MULTI-JURISDICTIONAL MITIGATION PLAN

Barton County, Kansas

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4.0 Risk Assessment

This risk assessment identifies the natural hazards affecting Barton County. It provides information on the history and severity of hazards, evaluates the possible effects, identifies vulnerable populations and assets (buildings, critical facilities and essential infrastructure), and estimates potential losses that might occur. This risk assessment process identifies the most critical problems and issues--identified as high and moderate--that require mitigation actions. In summary, the assessment identifies the hazards, assigns a likelihood value, evaluates vulnerability, and then calculates an overall risk index value.

The goal of risk analysis is to formulate an assessment of the probability of occurrence for a hazardous event in tandem with its anticipated severity. Probability or likelihood of occurrence is expressed in terms of events over time. Occurrence probability is determined from actual historical data when available. Otherwise, it may be described in relative terms (negligible, low, moderate, and high). Severity is expressed in relative terms of damage, injury, and overall residual impact resulting from the event. Severity is determined from utilizing established rating systems (e.g., National Fire Protection Association (NFPA) Material Factors, Fujita Scale, Mercalli/Richter Scale, etc.) or may be derived from subjective criteria based on justifiable assumptions. Worst-case scenarios can be assumed. Elaborate quantitative release probabilities are generally not required. Risk analysis should focus on creating reasonable estimates based on the best available data. Primary components include the following:

- Probability that a release will occur and any unusual environmental conditions, such as flood plain areas, seismic activity, or potential for simultaneous occurrence of emergency incidents (e.g., flooding or fire hazards associated with the release of hazardous materials).
- Classification of potential harm to humans (acute, delayed, chronic) and identification of high-risk groups.
- Classification of potential harm and damage to commercial livestock (when applicable).
- Classification of potential damage to property (temporary, repairable, permanent).
- Classification of potential damage to the environment (recoverable, permanent).

4.1 Identification of Hazards

State Hazards Review

When considering the hazards identified for Barton County, the State Mitigation Plan was referenced as a comparison to the identified county hazards. The hazards identified on the State list were compared/eliminated based on the county-specific hazard analysis.

TABLE 4.1 (1) STATE OF KANSAS HAZARDS LIST (Alphabetically)

Agricultural Infestation	Dam and Levee Failure	Drought
Earthquake	Expansive soils	Extreme Temperatures
Flood	Fog	Hailstorm
Hazardous Materials	Land Subsidence	Lightning
Major Disease Outbreak	Radiological	Soil Erosion and Dust
Terrorism/Agri-Terrorism/Civil Disorder	Tornado	Utility/Infrastructure Failure
Wildfire	Windstorm	Winter Storm

The State, County, and local plans do not address the FEMA listed hazards in Table 4.1 (2) because they do not exist or threaten the jurisdictions of Kansas. As an example, the topography of Kansas does not contain mountainous areas which would support the possibility of avalanche; the county is not adjacent to a coastline.

TABLE 4.1 (2) NON-PROFILED HAZARDS

*Thunderstorm
Avalanche
Coastal Erosion
Coastal Storm
Hurricane
Tsunami
Volcano

*FOOTNOTE: Thunderstorm, as a specific event, is not included in this analysis. Thunderstorms are common occurrences in Barton County, but are considered low-risk due to their typical weak intensity. However, this plan does address some of the more significant and severe effects of thunderstorms that are ranked as high and moderate as stand-alone events.

The jurisdictions comprising this plan have chosen to use the 60 years of data (1950 through 2010) available from NOAA's National Weather Service (NWS) in order to identify hazards which have had an impact on a local basis. The advantage to using this database is that it provides location, extent, probability and severity for documented and reported events over the designated time period. The intent is to compare the hazards to the State Hazard list and then to apply extent and probability in order to prioritize and rank the hazards.

NOAA has indicated that the weather database is updated and revised as new information is made available. As a result, data found in the online database at one year may not match to the data listed in consequent years. This Plan uses the following to establish likelihood:

Tornado: 1950 (or 1st reported event date) through 2010
Hail: 1955 (or 1st reported event date) through 2010
TSTM Wind: 1955 (or 1st reported event date) through 2010
All other hazards: 1993 through 2010 (18 years)

A summary of Federally-declared disasters for the the State of Kansas from 2008 through 2010 is provided in the appendix under Supporting Documents.

The MPC found insufficient local data to document or report on these hazards; estimated the overall probability as low; or found that they are covered by other circumstances or plans as noted below. Consequently, the MPC eliminated them as hazards to address in the plan (reference Section 4.2 - Risk and Vulnerability). It should be recognized that the NOAA data for the overall multi-jurisdictional area did not document or report events for the following State listed hazards.

Agricultural infestation – Eliminated; the MPC found insufficient jurisdiction specific data to support this hazard. Generally, local infestations are mitigated by the land owner with limited other assistance. Livestock related infestation would be covered by the County Foreign Animal Disease Plan.

Drought - NOAA data for drought has been matched to this state hazard. Eliminated; the MPC found insufficient data to support this hazard as a high or moderate type. Related crop or agro damage was found to be covered by private insurance.

Expansive soils - Eliminated; the MPC found insufficient data to support this hazard as a high or moderate type.

Extreme Temperatures – NOAA data for Extreme Windchill/Cold has been matched to this state hazard. Eliminated; the MPC found insufficient data to support this hazard as a high or moderate type.

Fog - NOAA data for fog has been matched to this state hazard. Eliminated; the MPC found insufficient data to support this hazard as a high or moderate type.

Hazardous materials – Eliminaated. The MPC found that this potential hazard is addressed by the County Local Emergency Operations Plan (LEOP) and other requirements of SARA Title III. Preparation, mitigation, and funding are addressed by the LEOP.

Land subsidence - Eliminated; the MPC found insufficient data to support this hazard as a high or moderate type. There was one reported incidence of land subsidence that occurred at the Panning Sinkhole in the Chase-Silica oil field in Barton County, Kansas, on April 24, 1959. The event was reported to be caused by oil drilling operations in the area. Since the occurrence in 1959, there has not been any expansion or movement of the Panning Sinkhole. It was determined in the KGS Study published in 1978 (Kansas Geological Survey Bulletin 214), that land subsidence areas in central Kansas associated with rock salt dissolution that such subsidence areas attributable to man's activities are rare and unusual features. Oil-related subsidence areas occur in a ratio of one to each 10,000 holes drilled through the Hutchinson Salt. Subsidence areas related to the mining of salt average only one for each 17 years for 88 years of continuous salt production. The MPC will continue to monitor and evaluate this area for future plan undates.

Lightning - NOAA data for lightning has been matched to this state hazard. Eliminated; the MPC found insufficient data to support this hazard as a high or moderate type.

Major disease outbreak – Eliminated; the MPC found that this potential hazard is addressed by the County Public Health Plan (CPHP) and its continuing development. Preparation, mitigation, and funding are addressed by the CPHP.

Radiological – Eliminated; no documented or reported significant events. No reported facilities in the jurisdictions with reportable quantities per SARA Title III. This hazard would be addressed as part of the Local Emergency Operations plan when identified.

Soil Erosion and Dust – Eliminated; the MPC found insufficient data to support this hazard as a high or moderate type.

Unique Hazards

(Hazards which are not on the state list, but may be in the NOAA data, or supported by the MPC, will be listed.)

Microburst - NOAA data reviewed. Eliminated; the MPC found insufficient data to support this hazard as a high or moderate type.

Funnel Cloud - NOAA data reviewed. Eliminated; the MPC found insufficient data to support this hazard as a high or moderate type.

Blizzard - NOAA data reviewed. Eliminated; the MPC found insufficient data to support this hazard as a high or moderate type.

Sleet - NOAA data reviewed. Eliminated; the MPC found insufficient data to support this hazard as a high or moderate type.

Freeze - NOAA data reviewed. Eliminated; the MPC found insufficient data to support this hazard as a high or moderate type.

Freezing fog- NOAA data reviewed. Eliminated; the MPC found insufficient data to support this hazard as a high or moderate type.

Where provided, the NOAA data for all types is listed for informational purposes and future planning consideration. Please note the following with regard to the following Tables and Figures:

- Flood - NOAA data for flood and flash flood has been matched to this state hazard and are combined under Flood for planning purposes. Event magnitude and severity ratings are averaged from the event ratings (reference Tables 4.2 (1) and 4.2 (2)). Worst case scenario for flood is applied to each jurisdiction by applying the county risk ranking (that accounts for NCDC reports in the jurisdiction).
- Windstorm - NOAA data for TSTM wind and high wind has been matched to this state hazard and are combined in the plan as TSTM wind. Event magnitude and severity ratings are averaged from the event ratings (reference Tables 4.2 (1) and 4.2 (2)).
- Winter Storm - NOAA data for hazards listed under Snow and Ice has been matched to this state hazard. Event magnitude and severity ratings are averaged from the event ratings (reference Tables 4.2 (1) and 4.2 (2)).
- Magnitude classifications for tornadoes are based upon the accepted intensity scales for each. Other hazards are classified by their maximum potential severity or as otherwise deemed appropriate.
- The following tables illustrate the results from applying the risk-rating algorithm for analysis and hazard profile, and form the basis of risk for each type of potential hazard event identified in Barton County.
- The hazards Dam/Levee, Terrorism/Agri-Terrorism/Civil Disorder, and Utility Failure are State mandated hazards which must be considered and addressed in all Kansas plans. Table 4.1 (3) indicates no documented or reported events in the NOAA database. Any documentation of events outside this database will be discussed in the hazard profile. Since the MPC has elected to address only hazards ranked as high and moderate, these hazards were given a risk rating of 1, which would cause them to rank in the moderate category. This will also incorporate the hazards into the review process over the next five years.

TABLE 4.1 (3) BARTON COUNTY RISK RATING

Event	# Events	# Years	Likelihood (Li)	Severity Index (Avg)	Severity Index (Avg)	Severity Index (Avg)	Severity Index (Avg)	Severity Index (Avg)	Severity Rating	Risk Rating
			Events/ Years	M	D	I	Pd	Cd	Sr=M+D+ I+Pd+Cd	R=(Sr) x (L)
Hail	291	56	5.20	3	0.5	0.5	2	2	8	41.57
* Wildfire	712	52	13.69	0.5	0.5	0.5	0	1	2.5	34.23
TSTM Wind	207	55	3.76	0.5	0.5	0.5	2	0.5	4	15.06
Winter Storm	27	18	1.50	3.5	1	0.5	2	0.5	7.5	11.25
Flood	22	18	1.22	4.5	0.5	0.5	2	0.5	8	9.78
Tornado	77	60	1.28	1	1	0.5	2	0.5	5	6.41
Excessive Heat	5	18	0.28	2	2	0.5	0.5	0.5	5.5	1.53
(M) Terrorism / AT / CD	0	0	0.00	0	0	0	0	0	0	1.00
(M) Dam/Levee	0	0	0.00	0	0	0	0	0	0	1.00
(M) Utility Failure	0	0	0.00	0	0	0	0	0	0	1.00
** Earthquake	25	110	0.23	1	0.5	0.5	0.5	0.5	2.5	0.68

Table Footnotes:

*Reported events and likelihood estimates are based on averages from wildfire exponential smoothing of Kansas Fire Marshal data.
**Reported events and likelihood estimates are based on KSGS data for earthquake, and include an analysis for the State average of occurrences.
(M) = State-mandated planning hazard. (Dam data is provided by the State of Kansas Department of Agriculture-Water Resources, and provides dam “classifications” based on potential downstream damage, and is not an evaluation of dam condition or determination of “likelihood”.)

4.2 Risk and Vulnerability

Due to the limitations of capabilities, discussed in other sections, and the overall desire to focus on the key hazards, the participating jurisdictions chose to rank or prioritize the local hazards. As most jurisdictions are just beginning the overall mitigation planning process and are cognizant of the need to focus the available time and effort, the following methods were used to produce the overall priority rankings of the local hazards. Each year the jurisdictions will review and update its available resources and evaluate the benefit of including low or negligible hazards.

The availability of detailed, consistent, and reliable data provided by the National Climatic Data Center (NCDC) allows the calculation of relative risk values for natural weather events. A standardized set of data is routinely tracked by the NCDC for an established inventory of individual natural hazard types. NCDC has tracked this type of data for over 60 years, and has set the standard for developing likelihood and severity for damage events. For this reason, a similar algorithm has been established for other hazards identified in this plan to formulate a hazard risk rating to normalize risk comparison.

The columns in Table 4.1 (3) record information regarding the frequency, and impact (or strength) of the particular natural event and include the following:

- Likelihood (occurrences over time);
- Magnitude (in terms of Fujita Scale, hail diameter, or wind speed);
- Deaths;
- Injuries;
- Property damage;
- Crop damage.

This information provides the basis for establishing likelihood and severity ratings. The rate of occurrence is established from the data record time interval and the number of events recorded. These primary factors of severity and likelihood of occurrence provide the basis for calculating hazard risk.

As published in Hazard Identification and Risk Assessment by Geoff Wells (copyright 1996), a reasonable determination of risk may be obtained through the combined calculation of measured severity and the likelihood of occurrence for any particular hazard. Risk Rating can then be defined in the following equation:

Risk Rating (RR) = Severity Index (Si) X Likelihood of Occurrence (Li)

Risk Ratings were calculated for individual weather events and are presented in column 10 of Table 4.1 (3) – Barton County Risk Rating. This table combines the categories of likelihood and vulnerability to obtain the risk rating for each potential hazard.

The following table and figures have been completed to provide a summary of hazard events analysis, and present a broad profile of each hazard relative to one another. Determining the risk rating establishes a numeric ranking for each hazard relative to one another. The risk-rating process is then simplified into the risk index, Table 4.3 (1), which leads to conclusions on hazard risk and forms a basis for prioritizing future mitigation efforts as outlined in this plan.

The columns for Table 4.1 (3) are defined per the following two Figures. These assigned values are taken directly from the NWS data and allow for a direct calculation of overall risk by providing severity and likelihood.

The column labeled Severity Rating, or M, in Table 4.1 (3) is defined by Figure 4.2 (1) which is itself titled Event Magnitude Ratings (M) for natural events. Each event has been assigned a severity rating for magnitude based on the probable impact of the event. Gradational rating systems were employed to allow a more precise determination of magnitude. Where possible, gradational rating systems were developed from widely accepted rating systems currently in use. Gradational rating systems have been established for the following natural events: hail, wind, seismic, and wildfire. Magnitudes for hail events were developed from an assessment of the NCDC severe weather event database and are based on hailstone diameter. Magnitudes for tornado and high wind events are drawn directly from the Fujita Scale and are based on wind speed ranges. Magnitudes for seismic events were assigned relative to the Modified Mercali Index rating system which establishes earthquake magnitudes relative to damage thresholds. Magnitudes for wildfire events were generated through an assessment of the State Fire Marshall Office database and are based on financial loss in terms of appraised value per acre burned.

The columns labeled (D) Death, (I) Injury, (Pd) Property Damage, and (Cd) Crop Damage in Table 4.1 (3) are defined by Figure 4.2 (2) Severity Ratings. All of these categories are common parameters to natural events and are typically captured when recording and reporting natural event data. Death and injury indices are measured in terms of population impacted. Property and crop damage indices are measured in terms of financial loss (dollars). The gradational rating system for population and assets severity indices was established through evaluation of severity categories published in the Geoff Wells text, Hazard Identification and Risk Assessment (1996). These values are assigned based on the parameters listed in the body of the matrix which is in the last column.

Table 4.1 (3) uses all this data to calculate the Likelihood, total a Severity value, and then uses the formula of Likelihood X Severity = Risk to produce a risk or vulnerability value for each local hazard.

The data in images 4.2 (1) and 4. 2 (2) are either NOAA provided ratings or calculated ratings.

FIGURE 4.2 (1) MAGNITUDE RATINGS

Event Magnitude Ratings (M)								
		Assigned Values						
Weather Event	Criteria	0.5	1	2	3	4	5	Ratings
Earthquake (MMI)	IV	X						0.5
Earthquake (MMI)	V		X					1
Earthquake (MMI)	VI - VII			X				2
Earthquake (MMI)	VIII				X			3
Earthquake (MMI)	IX - X					X		4
Earthquake (MMI)	XI						X	5
Excessive Heat	> 105 Heat Index			X				2
Flood						X		4
Hail	<0.75 inch dia	X						0.5
Hail	> 0.75 to 1.0 inch dia		X					1
Hail	> 1.0 to 1.25 inch dia			X				2
Hail	> 1.25 to 1.5 inch dia				X			3
Hail	> 1.5 to 2.0 inch dia					X		4
Hail	> 2.0 inch dia						X	5
Tornado (F0)	65 - 85 MPH	X						0.5
Tornado (F1)	86 - 110 MPH		X					1
Tornado (F2)	111 - 135 MPH			X				2
Tornado (F3)	136 - 165 MPH				X			3
Tornado (F4)	166 - 200 MPH					X		4
Tornado (F5)	> 200 MPH						X	5
TSTM/High Wind(s)	40 - 72 MPH (35-62 knots)	X						0.5
TSTM/High Wind(s)	73 - 112 MPH (63-97 knots)		X					1
TSTM/High Wind(s)	113 - 157 MPH (98-136 knots)			X				2
Wild / Forest Fire	<= 1000	X						0.5
Wild / Forest Fire	> 1000 - 2000		X					1
Wild / Forest Fire	> 2000 - 3000			X				2
Wild / Forest Fire	> 3000 - 4000				X			3
Wild / Forest Fire	> 4000 - 5000					X		4
Wild / Forest Fire	> 5000						X	5
Winter Storm				X				2

The 3 hazards: Dam/Levee, Terrorism/AT/CD, and Utility Failure are mandated hazards. Each is assigned a Rating of 1.

FIGURE 4.2 (2) SEVERITY RATINGS

	Severity Ratings for People and Assets					
Parameter	0.5	1	2	3	4	5
Death (D)	0	1	>1 - 5	>5 - 10	>10 - 50	>50
Injury (I)	1	>1 - 10	>10 - 50	>50 - 100	>100 - 500	>500
Property Damage (Pd)	< 10K	>10K - 100K	>100K - 1M	>1M - 10M	>10M - 100M	>100M
Crop Damage (Cd)	< 10K	>10K - 100K	>100K - 1M	>1M - 10M	>10M - 100M	>100M

4.2.1 Likelihood of Occurrence

The data record time interval is determined from the difference between the beginning and ending dates of the record inventory. For natural hazard data, the data record time varies from approximately 18 years to 60 years. Table 4.1 (3) provides the data record time in the "#Years" column. The total number of individual weather events can be extracted from the inventory of data. Given this information, likelihood of occurrence (in units of events/year) for a particular weather event is calculated as the quotient of the number of weather events as the numerator and data record time interval as the denominator. Similar data is extrapolated for other hazards.

Likelihood of Occurrence (Li) = Number of Events / data record time interval (years).
Risk ratings for other types of hazards may be determined on the availability of historical frequency data and a subjective assessment of predicted severity.

NOAA has indicated that the weather database is updated and revised as new information is made available. As a result, data found in the online database at one year may not match to the data listed in consequent years.

The NCDC also reports certain types of storm events, such as blizzards, in regions or "zones", and as a consequence does not attribute certain hazard events to individual counties. To increase the accuracy of individual county event reporting, EFm's algorithm adjusts for the zone factor and attributes the events to each county that is included in the zone.

4.2.2 Severity Rating

Severity rating tables were established for each of the standard data categories tracked by the NCDC and assigned a lower limit of 0.5 and an upper limit of 5.0. From these tables, severity ratings were derived for each of the possible natural events. The severity ratings are identified as follows:

- Magnitude Sr (M)
- Death Sr (D)
- Injury Sr (I)
- Property damage Sr (Pd)
- Crop damage Sr (Cd)

The Severity Index (Si) for a particular event (Column 9 in Table 4.1 (3) is calculated as the sum of the five individual Severity ratings (Sr)).

4.2.3 Other Likelihood and Severity Values

Kansas Wildfire Risk Rating Procedure

The State Fire Marshal's Office has required counties to formally report wildfire since 1997. A summary of the database, by county, was provided to E-Fm for use in developing a severity and risk rating for this hazard event. Relatively little historical data was available, making a comparative analysis to other hazard events difficult. It was necessary to develop an events/time baseline for comparison of wildfire to other reported hazard events. To obtain the desired results, the consultant normalized existing data to more closely resemble reporting patterns found in the NCDC database, and expands the time element of the wildfire reporting data. Our target was to predict data for the time period of approximately 1950 to 2002.

The Plan Author compiled a state-wide database from all reported NCDC weather events since 1950 to develop the annual reporting events for the State of Kansas. This data was then sorted by year and analyzed utilizing exponential smoothing of the data. This is an accepted methodology to produce a smoothed Time Series. Comparatively, in single moving averages, the past observations are weighted equally, exponential smoothing assigns exponentially decreasing weights as the observations get older. In other words, recent observations are given relatively more weight in forecasting than the older observations. Based on the review of weather data, the assumption that wildfire reporting would follow a similar pattern was adopted.

In the case of moving averages, the weights assigned to the observations are the same and are equal to 1/N. In exponential smoothing, however, there are one or more smoothing parameters to be determined (or estimated) and these choices determine the weights assigned to the observations. For this analysis, 0.25 was used as the damping factor to eliminate unwanted cyclical and irregular variations. The result was a representative curve which could be used to predict past reporting of wildfire data.

The seven years of county data was averaged and used as the maximum value on the curve. The exponential curve was applied using this maximum value and individual yearly data were produced. This process provided a longer reporting period which effectively lowered the overall likelihood value and placed the risk rating for wildfires in a more usable range.

Seismic Risk Rating

Advances in technology, coupled with numerous federal, state and local research institutions have increased our awareness and understanding of seismic events through monitoring and tracking seismic activity across the country. There are two generally accepted methods for measuring the strength of a seismic event. The Richter scale is the most common method used by seismologists to quantify the magnitude of an earthquake. The modified Mercalli Scale (MMI) provides a semi-quantitative method for expressing earthquake intensity and is based on the type and amount of damage caused by the earthquake and the observations of people within the area where the activity is felt. By comparative conversion of the Richter and Mercalli measurements, in conjunction with past-recorded events and the seismic zone rating map of the United States, it possible to develop relative probability of occurrence for seismic events in tandem with its anticipated severity.

An objective assessment of this information will be made to determine the best available data for risk calculation. Likelihood of Occurrence will be measured in units of events/year. In cases where local or regional data is unavailable, state averages for occurrence frequencies will be used. Risk ratings for other hazards may be based on the availability of historical frequency data and a subjective assessment of predicted severity. Seismic event (earthquake) likelihood is based on statewide recorded events across a database time-frame of ~110 years.

4.3 Risk and Vulnerability Index

In order to accomplish the final relative priority ranking, a statistical analysis of the Risk Ranking values was undertaken for a representative number of values from across the state. The analysis was used to produce quadrants which could be used to identify the highest ranking through the lowest ranking hazards. The graphing of the data produced the normal curve of values and the three interior break points (changes in the slope of the curve) were identified. The analysis suggested the following values as dividing lines to form four ranking quadrants. The jurisdictions agreed to use the following definitions based on the Risk Ranking value analysis.

- High Risk = 5.0 or greater
- Moderate Risk = 1.00 to 5.0
- Low Risk = 0.76 - 0.99
- Negligible Risk = less than 0.75

Risk Index: reference the methodology section for greater detail in development of hazard risk-ratings for the identified hazards. For ease of interpretation in this format the Hazard Risk Index Ratings are based on either:

- 1 = High Risk
- 2 = Moderate Risk
- 3 = Low Risk
- 4 = Negligible

TABLE 4.3 (1) BARTON HAZARD RISK INDEX

Hazard	Relative Risk Rating	Hazard Risk Index Rating
Hail	41.57	1
Wildfire	34.23	1
TSTM Wind	15.06	1
Winter Storm	11.25	1
Flood	9.78	1
Tornado	6.41	1
Excessive Heat	1.53	2
Terrorism / AT / CD	1	2
Dam/Levee	1	2
Utility Failure	1	2
Earthquake	0.68	4

Table Footnote: M - State Mandated

4.3.1 Barton County Hazards Index

In many cases, the hazards common to the State Plan and Barton County's hazard assessment were determined to be low or negligible risk, and as a consequence, are not included as primary planning risks for the county. The focus of this mitigation plan is natural hazards, and also includes FEMA and State-required planning hazards for utility failure, terrorism/agri-terrorism/civil disorder, and dam/levee.

Barton County, Kansas, is faced with the following prioritized hazards and potential hazardous events. For the purposes of this planning event, Barton County has elected to only address the hazards classified as high and moderate, based on severity and frequency of occurrence. The results are presented in the following table:

Table 4.3.1 (1) NATURAL HAZARDS PRIORITIZATION (High, Moderate, Low, Negligible)

High Risk	Moderate Risk	Low Risk	Negligible Risk
Hail	Excessive Heat		Earthquake
Wildfire	Terrorism / AT / CD		
TSTM Wind	Dam/Levee		
Winter Storm	Utility Failure		
Flood			
Tornado			

4.3.2 Conclusions on Hazard Risk

Based upon the completion of the hazard identification and analysis, hazards of significance have been classified as high or moderate. A majority of these hazards impact the entire county and are considered multijurisdictional hazards. FEMA and the State of Kansas has further delineated flood, dams/levees, and wildfire as hazards that vary across the planning area, and will be addressed as such in this plan. These classifications will be used as a basis for concentrating and prioritizing current and future mitigation efforts.

A summary of hazards is provided in Table 4.3.2 (1) for jurisdictions included in the Barton County Plan.

TABLE 4.3.2 (1) BARTON COUNTY HAZARDS SUMMARY

	Dam / Levee	**Excessive Heat**	**Flood**	**Hail**	**Terrorism/ AT / CD**	**Tornado**	**TSTM Wind**	**Utility Failure**	**Wildfire**	**Winter Storm**
Barton (UnInc.)	X	X	X	X	X	X	X	X	X	X
Albert		X	X	X	X	X	X	X		X
Claflin		X	X	X	X	X	X	X		X
Ellinwood		X	X	X	X	X	X	X		X
Galatia		X		X	X	X	X	X		X
Great Bend	X	X	X	X	X	X	X	X		X
Hoisington		X	X	X	X	X	X	X		X
Olmitz		X		X	X	X	X	X		X
Pawnee Rock		X	X	X	X	X	X	X		X
Susank		X	X	X	X	X	X	X		X
Barton County Community College		X		X	X	X	X	X		X
USD 112 - Claflin		X		X	X	X	X	X		X
USD 355 - Ellinwood		X		X	X	X	X	X		X
USD 428 - Great Bend	X	X		X	X	X	X	X		X
USD 431 - Hoisington		X		X	X	X	X	X		X

4.4 Moderate / High Hazard Profiles

A descriptive analysis follows with the general hazard profile, history and jurisdiction impacts, location and extents, and probability of occurrence for the significant hazards identified in Barton County. Historical records are used to help identify the level of risk, with the methodological assumption that the data sources cited are reliable and accurate.

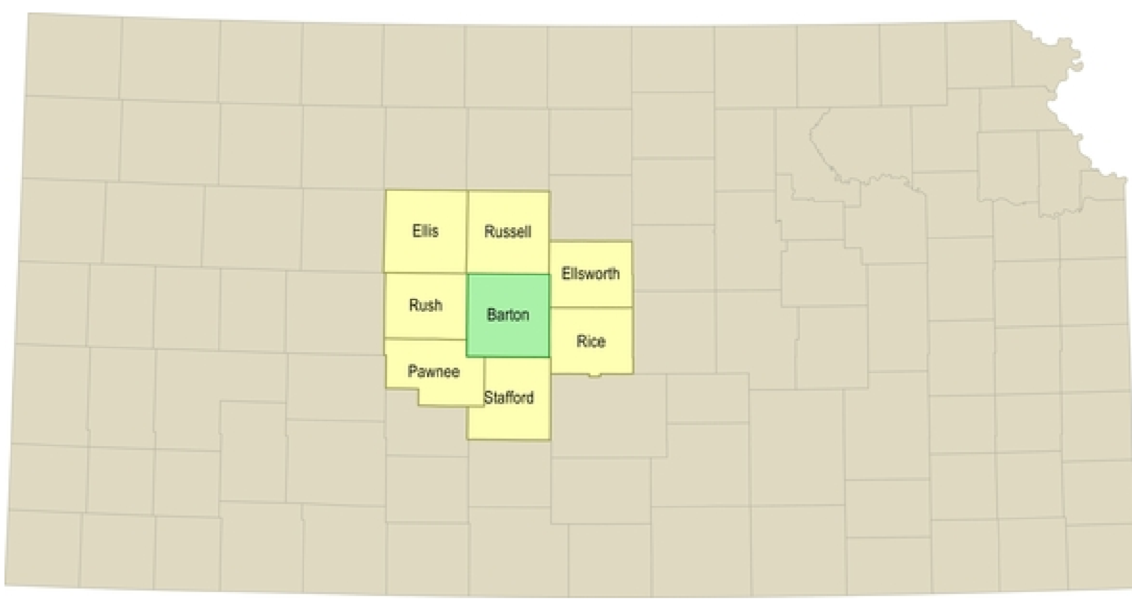
Due to its unique geographical setting, Barton County is vulnerable to a wide array of natural and man-made phenomena that pose a threat to life and property. This multi-jurisdictional mitigation plan is developed to address only the high and moderate hazards classified in the hazard/risk assessment. Other hazards identified during the assessment which were classified as low or negligible were statistically eliminated from priority planning based on the probability (likelihood) and vulnerability (severity) of these hazard events.

Barton County Profiles

Some hazards common to the State Plan and Barton County's hazard assessment were determined to be low or negligible risk, and as a consequence, are not included as primary planning risks for the county. The focus of this mitigation plan is natural hazards, and also includes FEMA and State required planning hazards for Utility Failure, Terrorism/Agri-terrorism/Civil Disorder, and Dams/Levees planning requirements.

In some instances, local jurisdictions have identified unique hazards not identified at the county level. These hazards are profiled by the specific jurisdiction.

Barton County and Surrounding Counties



4.4.1 MultiJurisdictional Hazard Profiles

Utility Failure

Hazard Profile

The concept of "cascading hazards" relates to the propensity of a primary or source hazard to spawn or generate additional hazards, commonly known as cascading hazards. On the first level, primary hazards can bring about secondary hazards. Subsequently, secondary hazards may escalate into tertiary hazards and so forth. The extent of cascading hazards is potentially limitless.

Power failure can be defined as any interruption or loss of electrical service due to disruption of power transmission caused by natural hazards (weather events), accident, sabotage, or equipment failure. A significant power failure is defined as a power incident, which would require the involvement of the local and/or state emergency management organizations to coordinate provision of food, water, heating, shelter, etc. Typically, a power outage is a cascading effect of a larger natural hazard.

In terms of electric power, Ark-Valley Electric COOP, Midwest Energy, Aquila Networks (now Wheatland and Western Electric COOPs), Rolling Hills Electric COOP, and municipal sources provides service to its citizens.

This disaster deals with the loss of electric power supplied by the local utility providers for potential loss of electricity during severe storms or ice accumulation on lines causing large areas of power outages within Barton County.

Additionally, this disaster could also cover very high levels of power usage during a severe heat wave that causes a utility company to resort to a series of rolling blackouts in which certain areas would be purposely shut off from power during peak usage times for four to five hours or more.

The failure of larger main electric feeder lines can also result in large area power outages.

History and Jurisdiction Impacts

The State of Kansas is part of one of four interdependent power grids (Eastern Interconnection) spanning the United States and Quebec, Canada. The electric power grid is a highly interconnected and dynamic system of over 3,000 public and private utilities and rural cooperatives. These utilities have incorporated a wide variety of information and telecommunications systems to automate the control of electric power generation, transmission, and distribution. Due to this interconnectivity, small outages can sometimes create problems on a large scale.

In recent years, regional electric power grid system failures in the western and northeastern United States have demonstrated that similar failures could happen in Kansas. This vulnerability is most appropriately addressed on a multi-state regional or national basis. Another recent concern that could affect the functioning of utilities and infrastructure is cybersecurity.

For the most part, it appears winter storms create the most widespread threat to electrical transmission failure in Barton County. Recent winter storms are discussed below.

December 6, 1994 - Beginning on the morning of the 6th, widespread freezing rain and sleet were reported across a large part of central Kansas. Numerous tree limbs were broken from trees and fell on power lines causing widespread power outages. One fatality was to blame on icy roads. An 18-year-old male was killed in a head-on collision on US Highway 56, 11 miles west of Great Bend. There were no reported damages or injuries for this event in the NCDC database.

March 17, 1998 - extensive damage to trees, power lines and power poles resulted from a winter storm.

There was $1,000,000 in reported damages, but no reported injuries.

December 10, 2007 - one to two inches of ice accumulated across Barton County during an ice storm. This resulted in approximately 500 downed power poles and 2000 downed lines. Damage to the electrical infrastructure was estimated at $9.8 million. There were no reported injuries for this event.

<u>Location and Extents</u>

The entire county is susceptible to utility failure.

<u>Probability of Future Occurrences</u>

Statistical data for analysis at the county level was not readily available so Barton County relied on the local winter storm data to quantify this hazard. Barton County can expect 1.50 utility failure events a year.

The risk of utility failure appears to be a random event.

Excessive Heat

Hazard Profile

Excessive heat is characterized by a combination of a very high temperatures and exceptionally humid conditions. The National Weather Service defines Excessive Heat as a Heat Index expected to exceed 105°- 110°F for at least 2 consecutive days. Reference Figure 1 – Heat Chart Index.

The major human risks associated with excessive heat include heatstroke, heat exhaustion, heat syncope, and heat cramps. Most at risk are outdoor laborers, the elderly, children, and people in poor physical health. The effects of severe summer heat are always more pronounced in urbanized areas than in rural areas. Within urbanized areas, the problem is exacerbated by what is known as the heat island effect, in which the concrete and metal infrastructure absorbs radiant heat energy from the sun during the day and radiates that heat energy during the night. This cyclical process essentially traps the heat in the urbanized area and makes it as much as 10 degrees warmer than the surrounding hinterland.

Excessive heat is an invisible killer. Although a heat wave does not happen with the spectacle of other hazards such as tornadoes and floods, the National Center for Environmental Health reports that, from 1979 to 1999, excessive heat exposure caused 8,015 deaths in the United States. In other words, during this period, more people in the U.S. died from severe summer heat than from hurricanes, lightning, tornadoes, floods and earthquakes combined.

History and Jurisdiction Impacts

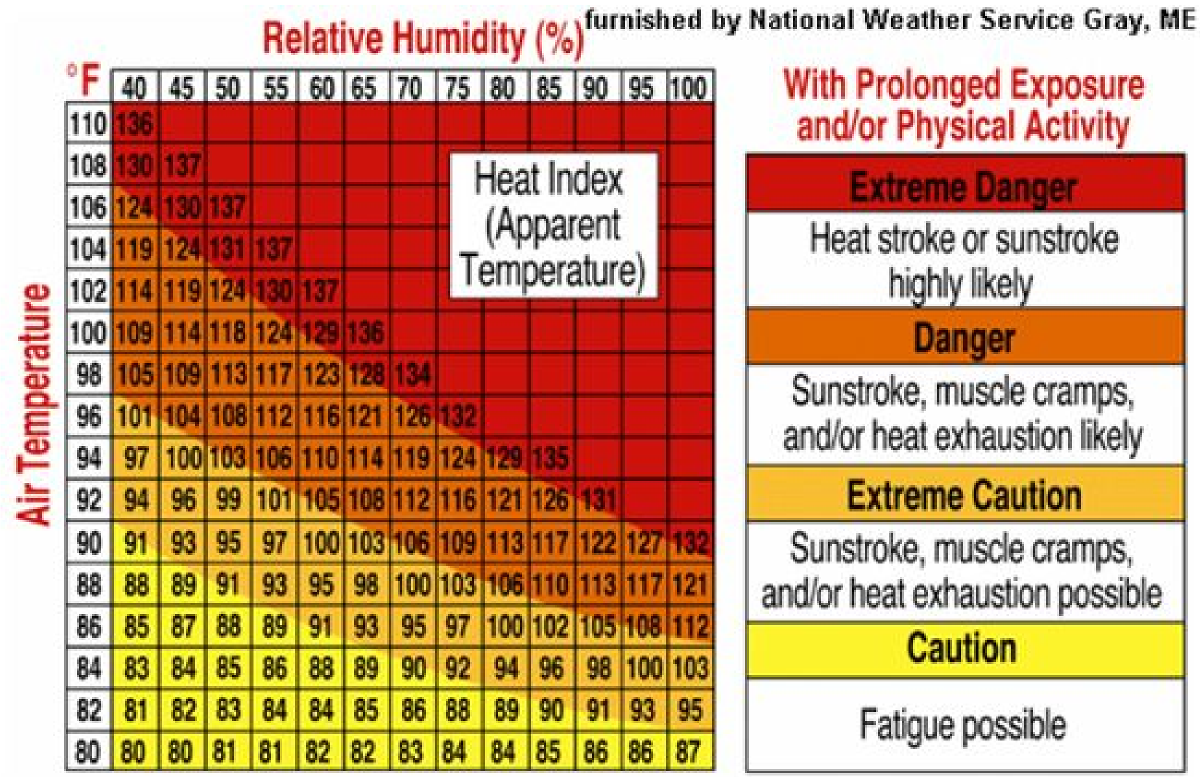
During the summer months, the State of Kansas is frequently affected by excessive heat. Persistent domes of high pressure establish themselves, which set up hot and dry conditions. This high pressure prevents other weather features such as cool fronts or rain events from moving into the area and providing necessary relief. Daily high temperatures range into the upper 90’s and low 100’s. When combined with moderate to high relative humidity levels, the heat index moves into dangerous levels, and a heat index of 105 degrees is considered the level where many people begin to experience extreme discomfort or physical distress. A summary of three events is as follows:

July 20, 2006 - From July 16-20, a deadly heat wave gripped much of central, south-central and southeast Kansas. Broad high pressure in the mid and upper levels of the atmosphere caused temperatures to soar into the 105-110 degree range, with afternoon heat indices about the same. The cover of darkness provided little in the way of relief, as overnight temperatures were slow to fall off, reaching only the upper 70s by sunrise for some locations. Unfortunately, the prolonged heat claimed five lives across south-central and southeast Kansas, most of them elderly men. Three occurred in Wichita, one in Iola, and another in Coffeyville. The heat unofficially claimed three other lives, two in Wichita and one in Coffeyville. Additionally, dozens of individuals across central, south-central and southeast Kansas were treated for heat-related illnesses. No damages were reported for this event.

June 20, 2010 - Oppressive heat and humidity for June standards affected central, south-central and southeast Kansas from the 20th through the 23rd. Afternoon heat indices from 103 to 107 degrees were common, highest generally east of the Kansas Turnpike over southeast Kansas. No reports of heat related illnesses, deaths, property or crop damages were received.

August 1, 2010 - The combination of temperatures around 100 degrees and dew points in the low to mid 70s combined to produce oppressive heat and humidity during the afternoon and early evening hours of August 1st through August 4th. The warm temperatures topped out at 109 degrees on August 3rd. Heat indices ranged from 105 to 115 degrees, mainly over south-central and southeast Kansas, but also over southern portions of central and east-central Kansas. The only relief from the heat was a stout southerly wind. No damages or injuries were reported for this event.

Figure 1 - Heat Index Chart



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

Location and Extents

The entire county is susceptible to excessive heat.

Probability of Future Occurrences

The likelihood or future probability is considered to remain as currently calculated. Barton County can expect one excessive heat event every 3.57 years (0.28 chance/year).

Although we extract data and probability of occurrence from historical data, the risk of excessive heat appears to be a random event.

Terrorism / AT / CD

Hazard Profile

Vector-based hazards have become an "emerging" threat to the state, local governments, and its citizens. Insects, infectious diseases, and naturally-occurring and man-made biological agents can pose a direct or indirect hazard to humans, livestock, and the state's economy. The State of Kansas has made this hazard a priority for the State and local government planning requirements.

Numerous definitions for “vector” have been proposed, and vary with the nature and focus of the specific discipline of research such as epidemiology, public health, mathematics, and most recently - Emergency Management. This section will focus primarily on Emergency Management’s role with infectious Foreign Animal disease (FAD), biological agents, and/or by-products utilized to create weapons of mass destruction (WMD), which could otherwise require a response from emergency management departments.

Other forms of communicable disease and biological/chemical agents are causes for concern. However, authority and response to these potential health issues resides with agencies and disciplines such as the Food and Drug Administration (FDA), Center for Disease Control (CDC), and Public Health Departments, and therefore will not be mentioned in this section. Emergency Management roles and responsibilities will likely change with time requiring refinement and expansion of response for this discipline.

Potential threats to U.S. agriculture and livestock can arise from a variety of pathogens and causative agents. Terrorist attacks against agricultural assets might be tempting, due to the perceived relative ease of attack, the plausible deniability toward accusations, and the limited number of plant seed varieties in use. Highly infectious naturally-occurring plant and animal pathogens exist outside the U.S. borders, and some agents are readily transported, inadvertently or intentionally, with little risk of detection.

Nature has already shown how easy it might be for a sophisticated, technically-informed state, group, or individual to attack crops and livestock by introducing a new parasite, predator, or disease. There are a host of “rusts” and “smuts” that can attack grain crops, as evidenced by past naturally-occurring events in the U.S.

The list of threats (exotic diseases) to livestock is substantial. They include, but are not limited to, animal disease, plant disease, Foot and Mouth Disease (FMD), vesicular stomatitis, Bovine Spongiform Encephalopathy (BSE), rinderpest, gibberella, African swine fever, highly pathogenic avian influenza, Rift Valley fever, lumpy skin disease, blue tongue, sheep and goat pox, swine vesicular disease, contagious bovine pleuropneumonia, Newcastle disease, African horse sickness, and classical swine fever.

Animal health officials define an exotic or FAD as an important transmissible livestock or poultry disease believed to be absent from the United States and its territories, and capable of generating potential significant health or economic impact. FMD, anthrax, BSE, rinderpest, and swine fever are potential ways to attack livestock.

History and Jurisdiction Impacts

Although terrorist-type activities/incidences are a relatively new type of threat to Kansas, these types of activities, if present, are not readily available or reported to the public. Barton County has not documented terrorist activities in their county, but the State of Kansas has made this hazard a priority for the State and local government planning requirements. Federal and state officials understand local-level resources will be the first to respond to any emergency situation and have acknowledged the fact that local planning and preparation, even if resources are exhausted quickly, will play a major role in mitigating a terrorist attack or outbreak of an exotic disease. Research suggests the best approach is to broaden the prevention, response and recovery spectrum for emergency operations planning to include all hazards, with the understanding that limited resources and funding at the local level will require quick evaluation of an event in order to efficiently respond to the emergency and to obtain state and federal assistance in a timely fashion.

The Department of Homeland Security required all states and local jurisdictions to update their terrorist security databases in 2003. Barton County provided a self-assessment of risk and vulnerability during this planning event. Additionally, the State of Kansas required all jurisdictions to plan for potential bio-terrorism events, and develop local foreign animal disease plans. As a result, Barton County has selected this hazard category as a priority for inclusion in the county's Mitigation Plan, as the role of emergency management will be fine tuned for prevention, response, and recovery activities involving a FAD and/or bio-terrorist event to provide the resource support needed to effectively and efficiently deal with the disease onset and lifespan.

Location and Extents

The entire county is susceptible to terrorism.

Probability of Future Occurrences

Although initial detection of this type of event is considered uncontrollable, it is highly possible an act of terrorism (domestic or other) could occur at any time given the right circumstances. However, the probability of future occurrence is reduced due to proactive preventative action on the part of Federal, State and local authorities. This proactive approach to preparation and prevention will help reduce the potential for losses to property and life as a result of terrorist or FAD outbreaks.

The risks associated with Terrorism appear to be a random event with a low risk probability, but is included in the plan as a state-mandated planning hazard.

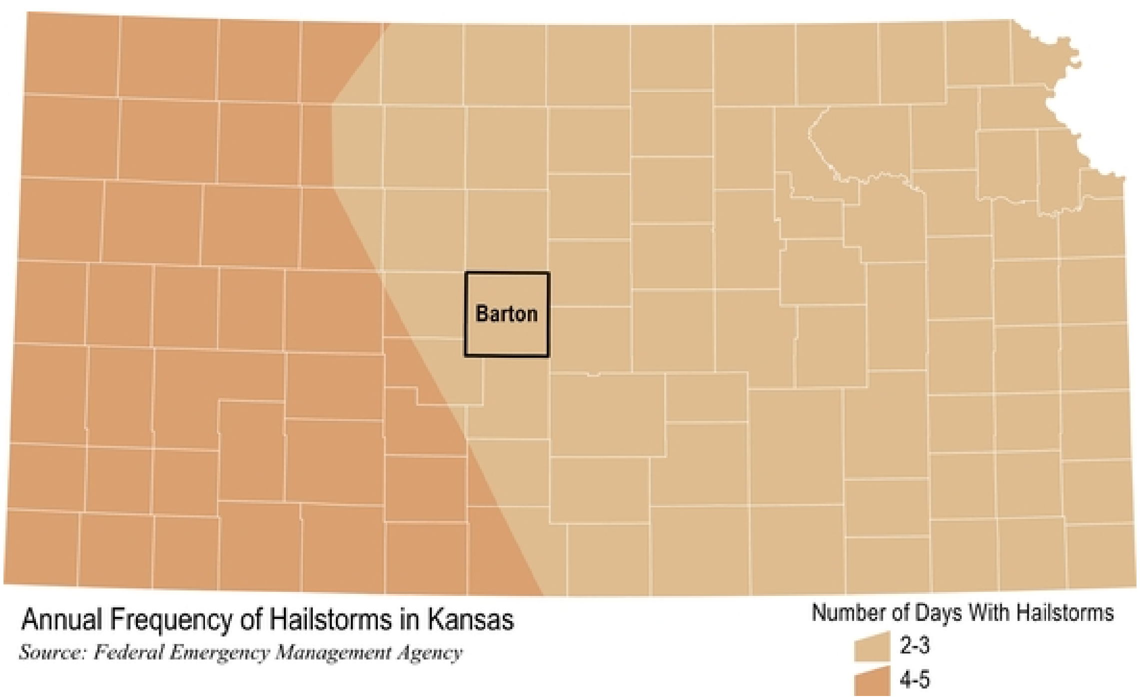
Hail

Hazard Profile

Hail can be produced from many different storm types. Typically, hail is a cascading hazard of a thunderstorm event. It is estimated that damage from hail approaches $1 billion in the U.S. annually. U.S. agriculture is typically the most affected by such hail storms. Hail causes severe crop damage and even a minor storm with relatively small-size hailstones can have a devastating effect. Damage to vehicles, roofs (residential/commercial), and landscaping are the other things most commonly damaged by hail, according to the National Weather Service (NWS) and National Oceanic and Atmospheric Administration (NOAA).

Early in the developmental stages of a hail event, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until, having developed sufficient weight, they fall as precipitation - as balls or irregularly shaped masses of ice greater than 0.75 in. (1.91 cm) in diameter. The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth's surface. Higher temperature gradients relative to elevation above the surface result in increased suspension time and hailstone size. Figure 1 shows the annual frequency of hailstorms in Kansas.

Figure 1 - Hailstorms in Kansas



History and Jurisdiction Impacts

There were 291 reported hail events in the 56-year recorded time frame for Barton County. No deaths and five injuries were attributed to the reported events. the National Climatic Data Center (NCDC) reported $21,538,000 in property damage and $6,075,000 in crop damages over the reporting period.

The largest hail event reported in Barton County was a 4.5-inch event which occurred May 15, 2002. There was no associated property or crop damage reports available through the NCDC for this event.

May 7, 1993 - Galatia reported 1.75 inch hail. The hail caused $50,000 in property damage, and $50,000 in crop damage. No deaths or injuries were reported for this event.

June 29, 2000 - 2.75 inch hail was reported in Great Bend. The hail injured five people, and caused $20,000,000 in property damage. No crop damage or deaths were reported for this event.

April 20, 2005 - Great Bend reported 3 inch hail. There were no injuries or crop damage associated with this event, but there was $500,000 in property damage.

Location and Extents

The entire county is susceptible to hail.

Probability of Future Occurrences

The probability of a hail event depends on certain atmospheric and climatic changes. The likelihood of future events is estimated to remain the same as currently calculated. Barton County can expect approximately 5.17 hail events a year with average annual damages of $493,089.

Although we can extract data and probability of occurrence from historical information the risk of hail appears to be a random event.

Tornado

Hazard Profile

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. It is most often generated by a thunderstorm and produced when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The damage from a tornado is a result of the high wind velocity and wind-blown debris, although they are commonly accompanied by large hail as well. The most violent tornadoes have rotating winds of 250 miles per hour or more and are capable of causing extreme destruction, including uprooting trees and well-made structures, and turning normally harmless objects into deadly missiles.

Most tornadoes are just a few dozen yards wide and touch down only briefly, but highly destructive tornadoes may carve out a path over a mile wide and several miles long. The destruction caused by tornadoes may range from light to inconceivable depending on the intensity, size and duration of the storm. Typically, tornadoes cause the greatest damages to structures of light construction, such as residential homes, and are quite localized in impact.

Each year an average of 800-1,000 tornadoes are reported nationwide and they are more likely to occur during the spring and early summer months of March through June. Tornadoes can occur at any time of day but are mostly likely to form in late afternoons and early evenings.

The magnitude or severity of a tornado was originally categorized using the Fujita Scale or Pearson Fujita Scale (introduced in 1971). The Fujita Scale categorizes tornadoes from F0 (Gale) to F5 (Inconceivable) based on wind speed. It is used to rate the intensity of a tornado by examining the damage caused by the tornado after it has passed over a man-made structure. Other scales have been developed to measure wind and tornado intensity including the Beaufort Wind Scales (B-Scales) and Britain's Tornado Storm and Research Organization (TORRO) Scale (T-Scale). However, the Beaufort and TORRO scales are generally not used to identify the severity or intensity of a tornado or wind event in the United States.

However, the original Fujita Scale recently become obsolete, due to many weaknesses in the system that have resulted is misuse and/or misunderstanding of the scale. It was replaced on February 1, 2007, by the Enhanced Fujita Scale, or EF Scale (Figure 1). This new scale continues to rate the strength of tornadoes in the United States based on the damage caused. The scale has the same basic design as the original Fujita Scale (six categories from 0 to 5 representing increasing degrees of damage). It was revised to reflect better examinations of tornado damage surveys, to align wind speeds more closely with associated storm damage. As with the Fujita Scale, though, each damage level is associated with a wind speed; the Enhanced Fujita Scale is a damage scale and the wind speeds associated with the damage listed remain unverified and little more than educated guesses. The EF Scale improved on the old scale on many counts - it accounts for different degrees of damage that occur with different types of structures based on how they are designed, both man-made and natural. It also provides much better estimates for wind speeds and sets no upper limit on the wind speeds for the strongest level, EF5 (NOAA-SPC, 2007).

Figure 1 - Enhanced Fujita Scale

Enhanced Fujita Scale Summary			
EF Scale Number	Intensity Phrase	Wind Speed (mph)	Type of Damage and Observations
EF0	Light Tornado	65-85	Light damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e. those that remain in open fields) are always rated EF0.
EF1	Moderate Tornado	86-110	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	Significant Tornado	111-135	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	Severe Tornado	136-165	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	Devastating Tornado	166-200	Devastating damage. Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	Incredible Tornado	>200	Total destruction. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (300 ft); steel reinforced concrete structure badly damaged; high-rise buildings have significant structural deformation; incredible phenomena will occur.

History and Jurisdiction Impacts

There have been 3,454 confirmed tornadoes in the State of Kansas since 1950-2008, resulting in 228 deaths and 2,699 injuries, with total damages estimated at $2,602,507,870. Typically, Kansas' tornadoes can be severe when compared to other parts of the country. Compared with other states, Kansas ranks number four in the country for frequency of tornadoes, third for number of deaths, third for injuries, and third for cost of damages.

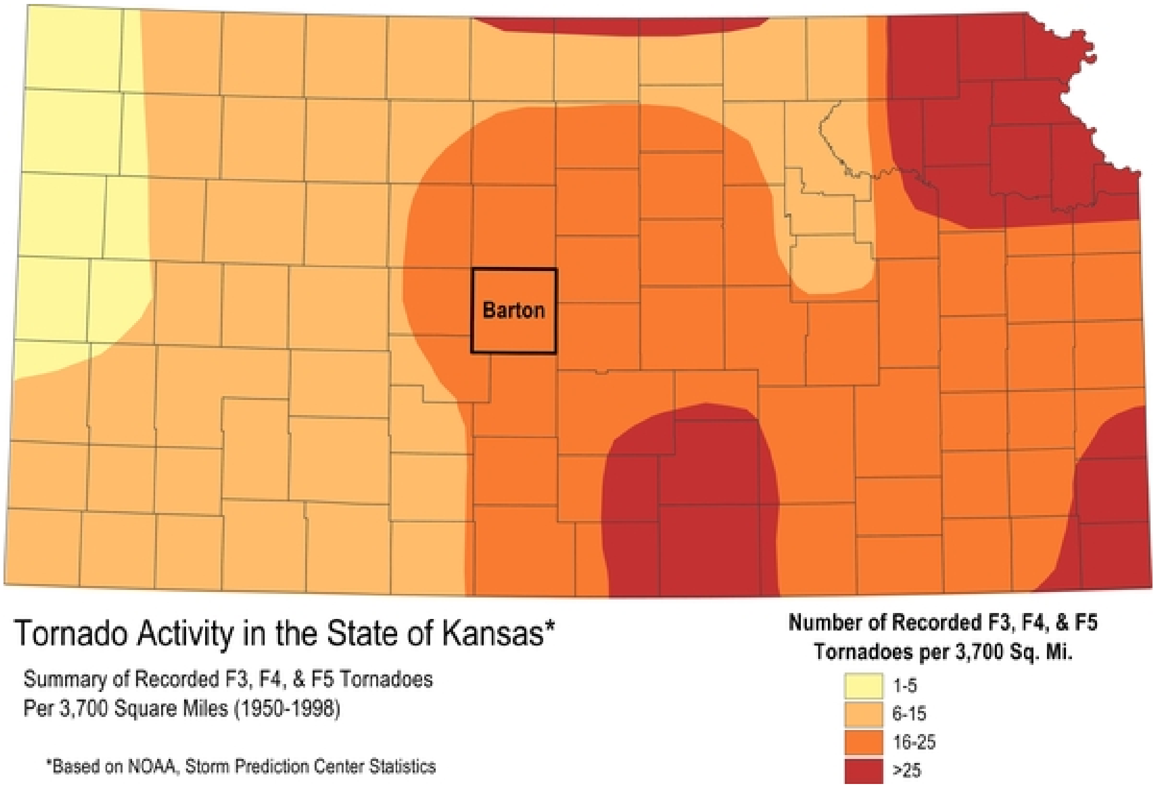
According to the National Climatic Data Center, there have been 77 reported tornadoes in Barton County since 1950 which have resulted in two deaths, forty one injuries, and approximately $49,382,000 in property damages and $10,000 in crop damages. To view the entire record of Barton County tornado events reference Figure 3. A summary of three events is provided as follows:

April 2, 1956 - a tornado with a magnitude of F3 was reported to be 350 yards wide and on the ground for twelve miles, injuring one person and causing $25,000 in property damage. No crop damage or deaths were reported for this event.

April 21, 2001 - a tornado with a magnitude of F4 was reported in Hoisington. The tornado was reported to be 660 yards wide and on the ground for five miles. The tornado killed one person, injured twenty-eight, and caused $43,000,000 in property damage.

May 5, 2007 - a tornado with a magnitude of F1 was reported in Claflin. The tornado was on the ground for six miles and 100 yards wide, and caused $2,000,000 in property damage, with no reported injuries.

Figure 2 - Tornado Activity in the State of Kansas



<u>Location and Extents</u>

The damage from a tornado is a result of high wind velocity and wind-blown debris. The potential damage resulting from a tornado is directly correlated to the strength of the particular tornado and is qualified utilizing the Enhanced Fujita Scale. The EF Scale assigns numerical values based on wind speeds and categorizes tornadoes from EF0 through EF5. The Enhanced Fujita Scale is shown in Figure 1. The entire planning area is susceptible to tornado.

<u>Probability of Future Occurrences</u>

The likelihood of future events is estimated to remain the same as currently calculated. Barton County can expect 1.28 tornadoes a year with average annual damages of $823,200.

Although we extract data and probability of occurrence from historical information, the risk of a tornado appears to be a random event.

Figure 3 - Tornadoes in Barton County

Date	Time	Mag	Dth	Inj	PrD	CrD
5/4/1950	11:10 PM	4	0	0	$250,000	
5/6/1955	5:00 PM	0	0	0	$2,500	$0
9/22/1955	5:45 PM	0	1	0	$0	$0
4/2/1956	6:00 PM	0	0	0	$0	$0
4/2/1956	8:30 PM	3	0	1	$25,000	$0
4/2/1956	8:50 PM	3	0	0	$25,000	$0
5/28/1956	7:18 PM	0	0	0	$0	$0
10/29/1956	9:33 PM	3	0	1	$250,000	$0
4/22/1957	6:35 PM	0	0	0	$30	$0
5/28/1962	4:30 PM	2	0	0	$2,500	$0
6/26/1962	4:30 PM	0	0	0	$250	$0
7/12/1963	5:30 PM	0	0	0	$0	$0
7/17/1963	12:01 AM	0	0	0	$25,000	$0
4/22/1964	4:00 PM	3	0	0	$250,000	$0
5/5/1964	2:50 PM	2	0	0	$25,000	$0
6/10/1964	7:00 PM	1	0	0	$0	$0
6/10/1964	7:00 PM	1	0	0	$0	$0
6/10/1964	7:40 PM	2	0	0	$250,000	$0
6/12/1964	9:25 PM	2	0	1	$25,000	$0
8/6/1966	7:25 PM	2	0	1	$25,000	$0
6/11/1970	6:45 PM	0	0	0	$0	$0
11/19/1973	6:35 PM	1	0	0	$250,000	$0
8/30/1974	5:30 PM	1	0	0	$25,000	$0
5/27/1975	9:30 PM	3	0	0	$250,000	$0
6/28/1976	3:40 PM	1	0	0	$25,000	$0
5/29/1980	7:17 PM	0	0	0	$0	$0
7/8/1982	3:55 PM	1	0	3	$25,000	$0
10/16/1984	12:36 PM	0	0	0	$0	$0
5/24/1990	4:03 PM	0	0	0	$0	$0
5/24/1990	4:10 PM	3	0	4	$250,000	$0
5/16/1991	5:12 PM	0	0	0	$25,000	$0
5/16/1991	5:28 PM	0	0	0	$0	$0
5/16/1991	4:38 PM	1	0	0	$2,500	$0
5/16/1991	4:38 PM	1	0	0	$25,000	$0

5/7/1993	4:50 PM	0	0	0	$5,000	$5,000
5/7/1993	5:20 PM	1	0	0	$50,000	$5,000
5/25/1997	3:20 PM	0	0	0	$0	$0
5/25/1997	4:10 PM	0	0	0	$0	$0
5/25/1997	4:16 PM	0	0	0	$0	$0
9/29/1998	6:31 PM	0	0	0	$0	$0
9/29/1998	6:33 PM	0	0	0	$0	$0
5/10/1999	6:20 PM	1	0	0	$100,000	$0
3/23/2000	6:15 PM	0	0	0	$0	$0
4/21/2001	8:37 PM	0	0	0	$0	$0
4/21/2001	8:15 PM	4	1	28	$43,000,000	$0
5/20/2001	5:48 PM	0	0	0	$0	$0
5/20/2001	5:49 PM	0	0	0	$0	$0
5/11/2002	3:14 PM	0	0	0	$0	$0
5/11/2002	3:20 PM	0	0	0	$0	$0
5/26/2002	6:53 PM	0	0	0	$0	$0
5/26/2002	6:55 PM	0	0	0	$0	$0
3/27/2004	3:14 PM	0	0	0	$0	$0
7/7/2004	7:44 PM	0	0	0	$0	$0
7/7/2004	8:03 PM	0	0	0	$0	$0
7/7/2004	8:13 PM	0	0	0	$0	$0
7/7/2004	8:27 PM	0	0	0	$0	$0
4/10/2005	5:12 PM	0	0	0	$0	$0
8/19/2005	3:04 PM	0	0	0	$500,000	$0
8/19/2005	3:44 PM	1	0	0	$250,000	$0
8/19/2005	3:46 PM	0	0	0	$0	$0
5/4/2007	11:48 PM	0	0	0	$0	$0
5/4/2007	11:55 PM	0	0	0	$5,000	$0
5/5/2007	8:03 PM	1	0	0	$25,000	$0
5/5/2007	8:08 PM	1	0	0	$1,000,000	$0
5/5/2007	12:21 AM	1	0	0	$2,000,000	$0
5/5/2007	12:28 AM	1	0	0	$57,000	$0
5/5/2007	12:46 AM	1	0	0	$20,000	$0
5/5/2007	5:45 PM	0	0	0	$0	$0
5/5/2007	5:54 PM	0	0	0	$0	$0
5/5/2007	6:32 PM	1	0	0	$60,000	$0

Source: National Climatic Data Center

Mag: Magnitude	*Dth: Death*	*Inj: Injury*
PrD: Property Damage	*CrD: Crop Damage*	

TSTM Wind (thunderstorm / high wind)

Hazard Profile

TSTM / high winds are generally the result of severe thunderstorms. Severe thunderstorms are defined by the National Weather Service as storms that have wind speeds of 58 miles per hour or higher, produce hail at least three-quarters of an inch in diameter, or produces tornadoes. Thunderstorms simply require moisture to form clouds and rain, coupled with an unstable mass of warm air that can rise rapidly. Thunderstorms are most likely to happen in the spring and summer months and during the afternoon and evening hours, but can occur year-round and at all hours.

The National Weather Service defines high winds as sustained wind speeds of 40 mph or greater lasting for one hour or longer, or winds of 58 mph or greater for any duration. Reference Figure 4.2 (1) for magnitude indices.

History and Jurisdiction Impacts

Severe thunderstorms and high wind events are very common in Kansas, and cause a significant amount of property and crop damage annually. According to the National Climatic Data Center, there were a total of 207 reported TSTM / high wind events in Barton County during the period of 1956 to 2010, causing a reported $7,681,000 in property damage. Damages recorded included-downed trees and damaged roofs and structures (these events do not include tornadoes, as this hazard is discussed separately).

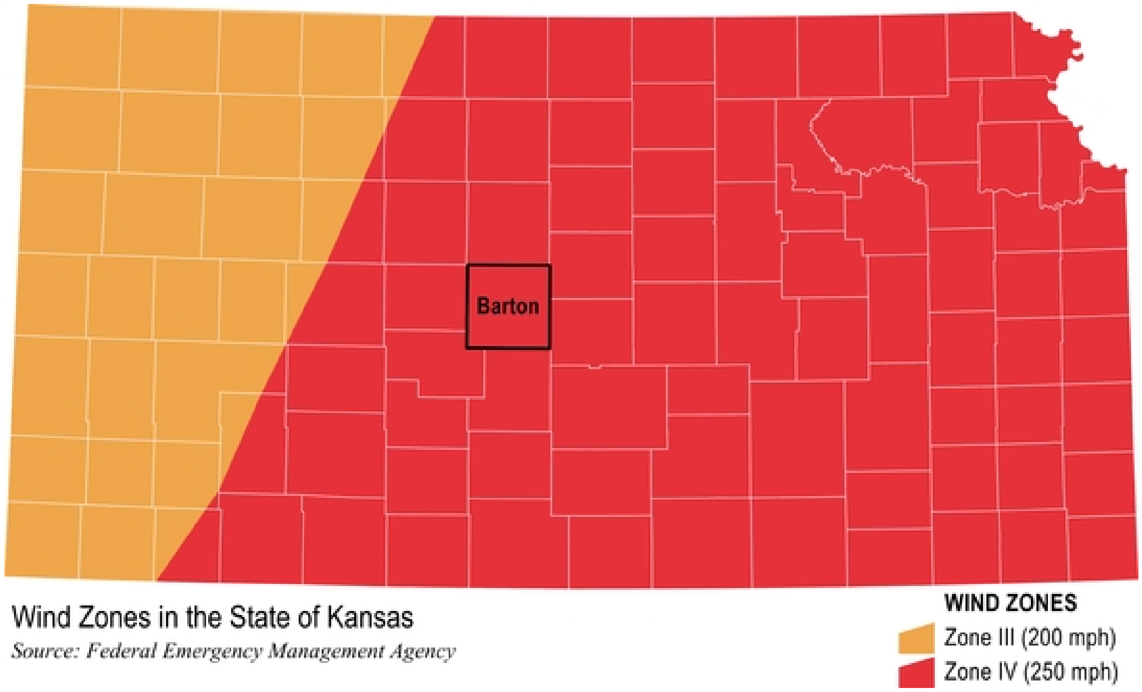
July 1, 1994 - TSTM winds were reported three miles north of Albert. The winds caused $500,000 in property damage. No crop damage or injuries were reported for this event.

September 29, 1998 - TSTM winds were reported in Great Bend. Property damage was estimated at $25,000, with no reported injuries for this event.

August 19, 2005 - Great Bend reported TSTM winds. Several buildings were damaged, and twelve people were injured. Property damage was reported to be $5 million, with no injuries attributed to this event.

The Wind Zones in the State of Kansas (Source: FEMA), depicted in Figure 1 provides an overview of the potential wind strength potential. Barton County lies within Zone IV, with wind speeds capable of up to 250+ miles per hour based on past historical data.

Figure 1 - FEMA Wind Zones in the State of Kansas



<u>Location and Extents</u>

The entire county is susceptible to TSTM Wind.

<u>Probability of Future Occurrences</u>

The probability of a thunderstorm event depends on certain atmospheric and climatic changes. The likelihood of future events is estimated to remain the same as currently calculated. Barton County can expect approximately 3.76 TSTM wind events a year with average annual damages of $139,655.

Although we can extract data and probability of occurrence from historical information, the risk of TSTM wind appears to be a random event.

Winter Storm

Hazard Profile

Winter storm can produce an array of severe weather conditions and is usually fueled by strong temperature gradients and an active upper-level cold jet stream. Winter storm can paralyze a community by shutting down normal day-to-day operations as accumulating snow and ice result in downed trees, power outages, and blocked transportation routes. Frequently, the loss of electric power means loss of heat for residents, which poses a significant threat to human life, particularly the elderly.

The level of impact winter weather will have upon a community greatly depends on its ability to manage and control the effects, such as the rapid mobilization of snow removal equipment. Many Kansas counties are small, and the costs to acquire and maintain the necessary resources to combat winter storm effects is expensive. Hence, many small communities are not prepared for such events.

The National Weather Service (NWS) describes different types of winter storm events as follows:

- Blizzard—Winds of 35 miles per hour (mph) or more with snow and blowing snow reducing visibility to less than 1/4 mile for at least three hours.
- Heavy Snow – Snowfall accumulating to four inches or more in depth in 12 hours or less, or snowfall accumulating to six inches or more in depth in 24 hours or less.
- Freezing Rain—Measurable rain that falls onto a surface with a temperature below freezing. This causes it to freeze to surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Most freezing rain events are short lived and occur near sunrise between the months of December and March.
- Sleet—Rain drops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects.

Figure 1 - Wind Chill Chart - National Weather Service (NWS)

Wind Chill Chart

Temperature (°F)

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

Frostbite Times: 30 minutes; 10 minutes; 5 minutes

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

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

History and Jurisdiction Impacts

Winter storm is typically associated with cold climates; but it is not uncommon for the State of Kansas to experience significant and even disastrous winter weather events. Since 1993, 38 deaths and 98 injuries have been attributed to snow and ice events throughout the state, along with an estimated $81,900,000 in property damage. In most instances, these impacts are determined by weather patterns and cannot be readily identified to particular regions of the state.

Barton County averages 16.2 inches of snow per year and has reported 27 winter storm-type events causing $40,898,000 in damages from 1993 through 2010. A summary of three events is as follows:

March 17, 1998 - an ice storm caused by a low pressure system that moved in a northeast direction across Oklahoma and southern Kansas. The low pressure induced a strong, sub-freezing northeast surface upslope that, when combined with strong 850-mb warm advection, produced widespread freezing rain across Central and parts of South-Central Kansas. The freezing rain combined with northeast winds of 20-30 mph to produce 1/2-1 inch of glazing across Central Kansas with the greater accumulation across Russell and Barton counties. Extensive damage to trees, power lines and power poles resulted including a 300-foot radio tower that toppled over in northern Russell County. Property damage was reported to be $1,000,000.

March 13, 1999 - heavy snow was reported when a low pressure system moved from northern New Mexico into northeast Texas and spread heavy snow across much of central, south-central and southeast Kansas resulting in accumulations ranging from 6-11 inches. South-central Kansas bore the brunt of the storm where 8-11 inches buried much of this region. The weight of the snow caused a roof to collapse at a shop in Harper (North-central Harper County) causing an estimated $5,000 damage. In Attica (West-central Harper County) snow inflicted damage to car awnings and tree limbs and was estimated at $3,000.

January 5, 2005 - a winter storm cold front surged south across Kansas & Oklahoma starting on January 3rd before stalling along/near the Red River during the afternoon of the 4th. A shallow layer of moist, sub-freezing air spread south over all but Southeast Kansas, as an 850-mb cold front, oriented in a southwest to northeast manner from the Oklahoma panhandle to near Kansas City, teamed with an inverted 850-mb trof positioned over western Kansas to enable much warmer, moisture-laden air to overrun the layer of sub-freezing air beneath. The result was what many consider to be the worst ice storm since 1982 to ravage all of central and most of south-central Kansas from the afternoon of the 4th through the morning of the 5th, coating almost the entire warning area with 1/2 to 1 inch of ice. Although freezing rain was the primary culprit, the winter storm was magnified considerably by periods of sleet that accumulated to depths of 1 to 2 inches. In Central Kansas, the situation was further worsened by periods of light snow that accumulated to 3 to 5 inch depths in Russell, Lincoln, and Saline counties. Damage to trees and power lines was major! In the latter case, the damage resulted both from heavy ice accumulations as well as from trees and limbs that fell onto the power lines in question. Trees as tall as 22 feet were split and either fell or were eventually felled, and limbs of 6-12 inches were downed at many locations. In some cases, the downed trees and limbs blocked roads and highways. Power outages were widespread, with many areas experiencing multiple outages. A few areas were without power for 1-1/2 weeks. Countless residents were forced to evacuate their homes, seeking refuge in designated shelters. Kansas Governor Kathleen Sebelius issued a declaration of state disaster emergency to 56 counties, and a federal disaster declaration was expected to be issued. There were three fatalities, two injuries and $30,000,000 in property damage over the 56-county area affected by the storm.

Location and Extents

The entire county is susceptible to winter storm.

Probability of Future Occurrences

The probability of a winter storm event depends on weather patterns that pass through the state. The likelihood of future events is estimated to remain the same as currently calculated. Barton County can expect 1.50 winter storm events a year with average annual damages of $2,272,111.

Although we can extract data and probability of occurrence from historical information, the risk of winter storm appears to be a random event.

4.4.2 Jurisdiction Hazard Profiles

Flood - Barton (UnInc.)

Hazard Profile

Flooding is the most frequent and costly natural hazard in the United States. Floods are generally the result of excessive precipitation, and can be classified under two categories: flash floods, the product of heavy localized precipitation in a short time period over a given location; and general floods, caused by precipitation over a longer time period and over a given river basin. The severity of a flooding event is determined by a combination of stream and river basin topography and physiography, precipitation and weather patterns, recent soil moisture conditions and the degree of vegetative clearing.

Flash flooding events usually occur within minutes or hours of heavy amounts of rainfall, from a dam or levee failure, or from a sudden release of water held by an ice jam. Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. Although flash flooding occurs often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces.

General floods are usually longer-term events and may last for several days. The primary types of general flooding include riverine flooding, coastal flooding, and urban flooding. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Coastal flooding is typically a result of storm surge, wind-driven waves, and heavy rainfall produced by hurricanes, tropical storms, nor’easters and other large coastal storms. Urban flooding occurs where man-made development has obstructed the natural flow of water and/or decreased the ability of natural ground cover to absorb and retain surface water runoff.

Periodic flooding of lands adjacent to rivers, streams and shorelines is a natural and inevitable occurrence that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval.

A "floodplain" is the lowland area adjacent to a river, lake or ocean. Floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will likely be covered once every 10-years, and the 100-year floodplain covered once every 100-years.

Flood frequencies, such as the "100-year flood," are determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. Another way of expressing the flood frequency is the chance of occurrence in a given year, which is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1% chance of occurring in any given year.

History and Jurisdiction Impacts

According to the National Climatic Data Center, there were a total of twenty two reported flood events for Barton County since 1993. A description of three events is as follows:

August 5, 1995 - radar estimates of four inches had fallen across northern Barton County. Local officials reported that Highway 4 near Galatia was under water. The Blood and Deception creeks also rose above their banks. There were no reported injuries or damages for this event.

June 26, 2006 - widespread flooding occurred from Hoisington to Great Bend. High water forced the closure of Highway 281 four miles south of Hoisington for two hours. Numerous rural and city roads and intersections, especially those in and around Hoisington and Great Bend, were barricaded due to high water. Several businesses and homes received water damage. Property damage was reported to be

$100,000, with no associated injuries.

May 5, 2007 - An observer in the area reported 3.22 inches of rain in three hours. Highway 56 in Pawnee Rock was closed due to flood water. In Hoisington the intersection of 3rd Street and Main was closed due to high water. An observer reported approximately three inches of rain in three hours in that part of Barton County. Seventy to eighty homes were flooded on the north side of Ellinwood. According to Barton County Emergency Management, the county documented roughly $30,000,000 in damage. This includes damages to private property including crop damage, damage to farm equipment, farmsteads and public roads. No injuries were reported for this event.

Location and Extents

A review of the FEMA Digital Flood Insurance Rate Map (D-FIRM), dated September 2, 2009, revealed areas of the county that have the most risk of flooding appear to be along the low-lying areas surrounding the Arkansas River, Blood Creek, and their tributaries. The Arkansas River flows west to east south of Pawnee Rock, Great Bend, and Ellinwood. Blood Creek flows across the northern half of the county, south of Hoisington. These bodies of water are predominantly located in unpopulated and undeveloped areas of the county. Numerous other creeks and tributaries criss-cross the county.

Probability of Future Occurrences

The likelihood of future events is estimated to remain the same as calculated. Barton County can expect 1.22 flood events a year, with average annual damages estimated at $1,672,667.

Although we can extract data and probability of occurrence from historical information, the risk of flood appears to be a random event.

Wildfire - Barton (UnInc.)

Hazard Profile

A wildfire is an undesirable, uncontrolled burning of grasslands, brush or woodlands. According to the National Weather Service, more than 100,000 wildfires occur in the United States each year. About 90% of these wildfires are started by humans (i.e., campfires, debris burning, smoking, etc.); the other 10% are started by lightning.

The potential for wildfire depends upon surface fuel characteristics, weather conditions, recent climate conditions, topography, and fire behavior. Fuels are anything that can and will burn, and are the combustible materials that sustain a wildfire. Typically, this is the most prevalent vegetation in a given area. Weather is one of the most significant factors in determining the severity of wildfire. The intensity of fires and the rate with which they spread is directly related to the wind speed, temperature and relative humidity. Climatic conditions such as long-term drought also play a major role in the number and intensity of wildfires, and topography is important because the slope and shape of the terrain can change the rate of speed at which fire travels.

There are four major types of wildfire. Ground fire burns in natural litter, duff, roots or sometimes high organic soils. Once started they are very difficult to control, and some ground fires may even rekindle after being extinguished. Surface fire burns in grasses and low shrubs (up to 4’ tall) or in the lower branches of trees. They have the potential to spread rapidly, and the ease of their control depends upon the fuel involved. Crown fire burns in the tops of trees, and the ease of their control depends greatly upon wind conditions. Spotting fire occurs when burning embers are thrown ahead of the main fire, and can be produced by crown fires as well as wind and topographic conditions. Once spotting begins, the fire will be very difficult to control.

Wildfire in the State of Kansas is better defined as rangeland fire. This type of fire generally originates as a surface fire and can spread quickly across large areas. Wild fire initiated by lightning is also an issue in the plains states.

When wildfire does occur in Barton County, it is very rare that a home or business is lost, with most damage limited to field crops. Wildfires are most common in the spring when brush is still brown and dry, and when fields have reached maturity in the fall months.

History and Jurisdiction Impacts

The NCDC database collects wildfire data for federally-owned land, but does not track private property; consequently, the Kansas Fire Marshal’s office tracks fire data for private property owners in Kansas. Collection of data began in 1997. Current information is provided in summary form only and reflects reported fires on an annual basis by county.

Location and Extents

Due to the nature of wildfire and the rural setting of the county, wildfire will be evaluated on a jurisdictional basis.

Probability of Future Occurrences

The likelihood of future events is estimated to remain the same as currently calculated. Barton County can expect an average of 13.69 significant wildfires per year that damage or destroy a total of 1,081 acres. The average area burned is approximately 180 acres with damages of $16,768.

Although one can extract data and probability of occurrence from historical data, the risk of wildfire appears to be random.

Dam / Levee - Barton (UnInc.)

This discussion includes dam and levee structures identified in the county and participating jurisdictions. A discussion regarding dams and levees was required by FEMA as part of this plan. Vulnerability for each jurisdiction is discussed in the next section.

There was one high hazard dam identified in the county and one certified levee located in the city of Great Bend, with no reports of breach or failure from any structures.

Hazard Profile

DAM

A dam failure is defined as an uncontrolled release of the reservoir. The causes of dam failures can be divided into three groups: dam over-topping, excessive seepage, and structural failure of a component. Despite efforts to provide sufficient structural integrity and to perform inspection and maintenance, problems can develop that can lead to failure. While most dams have storage volumes small enough that failures have little or no repercussions, dams with large storage amounts can cause significant flooding downstream. Dam planning is a state-mandated hazard for inclusion in this plan.

Dam failures can result from any one or a combination of the following causes:

1. Prolonged periods of rainfall and flooding, which cause most failures;
2. Inadequate spillway capacity, resulting in excess over-topping flows;
3. Internal erosion caused by embankment or foundation leakage or piping;
4. Improper maintenance, including failure to remove trees, repair internal seepage problems, replace lost material from the cross section of the dam and abutments, or maintain gates, valves, and other operational components;
5. Improper design, including the use of improper construction materials and construction practices;
6. Negligent operation, including the failure to remove or open gates or valves during high flow periods;
7. Failure of upstream dams on the same waterway;
8. Landslides into reservoirs, which cause surges that result in over-topping;
9. High winds, which can cause significant wave action and result in substantial erosion; and
10. Earthquakes, which typically cause longitudinal cracks at the tops of the embankments, which can weaken entire structures.

LEVEE

A levee is a man-made structure; usually earthen embankments designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding.

A levee is generally built parallel to a body of water (most often a river) in order to protect lives and property behind it from some level of flooding (100-year; 300-year; 500-year flood). Some reasons a levee may fail include:

1. A flood that exceeds the specific flood level for which the levee was designed may “over-top” (water can go over the top of the levee);
2. Failure to perform required maintenance, the need for which increases with age;
3. Lack of advance planning, resources and timely action to make the levee system ready for a flood event;
4.Soil failure, erosion, and intrusion of animals.

History and Jurisdiction Impacts

DAM

The Dam Safety Program is part of the broader Water Structures Program of the Kansas Department of Agriculture, Division of Water Resources. The Kansas Stream Obstructions Act (K.S.A. 82a-301 through 305a) gives the Chief Engineer, Kansas Department of Agriculture – Division of Water Resources the exclusive authority to regulate the construction, operation and maintenance of dams in Kansas. The written consent or permit of the Chief Engineer is required to construct a dam or make changes in any dam which meets the regulatory criteria.

NOTE: The State does not regulate Federal Reservoirs. In the State of Kansas, Federal Reservoirs are inspected, maintained and managed by either the U.S. Corps of Engineers or the Bureau of Reclamation. Emergency Action Plans (EAP) for these reservoirs, although classified, should be available for local governments upon request. The EAP should include inundation maps in the event of a flooding event, or an emergency at the facility.

The Chief Engineer has the power and duty to inspect any State-regulated dam. The Chief Engineer may issue orders requiring correction of deficiencies or removal of the dam. An annual inspection of all dams found to be unsafe is required until the deficiency is corrected or the dam is removed.

Where a dam condition is so dangerous as to pose an immediate safety threat, the Chief Engineer shall immediately employ any remedial means considered necessary. The Chief Engineer shall continue in full charge and control of any such dam until it is considered safe or the emergency prompting the remedial action has ceased.

Three dam hazard classifications have been established as described in K.A.R. 5-40-9. These classes are:

1. Class A (low hazard) – dams located in rural or agricultural areas where failure may damage farm buildings, limited agricultural land, or county, township and private roads.

2. Class B (significant hazard) – dams located in predominately rural or agricultural areas where failure may endanger few lives, damage isolated homes, secondary highways or minor railroads or cause interruption of use or service of relatively important public utilities.

3. Class C (high hazard) – dams located in areas where failure may cause extensive loss of life, serious damage to homes, industrial and commercial facilities, important public utilities, main highways or railroads.

The referenced hazard classes are solely impact-based. It is important to note that a high hazard dam is not necessarily unsafe. An individual dam's hazard classification is based upon the potential consequences of dam failure and does not reflect the physical condition of the dam. Post-construction development in the area is evaluated for potential to flood due to failure of the dam (breach inundation zone), and may result in the dam's reclassification to a higher hazard class than was originally assigned (Reference: Kansas Water Plan, Small Dam Safety and Rehabilitation, Policy Section, approved by the Kansas Water Authority November 18, 2005).

The classifications do not use a calculation of "likelihood" since the inspections do not include an evaluation of "worthiness" or probability of failure. Also, there are no reported dam failures in Barton County, which precludes the calculation of an overall county likelihood. Since likelihood data is not available for potential dam failure, the county has elected to rely on the State classifications to prioritize, and to plan for High Hazard Class C dams only for this study.

As a general rule, populations, property and environment residing downstream of dams are most susceptible to damage from dam failure. The Department of Agriculture - Water Resources identified one dam in Barton County as High Hazard, and there have been no reports of failure or damage from past incidents.

LEVEE
The State of Kansas has four statutes that regulate the design and construction of levees. The Statutes include: 12-635 Flood Protection; Eminent Domain; 14-434 Power to Regulate; 19-3301 Flood Control; Counties, and 24-816 Within 1st Class Cities. These statutes guide an owner or community through the process of developing levees within the county, and mandate requirements for reporting and maintenance of the levee(s).

FEMA is responsible for identifying flood risks in areas behind levees through flood analysis and flood hazard mapping projects, including updating the nation's hazard maps through an effort called Flood Map Modernization (Map Mod). In addition, FEMA also provides criteria to define which protect against the 1-percent-annual-chance flood. FEMA does not examine or analyze structures to determine their performance in a given flood event. The levee owner must provide documentation to show that a levee meets current design, operations, and maintenance criteria. FEMA will accredit levees based on a review of these criteria. Levee owners or communities have a responsibility to provide documentation that a levee meets the requirements of Title 44 of the Code of Federal Regulations, Section 65.10, as part of a study/mapping project. Procedure Memorandum 34 (PM 34) allows for the issuance of a deadline to the community for submitting the required documentation. (Source: FEMA)

FEMA – Region VII reported that their MAP Mod modernization program focuses on levees found on existing FEMA Flood Maps (FIRMS) prior to update. FEMA is initiating a process to notify owners, schedule meetings, and provide guidance to owners. The intent is to assist meeting Federal requirements and accredit identified levees.

As a general rule, populations, property and environment residing adjacent to levees are most susceptible to damage from failure. The Department of Agriculture - Water Resources identified six agricultural levees and two city levees in the county. There have been no reports of levee failure in Barton County.

<u>Location and Extents</u>
DAM
In Barton County there are 33 known dams included in the State of Kansas, Department of Agriculture, Division of Water Resources database. The State data includes public and private-owned dams, as well as Federal Reservoirs, if within the county boundary. The volume of water impounded, and the density, type, and value of development downstream determine the potential severity and potential classification of dam/levee failure.

The Kansas Department Agriculture - Division of Water Resources (KDA) identified one high-hazard dam in Barton County that could impact the county in the event of breach or dam failure (Dam Name / State ID / Dam Owner):

Barton County Club Dam (State ID No. DBT-0024) / Barton County Club

It was reported that there is not an EAP on file for this dam, but the MPC noted that a local property and a county road downstream of the Barton Lake Dam may be susceptible to inundation in the event of dam failure on a localized basis.

The MPC also reported one dam located in Rush County (DRH-0063), owned by Wet Walnut

Subwatershed No. 1, that could have an impact on K-96 highway in Barton County in the event of failure. The dam is currently classified as a low hazard dam, but reclassification is currently under consideration with the KDA.

An action has been included to obtain the EAPs for future plan updates. Reference Section 5.2 - Actions.

LEVEE

The Kansas Department of Agriculture Division of Water Resources (KDA) identified eighteen individual levee records that appear to describe eight levee systems in the county. KDA ownership data was limited and no information was provided in the database. The levees are identified as follows: LBT-0001, LBT-0003, LBT-0010, LBT-0013, LBT-0014/LBT-0015, LBT-0017, LBT-0018-C, and LBT-0019. The levee identified as LBT-0014/LBT-0015 is the system that protects Great Bend to the west and south of the city limits.

KDA identified levees are not geo-located, but rather are located by Section, Township, and Range only. Levees were placed into a GIS produced county background to view general locations. A review of the plotted records indicates that five of the above eight referenced levees (LBT-0001, LBT-0003, LBT-0013, LBT-0017, LBT-0018-C, and LBT-0019) were reported to be agricultural levees located in non-populated areas of the county, and not listed on existing FEMA DFIRM maps.

Great Bend

The flood control levee (KDA levee identification numbers: LBT-0014/LBT-0015) was identified by the City of Great Bend; and is located along the south and west boundaries of the city limits along the Arkansas River and Walnut Creek diversion channel. The levee system is both earthen and concrete and was constructed by the US Army Corps of Engineers, with final inspection made in 2005. The levee system was reported to be owned and maintained by the City of Great Bend, and PM-43 certification was completed in 2009. Marty Bren, Engineering Technician, has directed the operation and maintenance of the levee-system since 2005.

The levee identified as LBT-0010 is located along Dry Walnut Creek along the north boundaries of Great Bend and is also owned and maintained by the city of Great Bend. The levee is not identified on the FEMA DFIRMS.

A review of the FEMA DFIRMS GIS overlay of the city show the majority of Great Bend (81.44%), including eight USD 428 schools, are within Zone X - protected by levee. There have been no reported inundation issues for Great Bend or the school district regarding the levee. Reference dam/levee vulnerability.

Probability of Future Occurrences

For reasons previously mentioned and uncontrollable by humans, it is possible a dam or levee can fail at any time given the right circumstances. However, the probability of future occurrence is reduced due to proactive preventative action on the part of KDA-DWR. As previously discussed in this section, KDA-DWR provides oversight to dam/levee repairs, oversees and issues construction permits, enforces safety standards and mandates, conducts periodic inspections, and provides public information to levee owners, engineers, and the general public. This proactive approach to managing dam safety in Kansas reduces impact of losses to property and life as a result of potential dam failure.

Flood - Albert

Hazard Profile

Flooding is the most frequent and costly natural hazard in the United States. Floods are generally the result of excessive precipitation, and can be classified under two categories: flash floods, the product of heavy localized precipitation in a short time period over a given location; and general floods, caused by precipitation over a longer time period and over a given river basin. The severity of a flooding event is determined by a combination of stream and river basin topography and physiography, precipitation and weather patterns, recent soil moisture conditions and the degree of vegetative clearing.

Flash flooding events usually occur within minutes or hours of heavy amounts of rainfall, from a dam or levee failure, or from a sudden release of water held by an ice jam. Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. Although flash flooding occurs often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces.

General floods are usually longer-term events and may last for several days. The primary types of general flooding include riverine flooding, coastal flooding, and urban flooding. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Coastal flooding is typically a result of storm surge, wind-driven waves, and heavy rainfall produced by hurricanes, tropical storms, nor’easters and other large coastal storms. Urban flooding occurs where man-made development has obstructed the natural flow of water and/or decreased the ability of natural ground cover to absorb and retain surface water runoff.

Periodic flooding of lands adjacent to rivers, streams and shorelines is a natural and inevitable occurrence that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval.

A "floodplain" is the lowland area adjacent to a river, lake or ocean. Floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will likely be covered once every 10-years, and the 100-year floodplain covered once every 100-years.

Flood frequencies, such as the "100-year flood," are determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. Another way of expressing the flood frequency is the chance of occurrence in a given year, which is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1% chance of occurring in any given year.

History and Jurisdiction Impacts

According to the National Climatic Data Center, there were a total of twenty two reported flood events in Barton County since 1993. There were no events reported for the town of Albert in the NCDC database.

Location and Extents

A review of the FEMA Digital Flood Insurance Rate Map (D-FIRM), dated September 9, 2009, noted that the majority of Albert in located in the flood zone. Albert is divided into two areas by the railroad tracks. Zone AH covers most of the southern portion of the town (south of the tracks), and the area that lies north of the Atchison, Topeka, and Santa Fe Railway, is Zone AE. The extreme northeastern portion of the town is designated Zone A. It appears the majority of residential and commercial facilities in the town are located within the floodplain.

Probability of Future Occurrences

The likelihood of future events is estimated to remain the same as calculated. Albert can expect 1.22 flood events a year.

Although we can extract data and probability of occurrence from historical information, the risk of flood appears to be a random event.

Flood - Claflin

Hazard Profile

Flooding is the most frequent and costly natural hazard in the United States. Floods are generally the result of excessive precipitation, and can be classified under two categories: flash floods, the product of heavy localized precipitation in a short time period over a given location; and general floods, caused by precipitation over a longer time period and over a given river basin. The severity of a flooding event is determined by a combination of stream and river basin topography and physiography, precipitation and weather patterns, recent soil moisture conditions and the degree of vegetative clearing.

Flash flooding events usually occur within minutes or hours of heavy amounts of rainfall, from a dam or levee failure, or from a sudden release of water held by an ice jam. Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. Although flash flooding occurs often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces.

General floods are usually longer-term events and may last for several days. The primary types of general flooding include riverine flooding, coastal flooding, and urban flooding. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Coastal flooding is typically a result of storm surge, wind-driven waves, and heavy rainfall produced by hurricanes, tropical storms, nor'easters and other large coastal storms. Urban flooding occurs where man-made development has obstructed the natural flow of water and/or decreased the ability of natural groundcover to absorb and retain surface water runoff.

Periodic flooding of lands adjacent to rivers, streams and shorelines is a natural and inevitable occurrence that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval.

A "floodplain" is the lowland area adjacent to a river, lake or ocean. Floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will likely be covered once every 10-years, and the 100-year floodplain covered once every 100-years.

Flood frequencies, such as the "100-year flood," are determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. Another way of expressing the flood frequency is the chance of occurrence in a given year, which is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1% chance of occurring in any given year.

History and Jurisdiction Impacts

According to the National Climatic Data Center, there were a total of twenty two reported flood events in Barton County since 1993. There was one event reported for the town of Claflin in the NCDC database and is described as follows:

August 2, 2007 - Northeast 130 Avenue was closed from Highway 156 to one mile south of Highway 156 due to high water. There were no reported damages or injuries for this event.

Location and Extents

A review of the FEMA Digital Flood Insurance Rate Map (D-FIRM), dated September 9, 2009, noted that there is only one small flood area, less than one percent of the corporate limits, located along the extreme western boundary of the town. There does not appear to be any improvements in the floodplain area.

Probability of Future Occurrences

The likelihood of future events is estimated to remain the same as calculated. Claflin can expect 1.22 flood events a year.

Although we can extract data and probability of occurrence from historical information the risk of flood appears to be a random event.

Flood - Ellinwood

Hazard Profile

Flooding is the most frequent and costly natural hazard in the United States. Floods are generally the result of excessive precipitation, and can be classified under two categories: flash floods, the product of heavy localized precipitation in a short time period over a given location; and general floods, caused by precipitation over a longer time period and over a given river basin. The severity of a flooding event is determined by a combination of stream and river basin topography and physiography, precipitation and weather patterns, recent soil moisture conditions and the degree of vegetative clearing.

Flash flooding events usually occur within minutes or hours of heavy amounts of rainfall, from a dam or levee failure, or from a sudden release of water held by an ice jam. Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. Although flash flooding occurs often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces.

General floods are usually longer-term events and may last for several days. The primary types of general flooding include riverine flooding, coastal flooding, and urban flooding. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Coastal flooding is typically a result of storm surge, wind-driven waves, and heavy rainfall produced by hurricanes, tropical storms, nor’easters and other large coastal storms. Urban flooding occurs where man-made development has obstructed the natural flow of water and/or decreased the ability of natural groundcover to absorb and retain surface water runoff.

Periodic flooding of lands adjacent to rivers, streams and shorelines is a natural and inevitable occurrence that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval.

A "floodplain" is the lowland area adjacent to a river, lake or ocean. Floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will likely be covered once every 10-years, and the 100-year floodplain covered once every 100-years.

Flood frequencies, such as the "100-year flood," are determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. Another way of expressing the flood frequency is the chance of occurrence in a given year, which is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1% chance of occurring in any given year.

History and Jurisdiction Impacts

According to the National Climatic Data Center, there were twenty two reported flood events in Barton County since 1993. There were no events reported for Ellinwood in the NCDC database, but the MPC reported a flood event north of Ellinwood on May 6, 2007 that caused flash flooding north of 7th Street in town. The waters flooded several basements in this area.

Location and Extents

A review of the FEMA Digital Flood Insurance Rate Map (D-FIRM), dated September 9, 2009, noted that the majority of the eastern corporate limits of Ellinwood are designated Zone AE, with some Zone A in the southeast corner of the city limits. It appears the flood zones include some improved areas in the town.

Probability of Future Occurrences

The likelihood of future events is estimated to remain the same as calculated. Ellinwood can expect 1.22

flood events a year.

Although we can extract data and probability of occurrence from historical information, the risk of flood appears to be a random event.

Flood - Great Bend

Hazard Profile

Flooding is the most frequent and costly natural hazard in the United States. Floods are generally the result of excessive precipitation, and can be classified under two categories: flash floods, the product of heavy localized precipitation in a short time period over a given location; and general floods, caused by precipitation over a longer time period and over a given river basin. The severity of a flooding event is determined by a combination of stream and river basin topography and physiography, precipitation and weather patterns, recent soil moisture conditions and the degree of vegetative clearing.

Flash flooding events usually occur within minutes or hours of heavy amounts of rainfall, from a dam or levee failure, or from a sudden release of water held by an ice jam. Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. Although flash flooding occurs often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces.

General floods are usually longer-term events and may last for several days. The primary types of general flooding include riverine flooding, coastal flooding, and urban flooding. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Coastal flooding is typically a result of storm surge, wind-driven waves, and heavy rainfall produced by hurricanes, tropical storms, nor’easters and other large coastal storms. Urban flooding occurs where man-made development has obstructed the natural flow of water and/or decreased the ability of natural groundcover to absorb and retain surface water runoff.

Periodic flooding of lands adjacent to rivers, streams and shorelines is a natural and inevitable occurrence that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval.

A "floodplain" is the lowland area adjacent to a river, lake or ocean. Floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will likely be covered once every 10-years, and the 100-year floodplain covered once every 100-years.

Flood frequencies, such as the "100-year flood," are determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. Another way of expressing the flood frequency is the chance of occurrence in a given year, which is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1% chance of occurring in any given year.

History and Jurisdiction Impacts

According to the National Climatic Data Center, there were twenty two reported flood events in Barton County since 1993. There were four events reported for the City of Great Bend in the NCDC database; a summary of three are provided as follows:

September 17, 2001 - Highway 281 flooded to depths of two-three feet. Some houses were flooded as well. There were no reported damages or injuries for this event.

May 5, 2007 - flooding was reported throughout Barton county. Highway 96, nine miles west of Great Bend, was closed due to flooding. An observer in the area reported 3.22 inches of rain in just three hours. This event was reported to have caused $30,000,000 in property and crop damages, but no injuries were reported.

June 5, 2008 - several roads in and around Great Bend were closed due to water. There was $5,000 in reported damages, with no injuries for the this event.

Location and Extents

A review of the FEMA Digital Flood Insurance Rate Maps (6 D-FIRMs), dated September 9, 2009, noted that the Great Bend corporate limits includes the Municipal Airport, which is located southwest of town. It appears that the majority of Great Bend lies within Zone X - protected by levee, and is classified as outside the 100-year floodplain. A discussion of levee is provided in the Dam/Levee hazard profile. Other flood zone areas in Great Bend are described as follows:

The first Zone A area is a very small area located at the northwest city limits between Highway 96 and the railroad tracks, and appears to be vacant land. The second area is located south of Highway 56, north of Railroad Avenue, and west of McKinley Street. The area appears to be undeveloped. The third Zone A is located along the southern city limits in an undeveloped area between Washington Street and Highway 281 just north of the Arkansas River Levee. The fourth area is designated along Dry Walnut Creek which forms the north city limits of Great Bend, and appears to have a small Zone A that follows the length of the creek bed, then trends south along Frey Street, which is the east city limits to Park Avenue, before trending east along NE 3rd Road into the county. It does not appear to impact improved areas of the city.

Municipal Airport: The airport is located approximately two miles southwest of Great Bend in an agricultural area of the county, but is owned by the the city. A review of the D-FIRMs indicates that portions of the airport city limits along SW 40th Avenue are designated Zone X - protected by Levee. This area appears to contain the airport operations and support buildings. A small area in the southeast corner of the airport property along the Cheyenne Bottoms Diversion Channel is also Designated Zone AO. This small area appears to be agricultural and unimproved.

Probability of Future Occurrences

The likelihood of future events is estimated to remain the same as calculated. Great Bend can expect 1.22 flood events a year.

Although we can extract data and probability of occurrence from historical information the risk of flood appears to be a random event.

Flood - Hoisington

Hazard Profile

Flooding is the most frequent and costly natural hazard in the United States. Floods are generally the result of excessive precipitation, and can be classified under two categories: flash floods, the product of heavy localized precipitation in a short time period over a given location; and general floods, caused by precipitation over a longer time period and over a given river basin. The severity of a flooding event is determined by a combination of stream and river basin topography and physiography, precipitation and weather patterns, recent soil moisture conditions and the degree of vegetative clearing.

Flash flooding events usually occur within minutes or hours of heavy amounts of rainfall, from a dam or levee failure, or from a sudden release of water held by an ice jam. Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. Although flash flooding occurs often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces.

General floods are usually longer-term events and may last for several days. The primary types of general flooding include riverine flooding, coastal flooding, and urban flooding. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Coastal flooding is typically a result of storm surge, wind-driven waves, and heavy rainfall produced by hurricanes, tropical storms, nor'easters and other large coastal storms. Urban flooding occurs where man-made development has obstructed the natural flow of water and/or decreased the ability of natural groundcover to absorb and retain surface water runoff.

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A "floodplain" is the lowland area adjacent to a river, lake or ocean. Floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will likely be covered once every 10-years, and the 100-year floodplain covered once every 100-years.

Flood frequencies, such as the "100-year flood," are determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. Another way of expressing the flood frequency is the chance of occurrence in a given year, which is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1% chance of occurring in any given year.

History and Jurisdiction Impacts

According to the National Climatic Data Center, there were twenty two reported flood events in Barton County since 1993. There were four events reported for the town of Hoisington in the NCDC database; a summary of three events are provided as follows:

June 26, 1997 - Blood Creek flooded several roads in Hoisington. There were no reported damages or injuries for this event.

April 21, 2001 - several streets across Hoisington and Highway 281 were inundated with water. There were no damages or injuries reported for this event.

June 26, 2006 - high water forced the closure of Highway 281 four miles south of Hoisington for two hours. Numerous rural and city roads and intersections, especially those in and around Hoisington were barricaded due to high water. Several businesses and homes received water damage. Property damage was reported to be $100,000, with no associated injuries for this event.

Location and Extents

A review of the FEMA Digital Flood Insurance Rate Map (D-FIRM), dated September 2, 2009, noted that there is a Zone AH flood area located within the city limits of Hoisington. This flood area correlates with Shop Creek tributary, which trends north and south along the western boundary of the town. The creek begins near west First Street and trends northeast to west Fifteenth Street, where it exits the town limits. It appears there may be some improved areas within this SFHA along the northwest area of the town.

Probability of Future Occurrences

The likelihood of future events is estimated to remain the same as calculated. Hoisington can expect 1.22 flood events a year.

Although we can extract data and probability of occurrence from historical information the risk of flood appears to be a random event.

Flood - Pawnee Rock

Hazard Profile

Flooding is the most frequent and costly natural hazard in the United States. Floods are generally the result of excessive precipitation, and can be classified under two categories: flash floods, the product of heavy localized precipitation in a short time period over a given location; and general floods, caused by precipitation over a longer time period and over a given river basin. The severity of a flooding event is determined by a combination of stream and river basin topography and physiography, precipitation and weather patterns, recent soil moisture conditions and the degree of vegetative clearing.

Flash flooding events usually occur within minutes or hours of heavy amounts of rainfall, from a dam or levee failure, or from a sudden release of water held by an ice jam. Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. Although flash flooding occurs often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces.

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History and Jurisdiction Impacts

According to the National Climatic Data Center, there were twenty two reported flood events in Barton County since 1993. There were four events reported for Pawnee Rock in the NCDC database. A summary of three events is provided as follows:

May 31, 1996 - water covered Highway 56 with water level to car tire depth. There were no reported damages or injuries for this event.

June 22, 2006 - Southwest 70 County Road near Pawnee Rock was closed due to high water. The road did not re-open until around 12:00 CST on the 23rd of June. There were no reported damages or injuries for this event.

Aug 21, 2006 - a week of on and off heavy rainfall closed Highway 56 near Pawnee Rock. Standing water over the highway stranded a few motorists, and eventually lead to law enforcement officials barricading the highway. There were no reported damages or injuries for this event.

Location and Extents

A review of the FEMA Digital Flood Insurance Rate Map (D-FIRM), dated September 2, 2009, noted that the area of Pawnee Rock that lies north of Highway 56 generally resides within Zone AH, with a smaller area southeast of the highway noted to be outside the floodplain. It appears that residential and commercial improvements are located within Zone AH.

Probability of Future Occurrences

The likelihood of future events is estimated to remain the same as calculated. Pawnee Rock can expect 1.22 flood events a year.

Although we can extract data and probability of occurrence from historical information the risk of flood appears to be a random event.

Flood - Susank

Hazard Profile

Flooding is the most frequent and costly natural hazard in the United States. Floods are generally the result of excessive precipitation, and can be classified under two categories: flash floods, the product of heavy localized precipitation in a short time period over a given location; and general floods, caused by precipitation over a longer time period and over a given river basin. The severity of a flooding event is determined by a combination of stream and river basin topography and physiography, precipitation and weather patterns, recent soil moisture conditions and the degree of vegetative clearing.

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Periodic flooding of lands adjacent to rivers, streams and shorelines is a natural and inevitable occurrence that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval.

A "floodplain" is the lowland area adjacent to a river, lake or ocean. Floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will likely be covered once every 10-years, and the 100-year floodplain covered once every 100-years.

Flood frequencies, such as the "100-year flood," are determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. Another way of expressing the flood frequency is the chance of occurrence in a given year, which is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1% chance of occurring in any given year.

History and Jurisdiction Impacts

According to the National Climatic Data Center, there were twenty two reported flood events in Barton County since 1993. There were no events reported for the town of Susank in the NCDC database.

Location and Extents

A review of the FEMA Digital Flood Insurance Rate Map (D-FIRM), dated September 9, 2009, noted that there does not appear to be any SFHA zones identified in the town, but is included here since Susank participates in the NFIP as a NSFHA community.

Probability of Future Occurrences

The likelihood of future events is estimated to remain the same as calculated. Susank can expect 1.22 flood events a year.

Although we can extract data and probability of occurrence from historical information the risk of flood appears to be a random event.

4.5 Vulnerability Assessment

The vulnerability assessment was completed predominantly through the use of objective hazard and risk analysis, along with the use of county-provided data and best available information at the time of the study. It describes the county's hazard prone locations and provides an inventory of repetitive loss properties (if applicable) and critical facilities. This portion of the plan also describes current development trends and implications for Barton County, and includes maps that were generated specifically to illustrate jurisdiction vulnerability. Lastly, this section discusses what was learned through the process of determining the county's current and future vulnerability to natural hazards, and provides several conclusions on community vulnerability.

Natural Hazards

Situated in the central portion of the country, Barton County is located in an area that is prone to the effects of sudden collision of cold/warm fronts creating severe winter storms and thunderstorms. Areas throughout the county are vulnerable to the natural hazards identified in Section 4.0, and for the most part, face a uniform level of risk for each hazard, with the exception of flood, wildfire, and dam/levee failure. This is due to the nature of the natural weather events that occur in the county. Severe winter storms and thunderstorms are unpredictable and random in nature. Since the majority of the county is rural, coupled with its sparse pattern of land development, it does not present areas that are significantly more vulnerable to property loss than others. The majority of people who live and work in Barton County reside in Great Bend, Ellinwood, and Hoisington and several other smaller communities, but the probability that a jurisdiction would be affected more often than other areas in the county is considered statistically very low.

Based on historical data, and for purposes of this hazard mitigation plan, Barton County will assess the above-referenced natural hazards vulnerability on a countywide planning basis. Flood, dam/levee and wildfire will be addressed as separate geographic planning areas.

4.5.1 Damage and Vulnerability Overview

The data to develop inventory estimates were obtained through various sources including the following:

- Barton County Appraiser
- Kansas Department of Revenue, Division of Property Valuation
- HAZUS
- Barton County Mitigation Planning Committee
- Kansas Department of Transportation
- RS Means estimator tools
- Emergency Management Department
- Kansas Water Office

Where data failure occurred, subjective data was used to obtain estimated facility/infrastructure costs. The following tables attempt to assess the potential damage and vulnerability of Barton County based on these estimates. Table 4.5.1 (1) was completed to assess the current and future vulnerability of Barton County based upon the assessed value of assets within the jurisdiction. The inventory costs are based on the number and assessed valuation and do not reflect replacement value for other assets such as land, equipment, fixture, and furniture assets.

Table 4.5.1 (1) All-Hazards County Potential Damage Inventory includes appraiser data for county assets that are used in Section 4.5.3 Vulnerability Estimation by Hazard tables for Residential and Commercial classifications. Critical Facility estimates were provided by each jurisdiction.

The Residential classification in Table 4.5.1 (1) is matched to the Residential classification for each vulnerability table in Section 4.5.3, respective to each jurisdiction.

The classes identified in Table 4.5.1 (1) as Ag Improvement, Com/Industrial, Not for Profit, and All Other were combined to represent the Commercial classification for each vulnerability table in Section 4.5.3, respective to each jurisdiction.

A breakdown between urban and rural public utilities was not available, consequently, all utilities are included under the urban category in Table 4.5.1 (1).

CAGR: Acronym for Compound Annual Growth Rate. CAGR is a calculated annualized growth rate using year-over-year data for a specified period of time. In this plan, year-over-year data from the Kansas Water Office is used to calculate an annualized rate over a specific time period (2000 to 2040), unless noted for a different span of years.

TABLE 4.5.1 (1) ALL-HAZARDS COUNTY POTENTIAL DAMAGE INVENTORY

	Current Conditions		Projection Yr: 2040 (CAGR: 0.30%)
Type of Development	Current Dollar Exposure	Number of Buildings	Future Replacement Value
Urban/Rural Real Property			
Residential	$575,462,240	10268	$632,546,480
Agricultural	$0	0	$0
Vacant Lots	$0	0	$0
Not-For-Profit	$430,490	9	$473,193
Com/Industiral	$135,435,323	1276	$148,870,127
Ag Improvement	$60,936,791	4400	$66,981,550
All Other	$222,712,147	663	$244,804,567
Total Real Property	$994,976,991		$1,093,675,917
Urban/Rural Personal Property			
Res. Mobile Homes	$294,562	12	$323,782
Mineral Leasehold	$30,290,317	0	$33,295,031
Motor Vehicles	$2,692,562	0	$2,959,657
C/I Mach/Equipment	$15,265,893	0	$16,780,227
Boat/Marine/Trailer	$1,056,479	0	$1,161,279
Other	$665,253	0	$731,244
Total Personal Property	$50,265,066		$55,251,220
Public Utility			
Urban - Public Utility	$6,405,380	90	$7,040,776
Rural - Public Utility	$16,561,740	0	$18,204,618
Total Public Utility	$22,967,120		$25,245,394
Totals			
Totals	$1,068,209,177		$1,174,172,531

It is anticipated that when more data is obtained through development and cataloging of cadastral data, more accurate replacement cost data will be included in future updates to this Plan.

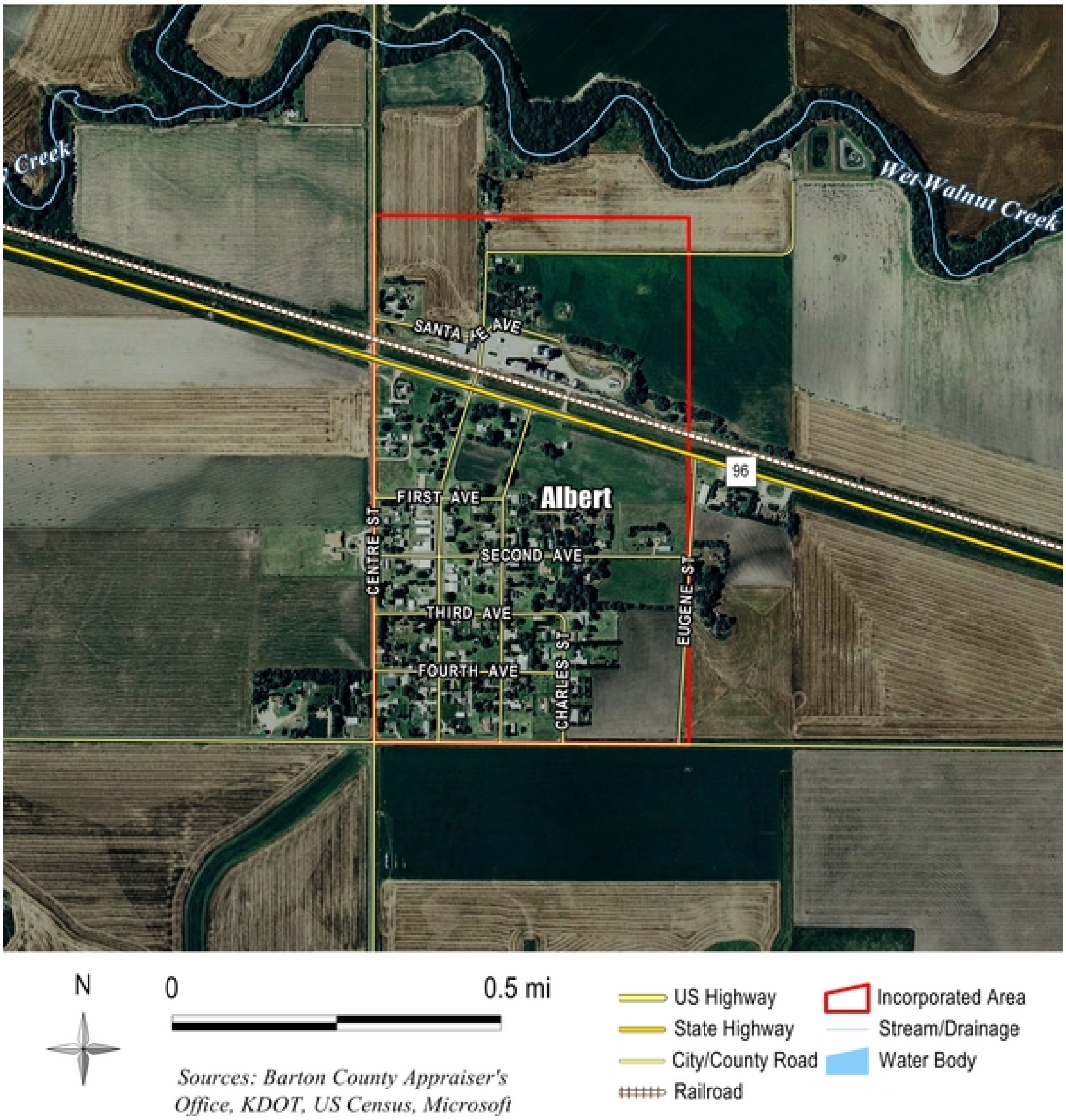
In addition to being used for general mitigation planning purposes, this vulnerability assessment can be used by Barton County as documentation to support the need for mitigation projects that can be funded through the Federal Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Program (PDM) and/or similar grant programs. The information gathered for public buildings and critical facilities can also be used when applying for both Federal and State Public Assistance funds which provide assistance for the repair and mitigation of public facilities and infrastructure following declared disaster events.

4.5.2 Vulnerability Maps

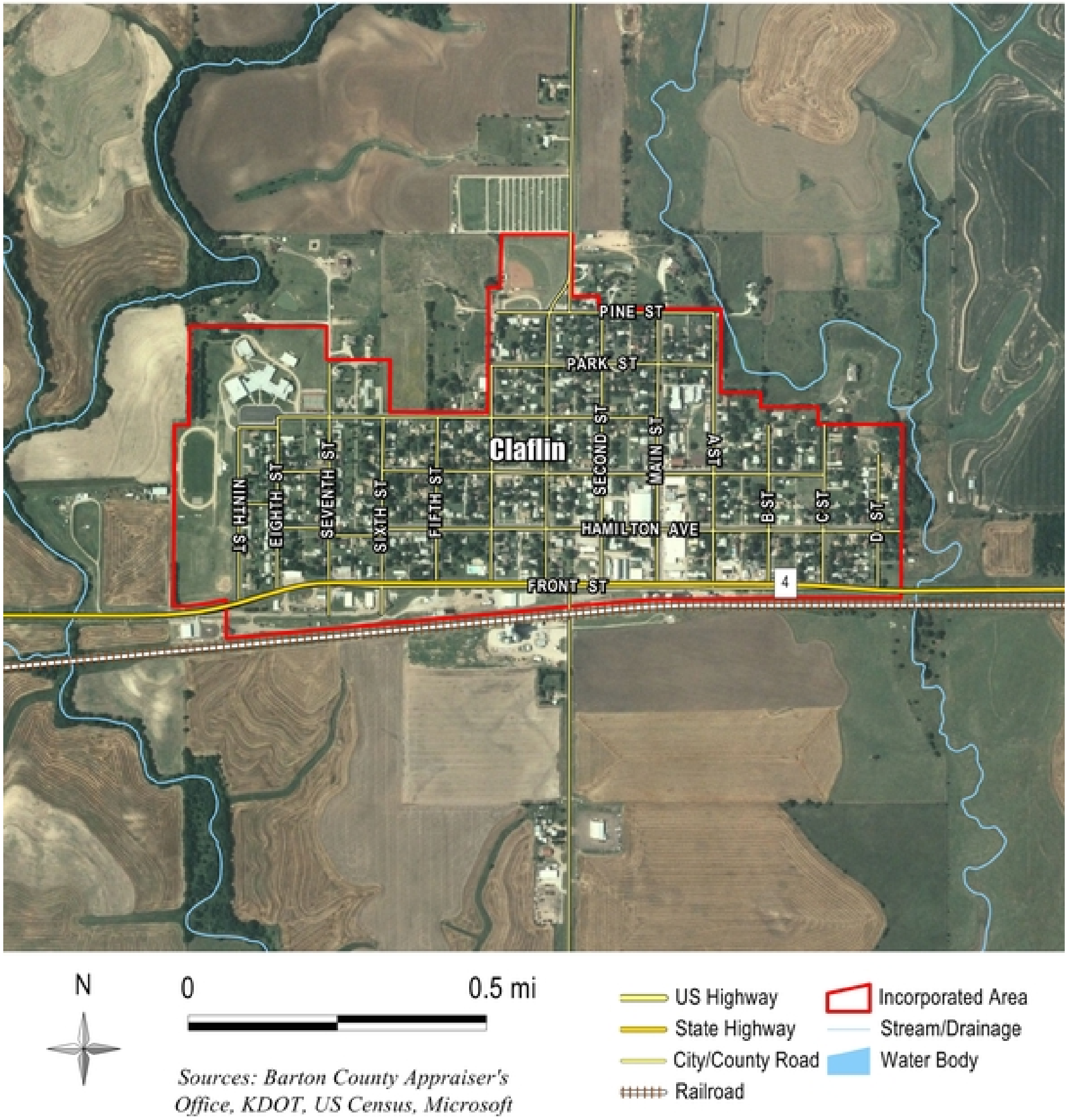
The following maps provide brief descriptions for the data layers used to assess hazard vulnerability for Barton County. Digital data used for the production of these maps was acquired from the Kansas Geospatial Community Commons, U.S Census Tiger/Line, FEMA, and other resources.

1. Barton County Base Maps

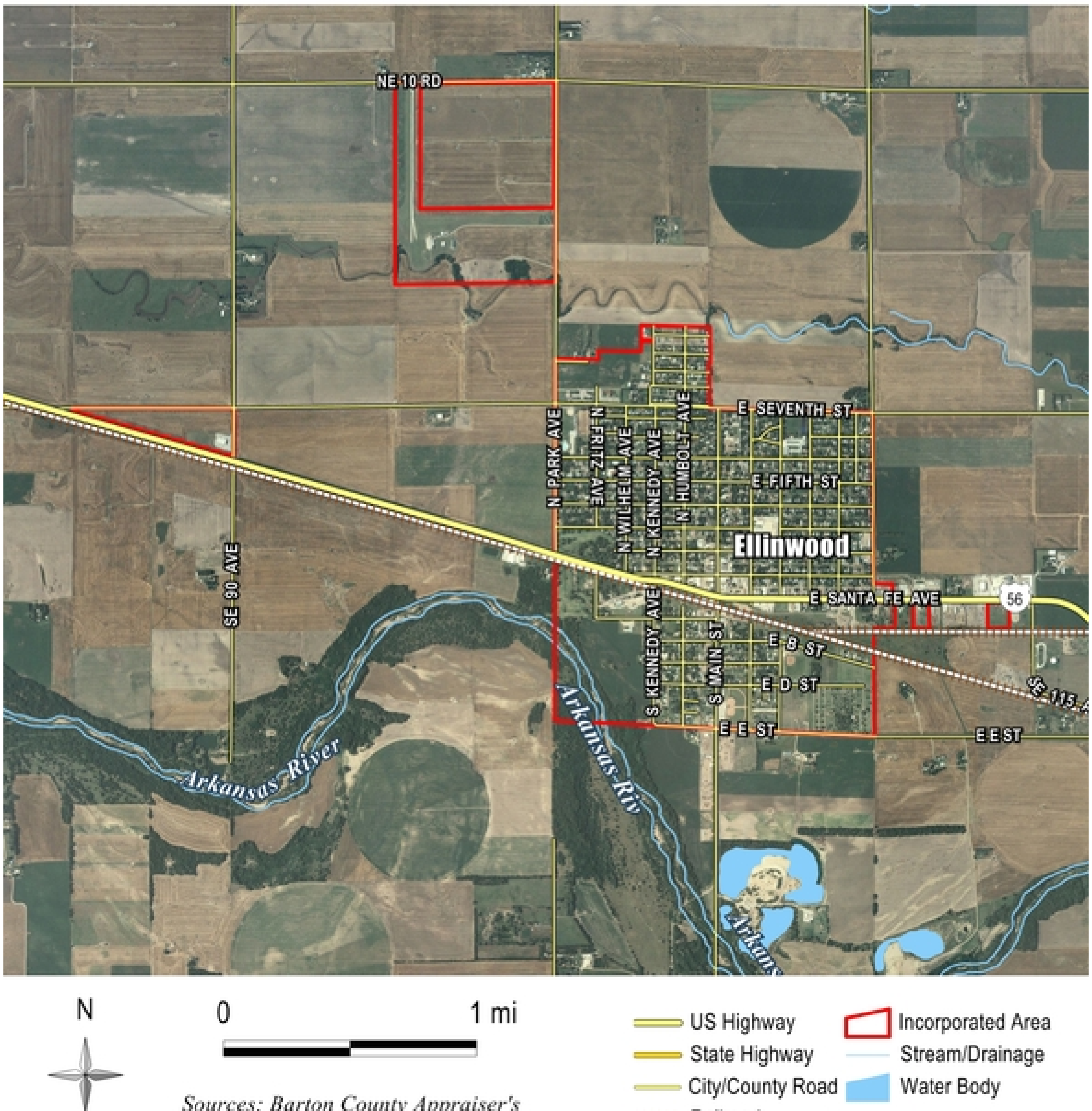
Albert, Kansas



Claflin, Kansas

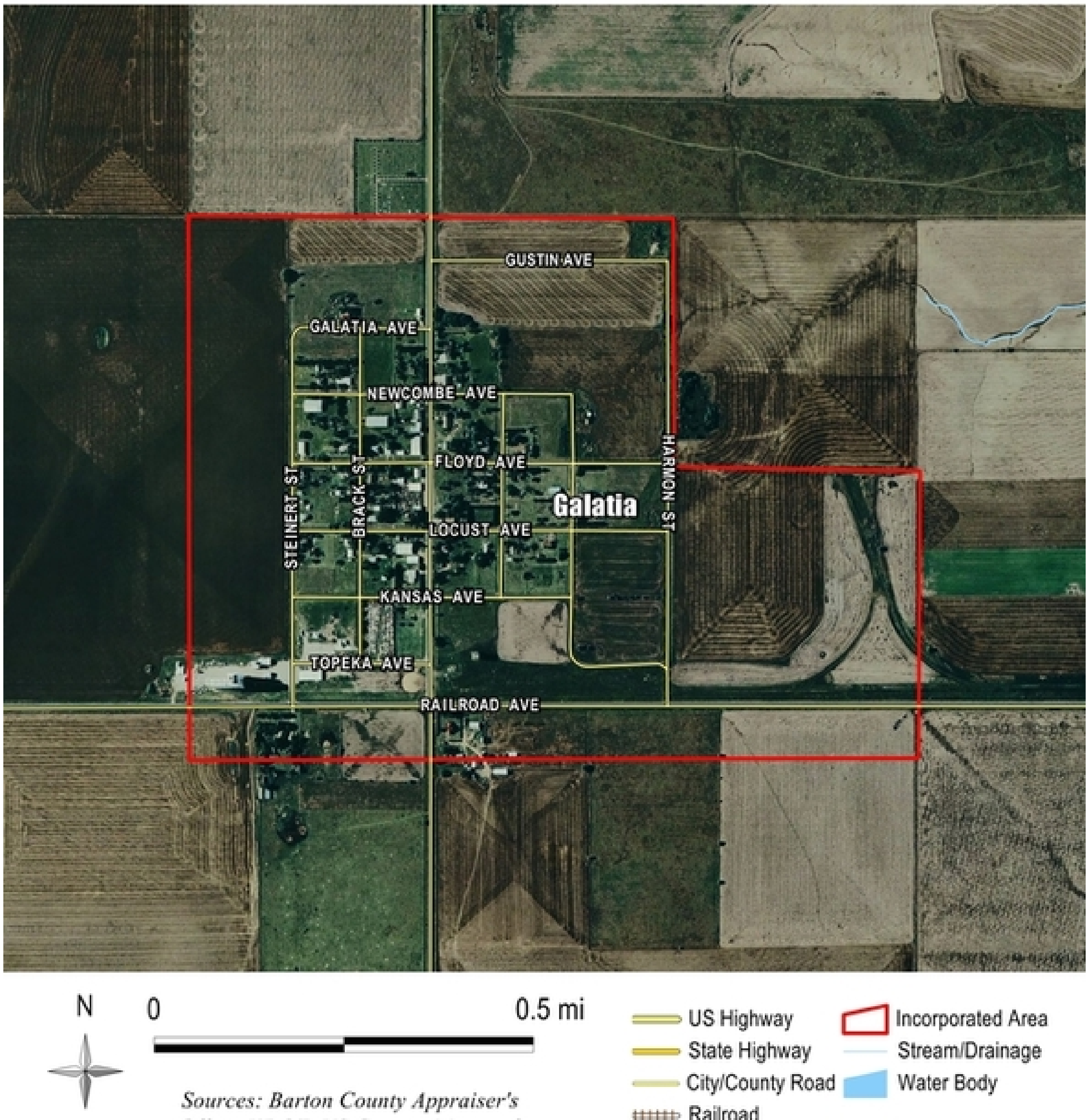


Ellinwood, Kansas



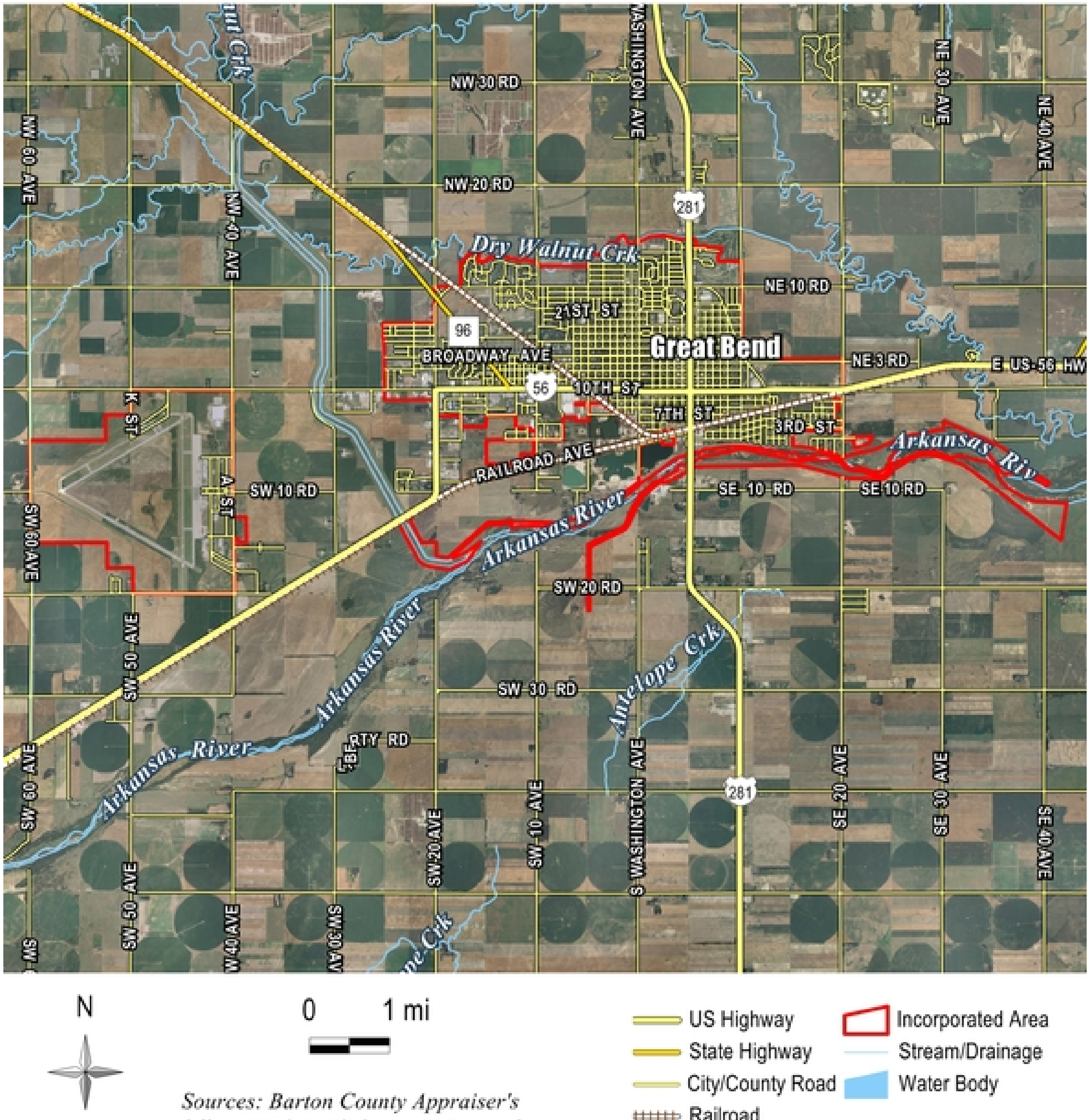
Sources: Barton County Appraiser's Office, KDOT, US Census, Microsoft

Galatia, Kansas



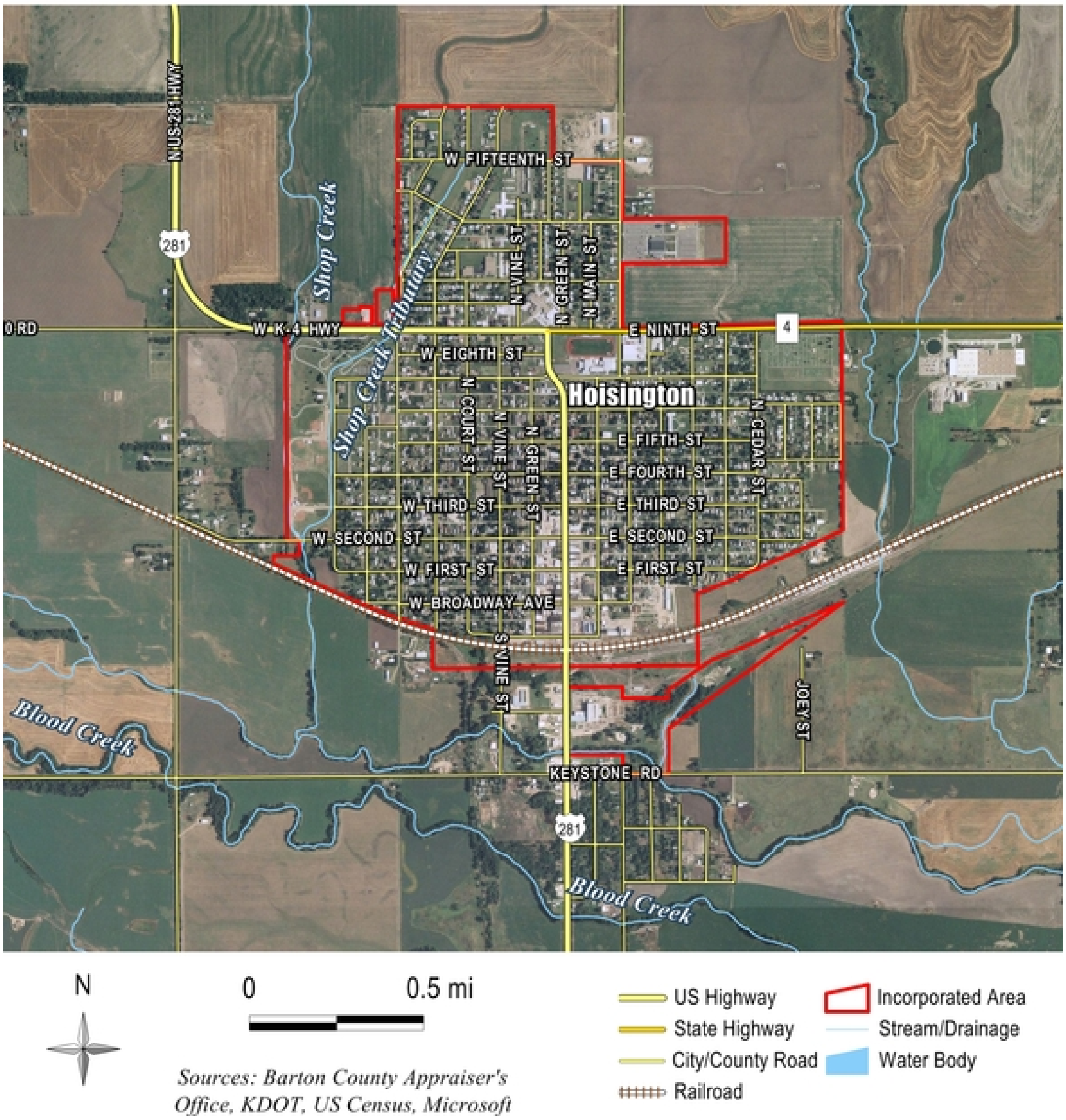
Sources: Barton County Appraiser's Office, KDOT, US Census, Microsoft

Great Bend, Kansas

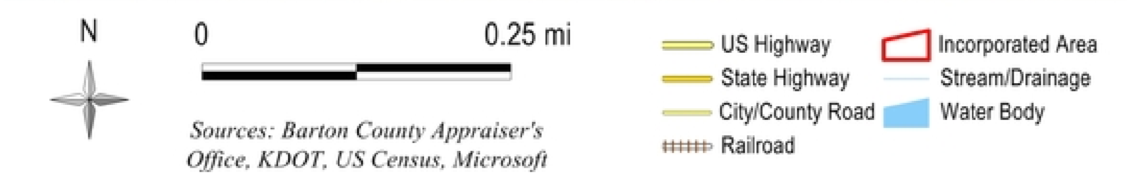


Sources: Barton County Appraiser's Office, KDOT, US Census, Microsoft

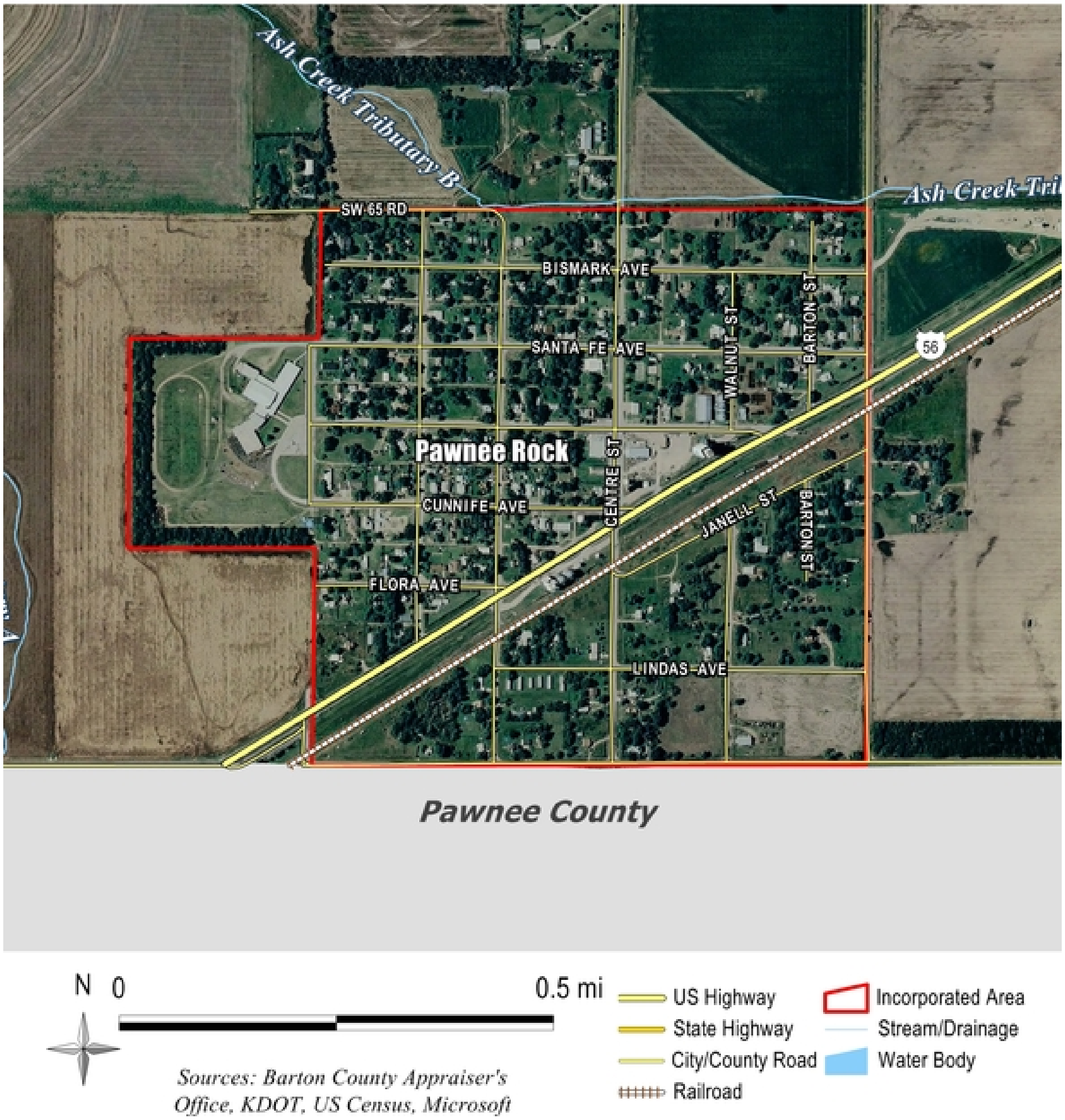
Hoisington, Kansas



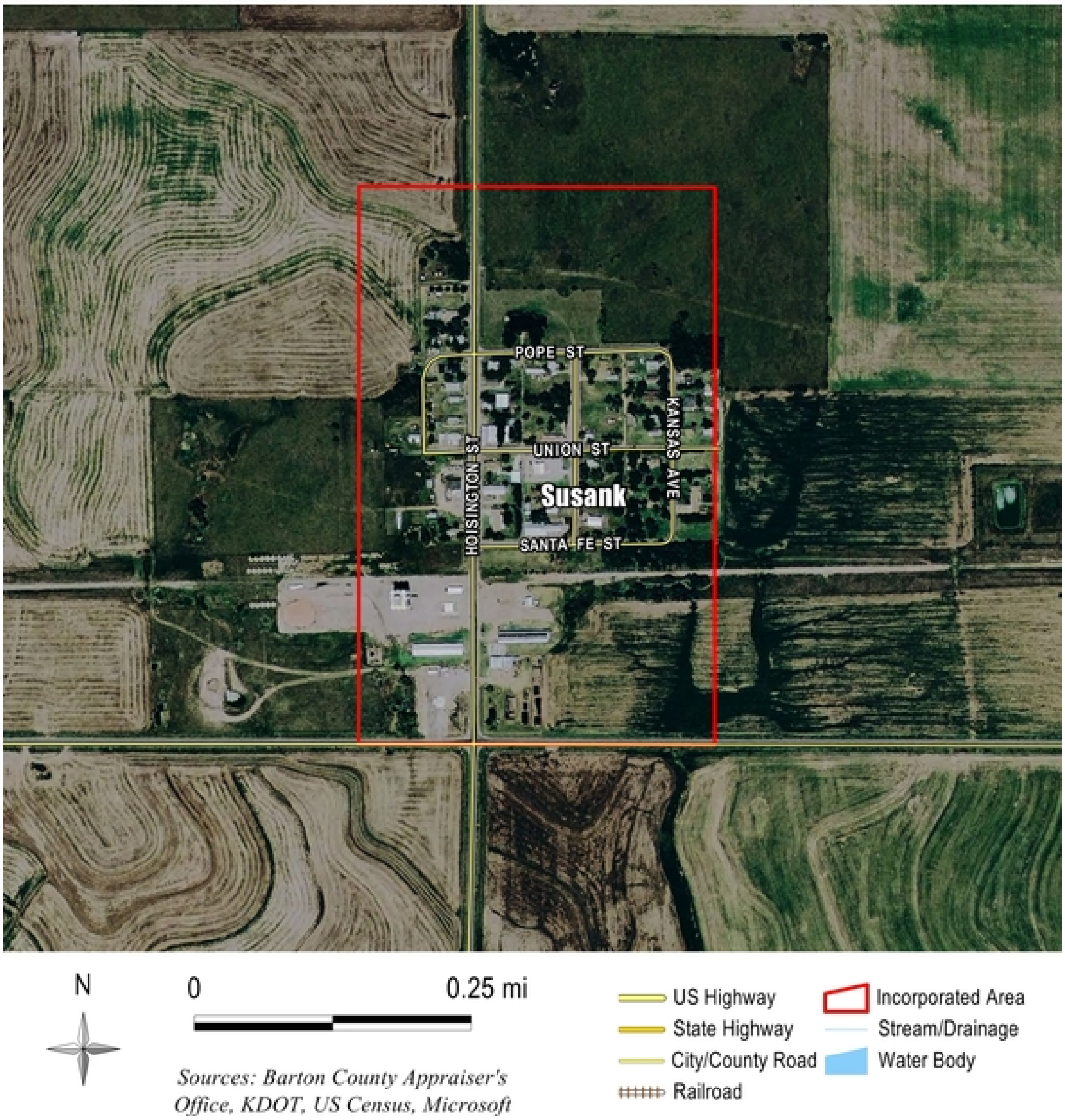
Olmitz, Kansas



Pawnee Rock, Kansas



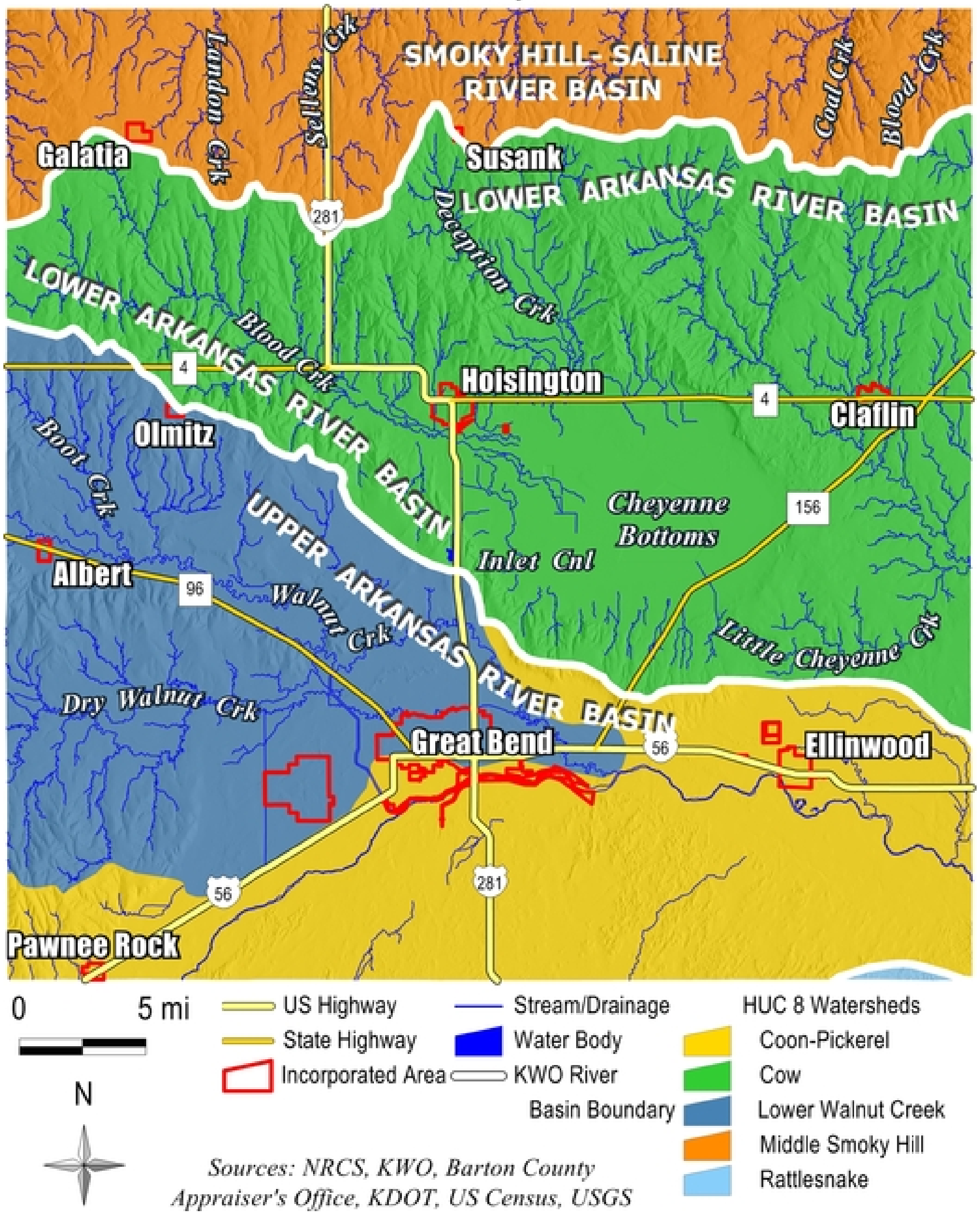
Susank, Kansas



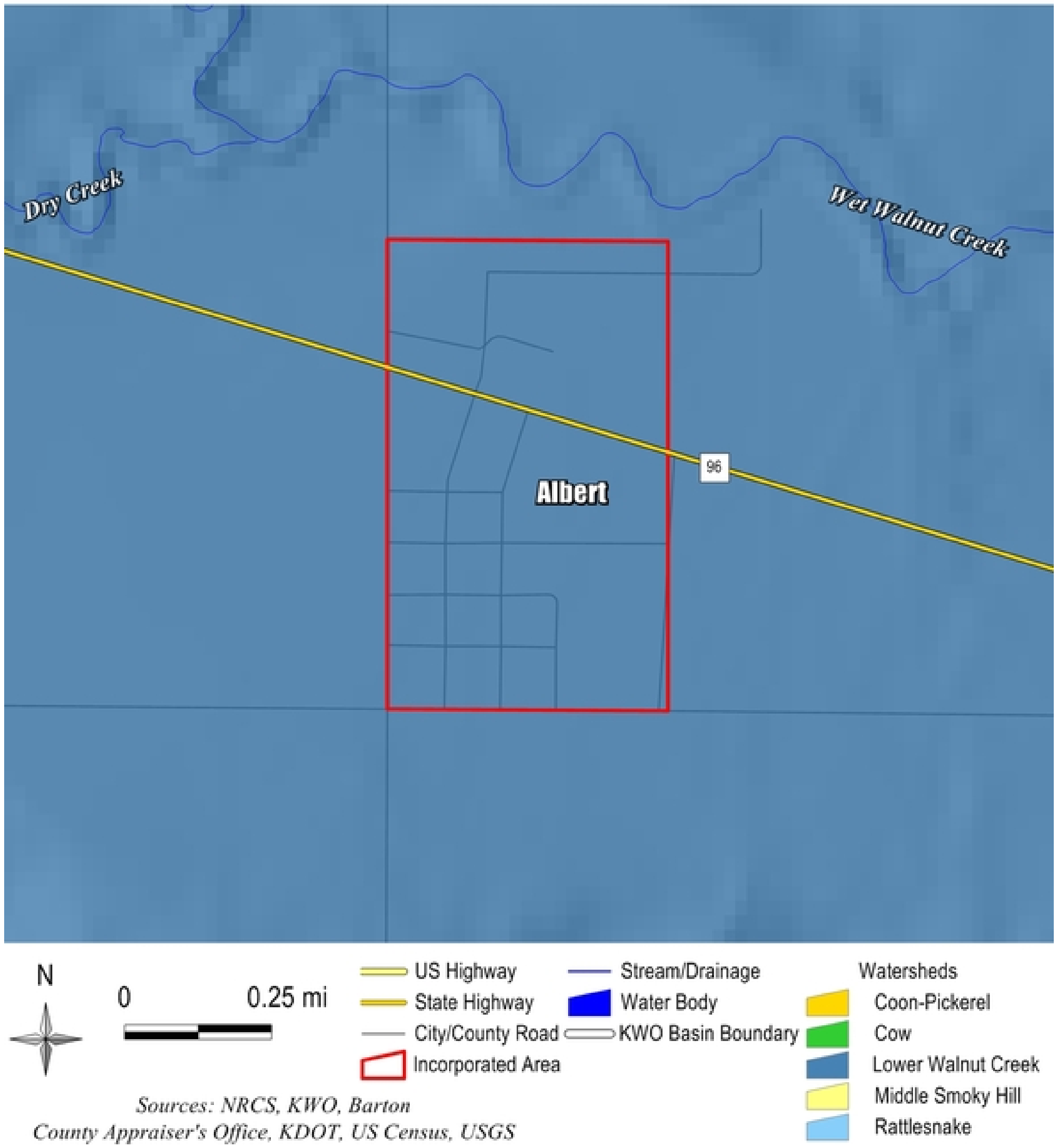
2. Regional Hydrography

The following maps display the major surface water features that form the drainage network for Barton County. Three river basins are designated by the Kansas Water Office: the Smoky Hill-Saline River Basin, the Lower Arkansas River Basin, and the Upper Arkansas River Basin. Five watersheds are designated by the Environmental Protection Agency: Coon-Pickerel, Cow, Lower Walnut Creek, Middle Smoky Hill, and Rattlesnake.

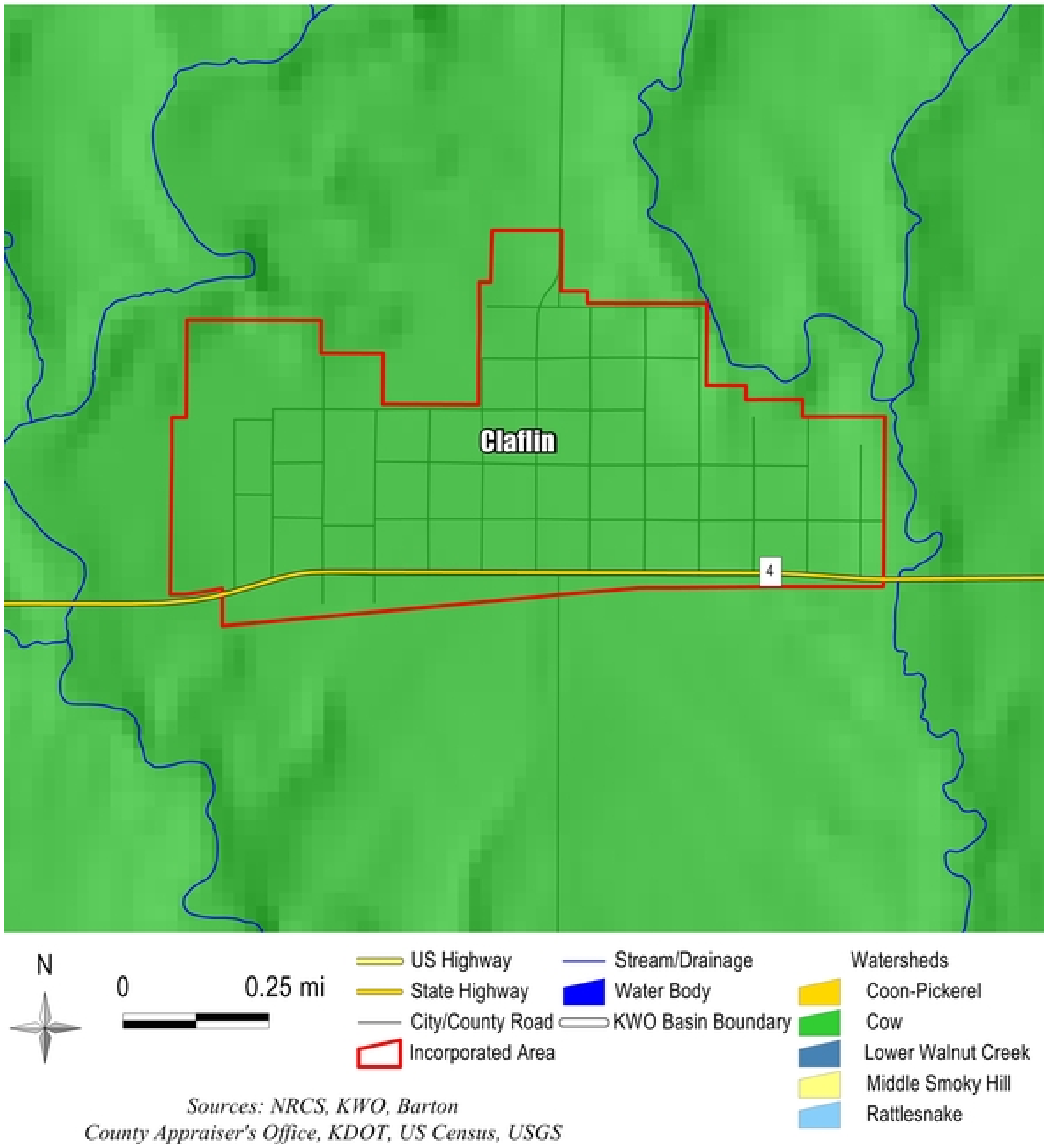
Hydrography Map
Barton County, Kansas

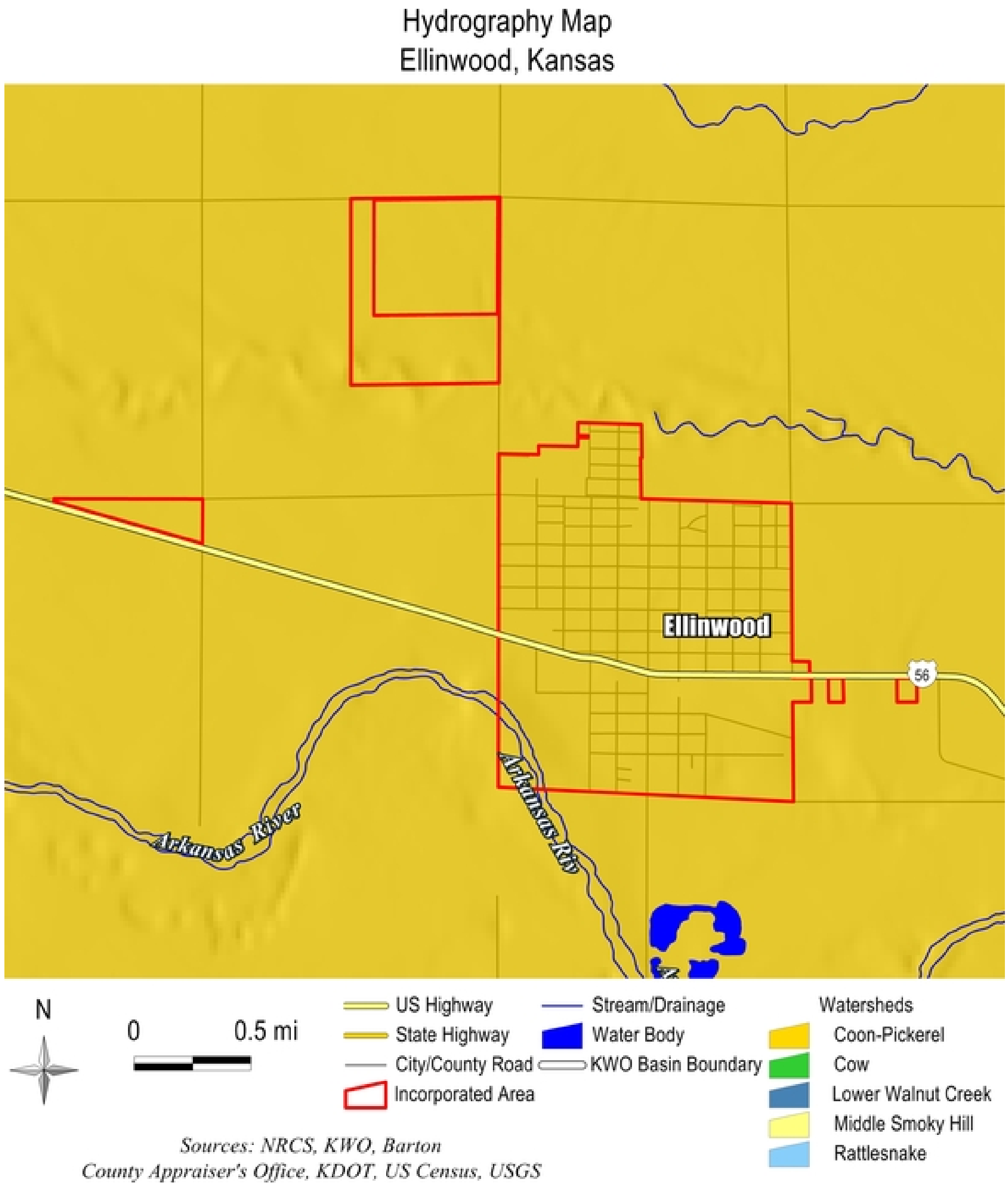


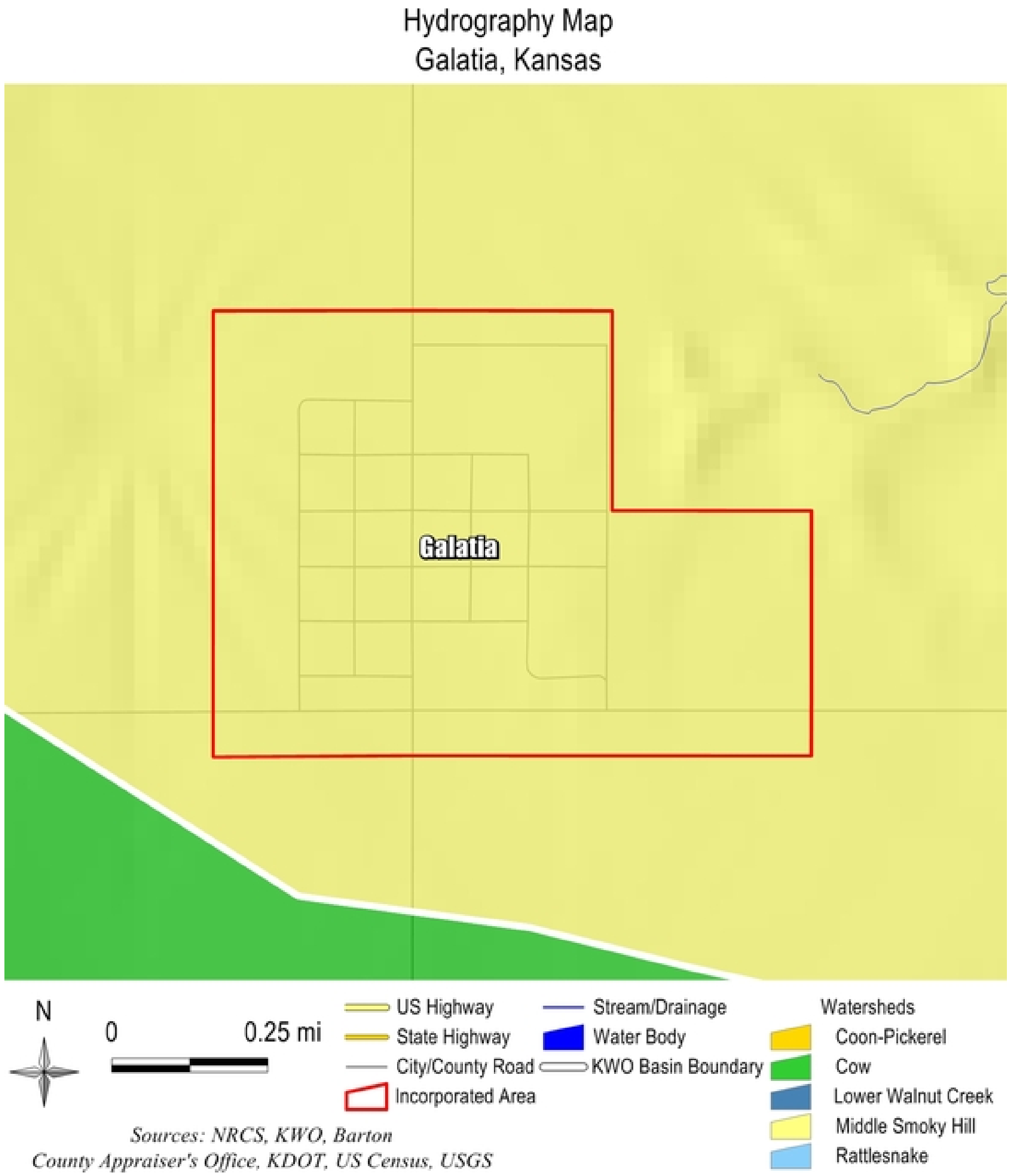
Hydrography Map
Albert, Kansas



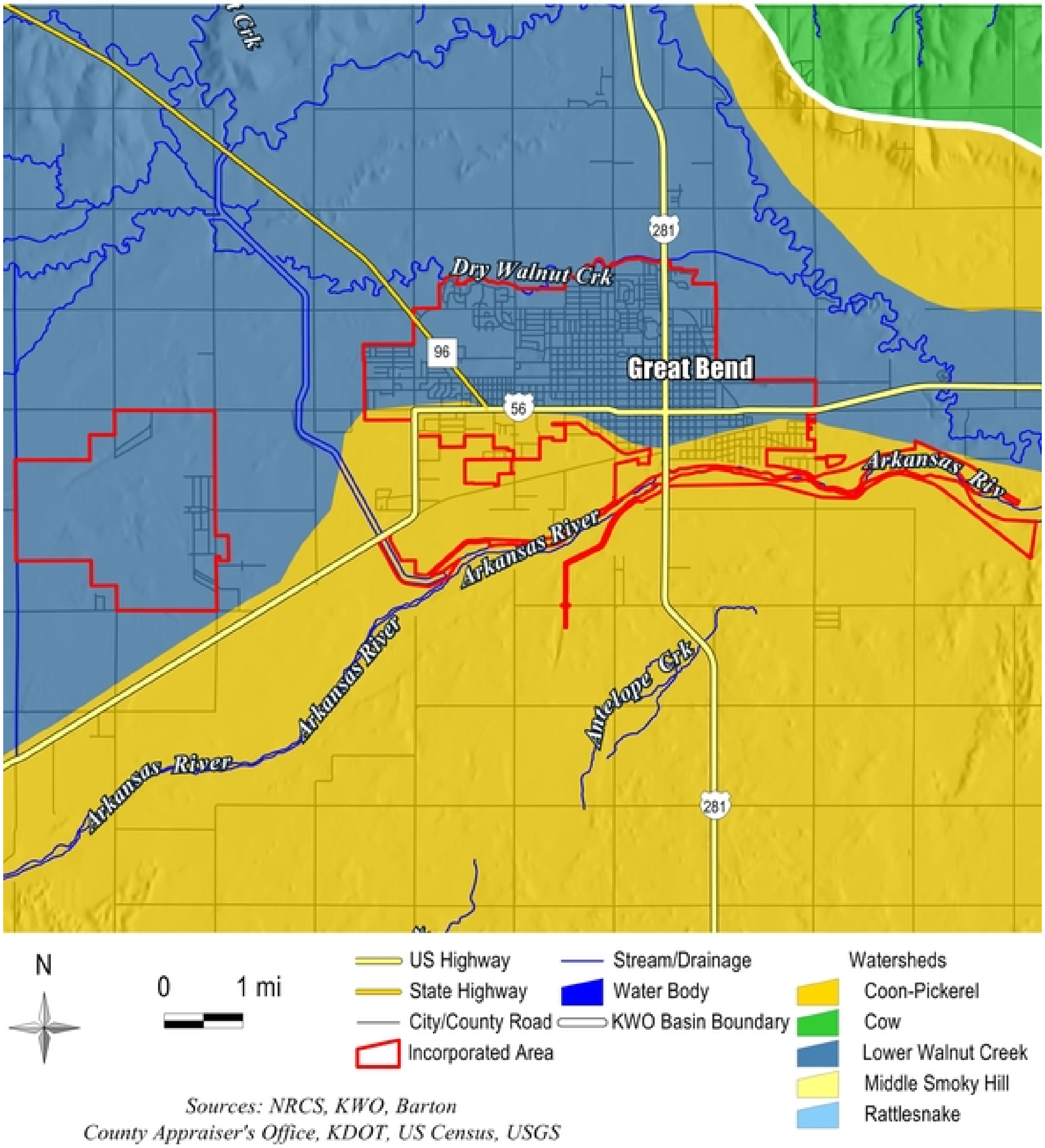
Hydrography Map
Claflin, Kansas



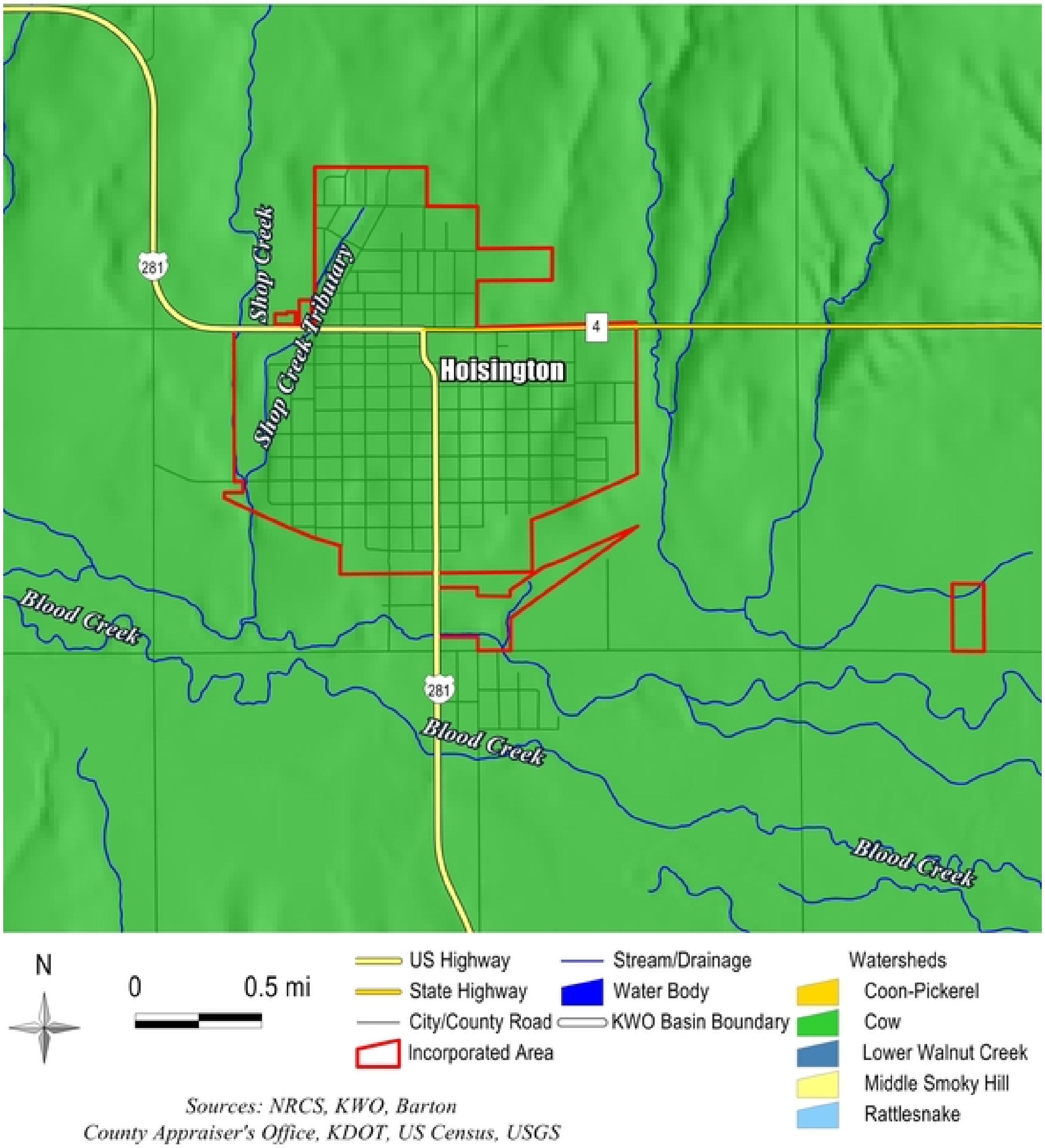

Hydrography Map
Ellinwood, Kansas
Ellinwood
Arkansas River
Arkansas Riv
56
N
0
0.5 mi
US Highway
State Highway
City/County Road
Incorporated Area
Stream/Drainage
Water Body
KWO Basin Boundary
Watersheds
Coon-Pickerel
Cow
Lower Walnut Creek
Middle Smoky Hill
Rattlesnake
Sources: NRCS, KWO, Barton
County Appraiser's Office, KDOT, US Census, USGS

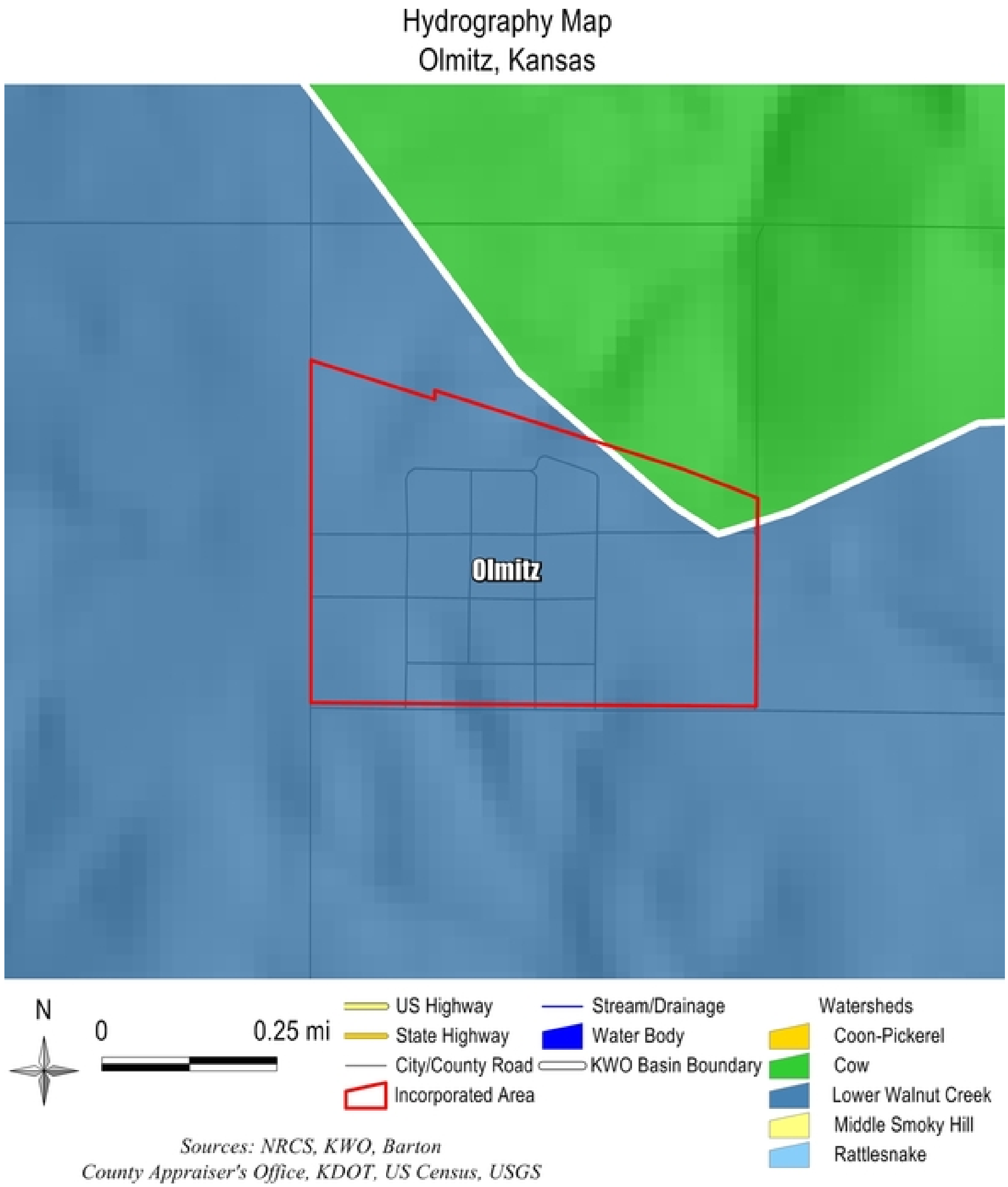

Hydrography Map
Galatia, Kansas
Galatia
N
0
0.25 mi
US Highway
State Highway
City/County Road
Incorporated Area
Stream/Drainage
Water Body
KWO Basin Boundary
Watersheds
Coon-Pickerel
Cow
Lower Walnut Creek
Middle Smoky Hill
Rattlesnake
Sources: NRCS, KWO, Barton
County Appraiser's Office, KDOT, US Census, USGS

Hydrography Map
Great Bend, Kansas

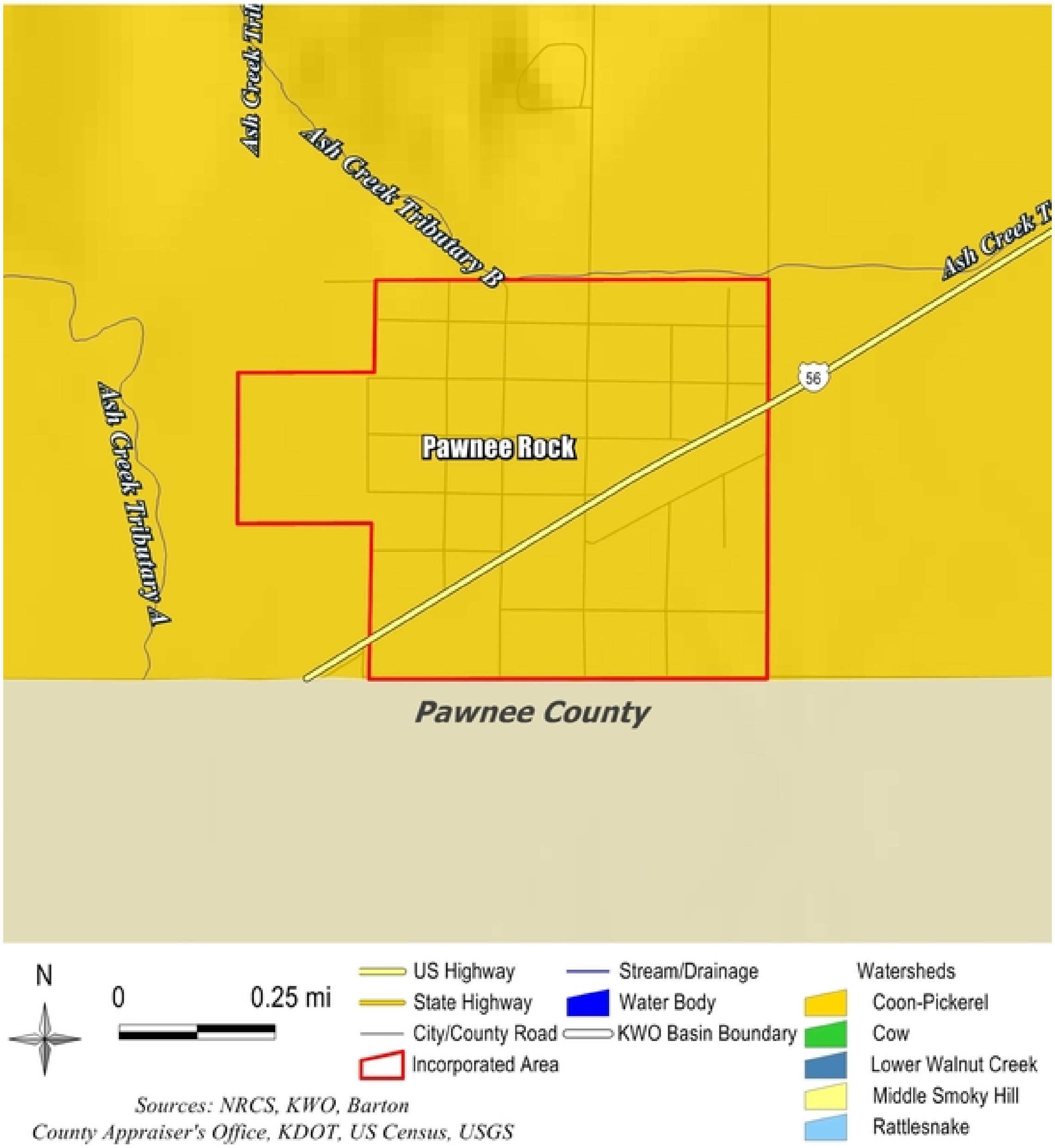


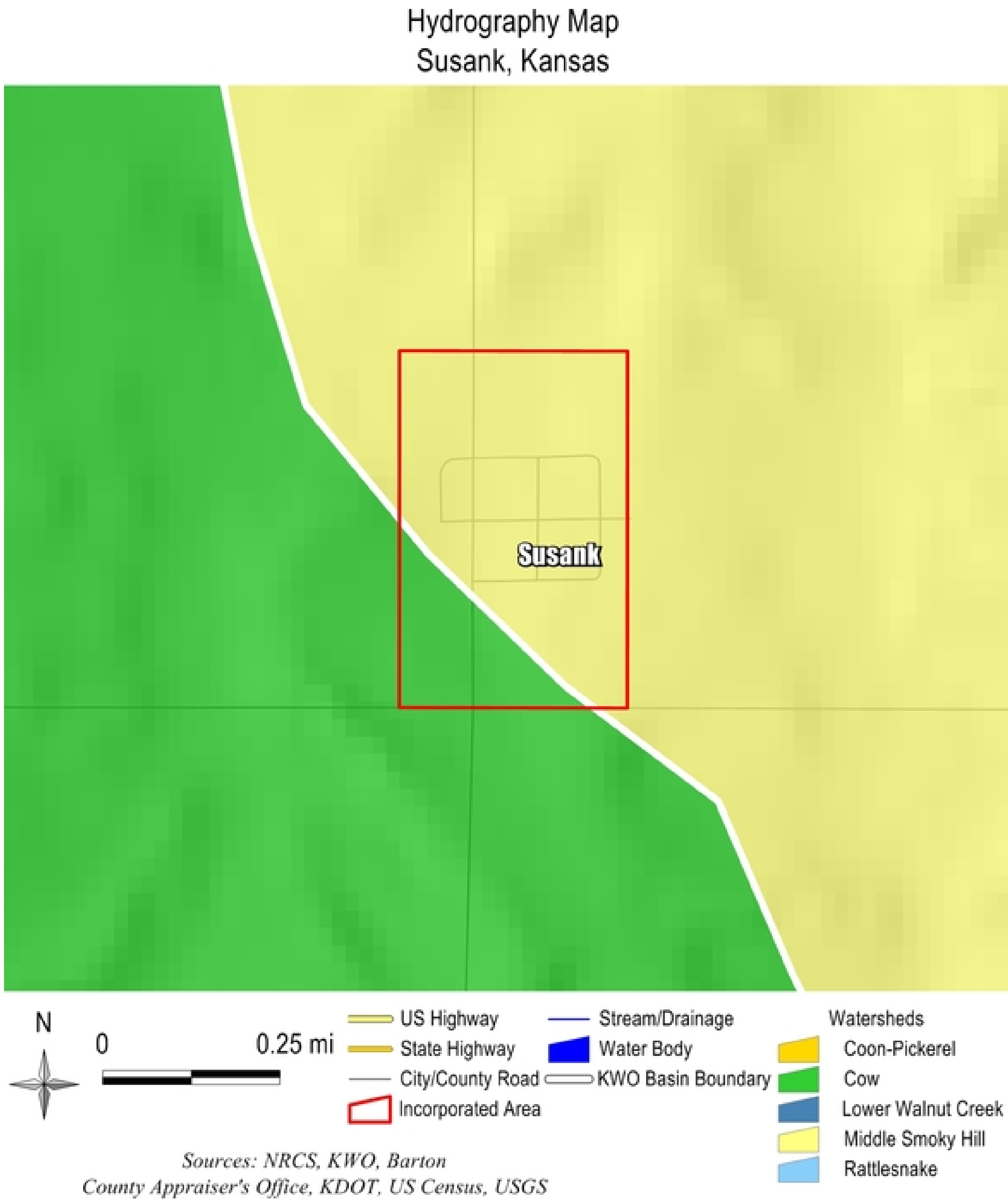
Hydrography Map
Hoisington, Kansas




Hydrography Map
Olmitz, Kansas
Olmitz
N
0
0.25 mi
US Highway
State Highway
City/County Road
Incorporated Area
Stream/Drainage
Water Body
KWO Basin Boundary
Watersheds
Coon-Pickerel
Cow
Lower Walnut Creek
Middle Smoky Hill
Rattlesnake
Sources: NRCS, KWO, Barton
County Appraiser's Office, KDOT, US Census, USGS

Hydrography Map
Pawnee Rock, Kansas



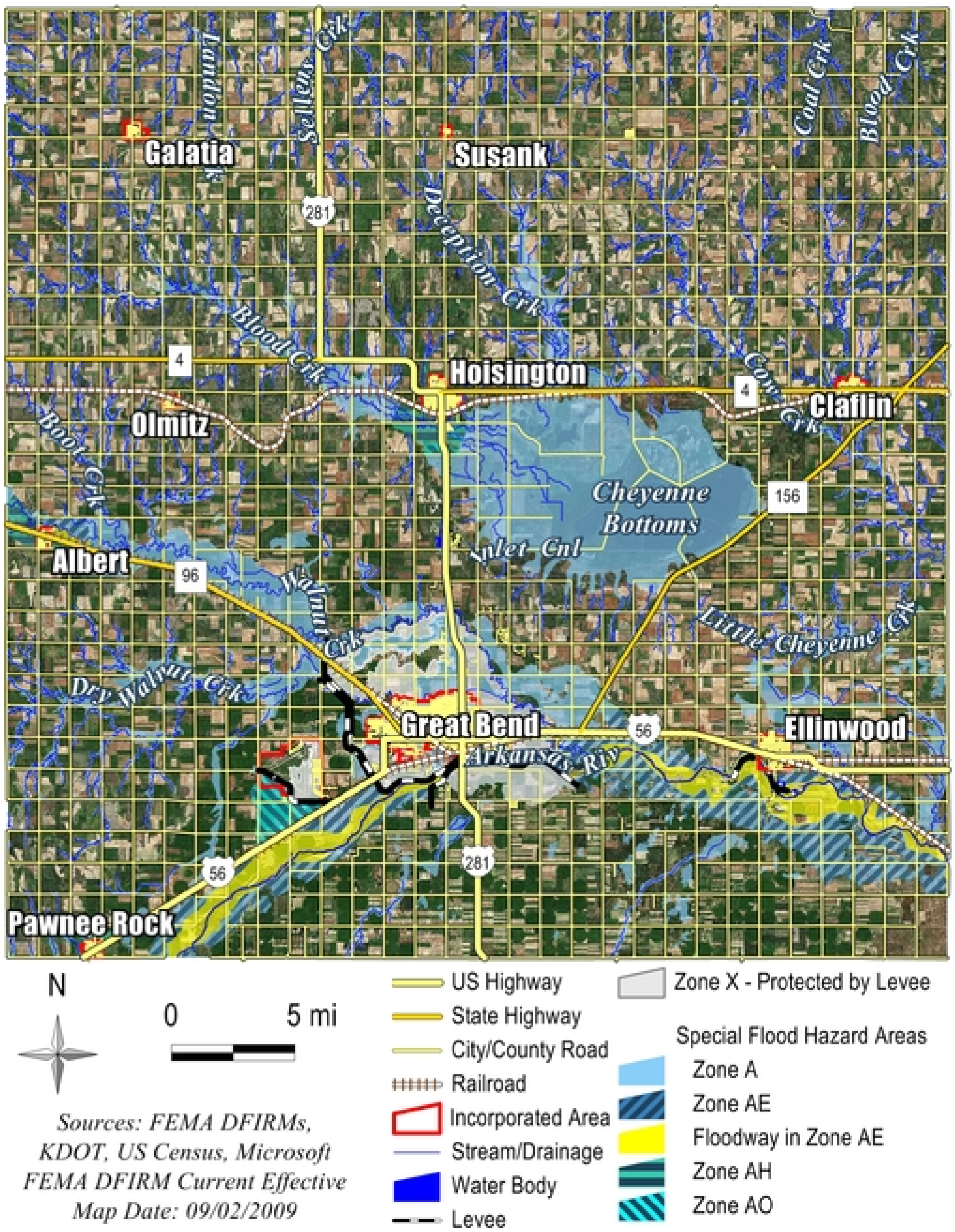


3. Flood Hazard Areas

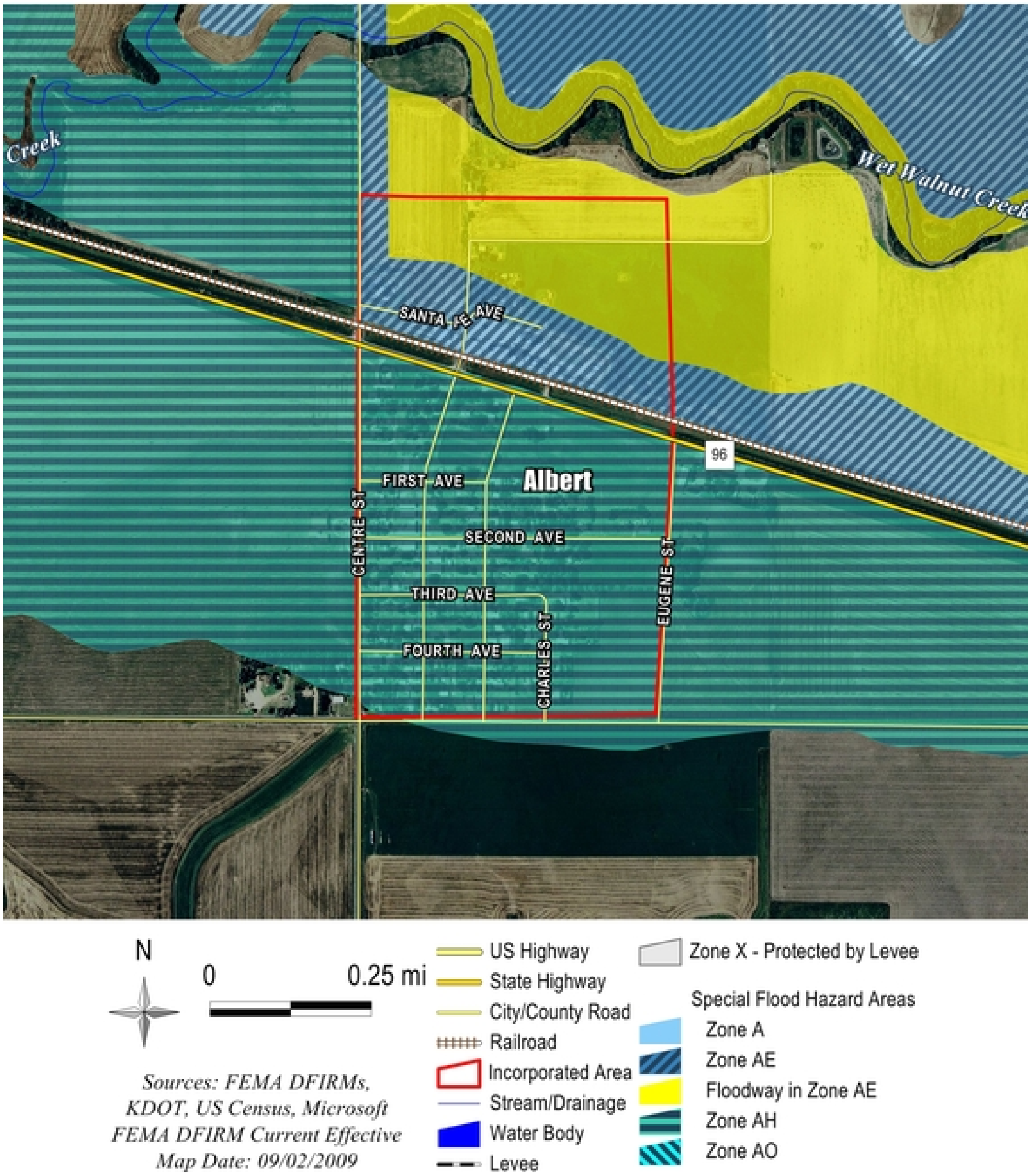
The following map displays the Special Flood Hazard Areas (SFHAs) in Barton County as delineated by the Federal Emergency Management Agency through their Digital Flood Insurance Rate Maps (DFIRMs). SFHAs are defined by one of the following: (1) areas inundated by 100-year flooding, for which no base flood elevations (BFEs) have been determined, (2) areas inundated by 100-year flooding for which BFEs have been determined, or (3) areas inundated by 100-year flooding with velocity hazard (wave action); BFEs have been determined.

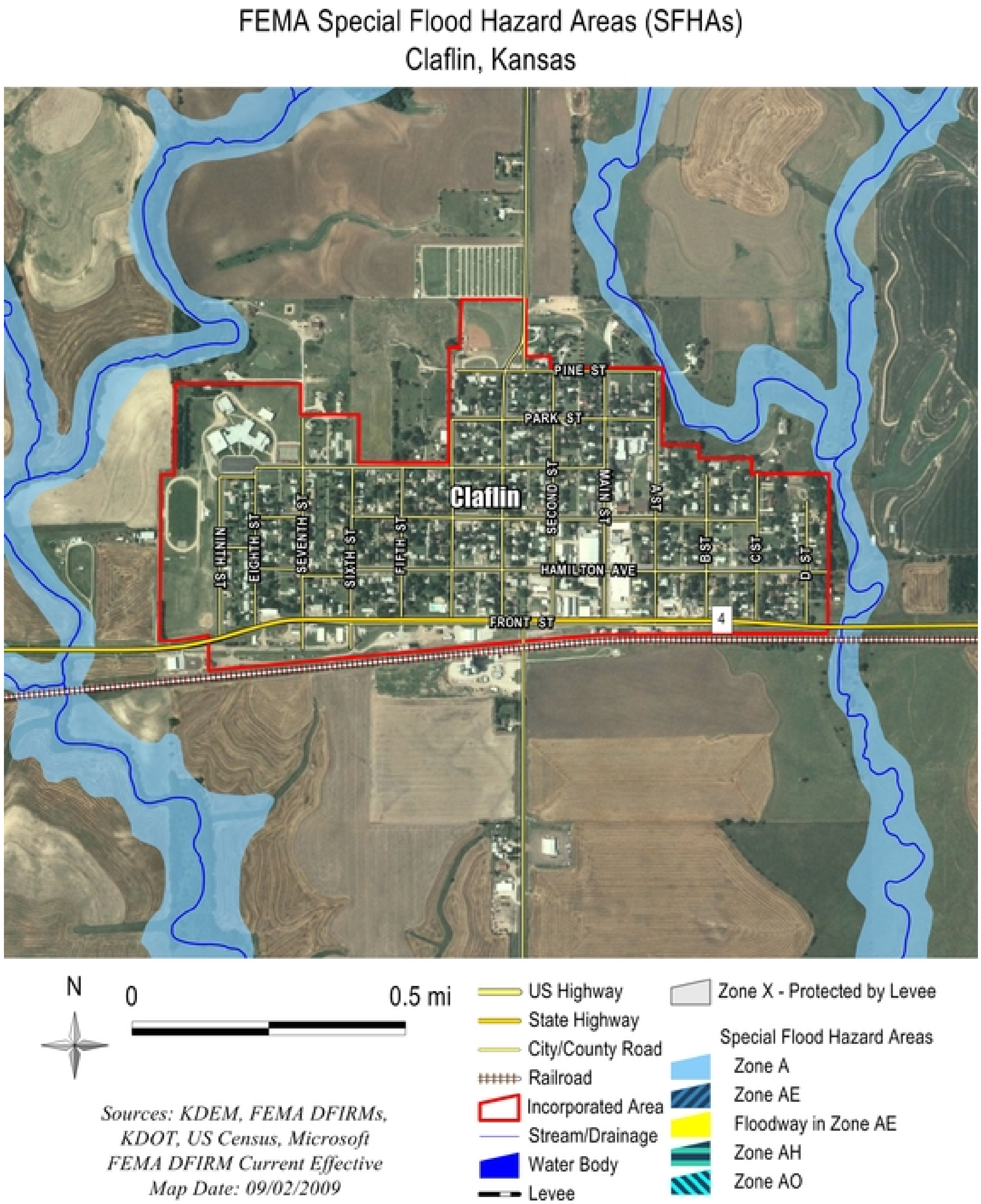
SFHAs are present in Barton County's unincorporated areas and within or near the cities of Albert, Claflin, Ellinwood, Great Bend, Hoisington, and Pawnee Rock.

FEMA Special Flood Hazard Areas (SFHAs)
Barton County, Kansas

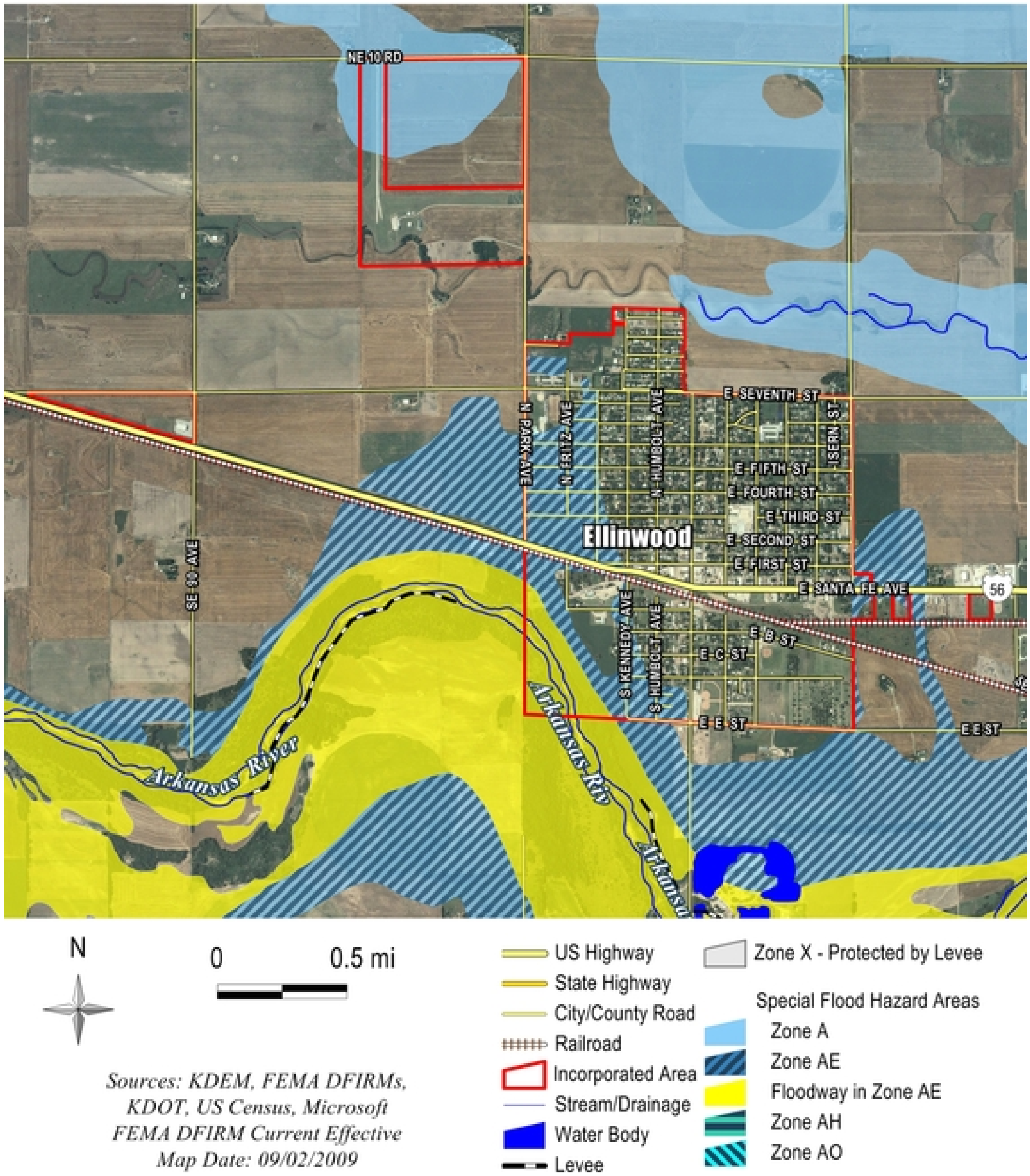


FEMA Special Flood Hazard Areas (SFHAs)
Albert, Kansas

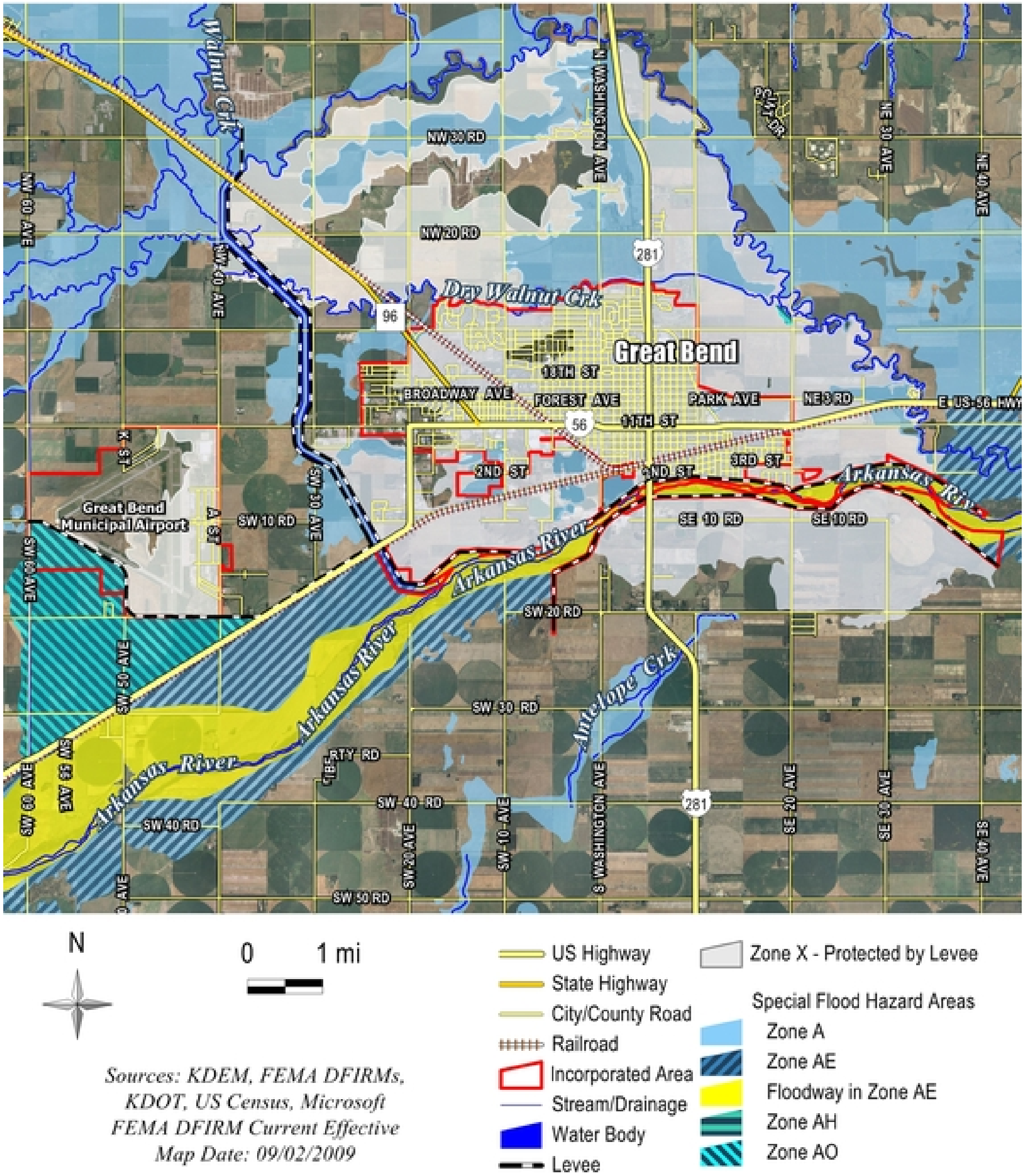



FEMA Special Flood Hazard Areas (SFHAs)
Claflin, Kansas
PINE ST
PARK ST
Claflin
SECOND ST
MAIN ST
A ST
NINTH ST
EIGHTH ST
SEVENTH ST
SIXTH ST
FIFTH ST
B ST
C ST
D ST
HAMILTON AVE
FRONT ST
4
N
0
0.5 mi
US Highway
State Highway
City/County Road
Railroad
Incorporated Area
Stream/Drainage
Water Body
Levee
Zone X - Protected by Levee
Special Flood Hazard Areas
Zone A
Zone AE
Floodway in Zone AE
Zone AH
Zone AO
Sources: KDEM, FEMA DFIRMs, KDOT, US Census, Microsoft
FEMA DFIRM Current Effective
Map Date: 09/02/2009

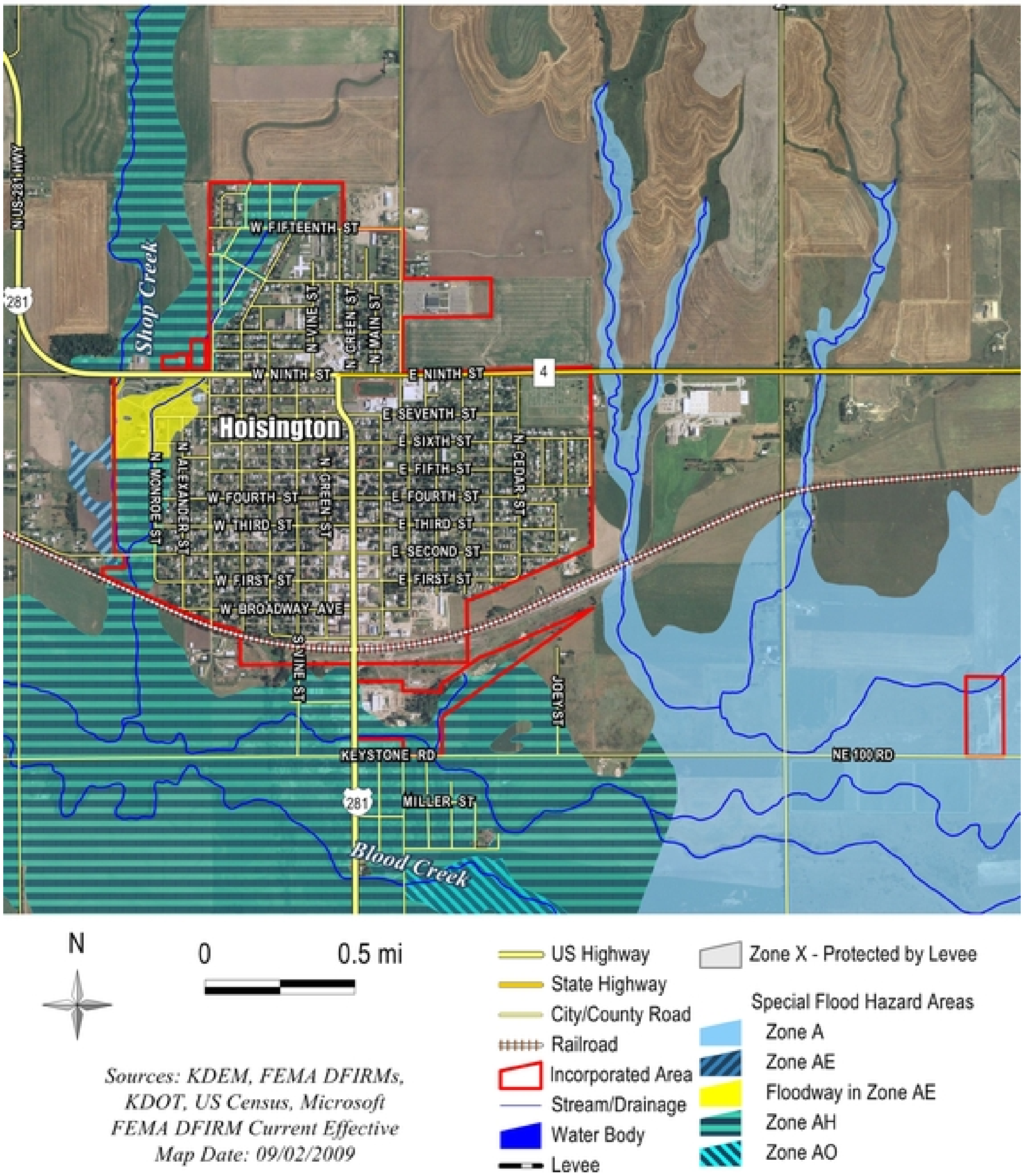
FEMA Special Flood Hazard Areas (SFHAs)
Ellinwood, Kansas



FEMA Special Flood Hazard Areas (SFHAs)
Great Bend, Kansas

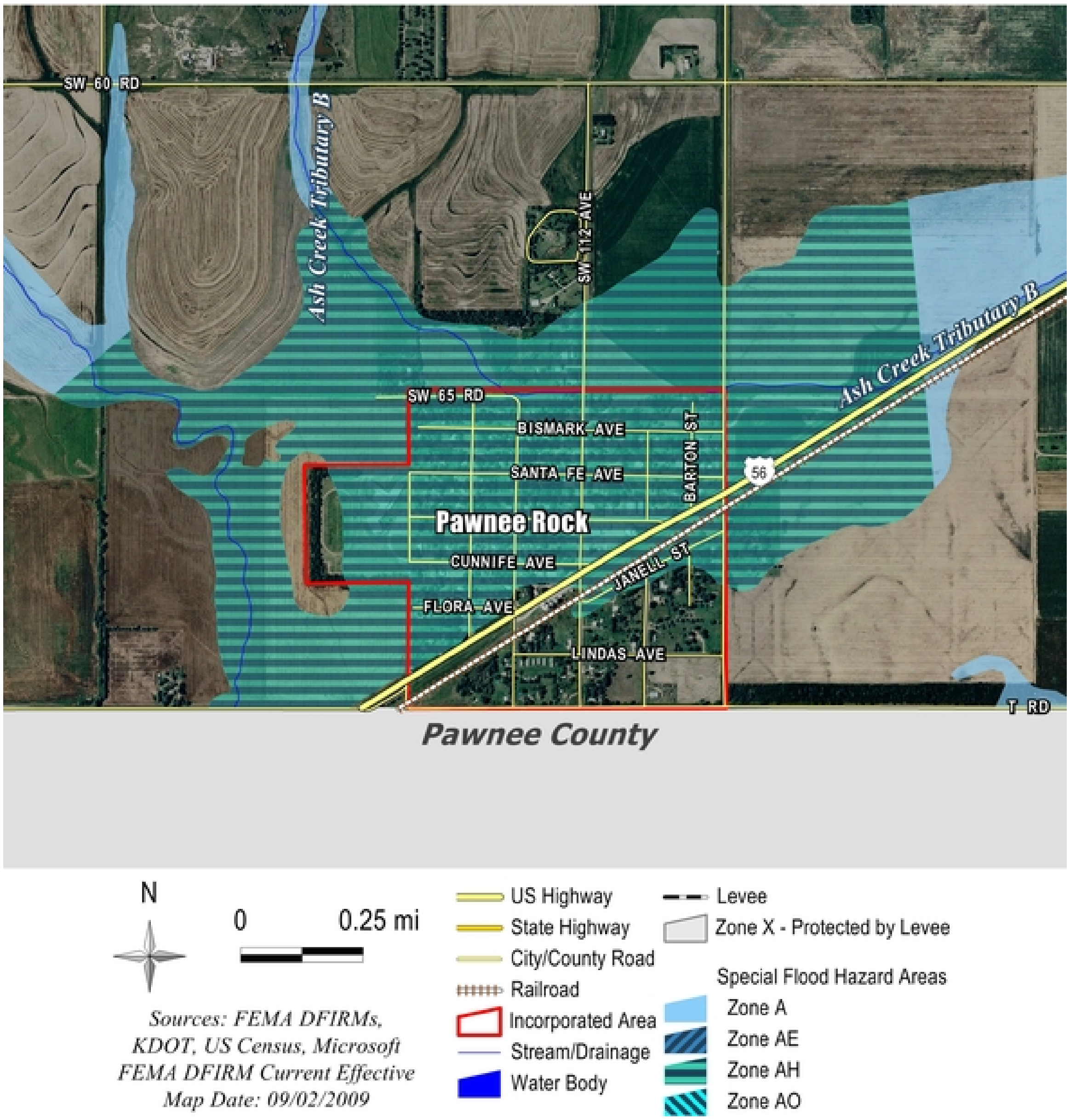


FEMA Special Flood Hazard Areas (SFHAs)
Hoisington, Kansas

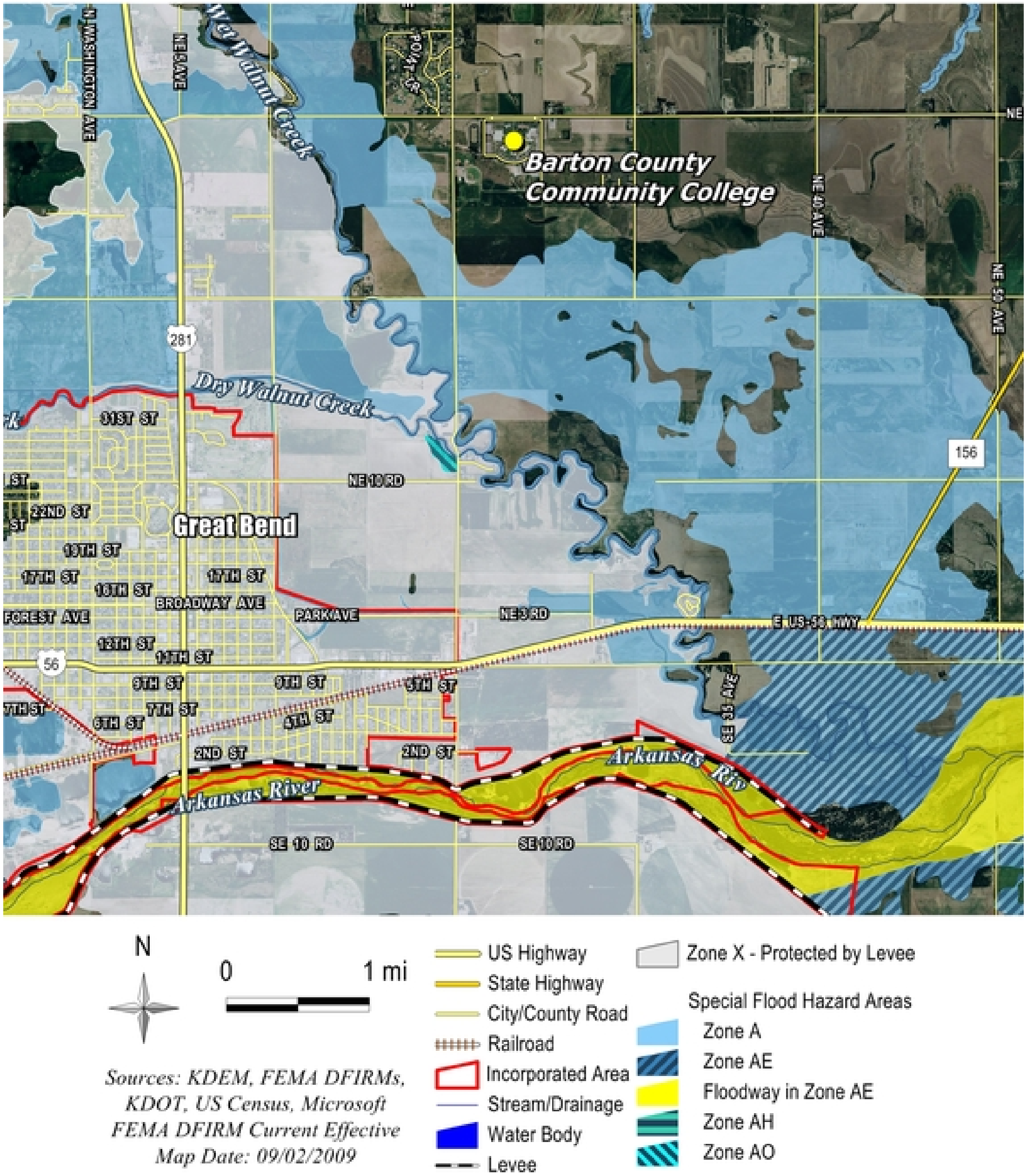


Sources: KDEM, FEMA DFIRMs, KDOT, US Census, Microsoft FEMA DFIRM Current Effective Map Date: 09/02/2009

FEMA Special Flood Hazard Areas (SFHAs)
Pawnee Rock, Kansas

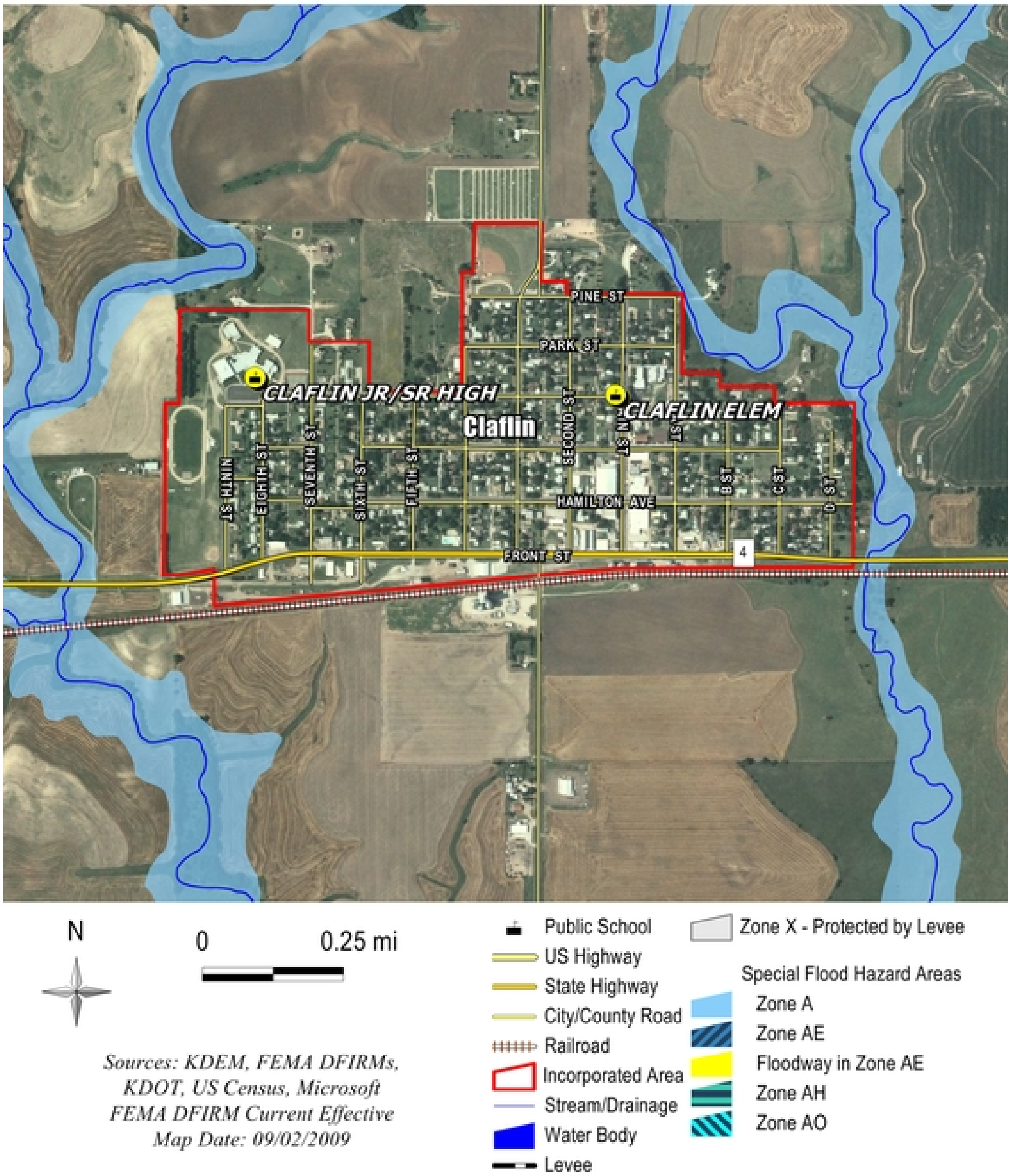


FEMA Special Flood Hazard Areas (SFHAs) and Barton County Community College
Northeast of Great Bend, Kansas

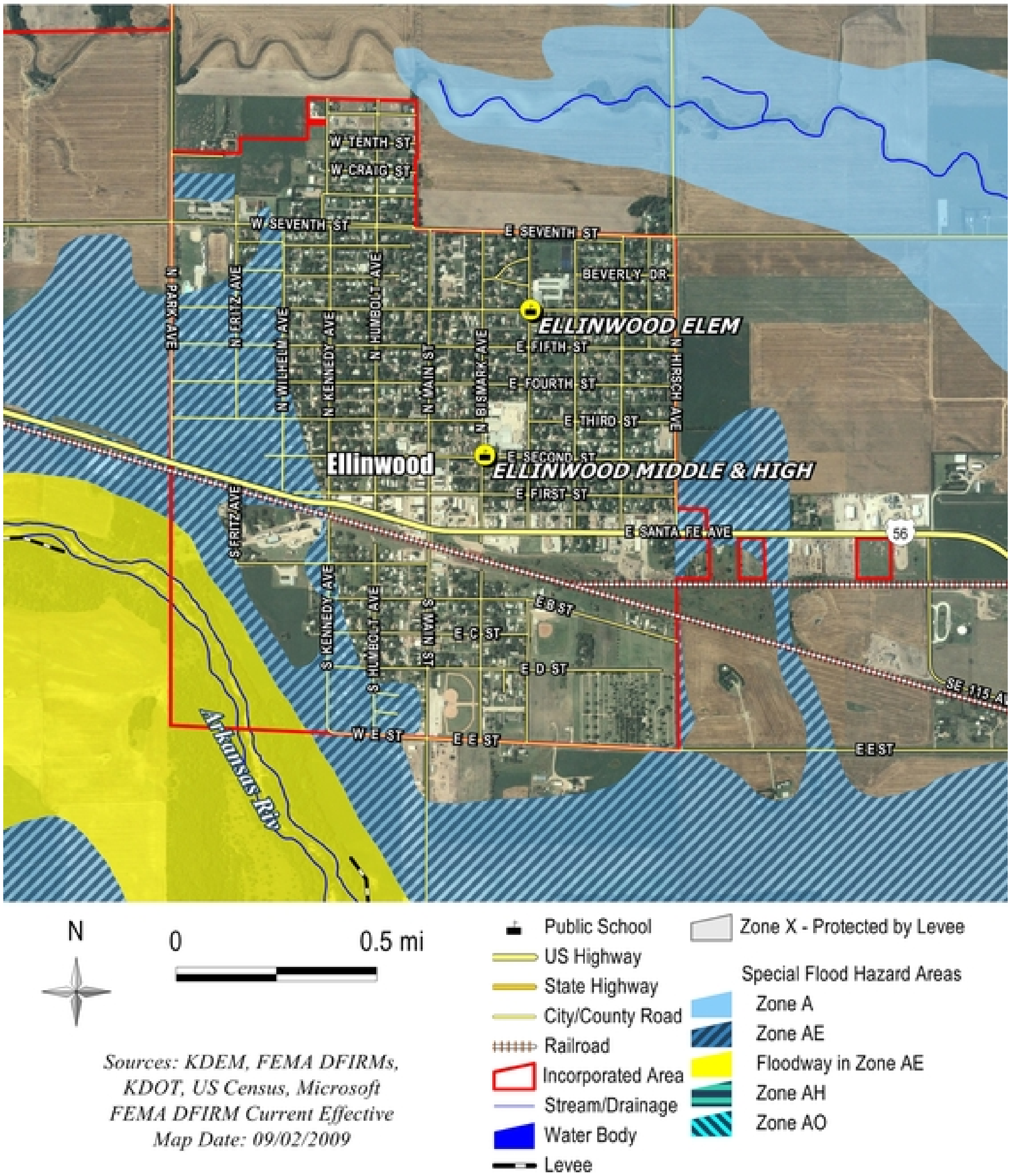


Sources: KDEM, FEMA DFIRMs, KDOT, US Census, Microsoft
FEMA DFIRM Current Effective Map Date: 09/02/2009

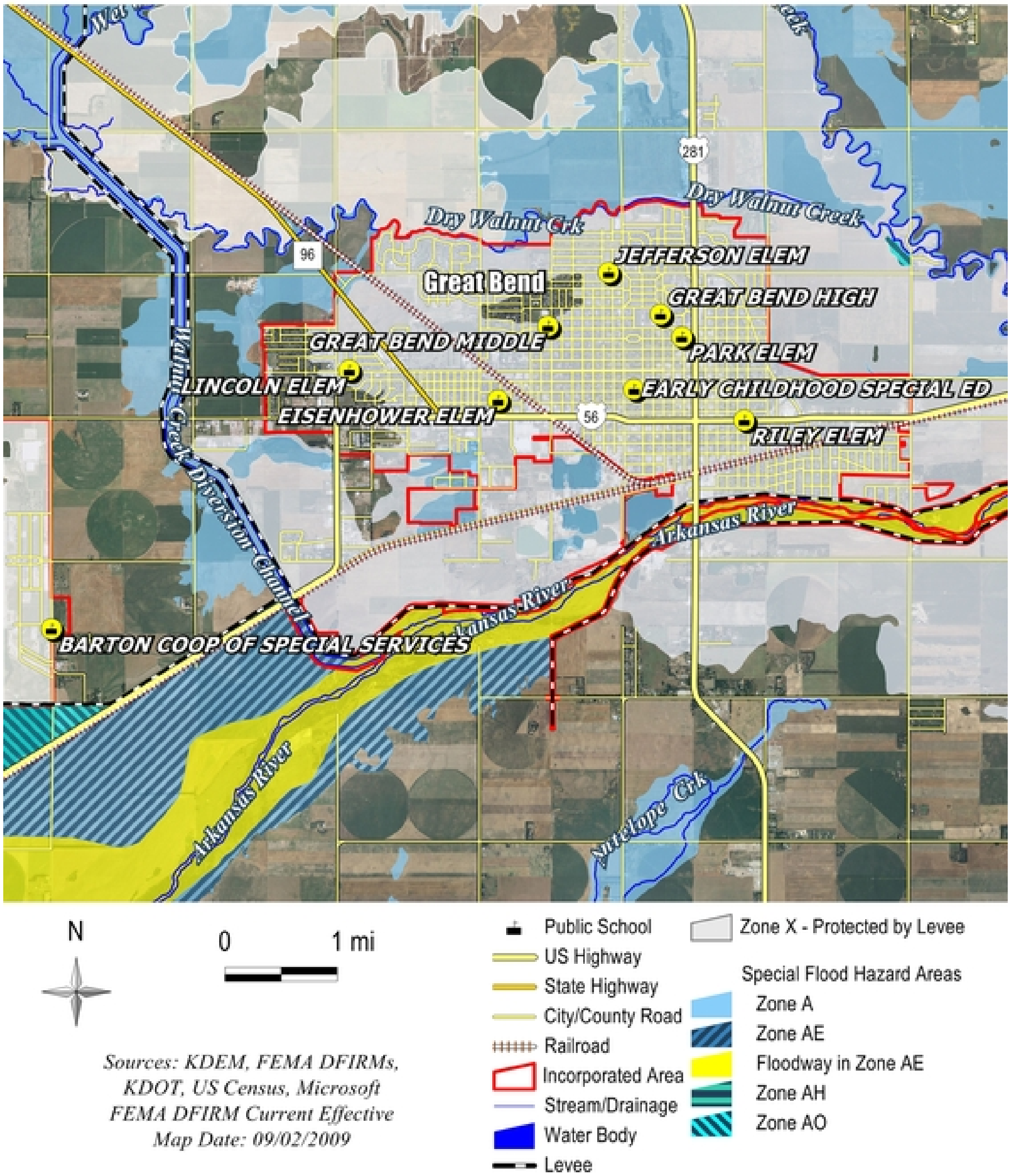
FEMA Special Flood Hazard Areas (SFHAs) and USD 112 Schools
Claflin, Kansas

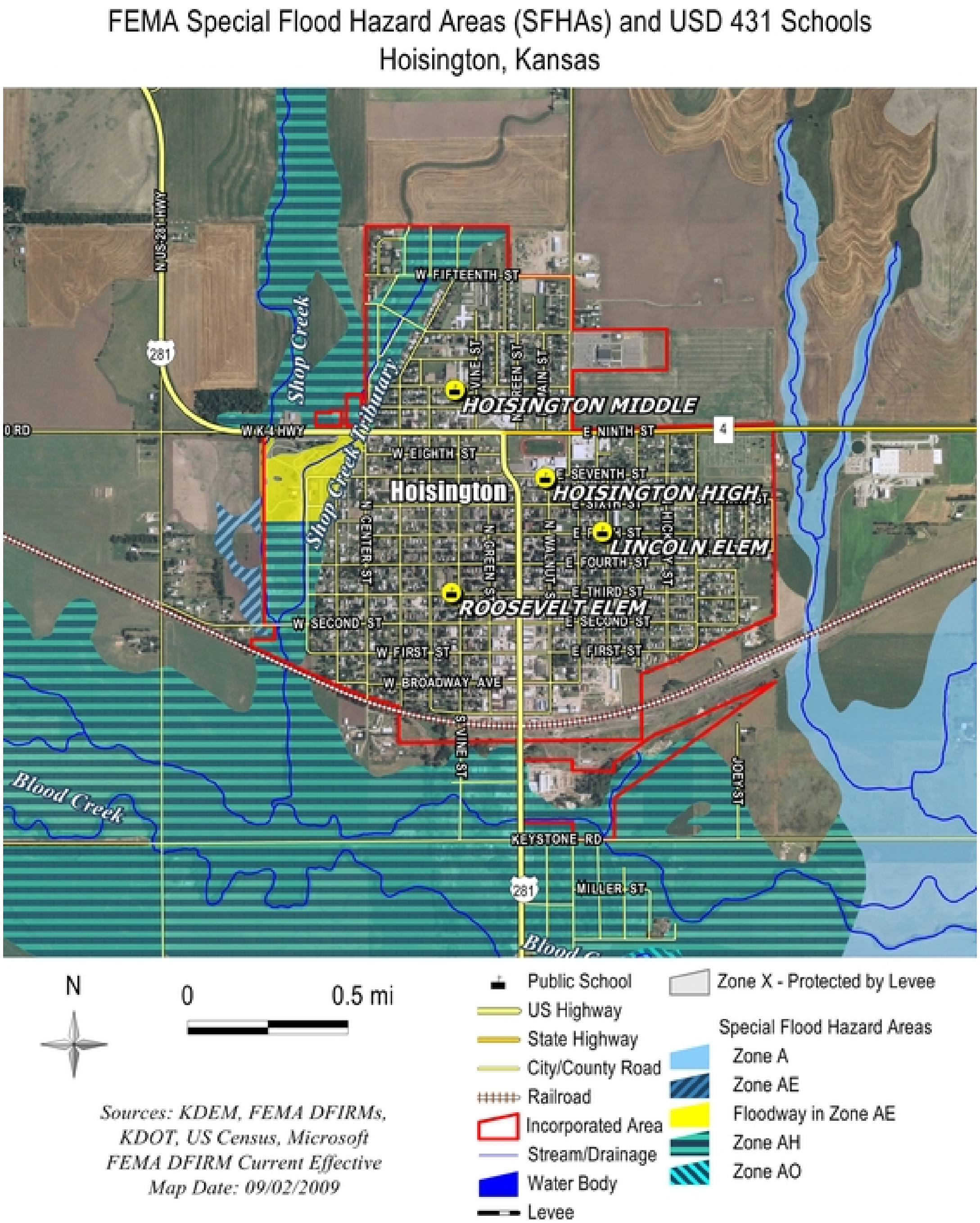


FEMA Special Flood Hazard Areas (SFHAs) and USD 355 Schools
Ellinwood, Kansas



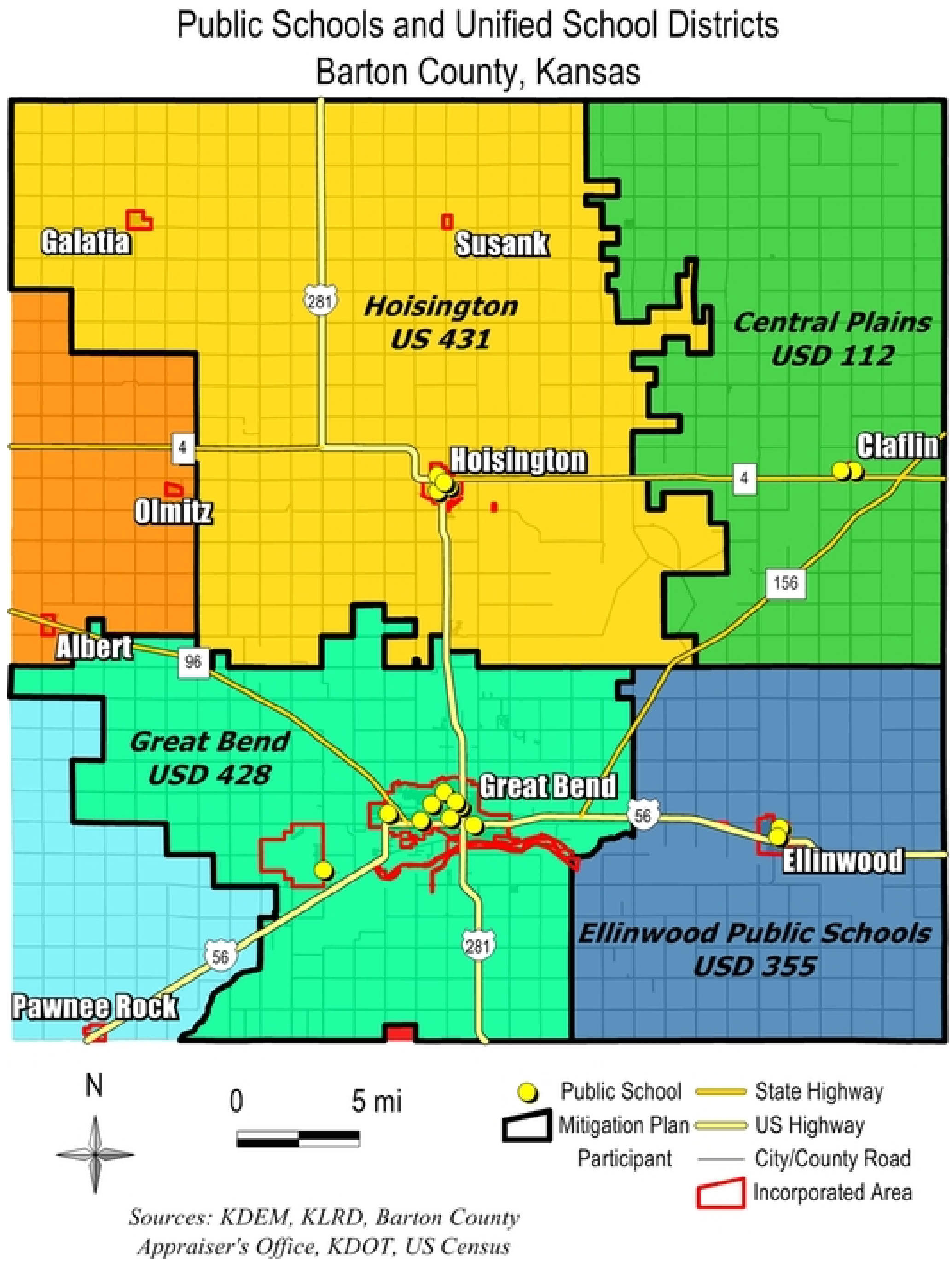
FEMA Special Flood Hazard Areas (SFHAs) and USD 428 Schools
Great Bend, Kansas





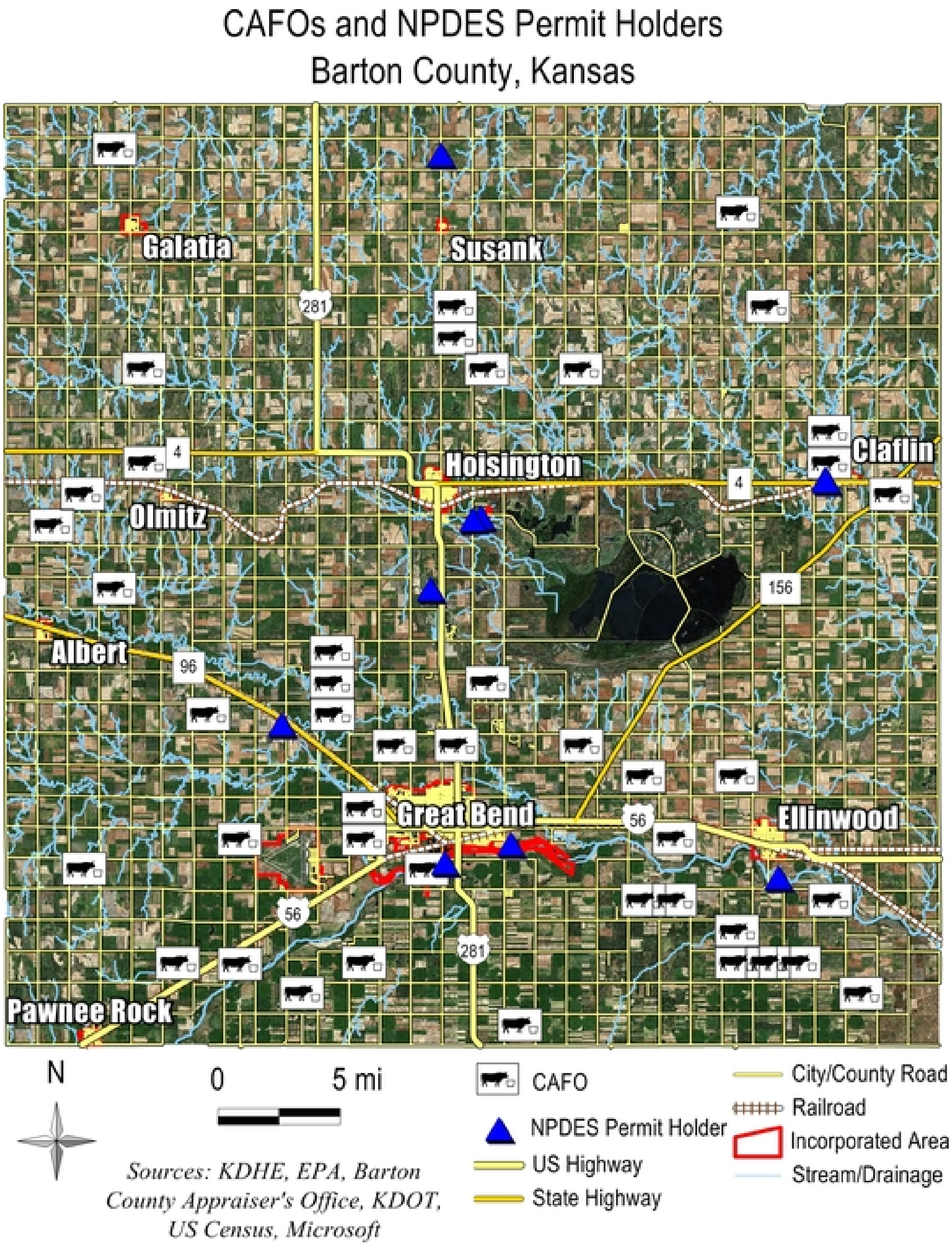
4. Public Schools

The following maps display the public schools and unified school districts located in Barton County.



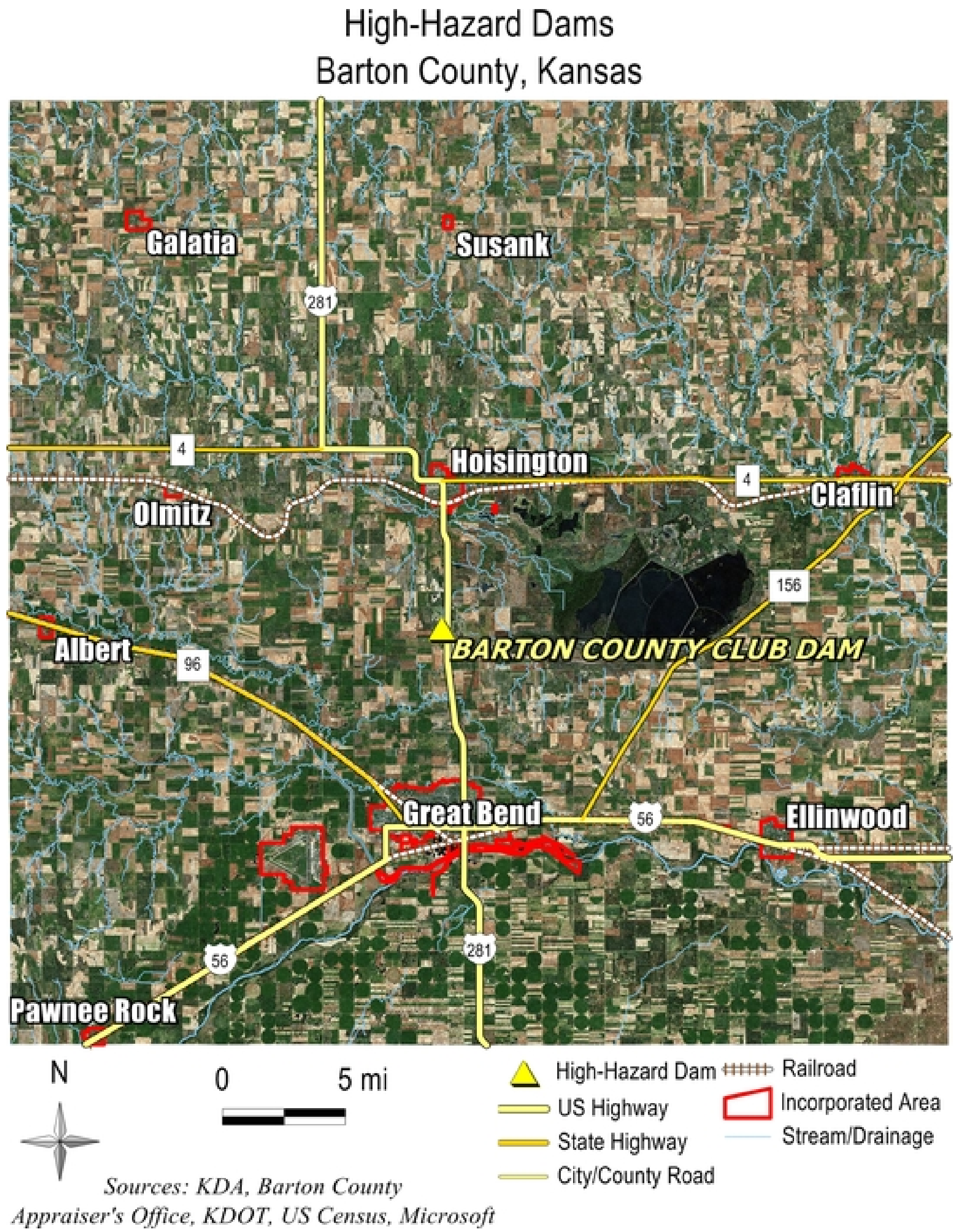
5. Pollution Sources

The following maps display the locations of individual National Pollutant Discharge Elimination System (NPDES) sites permitted for wastewater discharges to surface waters in Barton County, as recorded by the Environmental Protection Agency (EPA). The map also displays the locations of Confined Animal Feeding Operations (CAFOs) currently registered with Kansas Department of Health and Environment (KDHE).

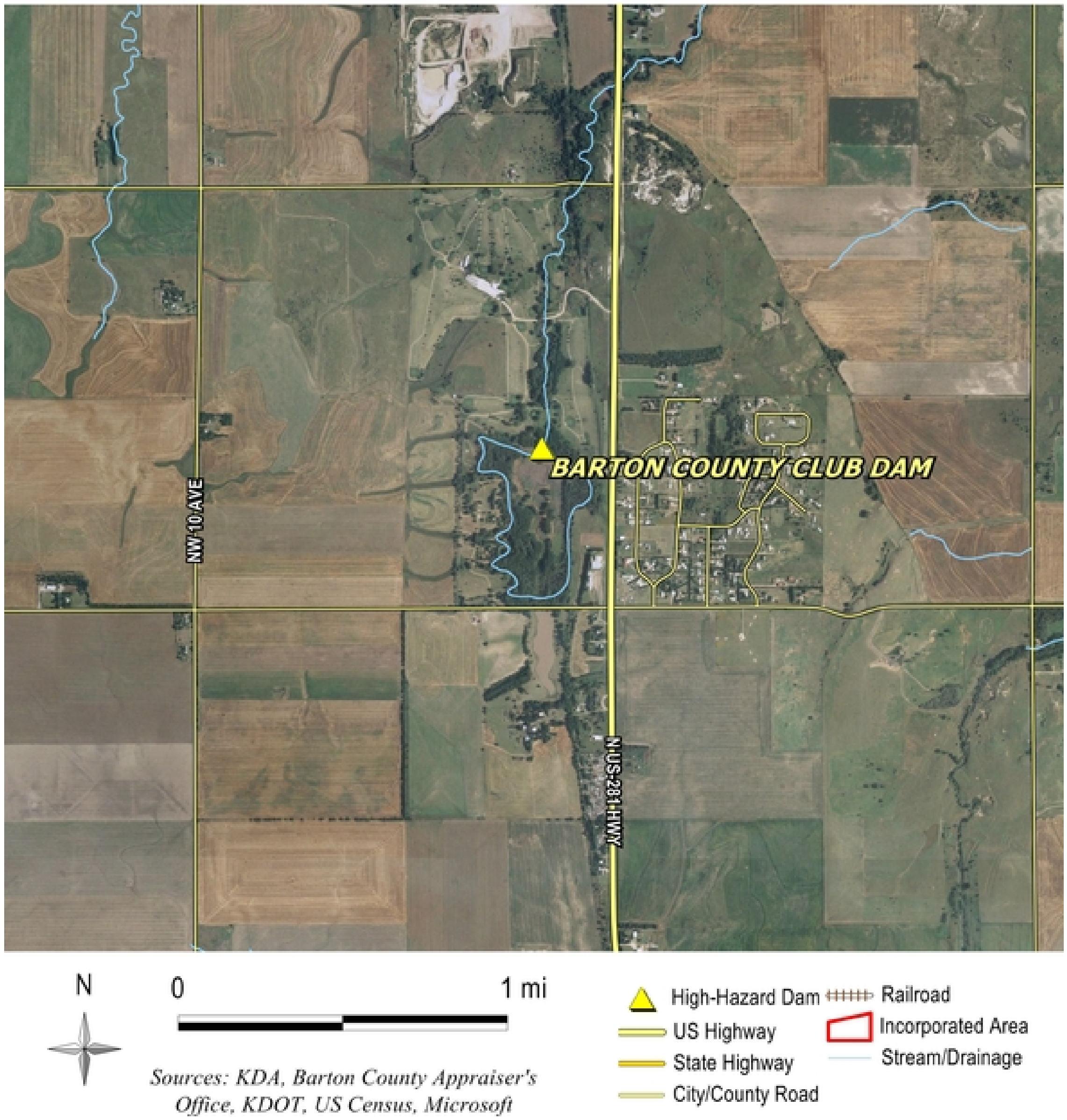


6. Dams & Levees

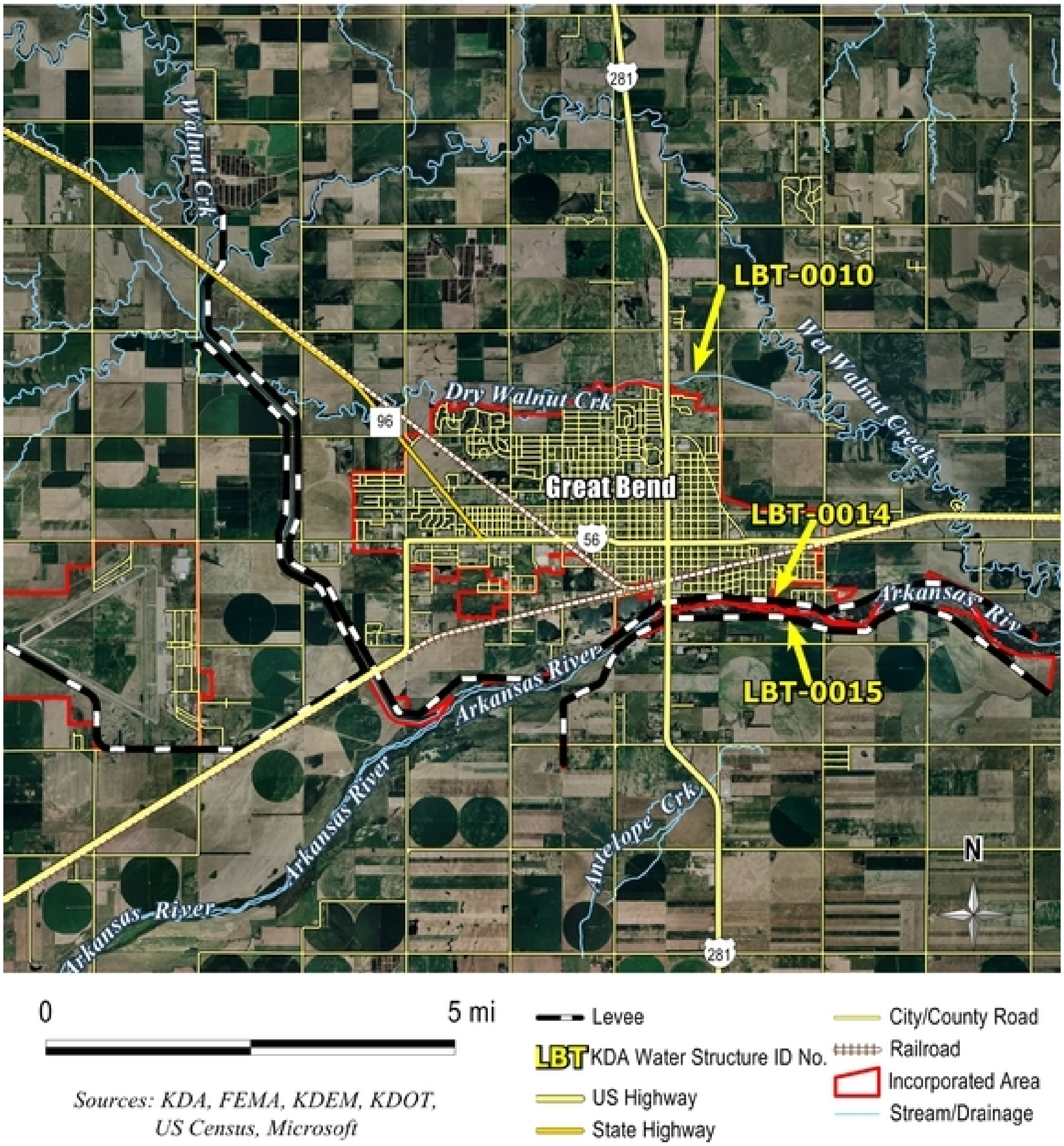
The following maps display the one high-hazard dam and the Great Bend levee systems. The Arkansas River levee (KDA ID# LBT-0014 and LBT-0015) is subject to PM 43 certification.


High-Hazard Dams
Barton County, Kansas
Galatia
Susank
281
4
Hoisington
Olmitz
Claflin
156
Albert
96
BARTON COUNTY CLUB DAM
Great Bend
56
Ellinwood
281
56
Pawnee Rock
N
0
5 mi
High-Hazard Dam
Railroad
US Highway
Incorporated Area
State Highway
Stream/Drainage
City/County Road
Sources: KDA, Barton County Appraiser's Office, KDOT, US Census, Microsoft

Barton County Club High-Hazard Dam



Great Bend Levee Systems



Levee LBT-0010
Northeast side of Great Bend

4.5.3 Vulnerability Estimation by Hazard

EFM utilized geographic distribution of natural hazards to develop vulnerability estimates, as recommended by FEMA, for hazards of planning significance. This generally involves assessment of the event location along with the extent and frequency of damage incurred over time. Natural hazards identified as multi-jurisdictional are those hazards that impact the entire geographical area of the county in a generally random and unpredictable manner.

Natural hazards identified by FEMA, that are considered local hazards for vulnerability assessment, include: flood, wildfire, and dam/levee failure. These hazards generally create localized damage exposure so vulnerability is treated as a separate geographical planning area for these hazards.

With limited objective flood related data on structures and populations in flood hazard areas and limited data on the appraised and assessed values of real property by land use, in the overall multi-jurisdictional areas of Barton County, estimates of damage inflicted by various types of natural hazards will be offered in a tabular format.

The principal resource in developing loss estimates for the county or municipality was provided by the National Climatic Data Center (NCDC), and best available information relating to populations and the value of real, commercial, and personal property, by jurisdiction, as obtained from various state and county sources. The purpose of this information is to show the overall population numbers and property values that would be subject to natural hazards in the jurisdictions of Barton County.

The qualitative approach used a two step process. The first step analyzed Severity Table 4.2 (2). NCDC provides five categories for severity of damage for deaths, personal injury, property damage, and crop damage. As an example, property damage reported in the database ranges from less than $10,000 to greater than $100,000,000 per event. The consultant recommended the following for consideration:

- A value of 5 in the Severity table be considered as complete destruction (> $100,000,000);
- Values of 0.5, 1 and 2 be considered as 1% damage (1,000,000/100,000,000 = 1% in a worst case scenario)
- Value of 3 be considered as greater than 1% and up to 10% damage (10,000,000/100,000,000 = 10% in a worst case scenario)
- Value of 4 be considered as greater than 10% and up to 50% damage (50,000,000/100,000,000 = 50% in a worst case scenario)

The MPC accepted this scale based on the fact that it is documented data provided by NCDC records.

Step 2 required each jurisdiction to agree on a final damage percentage considering local observations, total values in Table 4.5.1 (1), and specific jurisdiction values provided by the Appraisers office and listed in the vulnerability tables in Section 4. After this consideration, the damage percentage was assigned and used for calculations. If, by consensus, the jurisdiction chose a percentage outside the proposed ranges, then an explanation is provided, such as for flood and tornado.

Wildfire related data for structures, crops, and people were provided by the Kansas Fire Marshal's Office. Data for dam/levee was provided by the Kansas Department of Agriculture (KDA) - Division of Water Structures, and consists of dam/levee inventories and dam classifications developed by the KDA. The hazards identified as high and moderate were assessed utilizing available quantitative analysis and/or loss estimation. Hazards that were researched, but provided little data for evaluation, were analyzed from a qualitative perspective.

In November 1998, the Kansas Water Office completed estimated population and water demand projections for every county, city, and rural water district in Kansas for the years 2000, 2010, 2020, 2030, and 2040. These data were used for developing exposed population numbers for vulnerability estimation. Numbers may vary from actual census data. Information regarding methodology and projections can be found at: www.kwo.org/index.htm."

Flood

Floods are generally a result of slow-moving thunderstorms that deposit large volumes of water over an extended period of time. Heavy thunderstorm/rain may result in localized areas of flash flooding. This hazard is addressed separately by geographical area where data is provided by the jurisdiction.

National Flood Insurance Program (NFIP)

The decision on whether to join the NFIP is very important for a jurisdiction (community). There is no Federal law that requires a jurisdiction to join the program, and participation is voluntary. A benefit of participation is that the citizens are provided the opportunity to purchase flood insurance to protect themselves against flood losses. Another consideration is that a jurisdiction that has been identified by FEMA as being flood-prone and has not joined the NFIP within one year of being notified of being mapped as flood-prone will be sanctioned.

Jurisdictions that regulate development in floodplains are able to participate in the National Flood Insurance Program (NFIP). To participate in the NFIP the jurisdiction must adopt and enforce floodplain management regulations that meet or exceed the minimum requirements of the program.

The jurisdiction must submit an application package that includes the following:

- The jurisdiction must make an Application for Participation in the NFIP (FEMA Form 81-64);
- The jurisdiction must adopt a Resolution of Intent, which indicates an explicit desire to participate in the NFIP and a commitment to recognize flood hazards and carry out the objectives of the program;
- The jurisdiction must adopt and submit Floodplain Management Regulations that exceed the minimum flood plain management requirements of the NFIP (Title 44 of the Code of Federal Regulations (44 CFR) section 60.3);
- The jurisdiction's floodplain management regulations must be legally enforceable.

Barton County (UnInc) updated and adopted floodplain management regulations on August 3, 2009. The resolution rescinded previous flood plain ordinances and incorporates the Flood Insurance Rate Map for Barton County, Kansas, and Incorporated Areas dated September 2, 2009 into the Floodplain Management Ordinance No. 60.3d, "Regulatory Floodway Identified", as approved by the Kansas Department of Agriculture, Division of Water Resources, on July 21, 2009.

Barton County (UnInc), and the cities of Claflin, Great Bend, Hoisington, Pawnee Rock, Ellinwood, Susank, and Albert participate in the National Flood Insurance Program, and are committed to continued participation and compliance with the NFIP. Actions identified in support of the NFIP are provided in Section 5.2 - Mitigation Actions.

Community Rating System Activities (CRS)

Jurisdictions that regulate development in floodplains are able to participate in the National Flood Insurance Program (NFIP). In return, the NFIP makes federally backed flood insurance policies available for properties in the jurisdiction. The Community Rating System (CRS) was implemented in 1990 as a program for recognizing and encouraging jurisdiction floodplain management activities that exceed the minimum NFIP standards. There are ten CRS classes. Class 1 requires the most credit points and earns the largest premium reduction, while Class 10 receives no premium reduction. It is a long process to become a participating CRS community, taking almost one year from application to acceptance. New CRS communities are admitted only on October 1 and May 1 of each year.

Barton County and the incorporated cities do not currently participate in the CRS program.

Repetitive Loss Inventory

The Kansas Division of Emergency Management (KDEM), Plans and Mitigation Office, was contacted regarding "repetitive loss properties" that may exist in Barton County. KDEM maintains records obtained from the Federal Emergency Management Agency (FEMA), Region VII, on repetitive loss properties in the State of Kansas.

Although there are separate definitions for what constitutes a repetitive loss property among various programs, FEMA generally considers it to be "any property, which the National Flood Insurance Program has paid two or more flood claims of $1,000 or more in any, given 10-year period since 1978."

FLOOD: REPETITIVE LOSS PROPERTIES

Address	City	Occupancy (type)	Building Value	# Loss Claims	Mitigated?
Center Street	PAWNEE ROCK	SINGLE FMLY	$32,500	2	NO
DRY CREEK	GREAT BEND	SINGLE FMLY	$75,000	2	NO
West 87th Lane	ELLINWOOD	SINGLE FMLY	$122,590	2	NO

The three repetitive loss properties identified in Barton County have not been mitigated as of the writing of this Plan.

Reference Section 3.10.2 Legal and Regulatory Capability - "Acquisition" for information on other properties mitigated in Barton County that were not classified as repetitive loss properties.

Flood inundation areas for Barton County (UnInc) and the towns of Albert, Ellinwood, Great Bend, Hoisington, and Pawnee Rock were determined by use of FEMA boundary maps which were geo-coded using Manifold.Net, a GIS application. The GIS application calculates the percentage of areas affected by dividing affected square footage by total square footage. This calculation results in a 22.2% value for the unincorporated county area, and values of 95.9% for Albert, 23.0% for Ellinwood, 27.0% for Great Bend, 15.9% for Hoisington, and 22.2% for Pawnee Rock areas which would be impacted respectively.

Historical record provided limited flood level or damage data. In a worst case scenario, the MPC estimated that the affected areas would be inundated by an average of one foot of water. Using the tables from FEMA 386-2, page 4-13, an average damage percent of 10% was estimated based on the values for a one foot flooding event. This percentage estimate was then applied to determine the worst case for potential flash flood damage based on a 100 year flood event. This approach allows the communities to average the impacts of the variety of hazard designations, flood depths and assets impacted. The values for exposed population and exposed asset values identified in the tables are estimated by multiplying affected area percentage to the appraised values supplied by the County Appraiser. Then the resulting value is discounted using the 10% average damage factor to produce potential dollar loss.

FLOOD: SUMMARY OF POTENTIAL HAZARD-RELATED EXPOSURE/LOSS IN JURISDICTIONS					
RESIDENTIAL					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	1,585	313	$19,212,212	10.00%	$1,921,221
Great Bend	4,292	1,604	$97,269,550	10.00%	$9,726,955
Hoisington	531	204	$9,138,882	10.00%	$913,888
Ellinwood	540	217	$11,084,496	10.00%	$1,108,450
Pawnee Rock	308	73	$2,172,648	10.00%	$217,265
Albert	215	89	$3,271,029	10.00%	$327,103
COMMERCIAL					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	751	1,105	$30,228,712	10.00%	$3,022,871
Great Bend	1,952	279	$55,279,497	10.00%	$5,527,950
Hoisington	215	25	$6,521,140	10.00%	$652,114
Ellinwood	231	32	$5,007,179	10.00%	$500,718
Pawnee Rock	112	19	$719,663	10.00%	$71,966
Albert	82	20	$602,234	10.00%	$60,223
CRITICAL FACILITIES					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	199	16	$250,998,594	10.00%	$25,099,859
Great Bend	5	13	$116,786,392	10.00%	$11,678,639
Hoisington	44	5	$9,695,025	10.00%	$969,503
Ellinwood	32	9	$29,571,100	10.00%	$2,957,110
Pawnee Rock	8	6	$6,710,628	10.00%	$671,063
Albert	5	2	$31,940	10.00%	$3,194

Barton County (UnInc)

A review of the FEMA Digital Flood Insurance Rate Map (D-FIRM), dated September 2, 2009, revealed areas of the county that have the most risk of flooding appear to be along the low-lying areas surrounding the Arkansas River, Blood Creek, and their tributaries. The Arkansas River flows west to east south of Pawnee Rock, Great Bend, and Ellinwood. Blood Creek flows across the northern half of the county, south of Hoisington. These bodies of water are predominantly located in unpopulated and undeveloped areas of the county. Numerous other creeks and tributaries criss-cross the county.

Albert
A review of the FEMA Digital Flood Insurance Rate Map (D-FIRM), dated September 9, 2009, noted that the majority of Albert in located in the flood zone. Albert is divided into two areas by the east-west trending railroad tracks. Zone AH covers most of the southern portion of the town (south of the tracks); and the area that lies north of the Atchison, Topeka, and Santa Fe Railroad, is Zone AE. The extreme northeastern portion of the town is designated Zone A. It appears the majority of residential and commercial facilities in the town are located within the floodplain.

Ellinwood
A review of the FEMA Digital Flood Insurance Rate Map (D-FIRM), dated September 9, 2009, noted that the majority of the eastern corporate limits of Ellinwood are designated Zone AE, with some Zone A in the southeast corner of the town. It appears the flood zones include some improved areas.

Great Bend
A review of the FEMA Digital Flood Insurance Rate Maps (6 D-FIRMs), dated September 9, 2009, noted that the Great Bend corporate limits includes the Municipal Airport, which is located southwest of town. It appears that the majority of Great Bend lies within Zone X - protected by levee, and is classified as outside the 100-year floodplain. A discussion of levee is provided in the Dam/Levee hazard profile. Other flood zone areas in Great Bend are described as follows:

The first Zone A area is a very small area located at the northwest city limits between Highway 96 and the railroad tracks, and appears to be vacant land. The second area is located south of Highway 56, north of Railroad Avenue, and west of McKinley Street. The area appears to be undeveloped. The third Zone A is located along the southern city limits in an undeveloped area between Washington Street and Highway 281 just north of the Arkansas River Levee. The fourth area is designated along Dry Walnut Creek which forms the north city limits of Great Bend, and appears to have a small Zone A that follows the length of the creek bed, then trends south along Frey Street, which is the east city limits to Park Avenue, before trending east along NE 3rd Road into the county. It does not appear to impact improved areas of the city.

Municipal Airport: The airport is located approximately two miles southwest of Great Bend in an agricultural area of the county, but is owned by the the city. A review of the D-FIRMs indicates that portions of the airport city limits along SW 40th Avenue are designated Zone X - protected by Levee. This area appears to contain the airport operations and support buildings. A small area in the southeast corner of the airport property along the Cheyenne Bottoms Diversion Channel is also Designated Zone AO. This small area appears to be unimproved.

Hoisington
A review of the FEMA Digital Flood Insurance Rate Map (D-FIRM), dated September 2, 2009, noted that there is a Zone AH flood area located within the city limits of Hoisington. This flood area correlates with Shop Creek tributary, which trends north to south along the western boundary of the town. The creek begins near west First Street and trends northeast to west Fifteenth Street, where it exits the town limits. It appears there may be some improved areas within this SFHA along the northwest area of the town.

Pawnee Rock
A review of the FEMA Digital Flood Insurance Rate Map (D-FIRM), dated September 2, 2009, noted that the area of Pawnee Rock that lies north of Highway 56 generally resides within Zone AH, with a smaller area southeast of the highway noted to be outside the floodplain. It appears that residential and commercial improvements are located within Zone AH.

Claflin
A review of the FEMA Digital Flood Insurance Rate Map (D-FIRM), dated September 9, 2009, noted that there is only one small flood area, less than one percent of the corporate limits, located along the extreme western boundary of the town. There does not appear to be any improvements in the floodplain area.

Galatia

A review of the FEMA Digital Flood Insurance Rate Map (D-FIRM), dated September 9, 2009, noted that Galatia has no identified SFHA's and is not a participant in the NFIP. Galatia did not identify any flood events for their community.

Olmitz

A review of the FEMA Digital Flood Insurance Rate Map (D-FIRM), dated September 9, 2009, noted that Olmitz has no identified SFHA's, and is not a participant in the NFIP. Olmitz did not identify any flood events for their community.

Susank

A review of the FEMA Digital Flood Insurance Rate Map (D-FIRM), dated September 9, 2009, revealed no SFHA zones within the town. Susank reported that they participate in the NFIP under the emergency program (NSFHA).

Barton County Community College

Barton County Community College reported that none of their facilities are located within a floodplain.

USDs 112, 355, 431, and 428

USD's 112, 355, and 431 reported that none of their facilities are located within a floodplain.

USD 428 reported that none of their facilities have been subject to flood events.

Tornado

The damage from a tornado is a result of high wind velocity and wind-blown debris. The potential damage resulting from a tornado is directly correlated to the strength of the particular tornado and is qualified utilizing the Enhanced Fujita Scale. The EF Scale assigns numerical values based on wind speeds and categorizes tornadoes from EF0 through EF5.

Situated in the central portion of the United States, Barton County is located in a region that is prone to the effects of sudden collision of cold/warm fronts creating severe thunderstroms and tornadoes, and for the most part, face an equal probability of risk for this hazard. This is due to the nature of the natural weather events that occur in the county. Thunderstorm high winds and tornadoes are unpredictable and random in nature. Since the majority of the county is rural, it does not present areas that are significantly more vulnerable to property loss than others. The majority of people who live and work in Barton County reside in the cities of Great Bend, Hoisington, Ellinwood, Albert, Claflin, Galatia, Olmitz, and Susank, but the probability that a jurisdiction would be affected more often than other areas in the county is considered statistically very low.

The entire county is susceptible to tornado. Although urbanized areas may face the greatest vulnerability because of their concentration of infrastructure and population, the economic impact from loss of crops, livestock, and storage facilities in the rural parts of the county can have permanent or long-lasting impact on the communities in Barton County.

Although we extract data and probability of occurrence from historical information, the risk of a tornado appears to be a random event. Additionally, the range of damage is largely dependent upon numerous storm factors. The jurisdictions utilized qualitative data to estimate the probable percent damage based on the overall average severity magnitude rating for Tornado identified in this plan. In many cases, due to the small nature of the towns in Barton County, a Tornado could virtually wipe out the entire community (90% to 100%). The MPC assigned a damage percent of 20% to Great Bend and the unincorporated county based on area-wide damage estimates.

TORNADO: SUMMARY OF POTENTIAL HAZARD-RELATED EXPOSURE/LOSS IN JURISDICTIONS					
RESIDENTIAL					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	7,140	1,407	$86,541,494	20.00%	$17,308,299
Great Bend	15,895	5,940	$360,257,594	20.00%	$72,051,519
Hoisington	3,341	1,282	$57,477,246	90.00%	$51,729,521
Ellinwood	2,346	945	$48,193,462	90.00%	$43,374,116
Claflin	670	295	$13,605,072	90.00%	$12,244,565
Pawnee Rock	477	166	$3,148,330	90.00%	$2,833,497
Albert	224	93	$3,410,875	90.00%	$3,069,788
Olmitz	135	73	$1,781,970	90.00%	$1,603,773
Galatia	58	34	$657,540	90.00%	$591,786
Susank	59	33	$388,668	90.00%	$349,801
COMMERCIAL					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	3,381	4,979	$136,165,370	20.00%	$27,233,074
Great Bend	7,229	1,032	$204,738,879	20.00%	$40,947,776
Hoisington	1,351	160	$41,013,458	90.00%	$36,912,112
Ellinwood	1,004	139	$21,770,343	90.00%	$19,593,309
Claflin	275	54	$9,162,760	90.00%	$8,246,484
Pawnee Rock	162	27	$1,042,990	90.00%	$938,691
Albert	85	21	$627,981	90.00%	$565,183
Olmitz	76	15	$1,056,000	90.00%	$950,400
Galatia	42	7	$440,800	90.00%	$396,720
Susank	6	4	$263,120	90.00%	$236,808
CRITICAL FACILITIES					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	896	71	$1,130,624,297	20.00%	$226,124,859
Great Bend	54	19	$446,747,346	20.00%	$89,349,469
Hoisington	278	30	$60,975,000	90.00%	$54,877,500
Ellinwood	139	37	$129,545,000	90.00%	$116,590,500

Claflin	3	8	$80,543,405	90.00%	$72,489,065
Pawnee Rock	11	9	$9,725,548	90.00%	$8,752,993
Albert	5	2	$31,940	90.00%	$28,746
Olmitz	44	7	$806,334	90.00%	$725,701
Galatia	60	4	$4,324,000	90.00%	$3,891,600
Susank	1	2	$90,000	90.00%	$81,000

The schools and community college have identified a need for shelters for protection from tornadoes, high winds, and other consequences of these events. Based on a major tornado, the estimated potential damage is 90% per school building.

Barton County Community College reported academic buildings, dorms, and athletic facilities for their campus as school buildings, and the support building category was not used used for any of the vulnerability estimates that follow.

TORNADO: SUMMARY OF POTENTIAL HAZARD-RELATED EXPOSURE/LOSS IN SCHOOL JURISDICTIONS					
SCHOOL(S)					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
USD 112 - Claflin	250	2	$10,308,344	90.00%	$9,277,510
USD 355 - Ellinwood	442	2	$27,963,375	90.00%	$25,167,038
USD 428 - Great Bend	3,452	8	$62,588,489	90.00%	$56,329,640
USD 431 - Hoisington	703	4	$25,836,917	90.00%	$23,253,225
Barton County Community College	2,500	33	$80,000,000	40.00%	$32,000,000
SUPPORTING FACILITIES					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Extimated Damage as %	Potential Dollar Exposure / Loss
USD 112 - Claflin	10	7	$1,634,217	90.00%	$1,470,795
USD 355 - Ellinwood	20	3	$438,314	90.00%	$394,483
USD 428 - Great Bend	75	4	$3,022,035	90.00%	$2,719,832
USD 431 - Hoisington	41	2	$7,930,365	90.00%	$7,137,329
Barton County Community College	0	0	$0	0.00%	$0

Dam / Levee

DAMS

For reasons previously mentioned and uncontrollable by humans, it is possible a dam can fail at any time given the right circumstances. However, the probability of future occurrence is reduced due to proactive preventative action on the part of KDA-DWR, and the overall number of sources in Barton County. As previously discussed in this section, KDA-DWR provides oversight to dam/levee repairs, oversees and issues construction permits, enforces safety standards and mandates, conducts periodic inspections, and provides public information to levee owners, engineers, and the general public. This proactive approach to managing dam safety in Kansas reduces the number of losses to property and life as a result of dam failure or near failure.

Dams are addressed by geographical area where data is available to the county.

Reference the Dam / Levee hazard profile for a detailed analysis of high-hazard dams within and outside Barton County.

LEVEES

For reasons previously mentioned and uncontrollable by humans, it is possible a levee can fail at any time given the right circumstances. However, the probability of future occurrence is reduced due to proactive preventative action on the part of KDA-DWR, and the overall number of sources in Barton County. As previously discussed in this section, KDA-DWR provides oversight to dam/levee repairs, oversees and issues construction permits, enforces safety standards and mandates, conducts periodic inspections, and provides public information to levee owners, engineers, and the general public. This proactive approach to managing dam safety in Kansas reduces the number of losses to property and life as a result of dam failure or near failure.

Levees are addressed by geographical area where data is available to the county.

Reference the Dam / Levee hazard profile for a detailed analysis of levees identified in Barton County.

Levee vulnerability is estimated in the table below, and is based on a worst-case scenario as there have been no levee failures reported in the past. Inundation areas for the City of Great Bend and USD 428 public schools were determined by use of FEMA boundary maps which were geo-coded using Manifold.Net, a GIS application. The GIS application calculates the affected percentage of areas which is used to determine the overall impact by the MPC. The exposed area is identified as Zone X within the city limits of Great Bend and is calculated to be 81.44%. These data were then applied to determine the potential flood damage based on a 100 year flood event, which would be less than one foot in depth, with estimated damage of 10%. The overall value of buildings and contents for community assets identified in the tables are estimated from appraised values supplied by the County Appraiser. The following table represents the potential exposure loss for each jurisdiction.

DAM/LEVEE: SUMMARY OF POTENTIAL HAZARD-RELATED EXPOSURE/LOSS IN JURISDICTIONS					
RESIDENTIAL					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Great Bend	12,945	4,838	$293,393,785	10.00%	$29,339,379
COMMERCIAL					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Great Bend	5,887	840	$166,739,343	10.00%	$16,673,934
CRITICAL FACILITIES					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Great Bend	44	16	$363,831,039	10.00%	$36,383,104

DAM/LEVEE: SUMMARY OF POTENTIAL HAZARD-RELATED EXPOSURE/LOSS IN SCHOOL JURISDICTIONS					
SCHOOL(S)					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
USD 428 - Great Bend	3,452	8	$62,588,489	10.00%	$6,258,849
SUPPORTING FACILITIES					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Extimated Damage as %	Potential Dollar Exposure / Loss
USD 428 - Great Bend	75	4	$3,022,035	10.00%	$302,204

Excessive Heat

During the summer months, the State of Kansas is frequently affected by severe heat hazards. Persistent domes of high pressure establish themselves, which set up hot and dry conditions. This high pressure prevents other weather features such as cool fronts or rain events from moving into the area and providing necessary relief. Daily high temperatures range into the upper 90’s and low 100’s. When combined with moderate to high relative humidity levels, the heat index moves into dangerous levels, and a heat index of 105 degrees is considered the level where many people begin to experience extreme discomfort or physical distress.

The entire county is susceptible to excessive heat. For purposes of this hazard mitigation plan, Barton County will assess this hazard's vulnerability on a multi-jurisdictional planning basis. The MPC noted that the greatest exposure to this hazard is on the population of Barton County rather than impacting physical county assets. Hazard workshops are considered a viable option to educate local residents to the dangers of excessive heat.

Hail

Hail can cause extensive property damage affecting both urban and rural landscapes across large areas. Fortunately, most hailstorms produce marble-size or smaller hailstones. These can cause damage to crops, but they normally do not damage buildings or automobiles. Larger hailstones can destroy crops, livestock, and wildlife and can cause extensive damage to buildings, including roofs, windows, and outside walls. Vehicles can be total losses. When hail breaks windows, water damage from accompanying rains can also be significant. A major hailstorm can easily cause damage running into the millions of dollars.

Hail occurs every year in Kansas. Fortunately, most of these cause minimal damage. However, storms producing large hail and causing extensive damage are ingrained in the memories of many Kansas residents. While it is not possible to prevent damage, efforts to mitigate the potential effects of hail can help property owners to minimize their losses.

Severe weather watches and warnings often provide ample time to prepare for a hailstorm. When there is a threat of severe weather, property owners should move vehicles and other valuable moveable objects to locations that provide shelter from falling hail. Farmers should move livestock and machinery to sheltered locations. If a hailstorm is approaching, take shelter inside. Close drapes, blinds, and window shades inside your house to reduce the likelihood of shattered glass being blown inside. Then, move to an interior room on the lowest level and stay there during the storm.

The entire county is susceptible to hail. The best protection against financial loss from hail is to purchase insurance. Homeowners and auto insurance should include coverage for hail damage. Farmers should invest in crop insurance to protect against catastrophic loss. Additionally, education can also provide benefits by teaching citizens how to reduce exposure to this hazard.

HAIL: SUMMARY OF POTENTIAL HAZARD-RELATED EXPOSURE/LOSS IN JURISDICTIONS					
RESIDENTIAL					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	7,140	1,407	$86,541,494	1.00%	$865,415
Great Bend	15,895	5,940	$360,257,594	1.00%	$3,602,576
Hoisington	3,341	1,282	$57,477,246	1.00%	$574,772
Ellinwood	2,346	945	$48,193,462	1.00%	$481,935
Claflin	670	295	$13,605,072	1.00%	$136,051
Pawnee Rock	477	166	$3,148,330	1.00%	$31,483
Albert	224	93	$3,410,875	1.00%	$34,109
Olmitz	135	73	$1,781,970	1.00%	$17,820
Galatia	58	34	$657,540	1.00%	$6,575
Susank	59	33	$388,668	1.00%	$3,887
COMMERCIAL					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	3,381	4,979	$136,165,370	1.00%	$1,361,654
Great Bend	7,229	1,032	$204,738,879	1.00%	$2,047,389
Hoisington	1,351	160	$41,013,458	1.00%	$410,135
Ellinwood	1,004	139	$21,770,343	1.00%	$217,703
Claflin	275	54	$9,162,760	1.00%	$91,628
Pawnee Rock	162	27	$1,042,990	1.00%	$10,430
Albert	85	21	$627,981	1.00%	$6,280
Olmitz	76	15	$1,056,000	1.00%	$10,560
Galatia	42	7	$440,800	1.00%	$4,408
Susank	6	4	$263,120	1.00%	$2,631
CRITICAL FACILITIES					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	896	71	$1,130,624,297	1.00%	$11,306,243
Great Bend	54	19	$446,747,346	1.00%	$4,467,473
Hoisington	278	30	$60,975,000	1.00%	$609,750
Ellinwood	37	139	$129,545,000	1.00%	$1,295,450

Claflin	3	8	$80,543,405	1.00%	$805,434
Pawnee Rock	11	9	$9,725,548	1.00%	$97,255
Albert	5	2	$31,840	1.00%	$318
Olmitz	44	7	$806,334	1.00%	$8,063
Galatia	60	4	$4,324,000	1.00%	$43,240
Susank	1	2	$90,000	1.00%	$900

HAIL: SUMMARY OF POTENTIAL HAZARD-RELATED EXPOSURE/LOSS IN SCHOOL JURISDICTIONS					
SCHOOL(S)					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
USD 112 - Claflin	250	2	$10,308,344	1.00%	$103,083
USD 355 - Ellinwood	442	2	$27,963,375	1.00%	$279,634
USD 428 - Great Bend	3,452	8	$62,588,489	1.00%	$625,885
USD 431 - Hoisington	703	4	$25,836,917	1.00%	$258,369
Barton County Community College	2,500	33	$80,000,000	1.00%	$800,000
SUPPORTING FACILITIES					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Extimated Damage as %	Potential Dollar Exposure / Loss
USD 112 - Claflin	10	7	$1,634,217	1.00%	$16,342
USD 355 - Ellinwood	20	3	$438,314	1.00%	$4,383
USD 428 - Great Bend	75	4	$3,022,035	1.00%	$30,220
USD 431 - Hoisington	41	2	$7,930,365	1.00%	$79,304
Barton County Community College	0	0	$0	0.00%	$0

Terrorism / AT / CD

Planning for this category of hazard is similar to natural hazards in that these types of hazards can occur randomly, or as a result of a natural plant or animal disease, which could impact the entire county (and beyond) before the disease or bio-agent is discovered. For this reason, this hazard category will be assessed on a countywide planning basis instead of establishing a separate geographic planning area for this type of event.

Although initial detection of this type of event is considered uncontrollable, it is highly possible an act of terrorism (domestic or other) could occur at any time given the right circumstances. However, the probability of future occurrence is reduced due to proactive preventative action on the part of Federal, State and local authorities. This proactive approach to preparation and prevention will help reduce the potential for losses to property and life as a result of terrorist or FAD outbreaks.

A review of this type of hazard revealed few sources for estimating risk associated with terrorism, and appears to have a low risk probability. The State of Kansas required each county to develop a Foreign Animal Disease Plan (FAD) for agricultural exotic diseases, and is included in the plan as a state-mandated planning hazard.

For planning purposes this hazard category is considered to be a multijurisdictional hazard and the entire planning area is considered equally susceptible to terrorism. There is currently no existing data available that can be used to evaluate future vulnerability, and no reports of terrorism have been recorded for the county. The MPC noted that the greatest exposure to this hazard is on the 30,329 residents of Barton County rather than the physical county assets.

TSTM Wind

A severe thunderstorm is a thunderstorm which produces tornadoes, hail 0.75 inches or more in diameter, or TSTM winds of 50 knots (58 mph) or more. Structural wind damage or damaged crops may imply the occurrence of a severe thunderstorm. A thunderstorm is approaching severe levels when it contains winds of 35 to 49 knots (40 to 57 mph) or hail ½-inch or larger but less than ¾-inch in diameter.

In the case of severe thunderstorms that create TSTM wind, the location and frequency of previous events are probably the best determiners of future events. NCDC recorded events provided the basis for the natural hazards analysis for Barton County, and identified severity and likelihood to prioritize the hazard.

The entire county is susceptible to TSTM wind, and is addressed as part of the multi-hazard planning category.

TSTM WIND: SUMMARY OF POTENTIAL HAZARD-RELATED EXPOSURE/LOSS IN JURISDICTIONS					
RESIDENTIAL					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	7,140	1,407	$86,541,494	1.00%	$865,415
Great Bend	15,895	5,940	$360,257,594	1.00%	$3,602,576
Hoisington	3,341	1,282	$57,477,246	1.00%	$574,772
Ellinwood	2,346	945	$48,193,462	1.00%	$481,935
Claflin	670	295	$13,605,072	1.00%	$136,051
Pawnee Rock	477	166	$3,148,330	1.00%	$31,483
Albert	224	93	$3,410,875	1.00%	$34,109
Olmitz	135	73	$1,781,970	1.00%	$17,820
Galatia	58	34	$657,540	1.00%	$6,575
Susank	59	33	$388,668	1.00%	$3,887
COMMERCIAL					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	3,381	4,979	$136,165,370	1.00%	$1,361,654
Great Bend	7,229	1,032	$204,738,879	1.00%	$2,047,389
Hoisington	1,351	160	$41,013,458	1.00%	$410,135
Ellinwood	1,004	139	$21,770,343	1.00%	$217,703
Claflin	275	54	$9,162,760	1.00%	$91,628
Pawnee Rock	162	27	$1,042,990	1.00%	$10,430
Albert	85	21	$627,981	1.00%	$6,280
Olmitz	76	15	$1,056,000	1.00%	$10,560
Galatia	42	7	$440,800	1.00%	$4,408
Susank	6	4	$263,120	1.00%	$2,631
CRITICAL FACILITIES					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	896	71	$1,130,624,297	1.00%	$11,306,243
Great Bend	54	19	$446,747,346	1.00%	$4,467,473
Hoisington	278	30	$60,975,000	1.00%	$609,750
Ellinwood	37	139	$129,545,000	1.00%	$1,295,450

Claflin	3	8	$80,543,405	1.00%	$805,434
Pawnee Rock	11	9	$9,725,548	1.00%	$97,255
Albert	5	2	$31,940	1.00%	$319
Olmitz	44	7	$806,334	1.00%	$8,063
Galatia	60	4	$4,324,000	1.00%	$43,240
Susank	1	2	$90,000	1.00%	$900

TSTM WIND: SUMMARY OF POTENTIAL HAZARD-RELATED EXPOSURE/LOSS IN SCHOOL JURISDICTIONS					
SCHOOL(S)					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
USD 112 - Claflin	250	2	$10,308,344	1.00%	$103,083
USD 355 - Ellinwood	442	2	$27,963,375	1.00%	$279,634
USD 428 - Great Bend	3,452	8	$62,588,489	1.00%	$625,885
USD 431 - Hoisington	703	4	$25,836,917	1.00%	$258,369
Barton County Community College	2,500	33	$80,000,000	1.00%	$800,000
SUPPORTING FACILITIES					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Extimated Damage as %	Potential Dollar Exposure / Loss
USD 112 - Claflin	10	7	$1,634,217	1.00%	$16,342
USD 355 - Ellinwood	20	3	$438,314	1.00%	$4,383
USD 428 - Great Bend	75	4	$3,022,035	1.00%	$30,220
USD 431 - Hoisington	41	2	$7,930,365	1.00%	$79,304
Barton County Community College	0	0	$0	0.00%	$0

Utility Failure

Failure of electrical utilities or other components of the power infrastructure in Barton County can seriously impact public safety and health, vital government services, and the economy of the county. Disruption of any of these functions could result from the majority of the natural, technological, and man-made hazards described in this plan. Data at the local level was not available, so Barton County relied on winter storm vulnerability for analysis of this hazard.

The electric power infrastructure in Kansas has been significantly affected by disasters and weather events in the past, and is expected to continue into the future. Potential losses to the electric line infrastructure are difficult to quantify. This information could potentially be obtained or estimated with assistance from rural electric cooperatives in future updates to this plan.

For purposes of this hazard mitigation plan, Barton County will assess this hazard's vulnerability on a multijurisdictional planning basis instead of establishing separate geographic planning areas for this type of event. The MPC noted that the greatest exposure to this hazard is on the population of Barton County rather that impacting physical county assets. Population impact is estimated at 30,329 residents.

Wildfire

Wildfire in the State of Kansas is better defined as rangeland fire. This type of fire generally originates as a surface fire and can spread quickly across large areas. Wildfire initiated by lightning is also an issue in the plains states. Wildfire is most common in the spring when brush is still brown and dry, as well as in the fall when fields have reached maturity.

Current statistical analysis for Barton County indicates an average of 13.69 wildfire events a year, but due to the rural setting of the county, and isolated locations of wildfire, this hazard is addressed on a jurisdictional planning basis. When wildfire does occur in Barton County, it is very rare that a home or business is lost, since the vast majority of reported wildfire occurs in unpopulated areas of the county. Vulnerability appears to be limited to row crops, with a low impact to infrastructure and people.

WILDFIRE: SUMMARY OF POTENTIAL HAZARD-RELATED EXPOSURE/LOSS IN JURISDICTIONS					
RESIDENTIAL					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	7,140	1,407	$86,541,494	1.00%	$865,415
COMMERCIAL					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	3,381	4,979	$136,165,370	1.00%	$1,361,654
CRITICAL FACILITIES					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	896	71	$1,130,624,297	1.00%	$11,306,243

Winter Storm

Winter storms can impact a community, county or region. The likelihood of future events is estimated to remain the same as currently calculated. Barton County can expect approximately 1.50 winter storms a year, with average annual damages of $2,272,111.

The entire county is susceptible to winter storm and is included as a multijurisdictional hazard for this plan. Although we can extract data and probability of occurrence from historical information, the risk of winter storm appears to be a random event.

WINTER STORM: SUMMARY OF POTENTIAL HAZARD-RELATED EXPOSURE/LOSS IN JURISDICTIONS					
RESIDENTIAL					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	7,140	1,407	$86,541,494	1.00%	$865,415
Great Bend	15,895	5,940	$360,257,594	1.00%	$3,602,576
Hoisington	3,341	1,282	$57,477,246	1.00%	$574,772
Ellinwood	2,346	945	$48,193,462	1.00%	$481,935
Claflin	670	295	$13,605,072	1.00%	$136,051
Pawnee Rock	477	166	$3,148,330	1.00%	$31,483
Albert	224	93	$3,410,875	1.00%	$34,109
Olmitz	135	73	$1,781,970	1.00%	$17,820
Galatia	58	34	$657,540	1.00%	$6,575
Susank	59	33	$388,668	1.00%	$3,887
COMMERCIAL					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	3,381	4,979	$136,165,370	1.00%	$1,361,654
Great Bend	7,229	1,032	$204,738,879	1.00%	$2,047,389
Hoisington	1,351	160	$41,013,458	1.00%	$410,135
Ellinwood	1,004	139	$21,770,343	1.00%	$217,703
Claflin	275	54	$9,162,760	1.00%	$91,628
Pawnee Rock	162	27	$1,042,990	1.00%	$10,430
Albert	85	21	$627,981	1.00%	$6,280
Olmitz	76	15	$1,056,000	1.00%	$10,560
Galatia	42	7	$440,800	1.00%	$4,408
Susank	6	4	$263,120	1.00%	$2,631
CRITICAL FACILITIES					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
Barton (UnInc.)	896	71	$1,130,624,297	1.00%	$11,306,243
Great Bend	54	19	$446,747,346	1.00%	$4,467,473
Hoisington	278	30	$60,975,000	1.00%	$609,750
Ellinwood	37	139	$129,545,000	1.00%	$1,295,450

Claflin	3	8	$80,543,405	1.00%	$805,434
Pawnee Rock	11	9	$9,725,548	1.00%	$97,255
Albert	5	2	$31,940	1.00%	$319
Olmitz	44	7	$806,334	1.00%	$8,063
Galatia	60	4	$4,324,000	1.00%	$43,240
Susank	1	2	$90,000	1.00%	$900

WINTER STORM: SUMMARY OF POTENTIAL HAZARD-RELATED EXPOSURE/LOSS IN SCHOOL JURISDICTIONS					
SCHOOL(S)					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Estimated Damage as %	Potential Dollar Exposure / Loss
USD 112 - Claflin	250	2	$10,308,344	1.00%	$103,083
USD 355 - Ellinwood	442	2	$27,963,375	1.00%	$279,634
USD 428 - Great Bend	3,452	8	$62,588,489	1.00%	$625,885
USD 431 - Hoisington	703	4	$25,836,917	1.00%	$258,369
Barton County Community College	2,500	33	$80,000,000	1.00%	$800,000
SUPPORTING FACILITIES					
Jurisdiction	Exposed Population	Exposed # of Buildings	Exposed Valuation $	Extimated Damage as %	Potential Dollar Exposure / Loss
USD 112 - Claflin	10	7	$1,634,217	1.00%	$16,342
USD 355 - Ellinwood	20	3	$438,314	1.00%	$4,383
USD 428 - Great Bend	75	4	$3,022,035	1.00%	$30,220
USD 431 - Hoisington	41	2	$7,930,365	1.00%	$79,304
Barton County Community College	0	0	$0	0.00%	$0

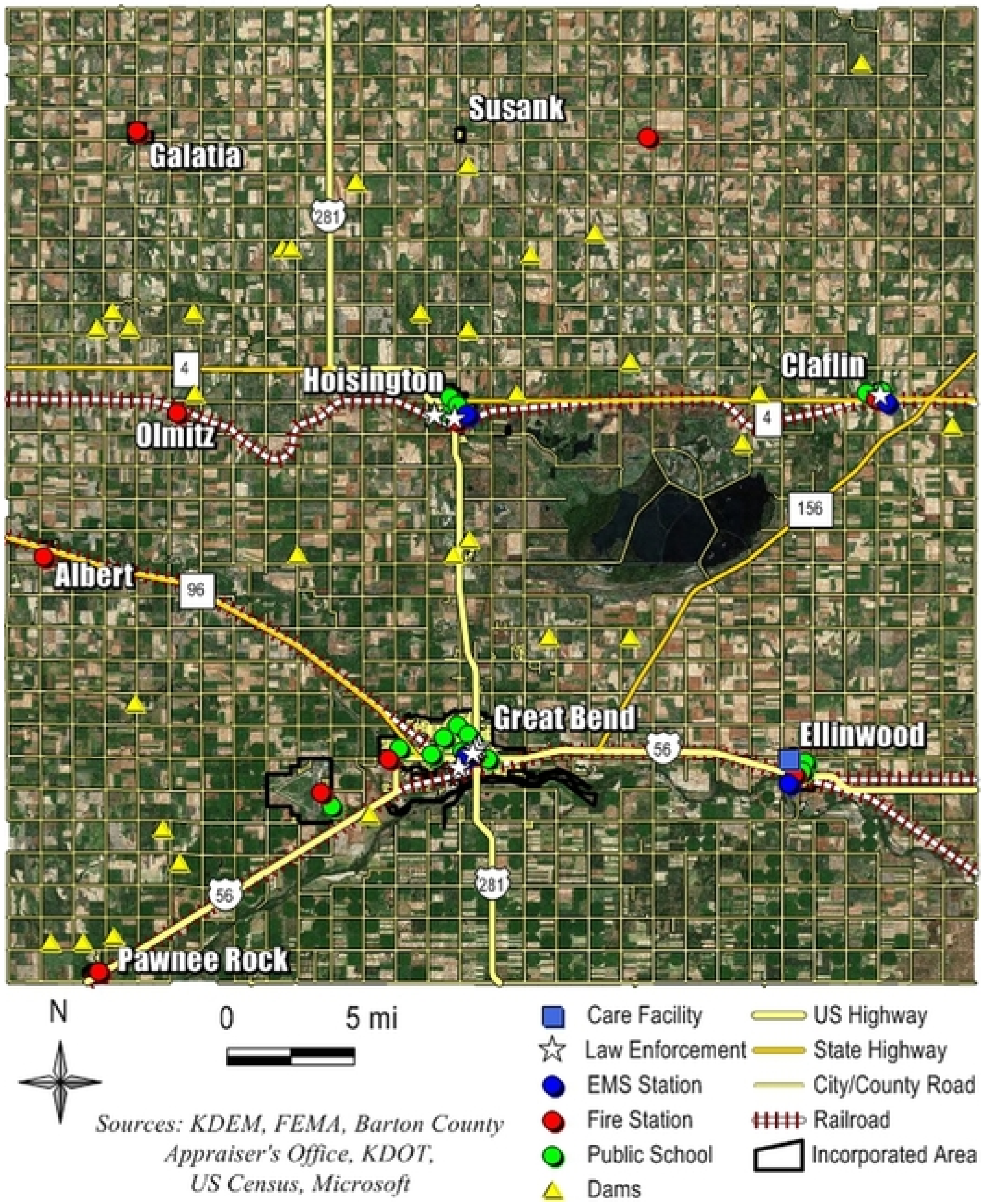
4.5.4 Critical Facilities

An essential component of this Mitigation Plan is the inventory and identification of Barton County's critical facilities. The objective of the critical facilities inventory is to maintain information on buildings and support infrastructure that are vital to the response and recovery of a community from a disaster. While it is important to reduce or eliminate risks to various sites throughout Barton County, there are several types of structures that should be prioritized because damage to these critical facilities can delay recovery, impact the delivery of vital services, cause greater damages to other sectors of the county, or can put special populations at risk. For this reason, emphasis on planning and protection of critical facilities is a priority for this mitigation plan.

There is no definitive list regarding what should be considered a “critical facility.” However, for purposes of this Mitigation Plan, Barton County considers critical facilities to be those structures from which essential services and functions for the continuation of public safety actions and disaster recovery are performed or provided. These facilities include the supporting “life-line” infrastructure essential to the mission of critical facilities.

A “best available” inventory of Barton County’s public and private assets, along with known critical facilities, has been compiled using best available data. Sources used included the Division of Property Valuation (Kansas Department of Revenue), HAZUS, and RS Means Estimated Construction data. RS Means is the world's largest provider of construction cost and replacement cost data. Its data is accepted and used by HAZUS and many other federal agencies. Since actual values associated with specific structures could not be produced, aggregate costs (assessed value or RS Means data), by class-type, were utilized along with the associated average unit cost. An objective was established to implement collection of this type of data / information for the county as they begin to develop and refine mitigation capability. It is anticipated that new information and data will continually be added to this plan as technical capabilities are enhanced and implemented.

State-Owned and Critical Facilities
Barton County, Kansas



Critical Facility Vulnerability

The following vulnerability assessment tables have been completed in order to best assess the current vulnerability of Barton County based upon the current number and value of structures of critical facilities. NOTE: The Barton County bridge inventory of 1,221 bridges consists of: 371 with a span >20 feet, and 850 with a span < 20 feet.

Tables 4.5.4 (1) provides critical facilities ranked by required operational status during an emergency event as follows (also reference the Table heading for description of levels 1 through 3):

Level 1 Facilities: Must not lose operational capability
Level 2 Facilities: Must be operational within 24-hours following an event

Level 3 Facilities: Must be operational within 72-hours following an event

TABLE 4.5.4 (1) BARTON COUNTY CRITICAL FACILITIES DEFINITION

LEVEL 1 Facilities	LEVEL 2 Facilities	LEVEL 3 Facilities
(must not lose operational capability)	(must be operational within 24 hours following event)	(must be operational within 72 hours following event)
Communications (radio, TV, similar) County Emergency Operations Center (EOC) Fire / EMS stations Hospitals Law Enforcement (Sheriff/Police Bldgs)	Emergency shelters (schools, other) Major government buildings Major roads (390 Mi) County Maintained Bridges (1,221 ea)	Electric / Gas utilities Response staging areas Sewage treatment plants *Transportation systems

Table 4.5.4 (2) provides potential damage estimates of current (2006) and future (2040) damage inventory for identified critical facilities in Barton County. For planning purposes, the asset replacement value is assumed to remain at current replacement value when the county is experiencing a negative growth in population (KWO).

TABLE 4.5.4 (2) BARTON COUNTY CRITICAL FACILITIES INVENTORY

		Current Conditions			Projection Yr: 2040 (CAGR: 0.30%)		
Priority Level	Type of Facility	Number of Existing Buildings/ Facilities	Current Replacement Value	Current Number of People	Number of Future Buildings/ Facilities	Future Replacement Value	Future Number of People
1	Communications (radio, TV, similar)	10	$1,085,000	7	11	$1,192,629	8
1	County Emergency Operations Center (EOC)	1	$9,300,000	50	1	$10,222,534	55
1	Fire / EMS stations	5	$2,850,000	25	5	$3,132,712	27
1	Hospitals	4	$10,325,000	400	4	$11,349,211	440
1	Law Enforcement (Sheriff/Police Bldgs)	6	$7,980,000	67	7	$8,771,594	74
2	Emergency shelters (schools, other)	26	$12,350,000	260	29	$13,575,085	286
2	Major government buildings	4	$2,924,000	57	4	$3,214,053	63
2	Major roads (390 Mi) County Maintained	0	$206,000,000	0	0	$226,434,622	0
2	Bridges (1,221 ea)	0	$70,000,000	0	0	$76,943,804	0
3	Electric / Gas utilities	5	$313,500,000	10	5	$344,598,321	11
3	Response staging areas	2	$400,000	0	2	$439,679	0
3	Sewage treatment plants	4	$253,080,000	4	4	$278,184,826	4
3	*Transportation systems	4	$240,910,297	16	4	$264,807,923	18

TABLE NOTES:
*Transportation systems may include public and private airports, bus services, rail, etc.
**Flammable and hazardous materials storage areas.

TABLE 4.5.4 (3) BARTON COUNTY DESIGNATED SCHOOL TORNADO SHELTERS

Name	Building Name	Address	Population
USD 112	Claflin Elementary	406 North Main / PO Box 287, Claflin, KS 67525	114
USD 112	Claflin Jr. / Sr. High	700 W. Albro / PO Box 348, Claflin, KS 67525	141
USD 355	Ellinwood Grade School	310 E 6th Street, Ellinwood, KS 67526	207
USD 355	Ellinwood MS/HS	210 E 2nd Street, Ellinwood, KS 67526	235
USD 428	Eisenhower Elementary School	1212 Garfield, Great Bend, KS	339
USD 428	Great Bend High School	2027 Morton, Great Bend, KS	1004
USD 428	Great Bend Middle School	1919 Harrison, Great Bend, KS	525
USD 428	Jefferson Elementary School	2716 - 24th Street, Great Bend, KS	326
USD 428	Lincoln Elementary School	5630 Broadway, Great Bend, KS	339
USD 428	Park Elementary School	1801 Williams, Great Bend, KS	280
USD 428	Riley Elementary School	1515 - 10th Street, Great Bend, KS	430
USD 428	Washington Early Childhood Center	2535 Lakin, Great Bend, KS	123
USD 431	Hoisington High School	1200 Susank Road, Hoisington, KS 67544	229
USD 431	Hoisington Middle School	360 W 11th Street, Hoisington, KS 67544	209
USD 431	Lincoln Elementary School	516 N Pine, Hoisington, KS 67544	99
USD 431	Roosevelt Elementary School	315 North Vine, Hoisington, KS 67544	166

4.5.5 Development Trends and Implications

Land use patterns in Barton County have not changed much in past years. The 2005 Kansas Land Cover

Patterns map produced by the Kansas Applied Remote Sensing (KARS) program provides a fairly accurate assessment of 11 land use/land cover classes. The bulk of the land cover in the county (91.2%) is comprised of cropland and grassland. Urban residential and urban commercial/industrial development comprises 1.13% of the land cover primarily in and around the towns of Great Bend and Hoisington. Generally built-up areas continue to be located in or around the (Number) communities in the county, with smaller concentrations located in rural areas. Commercial land use is primarily limited to these same communities. Overall, commercial, industrial, and residential development in Barton County has been largely unregulated.

The State of Kansas has developed a unique method for utilizing water use data to determine not only future water use, but also to project population in the state. Additionally, this method will be used to verify the accuracy of the U.S.Census Bureau's sub-county population estimates for Kansas. This method was developed by the Kansas Water Office and approved by the Kansas Water Authority.

In November 1998, the Kansas Water Office completed population and water demand projections for every county, city, and rural water district in Kansas for the years 2000, 2010, 2020, 2030, and 2040. These data will be utilized for growth projections for the county. Information regarding methodology and projections can be found at: www.kwo.org/index.htm.

The recent study conducted by the Kansas Water Office provides projection data for Barton County that predicts a gradual upswing in population over the next 32 years. These data are used to develop the Development Trends and Implications presented below.

Barton (UnInc.): Residential, Commercial, and Population Growth - Present and Future

Residential and commercial development is primarily concentrated around the incorporated cities of the county. Barton County is projected to increase in overall residential and commercial development by 0.30% annually, as projected by the Kansas Water Office (compound annual growth rate through 2040). Land use includes commercial and residential development in Barton County (UnInc) and has been largely regulated.

While difficult to forecast, Barton County's future development trend through 2040 is assumed to increase proportionate to the increase in population and will need to monitor and update mitigation initiatives as the process unfolds. The property valuation rate, for the foreseeable future, is also expected to parallel the county population growth pattern of 0.30% a year.

Albert: Residential, Commercial, and Population Growth - Present and Future

Albert's residential and commercial development is not projected to grow in the near future. Based on limited data, the population is expected to decrease at an annual rate of 0.07% over the next 32 years. (Kansas Water Office) Land use includes commercial and residential development in Albert, and has been largely unregulated.

While difficult to forecast, Albert's future development trend through 2040 is assumed to decrease proportionate to the decrease in population and will need to monitor and update mitigation initiatives as the process unfolds. The property valuation rate, for the foreseeable future, is also expected to parallel the city population growth pattern, and will remain neutral (0%) for purposes of mitigation planning until future data is available.

Claflin: Residential, Commercial, and Population Growth - Present and Future

Claflin's residential and commercial development is not projected to grow in the near future. Based on limited data, the population is expected to decrease at an annual rate of 0.11% over the next 32 years. (Kansas Water Office) Land use includes commercial and residential development in Claflin, and has been largely regulated by construction codes.

While difficult to forecast, Claflin's future development trend through 2040 is assumed to decrease proportionate to the decrease in population and will need to monitor and update mitigation initiatives as the process unfolds. The property valuation rate, for the foreseeable future, is also expected to parallel the city population growth pattern, and will remain neutral (0%) for purposes of mitigation planning until future data is available.

Ellinwood: Residential, Commercial, and Population Growth - Present and Future

Ellinwood's residential and commercial development is projected to experience a gradual increase in population growth over the next 32 years of 0.06% annually (KWO). Projections are based on Kansas Water Office data using Compound Annual Growth Rate as the means to develop projected growth. (KWO). Land use includes commercial and residential development in Ellinwood, and has been largely regulated by zoning and construction codes.

While difficult to forecast, Ellinwood's future development trend through 2040 is assumed to increase proportionate to the increase in population and will need to monitor and update mitigation initiatives as the process unfolds. The property valuation rate, for the foreseeable future, is also expected to parallel the city population growth pattern, and will remain at 0.06% growth for purposes of mitigation planning until future data is available.

Galatia: Residential, Commercial, and Population Growth - Present and Future

Galatia's residential and commercial development is not projected to grow in the near future. Based on limited data, the population is expected to decrease at an annual rate of 1.01% over the next 32 years. (Kansas Water Office) Land use includes commercial and residential development in Galatia, and has been largely unregulated.

While difficult to forecast, Galatia's future development trend through 2040 is assumed to decrease proportionate to the decrease in population and will need to monitor and update mitigation initiatives as the process unfolds. The property valuation rate, for the foreseeable future, is also expected to parallel the city population growth pattern, and will remain neutral (0%) for purposes of mitigation planning until future data is available.

Great Bend: Residential, Commercial, and Population Growth - Present and Future

Great Bend's residential and commercial development is projected to experience a gradual increase in population growth over the next 32 years of 0.31% annually (KWO). Projections are based on Kansas Water Office data using Compound Annual Growth Rate as the means to develop projected growth. (KWO). Land use includes commercial, industrial, and residential development in Great Bend, and has been largely regulated by zoning and construction codes.

While difficult to forecast, Great Bend's future development trend through 2040 is assumed to increase proportionate to the increase in population and will need to monitor and update mitigation initiatives as the process unfolds. The property valuation rate, for the foreseeable future, is also expected to parallel the city population growth pattern, and will remain at 0.31% growth for purposes of mitigation planning until future data is available.

Hoisington: Residential, Commercial, and Population Growth - Present and Future

Hoisington's residential and commercial development is projected to experience a gradual increase in population growth over the next 32 years of 0.44% annually (KWO). Projections are based on Kansas Water Office data using Compound Annual Growth Rate as the means to develop projected growth. (KWO). Land use includes commercial and residential development in Hoisington, and has been largely regulated by zoning and construction codes.

While difficult to forecast, Hoisington's future development trend through 2040 is assumed to increase proportionate to the increase in population and will need to monitor and update mitigation initiatives as the process unfolds. The property valuation rate, for the foreseeable future, is also expected to parallel the city population growth pattern, and will remain at 0.44% growth for purposes of mitigation planning until future data is available.

Olmitz: Residential, Commercial, and Population Growth - Present and Future

Olmitz's residential and commercial development is not projected to grow in the near future. Based on limited data, the population is expected to decrease at an annual rate of 0.09% over the next 32 years. (Kansas Water Office) Land use includes commercial and residential development in Olmitz, and has been largely unregulated.

While difficult to forecast, Olmitz's future development trend through 2040 is assumed to decrease proportionate to the decrease in population and will need to monitor and update mitigation initiatives as the process unfolds. The property valuation rate, for the foreseeable future, is also expected to parallel the city population growth pattern, and will remain neutral (0%) for purposes of mitigation planning until future data is available.

Pawnee Rock: Residential, Commercial, and Population Growth - Present and Future

Pawnee Rock's residential and commercial development is projected to experience a gradual increase in population growth over the next 32 years of 0.83% annually (KWO). Projections are based on Kansas Water Office data using Compound Annual Growth Rate as the means to develop projected growth (KWO). Land use includes commercial and residential development in Pawnee Rock, and has been largely unregulated.

While difficult to forecast, Pawnee Rock's future development trend through 2040 is assumed to increase proportionate to the increase in population and will need to monitor and update mitigation initiatives as the process unfolds. The property valuation rate, for the foreseeable future, is also expected to parallel the city population growth pattern, and will remain at 0.83% growth for purposes of mitigation planning until future data is available.

Susank: Residential, Commercial, and Population Growth - Present and Future

Susank's residential and commercial development is not projected to grow in the near future. Based on limited data, the population is expected to decrease at an annual rate of 0.46% over the next 32 years. (Kansas Water Office) Land use includes commercial and residential development in Susank, and has been largely unregulated.

While difficult to forecast, Susank's future development trend through 2040 is assumed to decrease proportionate to the decrease in population and will need to monitor and update mitigation initiatives as the process unfolds. The property valuation rate, for the foreseeable future, is also expected to parallel the city population growth pattern, and will remain neutral (0%) for purposes of mitigation planning until future data is available.

Barton County Community College: Residential, Commercial, and Population Growth - Present and Future

Barton is a comprehensive community college, located in Great Bend, providing training and educational opportunities for students throughout its seven county service area.

While difficult to forecast, the college's future development trend through 2040 is assumed to increase proportionately to the increase in population of the State of Kansas and will need to monitor and update mitigation initiatives as the process unfolds. The property valuation rate for the foreseeable future is also expected to parallel the increase in population growth of 0.69% annually through 2040 (KWO).

USD 112 - Claflin: Residential, Commercial, and Population Growth - Present and Future

USD 112 currently has two public school buildings located in the town of Claflin. School enrollment is largely determined by overall growth patterns of the city in which the schools reside. For planning purposes, the Kansas Water Office data was used to project population trends for each town through 2040.

While difficult to forecast future commercial and residential development, estimates of future community growth help predict school funding decisions and facility expansion needs for the immediate future. Commercial and residential growth projections are assumed to parallel the increase or decrease in local population projections, and will need to monitor and update mitigation initiatives as the process unfolds. The property valuation rate, for the foreseeable future, is also expected to parallel the city population growth patterns.

It is likely that the town of Claflin will continue to see a slow and gradual population decrease over the next 32 years of 0.11% annually. These figures are based on a compound annual growth rate (CAGR) developed from the Kansas Water Office population projections through 2040.

USD 355 - Ellinwood: Residential, Commercial, and Population Growth - Present and Future

USD 355 currently has two active schools located in the town of Ellinwood. School enrollment is largely determined by overall growth patterns of the city in which the schools reside. For planning purposes, the Kansas Water Office data was used to project population trends for each town through 2040.

While difficult to forecast future commercial and residential development, estimates of future community growth help predict school funding decisions and facility expansion needs for the immediate future. Commercial and residential growth projections are assumed to parallel the increase or decrease in local population projections, and will need to monitor and update mitigation initiatives as the process unfolds. The property valuation rate, for the foreseeable future, is also expected to parallel the city population growth patterns.

It is likely that the town of Ellinwood will continue to see a slow and gradual population increase over the next 32 years of 0.06% annually. These figures are based on a compound annual growth rate (CAGR) developed from the Kansas Water Office population projections through 2040.

USD 428 - Great Bend: Residential, Commercial, and Population Growth - Present and Future

USD 428 currently has seven active schools located in the town of Great Bend. School enrollment is largely determined by overall growth patterns of the city in which the schools reside. For planning purposes, the Kansas Water Office data was used to project population trends for each town through 2040.

While difficult to forecast future commercial and residential development, estimates of future community growth help predict school funding decisions and facility expansion needs for the immediate future. Commercial and residential growth projections are assumed to parallel the increase or decrease in local population projections, and will need to monitor and update mitigation initiatives as the process unfolds. The property valuation rate, for the foreseeable future, is also expected to parallel the city population growth patterns.

It is likely that the town of Great Bend will continue to see a slow and gradual population increase over the next 32 years of 0.31% annually. These figures are based on a compound annual growth rate (CAGR) developed from the Kansas Water Office population projections through 2040.

USD 431 - Hoisington: Residential, Commercial, and Population Growth - Present and Future

USD 431 currently has four active schools located in the towns of Hoisington. School enrollment is largely determined by overall growth patterns of the city in which the schools reside. For planning purposes, the Kansas Water Office data was used to project population trends for each town through 2040.

While difficult to forecast future commercial and residential development, estimates of future community growth help predict school funding decisions and facility expansion needs for the immediate future. Commercial and residential growth projections are assumed to parallel the increase or decrease in local population projections, and will need to monitor and update mitigation initiatives as the process unfolds. The property valuation rate, for the foreseeable future, is also expected to parallel the city population growth patterns.

It is likely that the town of Hoisington will continue to see a slow and gradual population increase over the next 32 years of 0.44% annually. These figures are based on a compound annual growth rate (CAGR) developed from the Kansas Water Office population projections through 2040.