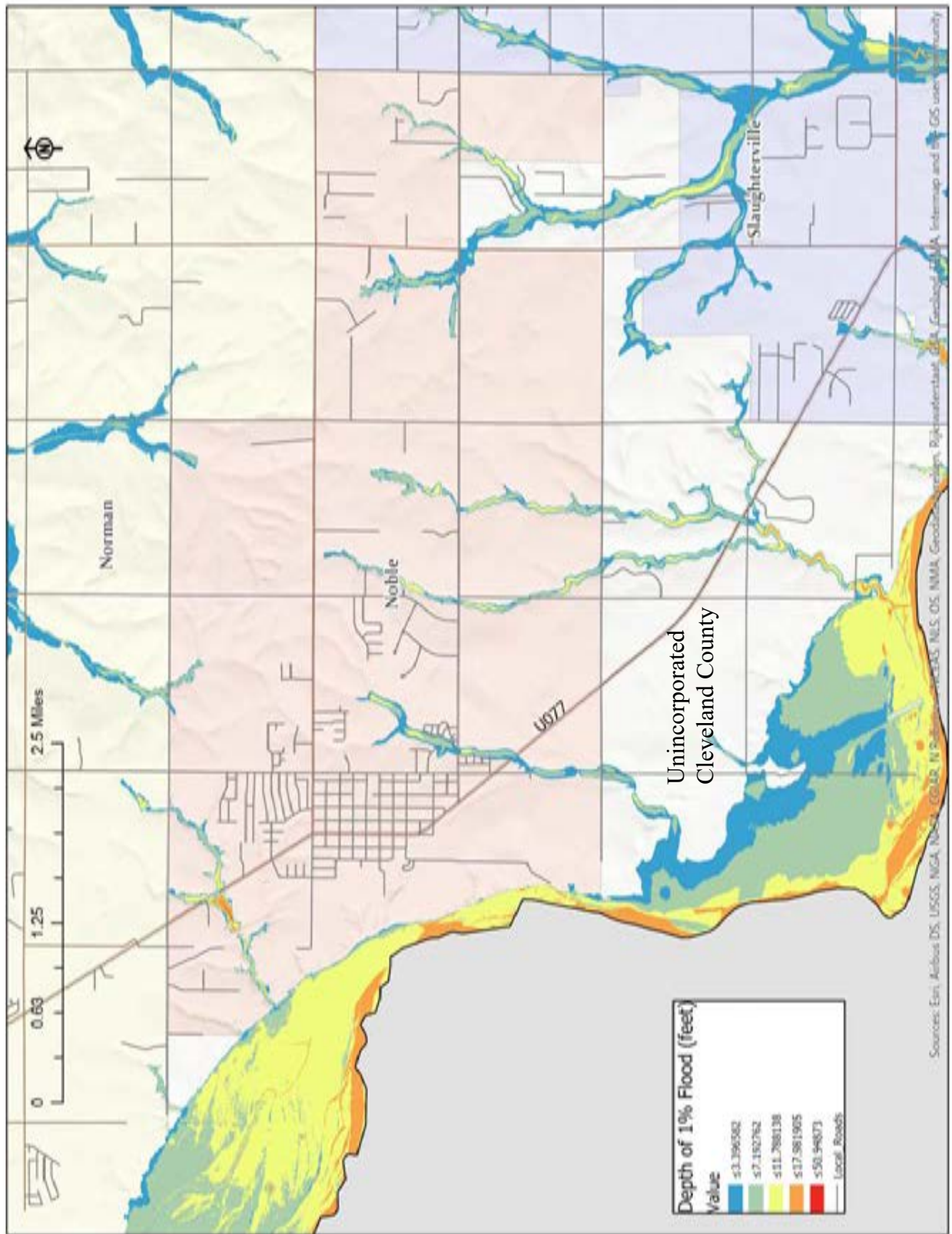
This map shows the 1% depth of flood areas on the east side of Norman and areas of unincorporated Cleveland County.



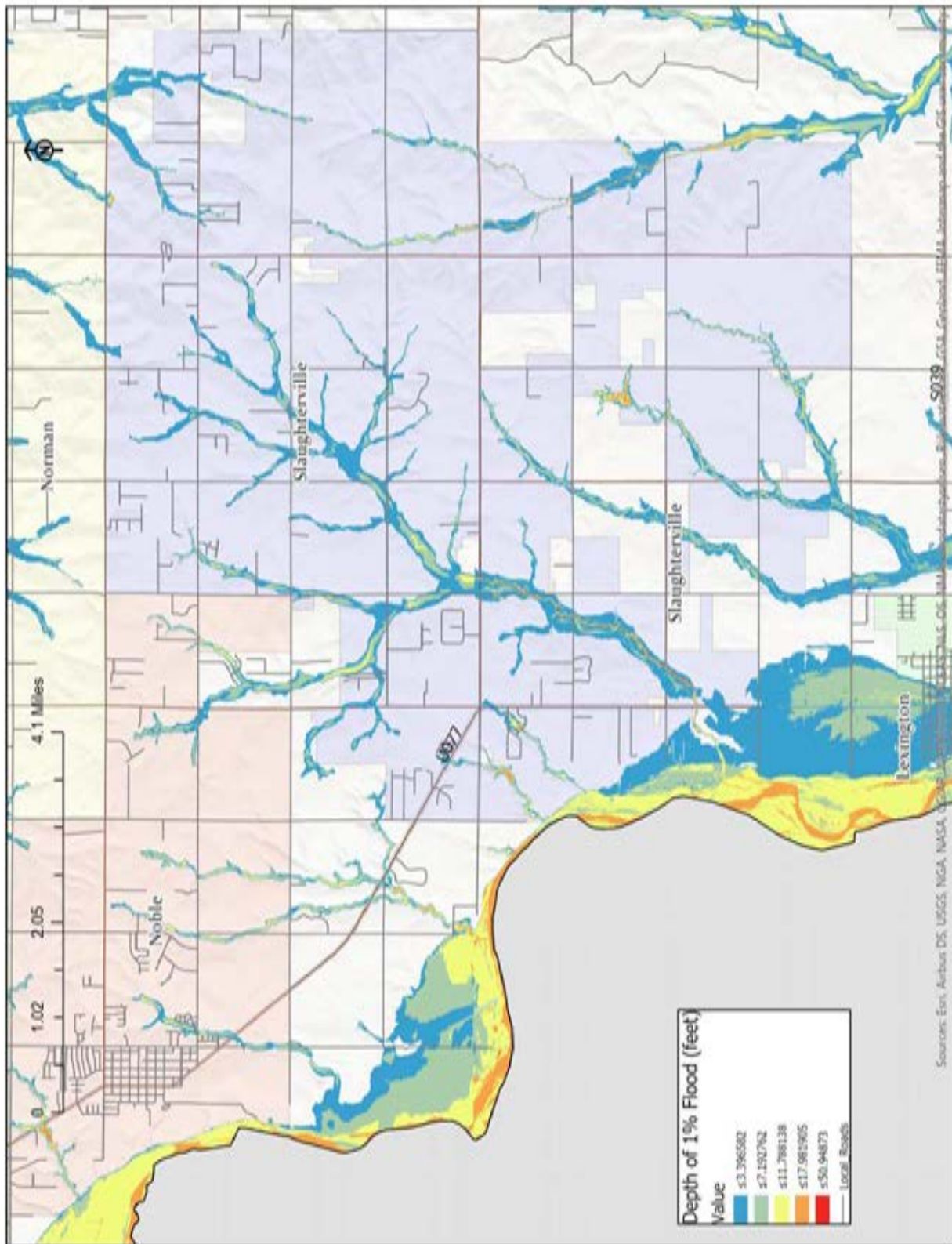
This map shows more detail of the 1% depth of flood areas on the west side of Norman.



This map shows the 1% depth of flood areas for Noble and unincorporated Cleveland County.



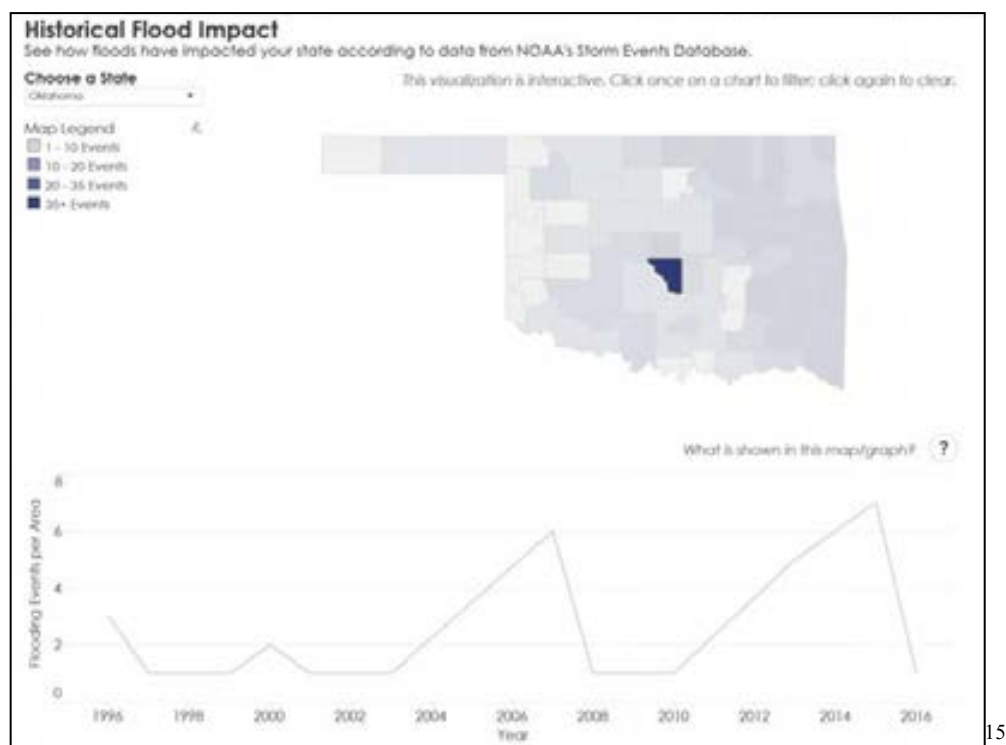
This map shows the 1% depth of flood areas surrounding Slaughter and Lexington.



Previous Occurrences

Since the last CCHMPU in 2014, none of the participating jurisdictions have experienced a flooding event that required a disaster declaration.

Between 2008 and 2018, Cleveland County was included in 241 flood/flash flood advisories or warnings. This graphic shows that Cleveland County had 30 flooding events between 1996 and 2016, and the cyclical nature of occurrences. At the time of this CCHMPU, this was the most current data available.



Norman Dam and Lake Thunderbird, May 2015

The only unusual and significant flooding event that transpired within Cleveland County since 2014 occurred in May 2015. Due to above average rainfall beginning on May 6, 2015, the Norman Dam and Lake Thunderbird reached historic levels and ultimately lead to the release of flood waters. The main agencies that managed the events were the United States Bureau of Reclamation (USBR)-Oklahoma-Texas Area Office (OTAO), the Central Oklahoma Master Conservancy District (COMCD), and Corps of Engineers Reservoir Control Section, Tulsa District (Corps.). Extensive coordination managed the releases.

The highest inflow recorded into Lake Thunderbird was recorded at midnight May 24th, nearly 53,870 cubic feet per second (cfs). Another area that was inundated included Twin Bridges (Alameda Drive). At noon on May 24th, the lake set a new record of reservoir elevation at 1053.2 feet; the previous record had been 1048.38 feet. Heightened levels of awareness continued until May 30th, when the forecast no longer predicted rain and all Norman Dam emergency response levels stopped.¹⁶

¹⁵ <https://www.fema.gov/data-visualization-floods-data-visualization>

¹⁶ Norman Dam and Lake Thunderbird, Norman Project, Oklahoma; February 2016. Pg 2-4.

Probability of Future Events

The probability of flooding within Cleveland County is high. However, as mentioned above, the localized flooding within any participating jurisdiction was not significant enough to warrant any disaster declarations since the last CCHMPU.

Vulnerability and Impact

Infrastructure, residents, and wildlife within these areas are vulnerable to experiencing flooding due to higher than average rainfall. Loss of property could be expected if flood levels reach significant levels. Loss of life could result if catastrophic flood levels occur and if citizens choose not to heed evacuation warnings.

Each jurisdiction has identified their flood prone areas and the FIRM maps are located in Appendix A on pages 141-169.

The planning area has 8,714 parcels susceptible to flooding or located in the special flood hazard area and the map is located in Appendix A. This data shows there is a significant disparity between the number of parcels versus the number of NFIP policies as shown below. Flood damages to their homes will impose more economic hardships for recovery than with homeowners who do have flood insurance. Long-term economic recovery could be more difficult for those who do not have flood insurance. According to the information FEMA provides through the Oklahoma Water Resources Board, this is the number of flood insurance policies and repetitive loss buildings per jurisdiction.

Jurisdiction	Number of Policies	Number of Repetitive Loss Buildings
Cleveland County	46	1
Lexington	41	2
Noble	14	0
Norman	495	14
Slaughterville	11	0

Based off the social vulnerability poverty data that was analyzed, the communities most affected by unplanned economic hardship would include portions of Norman and unincorporated Cleveland County.

Another flood vulnerability in the planning area is drainage issues that result from urban development. In particular, the City of Norman is vulnerable to flooding due to the amounts of storm water that runs off into the streets. This flooding potentially impedes commuting traffic, city bus routes, school bus routes, causes delays, and creates potentially dangerous areas to cross either by pedestrians or traffic.

Flooded bus routes cause delays and interruptions to school operations and affects both student bus routes and staff transportation routes. Lexington PS, Little Axe PS, Noble PS, Norman PS, and Robin Hill PS are all vulnerable to transportation routes being impacted by flooding. Since Slaughterville does not have any schools located in their town, those students must travel to either Lexington or Noble. This increases their travel distance and their vulnerability to being impacted by flooded transportation routes. In addition, Robin Hill PS district is located outside of Norman, but the school is in a rural setting. Transportation routes to this school are limited, and a flood event that impacts their transportation routes would cause a disruption to school operations.

3.4.6 Hail

Description

Hail is a frozen form of precipitation that occurs when precipitation has been swept back into the clouds by an updraft. Hailstones larger than the size of a quarter can result in thunderstorms with powerful updrafts. Hail is most likely to accompany supercell storms with a sustained rotating updraft.

Location

All jurisdictions within the geographic area of Cleveland County are susceptible to hail occurrences.

Extent

Since Cleveland County regularly experiences severe weather conditions, it is reasonable to expect that Cleveland County could continue to expect varying levels of hail under the correct atmospheric conditions. The presence of hail varies greatly as storms cross over Cleveland County geographically. All locations within Cleveland County have experienced the full range of hail on the scale below. This scale provides general guidelines on what kind of damage can be expected from various sizes of hailstones.

Hail Diameter/Description Scale¹⁷

Hail Diameter (Inches)	Description
1/4"	Pea; no damage
1/2"	Small Marble; slight damage to vegetation
3/4"	Penny or Large Marble; significant damage to vegetation and crops
7/8"	Nickel; severe damage to crops, damage to glass, plastic structures, paint and wood scoring
1"	Quarter; severe damage to crops, damage to glass, plastic structures, paint and wood scoring
1 1/4"	Half Dollar; Widespread glass damage and vehicle body damage
1 1/2"	Walnut or Ping Pong Ball; Widespread glass damage and vehicle body damage
1 3/4"	Golf Ball; destruction of glass, damage to tile roofs, significant risk of injury
2"	Hen's Egg; aircraft body dented, brick walls pitted
2 1/2"	Tennis Ball; Severe roof damage, risk of serious injury
2 3/4"	Baseball; severe damage to aircraft bodywork
3"	Teacup Size; severe damage to aircraft bodywork
4"	Grapefruit; Extensive structural damage. Risk of severe or fatal injury to people in the open
4 1/2"	Softball; Extensive structural damage, risk of severe or fatal injuries to people out in the open.

¹⁷ Converting Traditional Hail Size Descriptions; <https://www.spc.noaa.gov/misc/tables/hailsiz.htm>

April through June typically produces the most violent storms in central Oklahoma; however, violent storms can form any time of year.

Previous Occurrences

The National Centers for Environmental Information (NCEI) reports that Cleveland County as a whole had 62 days between 2008 and 2018 with hail events. Within those 62 days, 218 separate occurrences of hail were reported to the NCEI.

The largest reported hailstone measured 4.6 inches in Moore on May 10, 2010.

The City of Norman reported two events with significant hail damage during those years. The City of Norman reported \$40 million of damage on November 5, 2008 and the largest hail was 1.75 inches in diameter.

On March 31, 2013, a supercell storm system moved into central Oklahoma, and the City of Norman estimated damages totaling \$2 million, due to the largest hailstones being 2 inches in diameter.¹⁸ Both of these events demonstrate the severity of damage and loss hail can have within the geographic area of Cleveland County.

However, these events occurred prior to the previous CCHMPU 2014-2019. This table shows how many hail events have been documented since the last CCHMPU 2014-2019. None of these events resulted in loss of life, injury, or property loss.

Year	Jurisdiction	Number of Hail Events
2014	Noble	2
2014	Norman	2
2015	Norman	2
2015	Noble	1
2016	Noble	2
2016	Norman	3
2017	Noble	3
2017	Norman	3
2018	None reported	0
2019	None reported	0

The map on the next page shows the geographic area of Cleveland County experiencing 5 days of 1" hail within a year between 1986-2015. As seen in the close-up, Cleveland County typically experiences 4-5 days with hail annually. (This is the most recent data the NOAA has provided in this format online.)

¹⁸ NOAA National Centers of Environmental Information.

https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28C%29+Hail&beginDate_mm=04&beginDate_dd=01&beginDate_yyyy=2008&endDate_mm=12&endDate_dd=31&endDate_yyyy=2018&county=CLEVELAND%3A27&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=40%2COKLAHOMA

Probability of Future Events

The probability of all jurisdictions experiencing a hail event is high.

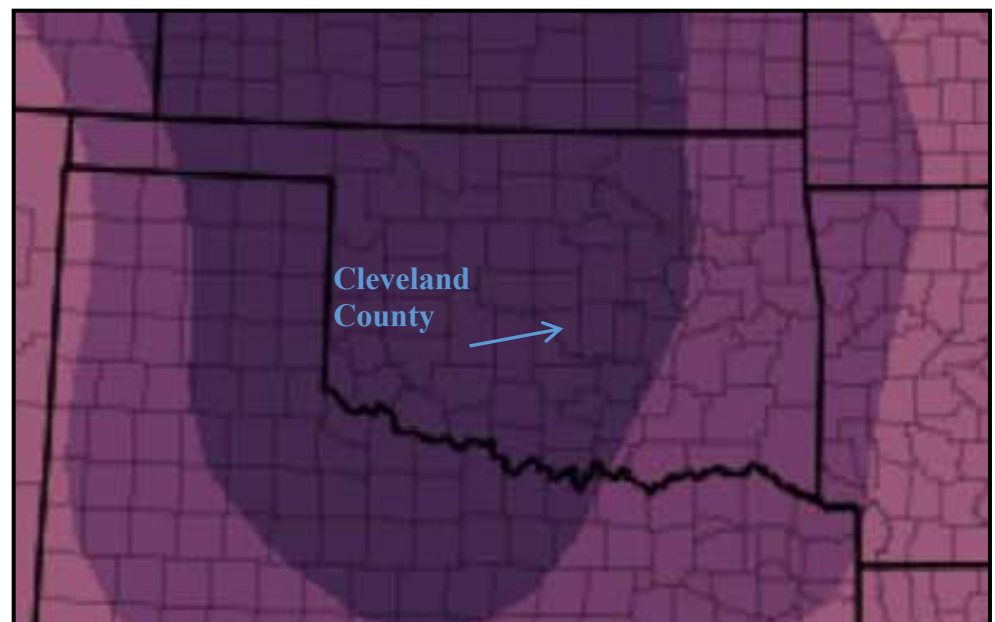
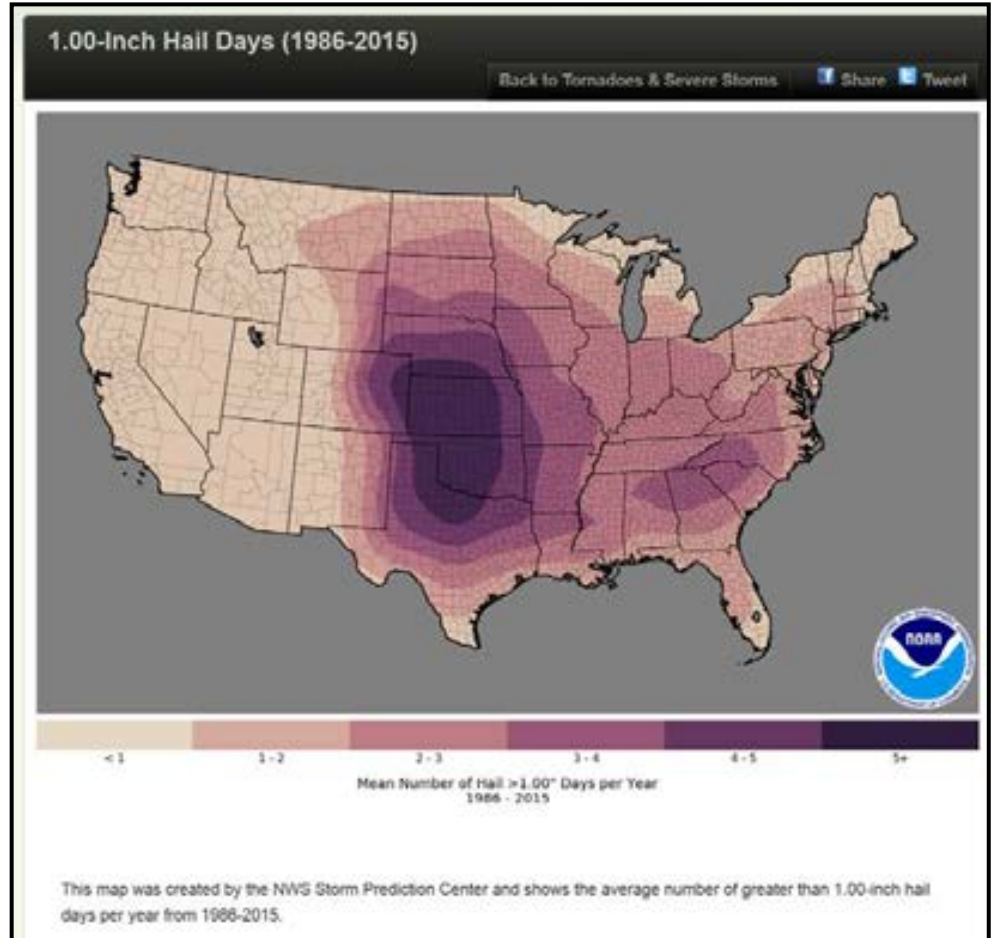
Vulnerability and Impact

All participating jurisdictions could experience hail at any time due to the strong storm systems that develop and pass through the Planning Area.

Any outdoor activity and the participants caught outdoors during a hailstorm are vulnerable to injury from hail, though loss of life is unlikely. All properties, privately or publicly owned,

are susceptible to hail related damage. Windows and roofs of infrastructure are particularly vulnerable to hail. Cars, employee vehicles, fleet vehicles and buses, could have windows break and body damage.

The critical facilities of Cleveland County, Lexington, Noble, Slaughterville, Lexington PS, Little Axe PS, and Robin Hill PS are vulnerable to hail due to the lack of hail resistant film on facility windows. The City of Norman, Norman PS, and Noble PS have incorporated shatterproof glass into some of their critical facilities, but not all.



Another vulnerability is the impact hail damage has on crops and agriculture. Some communities of unincorporated Cleveland County, Slaughterville, Lexington, and Noble depend on agriculture and ranching to sustain their economies. Given the frequent number of hail events in the Planning Area, these agricultural and ranching communities are vulnerable to crop loss, and animal injury and death, due to a hail event. These communities have much smaller populations and a smaller tax base on which to sustain their communities, when compared with Norman. A hail event which damaged crops or resulted in animal harm would have significant economic impacts to these communities, which could also impact the economic health of the school district that support these communities, (Lexington PS and Noble PS).

Lastly, the school districts of Lexington PS, Little Axe PS, Noble PS, Norman PS, and Robin Hill PS do not have covered parking for their school buses. This exposes their buses to damage due to a hail event. Depending on the extent of this damage, this could result in a significant loss to the schools' capabilities, and their ability to operate at normal levels.

3.4.7 High Winds

Description

High winds are associated with severe thunderstorms, but they can also occur on extraordinarily windy days. The National Weather Service issues wind advisories when sustained winds of 40 mph or greater occur.

Winds can be called “straight-line,” with speeds reaching 58 mph or more. Downdraft winds are small columns of air that sink quickly to the ground. Microbursts (less than 4 kilometers wide) and macrobursts (more than 4 kilometers wide) can also occur with or without precipitation.

Location

All jurisdictions are susceptible to damaging high winds.

Extent

The Beaufort Scale below¹⁹ is used to measure and categorize wind speeds. The Planning Area has experienced all values of wind speed on this scale and expects to experience all values of wind speed on this scale in the future.

Force	Wind (knots)	WMO Classification	Appearance on water	Appearance on land
0	>1	Calm	Water surface smooth, mirror like	Calm, smoke rises vertically
1	1-3	Light Air	Scaly ripples	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Small wavelets, glassy crests, no breaking	Wind felt on face, leaves rustle, vanes move
3	7-10	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Small waves 1-4 ft. become larger, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Moderate waves 4-8 ft take longer form, many whitecaps, some spray	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger waves 8-13 ft, whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	(On Sea) waves up to 13-20 ft, white foam streaks off breakers	Whole trees moving, resistance felt walking against the wind
8	34-40	Gale	High waves (20-32 ft), sea begins to roll, dense streaks of foam, spray may reduce visibility	Whole trees in motion, resistance felt walking against the wind
9	41-47	Strong Gale	High waves (20 ft), sea rolls, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Very high waves (29-41 ft) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	Exceptionally high (37-52 ft) waves, foam patches cover sea, visibility more reduced	
12	64+	Hurricane	Air filled with foam, waves over 45 ft, sea completely white with driving spray, visibility greatly reduced	

Previous Occurrences

Between January 1, 2008 to December 31, 2018, there have been six (6) high wind events reported to the National Weather Service. Three (3) of those events did not include monetary damage estimates. The other three (3) events did include monetary estimates for the damages

¹⁹ <https://www.spc.noaa.gov/faq/tornado/beaufort.html>

done to the properties, ranging from \$5,000 to \$7,000.²⁰ Sustained winds between 56-61 mph were reported and these winds were associated with a thunderstorm at the time.

On May 19-20, 2018, three (3) properties had property damage due to straight line winds, but it was not extensive enough for any declaration to be made by the municipalities or county. Property owners reported a variety of damages: 4"-5" broken tree limbs, roof and siding damage, a felled flagpole, and damage to outbuildings. These damages were reported to CCEM; the wind speeds were not known or recorded.

The Slaughterville Fire Department documented five (5) high wind events with damages between 2014 and 2019.

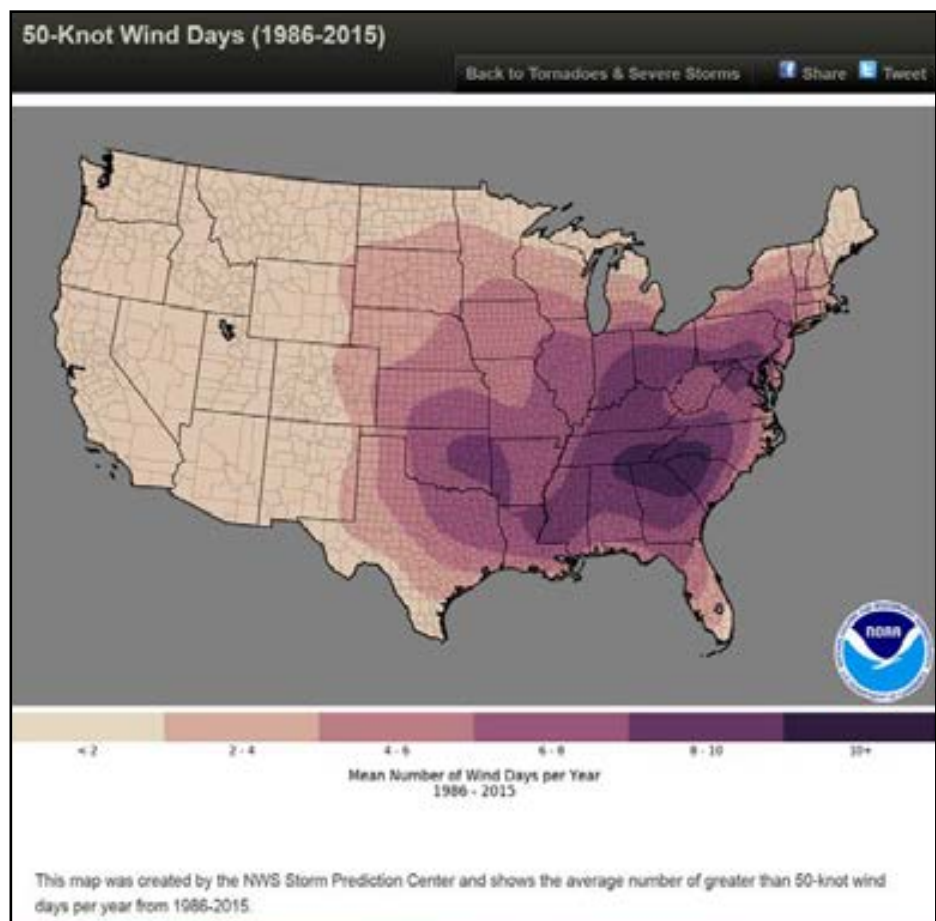
The Noble Fire Department documented five (5) high wind events with slight damages between 2014 and 2019.

The Lexington Fire Departments documented two (2) high wind events with severe damages between 2014 and 2019.

Probability of Future Events

The probability of Cleveland County having high winds is high based on the historical data shown in the graphic here. It is reasonable to expect similar future wind events.

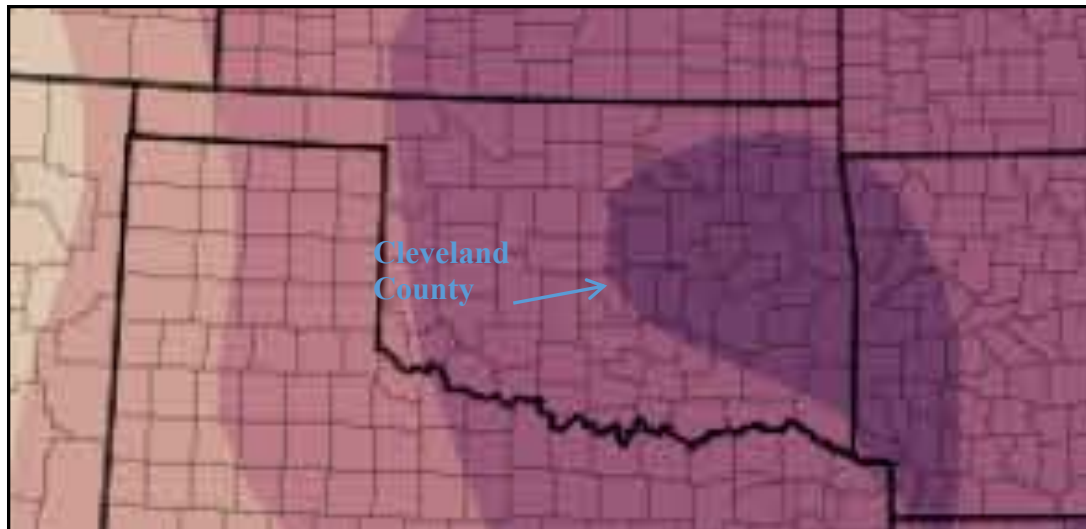
According to the National Oceanographic and Atmospheric Administration (NOAA)/ National Weather Service (NWS) Storm Prediction Center, (SPC) the geographic area of Cleveland County can expect 4 to 8 days of high winds annually, as the graphic shows.²¹ That prediction is based on data collected by NOAA/ NWSSPC between 1986 and 2015.



²⁰ NOAA NCEI Storm Event Database; High Wind Events for Cleveland County.
<https://www.ncdc.noaa.gov/stormevents/listevents>

²¹ http://climate.ok.gov/index.php/climate/map/50_knot_wind_days_1986_2015/tornadoes_severe_storms

See close up following for Cleveland County's location within the map for 50 Knot Days.



Vulnerability and Impact

High winds can occur any time of year across the planning area. Trees, homes, infrastructure, livestock, and people are at risk from damages of high winds. High winds accompanied with freezing rain or severe thunderstorms can cause additional damages.

Roofs are the most vulnerable part of any building structure, and susceptible to high wind damage. The City of Noble has adopted new building codes that require new construction to include hurricane straps/clips and wood sheathing to reinforce new structures, promoting a stronger connection against the uplift of high winds. Cleveland County, Lexington, Norman, and Slaughterville have not adopted building codes intended to mitigate high wind exposure of roofs. Structures in these jurisdictions, and older structures in Noble that were built before the updated codes were enacted are vulnerable to the high wind events that occur frequently across the planning area. The impact of this damage can include loss of life, temporary relocation of residents, interruptions to business and critical services and extensive repair costs.

There is a continual need for the school districts to educate the public and prioritize resiliency goals with their respective school boards who make the financial decisions. Most school buildings within the participating school districts do not have reinforced roofs, making the structures, and the students, faculty, staff, and visitors vulnerable to the effects of high winds. A compromised roof causes extensive structural damages, causing disruptions to routine school operations.

Additionally, this vulnerability is increased when it affects economically vulnerable populations such as those identified in portions of Norman, Noble, and Unincorporated Cleveland County, who might experience a financial burden if their home or business were damaged by high wind.

There is also a continual need for all participating jurisdictions to prioritize reinforcing the roofs of their critical facilities. None of the critical facilities have reinforced roofing. A compromised building envelope increases the vulnerability of the overall structure and can lead to extensive

structural damages. These damages could result in personal injury, a disruption of routine operations, and a disruption in critical response services.

Most school buildings in the Lexington PS, Noble PS, Norman PS, and Robin Hill PS districts do not have reinforced roofs. Little Axe PS has 2 older structures, the elementary and high schools that do not have reinforced roofs, but all other structures on their campus do. A lack of reinforced roofing makes the structures, and the students, faculty, staff, and visitors, vulnerable to the effects of high winds. Although structural improvements to a school facility are an expensive undertaking, there is a continual need for the school districts in the Planning Area to educate the public on hazard resiliency measures to mitigate damage from high wind events, with the goal of increased public support for school improvement measures.

Lastly, another vulnerability all participating jurisdictions in the Planning Area share is the predominance of above-ground utility lines in residential areas. Underground utilities exist for newer developments, but many areas across the Planning Area consist of older residential structures and neighborhoods. Overhead utility lines are particularly vulnerable to high wind damage, resulting in interruptions in service and potentially dangerous circumstances involving downed power lines.

3.4.8 Lightning

Description

The National Severe Storms Laboratory defines lightning as, “a giant spark of electricity in the atmosphere between clouds, the air, or the ground. In the early stages of development, air acts as an insulator between the positive and negative charges in the cloud and between the cloud and the ground. When the opposite charges builds up enough, this insulating capacity of the air breaks down and there is a rapid discharge of electricity that we know as lightning. The flash of lightning temporarily equalizes the charged regions in the atmosphere until the opposite charges build up again.”²²

Location

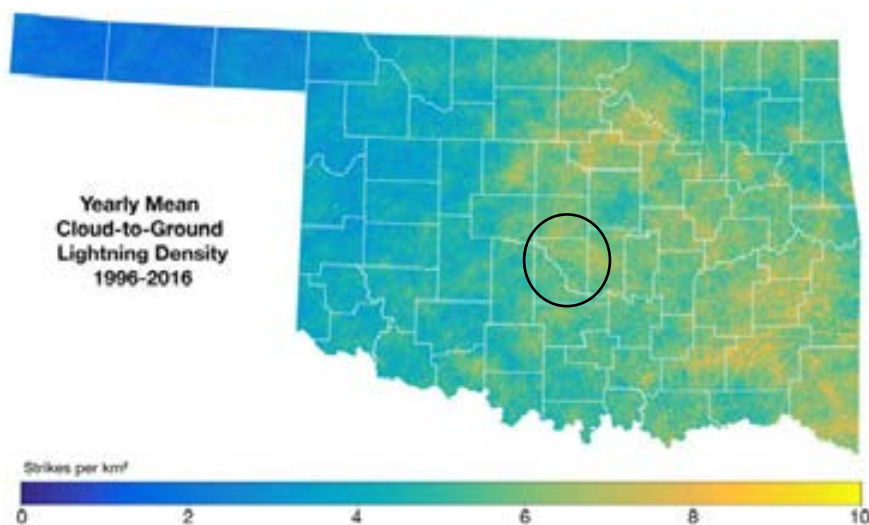
Lightning can strike anywhere in any/all jurisdictions, and it can cause minor to significant damages to structures, utility poles, and trees, and can cause injuries and wildfires.

Extent

Lightning strikes have been typically underreported due to their unpredictable and highly variable occurrences. A minor lightning event would be a lightning strike that causes no damage to structures or injuries to people. A major lightning event could include a lightning bolt that hits a residence and causes a fire, or ignites a wildfire during drought conditions, or a death occurs due to a person being hit by lightning. These events, while somewhat isolated, can occur anywhere across all jurisdictions. Based on the map below, the planning area could reasonably expect to have a Yearly Mean Cloud to Ground Lightning density of between 4 to 9 strikes per square kilometer.

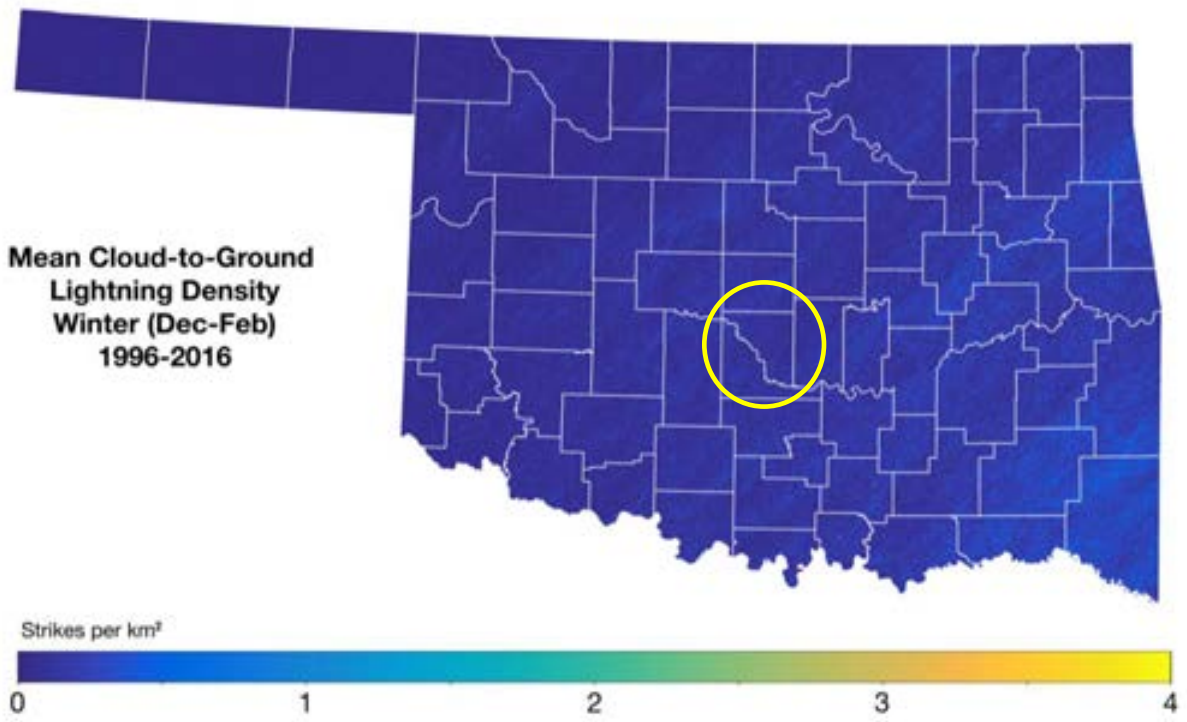
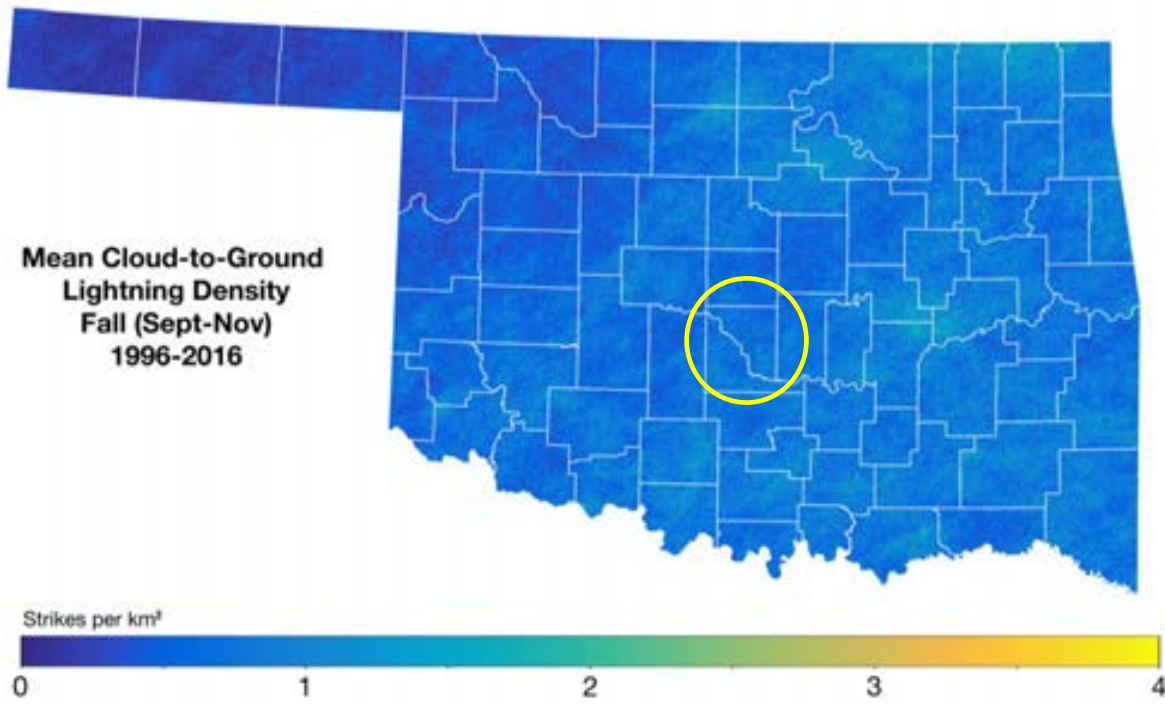
Previous Occurrences

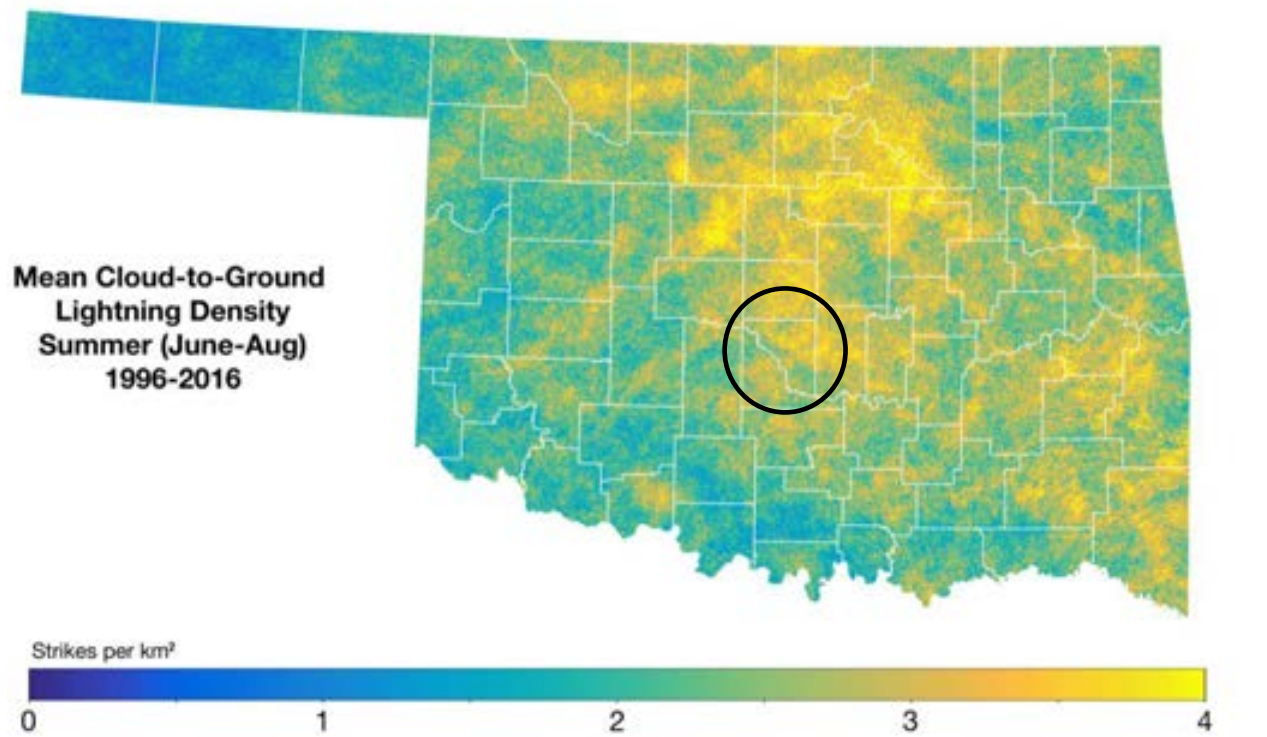
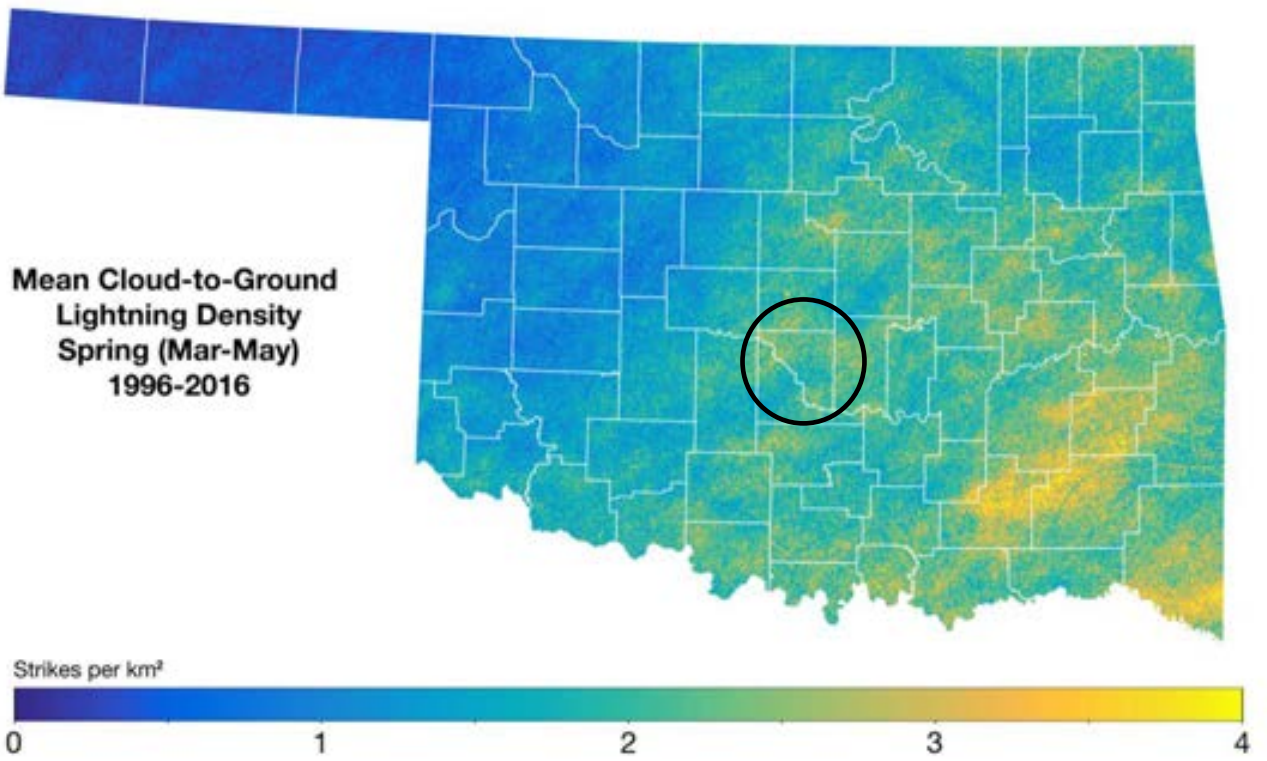
The Oklahoma Climatological Survey collected lightning strike data according to season. Each of these maps shows the estimated density of strikes per square kilometer.²³ As shown on each one, lightning is a year-round hazard and can strikes anywhere within the geographic area of Cleveland County, though it is rare in winter. The data shown in these graphics is the most recent data provided online by the Oklahoma Climatological Survey.



²² National Severe Storms Laboratory. <https://www.nssl.noaa.gov/education/svrwx101/lightning/>

²³ Oklahoma Climatological Survey. http://climate.ok.gov/index.php/climate/category/tornadoes_severe_storms





The number of lightning events, as recorded by the participating jurisdictions, are as follows:

Jurisdiction	Year(s)	Number of Lightning Events
Cleveland County, Uninc. (Includes Etowah)	2014-2019	None documented
City of Lexington	2014-2019	5
City of Noble	2014-2019	3
City of Norman	2014-2019	9
Town of Slaughterville	2014-2019	6

These occurrences resulted in loss of property but there was no loss of life or injury associated.

Probability of Future Events

The probability of any or all jurisdictions within Cleveland County experiencing future lightning strikes is high.

Vulnerability and Impact

Due to the number of severe thunderstorms that develop near the I-35 highway corridor and through the geographic area of Cleveland County, the Planning Area has a high risk for lightning events.

Even with proper grounding, lightning can cause significant damage to electrical power systems, poles, and any structure it strikes. Cleveland County, particularly District 3, has experienced repeated lightning strikes to their district barn security cameras, resulting in a loss of operations to the system that monitors the facility after hours.

Another lightning vulnerability for Cleveland County is the above ground fuel storage tanks that are located at each of the three district barns. A lightning strike to any of these fuel tanks could ignite an explosion, which could result in personal injury, infrastructure damage, and a loss of resources for Cleveland County. Due to the locations of these barns, Norman and Noble are also affected by this vulnerability.

A lightning vulnerability for many school districts in the Planning Area is the lack of handheld lightning detection systems that assist school staff and coaches in monitoring the proximity of storms during outdoor sporting events, Lexington PS does have one, but Little Axe PS, Robin Hill PS, Noble PS, and Norman PS do not have handheld lightning detection systems. The impact of not having a method for determining lightning proximity during outdoor events means that staff members and coaches must rely on personal observation and anecdotal analysis. This contributes to inconsistent mitigation efforts to protect students, staff, and coaches.

In addition to outdoor safety during lightning events, a lightning strike can also ignite a wildfire when fuel sources are very dry. The rural areas of Lexington, Lexington PS, Slaughterville, Noble, Norman, and Unincorporated Cleveland County are vulnerable to these events. The impacts include personal injury, property loss, crop loss, and injury to livestock.

3.4.9 Tornado

Description

The American Glossary of Meteorology defines tornado as, “A rotating column of air, in contact with the surface, pendant from a cumuliform cloud, and often visible as a funnel cloud and/or circulating debris/dust at the ground.”²⁴

Tornadoes can result from a warmer air front colliding with a cooler air front. While tornadoes often accompany supercell thunderstorms, the presence of a thunderstorm does not guarantee the development of a tornado. Tornadoes might last a few seconds or more than an hour.

These violently rotating columns can vary in appearance from thin rope-like columns to large wedge shapes more than a mile wide. Its size does not necessarily correlate with its wind speed.

Location

All jurisdictions of Cleveland County are susceptible to tornadoes. Most occur between 3pm and 9pm, between March and May. However, due to the extremely variable nature of weather in central Oklahoma, tornadoes can and have occurred any time of year if the wind shear, lift, atmospheric instability, and moisture are present.

Extent

Participating jurisdictions within Cleveland County have experienced the full range on this scale at some point within the past 10 years and expect to experience the same range of tornadic events

Enhanced F Scale for Tornado Damage

FUJITA SCALE (Used Prior to 2007)			ENHANCED FUJITA SCALE	
F Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85
1	73-112	79-117	1	86-110
2	113-157	118-161	2	111-135
3	158-207	162-209	3	136-165
4	208-260	210-261	4	166-200
5	261-318	262-317	5	Over 200

<http://www.spc.noaa.gov/faq/tornado/ef-scale.html>

NOTE ABOUT ENHANCED F-SCALE WINDS: The Enhanced F-scale still is a set of wind estimates (not measurements) based on damage. Its uses three-second gusts estimated at the point of damage based on a judgment of 8 levels of damage to the 28 indicators listed below. These estimates vary with height and exposure. Important: The 3 second gust is not the same wind as in standard surface observations. Standard measurements are taken by weather stations in open exposures, using a directly measured, "one minute mile" speed.

²⁴ Tornado. Meteorology Glossary. <http://glossary.ametsoc.org/wiki/Tornado>

Previous Occurrences

Between January 1, 2008 to December 31, 2018, participating jurisdictions of Cleveland County has had 21 tornadic events reported to the National Weather Service.²⁵ The City of Moore is included in this table because at the time of these tornado events, the City of Moore was part of the CCHMPU (2006-2011) and (2014-2019).

Location	Date	F-Scale	Deaths	Injuries	Damage Cost
Noble	5-7-2008	EF0	0	0	\$10,000
Stanley Draper Lake Dam	5-13-2009	EF0	0	0	0
Norman	6-12-2009	EF1	0	0	0
Lexington	5-10-2010	EF0	0	0	0
Stanley Draper Lake Dam	5-10-2010	EF1	0	0	0
Norman	5-10-2010	EF1	0	0	0
Slaughterville	5-10-2010	EF2	0	3	0
Westheimer Airport Norman	5-10-2010	EF3	0	20	0
Norman	5-10-2010	EF4	1	32	0
Moore	5-24-2011	EF0	0	0	0
Norman	4-13-2012	EF1	0	0	0
Lake Thunderbird Dam	5-19-2013	EF3	0	4	0
Moore	5-20-2013	EF5	24	207	\$2,000,000,000
Norman	5-29-2013	EF1	0	0	\$40,000
Moore	5-31-2013	EF1	0	0	\$100,000
Moore	3-24-2015	EF2	0	7	\$50,000,000
Westheimer Airport Norman	5-6-2015	EF0	0	0	0
Westheimer Airport Norman	5-6-2015	EF1	0	0	0
Lexington	5-19-2015	EF0	0	0	0
Lake Thunderbird	5-9-2016	EFU	0	0	0
Norman	10-21-2017	EF0	0	0	\$2,000
Lexington	5-2-2018	EF0	0	0	0
Norman	5-2-2018	EF1	0	0	\$10,000
Lake Thunderbird	10-9-2018	EF0	0	0	\$20,000
Stanley Draper Lake Dam	10-9-2018	EF1	0	0	\$75,000

Probability of Future Events

The risk of tornadoes affecting jurisdictions within Cleveland County is high. Cleveland County has experienced recent trends of extremely severe storms with tornadic activity in recent years. Climatologists have seen trends of these storms forming at accelerated rates compared to the historical data. It is reasonable to expect that these trends will continue and that extra awareness and precautions be taken in severe weather conditions.

²⁵

https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28C%29+Tornado&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=2008&endDate_mm=12&endDate_dd=31&endDate_yyyy=2018&county=CLEVELAND%20COUNTY%20OKLAHOMA&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=40%2COKLAHOMA

Vulnerability and Impact

Infrastructure, public and private buildings, livestock, roads, people, vehicles, and vegetation are vulnerable during tornadoes. Humans can be injured from the flying debris caused by a tornado's violent rotation; seeking shelter indoors does not necessarily guarantee that people inside will not receive an injury from either debris penetrating the walls or windows breaking.

As discussed under the High Winds hazard profile, Cleveland County, Lexington, Noble, and Slaughterville have not adopted newer building codes that require hurricane clips/straps on roofing to make the building envelope more resilient to the effects of high winds. This lack of enhanced building codes also makes the structures of these jurisdictions more vulnerable to tornado damage, which increases the likelihood of personal injury and infrastructure damage during a tornado event.

Another vulnerability for the Planning Area is the lack of community storm shelters across Cleveland County, Lexington, Norman, Noble, and Slaughterville. Vulnerable populations that are most affected by this include trailer homeowners, apartment renters, citizens who do not have a residential storm shelter, and the homeless.

Having a storm shelter in a residence can protect individuals from injury and death during a tornado event. Although there are residents in the Planning Area who have residential tornado shelters, some of these shelters are not registered with their respective municipalities. Residents who own a storm shelter but have not registered it with the county or municipality, are at risk for being overlooked by response personnel if their shelter became covered in tornado-generated debris. Cleveland County, Lexington, Noble, Norman, and Slaughterville offer storm shelter registration, but it is not required. Cleveland County and the City of Norman have required storm shelter registration when the shelter is part of a grant program, but this does not apply to residents who install a storm shelter independently of grant programs.

Another vulnerability during a tornado event is a lack of effective communication of tornado watches/warnings to residents who do not speak English. According to U.S. Census data, the City of Norman has 21.5% of residents who primarily speak a different language in their home.^[4] This disconnect in communication results in non-English speaking residents being less informed about tornado events, and it impedes their ability to seek appropriate shelter during tornado events.

Lexington PS, Noble PS, Norman PS, Robin Hill PS, and Little Axe PS all have storm shelters on their campuses. Little Axe PS and Noble PS have some structures with reinforced roofing. Norman PS, Lexington PS, Robin Hill PS, and the remaining school buildings at Noble PS and Little Axe PS do not have impact resistant window or reinforced roofs. These structural vulnerabilities increases the likelihood of personal injury and infrastructure damage during a tornado event.

3.4.10 Wildfire

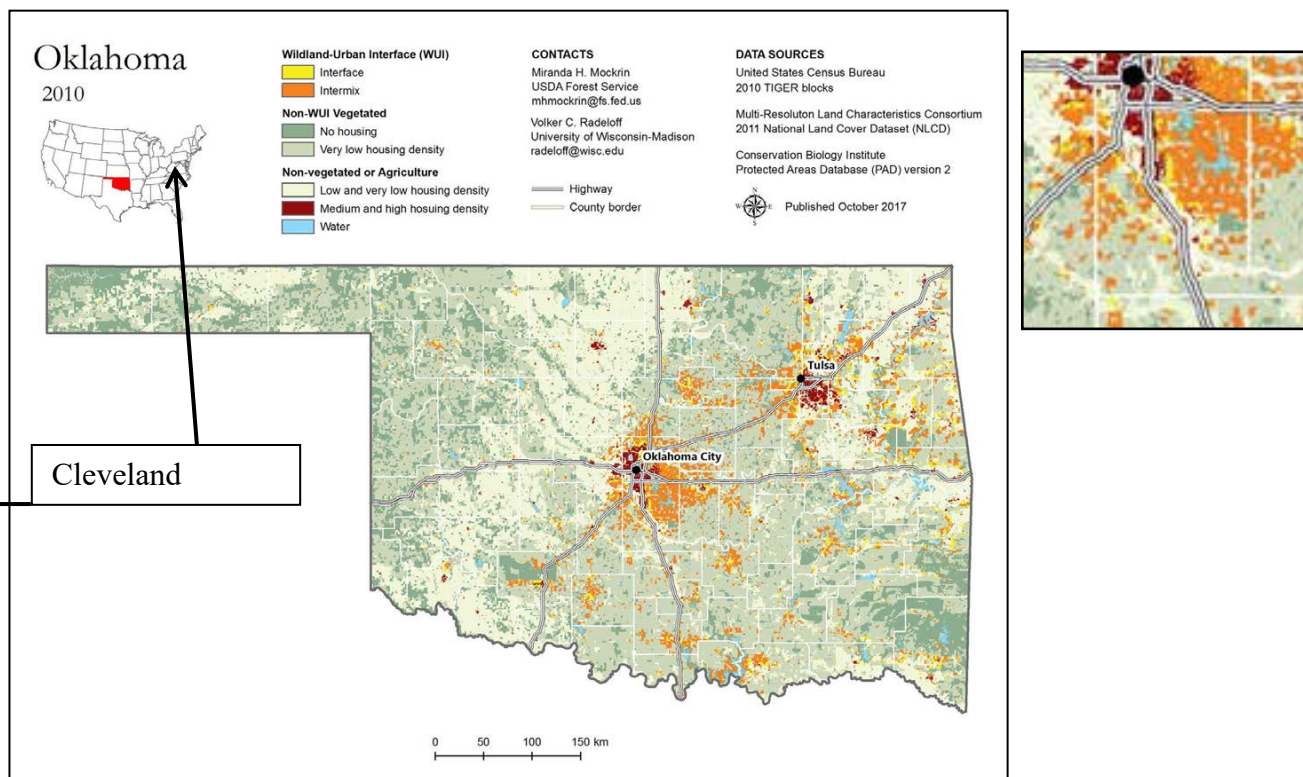
Description

Wildfire is an uncontrolled fire in a rural or wilderness area; wildfires can also extend into wildland-urban interface areas. Dry vegetation, low levels of precipitation, and high winds create the conditions for wildfires to begin unnoticed. However, they can quickly spread to an uncontrollable level if unnoticed for very long. The winds cause the fire to spread quickly, igniting brush, trees, and structures.

There are three different classes of wildfires. A surface fire is common in grasslands, or areas with open vegetation, and spreads quickly. A ground fire is a dense, very hot fire that has a thick fuel source and significantly damages the soil health where it occurs. Crown fires are those that move by jumping along the tops of trees.

Location

Wildfires are most likely to occur in the more rural jurisdictions near Noble, Slaughterville, Lexington, and unincorporated Cleveland County; however, with urban sprawl expanding throughout the southern and eastern areas of the county, these wildfires could spread into the “wildland-urban interface” where urban and rural areas meet. As this graphic shows, Cleveland County had significant intermix in 2010, and urban growth has only increased across the county. Only the southern part of the county has very little housing and is predominantly a rural area.²⁶



²⁶ Wildland-Urban interface.

http://silvis.forest.wisc.edu/GeoData/WUI_cp12/maps/gifs/white/Oklahoma_WUI_cp12_white_2010.gif

Extent

This graph below explains the rating used to determine the extent of drought influences the level of fire danger. The Keetch-Byram Drought Index (KBDI), mentioned above in the Drought section, gives a numerical representation to the range and description of the kind of fire to expect under specific drought conditions.

The Keetch-Byram Drought Index with Fire Danger Rating Data Incorporated	
0 – 200	Soil and fuel moisture are high. Most fuels will not readily ignite or burn. However, with sufficient sunlight and wind, cured grasses and some light surface fuels will burn in spots and patches.
200 - 400	Fires more readily burn and will carry across an area with no gaps. Heavier fuels will still not readily ignite and burn. Also, expect smoldering and the resulting smoke to carry into and possibly through the night.
400 - 600	Fire intensity begins to significantly increase. Fires will readily burn in all directions exposing mineral soils in some locations. Larger fuels may burn or smolder for several days creating possible smoke and control problems.
600 - 800	Fires will burn to mineral soil. Stumps will burn to the end of underground roots and spotting will be a major problem. Fires will burn thorough the night and heavier fuels will actively burn and contribute to fire intensity

Participating jurisdictions of Cleveland County have experienced fires across this entire range. This color code rating system below is what the Slaughterville Fire Department and the Lexington Fire Department use on signs to inform the public of the fire danger levels throughout the year. These communities are surrounded by wildland areas. This system is consistent with what the United States Forestry Service uses.

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

Source: <http://www.wfas.net/content/view/34/51/>

Previous Occurrences

As mentioned above in Section 3.2, the geographic area of Cleveland County has only had one wildfire event significant enough to be declared a state disaster on March 3, 2017. Several participating jurisdictions experience smaller wildland fires every summer. The details following are the number of calls each fire department received between 2014-2019.

The Cedar Country Fire Department received 235 calls related to vegetation, forest, woods, wildland, and brush-and-mixture fires.

The City of Lexington Fire Department received 70 calls related to wildfires. Of that total, 59 of those calls were responses to mutual aid requests for grass and brush fires.

The Little Axe Fire Department reported 121 calls related to wildfires and of those calls, 21 were mutual aid responses.

The City of Noble Fire Department received 95 calls related to wildfires.

The City of Norman Fire Department received 681 calls related to vegetation, forest, woods, wildland, brush-and-grass mixture fires. Of that total, 78 were mutual aid requests.

The Town of Slaughterville Fire Department received 227 calls related to wildfires, and of those calls, 93 were responses to mutual aid requests.

Probability of Future Events

The probability of experiencing wildfires is high. At the time of preparing this Hazard Mitigation Plan, Cleveland County had a moderate risk of wildfire. As this graphic shows from the SGSF Wildfire Risk Assessment Portal Public Viewer, Cleveland County has an overall moderate rating, but there are also areas of low risk and high risk, as the variations in color reveal.²⁷

The number of wildfires has increased across Oklahoma as a whole, and rural Cleveland County continues to see expanding rural-urban interface. Based on historical data and events, it is reasonable to expect Cleveland County to experience continued risk from wildfires in the rural areas due to drought conditions and extreme heat.



²⁷ SGSF Wildfire Risk Assessment Portal Public Viewer <https://www.southernwildfirerisk.com/Map/Public/#whats-your-risk>

Vulnerability and Impact

Wildfires are most threatening during times of drought accompanied by extreme heat and high winds, but wildfires can occur any time of year.

Wildfire occurs most often in the rural areas of unincorporated Cleveland County. The Lexington Fire Department, Slaughterville Fire Department, the Noble Fire Departments, and volunteer fire departments respond to fires across the unincorporated Cleveland County. This is a large area for these fire departments to cover. The Lexington Fire Department does not have adequate personal protective equipment, manpower, or trucks. These capability vulnerabilities make the personnel more vulnerable during wildfires because their equipment could fail. Volunteer firefighters have varying response times due to having primary occupations. The inconsistencies in responses place extra strain on the responding fire departments needing to respond to fires outside their main jurisdictions of Noble, Slaughterville, and Lexington.

Another vulnerability is the number of red cedar trees growing in the rural areas of unincorporated Cleveland County, rural Slaughterville, rural Lexington, rural Norman, and rural Noble. These trees are highly combustible and can explode during wildfires. Red cedar embers can ignite any structures in close proximity to houses or other outbuildings. Continued public education on the importance of red cedar eradication in Slaughterville, unincorporated Cleveland County, rural Noble, rural Norman, and rural Lexington is necessary.

Robin Hill PS and Little Axe PS are the most rural schools within the planning area and most vulnerable to the impacts of a wildfire. Due to their proximity to Norman, Robin Hill PS is vulnerable to wildfire as the response time takes longer than if they were located closer to a fire station. Little Axe PS is particularly vulnerable to wildfire as the campus is surrounded by red cedars, oaks, and other wildland brush. Additionally, there is also only one main road by which students could be evacuated during a wildfire event. Noble PS has one school near a red cedar tree line that requires continual maintenance and eradication due to its size.

There is a continual need for educating students who can drive about the dangers of driving through smoke associated with a wildfire. All participating schools need to educate their students about the dangers of driving through smoke as the Norman PS, Noble PS, Little Axe PS, and Lexington PS have students who drive into town to attend their respective schools.

There is also a need to educate students on manmade causes of wildfire, such as carelessly discarded cigarette butts, sparks from loose chains on utility trailers, sparks from welding, and embers from burning trash. All participating schools, rural or urban, need to educate their students on how to identify wildfire prone areas, such as abandoned lots or open fields in urban areas, or open fields and overgrown brush in rural areas. There needs to be more effective education on teaching students how natural hazards, such as lightning, drought, and high winds work together to result in dangerous conditions for wildfire.

3.4.11 Winter Storm

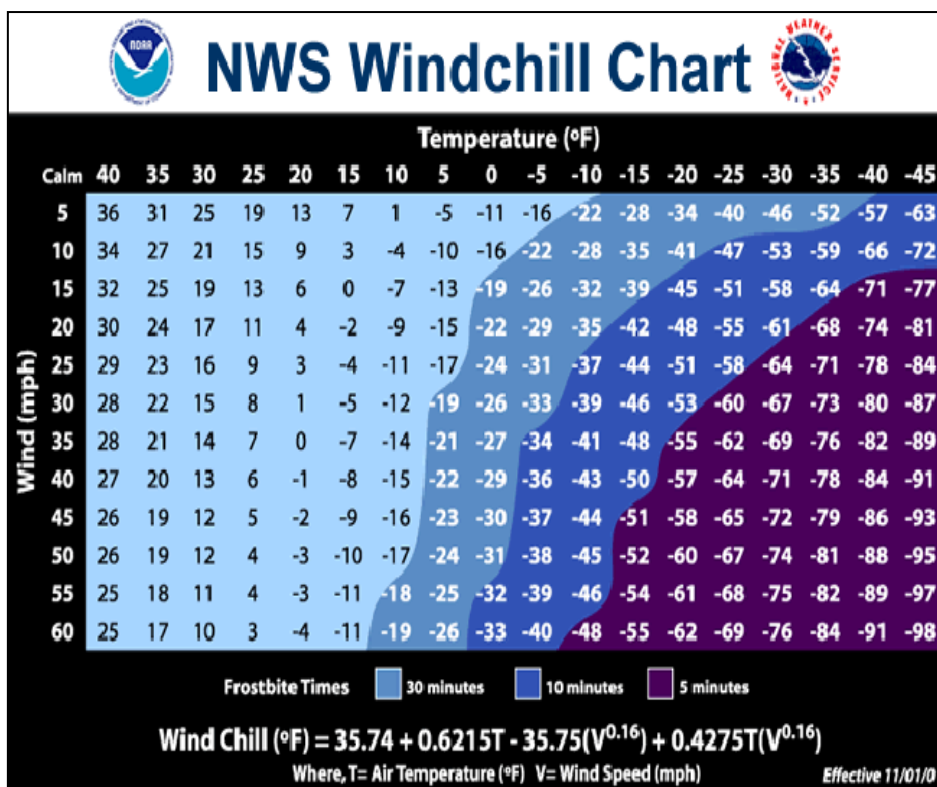
Winter storms can be incredibly difficult to predict since they usually involve any combination of precipitation, including snow, sleet, and freezing rain. A severe winter storm can range from freezing rain or sleet to moderate snow over a few hours, or it might develop into blizzard conditions and extremely cold temperatures that last several days. The effects of the winter storm can also widely vary depending on the ground temperatures and atmospheric conditions.

Wind-driven, or blowing, snow reduces visibility and causes significant drifting. Blowing snow can develop into a blizzard, which occurs when falling and blowing snow combine with winds of 35 mph or greater, reducing visibility to near zero.

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

Freezing rain falls as liquid and is frozen by 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 small accumulations can cause a significant hazard. Freezing rain can accumulate on tree branches and utility wires; if high winds develop, that can cause the wires to “gallop” and potentially cause breakage of the wires, connectors, and poles. This results in widespread power failure.

Other winter hazards include wind chill and extreme cold. Wind chill describes the relative discomfort and danger to people from the combination of cold temperatures and wind. This wind chill chart from the National Weather Service shows the apparent temperature derived from wind speed and temperature. It should be noted that extremely cold temperatures can occur without precipitation and/or high winds.



Location

All participating jurisdictions are susceptible to winter storms and the ensuing precipitations and damages that could occur. Not only could the participating jurisdictions be directly affected, but depending on where utility poles, transformers, transmission lines, and other utility infrastructure fails, power outages originating in adjacent jurisdictions of Oklahoma County and the Oklahoma City metro could impact participating jurisdictions.

Extent

The participating jurisdictions have experienced a range of record low temperatures from -8 degrees (Fahrenheit) on December 23, 1989; -11 degrees F on January 19, 1892; and -17 degrees F on February 12, 1899.

The Sperry-Piltz Ice Accumulation Index (SPIA Index) shows how ice storms are rated. Some communities within Cleveland County have experienced levels up to 4 at some time in the past.

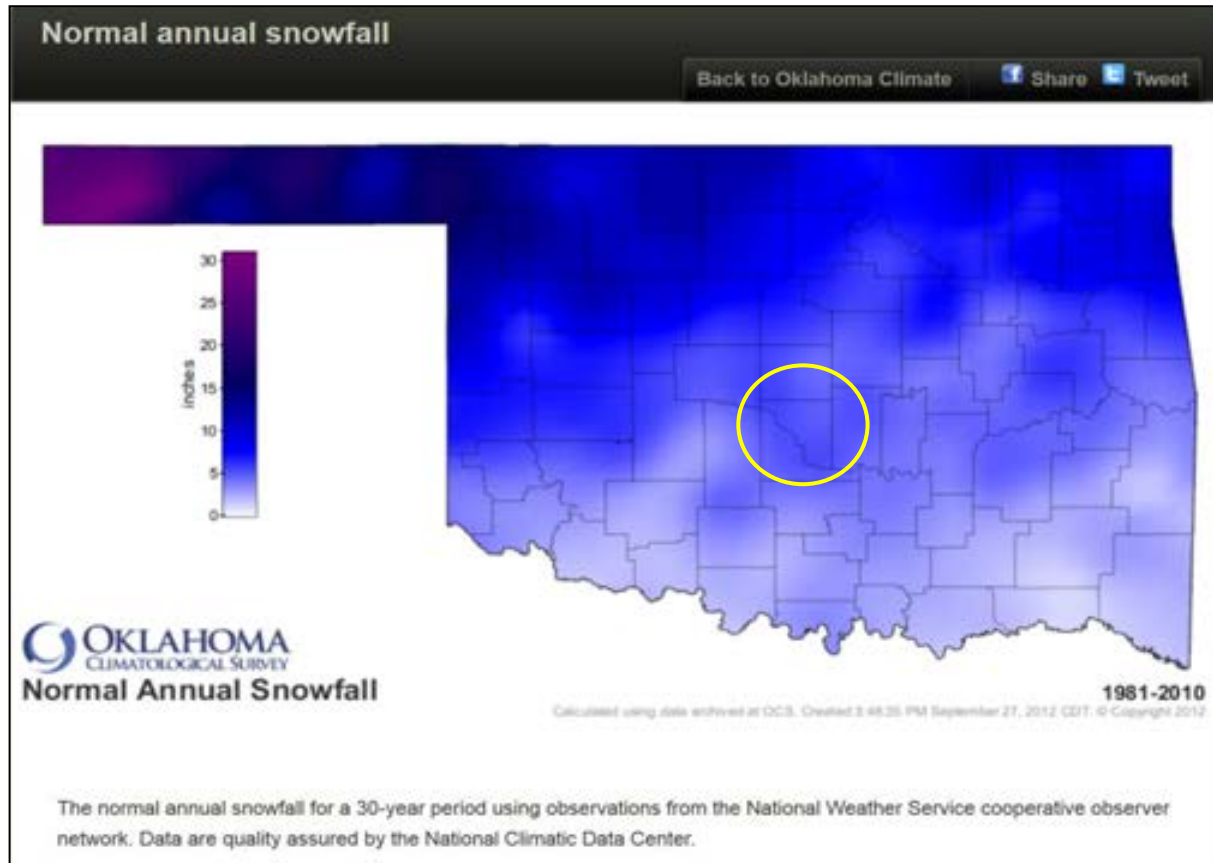
The Sperry-Piltz Ice Accumulation Index, or “SPIA Index” – Copyright, February, 2009

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

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

Previous Occurrences

The NWS has recorded past weather events for Oklahoma City, and since Cleveland County is located geographically within the greater Oklahoma City metro area, those records for record low temperatures are referenced here. The range of record low temperatures from -8 degrees (Fahrenheit) on December 23, 1989; -11 degrees F on January 19, 1892; and -17 degrees F on February 12, 1899 were documented.²⁸



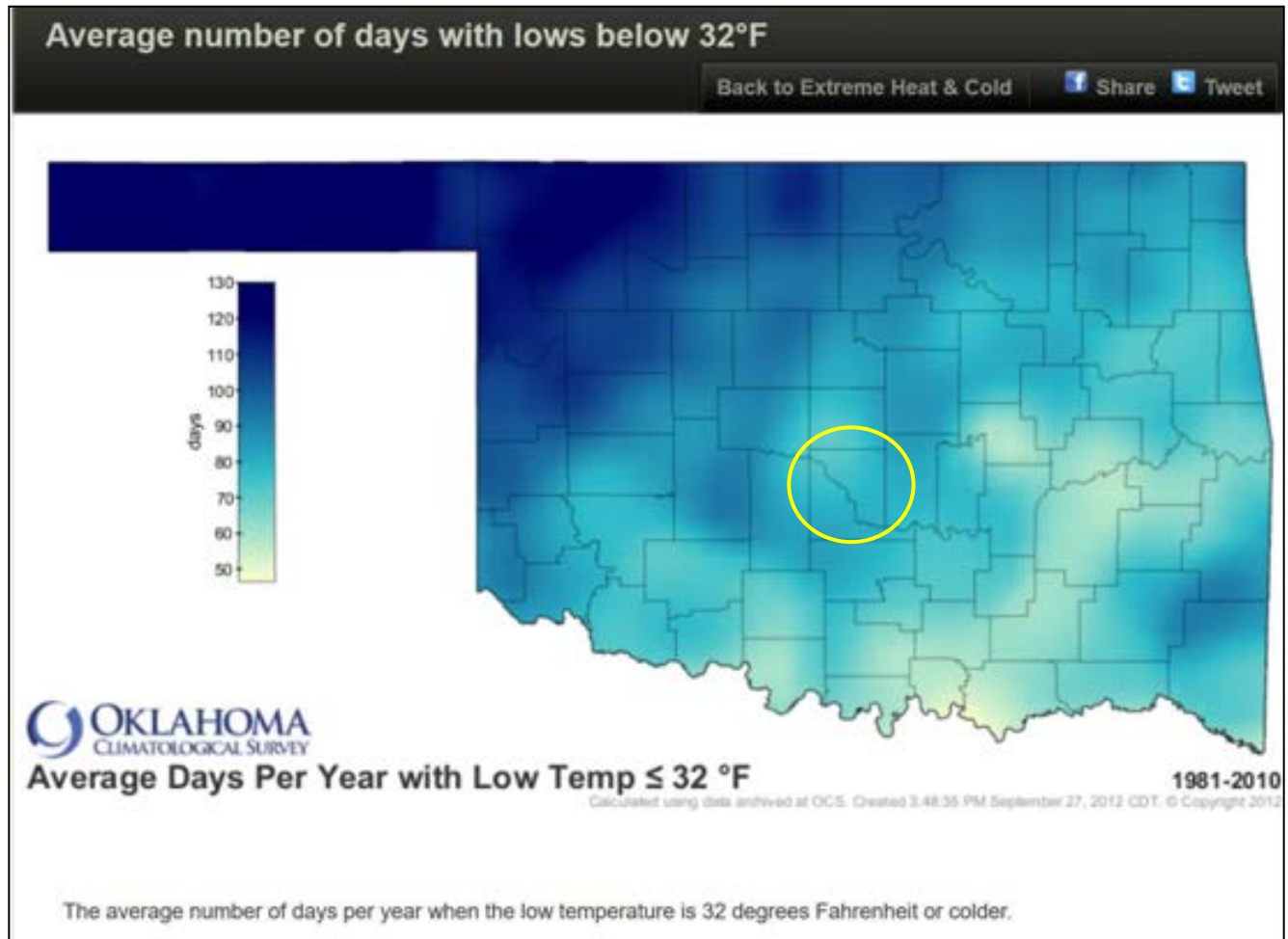
Snowfall within the participating jurisdictions varies from year to year; the Oklahoma Climatological Society shows that expected annual snowfall ranges between 1 to 7 inches.²⁹

While this is historical data, Cleveland County has not experienced any significant winter storm events since the previous CCHMPU approval.

²⁸ NWS/NOAA. <https://www.weather.gov/oun/climate-records>

²⁹ Oklahoma Climatological Survey.

http://climate.ok.gov/index.php/climate/map/normal_annual_snowfall/oklahoma_climate



Probability of Future Events

The probability of winter weather occurring within the participating jurisdictions is high.

Vulnerability and Impact

Transmission lines and utility infrastructure, building structures, trees, and those who work outdoors are vulnerable to the elements of winter weather. Ice is the most significant precipitation that causes the most damages during winter. Icy roads increase accident rates and can also delay emergency services in their response times.

Other potential risks include carbon monoxide poisoning due to home owners using alternative heat sources during power outages, frostbite for those working outdoors for prolonged periods. Potential loss of life could occur in any of these instances in extreme cases.

The impact of winter storms could range from minor power outages that last a few hours to major utility outages that last days or weeks.

For the purposes of this HMP, the entire population of Cleveland County is vulnerable to severe winter storm events. Snow accumulation and frozen/slippery road surfaces increase the frequency of traffic accidents for school related traffic, potentially resulting in personal injuries. The school-aged children are considered most susceptible to this hazard due to their increased

risk of injuries and overexertion and/or hypothermia from attempts to clear snow and ice. In addition, severe winter storm events can reduce the ability of these populations to access emergency services. Residents with low incomes may not have access to housing or their housing may be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply).

3.5 Repetitive and Severe Repetitive Loss Structures in Planning Area

All jurisdictions currently and intend to participate in the National Flood Insurance Program.

As required to participate in the NFIP according to 44 CFR 60.1, each jurisdiction has adopted a floodplain ordinance and regulations that govern the Special Flood Hazard Area as determined by FEMA Flood Insurance Rate Maps. Each jurisdiction requires the governing body to issue and maintain floodplain permits, development standards and approve or reject any construction in the special flood hazard area. Any new development or construction within floodplain areas are required to follow NFIP guidelines and obtain permits as enforced by each local jurisdiction. Additionally, Floodplain administrators are required to have annual training and accreditation by state statute.

The structures that have been designated by the NFIP as Severe/Repetitive Loss Structures are (23) residential and one commercial structure.

According to the FEMA NFIP Community Status Report for Cleveland County, Severe/Repetitive losses are as follows:³⁰

CID	Community	Policies	Total Paid Losses (Thousands of Dollars)	Repetitive Loss Buildings
400475	Cleveland County	46	38	4 (residential)
400043	Lexington	41	27	2 (1 residential, 1 commercial)
400045	Noble	14	2	0
400046	Norman	495	150	17 (residential) (2 are designated as Severe Repetitive Loss)
400539	Slaughterville	11	6	0

See **Section 4.2** for more details regarding the jurisdictions' NFIP Participation.

Repetitive Loss Properties – As of November 30, 2018, Cleveland County has reported four (4) repetitive loss properties under NFIP within any 10-year period since 1978.

The maps in Appendix B are areas within the City of Norman that have been identified as areas of repetitive loss: Bishop Creek, South Lahoma Avenue, The Vineyard Addition, West Tecumseh Road, and West Main Street. See Appendix B for reference maps.

Severe Repetitive Loss Properties – As of November 30, 2019, there are two severe repetitive loss properties within the City of Norman.

³⁰ This information was provided by the Oklahoma Water Resources Board. The FEMA NFIP Community Status Report for Cleveland County included the City of Oklahoma City, the City of Moore, and the City of Purcell; however, those three cities are not participants in the Cleveland County Hazard Mitigation Plan and not included in this table.

CHAPTER FOUR: MITIGATION STRATEGY

4.1 Capabilities Assessment

Each jurisdiction has their respective planning commissions/departments, mitigation planning/emergency management departments, and maintenance departments. Each jurisdiction individually decides how to appropriate or seek funding for their most urgent or most needed projects. They follow protocols of their respective governing bodies accordingly. The jurisdictions individually ensure that appropriate overlap with their comprehensive master plans, emergency operation plans, capital improvement plans, etc., as shown in Sections 4.1.1 to 4.1.5. Those tables show the planning mechanisms each jurisdiction has in place to accomplish their hazard mitigation goals.

Cleveland County maintains a floodplain manager and an emergency manager, and there have been no policy changes regarding development in hazardous and/or flood prone areas. Cleveland County's plans identified in the sections following are annually updated by the Board of County Commissioners, CCEM, and any other entity to the respective plan and/or project.

The Town of Lexington maintains water and sewer departments; they also have a floodplain manager, emergency manager, and a volunteer fire department. The city's plans and ordinances identified in the sections following are annually updated and/or reviewed by the city council and administration.

The City of Noble maintains water and sewer departments; they also have a floodplain manager, an emergency manager, and a fire department. Since Noble is a growing community, ongoing discussions with various city departments regarding development occur regularly. The city has made no policy changes related to development in hazard prone areas. The city administration and council review and update ordinances annually and are detailed in the sections following. The city administration reviews and updates plans as needed.

The City of Norman maintains a floodplain manager, emergency manager, a fire department, water, sewer, and public works departments. The city has made no policy changes related to development in hazard prone areas. The City of Norman has a Storm Water Master Plan as well as the plans and ordinances identified on page 59. Hazard mitigation projects are integrated into city plans accordingly. The city administration reviews and updates plans annually. The city administration and council update ordinances as needed.

The Town of Slaughterville maintains a floodplain manager, emergency manager, and a volunteer fire department. They have made no policy changes to development in hazard prone areas, but pursue necessary activities outlined in this update. The town administration and city council update their comprehensive plan every 5 years, and review and update the other plans as needed. Ordinances are reviewed continually and revised as needed. The ordinances and plans are identified in the sections following.

The school districts follow the recommendations of their respective school boards and administrators. Each year reviews their respective long-term strategies, compared to their annual enrollment. Then the school boards decide and modify their projects and goals accordingly.

4.1.1 Existing Institutions, Plans, and Ordinances

The checkmark (√) indicates that the jurisdiction reported to have the authority to implement the specified regulatory tool and that the tool is currently in place.

Jurisdiction	Building Code	Zoning Ordinance	Subdivision Ordinance	Special Purpose Ordinance	Growth Management Ordinance	Site Plan Review Requirements	Comprehensive Plan	Capital Improvement Plan	Economic Development Plan	Emergency Response Plan	Post-Disaster Recovery Plan
County	No	No	No	No	No	No	√	√	√	√	√
Norman	√	√	√	√	√	√	√	√	√	√	√
Noble	√	√	√	√	No	√	√	√	√	√	No
Slaughter-ville	No	√	√	√	√	√	√	√	No	No	No
Lexington	√	√	√	√	No	√	No	√	√	√	√

Cleveland County does not maintain or enforce any building, zoning, subdivision, special purpose, or growth management ordinances. There are no site plan review requirements. The county commissioners annually review and update the comprehensive, capital improvement, and economic development plans. The capital improvement plan would be the main plan to implement hazard mitigation efforts. The CCEM director annually reviews and updates the Emergency Response Plan and the Post-Disaster Recovery Plan, which would also contain hazard mitigation efforts.

The City of Norman (Norman) has several departments that maintain and enforce codes and ordinances. The Department of Planning and Community Development (DPCD) maintains and updates the building codes as needed and the last update occurred February 2019. There are two plans that fall under the Comprehensive or Master Plan category: the Storm Water Master Plan and the 2025 Norman Land Use and Transportation Plan. The Public Works Department adopted the Storm Water Master Plan on June 28, 2011, and is responsible for maintaining it. The DPCD adopted the 2025 Norman Land Use Plan November 16, 2004, and is responsible for maintaining that plan. These plans guide the decisions of the City of Norman. Chapter 22 of Norman's Code of Ordinances contains the zoning ordinances; the DPCD maintains them and last updated them in August 2019. Chapter 19 of Norman's Code of Ordinances contains the subdivision ordinance and the site plan review ordinance; they are updated as needed. The last update occurred in March 2013. Both the DPCD and Public Works are responsible for updating the subdivision ordinances. Growth management is addressed within the 2025 Norman Land Use Plan, which was adopted on November 16, 2004, and is maintained by DPCD. The Capital Improvement Plan is maintained by all of the municipal departments and was last updated in July 2019. This is the main plan that would implement hazard mitigation efforts. The Norman Economic Development Council is responsible for the maintenance of the Economic Development Plan; as of February 2020, it is in the process of being updated. The Norman Fire Department's Emergency Management Division is responsible for maintaining and updating the Emergency Operations Plan (EOP), which was last updated in March 2010. The EOP addresses hazard

mitigation efforts. Emergency Action Plans (EAPs) for Hall Park Lake Dam and Sutton Wilderness Lake Dam are maintained by the Parks and Recreation Department, the Public Works Department, and Norman Fire Department's Emergency Management Department. Both EAPS are updated annually and were last updated in November 2019. The Post-Disaster Recovery Plan is maintained by the Norman Fire Department's Emergency Management Division, under Ordinance 1137, and is updated after each event. The Public Works Department maintains the Disaster Debris Management Plan, and it was last updated in 2009.

The City of Noble: The city administration and council review and update ordinances, identified in Sections 4.1.1 to 4.1.5, annually. The city administration reviews and updates master plans as needed. Building Codes are reviewed and updated by the city council on a 3-year cycle; the last update was approved Feb 18, 2020. City of Noble building inspector is responsible for bringing the building codes before the city council. A comprehensive master plan has been codified and adopted; the master and comprehensive plans are formally updated every 25 years, with an annual review by the city manager; a formal update is scheduled to occur within the next 2-3 years. The zoning ordinance is a living document and updated multiple times a year by city manager; it was updated January 6, 2020. The Subdivision Ordinance update cycle is annual and is updated by the city manager, and the most recent update was October 1, 2019. Aspects of a Growth Management Ordinance are present in the subdivision ordinance and they are updated as needed by the city manager. Site plan review requirements have been codified; they are updated every 3-5 years as needed by the building official/inspector. The City of Noble administration is looking into creating and adopting a Capital Improvement Plan and Economic Development Plan within the next 2-3 years.

The Town of Slaughterville updated the Zoning Ordinance and site plan review requirements on November 20, 2018. The Subdivision Ordinance was updated June 16, 2015. The Specific Use Ordinance was updated September 17, 2019. The Growth Plan and Comprehensive Plan were updated in 2013. The Capital Improvement Plan was updated January 17, 2012. Hazard mitigation efforts would be implemented in conjunction with the Zoning Ordinance and the Floodplain Development Ordinance. The town recommends following the building code that is set forth by the Oklahoma Uniform Building Code Commission, but does not issue building permits. They are working on an economic development plan, an emergency response plan, and a post-disaster recovery plan.

The City of Lexington adopted the International Building Codes in 2009, and amended the code to include the International Property Maintenance Code in 2015. Biennial supplements are added every two years as applicable to each of these categories. This biennial supplementation will be completed in 2020, and every 2 years after that. A Capital Improvement Plan was adopted in 2018 and will be updated every 5 years by the city clerk. The hazard mitigation efforts of Lexington would be included in the capital improvement plan. The city has an informal economic development plan. The Emergency Response Plan and the Post-Disaster Recovery Plan are reviewed annually by the city emergency manager.

4.1.2 Administrative and Technical Capability

The checkmark (√) indicates that the jurisdiction reported to have the authority to implement the specified regulatory tool and that the tool is currently in place.

Jurisdiction	Planner(s) or Engineer(s) with knowledge of land development and management practices	Engineer(s) or professional(s) trained in construction practices related to buildings and fire	Planner(s) or Engineer(s) with an understanding of natural and/or human caused hazards	Floodplain Manager	Surveyors	Staff with education or expertise to assess the communities vulnerability to hazards	Personnel skilled in GIS and/or HAZUS	Scientists familiar with the hazards of the community	Emergency Manager	Grant writers
County	√	Contract only	√	√	Contract only	√	√	√	√	√
Norman	√	√	√	√	√	√	√	√	√	√
Slaughterville	√	Contract only	√	√	Contract only	√	No	No	√	√
Noble	√	√	√	√	Contract	√	√	No	√	√
Lexington	Contract only	Contract only	Contract only	√	No	√	√	No	√	√

The Cleveland County has an emergency management department, headed by the director of safety and emergency management. The department maintains a floodplain manager, a deputy director, a GIS analyst, and the department has working relationships with subject matter experts regarding natural hazards and man-made hazards. CCEM staff has the capability to write grants or it is done by contractors. The county commissioners, their staff, as well as the emergency management department, are considered planners for the county.

The City of Norman has planners and engineers on staff to inform decisions and policies regarding land development, construction practices, and natural and man-made hazards. They also have a floodplain manager, surveyors, subject matter experts on staff, GIS analysts, an emergency manager, and grant writers.

The Town of Slaughterville has planners who understand land development, natural and man-made hazards, a floodplain manager, subject matter experts, an emergency manager, and a grant writer. All other capabilities can be hired through contractors as needed.

The City of Noble has planners and engineers on staff to inform decisions and policies regarding land development, construction practices, and natural and man-made hazards. They also have a floodplain manager, subject matter experts on staff, GIS analysts, an emergency manager, and grant writers. Surveyors can be hired through contractors as needed.

The City of Lexington has a floodplain manager, emergency manager, staff who understands Lexington’s vulnerabilities, GIS skills, and has a grant writer. Lexington has the ability to contract planners, engineers, surveyors, and subject matter experts/scientists as needed.

4.1.3 Financial Capabilities

The checkmark (√) indicates that the jurisdiction reported to have the authority to implement the specified regulatory tool and that the tool is currently in place.

Jurisdiction	Capital Improvements Project Funding	Authority to levy taxes for specific purposes	Water, Sewer, Gas, or Electric service Fees	Incur fees for new development	Incur debt through general obligation funds and/or special tax bonds	Community Development Block Grant	Federal funding programs	State funding programs
County	√	√	No	No	√		√	√
Norman	√	√	√	√	√	√	√	√
Slaughterville	No	√	No	No	√	√	√	√
Noble	√	√	√	√	√	√	√	√
Lexington	√	√	√	√	√	√	√	√

4.1.4 Education and Outreach Capabilities

The checkmark (√) indicates that the jurisdiction reported to have the authority to implement the specified regulatory tool and that the tool is currently in place.

Jurisdiction	Local citizen groups/Non-profit organizations willing to assist with mitigation activities	Ongoing public education or information programs	Natural disaster or safety related programs	StormReady Certification	Firewise Communities Certification	Public-Private partnership initiatives addressing disaster-related issues
County	√	√	√	√	No	√
Norman	√	√	√	√	No	
Slaughterville	√	√	√	No	No	√
Noble	√	√	√	No	No	√
Lexington	√	√	√	No	No	

Cleveland County as a governmental entity has a partnership with the Long-Term Recovery Committee, that includes Catholic Charities, Red Cross, United Way, Salvation Army and other various churches and similar non-profit and private organizations. They also have established relationships with neighboring jurisdictions that would partner with them in the event of disasters.

The Town of Slaughterville is part of the Long-Term Recovery Committee as well. They also have established relationships with the other municipalities and the county that would partner with them in times of disaster.

The City of Lexington has established relationships within the community that would partner with the city in the event of disasters. In 2013, Lexington applied for a CDBG grant that required a participation plan for a water project and had public meetings to inform the community about the project. Lexington is able to utilize OMPA (Oklahoma Municipal Power Authority)'s newsletter through the utility bills and topics include seasonal safety and awareness for current hazards.

The City of Noble has been developing relationships with local businesses, healthcare facilities, and local churches so that in the event of disasters, they have a network to rely upon for resources. The Noble Fire Department actively promotes educational presentations for senior citizens, the schools, and any other organization or group that requests safety information. They also post updates for severe weather and fire safety as needed on the city website.

The City of Norman has established relationships within the community and neighboring jurisdictions that would partner with the city in the event of disasters.

4.1.5 School District Capability Assessment

The Oklahoma Department of Education oversees public K-12 education and public libraries in Oklahoma. Following the ratification of the Oklahoma Constitution in 1907, the governor, secretary of state and the attorney general of Oklahoma served as the State Board of Education. The Department in its current iteration was created by the Oklahoma School Code of 1971, which also established the Oklahoma State Board of Education. The schools districts are funded by way of local Ad Valorem taxes and from the allocations from the State of Oklahoma’s General Funds and Federal Allocations. The School districts are governed by locally elected school boards and superintendents.

Public Schools, Capabilities, Plans, and Policies

The checkmark (√) indicates that the jurisdiction School District reported to have the authority to implement the specified regulatory tool and that the tool is currently in place.

Jurisdiction	Capital Improvement Plan	Emergency Management Plan and/or procedures in place	Budget to raise funds for mitigation (bond)	Ways to raise funds through public partnerships, corporate donations etc.	Designated emergency manager (even as a secondary position)	PTO/PTA	Training for teachers to practice natural hazard response	Training for teachers/coaches to ensure consistency in evaluating lightning	Post-Disaster Recovery Plan
Lexington PS	√	√	√	√	√	√	√	√	√
Little Axe PS	√	√	√	√	√	√	√	√	√
Noble PS	√	√	√	√	√	√	√	√	√
Norman PS	√	√	√	√	√	√	√	√	√
Robin Hill PS	√	√	√	√	√	√	√	√	√

As noted in this matrix above, each participating school district has the following:

- Capital Improvement Plans
- Emergency Management/Emergency Operations Plans and procedures
- Budgets for mitigation projects or bonds
- Means of raising public funds with public partnerships in the communities
- Designated emergency manager and/or safety coordinator
- PTO/PTA
- Annually required training
- Annually required lightning evaluation training for coaches
- Post-Disaster Recovery Plans

School Districts are asked to provide information on their capabilities as they relate to those outlined for each participating jurisdiction. Each School Superintendent has answered the following questions:

1. Has your school district had positive responses to bond issues?

All five public school districts answered affirmatively that bond proposals have been positively received.

2. Based on population, is the school district population growing or declining?

- Lexington Public Schools: The Lexington Public School population is growing.
- Little Axe Public Schools: The Little Axe Public School population is continually growing.
- Noble Public Schools: The Noble Public Schools population is growing.
- Norman Public Schools: They have seen a consistent, flat rate of enrollment the past few years and anticipate the same for the next few years.
- Robin Hill Public Schools: They have averaged about 20 new students each year for the past five years.

3. What measures does the school district take to protect students during hazardous events?

Each public school district regularly practices drills related to taking shelter in case of tornadoes or evacuations due to fires.

4. List any damages your school has experienced during the last 10 years due to weather events or natural disasters.

Before Christmas break 2018, Noble Public Schools experienced very high winds that took off the roof at the high school library. They also address lightning strikes at the transportation building as they occur on a regular basis.

5. How will you integrate the requirements of your CCHMPU into other plans and policies?

The CCHMPU dovetails with the respective emergency plans the school districts have. The CCHMPU allows the opportunity for hazard mitigation grant applications for any structural improvements any school might wish to pursue in order to reduce funding required in the issuing of bonds.

6. How can the school district build upon their capabilities in the future?

The CCEM deputy director provides a copy of the CCHMPU to each school superintendent for the adoption with respective school board. This document is reviewed by the school board when they evaluate their plans and policies, and it is to be reviewed by each school principal when updating natural hazard response protocols.

Since public schools have fixed budgets regulated by state policy and statutes, schools' capabilities could be expanded by sharing budget resources via memorandums of understanding between the districts in order to expand mitigation activities among the districts involved. Future capability expansion is intrinsically linked to population and state funding.

Each superintendent will provide an update on mitigation action item progress to the CCEM deputy director during the subsequent annual CCHMPU meetings.

4.2 NFIP Participation

All municipalities and Cleveland County participate in the National Flood Insurance Program. NFIP Participation allows citizens of each jurisdiction the ability to purchase their own individual flood insurance as needed.

Cleveland County: According to the FEMA Community Status Book Report, Cleveland County's initial Flood Hazard Boundary Map was adopted April 6, 1982. The most current map updated by FEMA is from February 20, 2013. The Board of County Commissioners adopted a resolution on February 20, 2013 that accepted amended the FEMA maps.

City of Lexington: According to the FEMA Community Status Book Report, Lexington's initial Flood Hazard Boundary Map was adopted June 28, 1974. The most current map updated by FEMA is from September 26, 2008. The City of Lexington adopted a flood damage prevention ordinance in 2008 that pertains to new structures being built in flood prone areas.

City of Noble: According to the FEMA Community Status Book Report, Noble's initial Flood Hazard Boundary Map was adopted August 30, 1974. The most current map updated by FEMA is from February 20, 2013.

City of Norman: According to the FEMA Community Status Book Report, Norman's initial Flood Hazard Boundary Map was adopted August 23, 1974. The most current map updated by FEMA is from February 20, 2013.

Town of Slaughterville: According to the FEMA Community Status Book Report, Slaughterville's initial Flood Hazard Boundary Map was adopted April 15, 1992. The most current map updated by FEMA is from September 26, 2008. An amended ordinance was approved and revisions made on February 19, 2013 to update the town's flood damage prevention regulations to meet NFIP regulations.

4.3 Mitigation Goals

These goals remain consistent with the previous update and the CCHMPU planning committee voted to keep them the same. These goals include Cleveland County and all participating jurisdictions.

Goal 1: Protect lives and property.

Goal 2: To improve or enhance emergency services.

Goal 3: To prevent or reduce the effects of natural hazards/disasters.

Goal 4: To identify and protect critical facilities in participating jurisdictions.

Goal 5: To develop or improve structures to become a more disaster resistant county.

Goal 6: To provide more public awareness of the natural disaster threat.

4.4 Action Items

The 2020-2025 CCHMPU Action Projects follow the same format as found in the 2014-2019 Plan with a couple of editorial changes. As previously mentioned, the City of Moore and Moore Public schools will not be included in this section since those jurisdictions will now have their own separate plan. To reference the status updates for their projects, please refer back to pages 4-6. If they are mentioned on a specific project, it is only because they have completed specific action and it was a joint project with another jurisdiction.

These action items contain general projects, as well as jurisdiction specific action items that have been requested by the jurisdiction to incorporate into this CCHMPU.

This update will group all related projects as one project to avoid either leaving out a participating jurisdiction or duplicating jurisdictions. (Example 13, 13A, 13B, etc. from the 2014-2019 CCHMPU will now be listed as 13.) This will provide additional clarity and concision. Previous numerical listings will be included under each project as applicable to assist in cross referencing with the 2014-2019 Plan.

Action Item 1	Individual Safe Room Program					
Hazard(s) Addressed	Tornado, High Wind					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville					
Action	Provide a safe room rebate program to citizens within participating jurisdiction(s) to allow them to install safe rooms in their residences and shelter in place.					
Responsible Party	County, City, and Town Officials					
Potential Implementation Timeline	Ongoing, as funding becomes available, through grant programs					
Cost	\$2,000 rebate per shelter					
Potential Funding Sources	HMGP, county, local funding, private funding					

Action Item 2	Outdoor Early Warning Devices					
Hazard(s) Addressed	Tornado, High Winds					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville; Lexington Public Schools (PS), Little Axe PS, Noble PS, Norman PS, Robin Hill PS,					
Action	Install additional outdoor warning devices as needed to ensure adequate warning to citizens during an impending hazardous event. Replace older units with newer, technologically advanced devices.					
Responsible Party	County, local emergency management, school administration					
Potential Implementation Timeline	Ongoing, as funding becomes available; municipalities add new sirens as population expands within the city limits. Schools are covered under each municipality's coverage.					
Cost	Variable					
Potential Funding Sources	HMGP, county, local funding, REAP, School funds					

Action Item 3	Emergency Generator for Critical Facilities					
Hazard(s) Addressed	Earthquake, Extreme Heat, Hail, High Wind, Lightning, Wildfire, Winter Storm					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville; Lexington Public Schools (PS), Little Axe PS, Noble PS, Norman PS, Robin Hill PS,					
Action	Install emergency backup generator at critical facilities to mitigate impact from natural hazards causing power outages allowing critical facilities to remain operational					
Responsible Party	County, local emergency management, school administration					
Potential Implementation Timeline	Ongoing, as funding becomes available; almost all jurisdictions have back-up generators at their respective critical facilities					
Cost	Variable based on the needs of the facility					
Potential Funding Sources	HMGP, county, local funding, REAP, School funds					

Action Item 4	School Safe Rooms					
Hazard(s) Addressed	Tornado, High Winds					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Lexington Public Schools (PS), Little Axe PS, Noble PS, Norman PS, Robin Hill PS					
Action	Install safe rooms as needed to protect students, staff, and visitors for their protection in the event of a tornado					
Responsible Party	Local emergency management, school administration					
Potential Implementation Timeline	Ongoing, as funding becomes available					
Cost	Variable					
Potential Funding Sources	HMGP, school, local funds					

Action Item 5	Protective Crosswalks for Schools					
Hazard(s) Addressed	High Winds, Hail					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Lexington Public Schools (PS), Little Axe PS, Noble PS, Norman PS, Robin Hill PS					
Action	Install protective crosswalks to protect students, staff, and visitors for protection in the event of high winds, and hail.					
Responsible Party	Local emergency management, school administration					
Potential Implementation Timeline	Ongoing, as funding becomes available					
Cost	Variable according to design					
Potential Funding Sources	HMGP, local funding, school funds					

Action Item 6	Install redundant communication systems (Previously as 6 and 6A)					
Hazard(s) Addressed	Extreme Heat, Flood, Hail, High Winds, Lightning, Tornado, Wildfire, Winter Storms					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville					
Action	Install redundant communication system at critical facilities					
Responsible Party	County, local emergency management					
Potential Implementation Timeline	Ongoing, as funding becomes available					
Cost	Variable according to scope of the project					
Potential Funding Sources	HMGP, county, local funding, REAP, PDM, CDBG					

Action Item 7	Establish Water Lines/Supply					
Hazard(s) Addressed	Drought, Wildfire					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville					
Action	The county will collaborate with the local agriculturalist and agriculture committee in determining if the water lines and water supply amount is sufficient. The county will install new water lines where water supply is not sufficient enough to provide adequate water for citizens and for fighting wildfire.					
Responsible Party	County, local emergency management, school administration					
Potential Implementation Timeline	Ongoing, as funding becomes available; cooperation with municipalities in rural-urban interface areas.					
Cost	Variable according to the scope of the project					
Potential Funding Sources	HMGP, county, local funding, REAP					

Action Item 8	FireWise Awareness Program					
Hazard(s) Addressed	Wildfire					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville; Lexington Public Schools (PS), Little Axe PS, Noble PS, Norman PS, Robin Hill PS,					
Action	Firewise USA® is a voluntary program that provides a framework to help neighbors get organized, find direction, and take action to increase the ignition resistance of their homes and community.					
Responsible Party	Local fire departments, Emergency management, school administration					
Potential Implementation Timeline	Ongoing					
Cost	Variable					
Potential Funding Sources	HMGP, county, local funding, School funds					

Action Item 9	StormReady Business (Previously 10, 10A, 10B)				
Hazard(s) Addressed	Drought, Extreme Heat, Flood, Hail, High Wind, Lightning, Tornado, Wildfire, Winter Storm				
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville, Lexington Public Schools (PS), Little Axe PS, Noble PS, Norman PS, Robin Hill PS				
Action	This project proposes a public-private partnership in increasing the awareness and preparedness of local businesses and other high-census locations by establishing a “storm ready certification” process with the National Weather Service.				
Responsible Party	County, local emergency management				
Potential Implementation Timeline	Ongoing and continuing; Norman is certified.				
Cost	Variable				
Potential Funding Sources	HMGP, local government, business funds				

Action Item 10	Public Burn Ban Warning Signage				
Hazard(s) Addressed	Wildfire				
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville				
Action	Participating jurisdictions will post a color-coded warning sign to notify public of varying levels of fire danger				
Responsible Party	Local fire departments, local emergency management				
Potential Implementation Timeline	Ongoing and continuing				
Cost	Variable				
Potential Funding Sources	HMGP, local government, business funds				

Action Item 11	Window Film on Critical Facilities					
Hazard(s) Addressed	Earthquake, Extreme Heat, Hail, High Winds, Tornado					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville; Lexington PS, Little Axe PS, Noble PS, Norman PS, Robin Hill PS					
Action	Install tinted impact resistant window film to minimize the effects of high winds, tornadoes, and other hazards					
Responsible Party	Local elected officials, local emergency management, school administration					
Potential Implementation Timeline	Ongoing and continuing as funding is available					
Cost	Variable according to scope of the project					
Potential Funding Sources	County funds, school funds, HMPG, local funds					

Action Item 12	Drainage Improvements					
Hazard(s) Addressed	Dam Failure*, Flood					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville					
Action	The County and jurisdictions will review the infrastructure with the public works departments bi-annually to minimize flooding, addressing and mitigating such items as drainage improvements and creating reservoir ponds in heavy residential/commercial developments.					
Responsible Party	Local elected officials, local emergency management					
Potential Implementation Timeline	Ongoing and continuing					
Cost	Variable according to scope of the project					
Potential Funding Sources	HMPG, county, city					

***Dam Failure only affects Unincorporated Cleveland County and City of Norman**

Action Item 13	Drainage Bridge Structure (Eastern & Indian Hills)					
Hazard(s) Addressed	Flood					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	City of Norman					
Action	Elevate road at Eastern & Indian Hills intersection to mitigate repetitive flooding issues; complete Phase II of ongoing project					
Responsible Party	Norman					
Potential Implementation Timeline	TBD					
Cost	Variable					
Potential Funding Sources	HMPG, city					

Action Item 14	Bury Electrical Service Lines (Formerly “Bury Electrical Distribution Lines”)					
Hazard(s) Addressed	Hail, High Winds, Lightning, Tornado, Wildfire, Winter Storm					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville					
Action	The participating jurisdictions will collaborate with the local utility companies to plan or require the installation of new underground power lines where possible.					
Responsible Party	County, local elected officials, local utility companies					
Potential Implementation Timeline	Ongoing and continuing					
Cost	Variable					
Potential Funding Sources	County, local utility departments					

Action Item 15	Maguire Road 144th-156th Project (roadway flooding) District 2					
Hazard(s) Addressed	Flood					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County-District 2					
Action	Low lying area prone to flooding; project would build up the roadway and involve culvert installation to improve the drainage of Maguire Rd. west of 156th					
Responsible Party	Cleveland County Commissioners					
Potential Implementation Timeline	Ongoing and continuing					
Cost	Variable					
Potential Funding Sources	County					

Action Item 16	Portable Motorist Information Signs					
Hazard(s) Addressed	Dam Failure*, Drought, Earthquake, Extreme Heat, Flood, Hail, High Winds, Lightning, Tornado, Wildfire, Winter Storm					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville; Lexington PS, Little Axe PS, Noble PS, Norman PS, Robin Hill PS					
Action	Acquire portable, solar, programmable message signs (PCMS) to provide safety and mitigation information during hazard occurrences.					
Responsible Party	County, local elected officials, school administration					
Potential Implementation Timeline	Ongoing and continuing acquisitions					
Cost	Variable					
Potential Funding Sources	County, local, school administration					

***Dam failure impacts only Unincorporated Cleveland County, Norman**

Action Item 17	Establish Significant Hazard Dam Registration and Safety Checks					
Hazard(s) Addressed	Dam Failure					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Norman					
Action	The County will establish plans and regulations for Significant Hazard Dams to be registered and inspected on a bi-annual basis.					
Responsible Party	Floodplain manager					
Potential Implementation Timeline	Ongoing and continuing					
Cost	NA					
Potential Funding Sources	County, city					

Action Item 18	Pipeline Identification					
Hazard(s) Addressed	Earthquake					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County					
Action	The County will provide a yearly check on the location of the pipelines within the county. In addition, they will also provide a geographic map to the public denoting high risk areas for pipeline ruptures.					
Responsible Party	County Emergency Management					
Potential Implementation Timeline	Ongoing and continuing					
Cost	Variable					
Potential Funding Sources	HMPG, county					

Action Item 19	Convert Outdoor Warning Devices to Solar Power					
Hazard(s) Addressed	High Winds, Tornado					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville; Lexington PS, Little Axe PS, Noble PS, Norman PS, Robin Hill PS					
Action	Convert any non-solar outdoor warning devices to solar					
Responsible Party	County and local emergency management, school administration					
Potential Implementation Timeline	Ongoing and continuing					
Cost	Variable					
Potential Funding Sources	HMPG, county, local utility departments					

Action Item 20	Drainage Project with Norman (Telephone Road to I-35)					
Hazard(s) Addressed	Flood					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	City of Norman					
Action	Realign, reshape, and re-slope drainage channel between I-35 and Telephone Road/36 th NW on the Moore/Norman boundary. This is to include replacement of vegetation to prohibit additional siltation.					
Responsible Party	City of Norman					
Potential Implementation Timeline	Ongoing and continuing with City of Norman					
Cost	Variable					
Potential Funding Sources	HMPG, city					

Action Item 21	Public Information/Education on Natural Hazards (Previously 34)					
Hazard(s) Addressed	Dam failure*, Drought, Earthquake, Extreme Heat, Flood, Hail, High Winds, Tornado, Wildfire, Winter Storms					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville; Lexington PS, Little Axe PS, Noble PS, Norman PS, Robin Hill PS					
Action	The county and jurisdictions will provide the citizens with information on the effects of all natural hazards and safety precautions during an event.					
Responsible Party	County and local emergency management, school administration					
Potential Implementation Timeline	Ongoing and continuing					
Cost	Variable					
Potential Funding Sources	County, local, school funds					

***Unincorporated Cleveland County and Norman only affected**

Action Item 22	Cooling Stations/Facilities (Previously 37)					
Hazard(s) Addressed	Extreme Heat					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville					
Action	The county and local jurisdictions will work with local churches and other non-profit organizations to inform citizens and deploying cooling stations at designated buildings providing shelter during extreme heat.					
Responsible Party	County and local emergency management, school administration					
Potential Implementation Timeline	Ongoing and continuing					
Cost	Variable according to the scope of each project					
Potential Funding Sources	County, local, school funds					

Action Item 23	Inhofe Creek Channel Improvements (Previously 38)					
Hazard(s) Addressed	Flood					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Norman					
Action	Stabilize the banks of the channel					
Responsible Party	City of Norman Public Works					
Potential Implementation Timeline	Ongoing and continuing					
Cost	Variable					
Potential Funding Sources	City funds					

Action Item 24	Relocate/Elevate Mobile Home Parks (Previously 42)					
Hazard(s) Addressed	Flood					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville					
Action	Flooding of mobile homes in park due to placement of homes in floodplain, relocate					
Responsible Party	Cleveland County, City of Lexington, City of Noble, City of Norman, Town of Slaughterville					
Potential Implementation Timeline	Pending as funding becomes available					
Cost	Variable					
Potential Funding Sources	HMPG, County funding, city funding					

Action Item 25	Property Acquisition in Flood Plain (Previously 44 and 44A)					
Hazard(s) Addressed	Flood					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Norman					
Action	Acquire property located within the flood plain that floods frequently. Remove or demolish structures and turn acquisitions into open spaces.					
Responsible Party	Cleveland County elected officials					
Potential Implementation Timeline	Pending					
Cost	Variable					
Potential Funding Sources	HMPG, PDM, FMA, RFC, SRL, County funding					

Action Item 26	Parking Garage					
Hazard(s) Addressed	Extreme Heat, Hail, High Winds, Lightning, Winter Storms					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County					
Action	Construct a parking garage at the county courthouse to protect county employees and visitors to the courthouse from severe weather events.					
Responsible Party	Cleveland County elected officials					
Potential Implementation Timeline	Pending					
Cost	Variable					
Potential Funding Sources	HMPG, County funding					

Action Item 27	Vegetation Management					
Hazard(s) Addressed	Wildfire					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville; Lexington PS, Little Axe PS, Noble PS, Norman PS, Robin Hill PS					
Action	Encourage and assist in the removal and control of the invasive eastern red cedar population and other wild land growth to control water consumption and wildfire prevention.					
Responsible Party	County and local emergency management, local elected officials, school administration					
Potential Implementation Timeline	Ongoing and Continuing.					
Cost	Variable					
Potential Funding Sources	HMPG, Forestry, County funding, school funding					

Action Item 28	Earthquake Preparedness					
Hazard(s) Addressed	Earthquake					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville					
Action	Provide information to residents and contractors (residential/commercial) on minimizing effects of earthquakes and making structures more resilient					
Responsible Party	Emergency Management					
Potential Implementation Timeline	Ongoing and Continuing.					
Cost	None to Variable					
Potential Funding Sources	HMPG, County funds, local funds					

Action Item 29	Incorporate No Adverse Impact Floodplain Management Requirements (Previously 53, 53A)					
Hazard(s) Addressed	Flood					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville					
Action	Cleveland County and municipalities will investigate and incorporate No Adverse Impact floodplain management requirements					
Responsible Party	Cleveland County Commissioners, Local Emergency Management and/or local elected officials					
Potential Implementation Timeline	Ongoing and Continuing.					
Cost	Variable					
Potential Funding Sources	County funds, local funds					

Action Item 30	City of Lexington Flood Project-Chouteau Creek					
Hazard(s) Addressed	Flooding					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Lexington					
Action	City of Lexington will clear and re-route Chouteau Creek to allow better drainage					
Responsible Party	City of Lexington					
Potential Implementation Timeline	New Project					
Cost	Variable					
Potential Funding Sources	HMPG, PDM, FMA, RFC, SRL, Local Funds					

Action Item 31	Organize Youth Preparedness Camp				
Hazard(s) Addressed	Drought, Earthquake, Extreme Heat, Flood, Hail, High Winds, Lightning, Tornado, Wildfire, Winter Storms				
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects
Jurisdiction(s)	Norman				
Action	Organize a week-long youth camp and coordinate with local and state offices to educate youth on all-hazards preparedness				
Responsible Party	City of Norman Emergency Coordinator				
Potential Implementation Timeline	New Project				
Cost	Variable				
Potential Funding Sources	Grants				

Action Item 32	Construct stormwater retention pond at Cleveland County Fairgrounds				
Hazard(s) Addressed	Flood				
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects
Jurisdiction(s)	Cleveland County				
Action	Cleveland County would construct retention ponds to reduce storm water runoff				
Responsible Party	Cleveland County Commissioners				
Potential Implementation Timeline	New Project				
Cost	Variable				
Potential Funding Sources	County funds, Grants				

Action Item 33	Construction New Expo Center at Fairgrounds with enhanced wind resistance requirements and generators beyond current building codes					
Hazard(s) Addressed	High Winds, Tornados					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County					
Action	Cleveland County builds new structures with higher building codes to be a more resilient facility against high winds and tornadoes					
Responsible Party	Cleveland County					
Potential Implementation Timeline	New Project					
Cost	Variable					
Potential Funding Sources	County funds, Grants					

Action Item 34	Adopt more resilient building standards for new or remodeled structures/Update existing residential and commercial building codes					
Hazard(s) Addressed	Earthquake, Extreme Heat, Flood, Hail, High Winds, Lightning, Tornado, Wildfire, Winter Storms					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville					
Action	New or remodeled public buildings will use more resilient building codes					
Responsible Party	City of Norman Cleveland County, Lexington, Noble, Norman, Slaughterville					
Potential Implementation Timeline	New Project					
Cost	None					
Potential Funding Sources	None					

Action Item 35	Low Impact/Xeriscaping around public facilities				
Hazard(s) Addressed	Drought				
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects
Jurisdiction(s)	Cleveland County, Lexington, Noble, Norman, Slaughterville; Lexington PS, Little Axe PS, Noble PS, Norman PS, Robin Hill PS				
Action	Participants will landscape with low impact/xeriscape to reduce water use, reduce storm water runoff				
Responsible Party	Cleveland County, Lexington, Noble, Norman, Slaughterville; Lexington PS, Little Axe PS, Noble PS, Norman PS, Robin Hill PS				
Potential Implementation Timeline	New Project				
Cost	Variable				
Potential Funding Sources	Grants				

Action Item 36	Permeable Sidewalks and Parking Lot Surfaces				
Hazard(s) Addressed	Flooding				
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects
Jurisdiction(s)	Cleveland County, Norman, Noble, Slaughterville, Lexington				
Action	Participants will investigate the potential for new construction to include permeable surfaces for walking paths and parking lots				
Responsible Party	Cleveland County, Norman, Noble, Slaughterville, Lexington				
Potential Implementation Timeline	New Project				
Cost	Variable				
Potential Funding Sources	Grants				

Action Item 37	Bridge Redesign					
Hazard(s) Addressed	Flooding					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County					
Action	Bridge redesign and construction to improve drainage at 2 locations—192 nd & Lewis and 144 th & Lewis					
Responsible Party	Cleveland County					
Potential Implementation Timeline	New Project					
Cost	Variable					
Potential Funding Sources	STP funds, Grants					

Action Item 38	Lightning Protection Systems					
Hazard(s) Addressed	Lightning					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	City of Lexington, City of Noble, City of Norman, Town of Slaughterville, Lexington PS, Noble PS, Norman PS, Robin Hill PS, Little Axe PS					
Action	Use of lightning protection systems to prevent structural damage					
Responsible Party	City of Lexington, City of Noble, City of Norman, Town of Slaughterville, Lexington PS, Noble PS, Norman PS, Robin Hill PS, Little Axe PS					
Potential Implementation Timeline	New Project					
Cost	Variable					
Potential Funding Sources	HMGP, Municipal funding, School bonds					

Action Item 39	At Risk Transportation Routes					
Hazard(s) Addressed	Dam Failure, Flood					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	City of Norman, Unincorporated Cleveland County					
Action	Identify those transportation routes that at risk of Dam Failure and Flooding					
Responsible Party	City of Norman, Unincorporated Cleveland County					
Potential Implementation Timeline	New Project					
Cost	Variable					
Potential Funding Sources	HMGP, Municipal funding, School bonds					

Action Item 40	Property Acquisition in Dam Breach Inundation Areas					
Hazard(s) Addressed	Dam Failure					
Mitigation Action Type (Highlight box that applies.)	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs	5% Projects	
Jurisdiction(s)	Cleveland County, Norman					
Action	Acquire property located within the dam breach inundation area that is at risk. Remove or demolish structures and turn acquisitions into open spaces.					
Responsible Party	Cleveland County, City of Norman elected officials					
Potential Implementation Timeline	Pending					
Cost	Variable					
Potential Funding Sources	HMPG, PDM, FMA, RFC, SRL, County funding					

CHAPTER FIVE: PLAN UPDATE PRIORITIZATION AND REVIEW

5.1 Analyzing Development Trends

As mentioned above in Section 1.1, all municipal jurisdictions are growing at steady rates or have maintained populations in the past 5 years. Unincorporated areas have not lost population and urban areas are expanding slowly into unincorporated areas. All school districts have steady or growing student populations as noted in Section 4.1.5.

Due to the expanding urban-rural interface areas, there is potential for wildfires to affect more residents. Jurisdictions have ongoing discussions with their planning and development departments to ensure awareness of how the more common natural hazards of wildfires and flooding could affect the expanding areas.

Cleveland County: Since the approval of the previous CCHMPU, there have been no alterations to prioritization or endeavors related to vulnerabilities. There is no policy change related to development in hazard prone areas.

Lexington: The City of Lexington is looking more closely into options to develop and mitigate flood prone areas within city limits. Since the last CCHMPU approval, the town has reconstructed the waste water treatment facility. The water tower has also been refurbished and is now compliant with current standards. The volunteer fire department has made significant progress in updating equipment and vehicles through grant awards.

Lexington Public Schools: Options are being discussed to make the schools more resilient for tornadoes. No development has occurred since the last CCHMPU approval.

Little Axe Public Schools: Since the approval of the previous CCHMPU, there have been no alterations to prioritization or endeavors related to vulnerabilities. There is no policy change related to development in hazard prone areas.

Noble: Since the approval of the previous CCHMPU, there have been no alterations to prioritization or endeavors related to vulnerabilities. There is no policy change related to development in hazard prone areas.

Noble Public Schools: Since the approval of the previous CCHMPU, there have been no policy changes or changes in prioritization related to vulnerabilities. The repairs and roof replacements made were routine and not caused by natural hazards. The construction near the high school property has reduced the threat of wildfires by eliminating some of the red cedars in the immediate area.

Norman: The City of Norman maintains some of the strictest building and development codes in the state of Oklahoma. Since the approval of the previous CCHMPU, there have been no alterations to prioritization or endeavors related to vulnerabilities. There is no policy change related to development in hazard prone areas.

Norman Public Schools: Since the approval of the previous CCHMPU, there have been no alterations to prioritization or endeavors related to vulnerabilities.

Robin Hill Public Schools: Since the approval of the previous CCHMPU, there have been no alterations to prioritization or endeavors related to vulnerabilities. There is no policy change related to development in hazard prone areas.

Slaughterville: Since the approval of the previous CCHMPU, there have been no alterations to prioritization or endeavors related to vulnerabilities. There is no policy change related to development in hazard prone areas.

There have been no overall changes to the participating jurisdictions' vulnerabilities.

The only jurisdictional changes have been that the **City of Moore** and **Moore Public Schools** created their own hazard mitigation plan.

Economic and Transportation Trends

Since the last CCHMPU, the main large employer to come into the geographic area of Cleveland County is an Amazon Distribution Center. This development will bring approximately 1,500 jobs to the greater Oklahoma City metro area.

There has also been no development of a light rail or commuter rail within the geographic area of Cleveland County, though the City of Norman has engaged in ongoing discussions with the greater Oklahoma City area about extending a public transit system into the southern area of the greater Oklahoma City metro area.

5.2 Status of Previous Mitigation Action Items

Many of the action projects within the CCHMPU require ongoing maintenance, either due to the scope of the project, such as the cyclical nature of updating outdoor warning devices within a municipality, or due to the availability of funds, projects remain incomplete.

With that in mind, some projects remain on both lists as some jurisdictions have done particular projects, while others have not since the last update, but will be prioritizing them in the next five years.

The City of Moore and Moore Public School projects from 2014-2019 are not included since they are not participating in the CCHMPU 2020-2025.

These Action Items were accomplished between 2014-2019 from the CCHMPU. The numbers correlate to the numbers they have in the 2020-2025 CCHMPU, since so many projects have been consolidated.

Action Item	Hazard Mitigated	Jurisdiction Impacted
1. Individual Safe Room Program	Tornado, Hail, High Wind	Cleveland County, Norman
2. Outdoor Early Warning Devices	Tornado	Norman
3. Emergency Generator for Critical Facilities	All	Slaughterville (Station 2)
4. School Safe Rooms	Tornado, Hail, High Wind	All Schools
7. Tone Alert Radio Warning System	All	Cleveland Co., Noble, Norman, Lexington, Schools
11. Mass Communications System	All	All
14. 72 nd N of Slaughterville Rd & Etowah Rd	Flooding	Cleveland Co., Slaughterville
17. Drainage Bridge 84 th & Lewis Rd	Flooding	Cleveland Co.
22. Portable Motorist Information Signs	All	All
27. 34 th Street Drainage Bridge Structure	Flooding	Norman, Cleveland County
28. Web apps/Public Outreach	All	All

Ongoing Action Items Not Accomplished in 2014-2019 CCHMPU and retained in the 2020-2025 CCHMPU

Action Item	Hazard Mitigated	Jurisdiction Impacted	Reason Not Accomplished	Is Action Item Still Relevant?
1. Individual Safe Room Program	Tornado, high wind, hail	County, Municipalities	Lack of Funding	Y
2. Outdoor Early Warning Devices	Tornado	Municipalities	Lack of Funding; plans for future	Y
3. Emergency Generator for Critical Facilities	All	Municipalities	Lack of funding; plans for the future	Y
4. School Safe Rooms	Tornado, High Winds	Schools	Lack of funding; plans for the future	Y
5. Protective crosswalks for schools	High wind, Hail	Schools	Lack of funding	Y
6. Install redundant communication systems	All	Municipalities	Lack of funding; plans for the future	Y
7. Establish Water Lines/Supply	Wildfire, Drought	Cleveland Co., Municipalities	Ongoing	Y
8. FireWise Awareness Program	Wildfire, Drought	All	Ongoing	Y

9.	StormReady Business	All, except Dam Failure	All	Ongoing	Y
10.	Public Burn Ban Warning Signage	Wildfire	Municipalities	Ongoing	Y
11.	Window Film on Critical Facilities	Earthquake, Extreme Heat, High Wind, Hail, Tornado	All	Ongoing	Y
12.	Drainage Improvements	Dam Failure*, Flooding	*Cleveland Co, *Norman, All	Ongoing	Y
13.	Drainage Bridge at Eastern & Indian Hills	Flooding	Norman	Pending	Y
14.	Bury Electrical Service Lines	High Winds, Wildfire, Tornado, Winter Storms	All	Ongoing	Y
15.	Maguire Rd 144 th -156 th	Flooding	Cleveland County	Ongoing	Y
16.	Portable Motorist Info Signs	All	All	Ongoing	Y
17.	Establish Routine Dam Checks	Flooding, Dam Failure	Cleveland County, Norman	Ongoing	Y
18.	Pipeline Identification	Earthquake	Cleveland County, municipalities	Ongoing	Y
19.	Convert Outdoor Warning Systems to Solar Power	High Wind, Tornado	All	Ongoing	Y
20.	Drainage Project with Norman	Flooding	Norman	Ongoing	Y
21.	Public Info/ Education on All hazards	All	All	Ongoing	Y
22.	Cooling Stations	Extreme Heat	Cleveland Co., Municipalities	Ongoing	Y
23.	Inhofe Creek Channel Improvements	Flooding	Norman	Ongoing	Y
24.	Relocate Mobile Home Parks	Flooding	Municipalities	Ongoing as funding becomes available	Y
25.	Property Acquisition in Flood Plain	Flooding	Cleveland County, municipalities	Pending funding availability	Y
26.	Parking Garage	All	Cleveland County	Pending, construction to begin 2020	Y
27.	Vegetation Management	Wildfire	All	Ongoing	Y
28.	Earthquake Prep.	Earthquake	All	Ongoing	Y
29.	Incorporate No adverse impact Floodplain Management Requirements	Flooding	Cleveland County, Municipalities	Ongoing	Y
30.	City of Lexington Flood Project-Chouteau Creek	Flooding	Lexington	Pending funding availability	Y
31.	Organize Youth Camp	All	Norman	New Project	Y
32.	Construct stormwater retention pond	Flood	Cleveland County	New Project	Y
33.	New Expo Center at Fairgrounds	High Wind, Tornado	Cleveland County	New Project	Y
34.	Adopt more resilient building codes	All, except Dam failure	Municipalities, Cleveland Co	New Project	Y
35.	Low Impact/Xeriscape	Drought	All	New Project	Y
36.	Permeable Sidewalks and Parking Lot Surfaces	Flooding	Municipalities, Cleveland Co	New Project	Y

37. Bridge Redesign-2 locations	Flooding	Cleveland County	New Project	Y
38. Lightning Protection Systems	Lightning	All, except Cleveland Co.	New Project	Y
39. At-Risk Transportation Routes	Dam Failure, Flooding	Cleveland Co, Norman	New Project	Y
40. Property Acquisition in dam breach inundation area	Dam Failure	Cleveland Co, Norman	New Project	Y

5.3 Changes in Jurisdictional Priorities

There have been no jurisdictional changes to their priorities in hazard mitigation. Projects are ongoing and completed as funding becomes available and appropriated as respective decision makers.

5.4 Action Item Prioritization

The Cleveland County Hazard Mitigation planning team discussed how these projects would be prioritized and implemented. The determining factors for Cleveland County and all participating jurisdictions will be:

- the cost-benefit analysis for each project as it pertains to each individual jurisdiction and any particular community within that jurisdiction. Each jurisdiction intends to pursue hazard mitigation projects unique to the hazards they regularly experience and through consulting their respective planning departments and governing bodies.
- availability of local, state, and federal funding. Occasionally, each individual jurisdiction might choose to pursue specific grant opportunities (whether through private or public funding) for one-time hazard mitigation projects, example: federal funding for high-hazard dam reinforcement, or local bonds for a city project.
- the social, political, and public factors driving individual projects. Each jurisdiction has their own unique interests and long-term plans, and hazard mitigation projects will be integrated accordingly.

If the jurisdictions wish to use the STAPLEE evaluation table below, they can use this to assist the decision makers in prioritizing their respective projects.

Example STAPLEE Evaluation

Category	Evaluation
Social	Use this section to discuss the analysis of each criteria.
Technical	
Administrative	
Political	
Legal	
Economic	
Environmental	

5.5 Integration of Data, Goals, and Action Items

Each jurisdiction has their respective planning commissions/departments, mitigation planning/emergency management departments, and maintenance departments. Each jurisdiction individually decides how to appropriate or seek funding for their most urgent or most needed projects. They follow protocols of their respective governing bodies accordingly. The jurisdictions individually ensure that appropriate overlap with their comprehensive master plans, emergency operation plans, capital improvement plans, etc., as shown in Sections 4.1.1 to 4.1.5. Those tables show the planning mechanisms each jurisdiction has in place to accomplish their hazard mitigation goals.

Information on how each jurisdiction reviews its planning mechanisms is included in detail below. In each review, jurisdictional POCs will review the CCHMPU hazard data and mitigation action item list at least annually. All jurisdictions will incorporate any updated hazard profile data into their respective Emergency Action Plans. Whenever possible, each jurisdiction will look for funding opportunities to incorporate hazard mitigation action items into their respective Capital Improvement plans. In addition, jurisdictions that have the ability to enforce building codes will also review the CCHMPU for opportunities to incorporate enhanced building codes that promote hazard mitigating.

Cleveland County: Cleveland County’s plans identified in Sections 4.1.1 to 4.1.5 are annually updated by the Board of County Commissioners, CCEM, and any other entity to the respective plan and/or project. These plans are updated either January 1 of each year or July 1 of each year. The Cleveland County commissioners give the final approval for any changes or updates to prioritizing hazard mitigation project implementation.

The CCEM director annually reviews and updates the Emergency Response Plan and the Post-Disaster Recovery Plan, which would also contain any hazard mitigation efforts.

The City of Lexington: The city’s plans and ordinances identified in Sections 4.1.1 to 4.1.5 are annually updated and/or reviewed by the city council and administration. A Capital Improvement Plan was adopted in 2018 and will be updated every 5 years by the city clerk. Prior to updating any plan, the clerk and emergency manager review the hazard mitigation efforts of Lexington that could be included in the capital improvement plan. The city has an informal economic development plan. The Emergency Response Plan and the Post-Disaster Recovery Plan are reviewed annually by the city emergency manager.

The City of Noble: The city administration and council review and update ordinances, identified in Sections 4.1.1 to 4.1.5, annually. The city administration reviews and updates master plans as needed. Upon each plan’s renewal cycle, the building inspector, city manager, or emergency manager reviews whether or not hazard mitigation projects can be prioritized, integrated, and adopted. These projects are voted on and accepted by the city council according the respective renewal schedule of each plan.

The City of Norman: The City of Norman has a Storm Water Master Plan as well as the plans and ordinances identified in Sections 4.1.1 to 4.1.5. Hazard mitigation projects are integrated into city plans accordingly. The city administration reviews and updates all plans annually. The city administration and council update ordinances as needed. The City of Norman has multiple

departments that maintain and enforce codes and ordinances. Each department has their own respective codes, ordinances, or plans they are responsible to update on the respective renewal cycles. The heads of each department are responsible for bringing changes, updates, or new projects before the city council for review and approval. Projects requiring a new bond or tax is voted on by the people. The Department of Planning and Community Development and Emergency Management review and prioritize hazard mitigation related projects before bringing them to the city council for approval.

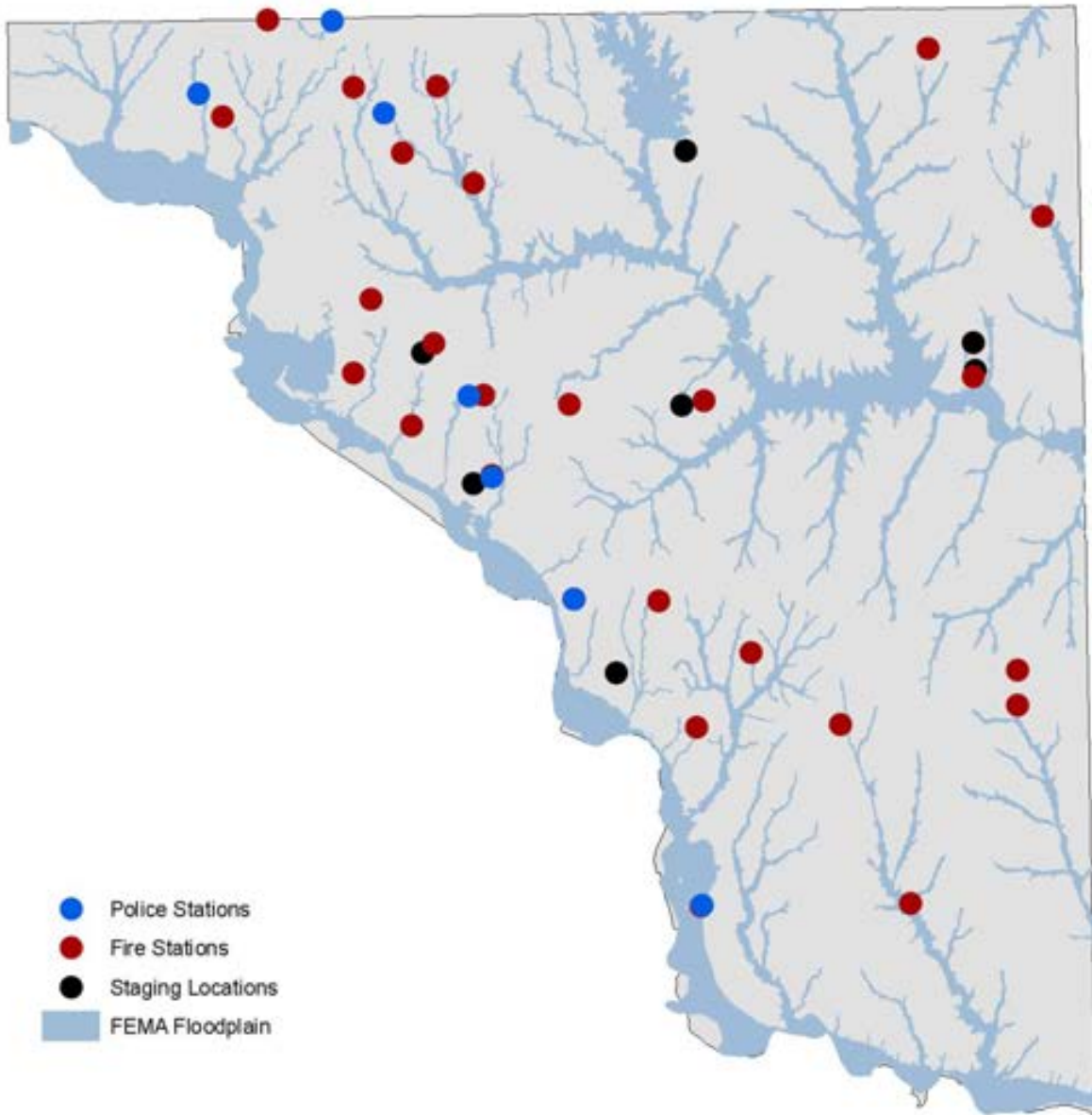
The Town of Slaughterville: The town administration and city council update their comprehensive plan every 5 years, and review and update the other plans as needed. Ordinances are reviewed continually and revised as needed. The ordinances and plans are identified in Sections 4.1.1 to 4.1.5 and they are updated and reviewed annually. The town administrator and emergency manager review, prioritize, and implement hazard mitigation projects according to the approval of the city council.

Schools:

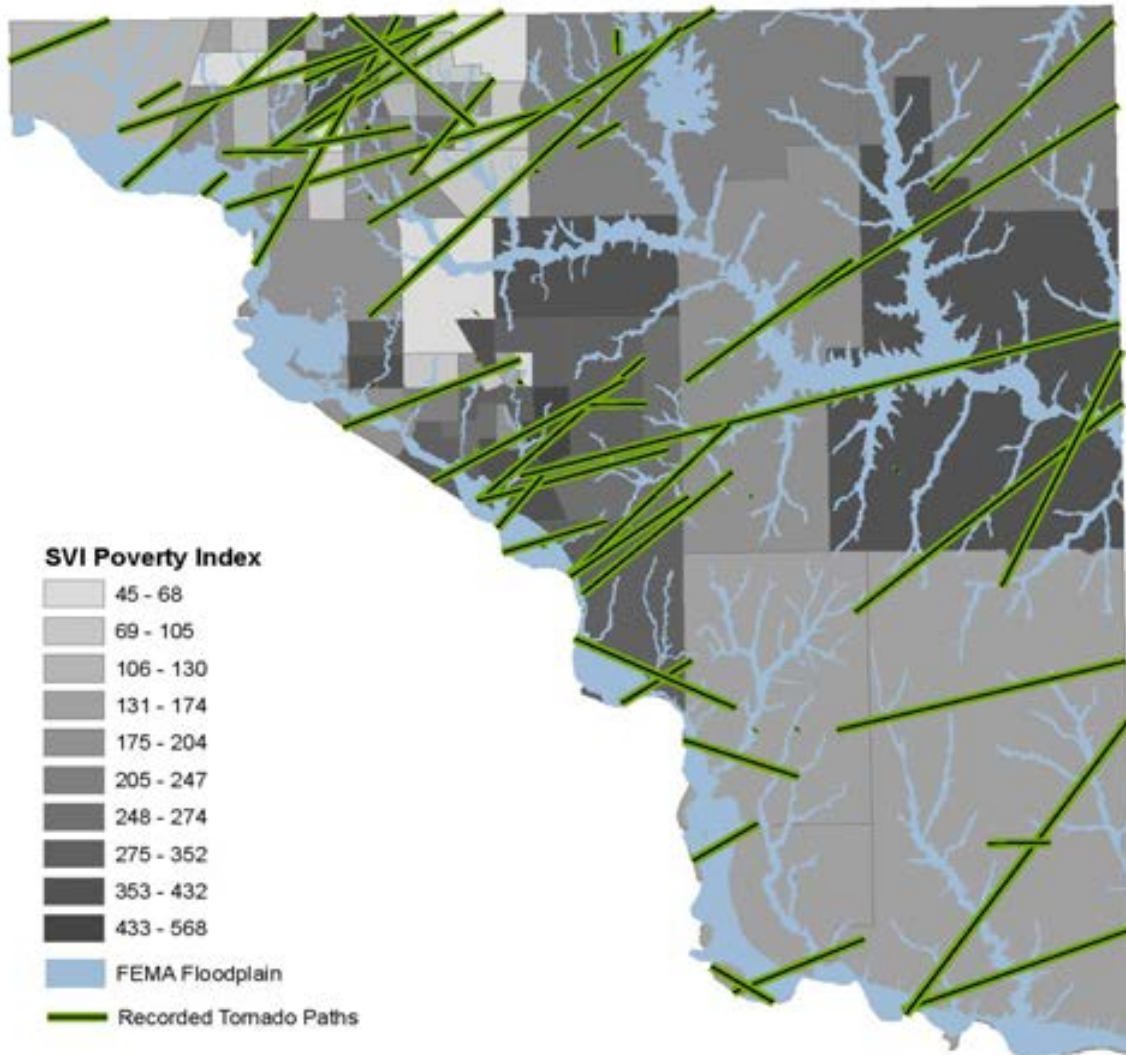
The school districts follow the recommendations of their respective school boards and administrators. Each school board reviews their respective Capital Improvement Plans annually. During this review, the HM Plan action items will be assessed for potential implementation and feasible projects will be included in any Capital Improvement Plan recommendations. Approved recommendations will be submitted as bond items and voted on during public school board meetings. Once an action item is complete, it will be documented in the following Capital Improvement Plan update.

Appendix A-Inundation Maps
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Cleveland County Critical Facilities

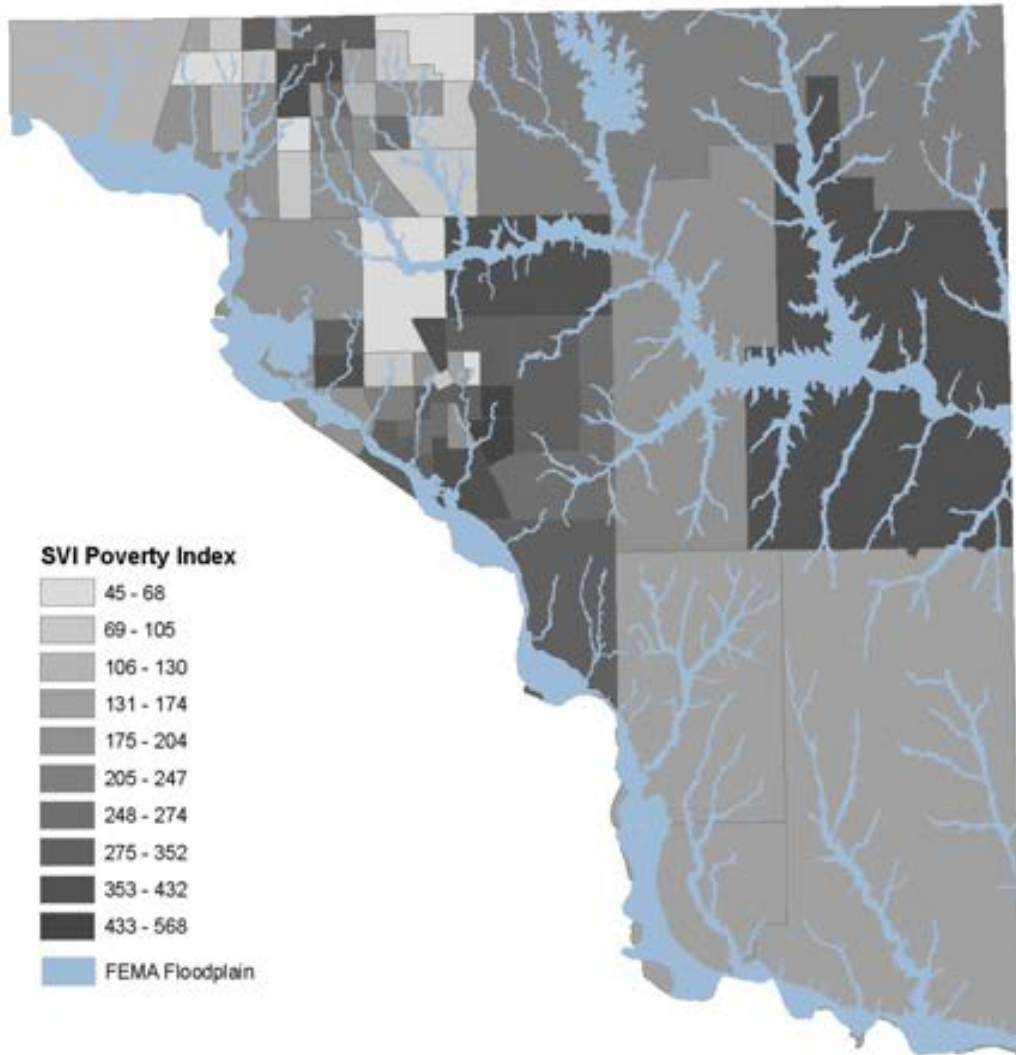


Social Vulnerability Index and Floodplain



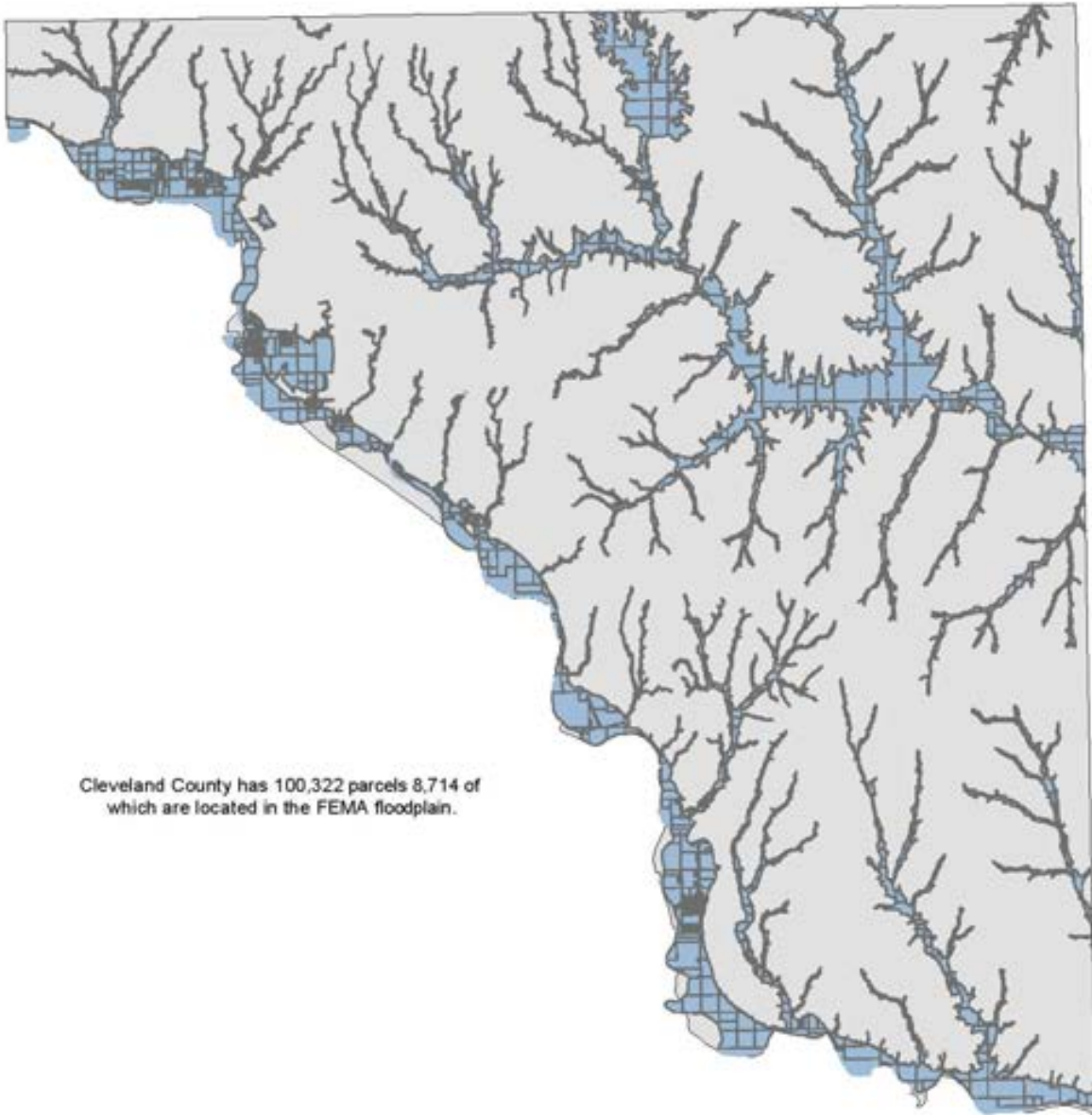
This map is based on the CDC’s social vulnerability index with the tornadic paths from the 1950’s to the present. The darker areas show a higher vulnerability index rating based on the socio-economic status of the population. Included are the FEMA designated flood plain areas.

Social Vulnerability Index and Floodplain

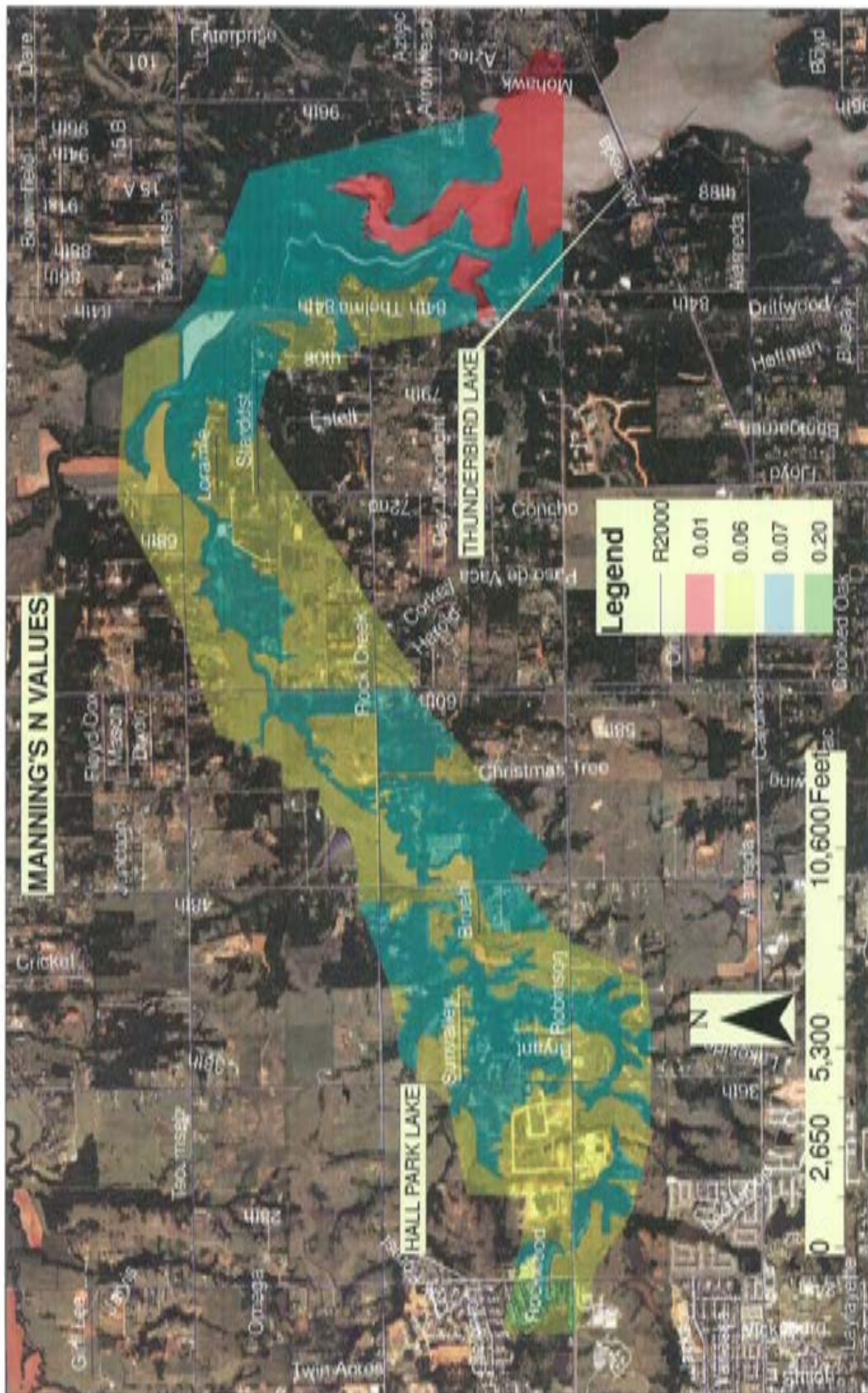


This map is based on the CDC's social vulnerability index with the FEMA Floodplains only.

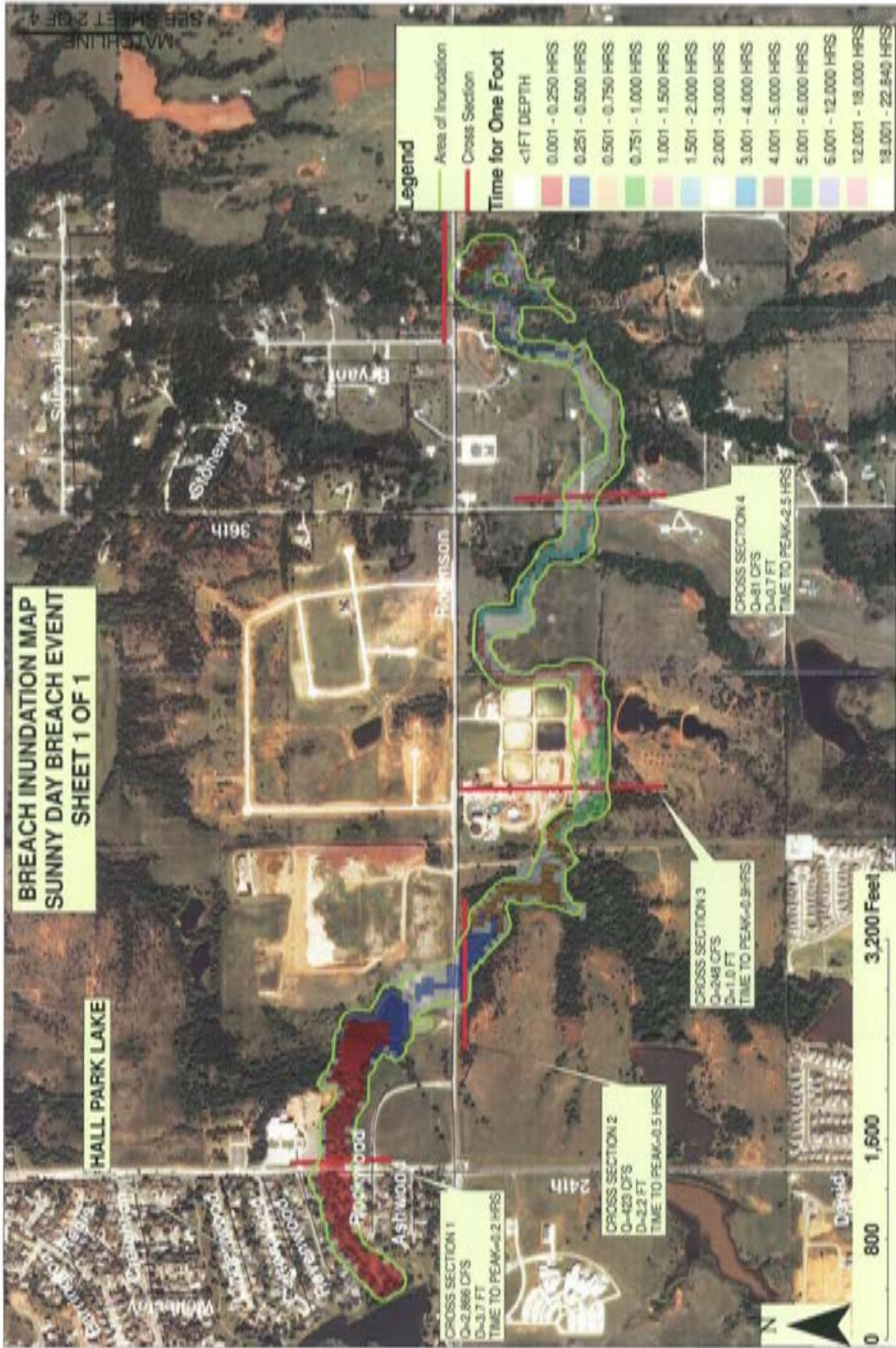
Cleveland County Floodplain Parcels

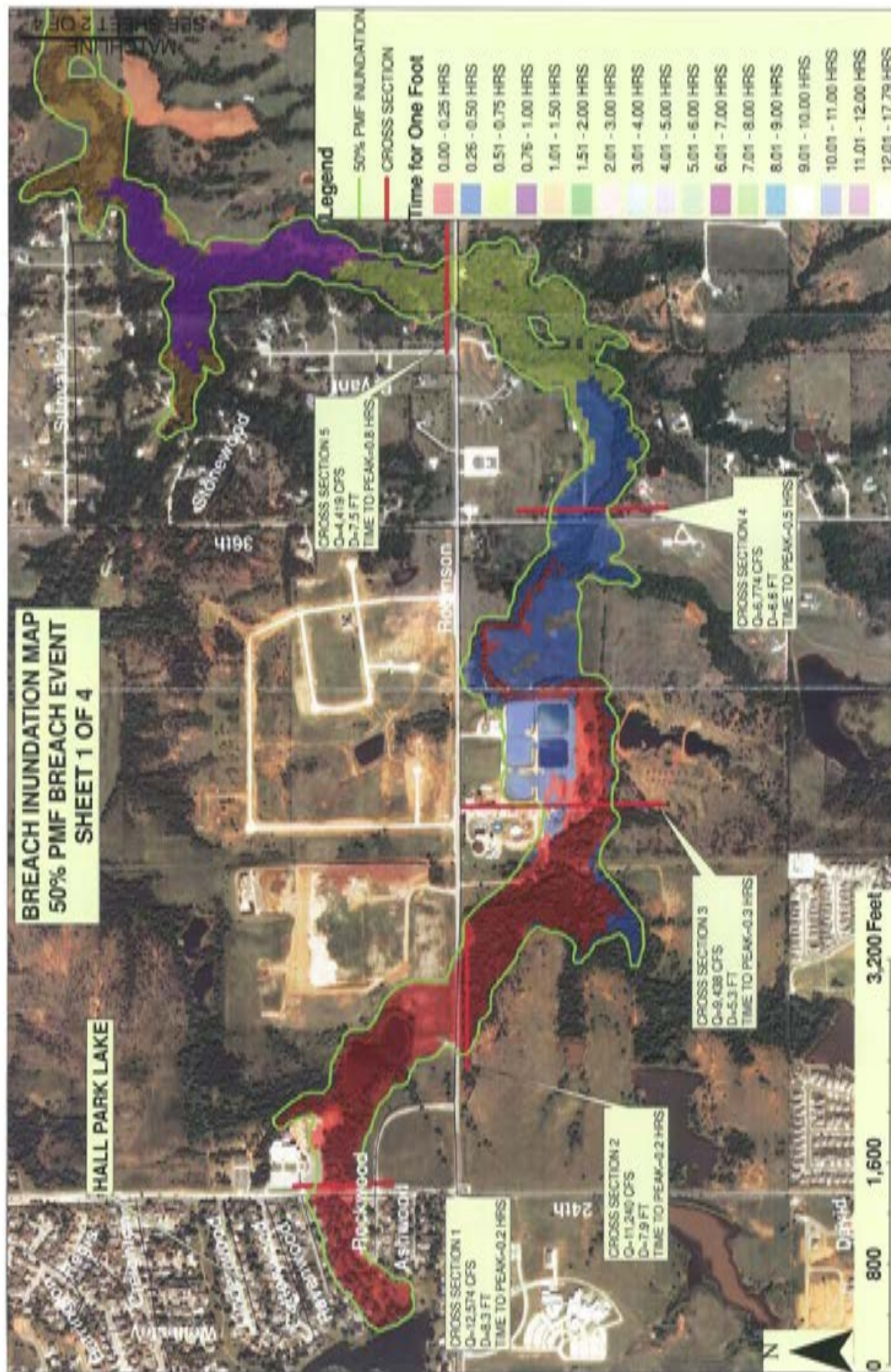


Cleveland County has 100,322 parcels 8,714 of which are located in the FEMA floodplain.

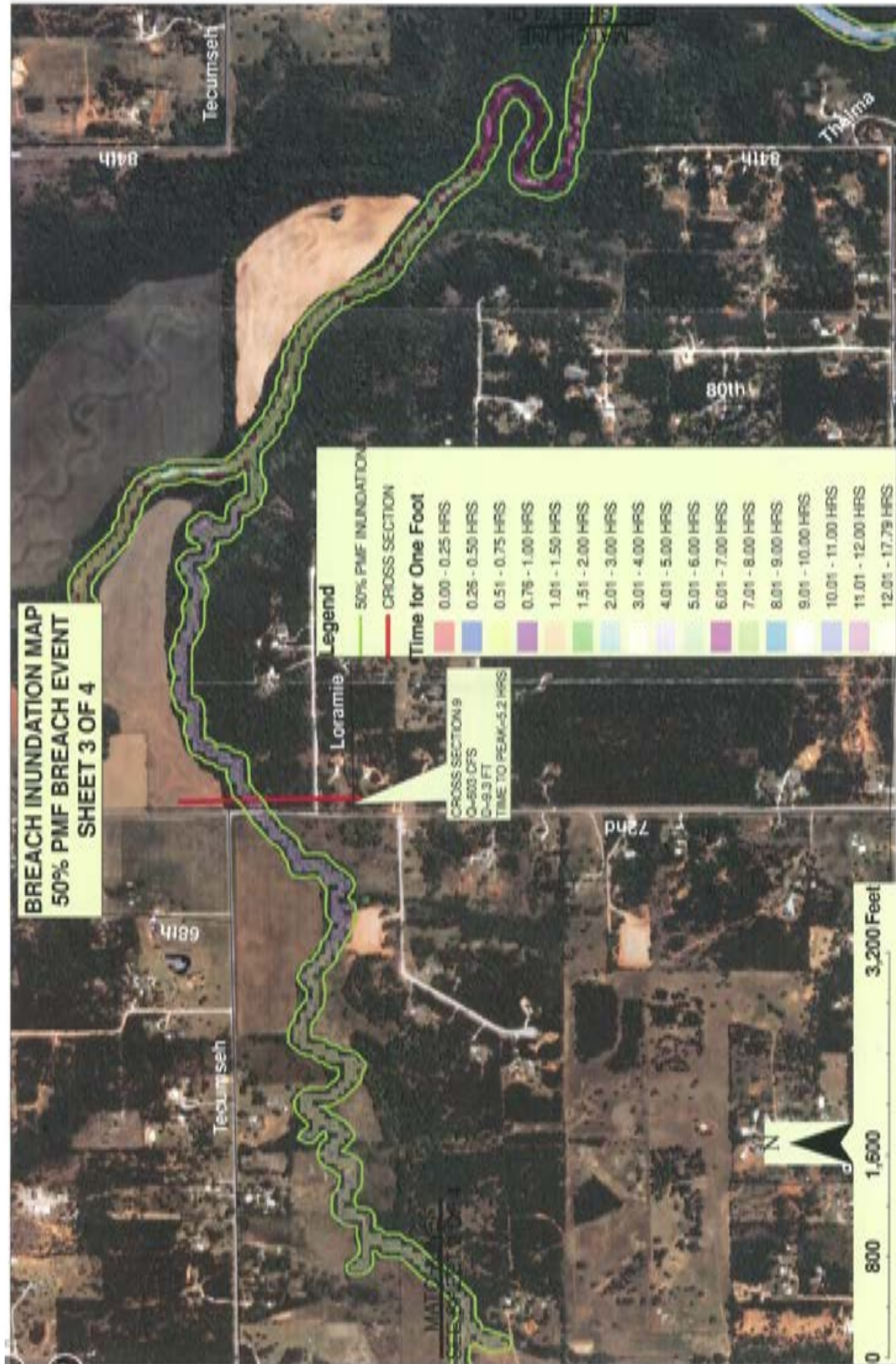


This map shows the inundation area for Hall Park Lake and the potential it has to reach Lake Thunderbird.

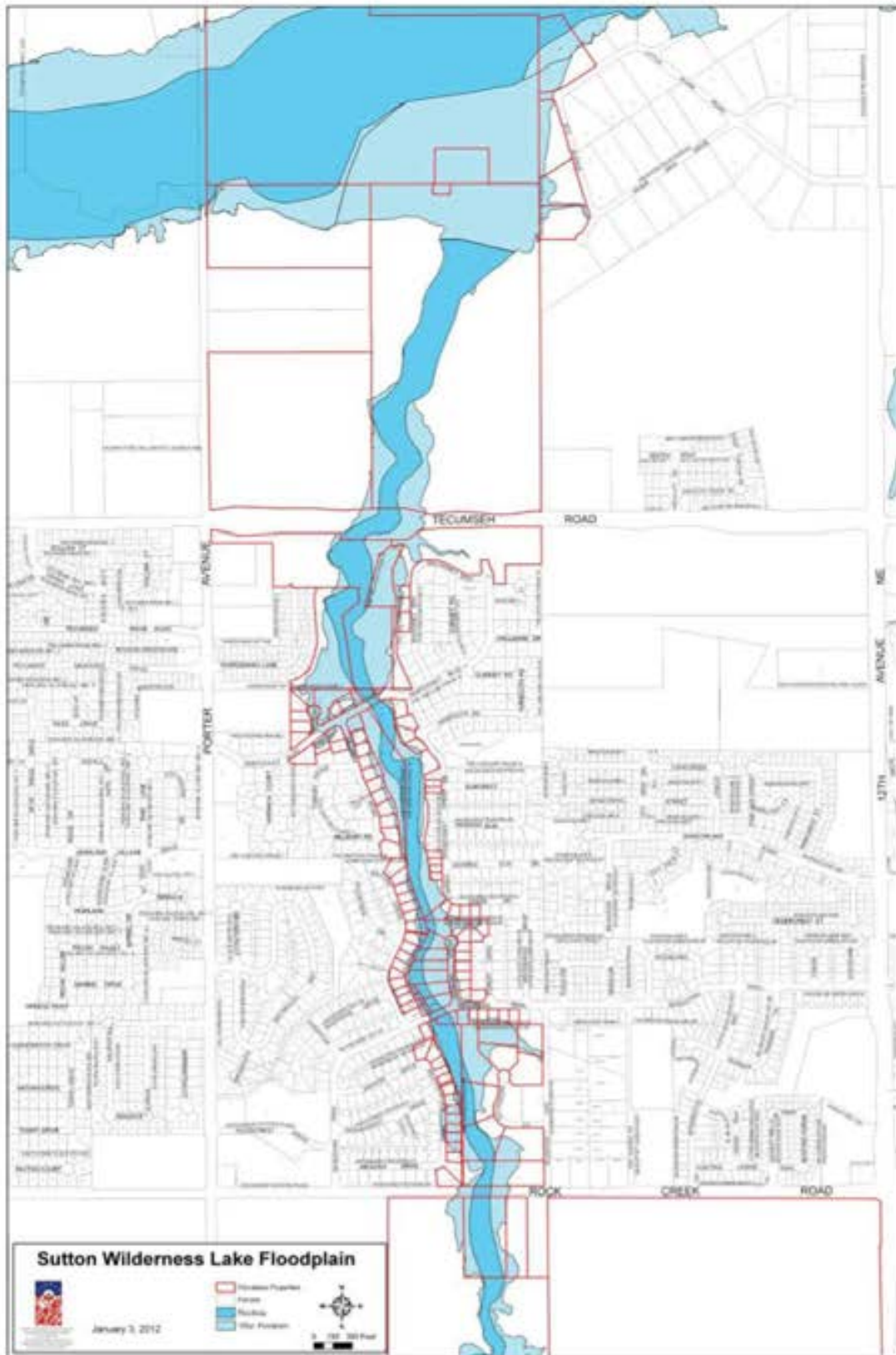


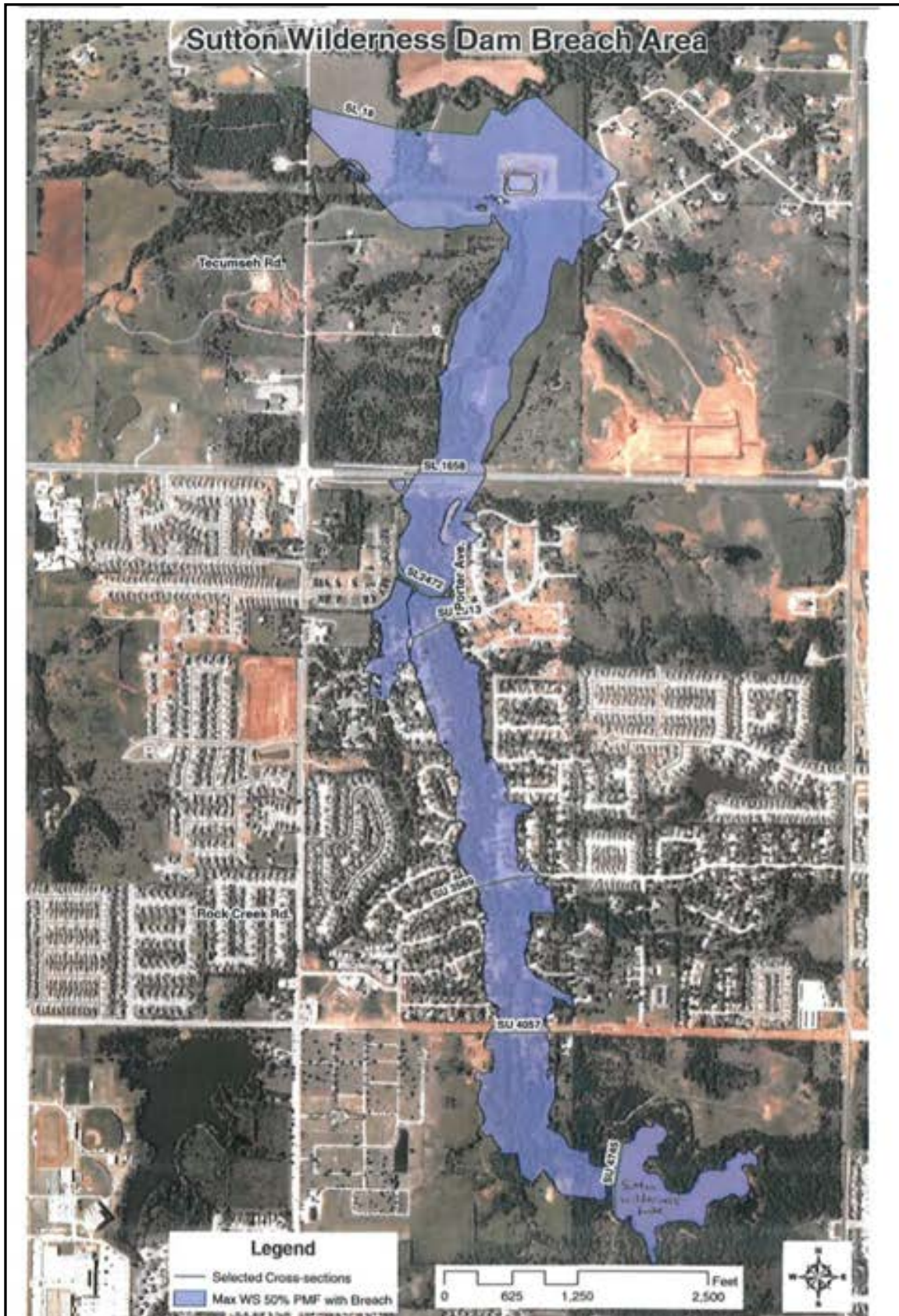












This map shows the dam breach area for Sutton Wilderness Dam.

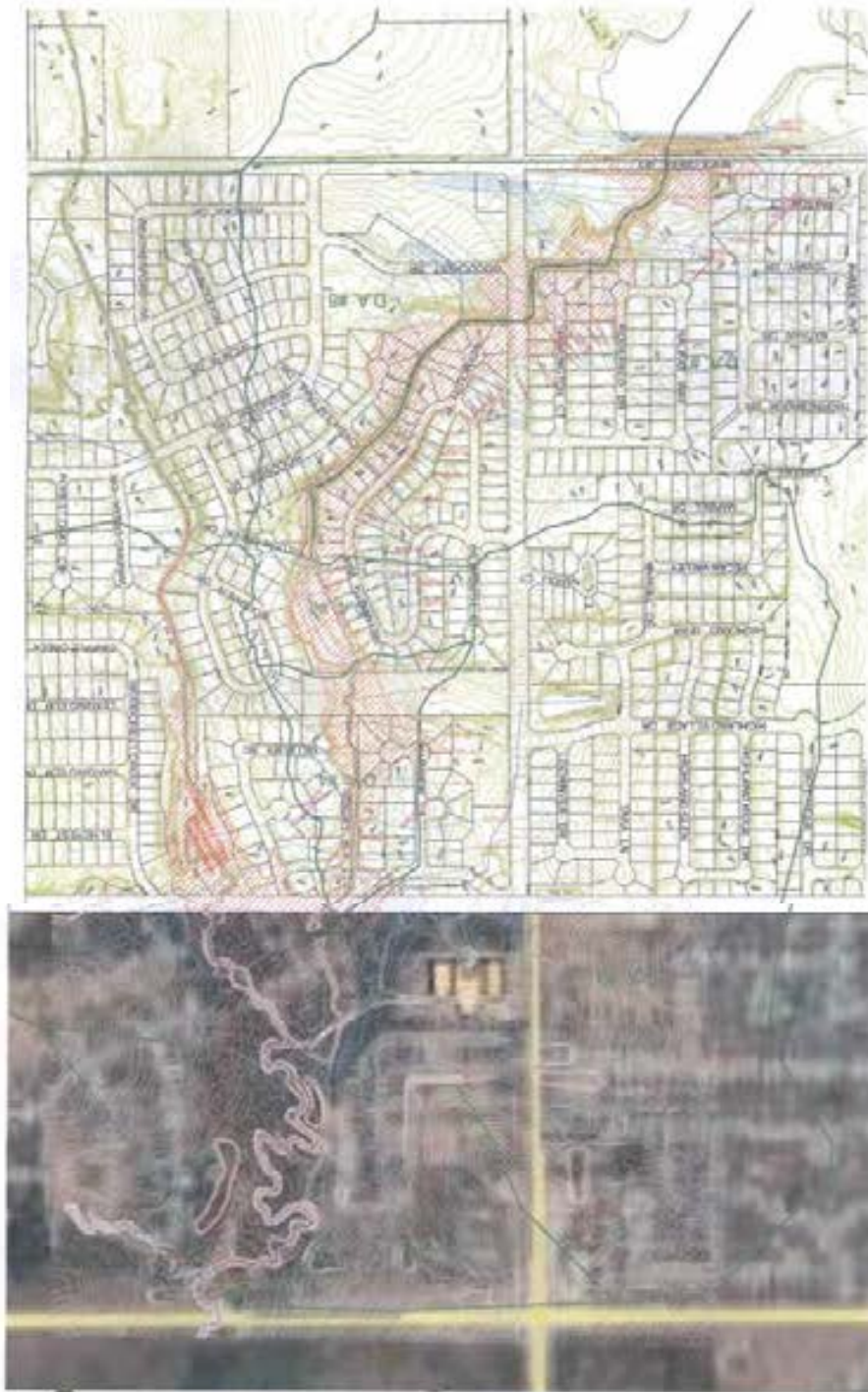


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Misty Lake Dam Emergency Action Plan, Cleveland County, April 16, 2013

This map shows the dam breach area for Summit Lake Dam.

This map show the dam breach area for Crystal Lake Dam.



Appendix B-Repetitive Loss & Severe Repetitive Loss Maps

The following maps were provided by the City of Norman and show the areas they have identified as potential repetitive loss areas. Each map has its own legend to explain where the inundation areas would be.



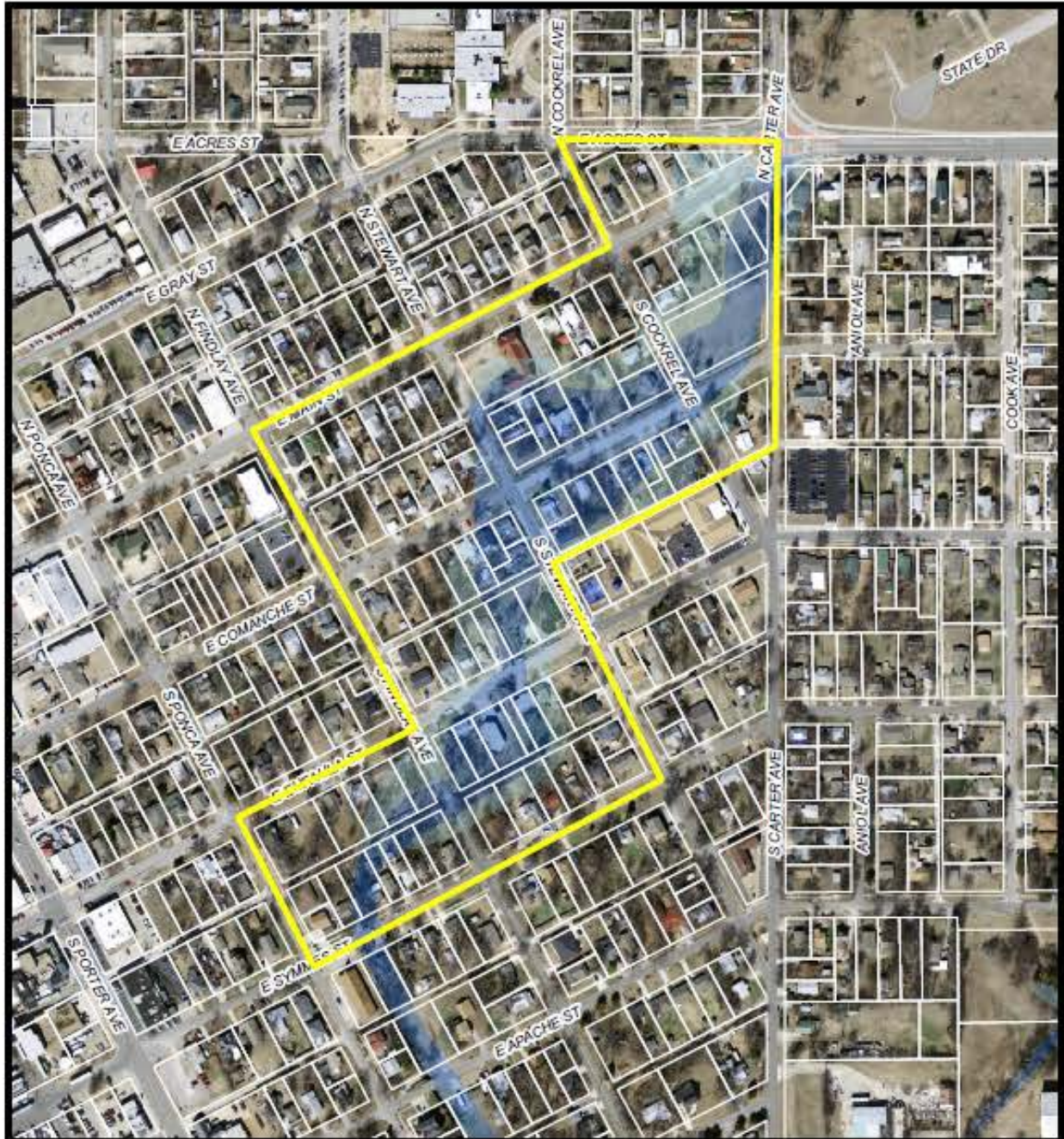


Repetitive Loss Area - The Vineyard Addition



The City of Norman assumes no responsibility for errors or omissions in the information presented.

1 inch = 100 feet



The City of Norman assumes no responsibility for errors or omissions in the information presented.

Repetitive Loss Area - Bishop Creek



1 inch = 300 feet

Legend

Flood Hazard Zone (2013)

- 1% Chance Floodplain
- Floodway



The City of Norman assumes no responsibility for errors or omissions in the information presented.

Repetitive Loss Area - S. Lahoma Avenue



1 inch = 100 feet

Legend

Flood Hazard Zone (2013)

- 1% Chance Floodplain
- Floodway



The City of Norman assumes no responsibility for errors or omissions in the information presented.

Repetitive Loss Area - West Tecumseh Road



1 inch = 400 feet

Legend

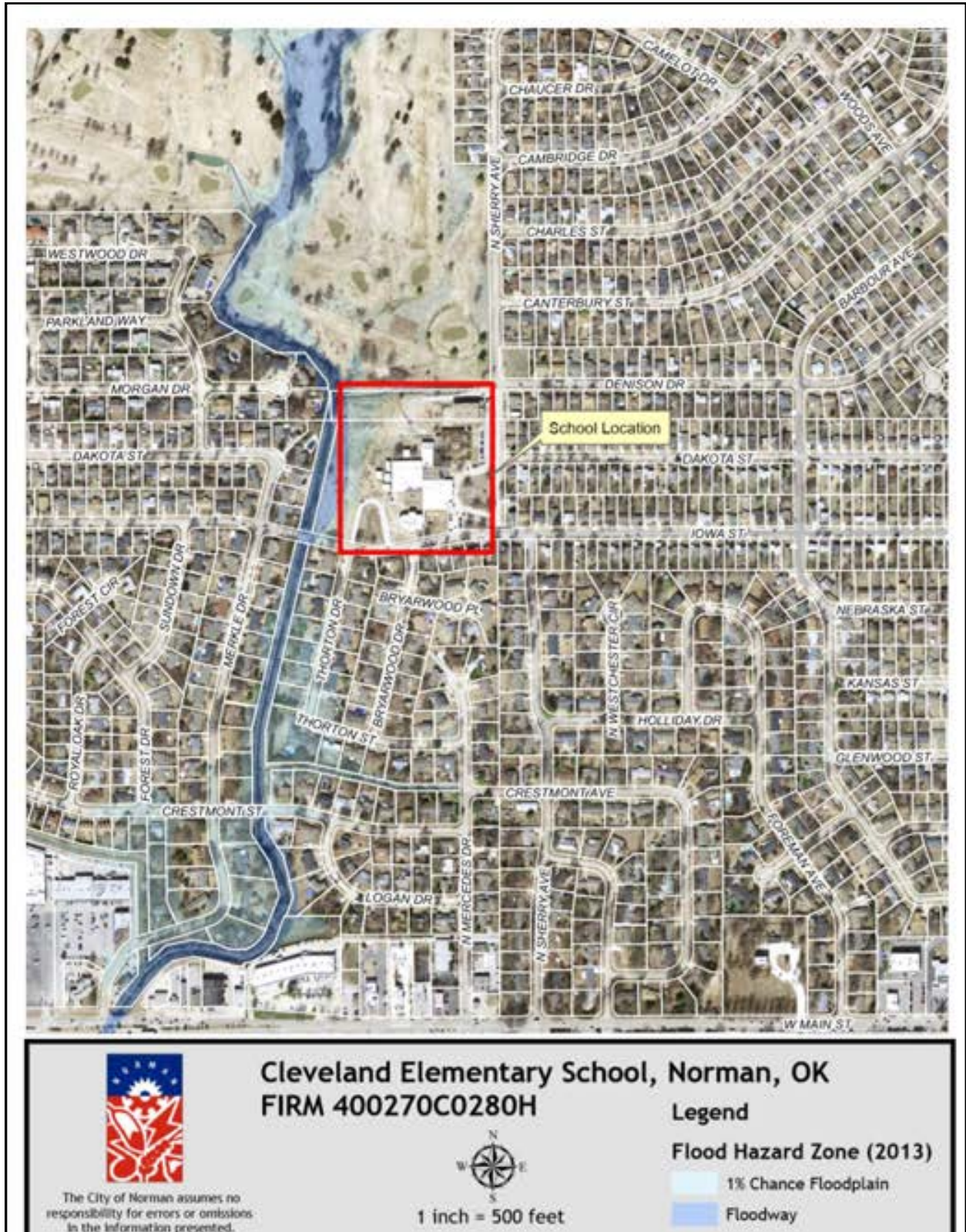
Flood Hazard Zone (2013)

- 1% Chance Floodplain
- Floodway


City of Norman School Maps












The City of Norman assumes no responsibility for errors or omissions in the information presented.

Dimensions Academy North & South, Norman, OK

FIRM 400270C0285H



1 inch = 500 feet

Legend

Flood Hazard Zone (2013)

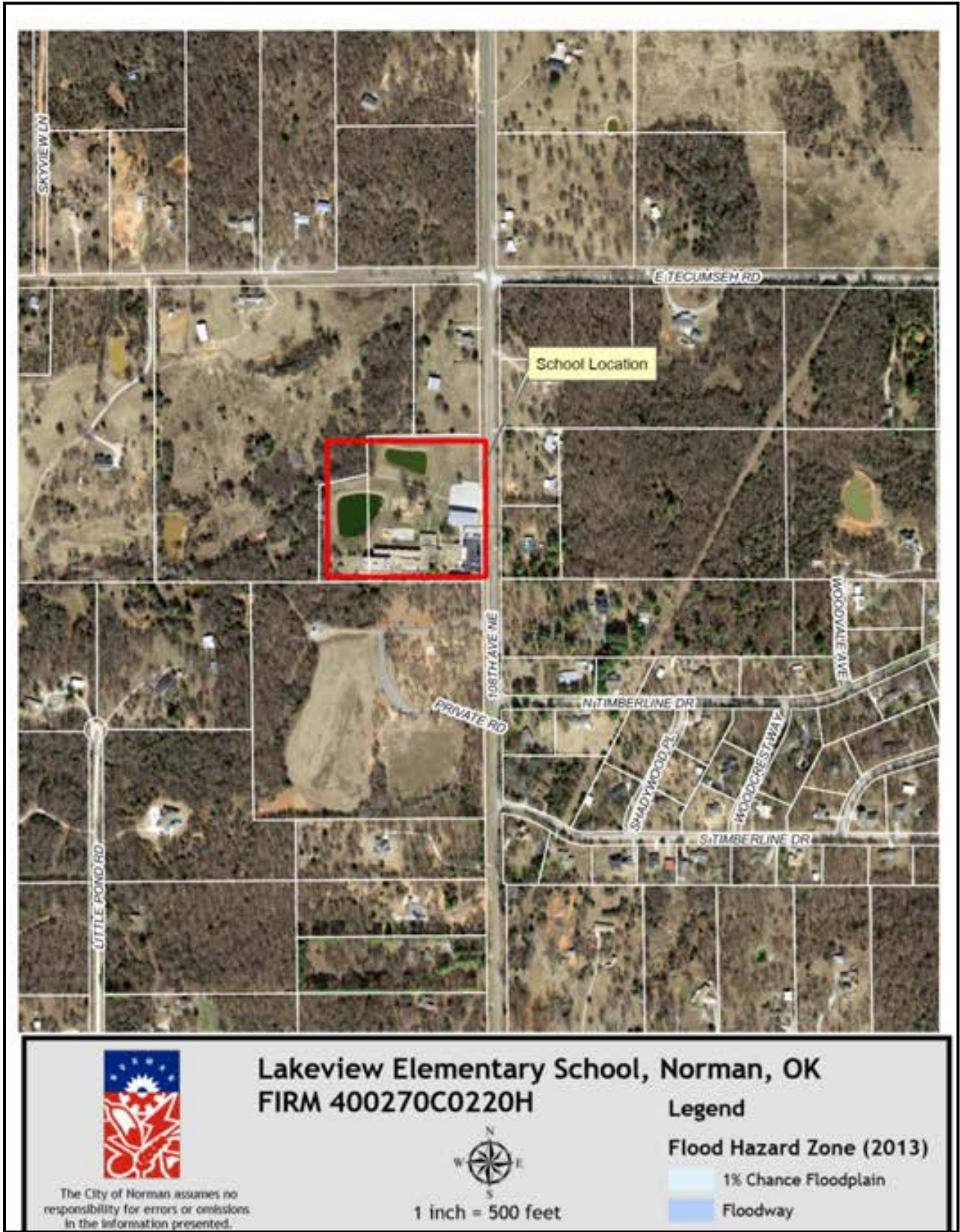
- 1% Chance Floodplain
- Floodway





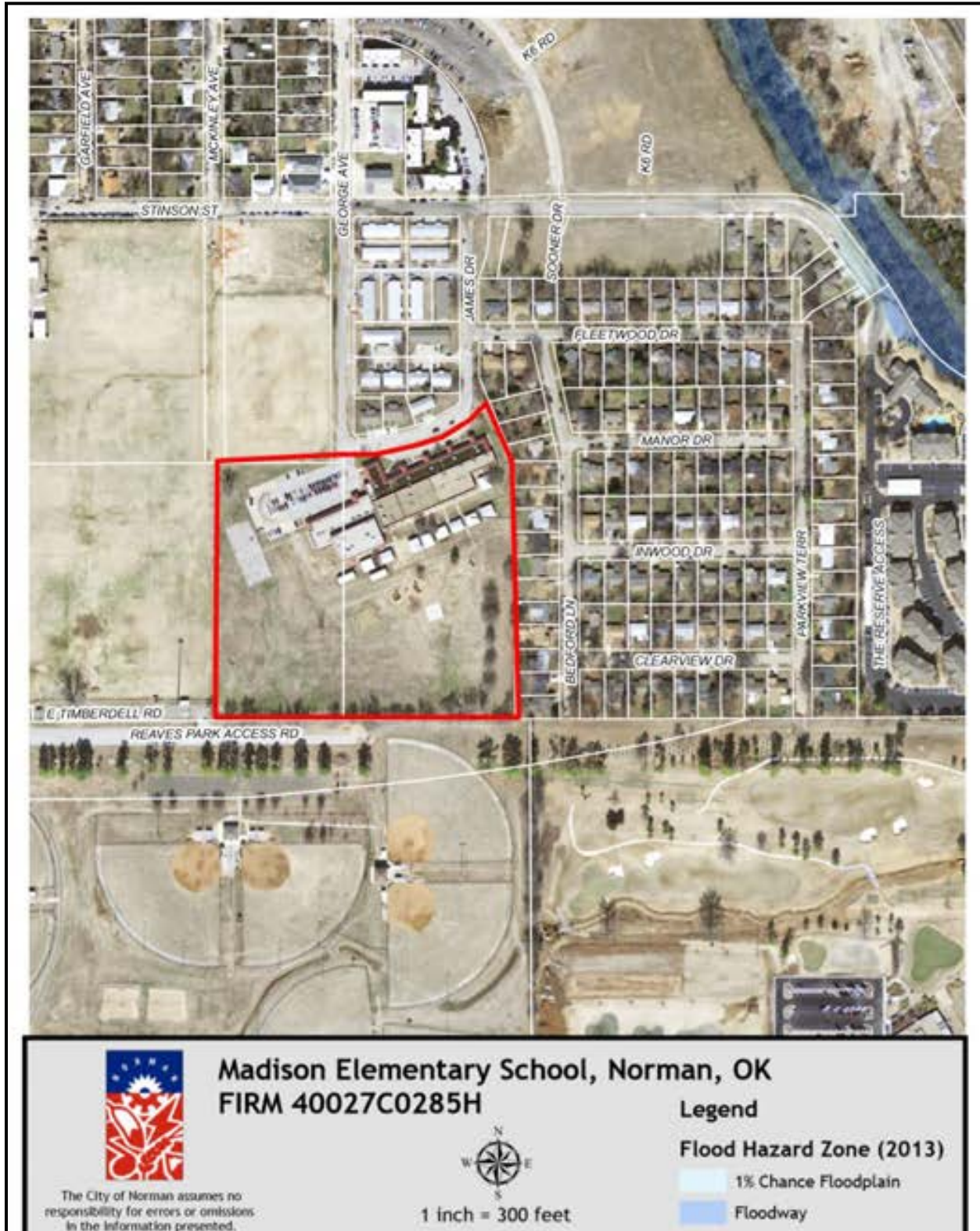














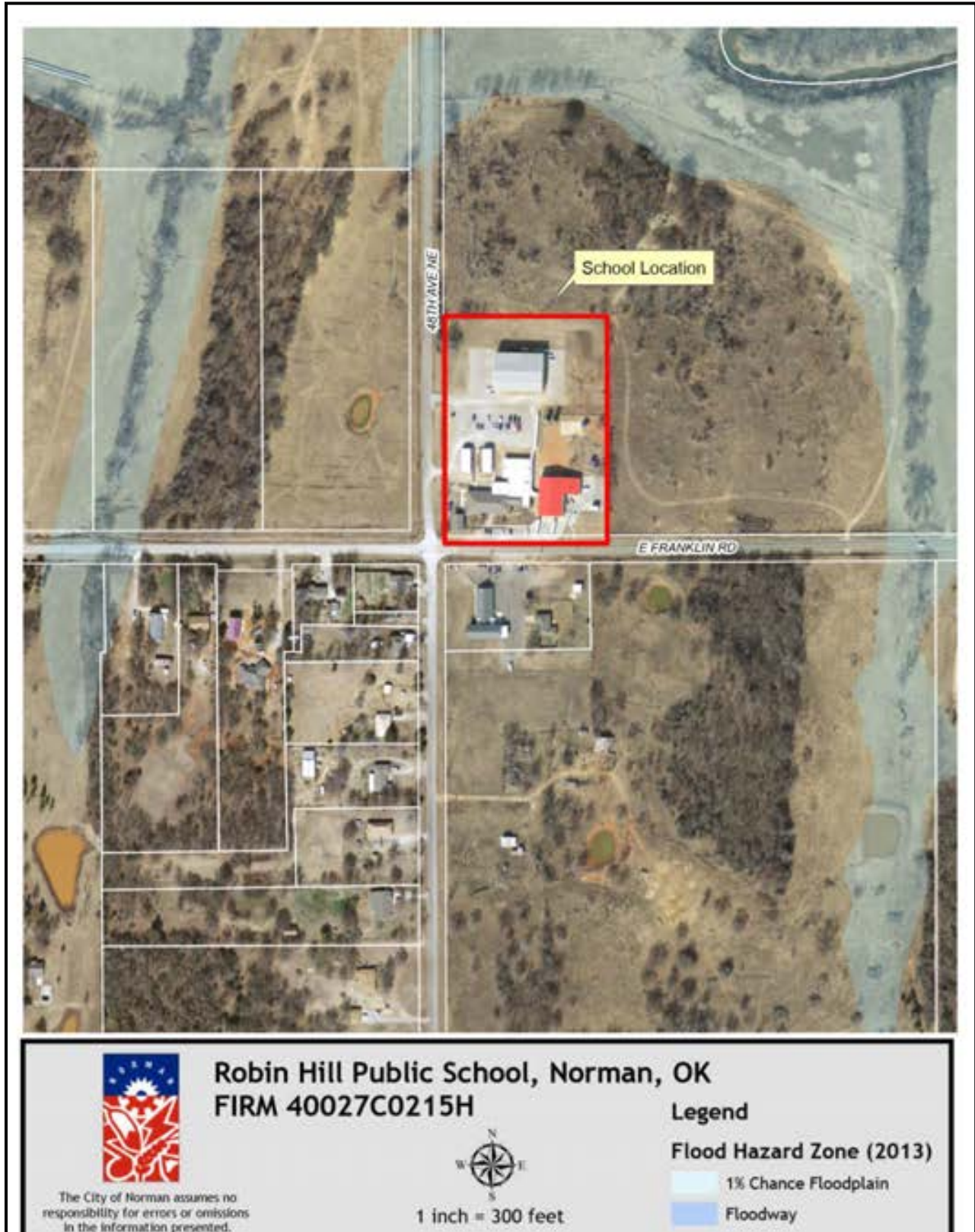








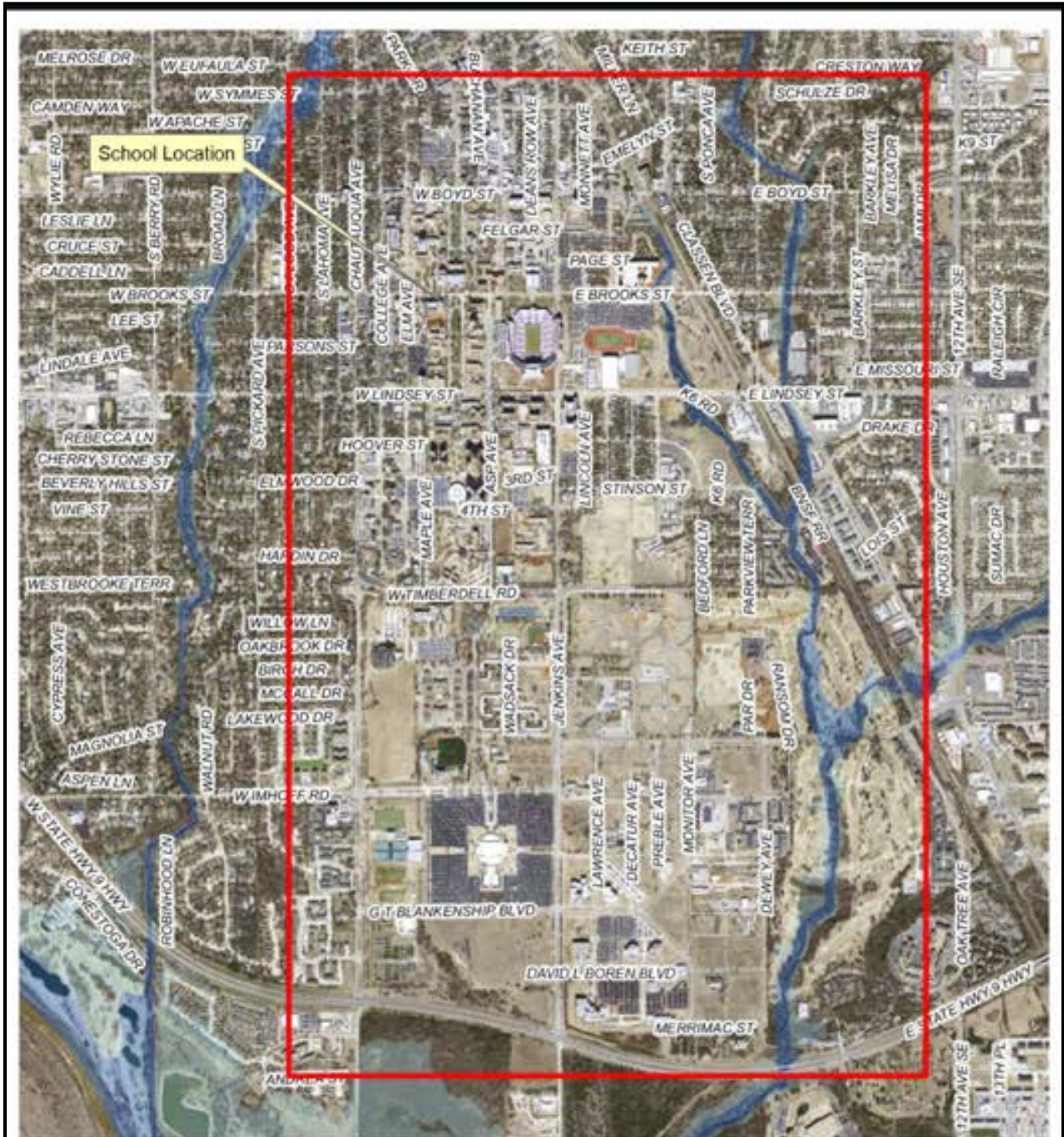
















The City of Norman assumes no responsibility for errors or omissions in the information presented.

University of Oklahoma, Norman, OK FIRMs 40027C0280H, 40027C0285H, 40027C0290H, 40027C0295J



1 inch = 1,667 feet

Legend

Flood Hazard Zone (2013)

- 1% Chance Floodplain
- Floodway





