CPNRD

CENTRAL PLATTE
NATURAL RESOURCES DISTRICT

HAZARD MITIGATION PLAN 2022

JEO CONSULTING GROUP

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List of Acronyms

ACS – American Community Survey
BRIC – Building Resilient Infrastructure and Communities
CDC – Centers for Disease Control and Prevention
CF – Cubic Feet
CFR – Code of Federal Regulations
COVID-19 – Coronavirus Disease 2019
CPNRD – Central Platte Natural Resource District
CRS – Community Rating System
CWPP – Community Wildfire Protection Plans
CyanoHABs – Cyanobacterial Harmful Algae Blooms
DMA 2000 – Disaster Mitigation Act of 2000
EAB – Emerald Ash Borer
EAP – Emergency Action Plan
EPA – Environmental Protection Agency
ESL – English as Second Language
FBI – Federal Bureau of Investigation
FEMA – Federal Emergency Management Agency
FIRM – Flood Insurance Rate Map
FMA – Flood Mitigation Assistance Program
FR – FEMA's Final Rule
GIS – Geographic Information Systems
HMA – Hazard Mitigation Assistance
HMGP – Hazard Mitigation Grant Program
HMP – Hazard Mitigation Plan
HPSA – Health Professional Shortage Areas
HPRCC – High Plains Regional Climate Center
HRSA – Health Resources and Services Administration
JEO – JEO Consulting Group, Inc.
LEOP – Local Emergency Operations Plan
LGA – Liquid Gallons
MUA – Medically Underserved Areas
MUP – Medically Underserved Populations
NCEI – National Centers for Environmental Information
NDA – Nebraska Department of Agriculture
NDMC – National Drought Mitigation Center
NeDNR – Nebraska Department of Natural Resources
NEMA – Nebraska Emergency Management Agency
NFIP – National Flood Insurance Program
NFS – Nebraska Forest Service
NOAA – National Oceanic and Atmospheric Administration
NPI – Nonpharmaceutical Interventions
NRC – National Response Center
NWS – National Weather Service
PDSI – Palmer Drought Severity Index
PHMSA – U.S. Pipeline and Hazardous Material Safety Administration
Risk MAP – Risk Mapping, Assessment, and Planning
RMA – Risk Management Agency
SBA – Small Business Administration

SPIA – Sperry-Piltz Ice Accumulation Index
START – National Consortium for the Study of Terrorism and Responses to Terrorism
TORRO – Tornado and Storm Research Organization
USACE – United States Army Corps of Engineers
USDA – United States Department of Agriculture
USGS – United States Geological Survey
WHO – World Health Organization

Executive Summary

Introduction

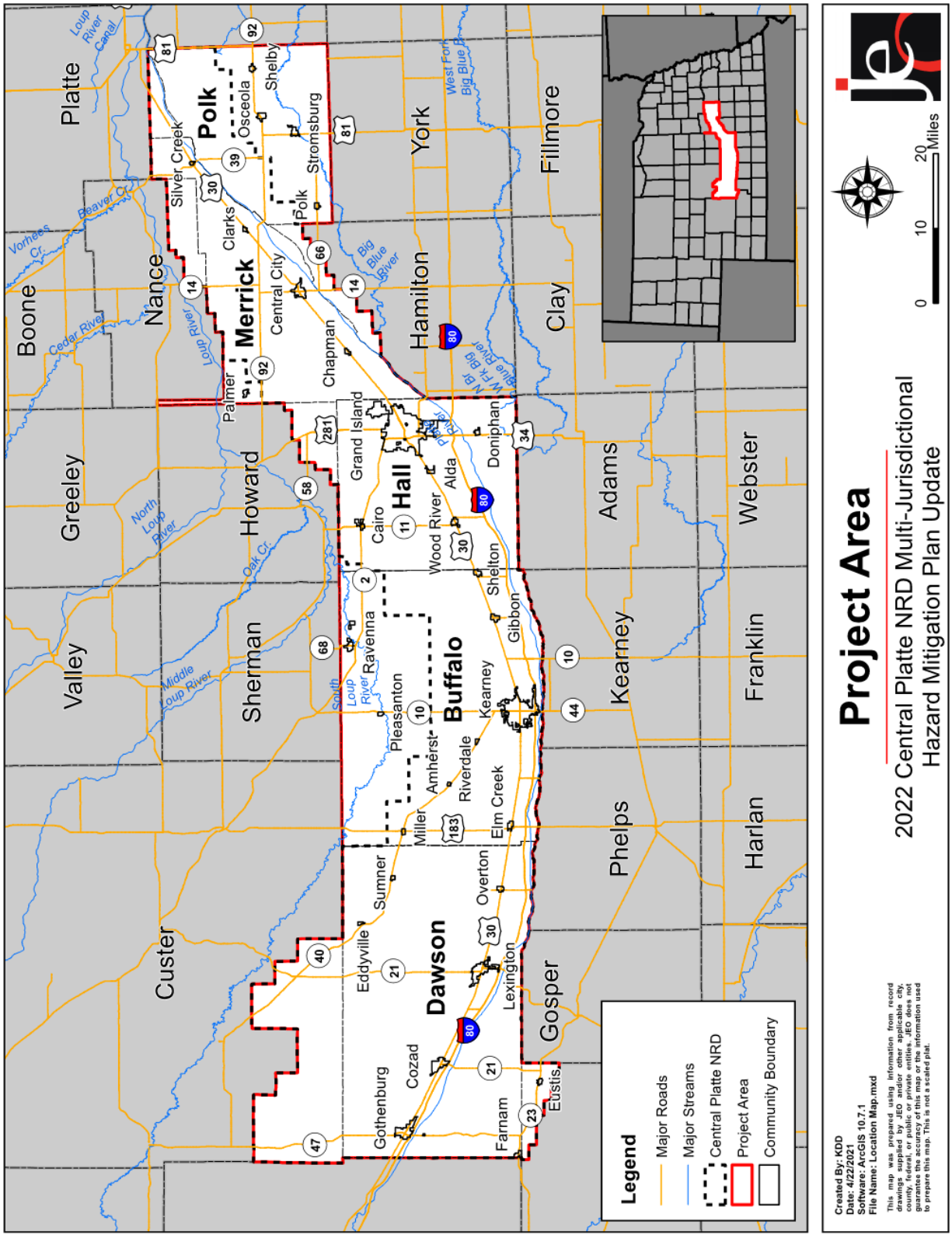
This plan is an update to the Central Platte Natural Resources District (CPNRD) Hazard Mitigation Plan (HMP) approved in 2017. The plan update was developed in compliance with the requirements of the Disaster Mitigation Act of 2000 (DMA 2000).

Hazard mitigation planning is a process in which hazards are identified and profiled; people and facilities at-risk are identified and assessed for threats and potential vulnerabilities; and strategies and mitigation measures are identified. Hazard mitigation planning increases the ability of communities to effectively function in the face of natural and human-caused disasters. The goal of the process is to reduce risk and vulnerability, in order to lessen impacts to life, the economy, and infrastructure. Plan participants are listed in the following table and illustrated in the following planning area map.

Table 1: Participating Jurisdictions

Participating Jurisdictions	
Central Platte NRD	Village of Polk
Buffalo County	Village of Shelby
Village of Amherst	City of Stromsburg
Village of Elm Creek	Village of Eustis (Frontier County)
City of Gibbon	**Special Jurisdictions**
City of Kearney	Central City Fire District
Village of Pleasanton	Central City Public Schools
City of Ravenna	Central District Health Department
Village of Riverdale	Centura Public Schools
Village of Shelton	Doniphan Fire District
Dawson County	Dawson County Drainage District No.2
City of Cozad	Dawson County Drainage District No.3
Village of Farnam	Eddyville Fire District
City of Gothenburg	Elm Creek Fire District
City of Lexington	Elm Creek Public Schools
Hall County	Eustis-Farnam Public Schools
Village of Alda	Four Corners Health Department
Village of Cairo	Gibbon Volunteer Fire District
Village of Doniphan	Gibbon Public Schools
City of Grand Island	Kearney Public Schools
City of Wood River	Pleasanton Fire District
Merrick County	Pleasanton Public Schools
Central City	Ravenna Public Schools
Village of Chapman	Shelton Public Schools
Village of Clarks	Two Rivers Public Health Department
Village of Silver Creek	University of Nebraska – Kearney
Polk County	Wood River Rural Schools
City of Osceola	

Figure 1: Project Area



Goals and Objectives

The potential for disaster losses and the probability of occurrence of natural and human-caused hazards present a significant concern for the jurisdictions participating in this plan. The driving motivation behind this hazard mitigation plan is to reduce vulnerability and the likelihood of impacts to the health, safety, and welfare of all citizens in the planning area. To this end, the Regional Planning Team reviewed and approved goals which helped guide the process of identifying both broad-based and community-specific mitigation strategies and projects that will, if implemented, reduce their vulnerability and help build stronger, more resilient communities.

Goals from the 2017 HMP were reviewed, and the Regional Planning Team agreed that they are still relevant and applicable for this plan update with some modifications. The planning team requested the language in Goals one, two, and three was changed from “Natural Hazard Events” to “All Hazard Events.” Goal four was added to encompass plan integration in the planning process better. Objective 1.11 was added to include more specific language on addressing cyber security threats in the planning area. Objective 1.12 and Objective 1.13 were included to enhance the understanding of risks from specific hazards. Following the agreed upon changes to the goals and objectives, jurisdictions that participated in this plan update agreed that the updated goals and objectives identified in 2017 would be carried forward and utilized for the 2022 plan. The Goals and Objectives for this plan update are as follows:

Goal 1: Protect the Health and Safety of Residents from All Hazard Events

Objective 1.1: Provide Adequate Public Safe Rooms and Post-Disaster Storm Shelters

Objective 1.2: Improve/Provide Adequate Backup and Emergency Generators

Objective 1.3: Improve Warning Systems

Objective 1.4: Improve Emergency Communication Systems

Objective 1.5: Improve Electrical Service

Objective 1.6: Develop Emergency Snow/Evacuation Routes

Objective 1.7: Study/Improve Drinking Water Supply

Objective 1.8: Reduce Water Demand/Improve Drought Education

Objective 1.9: Improve Response to Hazard Materials (Hazmat) Incidents

Objective 1.10: Improve Flood/Dam Failure Warning System

Objective 1.11: Improve Cyber Security Measures

Objective 1.12: Develop Hazard Specific Plans, Conduct Studies, or Assessments

Objective 1.13: Enact or Update Ordinances, Permits, Laws, or Regulations

Goal 2: Protect Existing and New Properties form All Hazard Events

Objective 2.1: Reduce Bottleneck/Flow Restrictions

Objective 2.2: Reduce Wildfire Damage

Objective 2.3: Reduce Stormwater Damage

Objective 2.4: Develop/Update Floodplain Information

Objective 2.5: Reduce Damages in Floodplain

Objective 2.6: Facility Flood Proofing

Objective 2.7: Reduce Tree Damage & Damage from Trees

Objective 2.8: Evaluate Stream Channelization/Bank Stabilization

Objective 2.9: Improve Construction Standards and Building Survivability

Objective 2.10: Evaluate and Improve Berm, Floodwall and/or Levee

Goal 3: Increase Public Awareness and Educate About All Hazard Events

Objective 3.1: Community Education and Awareness

Objective 3.2: Increase Soil and Water Conservation

Goal 4: Enhance Overall Resilience and Promote Sustainability

Objective 4.1: Incorporate Hazard Mitigation and Adaptation into Updating Other Existing Planning Endeavors (e.g., Comprehensive Plans, Zoning Ordinance, Subdivision Regulations, etc.)

Summary of Changes

The hazard mitigation planning process undergoes several changes during each plan update to best accommodate the planning area and specific conditions. Changes from the 2017 Hazard Mitigation Plan and planning process in this update included: greater efforts to reach and include stakeholder groups, effort to include all taxing authorities as participants; a more specific hazard risk assessment applicable to the planning area; updated and added new goals and objectives, changed any mention of natural hazards to all-hazards within the goals and objectives, and included additional mitigation strategies. This update also works to unify the various planning mechanisms in place throughout the participating communities (i.e. comprehensive plans, local emergency operation plans, zoning ordinances, building codes, etc.) to ensure that the goals and objectives identified in those planning mechanisms are consistent with the strategies and projects included in this plan. The 2017 HMP Plan Review Tool was reviewed for possible changes to incorporate into this plan update and were addressed where applicable. These changes are described in the table below.

Table 2: 2017 Plan Comments and Revisions

Comment/Revision from 2017 Review Tool	Location of Revision	Summary of Change
Hall County was included in the West Fork Big Blue Watershed Risk MAP project and several Risk MAP products are available, including a Flood Risk Database. In future updates, the planning team is encouraged to make use of this information.	Flooding Risk Assessment	Risk MAP products and maps have been included in this update of the plan.
Greater discussion as to how each community prioritized mitigation activities would give insight into the deliberative process and serve as a foundation for future decision making.	Section Five: Mitigation Strategy	Language was updated to provide a better insight as to how mitigation action priority levels were determined by each participant.
The Village of Farnam (and a few others) profile(s) indicate(s), “No other examples of plan integration were identified, and there are currently no plans to further integrate planning mechanisms.” However, the village is likely already integrating a number of mitigation goals/actions into existing planning mechanisms such as: annual budgets, maintenance plans,	Individual Participant Sections	All planning participants were asked to complete a new Plan Integration Worksheet in order to identify planning documents where plan integration has taken place.

Comment/Revision from 2017 Review Tool	Location of Revision	Summary of Change
public information programs, grant applications, etc., and should consider taking credit for these activities.		
Several jurisdictions have one or more actions in their mitigation strategies that are emergency response or operations preparedness in nature. These need not be removed from the plan but are not considered mitigation actions. In future updates, jurisdictions are encouraged to focus their strategies on mitigation projects, particularly those eligible for funding under HMA.	Individual Participant Sections	All planning participants were asked to update their mitigation actions from the previous plan and identify new mitigation actions. While discussion focused on actions eligible for funding under HMA, all types of mitigation actions were identified as the HMP may be utilized for other funding opportunities.

It should be noted as well that due to the coronavirus disease 2019 (COVID-19), some adjustments were made to the planning process to appropriately accommodate plan meeting dates and requirements. To accommodate those that were uncomfortable attending in person meetings, hybrid meetings with options to join in person, online, or by phone were utilized. In addition, an all-virtual meeting option was also given. Additional changes are described in Section Two.

Plan Implementation

Various communities across the planning area have implemented hazard mitigation projects following the 2017 Hazard Mitigation Plan. A few examples of completed projects include improving warning systems, flood risk reduction structures, reducing tree damage, installing storm shelters, purchasing equipment, mapping infrastructure, and others. In order to build upon these prior successes and to continue implementation of mitigation projects, communities will need to continue relying upon multi-agency coordination as a means of leveraging resources. Communities across the region have been able to work with a range of entities to complete projects; potential partners for future project implementation include but are not limited to: Nebraska Forest Service (NFS), Nebraska Department of Transportation, Nebraska Department of Natural Resources (NeDNR), Nebraska Emergency Management Agency (NEMA), United States Department of Agriculture (USDA), and United States Army Corps of Engineers (USACE).

Hazard Profiles

The hazard mitigation plan includes a description of the hazards considered, including a risk and vulnerability assessment. Data considered during the risk assessment process include: historic occurrences and recurrence intervals; historic losses (physical and monetary); impacts to the built environment (including privately-owned structures as well as critical facilities); and the local risk assessment. The following tables provide an overview of the risk assessment for each hazard and the losses associated with each hazard.

Table 3: Hazard Occurrences

Hazard	Previous Occurrence Events/Years	Approximate Annual Probability	Likely Extent	
Animal and Plant Disease	Animal: 98/7 Plant: 59/20	Animal 100% Plant 75%	~33 animals per event Crop damage or loss	
Dam Failure	6/130	5%	Varies by structure	
Drought	444/1,513 months	29%	D1-D4	
Earthquakes	1/120	Less than 1%	Less than 5.0 on the Richter Scale	
Extreme Heat	Avg 5 days per year >100°F	78%	>100°F	
Flooding	84/26	65%	Some inundation of structures (22.6% of structures) and roads near streams. Some evacuations of people may be necessary (19.4% of population)	
Grass/Wildfires	1,460/21	100%	Avg 32.3 acres Some homes and structures threatened or at risk	
Hazardous Materials Release	Fixed Site: 176/31 Transportation: 183/51	100% 65%	Avg Liquid Spill	277 gal
			Avg Gas Spill	440 gal
Levee Failure	0/120	Less than 1%	Varies by extent	
Public Health Emergency	2	Unknown	Varies by extent	
Severe Thunderstorms	1,599/26	100%	≤3.71” rainfall Avg 57 mph winds	
Severe Winter Storms	513/26	100%	0.25” – 1.5” Ice 30°-70° below zero (wind chill) 2-18” snow 20-90 mph winds	
Terrorism	1/48	Less than 1%	Varies by event	
Tornadoes and High Winds	258/26	92%	Avg: EF0 Range: EF0-EF3	

The following table provides loss estimates for hazards with sufficient data. Description of major events are included in *Section Seven: Community Profiles.*

Table 4: Hazard Loss History

Hazard Type		Count	Property Damage	Crop Damage[2]
Animal and Plant Disease	Animal Disease[1]	98	3,303 animals	N/A
	Plant Disease[2]	59	N/A	$770,256
Dam Failure[5]		6	N/A	N/A
Drought[6]		444 of 1,513 months	$0	$76,993,162
Earthquakes[12]		1	$0	N/A
Extreme Heat[7]		Avg. 5 Days a Year	N/A	$25,937,061
Flooding[8]	Flash Flood	47	$42,655,000	$4,140,050
	Flood	37	$9,118,000	
Grass/Wildfires[9] *7 injuries 3 fatalities*		1,460	41,435 acres	$248,598
Hazardous Materials Release	Fixed Site[3]	176	$0	N/A
	Transportation[4]	183	$1,325,150	N/A
Levee Failure[11]		0	$0	N/A
Public Health Emergency		2	N/A	N/A
Severe Thunderstorms[8] *25 injuries*	Thunderstorm Wind Range: 57 Average: 50-92	540	$34,940,000	$190,074,924
	Hail Range: 0.75-5.0 in. Average: 1.2 in	957	$117,794,000	
	Heavy Rain	94	$587,000	
	Lightning	8	$492,000	
Severe Winter Storms[8] *12 injuries 4 fatalities*	Blizzard	50	$905,000	$3,613,366
	Extreme Cold/Wind Chill	17	$0	
	Heavy Snow	16	$0	
	Ice Storm	35	$23,325,000	
	Winter Storm	216	$1,265,000	
	Winter Weather	179	$160,000	
Terrorism[10]		1	$0	N/A
Tornadoes and High Winds[8] *10 injuries*	Tornadoes Range: EF0-EF3 Average: EF0	68	$30,425,000	$6,490,000
	High Winds Range: 50 kts Average: 35-70 kts	190	$5,966,400.00	$24,439,112
Total		**4,440**	**$268,957,550**	**$332,706,530**

N/A: Data not available
1 - NDA, 2014 – April 2021
2 - USDA RMA, 2000 – 2020
3 - NRC, 1990 – February 2020
4 - PHSMA, 1971 – June 2021
5 – DNR Communication, July 2021
6 - NOAA, 1895 – January 2021
7 - NOAA Regional Climate Center, 1878 – June 2021
8 - NCEI, 1996 – June 2021
9 - NFS, 2000 - 2020
10 - University of Maryland, 1970-2018
11 – USACE NLN, 1900 – June 2021
12 – USGS, 1900 – June 2021

Events like wildfires, severe thunderstorms, and severe winter storms will occur annually. Other hazards like drought, dam failure, and terrorism will occur less often. The scope of events and how they will manifest themselves locally is not known regarding hazard occurrences. Historically, drought, flooding, severe thunderstorms, and tornadoes and high winds have resulted in the most significant damages within the planning area. These hazards are summarized below.

Drought

Drought is a regular and reoccurring phenomenon in the planning area with drought occurring in 29.3% of months from 1895-2020 according to NCEI data. Historical data shows that drought has occurred with regularity across the planning area and recent research indicates that trend will continue and potentially intensify.[1] The most common impacts of drought affect the agricultural sector. Over $76 million in total crop loss was reported for the planning area since 2000 according to the U.S. Department of Agriculture.

Prolonged drought events can have a profound effect on the planning area and individual communities within it. Expected impacts from prolonged drought events include but are not limited to economic loss in the agricultural sector; loss of employment in the agricultural sector; and limited water supplies (drinking and fire suppression).

Flooding

Flash flooding and riverine flooding are common for the planning area due to the regular occurrence of severe thunderstorms in spring and summer, the proximity of rivers to many communities, and aged or undersized stormwater drainage infrastructure. Flooding can occur on a local level, only affecting a few streets, but can also extend throughout an entire district, affecting whole drainage basins. The National Centers for Environmental Information (NCEI) has recorded 47 flash flood and 37 flood events in 26 years. All together flooding has caused over $51 million in property damages and $4 million in total crop loss for the planning area since 1996.

Severe Thunderstorms

Thunderstorms are generally large in magnitude, have a long duration, and travel across large areas and through multiple jurisdictions within a single region. Additionally, thunderstorms often occur in series, with one area potentially impacted multiple times in one day and producing a range of associated hazards, including strong winds, heavy rain, and lightning strikes. Severe thunderstorms are most likely to occur between April and October, with the highest number of events happening in May. The NCEI recorded 1,599 severe thunderstorm events in 26 years across the five-county planning area. These events caused over $153 million in property damages. Typical impacts resulting from severe thunderstorms include but are not limited to: loss of power; obstruction of transportation routes; grass/wildfires starting from lightning strikes; localized flooding; and damages discussed in the hazard profiles for hail and high winds.

Vulnerable populations related to severe thunderstorms include residents of mobile homes (10% of housing units), citizens with decreased mobility, and those caught outside during storm events. Most residents within the planning area are familiar with severe thunderstorms and know how to prepare and respond to events appropriately.

1 University of Nebraska-Lincoln. 2014. “Understanding and Assessing Climate Change: Implications for Nebraska”. http://snr.unl.edu/download/research/projects/climateimpacts/2014ClimateChange.pdf.

Tornadoes and High Winds

Tornadoes and high winds are an annual occurrence for the planning area. Tornadoes are known for high winds and a spinning vortex of air. Tornadoes typically occur between May and July while high winds are more likely to occur between October and March. The NCEI reported 258 tornado and high wind events that caused over $36 million in property damages in 24 years. Impacts resulting from tornadoes and high winds include but are not limited to: closure of transportation routes; downed power lines and power outages; collapsed roofs; and closure of critical facilities.

The most vulnerable citizens within the planning area are the elderly, individuals without basements or shelters, residents of mobile homes, citizens with decreased mobility, and those caught outside during storm events.

Mitigation Strategies

There are a wide variety of strategies that can be used to reduce the impacts of hazards for the built environment and planning area residents. *Section Five: Mitigation Strategy* shows the mitigation actions chosen by the participating jurisdictions to assist in preventing future losses.

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Section One: Introduction

Hazard Mitigation Planning

Severe weather and hazardous events are occurring more frequently in our daily lives. Pursuing mitigation strategies reduces risk and is socially and economically responsible to prevent long-term risks from natural and human-caused hazard events.

FEMA definition of Hazard Mitigation

"Any sustained action taken to reduce or eliminate the long-term risk to human life and property from [natural] hazards."

Natural hazards, such as severe winter storms, high winds and tornadoes, severe thunderstorms, flooding, extreme heat, drought, agriculture diseases, and wildfires are part of the world around us. Human-caused hazards are a product of the society and can occur with significant impacts to communities. Human-caused hazards can include dam failure, hazardous materials release, transportation incidents, and terrorism. These hazard events can occur as a part of normal operation or as a result of human error. All jurisdictions participating in this planning process are vulnerable to a wide range of natural and human-caused hazards that threaten the safety of residents and have the potential to damage or destroy both public and private property, cause environmental degradation, or disrupt the local economy and overall quality of life.

The CPNRD has prepared this multi-jurisdictional hazard mitigation plan to reduce impacts from natural and human-caused hazards and to better protect the people and property of the region from the effects of these hazards. This plan demonstrates a regional commitment to reducing risks from hazards and serves as a tool to help decision makers establish mitigation activities and resources. Further, this plan was developed to ensure the counties and participating jurisdictions are eligible for federal pre-disaster funding programs and to accomplish the following objectives:

- Minimize the disruption to each jurisdiction following a disaster.
- Establish actions to reduce or eliminate future damages in order to efficiently recover from disasters.
- Investigate, review, and implement activities or actions to ensure disaster related hazards are addressed by the most efficient and appropriate solution.
- Educate citizens about potential hazards.
- Facilitate development and implementation of hazard mitigation management activities to ensure a sustainable community.

Disaster Mitigation Act of 2000

The U.S. Congress passed the Disaster Mitigation Act 2000 to amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act[2]. Section 322 of the DMA 2000 requires that state and local governments develop, adopt, and routinely update a hazard mitigation plan to remain eligible for pre- and post-disaster mitigation funding.[3] These funds currently include the Hazard Mitigation Grant Program (HMGP)[4], Building Resilient Infrastructure and Communities Grant (BRIC)[5], and the Flood Mitigation Assistance Program (FMA)[6]. The Federal Emergency Management Agency (FEMA) administers these programs under the Department of Homeland Security.[7]

This plan was developed in accordance with current state and federal rules and regulations governing local hazard mitigation plans. The plan shall be monitored and updated on a routine basis to maintain compliance with the legislation – Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as enacted by Section 104 of the DMA 2000 (P.L. 106-390)[8] and by FEMA's Final Rule (FR)[9] published in the Federal Register on November 30, 2007, at 44 Code of Federal Regulations (CFR) Part 201.

Hazard Mitigation Assistance

On June 1, 2009, FEMA initiated the Hazard Mitigation Assistance (HMA) program integration, which aligned certain policies and timelines of the various mitigation programs. These HMA programs present a critical opportunity to minimize the risk to individuals and property from hazards while simultaneously reducing the reliance on federal disaster funds.

Each HMA program was authorized by separate legislative actions, and as such, each program differs slightly in scope and intent.

Mitigation is the cornerstone of emergency management. Mitigation focuses on breaking the cycle of disaster damage, reconstruction, and repeated damage. Mitigation lessens the impact disasters have on people's lives and property through damage prevention, appropriate development standards, and affordable flood insurance. Through measures such as avoiding building in damage-prone areas, stringent building codes, and floodplain management regulations, the impact on lives and communities is lessened.
- FEMA Mitigation Directorate

- **HMGP:** To qualify for post-disaster mitigation funds, local jurisdictions must have adopted a mitigation plan that is approved by FEMA. HMGP provides funds to states, territories, Indian tribal governments, local governments, and eligible private non-profits following a presidential disaster declaration. The DMA 2000 authorizes up to seven percent of HMGP

2 Federal Emergency Management Agency, Public Law 106-390. 2000. "Disaster Mitigation Act of 2000." Last modified September 26, 2013. https://www.fema.gov/media-library/assets/documents/4596.
3 Federal Emergency Management Agency. June 2007. "Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, and Related Authorities." Federal Emergency Management Agency 592: 22. Sec. 322. Mitigation Planning (42 U.S.C. 5165). https://www.fema.gov/media-library/assets/documents/15271
4 Federal Emergency Management Agency. "Hazard Mitigation Grant Program." Last modified July 8, 2017. https://www.fema.gov/hazard-mitigation-grant-program.
5 Federal Emergency Management Agency. "Building Resilient Infrastructure and Communities." Last modified July 10, 2020. https://fema.gov/bric.
6 Federal Emergency Management Agency. "Flood Mitigation Assistance Grant Program." Last modified July 11, 2017. https://www.fema.gov/flood-mitigation-assistance-grant-program.
7 Federal Emergency Management Agency. "Hazard Mitigation Assistance." Last modified March 29, 2017. https://www.fema.gov/hazard-mitigation-assistance.
8 Federal Emergency Management Agency: Federal Register. 2002. "Section 104 of Disaster Mitigation Act 2000: 44 CFR Parts 201 and 206: Hazard Mitigation Planning and Hazard Mitigation Grant Programs; Interim Final Rule." https://www.fema.gov/pdf/help/fr02-4321.pdf.
9 Federal Emergency Management Agency: Federal Register. 2002 "44 CFR Parts 201 and 206: Hazard Mitigation Planning and Hazard Mitigation Grant Programs; Interim Final Rule." https://www.fema.gov/pdf/help/fr02-4321.pdf.

funds available to a state after a disaster to be used for the development or update of state, tribal, and local mitigation plans.

- **FMA:** This program provides grant funds to implement projects such as acquisition or elevation of flood-prone homes. Jurisdictions must be participating communities in the National Flood Insurance Program (NFIP) to qualify for this grant. The goal of FMA is to reduce or eliminate claims under the NFIP.

- **BRIC:** This program replaced the Pre-Disaster Mitigation Program beginning in 2020 and provides funds on an annual allocation basis to local jurisdictions for implementing programs and projects to improve resiliency and local capacity before disaster events.

Plan Financing and Preparation

Regarding the plan financing and preparation, the CPNRD is the “sub-applicant” that is the eligible entity that submits a sub-application for FEMA assistance to the “Applicant”. The “Applicant” in this case is the State of Nebraska. If HMA funding is awarded, the sub-applicant becomes the “sub-grantee” and is responsible for managing the sub-grant and complying with program requirements and other applicable federal, state, territorial, tribal, and local laws and regulations.

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Section Two: Planning Process

Introduction

The process utilized to develop a hazard mitigation plan is often as important as the final planning document. For this planning process, CPNRD adapted the four-step hazard mitigation planning process outlined by FEMA to fit the needs of the participating jurisdictions. The following pages will outline how the Regional Planning Team was established; the function of the Regional Planning Team; critical project meetings and community representatives; outreach efforts to the general public; key stakeholders and neighboring jurisdictions; general information relative to the risk assessment process; general information relative to local/regional capabilities; plan review and adoption; and ongoing plan maintenance.

Requirement §201.6(b): Planning process. An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

Requirement §201.6(c)(1): The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Multi-Jurisdictional Approach

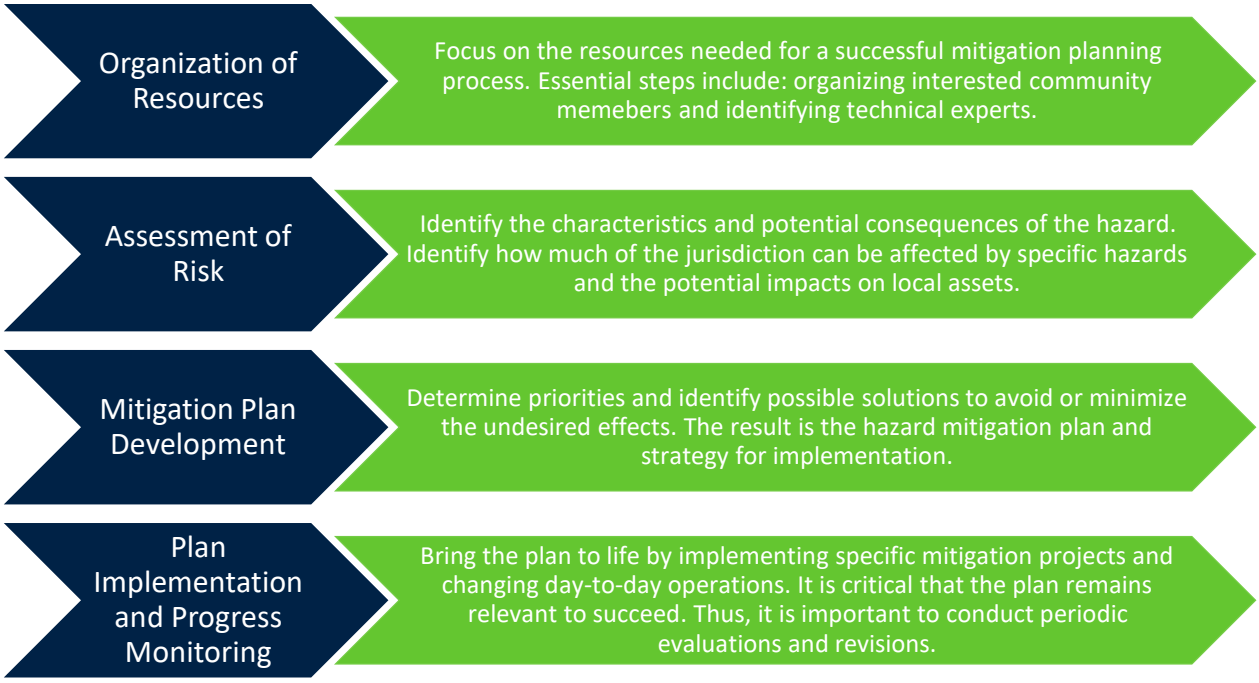
According to FEMA, "A multi-jurisdictional hazard mitigation plan is a plan jointly prepared by more than one jurisdiction." The term 'jurisdiction' means 'local government.' Title 44 Part 201, Mitigation Planning in the CFR, defines a 'local government' as "any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments, regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, any rural community, unincorporated town or village, or other public entity." For the purposes of this plan, a 'taxing authority' was utilized as the qualifier for jurisdictional participation. FEMA recommends the multi-jurisdictional approach under the DMA 2000 for the following reasons.

- It provides a comprehensive approach to the mitigation of hazards that affect multiple jurisdictions.
- It allows economies of scale by leveraging individual capabilities and sharing cost and resources.
- It avoids duplication of efforts.
- It imposes an external discipline on the process.

Both FEMA and NEMA recommend this multi-jurisdictional approach through the cooperation of counties, regional emergency management, and natural resources districts. CPNRD utilized the multi-jurisdictional planning process recommended by FEMA (Local Mitigation Plan Review Guide[10], Local Mitigation Planning Handbook[11], and Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards[12]) to develop this plan.

Hazard Mitigation Planning Process

The hazard mitigation planning process as outlined by FEMA has four general steps which are detailed in the figure below. The mitigation planning process is rarely a linear procedure. It's common that ideas developed during the initial risk assessment may need revision later in the process, or that additional information may be identified while developing the mitigation plan or during plan implementation that results in new goals or additional risk assessments.



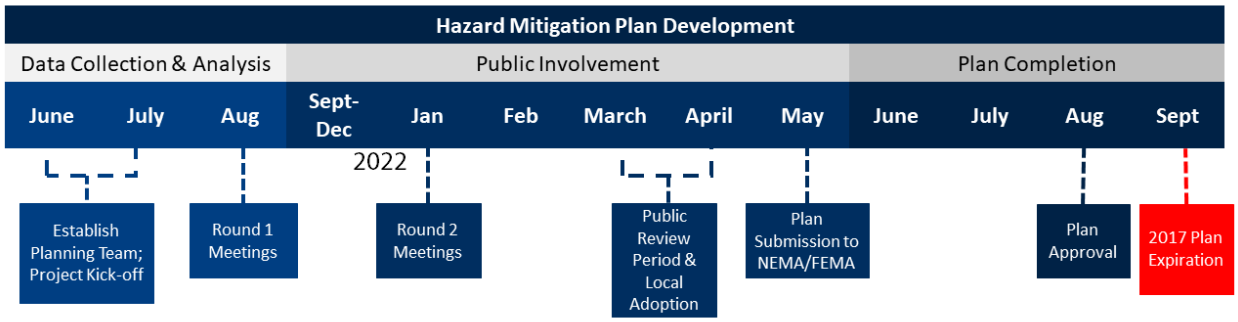
Organization of Resources

Plan Update Process

CPNRD was awarded FEMA grant funding for their multi-jurisdictional hazard mitigation plan in October 2020. JEO Consulting Group, INC. (JEO) was contracted in January 2020 to assist, guide, and facilitate the planning process and plan assembly. For the planning area, Jesse Mintken with CPNRD led the development of the plan and served as the primary point of contact throughout the project. A clear timeline of this plan update process is provided in Figure 2.

10 Federal Emergency Management Agency. 2011. "Local Mitigation Plan Review Guide." https://www.fema.gov/media-library/assets/documents/23194.
11 Federal Emergency Management Agency. 2013. "Local Mitigation Planning Handbook." https://www.fema.gov/media-library/assets/documents/31598.
12 Federal Emergency Management Agency. 2013. "Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards." https://www.fema.gov/media-library-data/20130726-1904-25045-0186/fema_mitigation_ideas_final508.pdf.

Figure 2: Project Timeline



Planning Team

At the beginning of the planning process, CPNRD and JEO staff identified who would comprise the Regional Planning Team. This planning team was established to guide the planning process, review the existing plan, and serve as a liaison to plan participants throughout the planning area. A list of the Regional Planning Team members can be found in Table 5. Staff from NEMA and NeDNR provided additional technical support.

Table 5: Regional Planning Team

Name	Title	Jurisdiction
Jesse Mintken	Assistant Manager	Central Platte NRD
Darrin Lewis	Emergency Manager	Buffalo County
Brian Woldt	Emergency Manager	Dawson County
Mark Streit	Floodplain Administrator	Dawson County
Job Rosenlund	Emergency Manager	Hall County
Chad Nabity	Floodplain Administrator	Hall County, Grand Island, Wood River
Jenna Clark	Emergency Manager	Merrick County/Region 44
Bob Carey	Emergency Manager	Polk County
***Becky Appleford**	Project Coordinator	JEO Consulting Group
***Karl Dietrich**	Planner	JEO Consulting Group
***Kayla Vondracek**	Planner	JEO Consulting Group
***Lexy Hindt**	Planning Specialist	NEMA
***Adele Phillips**	Floodplain Mitigation Planner	NeDNR

**Served as a consultant or advisory role.*

A kick-off meeting was held on July 8, 2021, at the Central Platte NRD office in Grand Island, NE, to discuss an overview of the planning process between JEO staff and members of the Regional Planning Team. Preliminary discussion was held over hazards to be included in this plan, changes to be incorporated since the last plan, goals and objectives, identification of key stakeholders to include in the planning process, and a general schedule for the plan update. This meeting also assisted in clarifying the role and responsibilities of the Regional Planning Team and strategies for public engagement throughout the planning process. Table 6 shows kick-off meeting attendees.

Table 6: Kick-off Meeting Attendees

Name	Title	Jurisdiction
Becky Appleford	Project Coordinator	JEO Consulting Group
Brian Woldt	Emergency Manager	Dawson County
Chad Nabity	Floodplain Administrator	Hall County, Grand Island, Wood River
Darrin Lewis	Emergency Manager	Buffalo County
Denise Ziemba	Ex-Emergency Manager	Merrick County/Region 44
Heather Thole	Hazard Mitigation Planning Specialist	NEMA
Jesse Mintken	Assistant Manager	Central Platte NRD
Karl Dietrich	Planner	JEO Consulting Group
Kayla Vondracek	Planner	JEO Consulting Group
Lexy Hindt	Hazard Mitigation Planning Specialist	NEMA
Mark Streit	Floodplain Administrator	Dawson County

Table 7 shows the date, location, and agenda items of for the kick-off meeting.

Table 7: Kick-off Meeting Location and Time

Location and Time	Agenda Items
Central Platte NRD 215 Kaufman Avenue Grand Island, NE July 8, 2021 1:00pm	-Consultant and planning team responsibilities -Overview of plan update process and changes from 2017 HMP -Review and adoption of goals and objectives -Plan goals/objectives -Hazard identification -Project schedule and dates/locations for public meetings

Public Involvement and Outreach

To notify and engage the public in the planning process, a wide range of stakeholder groups were contacted and encouraged to participate. There were 86 stakeholder groups or entities that were identified and sent letters to participate. Stakeholder groups that attended a Round 1 or Round 2 meeting include: Cozad Community Hospital, Grand Island Regional Medical Center, Dawson County Farm Service Agency, Emerald Nursing & Rehab Cozad, CHI Health St. Francis Medical Center / Common Spirit Health, and Azria Health Central City. Any comments these stakeholders provided were incorporated into the appropriate community profiles (see *Section Seven*). NEMA also attended meetings and provided data and guidance during the planning process. The general public was encouraged to participate through the project website or by providing comments to the Regional Planning Team members. No comments were received from the general public.

Table 8: Notified Stakeholder Groups

Organizations		
American Red Cross of Central and Western Nebraska	Annie Jeffrey Memorial County Health Center	Avamere at Lexington
Azria Health Broadwell	Azria Health Central City	Brickford Senior Living
Brookestone Gardens	Buffalo County Community Partners	Buffalo-Sherman County Farm Service Agency
Cambridge Court	CC Live	Central Assisted Living
Central Catholic Middle & Highschool	Central City Area Chamber of Commerce	Central City Municipal Airport
Central Nebraska Regional Airport	Central Nebraska Veterans Home	CHI Health Good Samaritan
CHI Health Richard Young Behavioral Health	CHI Health St. Francis	Cottonwood Estates

Organizations		
Cozad Chamber of Commerce	Cozad Community Hospital	Cozad Municipal Airport
Crane Meadows Assisted Living	Dawson Area Development	Dawson County Farm Service Agency
Dawson Public Power District	Economic Development Council of Buffalo County	Edgewood Grand Island Senior Living
Emerald Nursing & Rehab Cozad	Emerald Nursing & Rehab Lakeview	Faith Christian School
Good Samaritan Society – Grand Island Village	Good Samaritan Society - Osceola	Good Samaritan Society – Ravenna
Good Samaritan Society – St. John's	Good Samaritan Society – St. Luke's Village	Gothenburg Chamber of Commerce
Gothenburg Memorial Hospital	Grand Island Chamber of Commerce	Grand Island Country House
Grand Island Regional Medical Center	Hall County Farm Service Agency	Heartland Lutheran High School
Hilltop Estates	Kearney Ambulatory Surgical Center	Kearney Area Chamber of Commerce
Kearney Catholic High School	Kearney Countryhouse	Kearney Regional Airport
Kearney Regional Medical Center	Kinship Pointe Northridge	Lebensraum Assisted Living
Lexington Municipal Airport	Lexington Regional Health Center	Life Essentials Assisted Living
Lizenburg Memorial County Hospital	Meadowlark Pointe Assisted Living	Merrick County Farm Service Agency
Merrick Medical Center	Midwest Covenant Home	Midwest Homestead of Kearney
Mother Hull Home	Mt Carmel Home	Nebraska Christian Schools
New Hope Christian School	Polk County Farm Service Agency	Polk County Rural Public Power District
Polk County Senior Services	Prairie View Gardens	Prairie Winds
Primrose Retirement Community of Grand Island	Ravenna Chamber of Commerce	Ridgeview Heights
Riverside Lodge	Seneca Sunrise	Stone Hearth Estates
Stromsburg Municipal Airport	The Evangelical Lutheran Good Samaritan Society	The Heritage at Sagewood
The Plaza	Tiffany Square	Trinity Lutheran School
Well-Life at Kearney	Well-Life at Plum Creek	-

Neighboring Jurisdictions

Neighboring jurisdictions were notified and invited to participate in the planning process. The following table indicates which neighboring communities or entities were notified of the planning process. Invitation letters were sent to county emergency managers, and NRDs. The General Manager for the Tri-Basin NRD attended the Round 1 Meeting in Lexington. No comments or revisions were received from any neighboring jurisdictions.

Table 9: Notified Neighboring Jurisdictions

Notified Neighboring Jurisdictions	
Adams County	Lower Loup NRD
Butler County	Lower Platte North NRD
Clay County	Middle Republican NRD
Colfax County	Nance County
Custer County	Phelps County

Notified Neighboring Jurisdictions	
Frontier County	Platte County
Gosper County	Sherman County
Hamilton County	Tri-Basin NRD
Howard County	Twin Platte NRD
Kearney County	Upper Big Blue NRD
Lincoln County	York County

Participant Involvement

Participants play a key role in identifying hazards, providing a record of historical disaster occurrences and localized impacts, identifying and prioritizing potential mitigation projects and strategies, and the developing annual review procedures.

To be a participant in the development of this plan update, jurisdictions were required to have, at a minimum, one representative present at the Round 1 or Round 2 meeting, watch meeting recordings, or attend a follow-up meeting with a JEO staff member. Some jurisdictions sent multiple representatives to meetings. For jurisdictions who had only one representative, they were encouraged to bring meeting materials back to their governing bodies, to collect diverse input on their jurisdiction's meeting documents. Attendance was recorded on sign-in sheets for both in-person and virtual attendees. Jurisdictions that were unable to attend the scheduled public meetings were able to request a meeting with JEO staff to satisfy the meeting attendance requirement or watch a recording of the Round 1 and Round 2 meetings. This effort enabled jurisdictions which could not attend a scheduled public meeting to participate in the planning process.

Outreach to eligible jurisdictions included notification prior to all public meetings, phone calls and email reminders of upcoming meetings, and reminders to complete worksheets required for the planning process. Table 10 provides a summary of outreach activities utilized in this process.

Table 10: Outreach Activity Summary

Action	Intent
Project Website	Informed the public and local/planning team members of past, current, and future activities (https://jeo.com/central-platte-nrd-hazard-mitigation-plan-update).
Round 1 Meeting Letters and Emails (30-day notification)	Sent to participants, stakeholders, and neighboring jurisdictions to discuss the agenda/dates/times/ locations of the first round of public meetings.
Round 2 Meeting Letters and Emails (30-day notification)	Sent to participants and stakeholders to discuss the agenda/dates/times/locations of the second round of public meetings.
Notification Phone Calls	Called potential participants to remind them about upcoming meetings.
Follow-up Emails and Phone Calls	Correspondence was provided to remind and assist participating jurisdictions with the collection and submission of required local data.
Project Flyer	Flyers were shared with all Regional Planning team members to distribute. Flyers were also made available to local planning team members to distribute.
Word-of-Mouth	Staff discussed the plan with jurisdictions throughout the planning process.

Round 1 Meetings: Hazard Identification and Plan Integration

At the Round 1 meetings, jurisdictional representatives (i.e., the local planning teams) reviewed the hazards identified at the kick-off meeting and conducted risk and vulnerability assessments based on these hazards' previous occurrence and the communities' exposure. (For a complete list of hazards reviewed, see *Section Four: Risk Assessment.)*. In addition, local planning team members evaluated potential integration of the HMP alongside other local planning mechanisms.

Due to COVID-19 numbers across Nebraska, Round 1 meetings were held as either a hybrid or virtual meeting. Hybrid meetings were in-person public workshop meetings with additional options to join via an online or phone format. The virtual meeting was held as an online and phone format only, rather than in-person public workshop meetings. This was done to protect the health of residents and staff members with pre-existing health conditions and to increase participation from individuals who may not have felt comfortable in public situations during the pandemic. Table 11 shows the date and location of meetings held for the Round 1 meeting phase of the project.

Table 11: Round 1 Meeting Dates and Locations

Agenda Items	
General overview of the HMP update process, discuss participation requirements, begin the process of risk assessment and impact reporting, update critical facilities, capabilities assessment, and plan integration.	
Location and Time	**Date**
Hybrid Meeting In Person, Online, or by Phone Central City Venture Center 1532 17th Ave, Central City, NE	Thursday, August 12, 2021, at 2:00 pm
Hybrid Meeting In Person, Online, or By Phone Dawson County Annex 200 W. 7th St, Lexington, NE	Monday, August 16, 2021, at 2:00 pm
Hybrid Meeting In Person, Online, or By Phone Central Platte NRD Office 215 Kaufman Ave, Grand Island, NE	Thursday, August 19, 2021, at 1:00 pm
Virtual Zoom Meeting Online or By Phone	Wednesday, August 25, 2021, at 6:00 pm

The intent of these meetings was to familiarize local planning team members with the plan update process, expected actions for the coming months, the responsibilities of being a participant, and to collect preliminary information to update the HMP. Data collected at these meetings included: plan integration; identifying the top concerns from each jurisdiction; and reviewing and updating community profiles for demographics, capabilities, and critical facilities. Information/data reviewed include but was not limited to local hazard prioritization results; identified critical facilities and their location within the community; future development areas; and expected growth trends (refer to *Appendix B*).

The following table shows the attendees for each jurisdiction who attended a Round 1 meeting. No participants watched the meeting recording or had a one-on-one discussion with JEO staff during this round of meetings.

Table 12: Round 1 Meeting Attendees

Name	Title	Jurisdiction
Central City Hybrid Meeting – Thursday, August 12, 2021		
Barb Church	Ex Clerk / Treasurer / Floodplain Administrator	Village of Clarks
Bill Carlstrom	Utility Superintendent / Water Commissioner	Village of Polk
Brad Wells	Fire Chief	Central City Volunteer Fire Department
Bret Schroder	Superintendent	Elm Creek Public Schools
Chris Anderson	City Administrator	Central City
Clifford Yrkoski	Board Supervisor	Merrick County
Collins Haag	Utility Superintendent	Village of Palmer
Dan Theis	Highway Superintendent	Polk County
Darrin Lewis	Emergency manager	Buffalo County
Dennise Daniels	Planning / Zoning / Floodplain Administrator	Buffalo County
Dusty Newton	Municipal Administrator / Director of Admissions	Village of Elm Creek / University of Nebraska – Kearney
Edward Dexter	Board Supervisor	Merrick County
Jake Blackburn	Firefighter	Polk Fire District
Janice Taubenheim	Clerk / Treasurer / Floodplain Administrator	Village of Amherst
Jay Colson	Water Operator	City of Osceola
Jennifer Czarnick	Clerk / Treasurer / Floodplain Administrator	Village of Silver Creek
Jesse Mintken	Associate Director / Assistant Manager	Central Platte NRD
Katherine Klingsporn	Administrator	Azria Health Central City
Kim Beran	Superintendent	High Plains Community Schools
Nancy Bryan	Clerk / Treasurer	City of Stromsburg
Pam Holbrook	Planning / Zoning	Dawson County
Pamela Lancaster	Board Supervisor	Hall County
Pat Powell	City Utilities	City of Stromsburg
Reiny Dickhart	Deputy Sheriff	Merrick County
Roger Wiegert	Board Supervisor	Merrick County
Scott Umberger	Village Maintenance	Village of Polk
Zach Springer	Dean of Students	Central City Public Schools
Becky Appleford	Project Manager	JEO Consulting Group
Karl Dietrich	Planner	JEO Consulting Group
Kayla Vondracek	Planner	JEO Consulting Group
Lexington Hybrid Meeting – Monday August 16, 2021		
Alison Feik	Emergency Coordinator	Cozad Community Hospital
Bo Berry	Maintenance Supervisor / Firefighter	Lexington Public Schools / Lexington Volunteer Fire Department
Bret Schroder	Superintendent	Elm Creek Public Schools
Brian Woldt	Emergency Manager	Dawson County
Chad Nabity	Floodplain Administrator / Planning / Zoning	Hall County / Village of Alda / Village of Cairo / Village of Doniphan / City of Grand Island / City of Wood River
Chris Fankhauser	-	Two Rivers Public Health Department

Name	Title	Jurisdiction
Darrin Lewis	Emergency Manager	Buffalo County
Dennis Burnside	Assistant City Manager	City of Lexington
Dennise Daniels	Planning / Zoning / Floodplain Administrator	Buffalo County
Doug Swanson	Zoning / Floodplain Administrator	City of Gothenburg
Heather Thole	Planning Specialist	NEMA
Jesse Mintken	Associate Director / Assistant Manager	Central Platte NRD
Joe Pepplitsch	City Manager	City of Lexington
John Thorburn	General Manager	Tri-Basin NRD
John Valentine	County Executive Director	Dawson County Farm Service Agency
Kathie Carlstrom	Clerk / Treasurer	Village of Polk
Kiley Goff	Administrator	Emerald Nursing & Rehab Cozad
Kraig Johnson	Emergency Response Coordinator	Two Rivers Public Health Department
Marisa Alvares	Planning Specialist	NEMA
Mark Christiansen	Highway Superintendent	Dawson County
Mark Streit	Floodplain Administrator	Dawson County
Rod Reynolds	County Commissioner	Dawson County
Ryan Ruhl	Superintendent	Centura Public Schools
Thomas Barnett	Emergency Response Coordinator	Four Corner Health Department
Trent Boasard	Facilities Director	Kearney Public Schools
Troy Franzen	Sewer / Water Commissioner	City of Cozad
Vern Fisher	Superintendent	Gibbon Public Schools
Becky Appleford	Project Manager	JEO Consulting Group
Karl Dietrich	Planner	JEO Consulting Group
Kayla Vondracek	Planner	JEO Consulting Group
Grand Island Hybrid Meeting – Thursday August 19, 2021		
Andrew Hills	Emergency Response Coordinator	Central District Health Department
Bill Redinger	Risk Manager	Grand Island Regional Medical Center
Bob Carey	Emergency Manager	Polk County
Bryan Simonson	Deputy Sheriff	Hall County
Cannon Blauvelt	Principal	Ravenna Public Schools
Carla Maurer	-	Village of Doniphan
Curtis Rohich	-	City of Wood River
Dale Beye	Safety Specialist	CHI Health St. Francis Medical Center / Common Spirit Health
Dan Petsch	Director of Buildings and Grounds	Grand Island Public Schools
Dan Sell	Utility Superintendent / Floodplain Administrator	Village of Shelton
Darrin Lewis	Emergency Manager	Buffalo County
Dave Dunning	Public Works Director	City of Ravenna
Deb Van Matre	Mayor	City of Gibbon
Dennise Daniels	Planning / Zoning / Floodplain Administrator	Buffalo County
Eric Hellriegel	City Manager	City of Kearney
Eric Miller	Attorney	Drainage District No.2 / Drainage District No.3
Greg Cramer	Mayor	City of Wood River
Heather Thole	Planning Specialist	NEMA

Name	Title	Jurisdiction
Jaime Rathman	Clerk / Treasurer	Village of Cairo
Janice Taubenheim	Clerk / Treasurer / Floodplain Administrator	Village of Amherst
Jason Whalen	Fire Administrator	Kearney Fire Department / Suburban Protection District #1
Jeffrey Edwards	Superintendent	Northwest Public Schools
Joel Linn	Director of Maintenance	Cross County Community Schools
Jon Rosenlund	Emergency Manager	Hall County
Keith Kurz	Assistant Public Works Director	City of Grand Island
Larry Homan	Floodplain / City Administrator	City of Gibbon
Leora Hofmann	Clerk / Treasurer	Village of Pleasanton
Marisa Alvares	Planning Specialist	NEMA
Nathan Lightle	Superintendent	Pleasanton Public Schools
Ramona Schafer	Clerk / Treasurer	Village of Alda
Rashad Moxey	Member	Hall County Regional Planning Commission
Shanna Gannon	Superintendent	Shelton Public Schools
Steven Riehle	Highway Superintendent / Engineer	Hall County
Ted Eichholz	Emergency Management Coordinator	University of Nebraska-Kearney
Terry Zessin	Superintendent	Wood River Rural Schools
Tyler Doane	Member	Hall County Regional Planning Commission
Tyson Coble	Assistance Fire Chief	Doniphan Volunteer Fire Department
Becky Appleford	Project Manager	JEO Consulting Group
Karl Dietrich	Planner	JEO Consulting Group
Kayla Vondracek	Planner	JEO Consulting Group
Virtual Zoom Meeting – Wednesday August 25, 2021		
Amy Graham	Clerk / Treasurer / Water Commissioner	Village of Miller
Carol Jorgensen	-	Village of Elm Creek / Elm Creek Fire and Rescue
Chad Dixon	Fire Chief / Floodplain Administrator	Pleasanton Volunteer Fire Department / Village of Ravenna / Village of Pleasanton
Jason Lavaley	Superintendent	Osceola Public Schools
Jim Cudaback	Clerk / Floodplain Administrator	Village of Riverdale
Lexy Hindt	Deputy SHMO	NEMA
Nick Hodge	Superintendent	Eustis-Farnam Public Schools
Rick Brown	Fire Chief	Gibbon Volunteer Fire Department
Becky Appleford	Project Manager	JEO Consulting Group
Karl Dietrich	Planner	JEO Consulting Group

Round 2 Meetings: Mitigation Strategies and Plan Maintenance

Round 2 meetings are designed to identify and prioritize mitigation measures, update previous mitigation actions from the 2017 HMP, and identify when the plan would be reviewed and by whom. Mitigation actions and plan maintenance are essential components in effective hazard mitigation plans. Participating jurisdictions were asked to identify any new mitigation actions to pursue alongside continued actions from the 2017 HMP. Plan maintenance included identifying who would review and updated the plan, how often, and how the public would be involved.

Participating jurisdictions were also asked to review the information collected from the Round 1 meeting related to their jurisdiction through this planning process for accuracy. Information/data reviewed included but was not limited to local hazard prioritization results, identified critical facilities and their location within the community, future development areas, and expected growth trends (refer to *Appendix B*).

There was also a brief discussion about the planning process, when the plan would be available for public review and comment, the approval process, and grant opportunities available once the plan was approved. As with Round 1 meetings, any jurisdictions unable to attend were given the opportunity to have a one-on-one phone conference with the consultant or view a recording of the meeting in order to meet plan participation requirements and complete required information.

Round 2 meetings were again held as either a hybrid or virtual meeting. Hybrid meetings were in-person public workshop meetings with additional options to join via an online or phone format. The virtual meeting was held as an online and phone format only, rather than in-person public workshop meetings. Table 13 shows the date and location of meetings held for Round 2 Meetings. Meeting attendees are identified in Table 14 and Table 15.

Table 13: Round 2 Meeting Dates and Locations

Agenda Items	
Update 2017 mitigation actions, identify new mitigation actions, update the plan review process, review of local data and community profile, discuss review process, and discuss available grants and eligibility.	
Location and Time	**Date**
Hybrid Meeting In Person, Online, or by Phone Dawson County Annex 200 W. 7th St, Lexington, NE	Tuesday, January 25, 2022, at 2:00 pm
Hybrid Meeting In Person, Online, or By Phone Central Platte NRD Office 215 Kaufman Ave, Grand Island, NE	Tuesday, February 1, 2022, at 2:00 pm
Hybrid Meeting In Person, Online, or By Phone Central City Venture Center 1532 17th Ave, Central City, NE	Wednesday, February 2, 2022, at 2:00 pm
Virtual Zoom Meeting Online or By Phone	Wednesday, February 9, 2022, at 6:00 pm

Table 14: Round 2 Meeting Attendees

Name	Title	Jurisdiction
Lexington Hybrid Meeting – Tuesday January 25, 2022		
Alison Feik	Emergency Coordinator	Cozad Community Hospital
Adele Phillips	Floodplain Mitigation Planner	NeDNR
Bill Redinger	Risk Manager	Grand Island Regional Medical Center
Bo Berry	Maintenance Supervisor / Firefighter	Lexington Public Schools / Lexington Volunteer Fire Department
Bret Schroder	Superintendent	Elm Creek Public Schools
Brian Woldt	Emergency Manager	Dawson County
Dan Theis	Highway Superintendent	Polk County
Dennis Burnside	Assistant City Manager	City of Lexington
Diana Mendoza Cauley	-	FEMA

Name	Title	Jurisdiction
Doug Adkisson	Zoning & Planning / Floodplain Administrator	City of Cozad
Doug Swanson	Zoning / Floodplain Administrator	City of Gothenburg
Dusty Newton	Municipal Administrator	Village of Elm Creek
Eric Hellriegel	City Manager	City of Kearney
Fred Boon	Assistant Fire Chief / Village Treasurer	Village of Eddyville / Eddyville Volunteer Fire Department
Jay Colson	Water Operator	City of Osceola
Jesse Mintken	Associate Director / Assistant Manager	Central Platte NRD
Joe Carlson	President	Drainage District No. 4
Joe Pepplitsch	City Manager	City of Lexington
Kari Podliska	Village Clerk	Village of Clarks
Katie Griffis	Clerk	Village of Pleasanton
Kiley Goff	Administrator	Emerald Nursing & Rehab Cozad
Leora Hofmann	Clerk / Treasurer	Village of Pleasanton
Marisa Alvares	Planning Specialist	NEMA
Mark Christiansen	Highway Superintendent	Dawson County
Mark Streit	Floodplain Administrator	Dawson County
Michael Wolf	Board Chairperson	Village of Eustis
Nancy Bryan	Clerk / Treasurer	City of Stromsburg
Renee Johansen	Clerk / Treasurer	City of Osceola
Rod Reynolds	County Commissioner	Dawson County
Vern Fisher	Superintendent	Gibbon Public Schools
Zane Hoselton	Sewage Plan Operator / Street / Water Commissioner	Village of Eustis
Becky Appleford	Project Manager	JEO Consulting Group
Karl Dietrich	Planner	JEO Consulting Group
Kayla Vondracek	Planner	JEO Consulting Group

Grand Island Hybrid Meeting – Tuesday February 1, 2022

Andy Bartling	Floodplain Administrator	City of Kearney
Brett Gillming	-	Village of Shelton
Bryan Simonson	Deputy Sheriff	Hall County
Chad Nabity	Floodplain Administrator / Planning / Zoning	Hall County / Village of Alda / Village of Cairo / Village of Doniphan / City of Grand Island / City of Wood River
Courtney Widup	Water Resources Tech	Central Platte NRD
Dale Beye	Safety Specialist	CHI Health St. Francis Medical Center / Common Spirit Health
Darrin Lewis	Emergency Manager	Buffalo County
Dave Dunning	Public Works Director	City of Ravenna
Deb Van Matre	Mayor	City of Gibbon
Dennise Daniels	Planning / Zoning / Floodplain Administrator	Buffalo County
Greg Cramer	Mayor	City of Wood River
Ivan Klein	County Commissioner	Buffalo County
Jaime Rathman	Clerk / Treasurer	Village of Cairo
Jesse Mintken	Associate Director / Assistant Manager	Central Platte NRD
Jon Rosenlund	Emergency Manager	Hall County
Karen Bredthauer	County Commissioner	Hall County

Name	Title	Jurisdiction
Keith Kurz	Assistant Public Works Director	City of Grand Island
Larry Homan	Floodplain / City Administrator	City of Gibbon
Ramona Schafer	Clerk / Treasurer	Village of Alda
Scott Sorenson	County Commissioner	Hall County
Shanna Gannon	Superintendent	Shelton Public Schools
Shannon Callahan	Street Superintendent	City of Grand Island
Ted Eichholz	Emergency Management Coordinator	University of Nebraska – Kearney
Terry Zessin	Superintendent	Wood River Rural Schools
Tom Spaulding	-	City of Ravenna
Trent Bosard	Facilities Director	Kearney Public Schools
Becky Appleford	Project Manager	JEO Consulting Group
Karl Dietrich	Planner	JEO Consulting Group
Kayla Vondracek	Planner	JEO Consulting Group
Central City Hybrid Meeting – Wednesday February 2, 2022		
Andrew Hills	Emergency Response Coordinator	Central District Health Department
Brad Wells	Fire Chief	Central City Volunteer Fire Department
Chris Anderson	City Administrator	Central City
Dennise Daniels	Planning / Zoning / Floodplain Administrator	Buffalo County
Jan Placke	Board Supervisor	Merrick County
Janice Taubenheim	Clerk / Treasurer / Floodplain Administrator	Village of Amherst
Jeffrey Jenson	Superintendent	Central City Public Schools
Jenna Clark	Region 44 Emergency Manager	Merrick County
Jesse Mintken	Associate Director / Assistant Manager	Central Platte NRD
Lexy Hindt	Deputy SHMO	NEMA
Marisa Alvares	Planning Specialist	NEMA
Scott Stuhr	Planning / Zoning	Merrick County / Village of Chapman / Village of Silver Creek / Village of Palmer
Karl Dietrich	Planner	JEO Consulting Group
Kayla Vondracek	Planner	JEO Consulting Group
Zoom Meeting – Wednesday, February 9, 2022		
Chad Dixon	Fire Chief / Floodplain Administrator	Pleasanton Volunteer Fire Department / Village of Pleasanton
Kraig Johnson	Emergency Response Coordinator	Two Rivers Public Health Department
Rick Brown	Fire Chief	Gibbon Volunteer Fire Department
Thomas Barnett	Emergency Response Coordinator	Four Corners Health Department
Tyler Hillmer	Fire Chief	Elm Creek Fire & Rescue
Becky Appleford	Project Manager	JEO Consulting Group
Karl Dietrich	Planner	JEO Consulting Group
Kayla Vondracek	Planner	JEO Consulting Group

Table 15: Round 2 One-on-One or Recording Attendees

Name	Title	Jurisdiction
Jim Cudaback	Clerk / Floodplain Administrator	Village of Riverdale
Karee Dvorak	Village Emergency Manager	Village of Doniphan
Patrick Robinson	Utility Superintendent	Village of Silver Creek
Deanna Party	Clerk/Treasurer	Village of Shelby
Scott Umberger	Village Maintenance	Village of Polk
Eric Miller	Attorney	Dawson County Drainage Districts No.2 & No.3
Nathan Lightle	Superintendent	Pleasanton Public Schools
Nick Hodge	Superintendent	Eustis-Farnam Public Schools
Darcy Gurule	Clerk / Treasurer / Floodplain Administrator	Village of Farnam
Ryan Ruhl	Superintendent	Centura Public Schools
Tyson Coble	Assistant Fire Chief	Doniphan Fire District
Francis McCulla	Fire Chief	Village of Chapman
Brad Kjar	Superintendent	Ravenna Public Schools

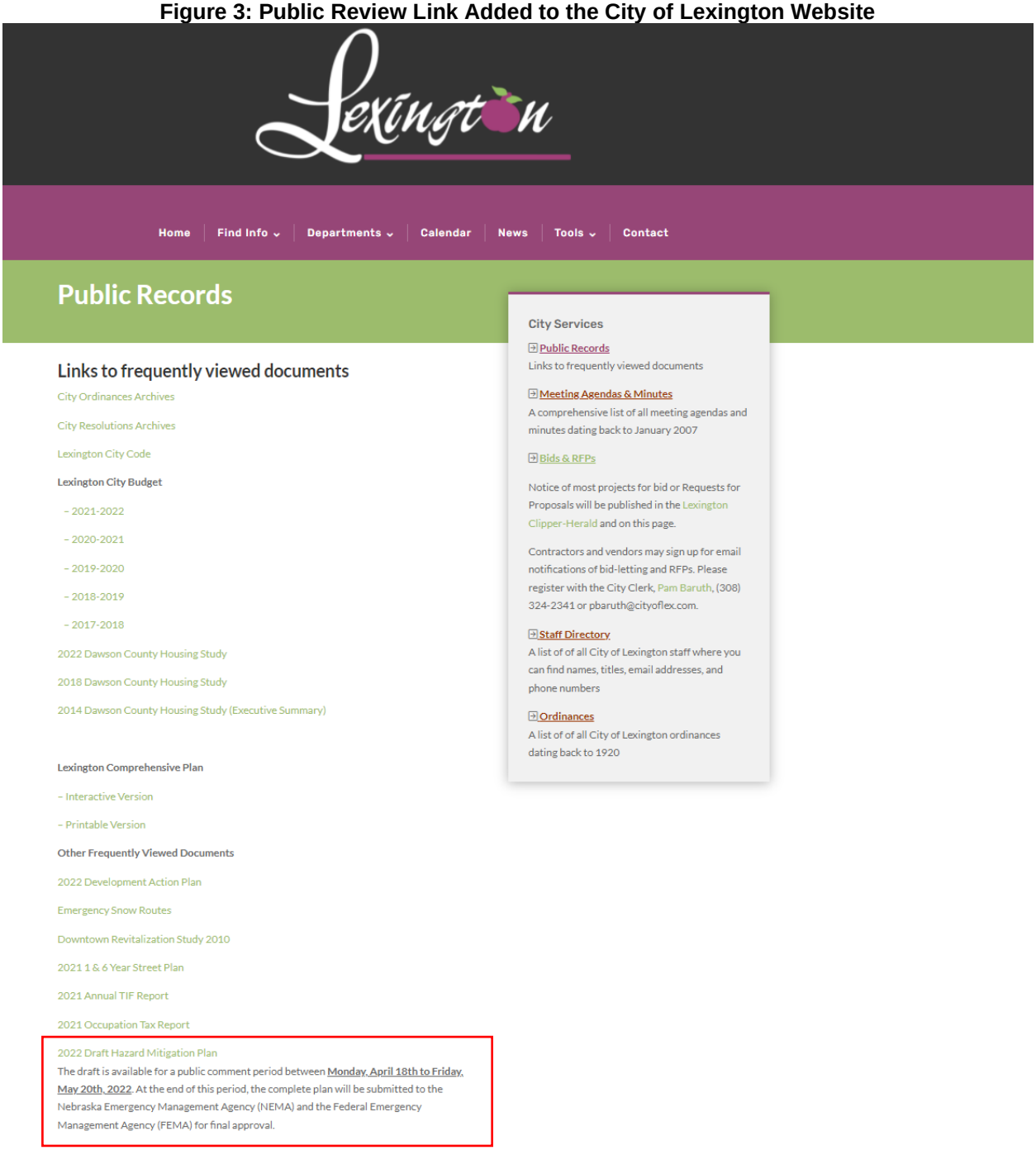
Public Review

Once the HMP draft was completed, a public review period was opened to allow for participants and community members at large to review the plan, provide comments, and request changes. The public review period was open from April 18, 2022, through May 20, 2022. Participating jurisdictions were emailed and mailed a letter notifying them of this public review period. The HMP was also made available on the project website (https://jeo.com/central-platte-nrd-hazard-mitigation-plan-update) to download the document. The City of Lexington also added a link about public review on their city website (Figure 3). Jurisdictions and the public could make provide comments via mail, email, or by using the comment box on the project website. A review of the comments and who they were from can be found below.

- **Buffalo County:** Updated chemical storage sites, severe winter storm dates, major employers, planning integration information, and added information about the avian flu.
- **Hall County:** Updated job titles, demographics information, and planning integration information.
- **Merrick County:** Updated job titles.
- **Polk County:** Updated job titles and local planning team members.
- **Village of Cairo:** Updated cost numbers for mitigation actions.
- **City of Grand Island:** Updated job titles and various updates to hazard prioritization.
- **City of Lexington:** Updated plan integration information, flooding information, and mitigation action information.
- **City of Kearney:** Identified new critical facilities.
- **Wood River Public Schools:** Updated plan integration information and timelines for mitigation actions.
- **Nebraska Forest Service:** Provided updated information for the grass/wildfire risk assessment and updated fire district profile information.
- **Nebraska Department of Natural Resources:** Provided updated dam inspection information and drought risk assessment information.
- **University of Nebraska Kearney:** Updated local planning team members.
- **Village of Clarks:** Critical facility changes.
- **Central Platte NRD:** Governance section updates.

All changes and comments from participating jurisdictional representatives (i.e., local planning teams) and stakeholders were incorporated into the plan.

Figure 3: Public Review Link Added to the City of Lexington Website



Source: City of Lexington

Plan Adoption and Implementation

Based on FEMA requirements, this multi-jurisdictional hazard mitigation plan must be formally adopted by each participant through approval of a resolution. This approval will create individual ownership of the plan by each participant. Formal adoption provides evidence of a participant's full commitment to implement the plan's goals, objectives, and action items. A copy of the resolution draft submitted to participating jurisdictions is located in *Appendix A*. Copies of adoption resolutions may be requested from the NEMA's State Hazard Mitigation Officer.

Requirement §201.6(c)(5): For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

To be effective, HMPs need to be living documents. Once an HMP has been adopted locally, participants are responsible for implementing identified projects, maintaining the plan with relevant information, and fully updating the plan every five years. The plan must be monitored, evaluated, and updated on a five-year or less cycle. Each participating jurisdiction identified positions or departments who will review and update their section of the plan outside the required five-year cycle. It is critical the plan be reviewed and updated regularly or when a hazard event occurs that significantly affects the area or individual participants. These reviews are the responsibility of each jurisdiction's local planning team and should be documented and reflected in the plan via amendments. However, participants are encouraged to work alongside the plan sponsor, CPNRD or the consultant, JEO, to document updates and revise the HMP.

Additional implementation of the mitigation plan should include integrating HMP goals, objectives, and mitigation actions into county and local comprehensive or capital improvement plans as they are developed or updated. *Section Six* describes the system that jurisdictions participating in the HMP have established to monitor the plan; provides a description of how, when, and by whom the HMP process and mitigation actions will be evaluated; presents the criteria used to evaluate the plan; and explains how the plan will be maintained and updated.

Section Three: Planning Area Profile

Introduction

To identify jurisdictional vulnerabilities, it is vitally important to understand the people and built environment of the planning area. The following section provides an overall description of the planning area's characteristics to create a summary profile for the region. Specific characteristics are covered in each jurisdiction's community profile, including demographics, transportation routes, and structural inventory. Redundant information will not be covered in this section. Therefore, this section will highlight at-risk populations and characteristics of the built environment that add to regional vulnerabilities.

Planning Area Geographic Summary

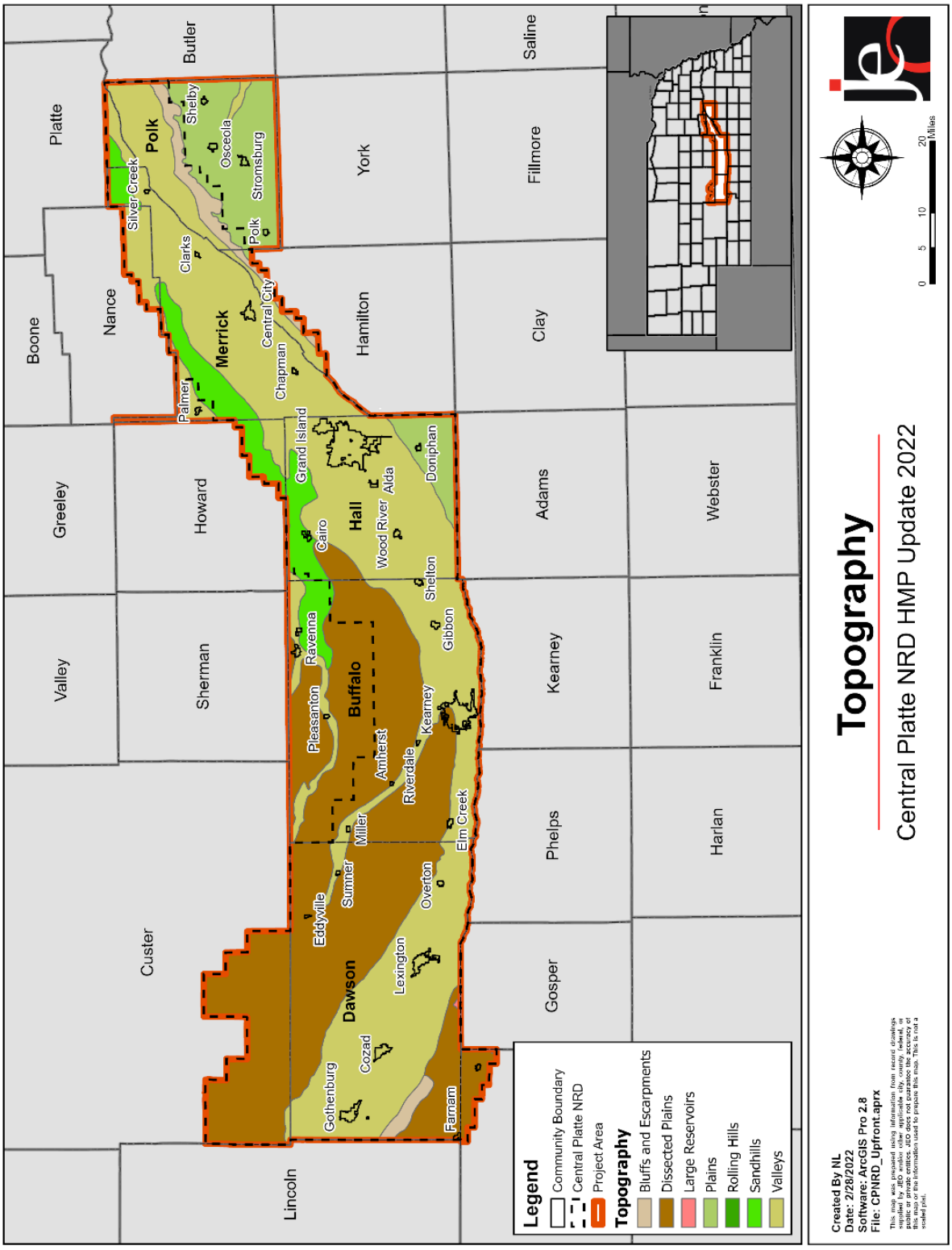
CPNRD's planning area includes the south-central portion of Nebraska and spans 3,338 square miles. For the purpose of this plan update, the planning area includes all of Buffalo, Dawson, Hall, Merrick, and Polk counties. The planning area has a diverse range of topographic regions including bluffs and escarpments, dissected plains, large reservoirs, plains, sandhills, and valleys (Figure 4). Descriptions of these topographic regions are below.

- **Bluffs and escarpments**: Rugged land with very steep and irregular slopes.
- **Dissected plains**: Hilly land with moderate to steep slopes and sharp ridge crests.
- **Large reservoirs**: Constructed for purposes such as water storage for irrigation, generation of electricity, flood control or recreation.
- **Plains**: Flat-lying land that lies above the valley. The materials of the plains are sandstone or stream-deposited silt, clay, sand and gravel overlain by wind-deposited silt.
- **Sandhills**: Hilly land composed of low to high dunes of sand stabilized by grass cover.
- **Valleys**: Flat-lying land along the major streams.[13]

The region resides in the Central Platte River, Loup River, and Upper Big Blue River watersheds. Major waterways in the area include 205 miles of the Platte River, 49.9 miles of the North Channel, and 173 miles of the Wood River. The Platte River is an important feature of the district. It is also the largest river in the state, traversing the entire length of the state from west to east and serving as a major tributary to the Missouri River. With origins in Colorado, the Platte is formed by two branches, the North and South Platte, converging near the City of North Platte. While there are some minor tributaries in the NRD that flow into the Platte, the major tributaries of the Loup and Elkhorn Rivers, join the Platte east of the district. The Platte River is too shallow for navigation and is used primarily for irrigation, recreation, generation of hydroelectric power and as a habitat for wildlife.

13 Conservation and Survey Division/Institute of Agriculture and Natural Resources. 2001. "Topographic regions map of Nebraska." https://digitalcommons.unl.edu/caripubs/62.

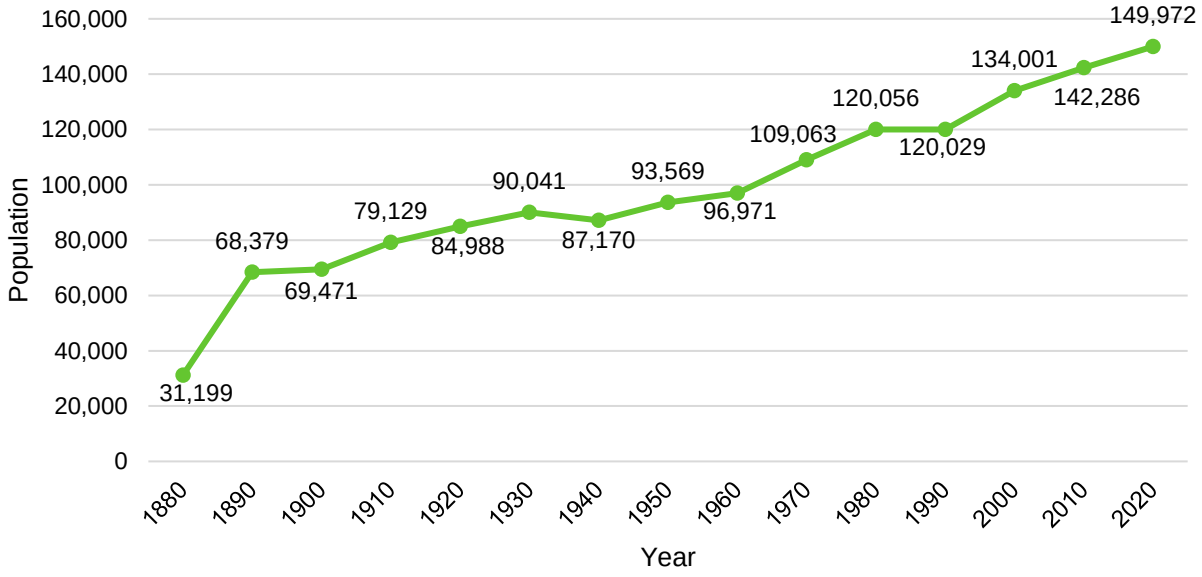
Figure 4: Topography



Demographics and At-Risk Populations

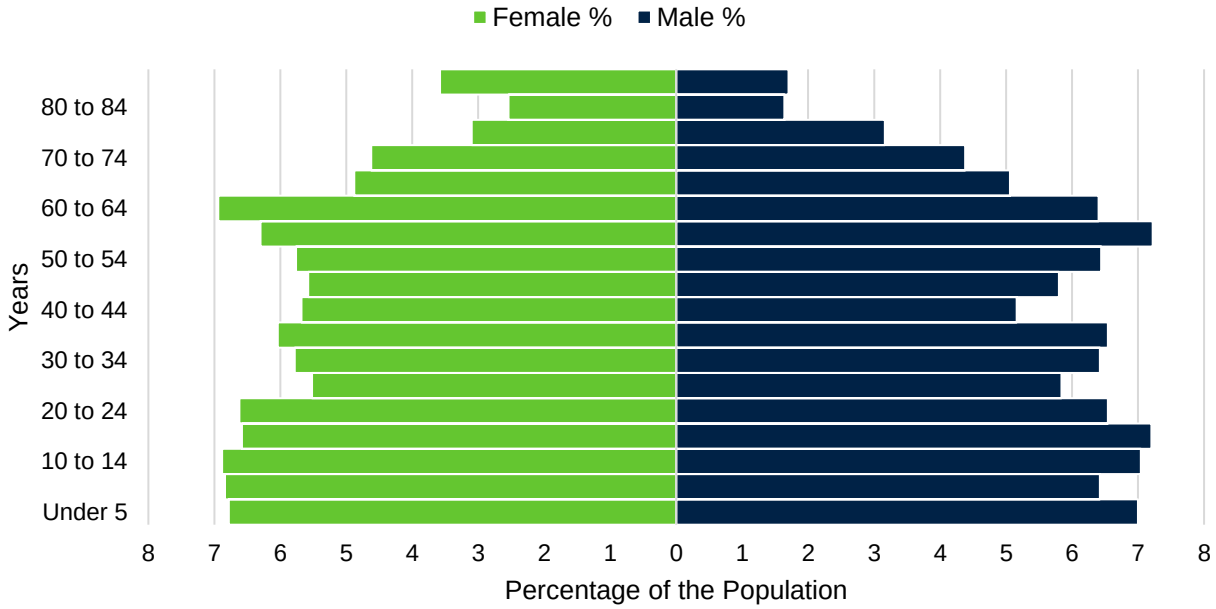
As noted above, the planning area includes all of Buffalo, Dawson, Hall, Merrick, and Polk Counties. The U.S. Census Bureau collects specific demographic information for each county. The estimated population of the planning area is 149,972.[14]

Figure 5: Planning Area Population, 1880-2020



Source: U.S. Census Bureau[15]

Figure 6: Population by Age Cohort and Sex (2020)



Source: U.S. Census Bureau

14 United States Census Bureau. "2020 Decennial Census: P1: DEC Redistricting Data." https://data.census.gov/cedsci/.
15 United States Census Bureau. "2020 Decennial Census: P1: DEC Redistricting Data." https://data.census.gov/cedsci/.

Community and regional vulnerability are impacted by growing or declining populations. Communities growing quickly may lack resources to provide services for all members of the community in a reasonable timeframe including snow removal, emergency storm shelters, repairs to damaged infrastructure, or even tracking the location of vulnerable populations. Communities experiencing population decline may be more vulnerable to hazards as a result of vacant and/or dilapidated structures, an inability to properly maintain critical facilities and/or infrastructure, and higher levels of unemployment and populations living in poverty. It is important for communities to monitor their population changes and ensure that potential issues be incorporated into hazard mitigation plans, as well as other planning mechanisms within the community. The planning area has displayed population growth since 1940.

At-risk Populations

In general, at-risk populations may have difficulty with medical issues, poverty, extremes in age, and communication issues due to language barriers. Several outliers may be considered when discussing potentially at-risk populations.

- Outward appearance does not necessarily mark a person as at-risk.
- A hazard event will, in many cases, impact at-risk populations in different ways.

The National Response Framework defines at-risk populations as "…populations whose members may have additional needs before, during, and after an incident in functional areas, including but not limited to maintaining independence, communication, transportation, supervision, and medical care."[16]

Dependent children under 20 years old are one of the most vulnerable populations to disasters.[17] The majority of people in this age group do not have access to independent financial resources and transportation. They lack practical knowledge necessary to respond appropriately during a disaster. Despite this vulnerability, children are generally overlooked in disaster planning because the presence of a caretaker is assumed. With approximately 25% of the planning area's population younger than 20, children are a key vulnerable group to address in the planning process.

Schools house a high number of children and adults within the planning area during the daytime hours of weekdays, as well as during special events on evenings and weekends. The following table identifies the various school districts located within the planning area, and Figure 7 is a map of the school district boundaries. School districts that participated in this plan update include: Central City Public Schools, Centura Public Schools, Elm Creek Public Schools, Eustis-Farnam Public Schools, Gibbon Public Schools, Kearney Public Schools, Pleasanton Public Schools, Ravenna Public Schools, Shelton Public Schools, and Wood River Rural Schools.

16 United States Department of Homeland Security. October 2019. "National Response Framework Third Edition." https://www.fema.gov/media-library/assets/documents/117791.

17 Flanagan, Gregory, Hallisey, Heitgerd, & Lewis. 2011. "A Social Vulnerability Index for Disaster Management." Journal of Homeland Security and Emergency Management, 8(11): Article 3.

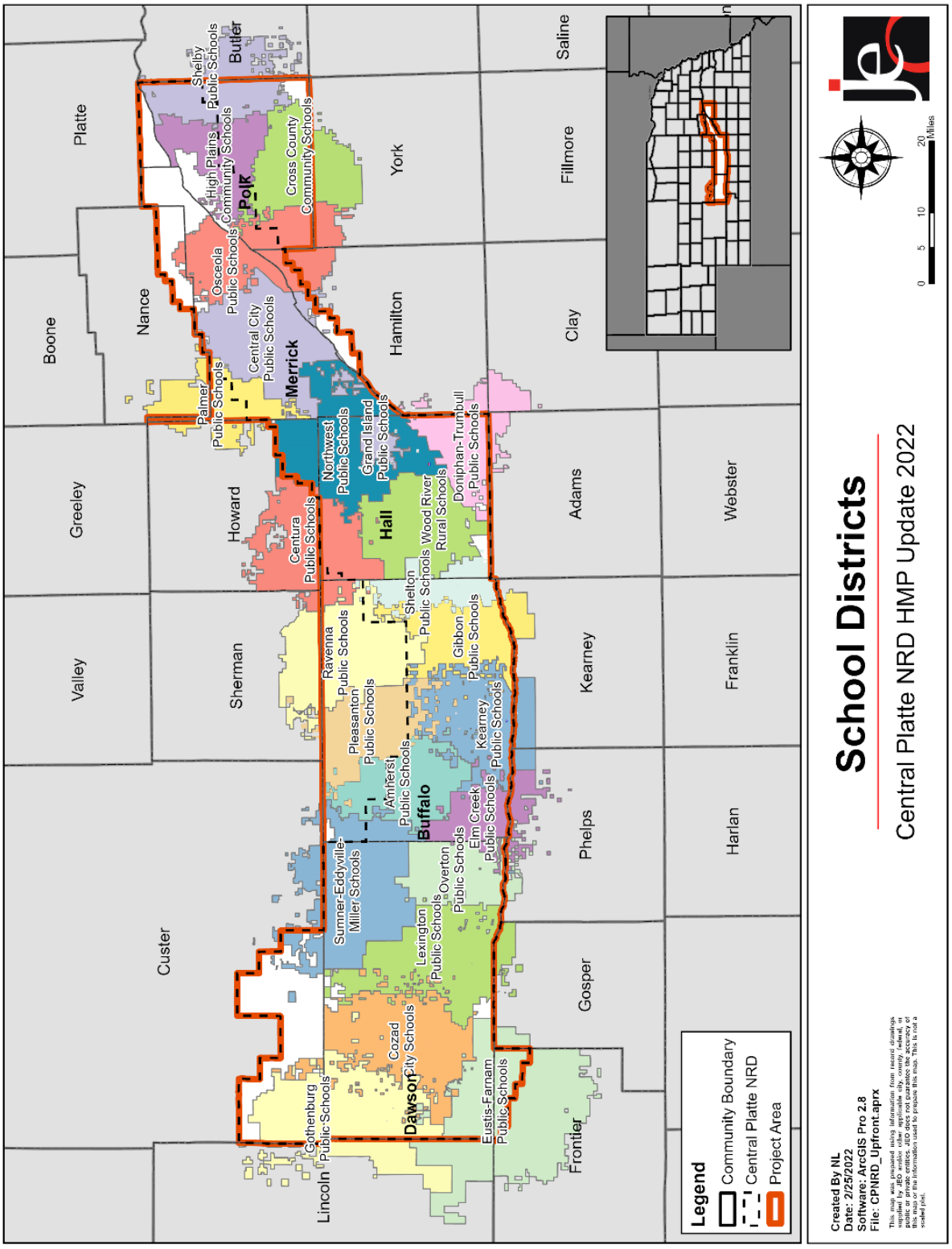
Table 16: School Inventory

School District	Total Enrollment (2019-2020)	Total Teachers
Amherst Public Schools	380	27
Central City Public Schools*	767	63
Centura Public Schools*	493	43
Cozad City School	951	72
Cross Country Community Schools	378	36
Doniphan-Trumbull Public Schools	460	42
Elm Creek Public Schools*	366	32
Eustis-Farnam Public Schools*	165	22
Gibbon Public Schools*	582	42
Gothenburg Public Schools	880	64
Grand Island Public Schools	10,070	711
High Plains Community Schools	266	29
Kearney Public Schools*	6,121	361
Lexington Public Schools	3,169	211
Northwest Public Schools	1,574	108
Osceola Public Schools	214	23
Overton Public Schools	303	27
Palmer Public Schools	326	24
Pleasanton Public Schools*	288	21
Ravenna Public Schools*	437	41
Shelby Public Schools	404	38
Shelton Public Schools*	285	26
Sumner-Eddyville-Miller Schools	216	21
Wood River Rural Schools*	521	47

Source: Nebraska Department of Education[18]
**Participated in this plan update*

18 Nebraska Department of Education. 2020. “Nebraska Education Profile.” Accessed June 2021. http://nep.education.ne.gov/.

Figure 7: Regional School Districts



The University of Nebraska-Kearney (UNK) is a public institution located in the west central portion of the City of Kearney in Buffalo County. The main office is located at 2504 9th Avenue, Kearney, NE 68849. Forty-nine degree programs are offered under three broad areas: Arts and Sciences, Business and Technology, and Education. There are 32 buildings on campus, nine of which are residence halls. A small canal runs through the center of the campus. In addition, the Kearney Canal and Kearney Lake are located directly north of the university. There are approximately 5,000 students and 1,200 staff at the university. Of the 5,000 students, over 300 are international students. Student housing is spread throughout campus with around 2,000 students living in the residence halls.[19] UNK is a participant in this plan update. Additional information regarding the university can be found in Section 7: Community Profiles.

Central Community College is a two-year public college serving a 25-county area in central Nebraska with three campuses located in Columbus, Grand Island, and Hastings. The college also has learning centers in Holdrege, Kearney, and Lexington. The college offers 37 career and technical education programs with a focus on programs requiring two years or less to complete. The college also offers an academic transfer program for students who want to transfer to a four-year university after completing their first two years of a bachelor's degree. The college also offers online learning, training and development for businesses, industries, and other organizations in the 25-county service area. As of 2019-2020, the college had approximately 18,897 students, with 23% full-time and 77% part-time.[20]

Like minors, seniors (age 65 and greater) are often more significantly impacted by hazards and temperature extremes. During prolonged heat waves or periods of extreme cold, seniors may lack resources to effectively address hazard conditions and as a result may incur injury or potentially death. Prolonged power outages (either standalone events or as the result of other contributing factors) can have significant impacts on any citizen relying on medical devices. One study conducted by the Center for Injury Research and Policy found that increases in vulnerability related to severe winter storms (with significant snow accumulations) begin at age 55.[21] The study found that on average there are 11,500 injuries and 100 deaths annually related to snow removal. Men over the age of 55 are 4.25 times more likely to experience cardiac events during snow removal.

While the previously identified populations live throughout the planning area, there is the potential that they will be located in higher concentrations at care facilities. Table 17 identifies the number and capacity of care facilities throughout the planning area.

19 University of Nebraska-Kearney. March 2022. "About UNK." https://www.unk.edu/about/index.php
20 Central Community College. March 2022. "Fast Facts." https://www.cccneb.edu/fastfacts
21 Center for Injury Research and Policy. January 2011. "Snow Shoveling Safety." Accessed July 2017. http://www.nationwidechildrens.org/cirp-snow-shoveling.

Table 17: Inventory of Care Facilities

Jurisdiction	Hospitals	Hospital Beds	Health Clinics	Adult Care Homes	Adult Care Beds	Assisted Living Homes	Assisted Living Beds
Buffalo	4	328	0	7	589	8	395
Dawson	3	57	1	3	197	5	244
Hall	2	222	0	5	377	10	470
Merrick	1	20	1	2	110	4	94
Polk	1	16	0	2	98	2	44

Source: Nebraska Department of Health and Human Services[22,23,24,25]

In addition to residents being classified as at-risk by age, there are other specific groups within the planning area that experience vulnerabilities related to their ability to communicate or their economic status. Table 18 provides statistics per county regarding households with English as a second language (ESL) and population reported as in poverty within the past 12 months.

Table 18: ESL and Poverty At-Risk Populations

County	Percent That Speaks English as Second Language	Individuals Below Poverty Level
Buffalo	8.0%	7.1%
Dawson	30.3%	10.6%
Hall	22.5%	9.8%
Merrick	6.0%	8.4%
Polk	6.0%	4.7%

Source: U.S. Census Bureau[26,27]

Residents below the poverty line may lack resources to prepare for, respond to, or recover from hazard events. Residents with limited economic resources might struggle to prioritize the implementation of mitigation measures over more immediate needs. Further, residents with limited economic resources are more likely to live in older, more vulnerable structures. These structures could be mobile homes; located in the floodplain; located in remote rural areas away from urban amenities; located near known hazard sites (i.e., chemical storage areas); or older poorly maintained structures. Residents below the poverty line will be more vulnerable to all hazards within the planning area.

Residents who speak English as a second language may struggle with a range of issues before, during, and after hazard events. General vulnerabilities revolve around what could be an inability to effectively communicate with others or an inability to comprehend materials aimed at notification and/or education of hazard events. When presented with a hazardous situation it is important that all community members be able to receive, decipher, and act on relevant

22 Department of Health and Human Services. 2021. "State of Nebraska: Assisted Living Facilities." https://dhhs.ne.gov/licensure/Documents/ALF%20Roster.pdf
23 Department of Health and Human Services. 2021. "State of Nebraska Roster: Hospitals." https://dhhs.ne.gov/licensure/Documents/Hospital%20Roster.pdf
24 Department of Health and Human Services. 2021. "State of Nebraska Roster: Long Term Care Facilities." https://dhhs.ne.gov/licensure/Documents/LTCRoster.pdf
25 Department of Health and Human Services. 2021. "State of Nebraska Roster: Rural Health Clinic." https://dhhs.ne.gov/licensure/Documents/RHC_Roster.pdf
26 United States Census Bureau. "2019 Census Bureau American Community Survey: S1601: Language Spoken at Home." https://data.census.gov/cedsci/.
27 United States Census Bureau. "2019 Census Bureau American Community Survey: DP03: Selected Economic Characteristics." https://data.census.gov/cedsci/.

information. An inability to understand warnings and notifications may prevent non-native English speakers from acting in a timely manner. Further, educational materials related to regional hazards are most often developed in the dominant language for the area, for the planning area that would be English. Residents who struggle with English in the written form may not have sufficient information related to local concerns to effectively mitigate potential impacts. Residents with limited English proficiency would be at an increased vulnerability to all hazards within the planning area.

Similar to residents below the poverty line, racial minorities tend to have access to fewer financial and systemic resources that would enable them to implement hazard mitigation projects and to respond and recover from hazard events, including residence in standard housing and possession of financial stability (Table 19).

Table 19: Racial Composition Trends

Race	2010		2019		%
	Number	% of Total	Number	% of Total	Change
White, Not Hispanic	125,145	88.0%	129,855	87.6%	-0.4
Black	2,008	1.4%	3,733	2.5%	1.1
American Indian and Alaskan Native	3,091	2.2%	1,624	1.1%	-1.1
Asian	1,244	0.9	1,504	1.0%	0.1
Native Hawaiian and Other Pacific Islander	0	0%	273	0.2%	0.2
Other Races	8,915	6.3	8,687	5.9%	-0.4
Two or More Races	1,883	1.3%	2,574	1.7%	0.4
Total Population	**142,286**	**-**	**148,250**	**-**	**-**

Source: U.S. Census Bureau[28,29]

Built Environment and Structural Inventory

The U.S. Census Bureau provides information related to housing units and potential areas of vulnerability as described in the following discussion.

Of the occupied housing units in the planning area, more than 34 percent are renter occupied. Renter-occupied housing units often do not receive many of the updates and retrofits that are needed to make them resilient to disaster impacts. Communities may consider enacting landlord outreach programs aimed at educating property owners about the threats in their area and what they can do to help reduce the vulnerability of the tenants living in their housing units. It should be noted that Hall County has the highest percentage of renter-occupied housing units in the planning area. The City of Grand Island, the largest community in the planning area, has more than 41 percent of housing stock occupied by renters.

Polk County has the highest percentage of vacant housing units compared to the other four counties. Unoccupied homes may not be maintained as well as occupied housing, thus adding to their vulnerability. During disaster events like high winds or tornadoes, these structures may fail and result in debris which can impact other structures as well as people, resulting in injuries or fatalities, as well as higher damage totals.

28 United States Census Bureau. “2010 Decennial Census: Demographic and Housing Estimates.” https://data.census.gov/cedsci/.
29 United States Census Bureau. “2019 Census Bureau American Community Survey: DP05: ACS Demographic and Housing Estimates.” https://data.census.gov/cedsci/.

Table 20: Housing Characteristics

Jurisdiction	Total Housing Units				Occupied Housing Units			
	Occupied		Vacant		Owner		Renter	
	#	%	#	%	#	%	#	%
Buffalo County	19,062	93.1%	1,420	6.9%	12,388	65.0%	6,674	35.0%
Dawson County	8,965	87.3%	1,303	12.7%	6,035	67.3%	2,930	32.7%
Hall County	23,096	93.0%	1,736	7.0%	14,398	62.3%	8,698	37.7%
Merrick County	3,373	88.3%	448	11.7%	2,514	74.5%	859	25.5%
Polk County	2,052	74.6%	699	25.4%	1,705	83.1%	347	16.9%
Alda	243	90.7%	25	9.3%	193	79.4%	50	20.6%
Amherst	65	78.3%	18	21.7%	52	80.0%	13	20.0%
Cairo	359	90.4%	38	9.6%	226	63.0%	133	37.0%
Central City	1,231	92.3%	102	7.7%	736	59.8%	495	40.2%
Chapman	118	88.7%	15	11.3%	87	73.7%	31	26.3%
Clarks	162	92.0%	14	8.0%	112	69.1%	50	30.9%
Cozad	1,594	88.7%	204	11.3%	1,055	66.2%	539	33.8%
Doniphan	353	89.6%	41	10.4%	277	78.5%	76	21.5%
Eddyville	43	87.8%	6	12.2%	39	90.7%	4	9.3%
Elm Creek	427	95.5%	20	4.5%	342	80.1%	85	19.9%
Eustis	224	89.2%	27	10.8%	184	82.1%	40	17.9%
Farnam	97	94.2%	6	5.8%	83	85.6%	14	14.4%
Gibbon	719	96.1%	29	3.9%	511	71.1%	208	28.9%
Gothenburg	1,339	85.8%	221	14.2%	961	71.8%	378	28.2%
Grand Island	19,243	93.5%	1,329	6.5%	11,310	58.8%	7,933	41.2%
Kearney	12,987	93.0%	972	7.0%	7,670	59.1%	5,317	40.9%
Lexington	3,494	94.2%	216	5.8%	2,043	58.5%	1,451	41.5%
Miller	61	80.3%	15	19.7%	48	78.7%	13	21.3%
Osceola	364	89.0%	45	11.0%	288	79.1%	76	20.9%
Overton	227	83.5%	45	16.5%	151	66.5%	76	33.5%
Palmer	205	84.0%	39	16.0%	172	83.9%	33	16.1%
Pleasanton	159	98.8%	2	1.2%	132	83.0%	27	17.0%
Polk	152	68.2%	71	31.8%	116	76.3%	36	23.7%
Ravenna	606	87.6%	86	12.4%	427	70.5%	179	29.5%
Riverdale	95	100.0%	0	0.0%	74	77.9%	21	22.1%
Shelby	297	94.3%	18	5.7%	237	79.8%	60	20.2%
Shelton	429	92.5%	35	7.5%	295	68.8%	134	31.2%
Silver Creek	187	88.2%	25	11.8%	155	82.9%	32	17.1%
Stromsburg	447	87.0%	67	13.0%	363	81.2%	84	18.8%
Sumner	85	80.2%	21	19.8%	58	68.2%	27	31.8%
Wood River	489	87.5%	70	12.5%	360	73.6%	129	26.4%

Source: U.S. Census Bureau[30]

30 United States Census Bureau. "2019 Bureau American Community Survey: DP04: Selected Housing Characteristics." https://data.census.gov/cedsci/.

The U.S. Census Bureau provides information related to housing units and potential areas of vulnerability. The selected characteristics examined in Table 21 include lacking complete plumbing facilities; lacking complete kitchen facilities; no telephone service available; housing units that are mobile homes; and housing units with no vehicles.

Table 21: Selected Housing Characteristics

Counties	Buffalo	Dawson	Hall	Merrick	Polk	Total
Occupied Housing Units	19,062 (93.1%)	8,965 (87.3%)	23,096 (93.0%)	3,373 (88.3%)	2,052 (74.6%)	**56,548**
Lacking Complete Plumbing Facilities	0.2%	0.2%	0.1%	0.9%	0.3%	**0.2%**
Lacking Complete Kitchen Facilities	1.6%	0.9%	1.2%	3.4%	0.8%	**1.4%**
No Telephone Service Available	2.6%	1.3%	2.2%	3.5%	1.9%	**2.3%**
No Vehicles Available	1.9%	1.6%	1.2%	0.4%	1.3%	**1.5%**
Mobile Homes	7.3%	8.6%	5.3%	5.9%	7.0%	**6.6%**

Source: U.S. Census Bureau[31]

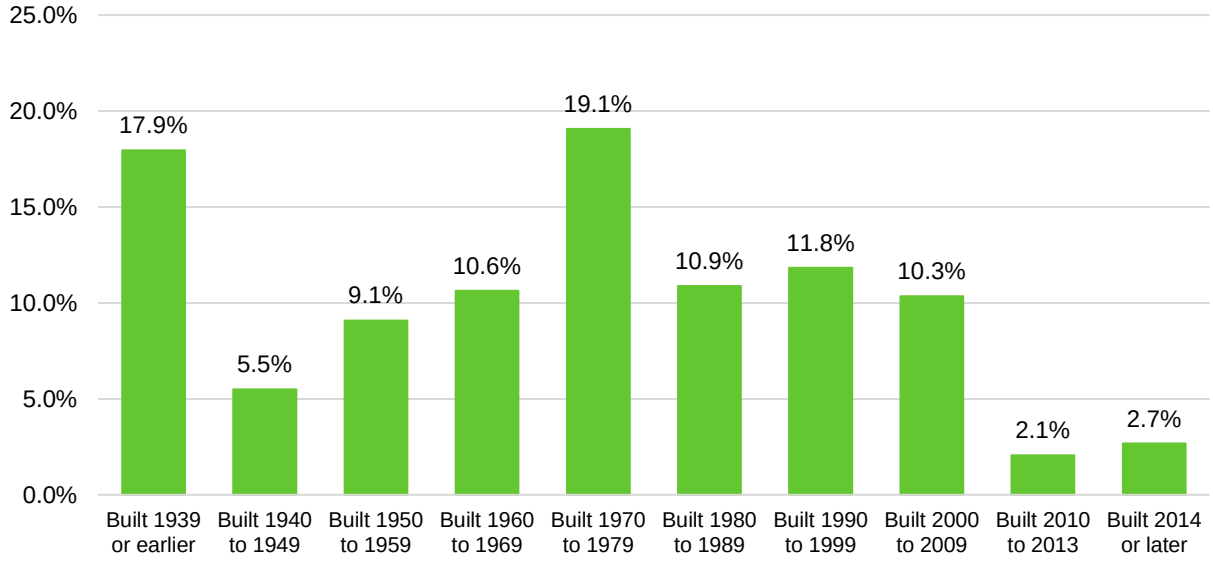
Slightly more than two percent of housing units lack access to landline telephone service. This does not necessarily indicate that there is not a phone in the housing unit, as cell phones are now the primary form of telephone service. However, this lack of access to landline telephone service does represent a population at increased risk to disaster impacts. Reverse 911 systems are designed to contact households via landline services and as a result, some homes in hazard prone areas may not receive notification of potential impacts in time to take protective actions. Emergency managers should continue to promote the registration of cell phone numbers with Reverse 911 systems. The CodeRED system is available for many communities and residents to use in the planning area. This opt-in program sends emergency alerts and hazard event updates to cellular devices located within specific geographical areas based on cell tower reception. Additionally, emergency managers, the National Weather Service, and other government agencies can utilize FEMA's Integrated Public Alert and Warning System (IPAWS) to send emergency alerts and weather warnings to cellphones within a designated area. Like CodeRED, notifications are sent to all cellphone users within specific geographical areas without needing to opt-in.

Approximately 6.6 percent of housing units in the planning area are mobile homes. Dawson County has the highest rate of mobile homes in its housing stock at 8.6 percent. Mobile homes have a higher risk of sustaining damages during high wind events, tornadoes, severe thunderstorms, and severe winter storms. Mobile homes that are either not anchored or are anchored incorrectly can be overturned by 60 mph winds. A thunderstorm is classified as severe when wind speeds exceed 58 mph, placing improperly anchored mobile homes at risk. Furthermore, approximately 1.5 percent of all housing units in the planning area do not have a vehicle available. Households without vehicles may have difficulty evacuating during a hazardous event and a reduced ability to access resources in times of need.

31 United States Census Bureau. "2019 Bureau American Community Survey: DP04: Selected Housing Characteristics." https://data.census.gov/cedsci/.

The majority of homes within the planning area were built prior to 1980 (62%), with nearly 18% of homes built prior to 1939 (Figure 8). Housing age can serve as an indicator of risk, as structures built prior to the development of state building codes and prior to the identification of flood prone areas in the 1970s and 1980s may be more vulnerable. Residents living in these homes maybe at higher risk to the impacts of flooding, high winds, tornadoes, severe winter storms, and thunderstorms.

Figure 8: Housing Age in Planning Area



Source: U.S. Census Bureau[32]

State and Federally Owned Properties

The following table provides an inventory of state and federally owned properties within the planning area by county.

Table 22: State and Federally Owned Facilities

Facility	Nearest Community
Buffalo County	
Windmill SRA	Gibbon, NE
Bassway Strip WMA	Gibbon, NE
Fort Kearney SRA	Kearney, NE
East Odessa WMA	Kearney, NE
Union Pacific SRA	Kearney, NE
Bufflehead WMA	Kearney, NE
Kea Lake WMA	Kearney, NE
Kea West WMA	Kearney, NE
North Kearney Rest Area (westbound) DOR	Kearney, NE
South Kearney Rest Area (eastbound) DOR	Kearney, NE
Coot Shallows WMA	Kearney, NE
Sandy Channel SRA	Kearney, NE
Blue Hole WMA	Kearney, NE
Sandy Channel SRA #6	Kearney, NE
University of Nebraska- Kearney	Kearney, NE

32 United States Census Bureau. "2019 Bureau American Community Survey: DP04: Selected Housing Characteristics." https://data.census.gov/cedsci/.

Facility	Nearest Community
Central Community College	Kearney, NE
Dawson County	
Dogwood WMA	Overton, NE
Hall County	
Cornhusker WMA	Grand Island, NE
Hannon WPA	Wood River, NE
Martin's Reach WMA	Wood River, NE
West Wood River WMA	Wood River, NE
Merrick County	
Dr. Bruce Cowgill WMA	Silver Creek, NE
Polk County	
Flatsedge WMA	Shelby, NE

Source: Nebraska Game & Parks,[33] U.S National Park Service[34]

Historical Sites

According to the National Register of Historic Places for Nebraska by the National Park Service, there are 61 historic sites located in the planning area. Several of the sites are located in the one percent and 0.2 percent annual chance floodplain.

Table 23: Historical Sites

Site Name	Date Listed	Nearest Community, County	In Floodplain
Barnd, John, House	3/31/1983	Kearney, Buffalo	N
Bartlett, John J. and Lenora, House	12/27/2007	Kearney, Buffalo	N
Fort Theater	7/12/2006	Kearney, Buffalo	N
Frank, George W., House	2/23/1973	Kearney, Buffalo	Y – 0.2%
Hanson-Downing House	12/10/1980	Kearney, Buffalo	N
Harmon Park	12/10/2010	Kearney, Buffalo	Unknown
Kearney Junior High School	7/5/2000	Kearney, Buffalo	N
Kearney National Guard Armory	7/16/2009	Kearney, Buffalo	N
Kilgore Bridge	6/29/1992	Kearney, Buffalo	Y – 1%
Klehm House	3/25/1999	Kearney, Buffalo	N
Masonic Temple and World Theater Building	11/10/2009	Kearney, Buffalo	N
Meisner Bank Building	3/25/1999	Shelton, Buffalo	N
Meisner, George, House	6/23/1988	Shelton, Buffalo	Unknown
Saint Luke's Protestant Episcopal Church	12/1/1986	Kearney, Buffalo	N
Sweetwater Mill Bridge	6/29/1992	Sweetwater, Buffalo	Y – 1%
Thomas, Dr. A. O., House	2/28/1980	Kearney, Buffalo	N
U.S. Post Office	9/17/1981	Kearney, Buffalo	N
Allen's Opera House	9/28/1988	Cozad, Dawson	N
Calling, Ernest A., House	10/25/1979	Gothenburg, Dawson	N
Carnegie Public Library	12/19/1986	Gothenburg, Dawson	N
Dawson County Courthouse	1/10/1990	Lexington, Dawson	Yes – 0.2%, 1%
Hendee Hotel	3/21/1979	Cozad, Dawson	N
Midway Ranch House	7/5/2001	Gothenburg, Dawson	Unknown
Midway Stage Station	10/15/1969	Gothenburg, Dawson	Unknown
Olive, Ira Webster, House	11/27/1989	Lexington, Dawson	Y – 1%

[33] Nebraska Game and Parks. 2021. "Public Access ATLAS." https://maps.outdoornebraska.gov/PublicAccessAtlas/.
[34] U.S National Park Service. 2021. "Parks." https://www.nps.gov/state/ne/index.htm.

Site Name	Date Listed	Nearest Community, County	In Floodplain
Lincoln Highway-Grand Island Seedling Mile	4/24/2013	Grand Island, Hall	Unknown
Bartenbach, H. J., House	12/8/1986	Grand Island, Hall	N
Cathedral of the Nativity of the Blessed Virgin Mary	7/15/1982	Grand Island, Hall	N
Evangelische Lutherische Dreienigkeit Kirche	12/1/1986	Grand Island, Hall	N
Giese, Heinrich, House	7/26/2006	Grand Island, Hall	N
Glade--Donald House	9/12/1985	Grand Island, Hall	N
Gloe Brothers Service Station	7/5/2000	Wood River, Hall	Y – 0.2%
Grand Island Carnegie Library	5/2/1975	Grand Island, Hall	N
Grand Island FCC Monitoring Station	1/16/1973	Grand Island, Hall	Unknown
Grand Island Senior High School	11/22/1999	Grand Island, Hall	N
Grand Island United States Post Office and Courthouse	2/14/2006	Grand Island, Hall	N
Hall County Courthouse	9/15/1977	Grand Island, Hall	N
Hamilton--Donald House	3/13/1986	Grand Island, Hall	N
Hargis, Andrew M., House	6/9/1978	Grand Island, Hall	N
Hotel Yancey (The)	12/13/1984	Grand Island, Hall	N
Huff, Lee, Apartment Complex	7/1/1994	Grand Island, Hall	N
Liederkranz	11/30/1978	Grand Island, Hall	N
Nine Bridges Bridge	6/29/1992	Doniphan, Hall	Y – Floodway, 1%, 0.2%
Roeser, Oscar, House	6/25/1982	Grand Island, Hall	N
Shady Bend Gas Station, Grocery, and Diner	7/2/2008	Grand Island, Hall	N
Stolley, William, Homestead and Site of Fort Independence	3/16/1972	Grand Island, Hall	N
Stuhr Museum of the Prairie Pioneer	5/18/2015	Grand Island, Hall	Y – 1%
Townsley--Murdock Immigrant Trail Site	3/5/1998	Alda, Hall	Unknown
Cahow Barber Shop	1/12/1984	Chapman, Merrick	Unknown
Ellen, Martha, Auditorium	9/28/1988	Central City, Merrick	Y – 0.2%
Hord, Heber, House	12/7/1987	Central City, Merrick	Y – 0.2%
Merrick County Courthouse	1/10/1990	Central City, Merrick	Y – 0.2%
Morris, Wright, Boyhood House	10/22/1980	Central City, Merrick	Y – 0.2%
Nelson Farm	8/26/2009	Central City, Merrick	Unknown
Patterson Law Office	3/13/1979	Central City, Merrick	Y – 0.2%
Riverside Park Dance Pavillion	12/31/1998	Central City, Merrick	Y – 1%
Clarks Site	8/14/1973	Osceola, Polk	Unknown
Mickey, Gov. John Hopwood, House	5/12/1977	Osceola, Polk	N
Morrill, Charles H., Homestead	6/4/1973	Stromsburg, Polk	N
Polk County Courthouse	1/10/1990	Osceola, Polk	N
Strickland Site	7/3/1996	Silver Creek, Polk	Unknown
Wilson, Victor E., House	7/7/1988	Stromsburg, Polk	N

Source: National Park Service[35]

[35] National Park Service. January 2021. "National Register of Historic Places NPGallery Database." https://npgallery.nps.gov/NRHP

Section Four: Risk Assessment

Introduction

The ultimate purpose of this hazard mitigation plan is to minimize the loss of life and property across the planning area due to natural and human-caused hazards. The basis for the planning process is the regional and local risk assessment. This section contains a description of potential hazards, regional vulnerabilities and exposures, probability of future occurrences, and potential impacts and losses. By conducting a regional and local risk assessment, participating jurisdictions can develop specific strategies to address areas of concern identified through this process. The following table defines terms that will be used throughout this section of the plan.

Table 24: Term Definitions

Term	Definition
Hazard	A potential source of injury, death, or damages
Asset	People, structures, facilities, and systems that have value to the community
Risk	The potential for damages, loss, or other impacts created by the interaction of hazards and assets
Vulnerability	Susceptibility to injury, death, or damages to a specific hazard
Impact	The consequence or effect of a hazard on the community or assets
Historical Occurrence	The number of hazard events reported during a defined period of time
Extent	The strength or magnitude relative to a specific hazard
Probability	Likelihood of a hazard occurring in the future

Methodology

The risk assessment methodology utilized for this plan follows the same methodology as outlined in the FEMA Local Mitigation Planning Handbook. This process consists of four primary steps: 1) Describe the hazard; 2) Identify vulnerable community assets; 3) Analyze risk; and 4) Summarize vulnerability.

When describing the hazard, this plan will examine the following items: previous occurrences of the hazard within the planning area; locations where the hazard has occurred in the past or is likely to occur in the future; extent of past events and likely extent for future occurrences; and probability of future occurrences. While the identification of vulnerable assets will be conducted across the entire planning area, *Section Seven* will discuss community-specific assets at risk for relevant hazards. Analysis for regional risk will examine historic impacts and losses and what is possible should the hazard occur in the future. Risk analysis will include both qualitative (i.e., description of historic or potential impacts) and quantitative data (i.e., assigning values and measurements for potential loss of assets). Finally, each hazard identified in the plan will provide a summary statement encapsulating the information provided during each of the previous steps of the risk assessment process.

For each of the hazards profiled, the best and most current appropriate data available have been considered. Further discussion relative to each hazard is discussed in the hazard profile portion of this section.

Requirement §201.6(c)(2): Risk assessment. The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

Requirement §201.6(c)(2)(i): The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction.

Requirement §201.6(c)(2)(i): The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

Requirement §201.6(c)(2)(ii): The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

Requirement §201.6(c)(2)(ii): The risk assessment] must also address National Flood Insurance Program insured structures that have been repetitively damaged floods.

Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

Requirement §201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

Average Annual Damages and Frequency

FEMA *Requirement §201.6(c)(2)(ii) (B)* suggests that when the appropriate data is available, hazard mitigation plans should also provide an estimate of potential dollar losses for structures in vulnerable areas. This risk assessment methodology includes an overview of assets at risk and provides historic average annual dollar losses for all hazards for which historic event data are available. Additional loss estimates are provided separately for those hazards for which sufficient data is available. These estimates can be found within the relevant hazard profiles.

Average annual losses from historical occurrences can be calculated for those hazards which there is a robust historic record and for which monetary damages are recorded. There are three main pieces of data used throughout this formula.

- **Total Damages in Dollars:** This is the total dollar amount of all property damages and crop damages as recorded in federal, state, and local data sources. The limitation to these data sources is that dollar figures usually are estimates and often do not include all damages from every event, but only officially recorded damages from reported events.

- **Total Years of Record:** This is the span of years there is data available for recorded events.

- **Number of Hazard Events:** This shows how often an event occurs. The frequency of a hazard event will affect how a community responds. A thunderstorm may not cause much damage each time, but multiple storms can have an incremental effect on housing and utilities. In contrast, a rare large tornado can have a widespread effect on a community.

An example of the Event Damage Estimate is found below:

$$\textbf{Annual Damages } (\$) = \frac{Total\ Damages\ in\ Dollars\ (\$)}{Total\ Years\ Recorded\ (\#)}$$

Each hazard will be addressed in this plan, while those which have caused significant damages or occurred in significant numbers are discussed in greater detail. It should be noted NCEI data are not all inclusive and the database provides very limited information on crop losses. To provide a better picture of the crop losses associated with the hazards within the planning area, crop loss information provided by the Risk Management Agency (RMA) of the USDA was also utilized for this update of the plan for counties with available data. The collected data were from 2000 to 2020. Data for all the hazards are not always available, so only those with an available dataset are included in the loss estimation.

Annual probability can be calculated based on the total years of record and the total number of years in which an event occurred. An example of the annual probability estimate is found below:

$$\textbf{Annual Probability } (\%) = \frac{Total\ Years\ with\ an\ Event\ Occuring\ (\#)}{Total\ Years\ of\ Record\ (\#)}\ x\ 100$$

Hazard Identification

The identification of relevant hazards for the planning area began with a review of the 2021 State of Nebraska Hazard Mitigation Plan. The Regional Planning Team and participating jurisdictions reviewed the list of hazards addressed in the state mitigation plan and determined which hazards were appropriate for discussion relative to the planning area. The hazards for which a risk assessment was completed are included in the following table.

Table 25: Hazards Addressed in the Plan

Hazards Addressed in the Plan		
Animal and Plant Disease	Flooding	Severe Thunderstorms
Dam Failure	Grass/Wildfire	Severe Winter Storms
Drought	Hazardous Materials Release	Terrorism
Earthquakes	Levee Failure	Tornadoes and High Winds
Extreme Heat	Public Health Emergency	

Hazard Elimination

Given the location and history of the planning area, hazards from the State HMP were eliminated from further review. These hazards are listed below with a brief explanation of why the hazards were eliminated.

- **Civil Disorder**: For the entire state, there have been a small number of civil disorder events reported; most date back to the 1960s, however, in 2020 civil disorder events occurred during Black Lives Matter Protests. Most events have occurred in the state's larger communities like Lincoln and Omaha. This approach is consistent with the 2021 Nebraska State HMP.

- **Landslides**: According to the data available related to landslides across the state, one landslide occurred in Merrick County in 1989. The event had no reported damages. Landslides that have occurred across the state have also not resulted in any reported damages or exceeded local response capabilities. Additionally, the local planning team

noted that this was not a hazard of concern. This approach is consistent with the 2021 Nebraska State HMP.

- **Urban Fire:** Fire departments across the planning area have mutual aid agreements in place to address this threat, and typically this hazard is addressed through existing plans and resources. As such, urban fire will not be profiled for this plan. Discussion relative to fire will be focused on wildfire and the potential impacts wildfire could have on the built environment. This approach is consistent with the 2021 Nebraska State HMP.

Hazard Assessment Summary Tables

The following table provides an overview of the data contained in the hazard profiles. Hazards listed in this table and throughout the section are in alphabetical order. This table is intended to be a quick reference for people using the plan and does not contain source information. Source information and full discussion of individual hazards are included later in this section. Annual probability is based off the number of years that had at least one event.

Table 26: Regional Risk Assessment

Hazard	Previous Occurrence Events/Years	Approximate Annual Probability	Likely Extent	
Animal and Plant Disease	Animal: 98/7 Plant: 59/20	Animal 100% Plant 75%	~33 animals per event Crop damage or loss	
Dam Failure	6/130	5%	Varies by structure	
Drought	444/1,513 months	29%	D1-D4	
Earthquakes	1/120	Less than 1%	Less than 5.0 on the Richter Scale	
Extreme Heat	Avg 5 days per year >100°F	78%	>100°F	
Flooding	84/26	65%	Some inundation of structures (22.6% of structures) and roads near streams. Some evacuations of people may be necessary (19.4% of population)	
Grass/Wildfires	1,460/21	100%	Avg 32.3 acres Some homes and structures threatened or at risk	
Hazardous Materials Release	Fixed Site: 176/31 Transportation: 183/51	100% 65%	Avg Liquid Spill	277 gal
			Avg Gas Spill	440 gal
Levee Failure	0/120	Less than 1%	Varies by extent	
Public Health Emergency	2	Unknown	Varies by extent	
Severe Thunderstorms	1,599/26	100%	≤3.71” rainfall Avg 57 mph winds	
Severe Winter Storms	513/26	100%	0.25” – 1.5” Ice 30°-70° below zero (wind chill) 2-18” snow 20-90 mph winds	
Terrorism	1/48	Less than 1%	Varies by event	

Hazard	Previous Occurrence Events/Years	Approximate Annual Probability	Likely Extent
Tornadoes and High Winds	258/26	92%	Avg: EF0 Range: EF0-EF3

The following table provides loss estimates for hazards with sufficient data. Detailed descriptions of major events are included in *Section Seven: Community Profiles.*

Table 27: Loss Estimation for the Planning Area

Hazard Type		Count	Property Damage	Crop Damage[2]
Animal and Plant Disease	Animal Disease[1]	98	3,303 animals	N/A
	Plant Disease[2]	59	N/A	$770,256
Dam Failure[5]		6	N/A	N/A
Drought[6]		444 of 1,513 months	$0	$76,993,162
Earthquakes[12]		1	$0	N/A
Extreme Heat[7]		Avg. 5 Days a Year	N/A	$25,937,061
Flooding[8]	Flash Flood	47	$42,655,000	$4,140,050
	Flood	37	$9,118,000	
Grass/Wildfires[9] *7 injuries* *3 fatalities*		1,460	41,435 acres	$248,598
Hazardous Materials Release	Fixed Site[3]	176	$0	N/A
	Transportation[4]	183	$1,325,150	N/A
Levee Failure[11]		0	$0	N/A
Public Health Emergency		2	N/A	N/A
Severe Thunderstorms[8] *25 injuries*	Thunderstorm Wind Range: 57 Average: 50-92	540	$34,940,000	$190,074,924
	Hail Range: 0.75-5.0 in. Average: 1.2 in	957	$117,794,000.00	
	Heavy Rain	94	$587,000	
	Lightning	8	$492,000	
Severe Winter Storms[8] *12 injuries* *4 fatalities*	Blizzard	50	$905,000	$3,613,366
	Extreme Cold/Wind Chill	17	$0	
	Heavy Snow	16	$0	
	Ice Storm	35	$23,325,000	
	Winter Storm	216	$1,265,000	
	Winter Weather	179	$160,000	
Terrorism[10]		1	$0	N/A
Tornadoes and High Winds[8] *10 injuries*	Tornadoes Range: EF0-EF3 Average: EF0	68	$30,425,000	$6,490,000
	High Winds Range: 50 kts Average: 35-70 kts	190	$5,966,400.00	$24,439,112

Hazard Type	Count	Property Damage	Crop Damage[2]
Total	**4,440**	**$268,957,550**	**$332,706,530**

N/A: Data not available
1 - NDA, 2014 – April 2021
2 - USDA RMA, 2000 – 2020
3 - NRC, 1990 – February 2020
4 - PHSMA, 1971 – June 2021
5 – DNR Communication, July 2021
6 - NOAA, 1895 – January 2021
7 - NOAA Regional Climate Center, 1878 – June 2021
8 - NCEI, 1996 – June 2021
9 - NFS, 2000 - 2020
10 - University of Maryland, 1970-2018
11 – USACE NLN, 1900 – June 2021
12 – USGS, 1900 – June 2021

Historical Disaster Declarations

The following tables show past disaster declarations that have been granted within the planning area.

Farm Service Agency Small Business Administration Disasters

The U.S. Small Business Administration (SBA) was created in 1953 as an independent agency of the federal government to aid, counsel, assist, and protect the interests of small business concerns, to preserve free competitive enterprise, and maintain and strengthen the overall economy of our nation. A program of the SBA includes disaster assistance for those affected by major natural disasters. The following table summarizes the SBA Disasters involving the planning area since 2006.

Table 28: SBA Declarations

Disaster Declaration Number	Declaration Date	Title	Primary Counties	Contiguous Counties
NE-00002	6/23/2005	Severe Storms, and Flooding	Buffalo, Hall, Merrick	-
NE-00005	1/26/2006	Severe Winter Storm	Dawson	-
NE-00011	1/7/2007	Severe Winter Storm	Buffalo, Dawson, Hall, Merrick, Polk	-
NE-00014	7/24/2007	Severe Storms, and Flooding	Buffalo, Dawson	-
NE-00020	6/20/2008, 6/24/2008,7/29/2008	Severe Storms, Tornadoes, and Flooding	Buffalo, Dawson	Hall, Merrick, Polk
NE-00021	6/20/2008, 6/24/2008,7/29/2008	Severe Storms, Tornados, and Flooding	Buffalo, Dawson, Hall, Merrick, Polk	-
NE-00033	02/25/2010 & 3/26/2010	Severe Winter Storms and Snowstorm	Merrick, Polk	-
NE-00035	04/21/2010 & 6/10/2010	Severe Storms, Ice Jams, and Flooding.	Polk	-
NE-00044	08/12/2011 & 8/25/2011	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	Buffalo, Polk	-

Disaster Declaration Number	Declaration Date	Title	Primary Counties	Contiguous Counties
NE-00048	3/25/2013	Drought	Merrick	Buffalo, Hall, Polk
NE-00049	4/1/2013	Drought	Buffalo, Dawson, Hall	Merrick, Polk
NE-00050	4/8/2013	Drought	Polk	Buffalo, Hall, Merrick
NE-00053	12/10/2013	Drought	Buffalo, Dawson, Hall, Merrick, Polk	-
NE-00059	1/28/2015	Drought	Dawson	Buffalo

Source: Small Business Administration, 2006-2019[36]

Presidential Disaster Declarations

Presidential disaster declarations are available via FEMA from 1953 to 2021. Declarations prior to 1964 are not designated by county on the FEMA website and are not included below. The following table describes presidential disaster declarations within the planning area for the period of record. Note that while data is available from 1953 onward, the planning area has received 28 presidential disaster declarations since 1967.

Table 29: Presidential Disaster Declarations

Disaster Declaration Number	Declaration Date	Title	Affected Counties	Public Assistance
228	7/18/1967	Severe Storms and Flooding	Buffalo, Hall, Merrick, Polk	-
500	4/8/1976	Severe Ice Storm	Hall, Merrick, Polk	-
552	3/24/1978	Storms, Ice Jams, Snowmelt, and Flooding	Buffalo, Dawson, Merrick	-
625	6/4/1980	Severe Storms and Tornadoes	Merrick, Hall	-
873	7/4/1990	Severe Storms, Tornadoes, and Flooding	Buffalo, Hall	-
983	4/2/1993	Ice Jams and Flooding	Hall, Merrick	-
998	7/19/1993	Severe Storms and Flooding	Buffalo, Dawson, Hall, Merrick, Polk	-
1027	5/9/1994	Severe Snow and Ice Storm	Buffalo, Dawson	-
1190	11/1/1997	Severe Snow Storms, Rain, and Strong Winds	Buffalo, Dawson, Hall, Polk	-
1480	7/21/2003	Severe Storms and Tornadoes	Polk	$3,891,329
1517	5/25/2004	Severe Storms, Tornadoes, and Flooding	Hall, Buffalo	$13,351,658

36 Small Business Administration. 2001-2019. [data files]. Office of Disaster Assistance | Resources." https://www.sba.gov/offices/headquarters/oda/resources/1407821.

Disaster Declaration Number	Declaration Date	Title	Affected Counties	Public Assistance
1590	6/23/2005	Severe Storms and Flooding	Buffalo, Hall, Merrick	$1,688,474
3245	9/13/2005	Hurricane Katrina Evacuees	Buffalo, Dawson, Hall, Merrick, Polk	$393,813
1627	1/26/2006	Severe Winter Storm	Dawson	$5,444,137
1674	1/7/2007	Severe Winter Storms	Buffalo, Dawson, Hall, Merrick, Polk	$124,357,843
1714	7/24/2007	Severe Storms and Flooding	Buffalo, Dawson	$2,306,259
1770	6/20/2008	Severe Storms, Tornadoes, and Flooding	Buffalo, Dawson, Hall, Merrick, Polk	$36,258,650
1878	2/25/2010	Severe Winter Storms and Snowstorm	Merrick, Polk	$6,577,021
1902	4/21/2010	Severe Storms, Ice Jams, and Flooding	Polk	$3,112,392
1924	7/15/2010	Severe Storms and Flooding	Buffalo, Dawson	$49,926,355
4014	8/12/2011	Severe Storms, Tornadoes, Straight-Line Winds, and Flooding	Buffalo, Polk	$3,362,468
4185	7/28/2014	Severe Storms, Tornadoes, Straight-Line Winds, and Flooding	Polk	$3,937,964
4325	8/1/2017	Severe Storms, Tornadoes, and Straight-Line Winds	Polk	$15,572,546
4375	6/29/2018	Severe Winter Storm and Straight-Line Winds	Hall, Merrick	$7,428,072
4420	3/21/2019	Severe Winter Storm, Straight Line Winds, and Flooding	Buffalo, Dawson, Hall, Merrick, Polk	$465,813,265
3483	3/13/2020	Covid-19	Buffalo, Dawson, Hall, Merrick, Polk	-
4521	4/4/2020	Covid-19 Pandemic	Buffalo, Dawson, Hall, Merrick, Polk	$222,708,357
4616	9/6/2021	Severe Storms and Straight-Line Winds	Hall	$1,208,818

Source: Federal Emergency Management Agency, 1953-Sept 2021[37]

Climate Adaptation

Long-term climate trends have shifted throughout the 21st century and have created significant changes in precipitation and temperature which have altered the severity and subsequent impacts from severe weather events. The Regional and Local Planning Teams identified changes in the

37 Federal Emergency Management Agency. 2021. “Disaster Declarations.” Accessed Sept 2021. https://www.fema.gov/disasters.

regional climate as a top concern impacting communities, residents, local economies, and infrastructure throughout the planning area. Discussions on temperature, precipitation, and climate impacts are included below.

The planning area is located in the Northern Great Plains region of the United States, which includes Montana, Wyoming, North Dakota, South Dakota, and Nebraska. A large elevation change across the region contributes to high geographical, ecological, and climatological variability, including a strong gradient of decreasing precipitation moving from east to west across the region. Significant weather extremes impact this area, including winter storms, extreme heat and cold, severe thunderstorms, drought, and flood producing rainfall. The Fourth National Climate Assessment has provided an overview of potential impacts within the planning area.[38]

- **Water**: Water is the lifeblood of the Northern Great Plains, and effective water management is critical to the region's people, crops and livestock, ecosystems, and energy industry. Even small changes in annual precipitation can have large effects downstream; when coupled with the variability from extreme events, these changes make managing these resources a challenge. Future changes in precipitation patterns, warmer temperatures, and the potential for more extreme rainfall events are very likely to exacerbate these challenges.

- **Agriculture:** Agriculture is an integral component of the economy, the history, and the culture of the Northern Great Plains. Recently, agriculture has benefited from longer growing seasons and other recent climatic changes. Some additional production and conservation benefits are expected in the next two to three decades as land managers employ innovative adaptation strategies, but rising temperatures and changes in extreme weather events are very likely to have negative impacts on parts of the region. Adaptation to extremes and to longer-term, persistent climate changes will likely require transformative changes in agricultural management, including regional shifts of agricultural practices and enterprises.

- **Recreation and Tourism:** Ecosystems across the Northern Great Plains provide recreational opportunities and other valuable goods and services that are at risk in a changing climate. Rising temperatures have already resulted in shorter snow seasons, lower summer stream flows, and higher stream temperatures. These changes have important consequences for local economies that depend on winter or river-based recreational activities. Climate-induced land-use changes in agriculture can have cascading effects on closely entwined natural ecosystems, such as wetlands, and the diverse species and recreational amenities they support.

- **Energy:** Fossil fuel and renewable energy production and distribution infrastructure is expanding within the Northern Great Plains. Climate change and extreme weather events put this infrastructure at risk, as well as the supply of energy it contributes to support individuals, communities, and the U.S. economy as a whole. The energy sector is also a significant source of greenhouse gases and volatile organic compounds that contribute to climate change and ground-level ozone pollution.

38 U.S. Global Change Research Program. 2018. "Fourth National Climate Assessment". https://nca2018.globalchange.gov/.

Nebraska's Changing Climate

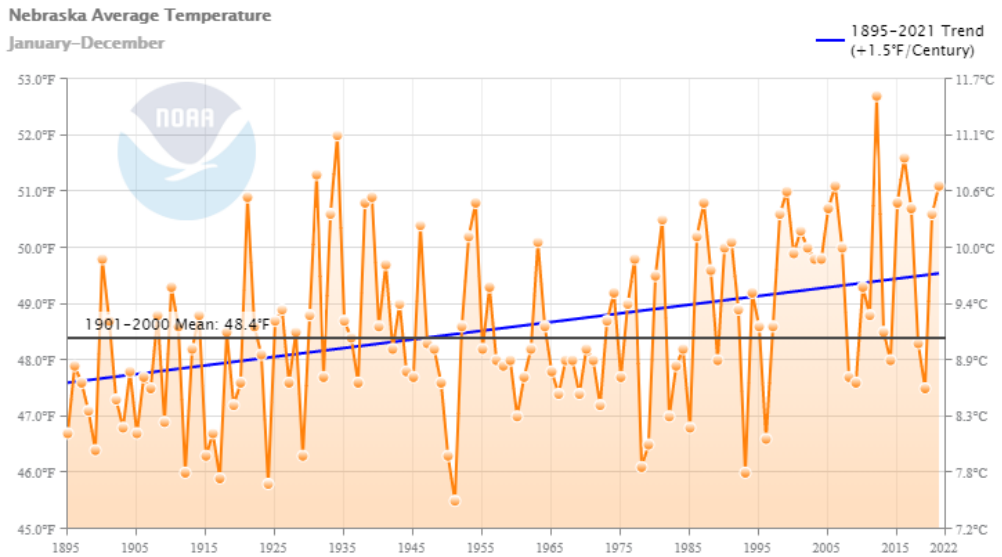
The United States as a whole is experiencing significant changes in temperature, precipitation, and severe weather events resulting from climate change. According to a University of Nebraska report (Understanding and Assessing Climate Change: Implications for Nebraska), the following changes can be expected for Nebraska's future climate:[39]

- Increase in extreme heat events (days over 100°F).
- Decrease in soil moisture by 5-10%.
- Increase in drought frequency and severity.
- Increase in heavy rainfall events.
- Increase in flood magnitude.
- Decrease in water flow in the Missouri River and Platte River from reduced snowpack in the Rocky Mountains.
- Additional 30-40 days in the frost-free season.

Changes in Temperature

Since 1895 Nebraska's overall average temperature has increased by almost 1.5°F (Figure 9). Climate modeling suggests warmer temperature conditions will continue in the coming decades and rise steadily into mid-century. Warming has increased the most in winter and spring months with winter minimum temperatures rising 2-4°F. In addition, there is greater warming for nighttime lows than for daytime highs. Since 1985, the length of the frost season has increased by an average of more than one week across Nebraska, with the length likely to continue to increase in the future. Projected temperature changes range from 4-9°F by 2099.[40]

Figure 9: Average Temperature (1895-2021)



Source: NOAA, 2021[41]

39 University of Nebraska-Lincoln. 2014. "Understanding and Assessing Climate Change: Implications for Nebraska". http://snr.unl.edu/download/research/projects/climateimpacts/2014ClimateChange.pdf.

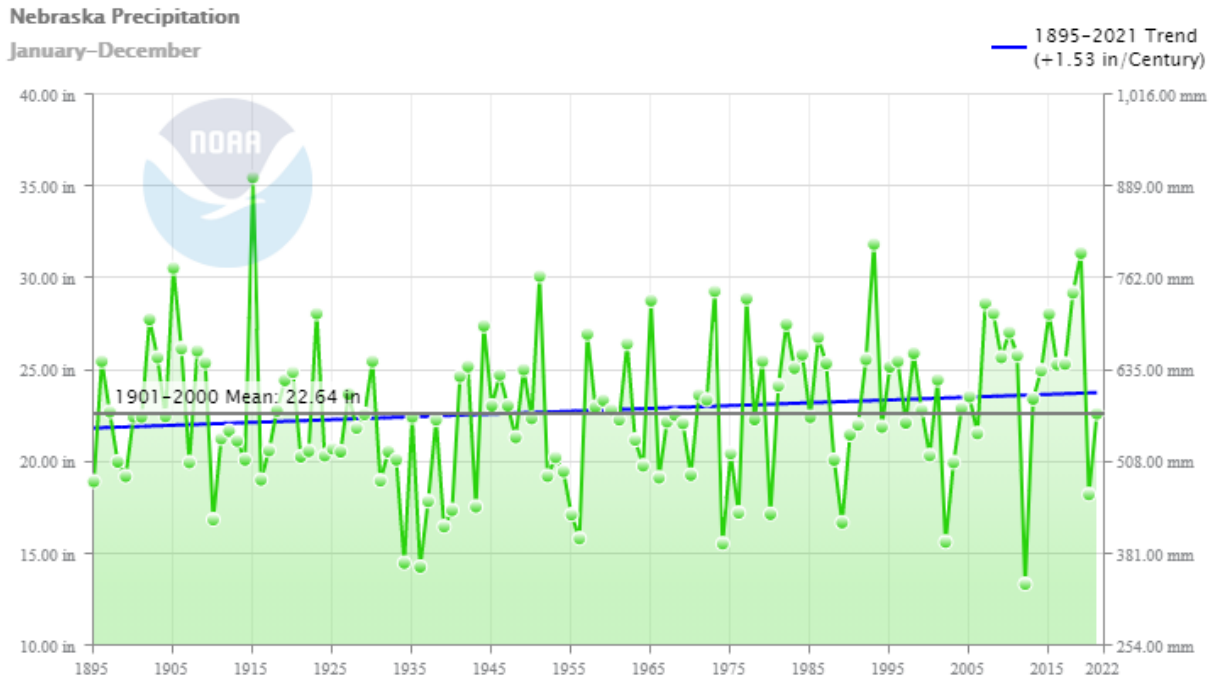
40 University of Nebraska-Lincoln. 2014. "Understanding and Assessing Climate Change: Implications for Nebraska". http://snr.unl.edu/download/research/projects/climateimpacts/2014ClimateChange.pdf.

41 NOAA. 2021. "Climate at a Glance: Statewide Time Series.". Accessed March 2022. https://www.ncdc.noaa.gov/cag/statewide/time-series/25/tavg/12/12/1895-

Changes in Precipitation

Changing extremes in precipitation are anticipated in the coming decades, with more significant rain and snowfall events and more intense drought periods. Seasonal variations will be heightened, with more frequent and more significant rainfall expected in the spring and winter and hotter, drier periods in the summer. Since 1895, yearly annual precipitation for Nebraska has increased slightly (Figure 10). This trend is expected to continue as the impacts of climate change continue to be felt. Climate modeling may show only moderate precipitation and streamflow changes; however, the state is already at risk to large annual and seasonable variability as seen by flooding and drought events occurring in concurrent years. There will likely be more days with a heavy precipitation event (rainfall of greater than one inch per day) across the state. Precipitation varies significantly across the state (Figure 11) and moves in a longitudinal gradient. The east receives twice as much precipitation (35 inches annually) as the Nebraska Panhandle (15 inches) on average.[42]

Figure 10: Average Precipitation (1895-2021)



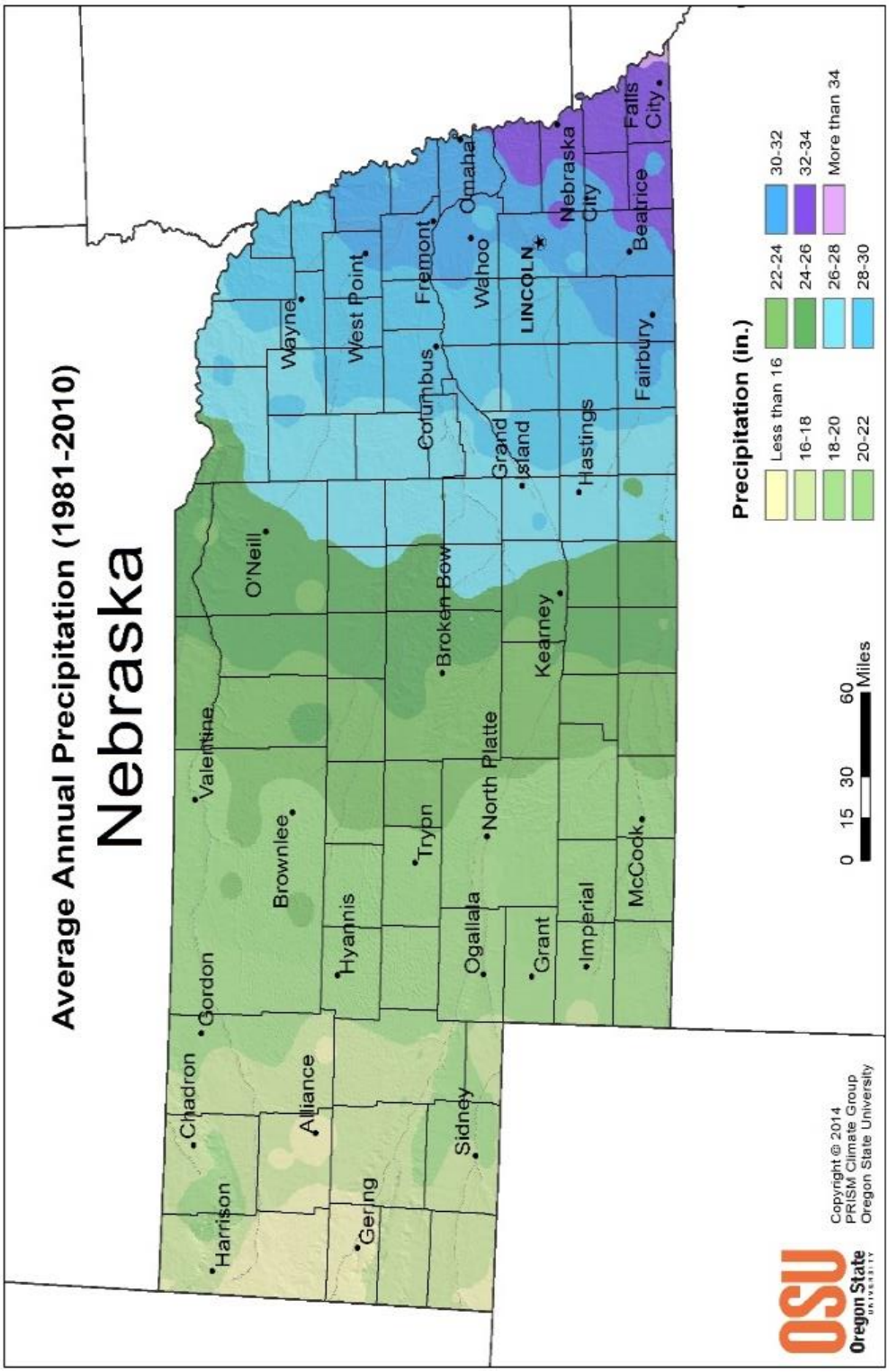
Source: NOAA, 2021[43]

2020?base_prd=true&begbaseyear=1901&endbaseyear=2000&trend=true&trend_base=100&begtrendyear=1895&endtrendyear=2021.

42 North Central Climate Collaborative. January 2020. "NC3 Nebraska Climate Summary." Accessed April 2021. https://northcentralclimate.org/files/2020/01/nc3-Nebraska-Climate-Summary-FINAL_2.12.pdf?x24082

43 NOAA. 2021. "Climate at a Glance: Statewide Time Series.". Accessed March 2022. https://www.ncdc.noaa.gov/cag/statewide/time-series/25/pcp/12/12/1895-2022?base_prd=true&begbaseyear=1901&endbaseyear=2000&trend=true&trend_base=100&begtrendyear=1895&endtrendyear=2022

Figure 11: Average Annual Precipitation for Nebraska (1981-2010)



Source: Oregon State University PRISM Climate Group, 2014

Impacts from Climate Change

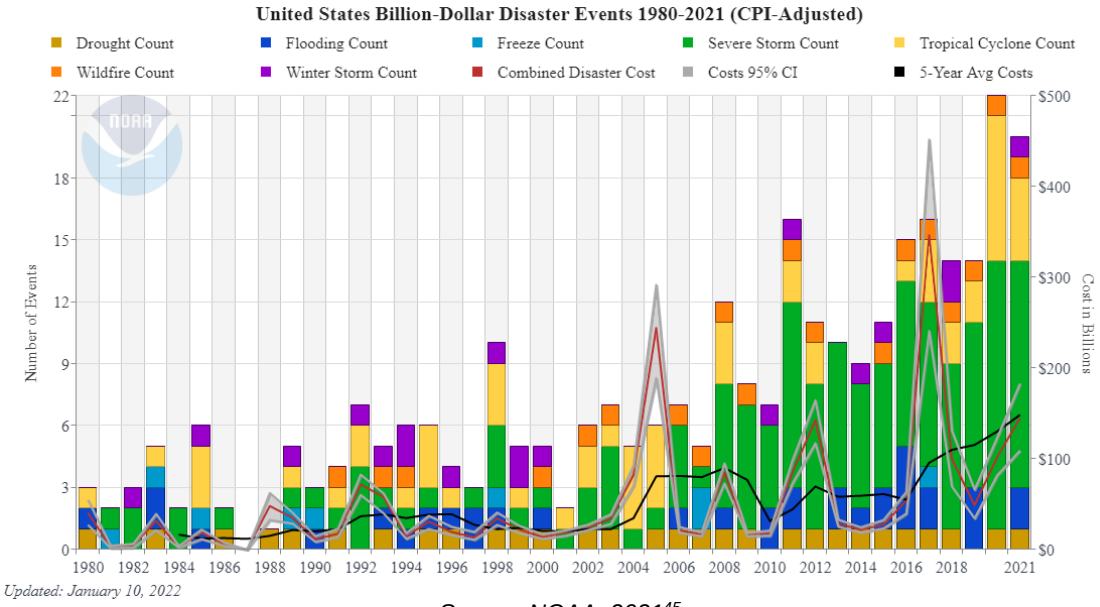
Observed changes in the intensity and frequency of extreme events are a significant concern now and in the future because of the social, environmental, and economic costs associated with their impacts. Challenges that are expected to affect communities, environments, and residents as a result of climate change include:

- Developing and maintaining sustainable agricultural systems.
- Resolving increasing competition among land, water, and energy resources.
- Conserving vibrant and diverse ecological systems.
- Enhancing the resilience of the region's people to the impacts of climatic extremes.

Certain groups of people may face greater difficulty when dealing with the impacts of a changing climate. Older adults, immigrant communities, and those living in poverty are particularly susceptible. Additionally, specific industries and professions tied to weather and climate, like outdoor tourism, commerce, and agriculture, are especially vulnerable.[44]

As seen in the figure below, the United States is experiencing an increase in the number of billion-dollar natural disasters due to increases in development and climate change.

Figure 12: U.S. Billion-Dollar Disaster Events (1980-2021)



Source: NOAA, 2021[45]

Agriculture

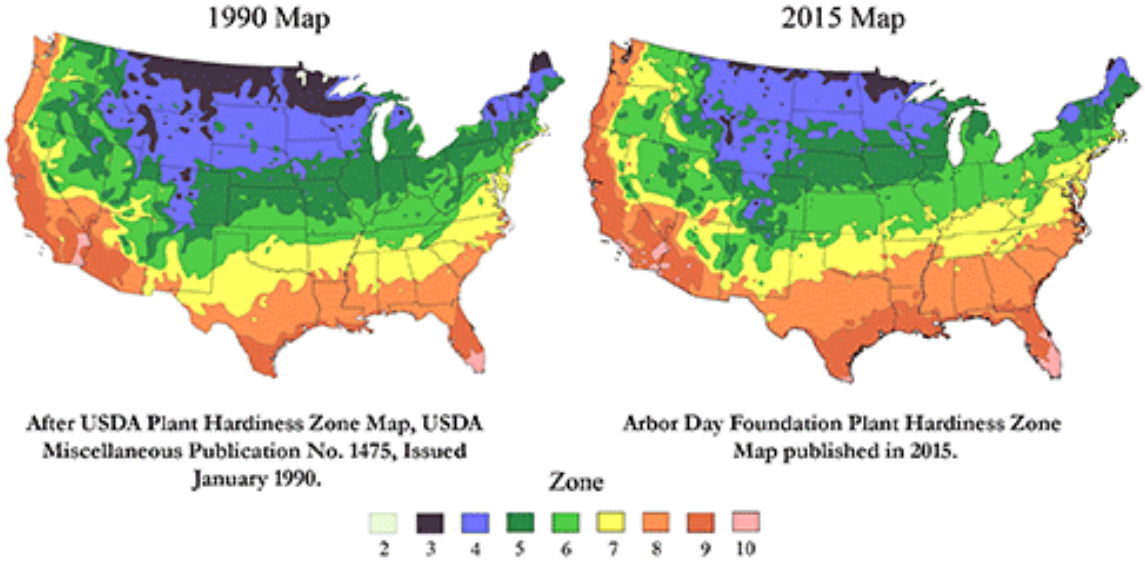
The agricultural sector will experience an increase in droughts, an increase in grass and wildfire events, changes in the growth cycle as winters warm, an influx of new and damaging agricultural diseases or pests, and changes in the timing and magnitude of rainfall. As described in the Plant Hardiness Zone map available for the United States (Figure 13), these changes have shifted the annual growing season and expected agricultural production conditions. Nebraska is vulnerable

44 U.S. Environmental Protection Agency. "Climate Impacts on Society." Accessed March 2022. https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-society_.html

45 NOAA National Centers for Environmental Information. 2021. "U.S. Billion-Dollar Weather and Climate Disasters". https://www.ncdc.noaa.gov/billions/

to changes in growing season duration and growing season conditions as a heavily agriculturally dependent state. These added stressors on agriculture could have devastating economic effects if new agricultural and livestock management practices are not adopted.

Figure 13: Plant Hardiness Zone Change



Source: Arbor Day Foundation, 2018[46]

Air Quality

Rising temperatures will also impact air quality. Harmful air pollutants and allergens increase as temperatures increase. More extended periods of warmth contribute to longer pollen seasons that allow plant spores to travel farther and increase exposure to allergens. More prolonged exposure to allergens can increase the risk and severity of asthma attacks and worsen existing allergies in individuals.[47] An increase in air pollutants can occur from the increased number of grass/wildfires. The public can be exposed to harmful particulate matter from smoke and ash that can cause various health issues. Depending on the length of exposure, age, and individual susceptibility, effects from wildfire smoke can range from eye and respiratory irritation to severe disorders like bronchitis, asthma, and aggravation of pre-existing respiratory and cardiovascular diseases.[48]

Water Quality

Increasing temperatures, shifting precipitation patterns, and extreme weather events impact water quality throughout the state. With the increasing intensity and frequency of extreme precipitation events, impacts to water systems ultimately threaten human health. Events can lead to flooding and stormwater runoff that can carry pollutants across landscapes and threaten human health by contaminating water wells, groundwater, and other bodies of water. Common pollutants include pesticides, bacteria, nutrients, sediment, animal waste, oil, and hazardous waste.

As average temperatures increase, water temperatures also rise and put water bodies at risk for eutrophication and excess algal growth that reduce water quality. In agricultural landscapes this can be exacerbated from major storm events that cause sediment and nutrients such as

46 Arbor Day Foundation. 2018. “Hardiness Zones.” https://www.arborday.org/media/map_change.cfm
47 Asthma and Allergy Foundation of America. 2010. “Extreme Allergies and Climate Change.” Accessed 2022. https://www.aafa.org/extreme-allergies-and-climate-change/.
48 AirNow. 2019. “Wildfire Smoke: A Guide for Healthcare Professionals.” Accessed 2022. https://www.airnow.gov/wildfire-smoke-guide-publications/

phosphorous and nitrogen to runoff into nearby water sources. The runoff can contribute to the buildup of nutrients in the water, increasing plant and algae growth that can deplete oxygen and kill aquatic life. Nutrient enrichment can lead to toxic cyanobacterial harmful algae blooms (cyanoHABs), which can be harmful to animal and human health. CyanoHABs can cause economic damage such as decreasing property values, reducing recreational revenue, and increasing the costs for treating drinking water.[49]

Zoonotic Disease

Changes in temperature and precipitation can alter the geographic range of disease-carrying insects and pests. Mosquitoes that transmit viruses such as Zika, West Nile and dengue may become more prevalent in Nebraska because of the increased temperatures and precipitation. These diseases may initially spread faster as the local population is not aware of the proper steps to reduce their risk.

Energy

As the number of 100°F days increases, along with warming nights, the stress placed on the energy grid will likely increase and possibly lead to more power outages. Severe weather events also stress emergency production, infrastructure transmission, and transportation. Roads, pipelines, and rail lines are all at risk of damages from flooding, extreme heat, erosion, or added stress from increased residential demands.[50] Critical facilities and vulnerable populations that are not prepared to handle periods of power outages, particularly during heat waves, will be at risk.

Drought and Extreme Heat

An increase in average temperatures will contribute to the raise in the frequency and intensity of hazardous events like extreme heat and drought, which will cause significant economic, social, and environmental impacts on Nebraskans. Although drought is a natural part of the climate system, increasing temperatures will increase evaporation rates, decrease soil moisture, and lead to more intense droughts in the future, having negative impacts on farming and community water systems. Extreme heat events have adverse effects on both human and livestock health. Heatwaves may also impact plant health, with negative effects on crops during essential growth stages. Increasing temperatures and drought may reduce the potential for aquifers to recharge, which has long-term implications for the viability of agriculture in Nebraska.

Grass/Wildfire

Rising temperatures will likely increase the frequency and intensity of grass/wildfires. Warmer temperatures cause snow to melt sooner and create drier soils and forests, which can ignite fires quicker and cause them to spread rapidly. Additionally, warmer nighttime temperatures contribute to the continued spread of wildfires over multiple days.[51]

49 USGS. “Nutrients and Eutrophication”. Accessed 2022. https://www.usgs.gov/mission-areas/water-resources/science/nutrients-and-eutrophication?qt-science_center_objects=0#qt-science_center_objects.

50 USGCRP, 2018: Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Report-in-Brief [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 186 pp.

51 NASA Global Climate Change. September 2019. “Satellite Data Record Shows Climate Change's Impact on Fires.” Accessed 2022. https://climate.nasa.gov/news/2912/satellite-data-record-shows-climate-changes-impact-on-fires/.

Severe Storms and Flooding

Nebraska experiences frequent snowstorms and ice storms during winter, which can produce heavy snowfall and high wind gusts that lead to whiteout conditions. In the warmer months, convective storms are common and include flash flood-producing rainstorms and severe thunderstorms capable of producing hail, damaging winds, and tornadoes. As temperatures continue to rise, more water vapor evaporates into the atmosphere, creating increased humidity, which can increase the frequency and intensity of these storms. An increase in severe storms and heavy rain events will lead to more flooding and larger magnitude flood events. These severe storm and flooding events can cause increased damages to structures and put more people at risk of injury or death.

Future Adaptation and Mitigation

The planning area will have to adapt to a changing climate and its impacts or experience an increase in economic losses, property damages, agricultural damages, and loss of life. Past events have typically informed HMPs to be more resilient to future events. This HMP includes strategies for the planning area to address these changes and increase resilience. However, future updates of this HMP should consider including adaptation as a core strategy to be better informed by future projections on the frequency, intensity, and distribution of hazards. Jurisdictions in the planning area should consider past and future climate changes and impacts when incorporating mitigation actions into local planning processes.

Hazard Profiles

Information from participating jurisdictions was collected and reviewed alongside hazard occurrence, magnitude, and event narratives as provided by local, state, and federal databases. Based on this information, profiled hazards were determined to either have a historical record of occurrence or the potential for occurrence in the future. The following profiles will broadly examine the identified hazards across the region. Hazards of local concern or events which have deviated from the norm are discussed in greater detail in each respective community profile (see *Section Seven* of this plan). Local jurisdictional planning teams selected hazards from the regional hazard list as the prioritized hazards for the jurisdiction based on historical hazard occurrences, potential impacts, and the jurisdictions' capabilities. However, it is important to note that while a jurisdiction may not have selected a specific hazard to be profiled, hazard events can impact any jurisdiction at any time and their selection is not a full indication of risk.

Animal and Plant Disease

Agriculture disease is any biological disease or infection that can reduce the quality or quantity of either livestock or vegetative crops. This section looks at both animal disease and plant disease, as both make up a significant portion of Nebraska's and the planning area's economy.

The State of Nebraska's economy is heavily invested in both livestock and crop sales. According to the Nebraska Department of Agriculture (NDA) in 2017, the market value of agricultural products sold was estimated at nearly $22 billion; this total is split between crops (estimated $9.31 billion) and livestock (estimated $12.67 billion). For the planning area, the market value of sold agricultural products exceeded $1.9 million.[52]

Table 30 shows the population of livestock within the planning area. This count does not include wild populations that are also at risk from animal diseases.

Table 30: Livestock Inventory

County	Market Value of 2017 Livestock Sales	Cattle and Calves	Hogs and Pigs	Poultry Egg Layers	Sheep and Lambs
Buffalo	$159,260,000	94,485	2,544	1,710	1,071
Dawson	$576,681,000	232,801	93,461	1,015	589
Hall	$127,977,000	68,427	4,272	835	137
Merrick	$126,524,000	51,674	(D)	1,047	478
Polk	$200,333,000	82,008	70,244	(D)	200
Total	**$1,190,775,000**	**529,395**	**170,521**	**2,475**	**4,607**

Source: U.S. Census of Agriculture, 2017
**(D) Withheld to avoid disclosing data for individual farms.*

The following tables provide the value and acres of land in farms for the planning area. Buffalo County has the highest number of farms and Dawson County has the highest number of land (acres) in the planning area. Corn is the most prevalent crop type in the region followed by soybeans.

Table 31: Land and Value of Farms in the Planning Area

County	Number of Farms	Land in Farms (acres)	Market Value of 2017 Crop Sales
Buffalo	953	528,404	$173,451,000
Dawson	686	610,097	$171,745,000
Hall	582	328,229	$174,424,000
Merrick	483	242,865	$113,804,000
Polk	432	251,028	$130,365,000
Total	**3,136**	**1,960,623**	**$763,789,000**

Source: U.S. Census of Agriculture, 2017

52 US Department of Agriculture, National Agricultural Statistics Server. 2021. "2017 Census of Agriculture – County Data." Accessed March 2022. https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Nebraska/.

Table 32: Crop Values

County	Corn		Soybeans		Wheat	
	Acres Planted	Value (2017)	Acres Planted	Value (2017)	Acres Planted	Value (2017)
Buffalo	182,561	$117,930,000	84,860	$49,326,000	2322	$422,000
Dawson	172,173	$120,091,000	69,149	$39,298,000	2161	$376,000
Hall	200,842	$140,236,000	51,287	$30,902,000	435	$98,000
Merrick	110,168	$70,115,000	65,840	$35,536,000	994	$224,000
Polk	118,264	$79,619,000	87,668	$49,547,000	316	(D)
Total	**784,008**	**$289,970,000**	**204,795**	**$115,985,000**	**1,429**	**$1,120,000**

Source: U.S. Census of Agriculture, 2017
**(D) Withheld to avoid disclosing data for individual farms.*

Location

Given the strong agricultural presence in the planning area, animal and plant disease have the potential to occur across the planning area. If a major outbreak were to occur, the economy in the entire planning area would be affected, including urban areas.

The primary land uses where animal and plant disease will be observed include agricultural lands, range or pasture lands, and forests. It is possible that animal or plant disease will occur in domestic animals or crops in urban areas.

Extent

There is no standard for measuring the magnitude of animal and plant disease. Historical events have impacted livestock ranging from a single individual to eight individuals. The planning area is heavily dependent on the agricultural economy. Any severe plant or animal disease outbreak which may impact this sector would negatively impact the entire planning area's economy.

Historical Occurrences

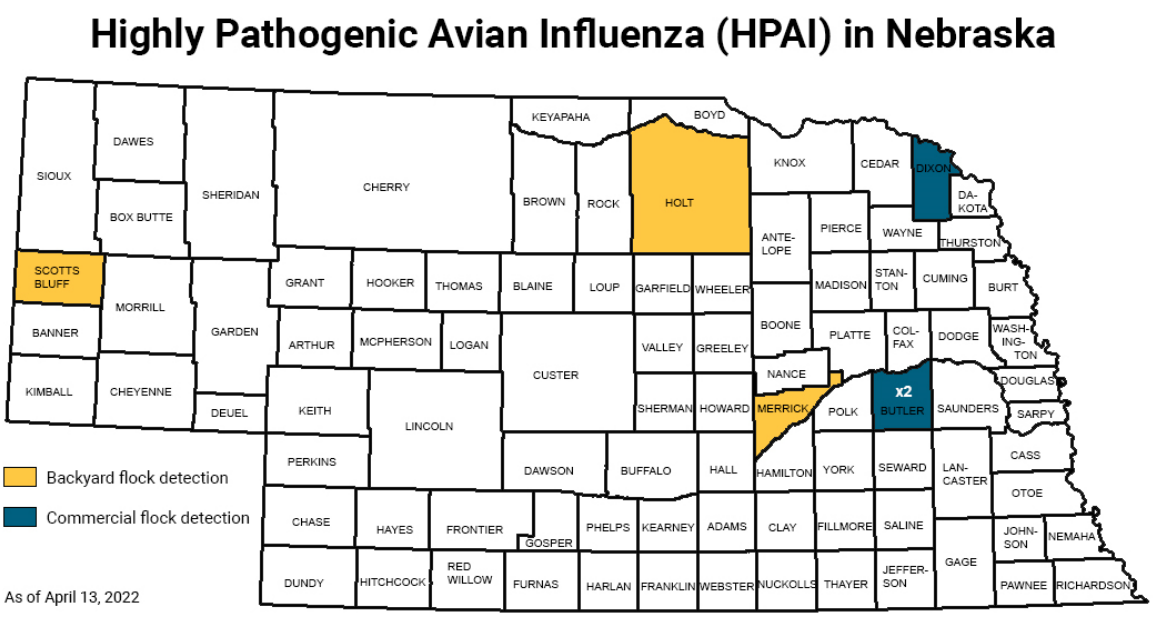
Animal Disease

The NDA provides reports on diseases occurring in the planning area. There were 98 instances of animal disease reported between January 2014 and April 2021 by the NDA (Table 33). These outbreaks affected 3,303 animals.

There is currently an ongoing Avian Influenza outbreak in the planning area and the State of Nebraska. Avian Influenza is a viral disease that affects chickens, turkeys, pheasants, quail, waterfowl, swans, peafowl, and guinea fowl. The virus is highly transferable between birds and can cause decreased egg production, respiratory issues, and death within the bird population. Avian Influenza was first detected in Nebraska in a non-commercial backyard flock in March 2022. As of April 13, 2022, within the planning area it has only been detected in Merrick County.[53]

53 Nebraska Department of Agriculture. April 13, 2022. "Avian Influenza". Accessed April 25, 2022. https://nda.nebraska.gov/animal/avian/index.html.

Figure 14: Avian Influenza in Nebraska



Source: Nebraska Department of Agriculture[54]

Table 33: Livestock Diseases Reported in the Planning Area

Disease	Year	County	Population Impacted
Avian Infectious Bursal Disease	2019	Hall	1
Avian Mycoplasmosis (M. gallisepticum)	2017	Hall	2
Avian Mycoplasmosis (M. Synoviae)	2017	Hall	2
Bovine Anaplasmosis	2014	Buffalo; Merrick	1; 1
	2015	Polk	1
	2016	Dawson	1
	2017	Dawson	1
	2018	Dawson; Polk	1; 1
	2019	Buffalo; Hall	1; 2
	2020	Buffalo; Dawson; Merrick	3; 1; 1
Bovine Bluetongue	2014	Dawson	4
	2016	Dawson	4
Bovine Leptospirosis	2014	Dawson	1
	2015	Buffalo; Dawson; Merrick	1; 1; 1
	2016	Buffalo; Dawson	1; 2
	2018	Merrick	1
Bovine Paratuberculosis	2014	Buffalo; Hall	1; 3
	2015	Buffalo; Dawson; Hall; Merrick	1; 1; 1; 1
	2016	Buffalo; Polk	2; 1
	2017	Dawson; Hall; Merrick	13; 1; 62

54 Nebraska Department of Agriculture. April 13, 2022. "Avian Influenza". Accessed April 25, 2022. https://nda.nebraska.gov/animal/avian/index.html.

Disease	Year	County	Population Impacted
	2018	Dawson; Hall; Merrick	11; 1; 4
	2019	Buffalo; Dawson; Hall; Merrick	6; 7; 1; 3
	2020	Buffalo; Dawson; Merrick	12; 6; 1
	2021	Buffalo; Dawson	3; 4
Bovine Trichomoniasis	2015	Merrick	1
Bovine Viral Diarrhea	2014	Dawson	5
	2015	Dawson	1
	2016	Dawson; Hall	2; 1
	2017	Dawson	2
	2018	Buffalo; Dawson	140; 216
	2019	Buffalo; Dawson	4; 5
	2020	Buffalo; Merrick	2; 1
	2021	Dawson	1
Caprine/Ovine Paratuberculosis	2017	Buffalo; Polk	147; 60
	2018	Buffalo	1,437
Enzootic Bovine Leukosis	2015	Merrick	1
	2016	Merrick; Polk	1; 1
	2017	Dawson	1
	2018	Merrick	3
	2019	Buffalo; Merrick	1; 3
	2020	Hall; Merrick	2; 2
Equine Herpes Myeloencephalopathy	2016	Hall	1
Equine Vesicular Stomatitis	2020	Buffalo	3
Infectious Bovine Rhinotracheitis/Infectious Pustul	2014	Buffalo	1
	2015	Dawson	1
	2018	Dawson	5
	2020	Dawson	1
Ovine Salmonellosis	2017	Dawson	1
Porcine Circovirus	2014	Merrick	520
	2019	Buffalo	1
	2020	Polk	1
Porcine Circovirus Type 2	2020	Polk	1
Porcine Delta Coronavirus	2016	Buffalo; Polk	1; 1
Porcine Epidemic Diarrhea	2014	Polk	2
	2015	Polk	1
	2016	Buffalo; Merrick; Polk	1; 2; 2
Porcine Reproductive and Respiratory Syndrome	2014	Merrick	520
	2017	Buffalo; Hall; Polk	2; 1; 3
	2018	Polk	2
	2019	Polk	1
	2020	Dawson; Polk	3; 1
Porcine Seneca Valley Virus	2017	Buffalo; Polk	1; 1

Source: Nebraska Department of Agriculture, January 2014- April 2021[55]

55 Nebraska Department of Agriculture. 2021. "Livestock Disease Reporting." http://www.nda.nebraska.gov/animal/reporting/index.html.

Plant Disease

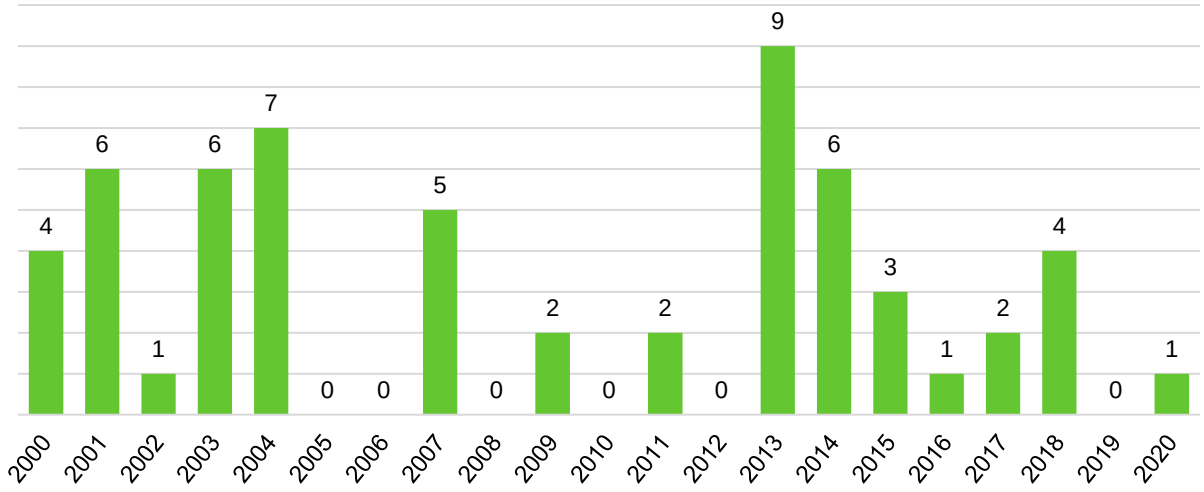
A variety of diseases can impact crops and often vary from year to year. The NDA provides information on some of the most common plant diseases, which are listed below.

Table 34: Common Crop Diseases in Nebraska by Crop Types

Crop Diseases		
Corn	Anthracnose	Southern Rust
	Bacterial Stalk Rot	Stewart's Wilt
	Common Rust	Common Smut
	Fusarium Stalk Rot	Gross's Wilt
	Fusarium Root Rot	Head Smut
	Gray Leaf Spot	Physoderma
	Maize Chlorotic Mottle Virus	
Soybeans	Anthracnose	Pod and Stem Blight
	Bacterial Blight	Purple Seed Stain
	Bean Pod Mottle	Rhizoctonia Root Rot
	Brown Spot	Sclerotinia Stem Rot
	Brown Stem Rot	Soybean Mosaic Virus
	Charcoal Rot	Soybean Rust
	Frogeye Leaf Spot	Stem Canker
	Phytophthora Root and Stem Rot	Sudden Death Syndrome
Wheat	Barley Yellow Dwarf	Leaf Rust
	Black Chaff	Tan Spot
	Crown and Root Rot	Wheat Soy-borne Mosaic
	Fusarium Head Blight	Wheat Streak Mosaic
Sorghum	Ergot	Zonate Leaf Spot
	Sooty Stripe	
Other Pests	Grasshoppers	Western Bean Cutworm
	European Corn Borer	Corn Rootworm
	Corn Nematodes	Bean Weevil
	Mexican Bean Beatle	Soybean Aphids
	Rootworm Beatles	Eastern Ash Borer

The RMA provides data on plant disease events and plant losses in the planning area. There are 59 instances of plant diseases reported from 2000-2020 by the RMA (Figure 15). These outbreaks caused $770,256 in crop losses.

Figure 15: Plant Disease Events by Year



Source: NDA, 2000-2020

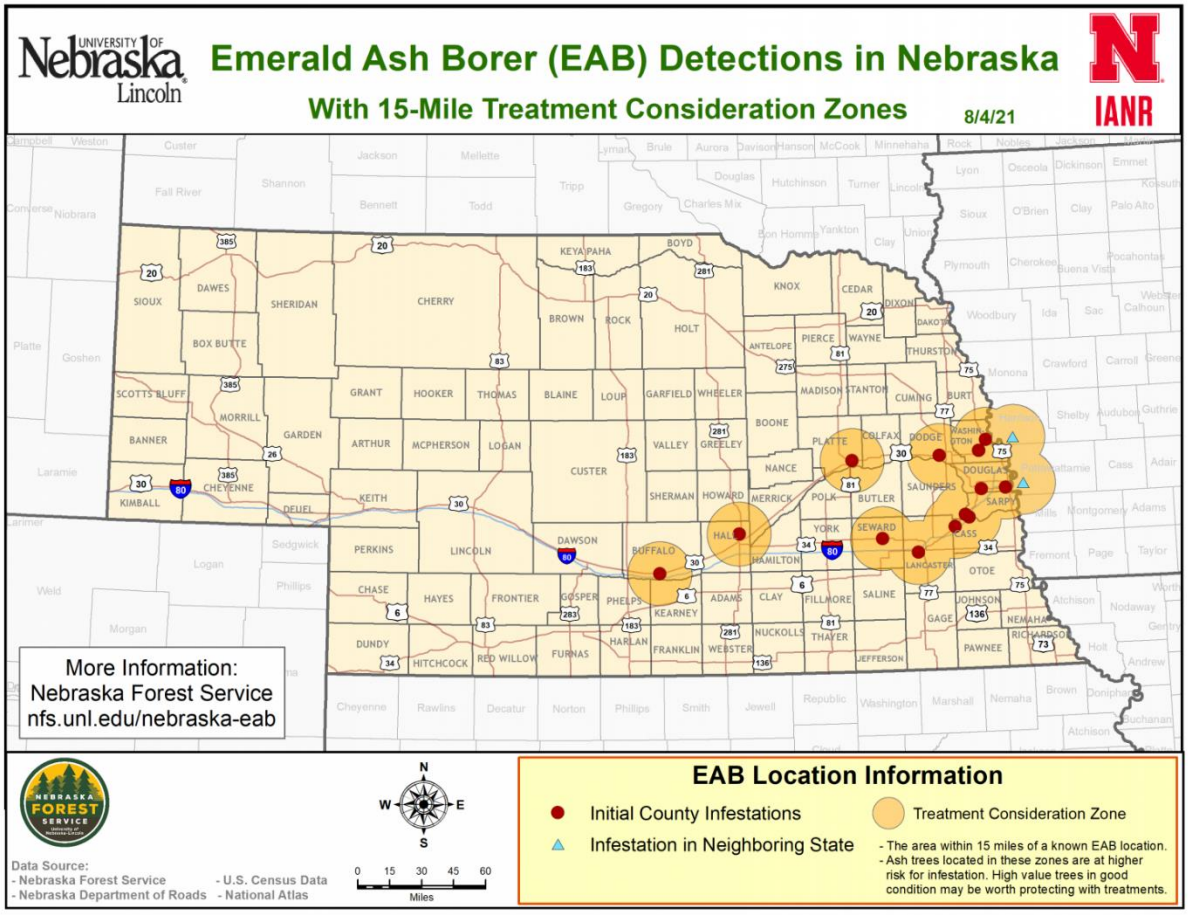
Emerald Ash Borer

The spread and presence of the Emerald Ash Borer (EAB) have become a rising concern for many Nebraskan communities in recent years. The beetle spreads through transport of infected ash trees, lumber, and firewood. All species of North American ash trees are vulnerable to infestation. Confirmed cases of EAB have been found in three Canadian provinces and 45 US states, primarily in the eastern, southern, and midwestern regions. The two most recent infestation confirmations came from Georgia and Vermont in 2020. Nebraska's first confirmed cases occurred on private land in Omaha and Greenwood in 2016.[56] Figure 16 shows the locations of Nebraska's confirmed EAB cases as of August 2021. Additional confirmed cases have likely occurred and many communities across the state are prioritizing the removal of ash trees to help curb potential infestations and tree mortality.

While adult beetles cause little damage, larvae damage trees by feeding on the inner bark of mature and growing trees, causing tunnels. Effects of EAB infestation include extensive damage to trees by birds, canopy dieback, bark splitting, and water sprout growth at the tree base, and eventual tree mortality. EAB has impacted millions of trees across North America, killing young trees one to two years after infestation and mature trees three to four years after infestation.[57] Estimated economic impacts to Nebraska's 44 million ash trees exceed $981 million.[58] Dead or dying trees affected by EAB are also more likely to cause damage during high winds, severe thunderstorms, or severe winter storms from weakened or hazardous limbs and can contribute a significant fuel load to grass/wildfire events.

56 Emerald Ash Borer Information Network. April 2018. "Emerald Ash Borer." http://www.emeraldashborer.info/.
57 Arbor Day Foundation. 2015. "Emerald Ash Borer." https://www.arborday.org/trees/health/pests/emerald-ash-borer.cfm.
58 "Nebraska Emerald Ash Borer Response Plan." May 2015. https://nfs.unl.edu/NebraskaEABResponsePlan.pdf.

Figure 16: EAB Detections in Nebraska



Phragmites

Non-native Phragmites australis, or Common Reed, is a perennial wetland grass located across North America and in the planning area. Phragmites continue to expand rapidly within Nebraska due to their ability to reproduce through wind and water dispersal of seeds and aggressive reproduction through rhizomes, which can grow 30 feet or more in one year. The plant threatens riparian ecosystems and spreads rapidly throughout river systems.[59] The non-native species outcompetes native species by blocking and slowing water flow and taking up large amounts of scarce water. Phragmites also impact hydrology by trapping sediment typically flushed through the river system. The plant can change how water drains and dry out wetlands, creating situations of localized flooding. Accumulated dead and dry growth from the plant can also increase fire hazards, especially in the spring.

59 Lancaster County Weed Control Authority. "Guide for Phragmites Control." Accessed March 2022. https://www.lancaster.ne.gov/DocumentCenter/View/694/Guide-for-Phragmites-Control-PDF#:~:text=In%20Nebraska%2C%20phragmites%20is%20growing,Platte%20River%20and%20other%20rivers.

In the planning area, the entire Platte River system is threatened by the large infestation of invasive Phragmites that have colonized floodplain woodlands and meadows. The river has had significant water depletion in recent years and dried out in parts during the summer. Phragmites also impact the health of forestlands which become less resilient with infestations.[60]

The Platte River Resilience Fund, established in June 2020, aims to support Platte Valley Weed Management Area activities focusing on the control of invasive plant species and support water conveyance for the Platte River System from Kingsley Dam to the South Platte River at the Colorado border downstream to the Highway 81 bridge in Columbus, Nebraska. The fund is led by a group of local private and government organizations and individuals and is affiliated with the Nebraska Community Foundation.[61]

Methods to control Phragmites on the Platte River include intensive grazing, mowing, prescribed burns, and herbicide annual application. Herbicide application has proven to be the most effective management practice to control Phragmites and other invasive species such as Russian Olive, Purple Loosestrife, and Leafy Spurge.

Average Annual Losses

According to the USDA RMA (2000-2020) there were 59 plant disease events in the planning area. While the RMA does not track losses for livestock, annual crop losses from plant disease can be estimated. Agricultural livestock disease losses are determined from the Nebraska Department of Agriculture.

Table 35: Plant Disease Losses

Hazard Type	Number of Events	Events per Year	Total Crop Loss	Average Annual Crop Loss
Plant Disease	59	3	$770,256	$38,513

Source: RMA, 2000-2020

Table 36: Animal Disease Losses

Hazard Type	Number of Events	Events per Year	Total Animal Losses	Average Animal Losses per Event
Animal Disease	98	12.3	3,303	413

Source: NDA, 2014-April 2021

Probability

Given the historic record of occurrence for animal disease (at least one animal disease outbreak reported in all eight years), for the purposes of this plan, the annual probability of animal disease occurrence is 100 percent. Given the historic record of occurrence for agricultural plant disease events (15 out of 20 years with a reported event), for the purposes of this plan, the annual probability of agricultural plant disease occurrence is 75%.

60 Nebraska Forest Service. 2020. "2020 Nebraska Forest Action Plan." https://nfs.unl.edu/documents/ForestActionPlan/2020%20FAP%20Public%20Comment%20-%20Final.pdf.
61 Nebraska Community Foundation. 2022. "Platte River Resilience Fund." https://www.nebcommfound.org/give/platte-river-resilience-fund/.

Community Top Hazard Status

The following table lists jurisdictions which identified animal and plant disease as a top hazard of concern.

Jurisdiction	
Buffalo County	Kearney
Central District Health Department	Polk County

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 37: Regional Agricultural Disease Vulnerabilities

Sector	Vulnerability
People	-Those in direct contact with infected livestock -Potential food shortage during prolonged events -Residents in poverty if food prices increase
Economic	-Regional economy is reliant on the agricultural industry -Large scale or prolonged events may impact tax revenues and local capabilities -Land value may largely drive population changes within the planning area
Built Environment	None
Infrastructure	-Transportation routes can be closed during quarantine
Critical Facilities	None
Climate	-Exacerbate outbreaks, impacts, and/or recovery period -Changes in seasonal normals can promote spread of invasive species and agricultural disease

Dam Failure

According to the Nebraska Administrative Code, dams are "any artificial barrier, including appurtenant works, with the ability to impound water, wastewater, or liquid-borne materials and which is:

- twenty-five feet or more in height from the natural bed of the stream or watercourse measured at the downstream toe of the barrier, or from the lowest elevation of the outside limit of the barrier if it is not across a stream channel or watercourse, to the maximum storage elevation or
- has an impounding capacity at maximum storage elevation of fifty acre-feet or more, except that any barrier described in this subsection which is not in excess of six feet in height or which has an impounding capacity at maximum storage elevation of not greater than fifteen acre-feet shall be exempt, unless such barrier, due to its location or other physical characteristics, is classified as a high hazard potential dam.

Dams do not include:

- an obstruction in a canal used to raise or lower water;
- a fill or structure for highway or railroad use, but if such structure serves, either primarily or secondarily, additional purposes commonly associated with dams it shall be subject to review by the department;
- canals, including the diversion structure, and levees; or
- water storage or evaporation ponds regulated by the United States Nuclear Regulatory Commission."[62]

The NeDNR uses a classification system for dams throughout the state, including those areas participating in this plan. The classification system includes three classes, which are defined in the table below.

Table 38: Dam Size Classification

Size	Effective Height (feet) x Effective Storage (acre-feet)	Effective Height
Small	≤ 3,000 acre-feet	and ≤ 35 feet
Intermediate	> 3,000 acre-feet to < 30,000 acre-feet	or > 35 feet
Large	≥ 30,000 acre-feet	Regardless of Height

Source: NeDNR, 2013[63]

The effective height of a dam is defined as the difference in elevation in feet between the natural bed of the stream or watercourse measured at the downstream toe (or from the lowest elevation of the outside limit of the barrier if it is not across stream) to the auxiliary spillway crest. The effective storage is defined as the total storage volume in acre-feet in the reservoir below the elevation of the crest of the auxiliary spillway. If the dam does not have an auxiliary spillway, the effective height and effective storage should be measured at the top of dam elevation.

62 Nebraska Department of Natural Resources. "Department of Natural Resources Rules for Safety of Dam and Reservoirs." Nebraska Administrative Code, Title 458, Chapter 1, Part 001.09.
63 Nebraska Department of Natural Resources. 2013. "Classification of Dams: Dam Safety Section." https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/dam-safety/resources/Classification-Dams.pdf.

Dam failure, as a hazard, is described as a structural failure of a water-impounding structure. Structural failure can occur during extreme conditions, which include, but are not limited to:

- Reservoir inflows in excess of design flows
- Flood pools higher than previously attained
- Unexpected drop in pool level
- Pool near maximum level and rising
- Excessive rainfall or snowmelt
- Large discharge through spillway
- Erosion, landslide, seepage, settlement, and cracks in the dam or area
- Earthquakes
- Vandalism/Terrorism

The NeDNR and U.S. Army Corps of Engineers (USACE) regulate dam safety in Nebraska. Dams are classified by the potential hazard each poses to human life and economic loss. The following are classifications and descriptions for each hazard class:

- **Low Hazard Potential**: Failure of the dam expected to result in no probable loss of human life and in low economic loss. Failure may damage storage buildings, agricultural land, and county roads.

- **Significant Hazard Potential**: Failure of the dam expected to result in no probable loss of human life but could result in major economic loss, environmental damage, or disruption of lifeline facilities. Failure may result in shallow flooding of homes and commercial buildings or damage to main highways, minor railroads, or important public utilities.

- **High Hazard Potential**: Failure of the dam expected to result in loss of human life is probable. Failure may cause serious damage to homes, industrial or commercial buildings, four-lane highways, or major railroads. Failure may cause shallow flooding of hospitals, nursing homes, or schools.

Location

According to USACE's National Inventory of Dams, there are a total of 183 dams located within the planning area, with classifications ranging from low to high hazard. Figure 17 maps the location of these dams in the planning area.

Table 39: Dams in the Planning Area

County	Low Hazard	Significant Hazard	High Hazard
Buffalo	39	5	6
Dawson	77	6	2
Hall	7	1	0
Merrick	1	0	0
Polk	36	3	0
Total	**160**	**15**	**8**

Source: USACE, 2020[64]

64 United States Army Corps of Engineers. 2020. "National Inventory of Dams." https://nid.sec.usace.army.mil/ords/f?p=105:1:::::::.

Dams classified with high hazard potential require the creation of an Emergency Action Plan (EAP). The EAP defines responsibilities and provides procedures designed to identify unusual and unlikely conditions which may endanger the structural integrity of the dam within sufficient time to take mitigating actions and to notify the appropriate emergency management officials of possible, impending, or actual failure of the dam. The EAP may also be used to provide notification when flood releases will create major flooding. An emergency situation can occur at any time; however, emergencies are more likely to happen when extreme conditions are present. There are eight high hazard dams located within the planning area. Six are in Buffalo County and two are in Dawson County.

Table 40: High Hazard Dams in the Planning Area

County	Dam Name	NID ID	Dam Height (Feet)	Max Storage (Acre Ft)	Last Inspection Date
Buffalo	Kearney Dam	NE00465	27	161	4/6/2021
Buffalo	4th Avenue Storm Detention Dam	NE02332	19	91	4/6/2021
Buffalo	Ravenna Northwest Dam	NE02492	22	295	4/6/2021
Buffalo	Stoneridge Dam	NE03239	11.5	393.3	4/6/2021
Buffalo	Prairie Creek Upland Dam 2	NE09348	34.5	4,465.3	4/6/2021
Buffalo	Prairie Creek Upland Dam 1	NE09349	38.5	5,776.3	4/6/2021
Dawson	Spring Creek 19-B	NE01734	53.8	17,745	10/13/2021
Dawson	Lake Helen Dam	NE02393	27.2	547.5	10/12/2021

Source: USACE, 2022[65]

Upstream Dams Outside the Planning Area

According to the Buffalo, Dawson, Hall, Merrick, and Polk Counties' Local Emergency Operations Plans, Kingsley Dam and Jeffrey Dam are upstream dams that could impact the planning area.[66,67,68,69,70]

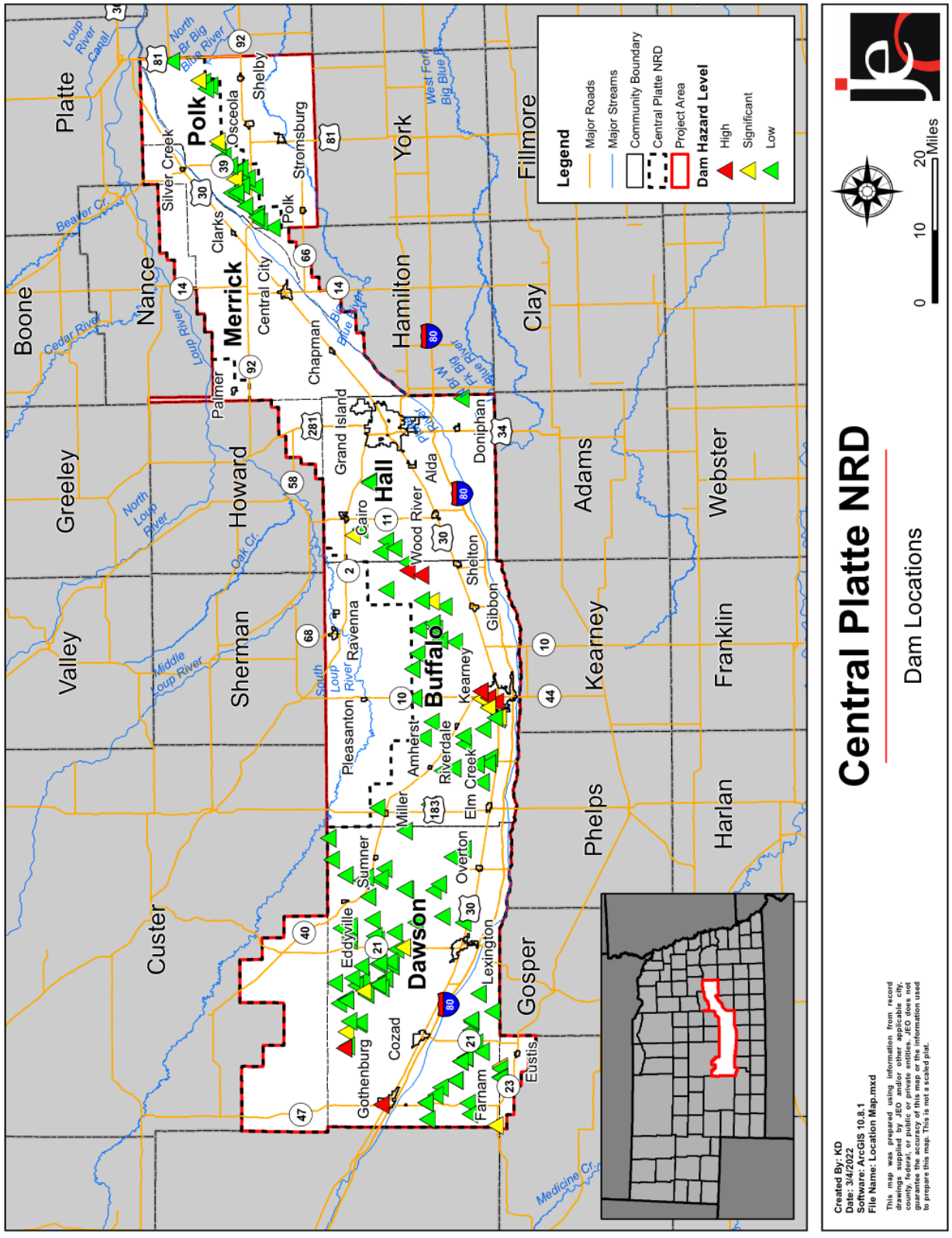
Table 41: Upstream Dams Outside the Planning Area

County	Dam Name	NID ID	Dam Height (Feet)	Max Storage (Acre Ft)	Last Inspection Date
Keith	Kingsley Dam	NE01048	162	1,900,600	10/28/2021
Lincoln	Jeffrey Dam	NE01036	90	6,937	10/27/2021

Source: USACE, 2022

65 United States Army Corps of Engineers. 2022. "National Inventory of Dams." https://nid.sec.usace.army.mil/ords/f?p=105:1:::::::.
66 Buffalo County Emergency Management Agency. 2019. "Buffalo County Local Emergency Operations Plan."
67 Dawson County Emergency Management Agency. 2020. "Dawson County Local Emergency Operations Plan."
68 Hall County Emergency Management Agency. 2020. "Hall County Local Emergency Operations Plan."
69 Merrick County Emergency Management Agency. 2020. "Merrick County Local Emergency Operations Plan."
70 Polk County Emergency Management Agency. 2020. "Polk County Local Emergency Operations Plan."

Figure 17: Dam Locations



Extent

Areas (i.e., agricultural land, out buildings, county roads, and communities) directly downstream of dams are at greatest risk in the case of dam failure. The extent of dam failure is indicated by its hazard classification and location. Note that hazard classification does not indicate the likelihood of a dam failure event to occur, but rather the extent of potential damages that may occur in case of a failure. Thus, the high hazard dams in the planning area would have the greatest impact if they were to fail. Inundation maps are not publicly available due to concerns of vandalism and terrorism. Key facilities located in inundation areas are discussed in each county's LEOP.

Historical Occurrences

According to the NeDNR, there were six reported dam failures within the planning area. There was only minor cropland damage reported.

Table 42: Dam Failures

Dam Name	Hazard Class	County	Failure Year	Failure Mode	Downstream Damage
Sartoria Dam	Low	Buffalo	2007	Spillway Erosion	No Damages Reported
Walter Dam	Low	Buffalo	2019	Overtopped	Minor Damage to Cropland
Kopf Dam	Low	Dawson	Unknown	Spillway Erosion	No Damages Reported
Krone Dam	Low	Dawson	1993	Overtopped	No Damages Reported
Lewis Dam	Low	Dawson	1993	Spillway Erosion	No Damages Reported
Hinrikus Dam	Low	Hall	1980	Spillway Erosion	No Damages Reported

Source: NeDNR, 2021

Average Annual Losses

Only minor cropland damage was reported from the dam failure events. In general, dam failure events would be confined to damage in the inundation area. Community members in the planning area that wish to quantify and evaluate the threat of dam failure should contact their County Emergency Management, local NRD, or the NeDNR to view EAPs and breach inundation area maps.

Probability

Based on the historic record of reported incidents, there is a four percent probability (5 out of 130 years with an occurrence) that dam failure will occur annually in the planning area.

Community Top Hazard Status

The following table lists jurisdictions which identified dam failure as a top hazard of concern.

Jurisdiction	
Buffalo County	Gothenburg
Central Platte NRD	Ravenna
Kearney	

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven* | *Community Profiles*.

Table 43: Regional Dam Failure Vulnerabilities

Sector	Vulnerability
People	-Those living downstream of high hazard dams -Those at recreational sites situated near high hazard dams -Evacuation needs likely with high hazard dam failure events -Hospitals, nursing homes, and the elderly at greater risk due to low mobility -Buffalo County: LEOP estimated 10% of the population could be affected -Dawson County: LEOP estimated 90% of the population could be affected -Hall County: LEOP estimated 5.9% of the population could be affected -Merrick County: LEOP estimated 54% of the population could be affected -Polk County: LEOP gave no estimation
Economic	-Loss of downstream agricultural land -Businesses or recreation sites located in inundation areas would be impacted and closed for an extended period of time -Employees of closed businesses may be out of work for an extended period of time
Built Environment	-Damage to facilities, recreation areas, and roads
Infrastructure	-Transportation routes could be closed for extended period of time -Dawson County: LEOP indicated Interstate 80 and Highway 30 could be affected
Critical Facilities	-Any critical facilities in inundation areas are vulnerable to damages
Climate	-Increased annual precipitation contributes to sustained stress on systems -Changes in water availability and supply can constrain energy production and reservoir stores

Drought

Drought is generally defined as a natural hazard that results from a substantial period of below normal precipitation. Although many inaccurately consider drought a rare and random event, it is actually a normal, recurrent feature of climate. Drought can occur in virtually all climatic zones, but its characteristics can vary significantly from one region to another. A drought often coexists with periods of extreme heat, which together can cause significant social stress, economic losses, and environmental degradation. The planning area is largely rural, which presents an added vulnerability to drought events; drought conditions can significantly and negatively impact the agricultural economic base.

Drought is a normal, recurrent feature of climate, although many erroneously consider it a rare and random event. It occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another.
~National Drought Mitigation Center

Drought is typically a slow onset, creeping phenomenon that can affect a wide range of people, livestock, and industries. However, in some cases "flash droughts" can occur quickly and last for shorter periods of time as seen in 2012-2013 across Nebraska. While many impacts of these hazards are non-structural, there is the potential that during prolonged drought events structural impacts like foundation cracking can occur from dry soil. Drought normally affects more people than other natural hazards, and its impacts are spread over a larger geographical area. Detection and early warning signs of drought conditions have improved recently but are still more difficult to identify than that of quick-onset natural hazards (e.g., flood, winter storms, tornadoes). According to the National Drought Mitigation Center (NDMC), droughts are classified into four major types:

- **Meteorological Drought** is defined based on the degree of dryness and the duration of the dry period. Meteorological drought is often the first type of drought to be identified and should be defined regionally as precipitation rates, frequencies (norms), and winds vary.

- **Agricultural Drought** occurs when there is deficient moisture that hinders planting germination, leading to low plant population per hectare and a reduction of final yield. Agricultural drought is closely linked with meteorological and hydrological drought, as agricultural water supplies are contingent upon the two sectors.

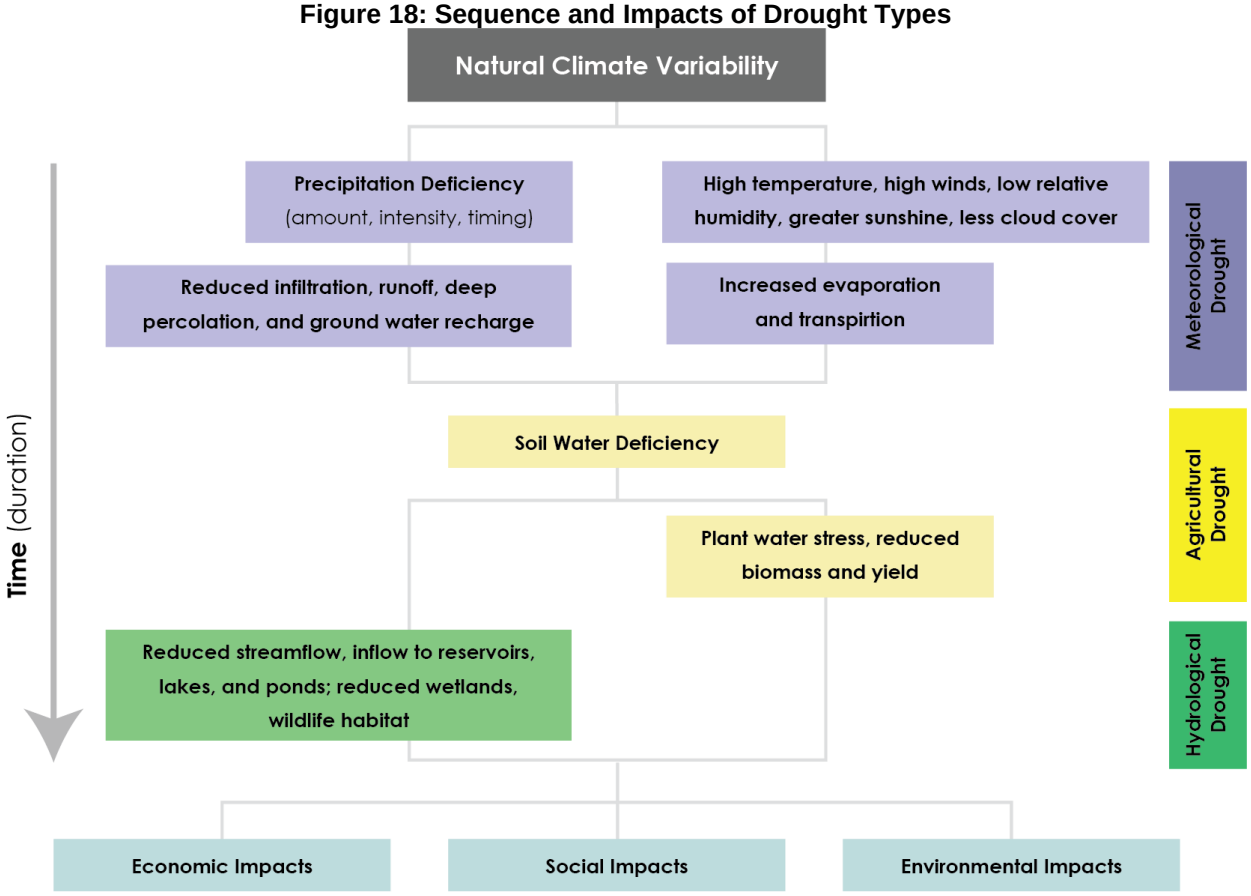
- **Hydrologic Drought** occurs when water available in aquifers, lakes, and reservoirs falls below the statistical average. This situation can arise even when the area of interest receives average precipitation. This is due to the reserves diminishing from increased water usage, usually from agricultural use or high levels of evapotranspiration, resulting from prolonged high temperatures. Hydrological drought often is identified later than meteorological and agricultural drought. Impacts from hydrological drought may manifest themselves in decreased hydropower production and loss of water-based recreation.

- **Socioeconomic Drought** occurs when the demand for an economic good exceeds supply due to a weather-related shortfall in water supply. The supply of many economic goods includes, but are not limited to, water, forage, food grains, fish, and hydroelectric power.[71]

71 National Drought Mitigation Center. 2017. "Drought Basics." https://drought.unl.edu/.

The following figure indicates different types of droughts, their temporal sequence, and the various types of effects they can have on a community.

Figure 18: Sequence and Impacts of Drought Types



Source: National Drought Mitigation Center, University of Nebraska-Lincoln, 2017[72]

Location

The entire planning area is susceptible to drought impacts.

Extent

The Palmer Drought Severity Index (PDSI) is utilized by climatologists to standardize global long-term drought analysis. Table 44 shows the details of the Palmer classifications. The data for the planning area was collected for Climate Division 5, which includes the planning area. The period of record at this station started in 1895. Figure 19 shows drought data from this time period. The negative Y axis represents the extent of a drought, for which '-2' indicates a moderate drought, '-3' a severe drought, and '-4' an extreme drought. The planning area has experienced several extreme droughts and moderate, severe, and extreme droughts are likely in the future.

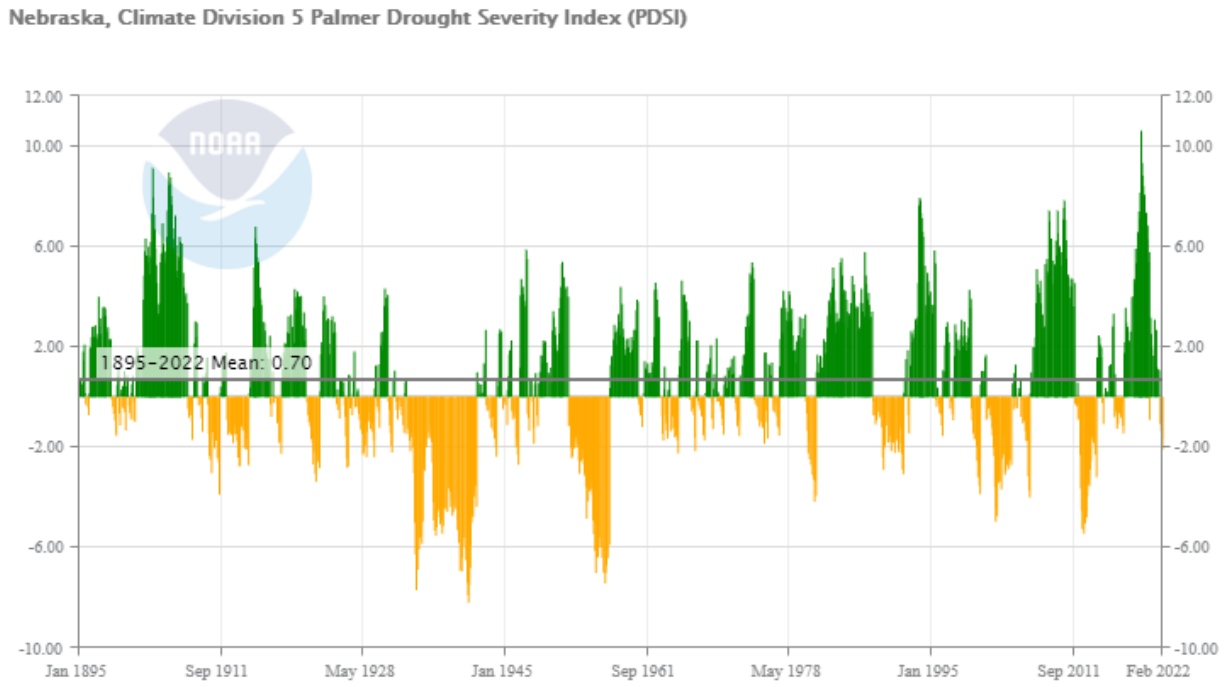
72 National Drought Mitigation Center. 2017. "Types of Drought." https://drought.unl.edu/.

Table 44: Palmer Drought Severity Index Classification

Numerical Value	Description	Numerical Value	Description
4.0 or more	Extremely wet	**-0.5 to -0.99**	Incipient dry spell
3.0 to 3.99	Very wet	**-1.0 to -1.99**	Mild drought
2.0 to 2.99	Moderately wet	**-2.0 to -2.99**	Moderate drought
1.0 to 1.99	Slightly wet	**-3.0 to -3.99**	Severe drought
0.5 to 0.99	Incipient wet spell	**-4.0 or less**	Extreme drought
0.49 to -0.49	Near Normal	--	--

Source: Climate Prediction Center[73]

Figure 19: Palmer Drought Severity Index

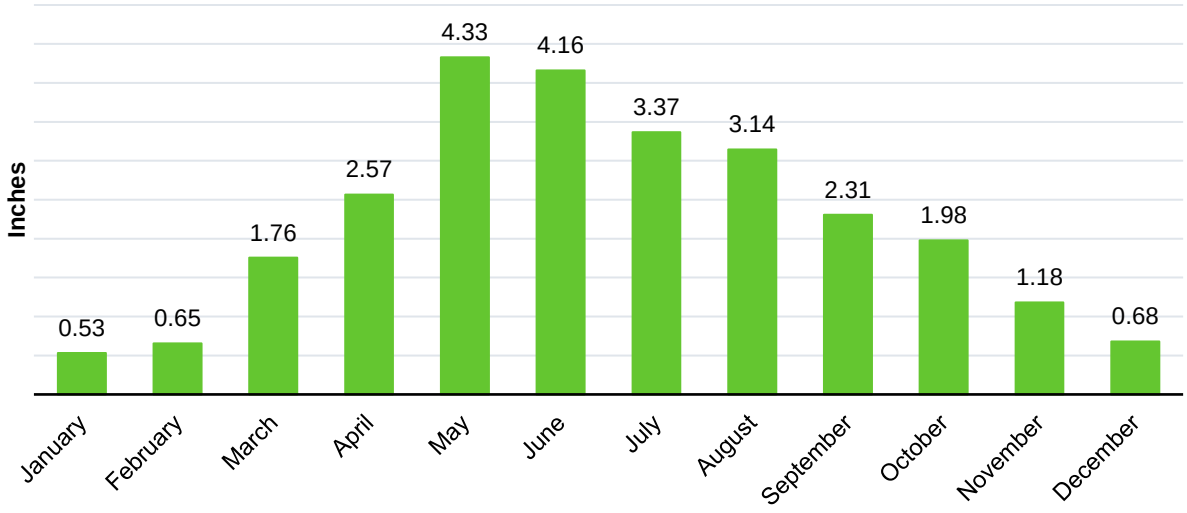


Source: NCEI, Jan. 1895-Feb. 2022[74]

Figure 20 shows the normal average monthly precipitation for the planning area, which is helpful in determining whether any given month is above, below, or near normal in precipitation. Prolonged negative deviations from the norm showcase drought conditions, which influenced growing conditions for producers at those times.

73 National Weather Service. 2017. "Climate Prediction Center." https://www.cpc.ncep.noaa.gov/.
74 National Centers for Environmental Information. 1895-2022. Accessed March 2022. "Climate at a Glance." https://www.ncdc.noaa.gov/cag/divisional/time-series/2505/pdsi/all/8/1895-2022?base_prd=true&begbaseyear=1895&endbaseyear=2022.

Figure 20: Average Monthly Precipitation for the Planning Area



Source: NCEI, 2021[75]

Historical Occurrences

Table 45 indicates it is reasonable to expect extreme drought to occur 7.1% of the time for at least some portion of the planning area (107 extreme drought months in 1,513 months). Severe drought occurred in 49 months of the 1,513 months of record (3.2% of months). Moderate drought occurred in 100 months of the 1,513 months of record (6.6% of months), and mild drought occurred in 188 of the 1,513 months of record (12.4% of months). Non-drought conditions occurred in 1,069 months, or 70.7% percent of months. These statistics show that the drought conditions of the planning area are highly variable. The average annual planning area precipitation is approximately 26.7 inches according to the NCEI.[76]

Table 45: Historic Droughts

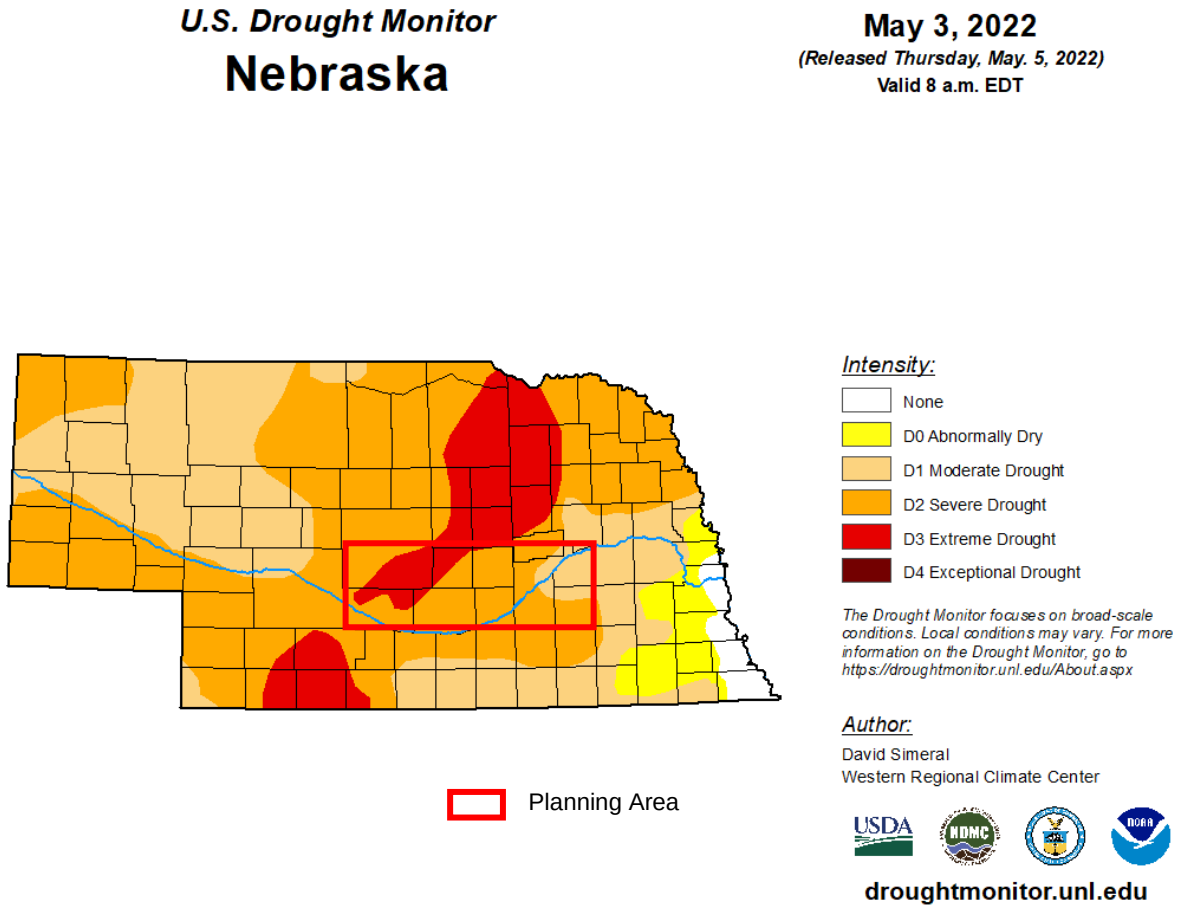
Drought Magnitude	Total Months	Percent Chance
-1 Magnitude (Mild)	188/1,513	12.4%
-2 Magnitude (Moderate)	100/1,513	6.6%
-3 Magnitude (Severe)	49/1,513	3.2%
-4 Magnitude or Greater (Extreme)	107/1,513	7.1%
Total Months in Drought	**444/1,513**	**29.3%**
Total Months not in Drought	**1,069/1,513**	**70.7%**

Source: NCEI, Jan 1895-June 2021

As of February 2022, the planning area is experiencing either a D1 (Moderate Drought), D2 (Severe Drought), or D3 (Extreme Drought) per the US Drought Monitor (Figure 21).

75 NOAA National Centers for Environmental Information. Feb 2021. "Data Tools: 1981-2010 Normals." [datafile]. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.
76 NOAA National Centers for Environmental Information. July 2021. "Data Tools: 1981-2010 Normals." [datafile]. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

Figure 21: U.S. Drought Monitor



Source: National Drought Mitigation Center, May 2022

The 2012 drought event is the most recent significant event on record for the planning area; however, the overall event did not warrant a presidential disaster declaration within Nebraska. The whole state of Nebraska was in severe drought conditions from the middle of July in 2012 to the end of May in 2013 and over 70% of the state was in exceptional drought conditions for over eight months. Numerous cities implemented mandatory water restrictions, and some encouraged voluntarily water conservation during the period of drought. As many as 81 municipal water systems in the state experienced drought-related water supply issues in 2012 according to the Nebraska Department of Health and Human Services.

Average Annual Losses

The annual property estimates for the five-county region was determined based upon NCEI Storm Events Database since 1996. Annual crop loss for the five-county region was determined based upon the RMA Cause of Loss Historical Database since 2000. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. High demand and intense use of air conditioning or water pumps can overload the electrical systems and damage infrastructure. Potential resultant power outages could affect businesses, homes, and critical facilities.

Table 46: Loss Estimate for Drought

Hazard Type	Total Property Loss[2]	Average Annual Property Loss[2]	Total Crop Loss[3]	Average Annual Crop Loss[3]
Drought	$0	$0	$76,993,162	$3,849,658

Source: 1 HPRCC (1878-2021); 2 Indicates data is from NCEI (Jan 1996 to June 2021); 3 Indicates data is from USDA RMA (2000 to 2020)

Probability

Based on historical occurrences, drought conditions are also likely to occur regularly in the planning area. The following table summarizes the magnitude of drought and monthly probability of occurrence.

Table 47: Period of Record in Drought

PDSI Value	Magnitude	Drought Occurrences by Month	Monthly Probability
4 or more to -0.99	No Drought	1,069/1,513	70.7%
-1.0 to -1.99	Mild Drought	188/1,513	12.4%
-2.0 to -2.99	Moderate Drought	100/1,513	6.6%
-3.0 to -3.99	Severe Drought	49/1,513	3.2%
-4.0 or less	Extreme Drought	107/1,513	7.1%

Source: NCEI, Jan 1895-June 2021

Community Top Hazard Status

The following table lists jurisdictions which identified drought as a top hazard of concern.

Jurisdiction	
Buffalo County	Gibbon Volunteer Fire District
Clarks	Kearney
Cozad	Merrick County
Dawson County	Osceola
Eddyville Fire District	Ravenna
Elm Creek Fire District	Shelby
Eustis-Farnam Public Schools	Silver Creek

Regional Vulnerabilities

The Drought Impact Reporter is a database of drought impacts throughout the United States, with data going back to 2000. The Drought Impact Reporter has recorded a total of 136 drought-related impacts throughout the region. One drought impact in 2003 cost Central Nebraska Public Power District approximately $5 million after water shortages in Lake McConaughy reduced the ability to generate hydroelectricity. The event impacted residents in multiple counties, including Dawson County. Other notable drought impacts are summarized in the following table. This is not a comprehensive list of droughts that may have impacted the planning area, however.

Table 48: Notable Drought Impacts in Planning Area

Category	Date	Affected Counties	Title
Energy, Water Supply & Quality	5/10/2013	Dawson	Electric power generation levels below peak production for Central Nebraska Public Power District
Plants & Wildlife, Water Supply & Quality	8/6/2012	Buffalo, Hall, Merrick, and Polk	Thousands of fish dead in dry Lower Platte River in Nebraska
Agriculture, Relief, Response & Restrictions, Water Supply & Quality	7/19/2012	Buffalo, Dawson, Hall, Merrick, and Polk	Low flow in several Nebraska rivers brought surface irrigation closures
Plants & Wildlife	6/1/2012	Dawson	Many trees in western Nebraska died from drought, high temperatures and strong winds in 2012
Water Supply & Quality	1/1/2003	Dawson	Central Nebraska Public Power and Irrigation District, which owns Lake McConaughy, lost a total of about $5 million dollars in 2003-2004 because there was not enough water in the lake to generate hydroelectricity

Source: NDMC, 2000-Sept 2021[77]

The following table provides information related to regional vulnerabilities. For jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*. The Central Platte NRD completed a Drought Management Plan in 2020 to help respond to and manage the impacts of future drought events.

Table 49: Regional Drought Vulnerabilities

Sector	Vulnerability
People	-Insufficient water supply -Loss of jobs in agricultural sector -Residents in poverty if food prices increase
Economic	-Closure of water intensive businesses (carwashes, pools, etc.) -Short-term interruption of business -Loss of tourism dollars -Decrease in cattle prices -Decrease of land prices→ jeopardizes educational funds -Decrease in recreational outdoor activities
Built Environment	-Cracking foundations (residential and commercial structures) -Damages to landscapes
Infrastructure	-Damages to waterlines below ground -Damages to roadways (prolonged extreme events)
Critical Facilities	-Loss of power and impact on infrastructure
Climate	-Increased risk of wildfire events, damaging buildings and agricultural land

[77] National Drought Mitigation Center. 2021. "U.S. Drought Impact Reporter." Accessed September 2021. http://droughtreporter.unl.edu/map/.

Earthquakes

An earthquake is the result of a sudden release of energy in the Earth's tectonic plates that creates seismic waves. The seismic activity of an area refers to the frequency, type, and size of earthquakes experienced over a period of time. Ground shaking, landslides, liquefaction, and amplification are the specific hazards associated with earthquakes. The severity of these hazards depends on several factors, including soil and slope conditions, proximity to a fault, earthquake magnitude, and type of earthquake. Although rather uncommon, earthquakes do occur in Nebraska and are usually small, generally not felt, and cause little to no damage.

- **Ground shaking** is the motion felt on the earth's surface caused by seismic waves generated by an earthquake. Ground shaking is the primary cause of earthquake damage. The strength of ground shaking depends on the magnitude of the earthquake, the type of fault, and distance from the epicenter (where the earthquake originates). Buildings on poorly consolidated and thick soils will typically see more damage than buildings on consolidated soils and bedrock.

- **Earthquake-induced landslides** are secondary earthquake hazards that occur from ground shaking. They can destroy roads, buildings, utilities, and other critical facilities necessary to respond to recover from an earthquake.

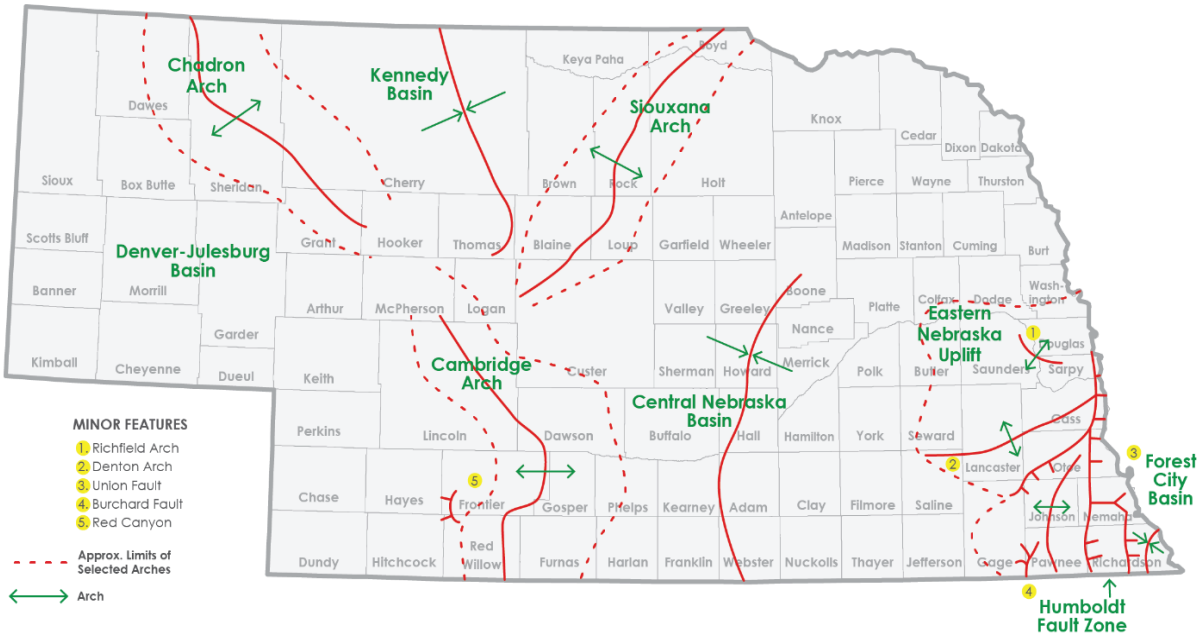
- **Liquefaction** occurs when ground shaking causes wet granular soils to change from a solid state to a liquid state. This results in the loss of soil strength and the soil's ability to support weight. Buildings and their occupants are at risk when the ground can no longer support these buildings and structures.

- **Amplification** is the phenomenon when soils and soft sedimentary rocks near the earth's surface increase the magnitude of the seismic waves generated by the earthquake. The amount of amplification is determined by the thickness of geologic materials and their physical properties. Buildings and structures built on soft and unconsolidated soils face greater risk.

Location

The planning area has two fault lines crossing it. The Cambridge Arch Fault is active in Dawson County, and the Central Nebraska Basin fault is active in Hall County. The following figure shows the fault lines in Nebraska.

Figure 22: Fault Lines in Nebraska



Source: Nebraska Department of Natural Resources

Extent

Earthquakes are measured by magnitude and intensity. Magnitude is measured by the Richter Scale, a base-10 logarithmic scale, which uses seismographs around the world to measure the amount of energy released by an earthquake. Intensity is measured by the Modified Mercalli Intensity Scale, which determines the intensity of an earthquake by comparing actual damage against damage patterns of earthquakes with known intensities. The following tables summarize the Richter Scale and Modified Mercalli Scale. Any earthquake that was to occur in the planning area, it would likely measure between 4.0 or less on the Richter Scale.

Table 50: Richter Scale

Richter Magnitudes	Earthquake Effects
Less than 3.5	Generally not felt, but recorded.
3.5 – 5.4	Often felt, but rarely causes damage.
Under 6.0	At most, slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1 – 6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0 – 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or greater	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Source: FEMA, 2021[78]

78 Federal Emergency Management Agency. 2021. "Earthquake Risk." https://www.fema.gov/emergency-managers/risk-management/earthquake

Table 51: Modified Mercalli Intensity Scale

Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs	
II	Feeble	Some people feel it	< 4.2
III	Slight	Felt by people resting, like a truck rumbling by	
IV	Moderate	Felt by people walking	
V	Slightly Strong	Sleepers awake; church bells ring	< 4.8
VI	Strong	Trees sway; suspended objects swing, objects fall off shelves	< 5.4
VII	Very Strong	Mild Alarm; walls crack; plaster falls	< 6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open	< 6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	< 7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards	< 8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves	> 8.1

Source: FEMA, 2021

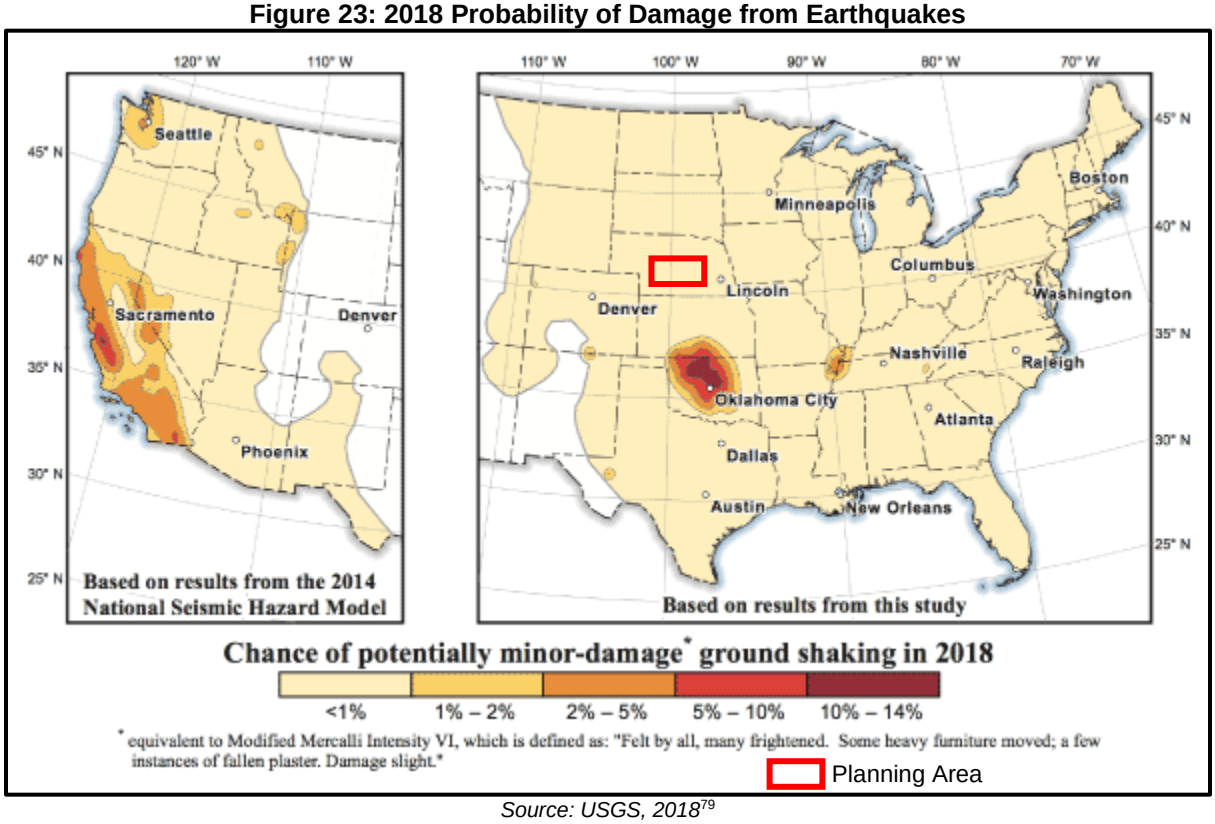
Historical Occurrences

According to the United States Geological Survey (USGS), there has been one earthquake that has occurred in the planning area since 1900. The earthquake occurred in northern Dawson County on September 26, 2010. The earthquake had a magnitude of 3.1.

Average Annual Losses

Due to the lack of sufficient earthquake data, limited resources, extremely low earthquake risk for the area, and no recorded damages with the reports of historical occurrences, it is not feasible to utilize the 'event damage estimate formula' to estimate potential losses for the planning area. Figure 23 shows the probability of damage from earthquakes, according to the USGS. The figure shows that the planning area has a less than one percent chance of damages from earthquakes.

Figure 23: 2018 Probability of Damage from Earthquakes



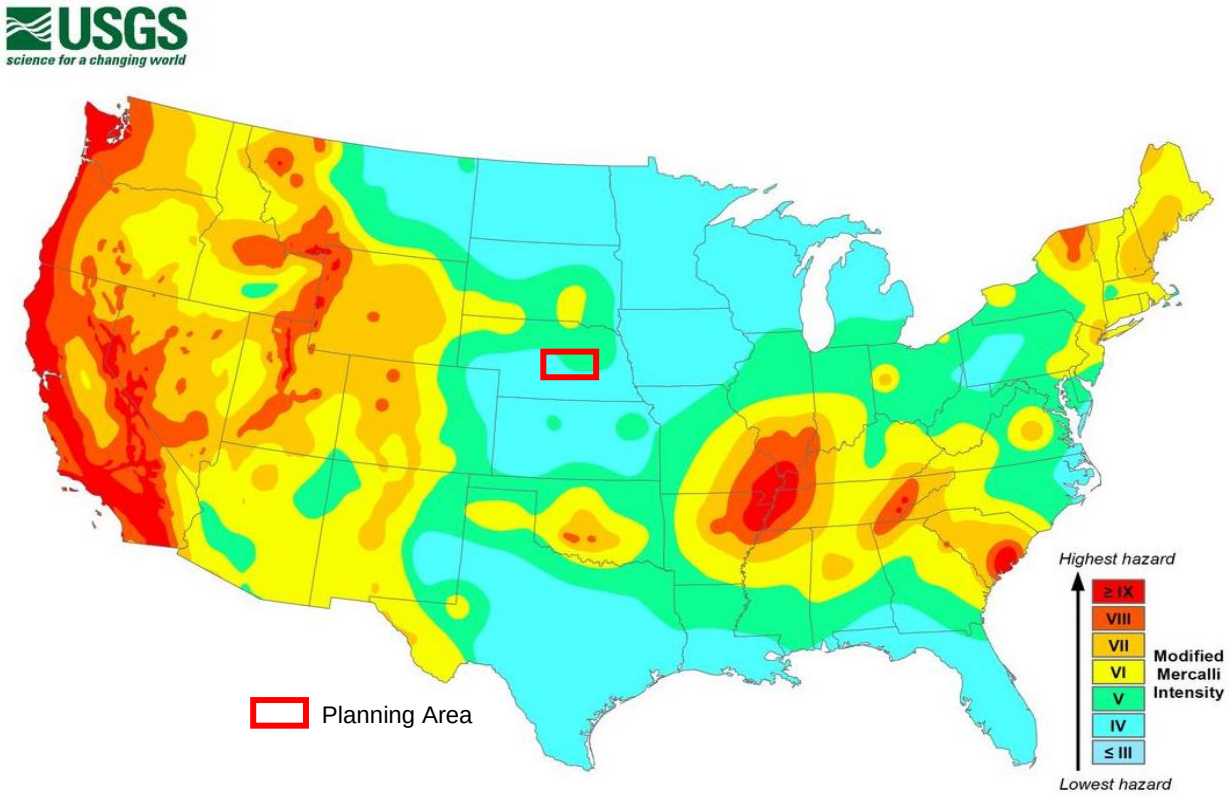
Source: USGS, 2018[79]

Probability

The following figure visualizes the probability of a 5.0 or greater earthquake occurring in the planning area within 50 years. Based on only one earthquakes occurrence over 120-year period, the probability of an earthquake in the five-county region in any given year is less than one percent.

79 United States Geological Survey. 2018. "Short-term Induced Seismicity Models: 2018 One-Year Model." https://www.usgs.gov/programs/earthquake-hazards/science/short-term-induced-seismicity-models.

Figure 24: Earthquake Probability



USGS map showing the intensity of potential earthquake ground shaking that has a 2% chance of occurring in 50 years

Source: USGS 2009 PSHA Model

Community Top Hazard Status

The following table lists jurisdictions which identified earthquakes as a top hazard of concern.

Jurisdiction	
Central Platte NRD	

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 52: Regional Earthquakes Vulnerabilities

Sector	Vulnerability
People	-Risk of injury or death from falling objects and structures
Economic	-Short term interruption of business
Built Environment	-Damage to buildings, homes, or other structures from foundation cracking, falling objects, shattered windows, etc.
Infrastructure	-Damage to subterranean infrastructure (i.e. waterlines, gas lines, etc.) -Damage to roadways
Critical Facilities	-Same as all other structures
Climate	-None

Extreme Heat

Extreme heat is often associated with periods of drought but can also be characterized by long periods of high temperatures in combination with high humidity. During these conditions, the human body has difficulty cooling through the normal method of the evaporation of perspiration. Health risks arise when a person is overexposed to heat. Extreme heat can also cause people to overuse air conditioners, which can lead to power failures. Power outages for prolonged periods increase the risk of heat stroke and subsequent fatalities due to loss of cooling and proper ventilation. The planning area is largely rural, which presents an added vulnerability to extreme heat events; those suffering from an extreme heat event may be farther away from medical resources as compared to those living in an urban setting.

Along with humans, animals also can be affected by high temperatures and humidity. Cattle and other farm animals respond to heat by reducing feed intake, increasing their respiration rate, and increasing their body temperature. These responses assist the animal in cooling itself, but this is usually not sufficient. When animals overheat, they will begin to shut down body processes not vital to survival, such as milk production, reproduction, or muscle building.

Other secondary concerns connected to extreme heat hazards include water shortages brought on by drought-like conditions and high demand. Government authorities report that civil disturbances and riots are more likely to occur during heat waves. In cities, pollution becomes a problem because the heat traps pollutants in densely populated urban areas. Adding pollution to the stresses associated with the heat magnifies the health threat to the urban population.

The National Weather Service (NWS) is responsible for issuing excessive heat outlooks, excessive heat watches, and excessive heat warnings.

- **Excessive heat outlooks** are issued when the potential exists for an excessive heat event in the next three to seven days. Excessive heat outlooks can be utilized by public utility staffs, emergency managers, and public health officials to plan for extreme heat events.

- **Excessive heat watches** are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours.

- **Excessive heat warnings** are issued when an excessive heat event is expected in the next 36 hours. Excessive heat warnings are issued when an extreme heat event is occurring, is imminent, or has a very high probability of occurring.

Location

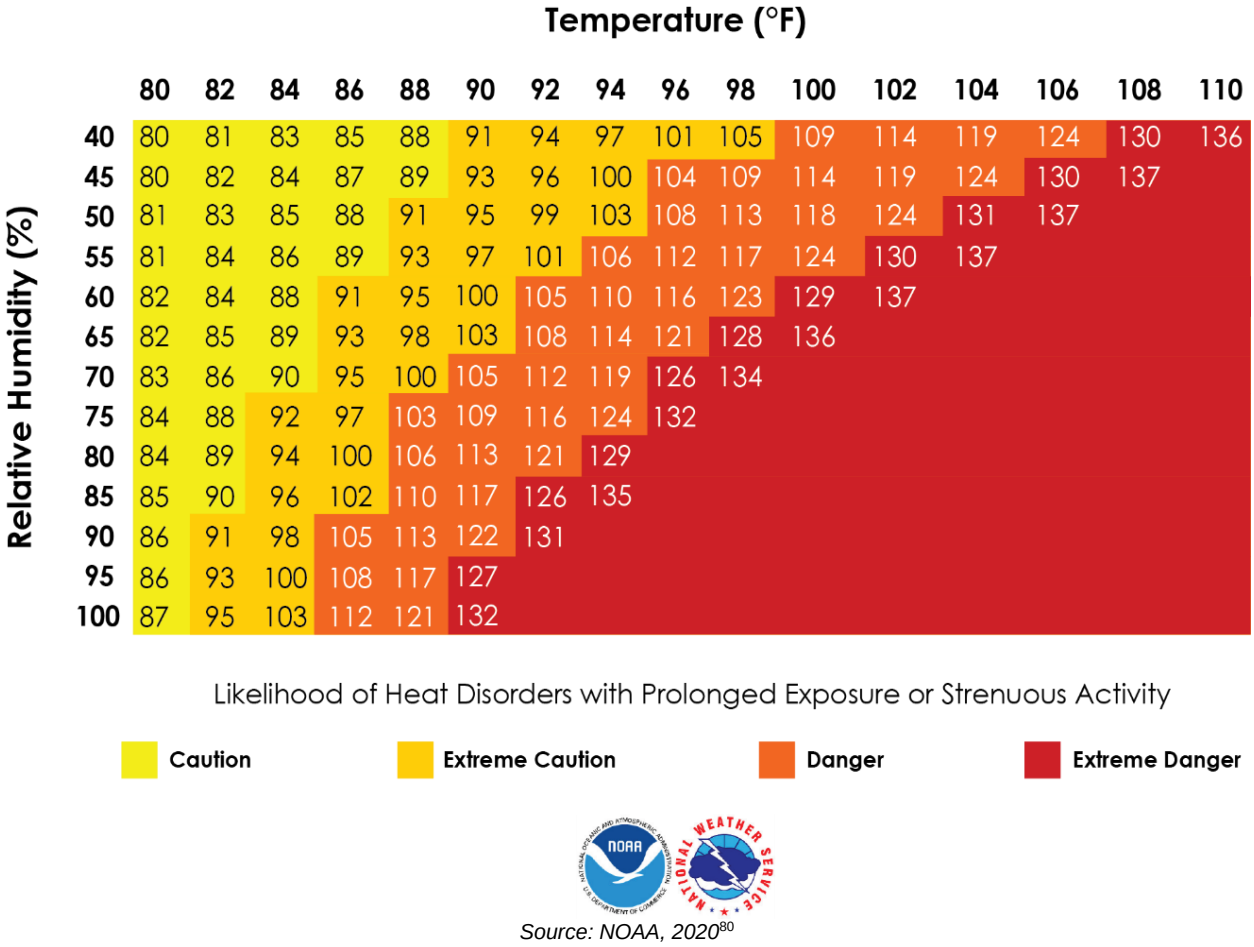
The entire planning area is susceptible to extreme heat impacts.

Extent

A key factor to consider regarding extreme heat situations is the humidity level relative to the temperature. As is indicated in the following figure from the National Oceanic and Atmospheric Administration, as the relative humidity increases, the temperature needed to cause a dangerous situation decreases. For example, for 100% relative humidity, dangerous levels of heat begin at 86°F whereas a relative humidity of 50%, require 94°F. The combination of relative humidity and temperature result in a heat index as demonstrated below:

Figure 25 is designed for shady and light wind conditions. Exposure to full sunshine or strong winds can increase hazardous conditions and raise heat index values by up to 15°F. For the purposes of this plan, extreme heat is being defined as temperatures of 100°F or greater. In the planning area, the months with the highest temperatures are June, July, and August.

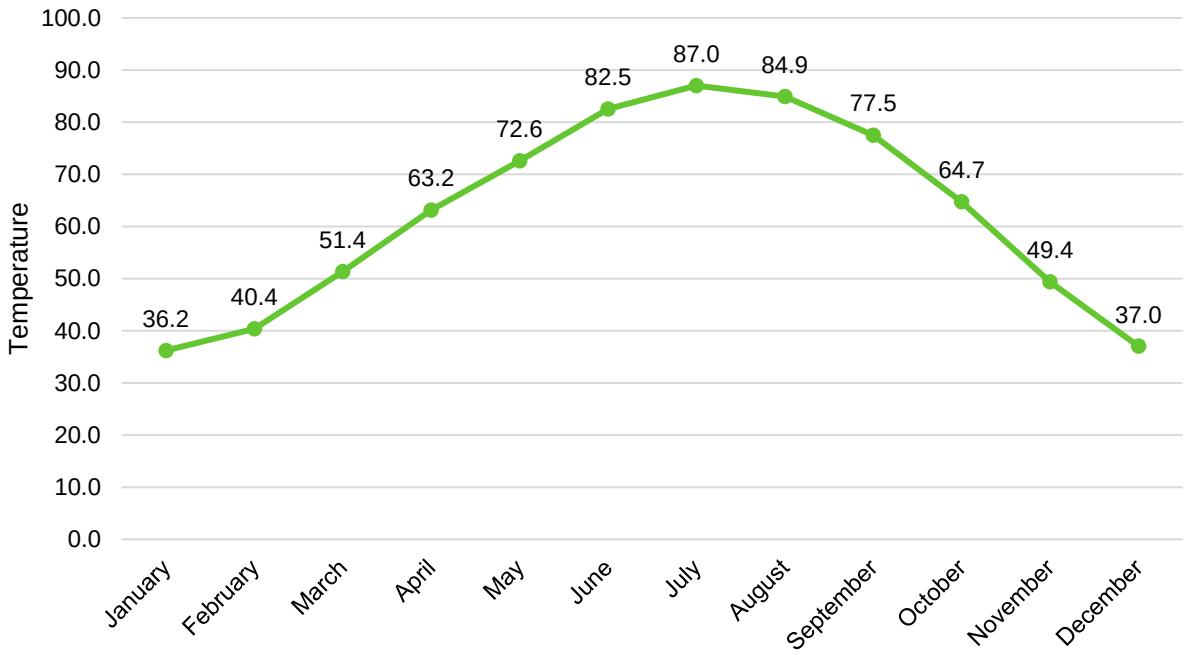
Figure 25: NOAA Heat Index



Source: NOAA, 2020[80]

80 National Oceanic and Atmospheric Administration, National Weather Service. 2020. "Heat Index." http://www.nws.noaa.gov/om/heat/heat_index.shtml.

Figure 26: Monthly Climate Normals Max Temperature (1981-2010)

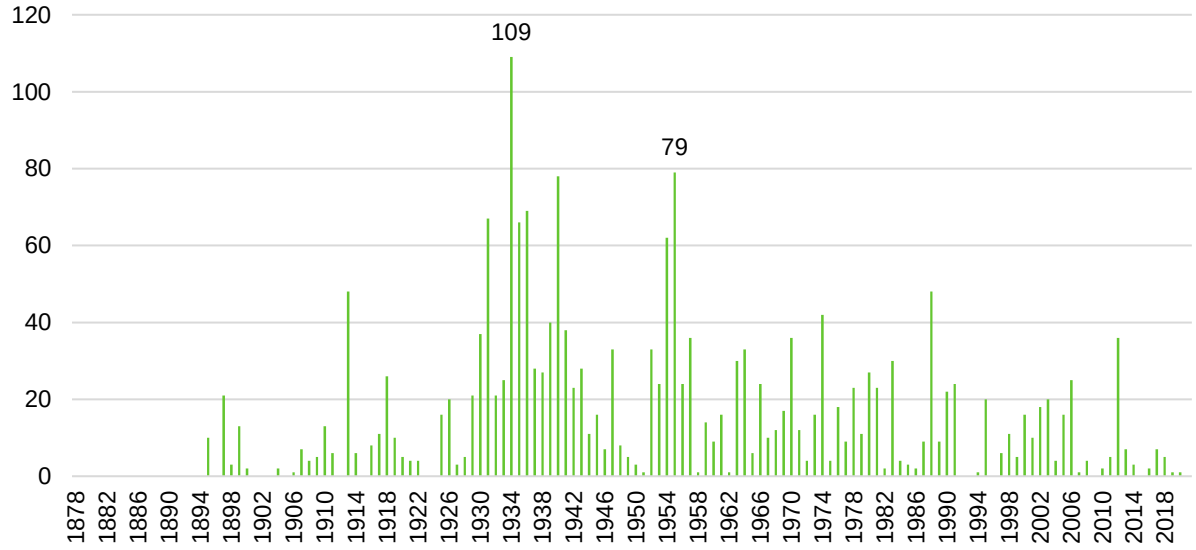


Source: NCEI, 2021

Historical Occurrences

According to the High Plains Regional Climate Center (HPRCC), on average, the planning area experiences six days above 100°F per year. The planning area experienced the most days on record above 100°F in 1934 with 109 days and in 1955 with 79 days. Conversely, 2020 was the most recent "coolest" year on record, with only one day above 100°F.

Figure 27: Number of Days Above 100°F



Source: HPRCC, 1878-2021

Average Annual Losses

The annual property estimate was determined based upon NCEI Storm Events Database since 1996. The annual crop loss was determined based upon the RMA Cause of Loss Historical Database since 2000. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. The direct and indirect effects of extreme heat are difficult to quantify. Potential losses such as power outages could affect businesses, homes, and critical facilities. High demand and intense use of air conditioning or water pumps can overload the electrical systems and damage infrastructure.

Table 53: Loss Estimate for Extreme Heat

Hazard Type	Avg. Number of Days Above 100°F[1]	Total Property Loss[2]	Average Annual Property Loss[2]	Total Crop Loss[3]	Average Annual Crop Loss[3]
Extreme Heat	6 days	$0	$0	$25,937,061	$1,296,853

Source: 1 HPRCC (1899-2021); 2 Indicates data is from NCEI (Jan 1996 to June 2021); 3 Indicates data is from USDA RMA (2000 to 2020)

Estimated Loss of Electricity

According to the FEMA Benefit Cost Analysis Reference Guide, if an extreme heat event occurred within the planning area, the following table assumes the event could potentially cause a loss of electricity for 10% of the population at a cost of $126 per person per day.[81] In rural areas, the percent of the population affected, and duration may increase during extreme events. The assumed damages do not take into account physical damages to utility equipment and infrastructure.

Table 54: Loss of Electricity - Assumed Damage by Jurisdiction

Jurisdiction	(est.) 2020 Population	Population Affected (Assumed)	Electric Loss of Use Assumed Damage Per Day
Buffalo	50,084	5,008	$631,008
Dawson	24,111	2,411	$303,786
Hall	62,895	6,290	$792,540
Merrick	7,668	767	$96,642
Polk	5,214	521	$65,646
Total	**149,972**	**14,997**	**$1,889,622**

Probability

Extreme heat is a regular part of the climate for the planning area; with 112 years out of 144 having at least one day of 100°F. The probability that extreme heat will occur in any given year in the planning area is 78 percent.

The Union for Concerned Scientists released a report in July 2019 titled *Killer Heat in the United States: Climate Choices and the Future of Dangerously Hot Days*[82] which included predictions for extreme heat events in the future dependent on future climate actions. The table below summarizes those findings for the planning area.

81 Federal Emergency Management Agency. June 2009. "BCA Reference Guide."
82 Union of Concerned Scientists. 2019. "Killer Heat in the United States: Climate Choices and the Future of Dangerously Hot Days." https://www.ucsusa.org/sites/default/files/attach/2019/07/killer-heat-analysis-full-report.pdf.

Table 55: Extreme Heat Predictions for Days over 100F

Jurisdiction	Midcentury Prediction 2036-2065 (Days per year)	Late Century Prediction 2070-2099 (Days per year)
Buffalo	25	51
Dawson	21	47
Hall	30	57
Merrick	34	61
Polk	36	63

Source: Union of Concerned Scientists, 2022[83]

Community Top Hazard Status

The following table lists jurisdictions which identified extreme heat as a top hazard of concern.

Jurisdiction	
Central District Health Department Lexington	Riverdale

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities. For jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 56: Regional Extreme Heat Vulnerabilities

Sector	Vulnerability
People	-Heat exhaustion -Heat stroke Vulnerable populations include: -People working outdoors -People without air conditioning -Young children outdoors or without air conditioning -Elderly outdoors or without air conditioning
Economic	-Short-term interruption of business -Loss of power -Agricultural losses
Built Environment	-Damage to air conditioning/HVAC systems if overworked
Infrastructure	-Damages to roadways (prolonged extreme events) -Stressing electrical systems (brownouts during peak usage)
Critical Facilities	-Loss of power
Climate	-Increased risk of wildfire events -Increases in extreme heat conditions are likely, adding stress on livestock, crops, people, and infrastructure

83 Union of Concerned Scientists. 2022. “Extreme Heat and Climate Change: Interactive Tool”. https://www.ucsusa.org/resources/killer-heat-interactive-tool?location=polk-county--ne

Flooding

Flooding can occur on a local level, sometimes affecting only a few streets, but can also extend throughout an entire district, affecting whole drainage basins and impacting property in multiple states. Heavy accumulations of ice or snow can also cause flooding during the melting and freezing stages. These events are complicated by the freeze/thaw cycles characterized by moisture thawing during the day and freezing at night. There are four main types of flooding: riverine flooding, flash flooding, stormwater flooding, and ice jam flooding.

Riverine Flooding

Riverine flooding, typically slower developing with a moderate to long warning time, is defined as the overflow of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt or ice melt. The areas adjacent to rivers and stream banks that carry excess floodwater called floodplains. A floodplain or flood risk area is defined as the lowland and relatively flat area adjoining a river or stream. The terms “base flood” and “100-year flood” refer to the area in the floodplain that is subject to a one percent or greater chance of flooding in any given year. Floodplains are part of a larger entity called a basin or watershed, which is defined as all the land drained by a particular river and its tributaries.

Flash Flooding

Flash floods, typically rapidly developing with little to no warning time, result from convective precipitation usually due to intense thunderstorms or sudden releases due to a failure of an upstream impoundment created behind a dam, landslide, or levee. Flash floods are distinguished from regular floods by a timescale of fewer than six hours. Flash floods cause the most flood-related deaths because of this shorter timescale.

Stormwater Flooding

In some cases, flooding may not be directly attributable to a river, stream, or lake overflowing its banks. Rather, it may simply be the combination of excessive rainfall or snowmelt, saturated ground, and inadequate drainage capacity. With no place to go, the water will find the lowest elevations – areas that are often not in a floodplain. This type of flooding, often referred to as stormwater flooding, is becoming increasingly prevalent as development exceeds the capacity of drainage infrastructure, therefore limiting its ability to convey stormwater. Flooding also occurs due to combined storm and sanitary sewers being overwhelmed by the high flows that often accompany storm events. Typical impacts range from dangerously flooded roads to water backing up into homes or basements, which damages mechanical systems and can create serious public health and safety concerns.

Ice Jam Flooding

Ice jams occur when ice breaks up in moving waterways, and then stacks on itself where channels narrow, or human-made obstructions constrict the channel. This creates an ice dam, often causing flooding within minutes of the dam formation. The thickness of this ice sheet depends upon the degree and duration of cold weather in the area. This ice sheet can freeze to the bottom of the channel in places. During spring thaw or winter freezing, rivers frequently become clogged with this winter accumulation of ice. Because of relatively low stream banks and channels blocked with ice, rivers overtop existing banks and flow overland. This type of flooding tends to ore frequently occur on wide, shallow rivers such as the Platte, although other rivers can be impacted.

Location

The region resides in the Middle Platte, Loup, and Big Blue watersheds. These rivers as well as their tributaries are potential locations for flooding to occur. Table 57 shows current statuses of Flood Insurance Rate Map (FIRM) panels. Figure 28 shows the FIRM panels for the planning area. For jurisdictional-specific maps as well as an inventory of structures in the floodplain, please refer to *Section Seven: Participant Sections.*

A 2020 watershed study of Wood River conducted by the Nebraska Silver Jackets found that the flow frequency is larger than the effective Flood Insurance Study for the Kearney to Alda reach of the Wood River.

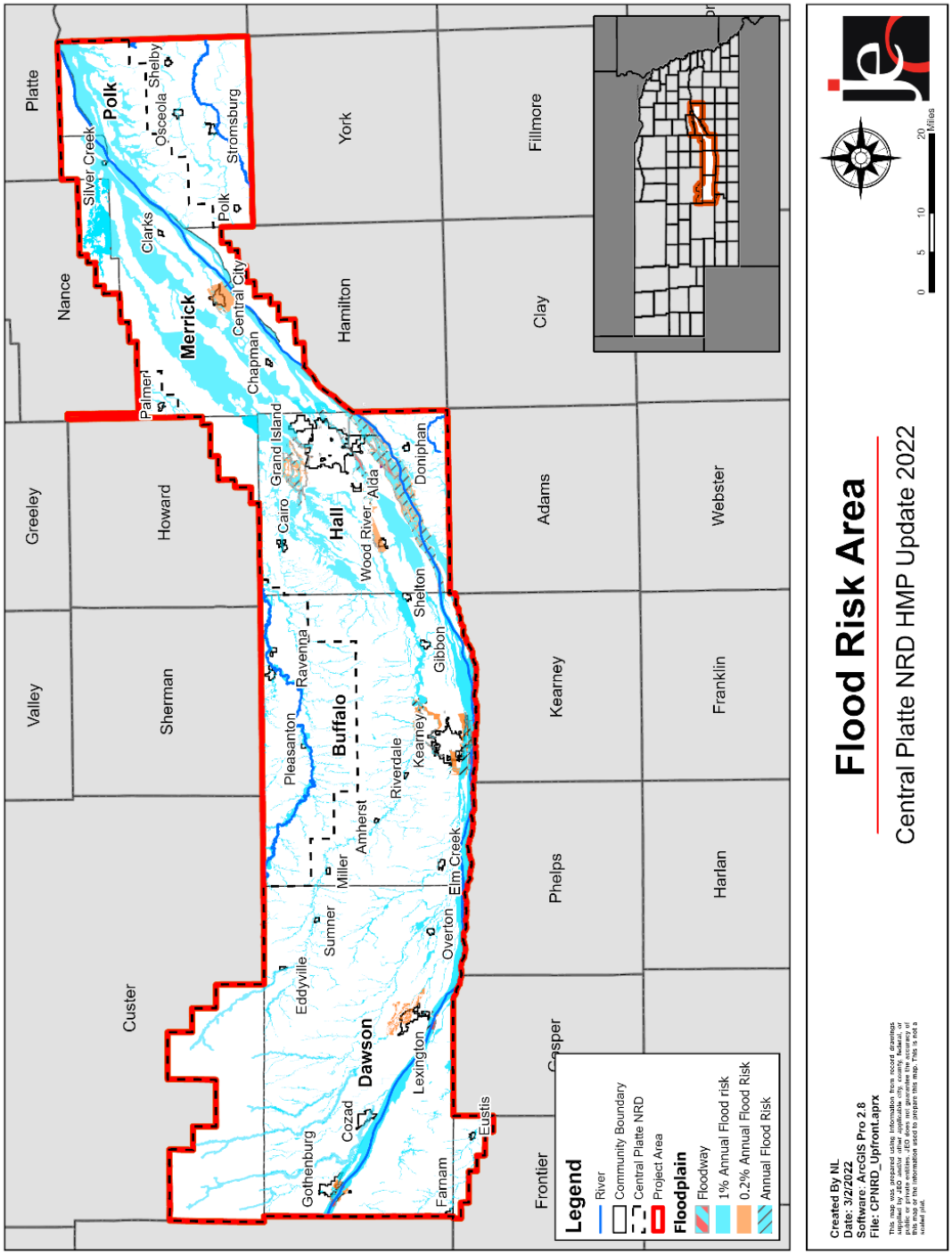
Table 57: FEMA FIRM Panel Status

Jurisdiction	Participating in NFIP (Y/N)	Panel Number	Effective Date
Buffalo County	Y	31019CIND0A, 31019C0025D, 31019C0050D, 31019C0075D, 31019C0100D, 31019C0150D, 31019C0175D, 31019C0250D, 31019C0275D, 31019C0300D, 31019C0325D, 31019C0350D, 31019C0375D, 31019C0400D, 31019C0525D, 31019C0550D, 31019C0575D, 31019C0675D, 31019C0700D	11/26/2010
Amherst	Y	31019CIND0A, 31019C0385D, 31019C0425D	11/26/2010
Elm Creek	Y	31019CIND0A, 31019C0535D, 31019C0555D	11/26/2010
Gibbon	Y	31019CIND0A, 31019C0475D, 31019C0490D, 31019C0650D, 31019C0655D	11/26/2010
Kearney	Y	31019CIND0A, 31019C0420D, 31019C0440D, 31019C0450D, 31019C0585D, 31019C0600D, 31019C0605D, 31019C0610D, 31019C0615D, 31019C0620D, 31019C0650D	11/26/2010
Miller	N	31019CIND0A, 31019C0195D, 31019C0200D, 31019C0225D	11/26/2010
Pleasanton	Y	31019CIND0A, 31019C0255D	11/26/2010
Ravenna	Y	31019CIND0A, 31019C0120D, 31019C0125D	11/26/2010
Riverdale	Y	31019CIND0A, 31019C0420D	11/26/2010
Shelton	Y	31019CIND0A, 31019C0500D, 31019C0515D	11/26/2010
Dawson County	Y	31047CIND0A, 31047C0025C, 31047C0050C, 31047C0075C, 31047C0100C, 31047C0125C, 31047C0150C, 31047C0175C, 31047C0275C, 31047C0300C, 31047C0375C, 31047C0400C, 31047C0425C, 31047C0525C, 31047C0575C, 31047C0600C, 31047C0700C	05/03/2011
Cozad	Y	31047CIND0A, 31047C0220C, 31047C0250C, 31047C0385C, 31047C0405C	05/03/2011
Eddyville	N	31047CIND0A, 31047C0120C, 31047C0140C	05/03/2011
Farnam	Y	31047CIND0A, 31047C0530C, 31047C0550C	05/03/2011
Gothenburg	Y	31047CIND0A, 31047C0185C, 31047C0191C, 31047C0192C, 31047C0195C, 31047C0200C, 31047C0225C	05/03/2011
Lexington	Y	31047CIND0A, 31047C0435C, 31047C0442C, 31047C0444C, 31047C0450C, 31047C0461C, 31047C0462C, 31047C0463C, 31047C0464C, 31047C0475C, 31047C0625C, 31047C0626C, 31047C0650C	05/03/2011
Overton	Y	31047CIND0A, 31047C0500C, 31047C0660C, 31047C0675C	05/03/2011

Jurisdiction	Participating in NFIP (Y/N)	Panel Number	Effective Date
Sumner	Y	31047CIND0A, 31047C0310C, 31047C0325C, 31047C0350C	05/03/2011
Hall County	Y	31001CIND0A, 31035CIND0A, 31079CIND0A, 31081CIND0A, 31001C0100C, 31035C0025C, 31035C0050C, 31079C0025D, 31079C0050D, 31079C0075D, 31079C0125D, 31079C0150D, 31079C0250D, 31079C0325D, 31079C0350D, 31079C0375D, 31079C0400D, 31081C0375D	09/26/2008
Alda	Y	31079CIND0A, 31079C0163D, 31079C0251D, 31079C0252D, 31079C0256D	09/26/2008
Cairo	Y	31079CIND0A, 31079C0019D, 31079C0038D, 31079C0039D, 31079C0107D, 31079C0127D	09/26/2008
Doniphan	Y	31079CIND0A, 31079C0267D, 31079C0269D, 31079C0286D, 31079C0288D, 31079C0289D	
Grand Island	Y	31079CIND0A, 31079C0100D, 31079C0157D, 31079C0158D, 31079C0159D, 31079C0167D, 31079C0168D, 31079C0169D, 31079C0175D, 31079C0178D, 31079C0183D, 31079C0186D, 31079C0187D, 31079C0188D, 31079C0189D, 31079C0191D, 31079C0193D, 31079C0200D, 31079C0252D, 31079C0256D, 31079C0257D, 31079C0275D, 31079C0276D, 31079C0277D, 31079C0300D	09/26/2008
Wood River	Y	31079CIND0A, 31079C0209D, 31079C0225D, 31079C0228D, 31079C0229D, 31079C0236D, 31079C0237D	09/26/2008
Merrick County	Y	31121CIND0A, 31121C0100D, 31121C0125D, 31121C0175D, 31121C0200D, 31121C0250D, 31121C0300D, 31121C0315D, 31121C0325D, 31121C0350D, 31121C0375D, 31121C0400D, 31121C0425D, 31121C0470D, 31121C0475D, 31121C0500D, 31121C0525D, 31121C0550D, 31121C0575D, 31121C0585D	01/06/2010
Central City	Y	31121CIND0A, 31121C0320D, 31121C0340D, 31121C0460D, 31121C0480D	01/06/2010
Chapman	Y	31121CIND0A, 31121C0450D	01/06/2010
Clarks	Y	31121CIND0A, 31121C0355D, 31121C0360D	01/06/2010
Palmer	N	31121CIND0A, 31121C0275D	01/06/2010
Silver Creek	Y	31121CIND0A, 31121C0225D	01/06/2010
Polk County	Y	31143CIND0A, 31143C0025C, 31143C0050C, 31143C0075C, 31143C0100C, 31143C0125C, 31143C0150C, 31143C0175C, 31143C0200C, 31143C0250C, 31143C0275C, 31143C0325C, 31143C0375C, 31143C0400C	08/19/2008
Osceola	Y	31143CIND0A, 31143C0220C, 31143C0225C	08/19/2008
Polk	N	31143CIND0A, 31143C0300C	08/19/2008
Shelby	N	N/A	-
Stromsburg	Y	31143CIND0A, 31143C0220C, 31143C0225C, 31143C0326C, 31143C0327C, 31143C0350C	08/19/2008
Eustis (Frontier County)	Y	31063CIND0A, 31063C0175C	04/02/2008

Source: FEMA, 2022[84],[85]

Figure 28: 1% and 0.2% Annual Flood Risk Hazard Areas



84 Federal Emergency Management Agency. 2021. "FEMA Flood Map Service Center." Accessed March 2022. http://msc.fema.gov/portal/advanceSearch.

85 Federal Emergency Management Agency. 2020. "Community Status Book Report." Accessed March 2022. https://www.fema.gov/national-flood-insurance-program-community-status-book.

Risk MAP Products

Risk Mapping, Assessment, and Planning (Risk MAP) is a FEMA program that provides communities with flood information and additional flood risk data (e.g., flood depth grids, percent chance grids, areas of mitigation interest, etc.) that can be used to enhance their mitigation plans and better protect their citizens. A portion of Hall County and Polk County, including the Village of Doniphan, City of Osceola, Village of Polk, and Village of Shelby have gone through the Risk MAP process. Specific Risk MAP information is included in the individual community profiles for those jurisdictions. Figure 30 and Figure 31 show the boundary for the Risk MAP projects. There are currently no planned Risk MAP projects in the planning area. NeDNR hosts the Risk MAP products on an interactive web map, which can be viewed on their webpage: https://dnr.nebraska.gov/floodplain.

Extent

The NWS has three categories to define the severity of a flood once a river reaches flood stage as indicated in Table 58.

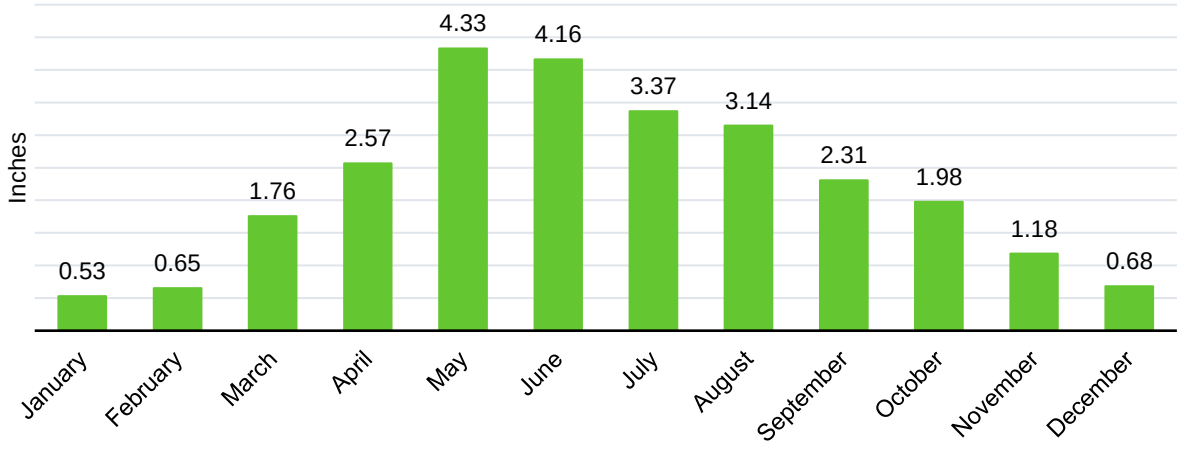
Table 58: Flooding Stages

Flood Stage	Description of flood impacts
Minor Flooding	Minimal or no property damage, but possibly some public threat or inconvenience
Moderate Flooding	Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary
Major Flooding	Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations

Source: NOAA, 2017[86]

Figure 29 shows the normal average monthly precipitation for the planning area, which is helpful in determining whether any given month is above, below, or near normal in precipitation. As indicated in Figure 32, the most common months for flooding within the planning area are May and June.

Figure 29: Average Monthly Precipitation for Planning Area



Source: NCEI, 2021[87]

86 National Weather Service. 2017. “Flood Safety.” https://www.weather.gov/safety/flood.
87 NOAA National Centers for Environmental Information. December 2019. "Data Tools: 1981-2010 Normals." [datafile]. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

Figure 30: Flood Risk Map - West Fork Big Blue Watershed

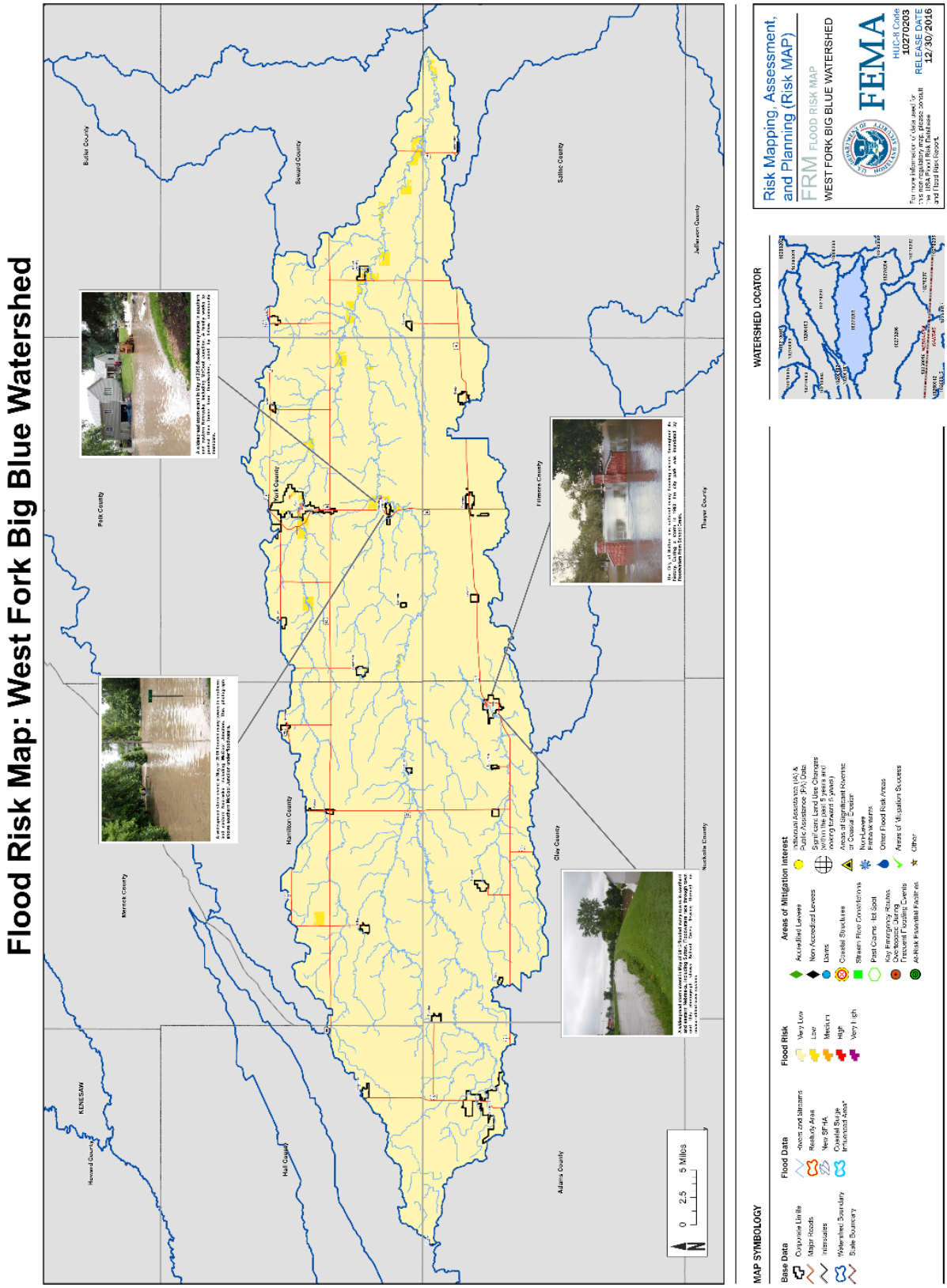


Figure 31: Flood Risk Map - Upper Big Blue Watershed

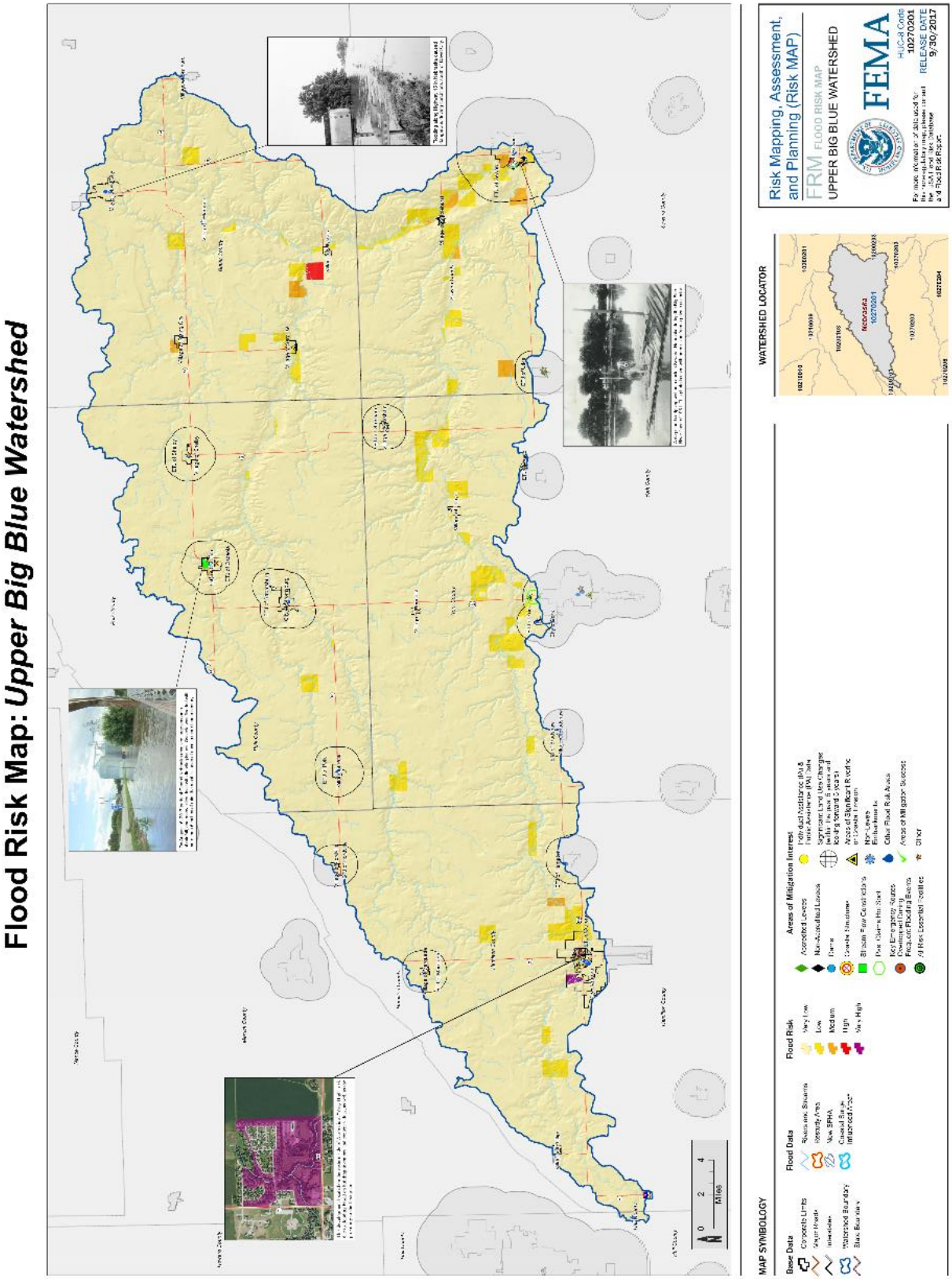
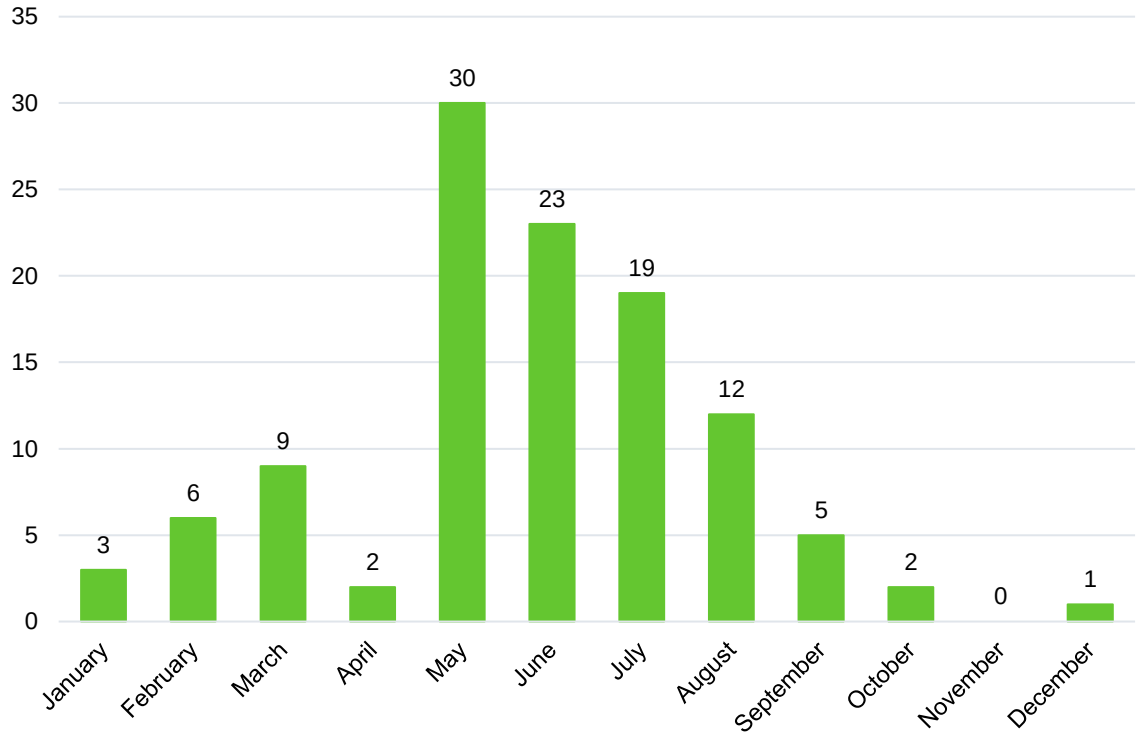


Figure 32: Monthly Events for Floods/Flash Floods



Source: NCEI, 1996-2021

National Flood Insurance Program (NFIP)

The NFIP was established in 1968 to reduce flood losses and disaster relief costs by guiding future development away from flood hazard areas where feasible; by requiring flood resistant design and construction practices; and by transferring the costs of flood losses to the residents of floodplains through flood insurance premiums.

In return for availability of federally backed flood insurance, jurisdictions participating in the NFIP must agree to adopt and enforce floodplain management standards to regulate development in special flood hazard areas as defined by FEMA's flood maps. One of the strengths of the program has been keeping people away from flooding rather than keeping the flooding away from people—through historically expensive flood control projects. The following tables summarize NFIP participation and active policies within the planning area.

Table 59: NFIP Participants

Jurisdiction	Participate in NFIP	Eligible-Regular Program	Date Current Map	Sanction	Suspension	Rescinded
Alda	Yes	6/20/1978	9/26/2008	-	-	-
Amherst	Yes	9/27/1985	11/26/10(M)	-	-	-
Buffalo County	Yes	3/1/1990	11/26/2010	-	-	-
Cairo	Yes	6/20/1978	09/26/08(M)	-	-	-
Central City	Yes	8/15/1979	1/6/2010	-	-	-
Chapman	Yes	2/1/2002	(NSFHA)	-	-	-

Jurisdiction	Participate in NFIP	Eligible-Regular Program	Date Current Map	Sanction	Suspension	Rescinded
Clarks	Yes	8/19/1987	1/6/2010	-	-	-
Cozad	Yes	6/30/1976	05/03/11(M)	-	-	-
Dawson County	Yes	7/1/1988	5/3/2011	-	-	-
Doniphan	Yes	8/1/1978	09/26/08(M)	-	-	-
Eddyville	No	-	-	-	-	-
Elm Creek	Yes	8/19/1987	11/26/10(M)	-	-	-
Eustis	Yes	3/1/1990	04/02/08(M)	-	-	-
Farnam	Yes	12/20/2021	05/03/11(M)	-	-	-
Gibbon	Yes	9/27/1985	11/26/10(M)	-	-	-
Gothenburg	Yes	1/3/1990	5/3/2011	-	-	-
Grand Island	Yes	3/2/1983	9/26/2008	-	-	-
Hall County	Yes	8/1/1980	9/26/2008	-	-	-
Kearney	Yes	7/5/1984	11/26/2010	-	-	-
Lexington	Yes	5/15/1984	5/3/2011	-	-	-
Merrick County	Yes	1/31/1994	1/6/2010	-	-	-
Miller	No	-	-	-	-	-
Osceola	Yes	7/2/1987	08/19/08(M)	-	-	-
Overton	Yes	9/27/1985	05/03/11(M)	-	-	-
Palmer	No	-	-	-	-	-
Pleasanton	Yes	9/27/1985	11/26/10(M)	-	-	-
Polk County	Yes	8/19/2008	8/19/2008	-	-	-
Polk	No	8/19/2008	8/19/2008	-	-	-
Ravenna	Yes	9/4/1985	11/26/10(M)	-	-	-
Riverdale	Yes	12/21/2010	11/26/10(M)	-	-	-
Shelby	No	-	-	-	-	-
Shelton	Yes	9/27/1985	11/26/10(M)		1/3/1986, 11/1/1985	9/24/1993, 11/1/1985
Silver Creek	Yes	8/26/1977	1/6/2010	-	-	-
Stromsburg	Yes	6/17/1986	8/19/2008	-	-	-
Sumner	Yes	9/27/1985	05/03/11(M)	-	-	-
Wood River	Yes	12/1/1978	9/26/2008	-	-	-

Source: Federal Emergency Management Agency, National Flood Insurance Program, 2022[88]
**(M) indicates no elevation determined – All Zone A, C, and X*
**(NSFHA) indicates No Special Flood Hazard Area – All Zone C*

88 Federal Emergency Management Agency. 2022. "Community Status Book Report." Accessed February 2022. https://www.fema.gov/cis/NE.html

The NFIP Emergency Program allows a community to voluntarily participate in the NFIP if no flood hazard information is available for their area; the community has a Flood Hazard Bound Map but no FIRM; or the community has been identified as flood-prone for less than a year.

Table 60: NFIP Policies in Force and Total Payments

Jurisdiction	Policies In-force	Total Coverage	Total Premiums	Total Losses	Total Payments
Buffalo County	52	$11,905,400	$45,333	16	$282,833
Amherst	0	N/A	N/A	0	N/A
Elm Creek	2	$424,000	$4,102	2	$19,380
Gibbon	17	$3,880,300	$14,330	11	$55,329
Kearney	129	$45,606,400	$125,991	33	$6,730,087
Miller	0	N/A	N/A	0	N/A
Pleasanton	13	$1,054,900	$16,031	3	$18,305
Ravenna	4	$385,800	$3,909	2	$5,664
Riverdale	3	$555,000	$2,016	0	$0
Shelton	4	$283,600	$4,725	2	$2,738
Dawson County	36	$6,715,500	$31,884	30	$165,370
Cozad	7	$1,341,100	$3,551	7	$96,322
Eddyville	0	N/A	N/A	0	N/A
Farnam	0	N/A	N/A	0	N/A
Gothenburg	10	$5,458,000	$20,661	9	$20,130
Lexington	130	$25,329,200	$99,280	34	$160,743
Overton	2	$144,300	$763	10	$49,278
Sumner	0	N/A	N/A	0	N/A
Hall County	32	$4,148,900	$25,766	21	$155,275
Alda	1	$175,000	$375	0	$0
Cairo	4	$616,400	$4,090	0	$0
Doniphan	0	$0	$0	1	$619
Grand Island	50	$11,315,600	$74,416	111	$620,318
Wood River	9	$2,058,000	$3,811	2	$39,089
Merrick County	56	$10,930,600	$58,420	6	$34,134
Central City	13	$844,700	$8,354	6	$2,140
Chapman	0	N/A	N/A	0	N/A
Clarks	1	$350,000	$467	1	$0
Palmer	0	N/A	N/A	0	N/A
Silver Creek	3	$495,900	$2,456	0	$0
Polk County	26	$2,833,300	$30,949	1	$0
Osceola	4	$514,900	$2,629	1	$150
Polk	0	N/A	N/A	0	N/A
Shelby	0	N/A	N/A	0	N/A
Stromsburg	0	N/A	N/A	0	N/A

Jurisdiction	Policies In-force	Total Coverage	Total Premiums	Total Losses	Total Payments
Eustis (Frontier County)	0	N/A	N/A	0	N/A

Source: FEMA, HUDEX Policy Loss Data, March 2022[89]

This plan highly recommends and strongly encourages each plan participant to remain in good standing and continue involvement with the NFIP. Compliance with the NFIP should remain a top priority for each participant, regardless of whether or not a flooding hazard area map has been delineated for the jurisdiction. Jurisdictions are encouraged to initiate activities above the minimum participation requirements, which are described in the Community Rating System Coordinator's Manual (FIA-15/2017). As of March 2022, no communities in the five-county planning area participate in the CRS.

NFIP Repetitive Loss Structures

NeDNR and FEMA Region VII were contacted to determine if any existing buildings, infrastructure, or critical facilities are classified as NFIP Repetitive Loss Structures. Note there are two definitions for repetitive loss structures. Severe repetitive loss is a grant definition for HMA purposes that has specific criteria while repetitive loss is a general NFIP definition. There are ten repetitive loss properties located in the planning area as of October 2021. Only jurisdictions with reported properties are included in the following table.

Table 61: Repetitive Loss Structures

Jurisdiction	Repetitive Loss	Severe Repetitive Loss	Type of Property	Total Losses	Total Payments
Buffalo County	2	0	Single Family	2	$68,838.98
Cozad	2	0	Single Family, Two-Four Family	2	$64,817.85
Dawson County	3	0	Single Family	3	$24,061.84
Elm Creek	1	0	Single Family	1	$19,379.76
Gibbon	4	0	Non-Residential Business	4	$38,560.48
Gothenburg	2	0	Non-Residential Business	2	$14,387.66
Grand Island	2	0	Single Family	2	$47,941.13
Hall County	1	0	Single Family	1	$56,292.77
Kearney	0	1	Single Family	1	$101,156.43
Overton	1	0	Single Family	1	$4,891.97

Source: NeDNR, October 2021

89 Federal Emergency Management Agency: National Flood Insurance Program. December 2019. Policy & Claim Statistics for Flood Insurance." Accessed November 2020. https://www.fema.gov/policy-claim-statistics-flood-insurance.

NFIP RL: Repetitive Loss Structure refers to a structure covered by a contract for flood insurance under the NFIP that has incurred flood-related damage on two occasions during a 10-year period, each resulting in at least a $1,000 claim payment.

NFIP SRL: Severe Repetitive Loss Properties are defined as single or multifamily residential properties that are covered under an NFIP flood insurance policy and:

(1) That have incurred flood-related damage for which four or more separate claims payments have been made, with the amount of each claim (including building and contents payments) exceeding $5,000, and with the cumulative amount of such claim payments exceeding $20,000; or

(2) For which at least two separate claims payments (building payments only) have been made under such coverage, with cumulative amount of such claims exceeding the market value of the building.

(3) In both instances, at least two of the claims must be within 10 years of each other, and claims made within 10 days of each other will be counted as one claim.

HMA RL: A repetitive loss property is a structure covered by a contract for flood insurance made available under the NFIP that:

(1) Has incurred flood-related damage on two occasions, in which the cost of the repair, on the average, equaled or exceeded 25 percent of the market value of the structure at the time of each such food event; and

(2) At the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage.

HMA SRL: A severe repetitive loss property is a structure that:

(1) Is covered under a contract for flood insurance made available under the NFIP.

(2) Has incurred flood related damage –

(a) For which four or more separate claims payments (includes building and contents) have been made under flood insurance coverage with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claim payments exceeding $20,000; or

(b) For which at least two separate claims payments (includes only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

Historical Occurrences

The NCEI reports events as they occur in each community. A single flooding event can affect multiple communities and counties at a time; the NCEI reports these large scale, multi-county events as separate events. The result is a single flood event covering a large portion of the planning area could be reported by the NCEI as several events. According to the NCEI, 47 flash flooding events resulted in $42,655,000 in property damage, while 37 riverine flooding events

resulted in $9,118,000 in property damage. USDA RMA data does not distinguish the difference between riverine flooding damages and flash flooding damages. The total crop loss according to the RMA is $ $4,140,050. Descriptions of the most damaging flood events from the NCEI are below:

- **May 11, 2005 – Flash Flood – Buffalo, Hall, Dawson, and Merrick Counties:** On the night of May 11th, thunderstorms ravaged a large part of south-central Nebraska with hail, high winds, a tornado and catastrophic flooding. During evening and early morning hours, four to 12 inches of fell from Dawson County east to York County. At Kenesaw and Wood River, over 11 inches of rain was measured. The City of Grand Island set a rainfall record for a single event with 7.21 inches of rain. Statistically, this event was a 100-year rain and flood event for the area. In Wood River, 12 people were evacuated due to rising water. It was estimated every structure in Wood River sustained some sort of storm damage and wave after wave of severe thunderstorms pounded the town. Twelve homes sustained severe damage. The Wood River crested at nine feet in town and flooded most streets. Thirty-six homes were evacuated in the City of Grand Island as flooding was rampant over the west and north part of the city. The city's sewer system handled about 75 million gallons of water, or about six times the normal amount during the storm. Many parts of the business and residential districts sustained flood damage as the Prairie, Silver and Moores Creeks flooded. The Wood River near Alda, which had been dry for three years, tied a record with a crest of 12.2 feet early on the 12th. Elsewhere, ten bridges were damaged in Merrick County. Hall County was declared a Federal Disaster Area. According to the NCEI, the event caused property damages in multiple counties for the following amounts: $5,000,000 in Hall County, $1,000,000 in Dawson County, $500,000 in Merrick County, and $5,000,000 in Buffalo County.

- **March 13, 2019 – Flood, Flash Flood – Buffalo, Dawson, Hall, and Merrick Counties:** Widespread flash flooding occurred the night of Wednesday March 13th into Thursday the 14th. People were trapped in vehicles Wednesday evening after driving into flood waters on roads that crossed the Wood River in Buffalo County. Multiple rescues were necessary. Two cars were swept off the road into the swollen Wood River north of Kearney. One woman waited for a rescue team on the roof of her car. She was rescued using a jet ski. A man was also rescued from a semi that was swamped by flood waters. U.S. Highway 30 was closed in both directions between Shelton and Alda due to flooding of the Wood River. Water one to two ft deep covered Highway 30 in Gibbon. Highway 30 was also closed from Silver Creek to Highway 81 due to flooding. In Hall County, 163 of the gravel roads were damaged. Preliminary cost estimates for repairing them was $2-3 million, with $700-800,000 to repair paved roads. The preliminary estimated cost to damaged roads and bridges in Buffalo County was $1.5-2 million, where ruts in some gravel roads were two to three feet deep. 150 miles of road and eight bridges were impassible. In northwest Buffalo County, six homes could not be reached via gravel road. Homeowners had to drive through approximately one-half mile of pasture to get to and from their homes. At the peak of the flooding, so many roads were closed that Buffalo and Dawson counties ran out of barricades.

  Flooding was extensive in Pleasanton, Gibbon, Wood River, and Alda. In the City of Wood River, water was three to four feet deep between 11th and 13th streets. The post office in Pleasanton were temporarily evacuated with mail operations moved to nearby post offices. People were evacuated in Gibbon, Pleasanton, Shelton, and Wood River, some even by boat. A Red Cross shelter was opened at the high school in Wood River. Trains were also severely impacted. The Union Pacific railroad tracks between Gibbon and Columbus were

shut down for several days. Rushing water eroded and washed out the bed underneath all three tracks in Gibbon. Six Union Pacific trains were parked at Central City and Clarks because they were unable to continue to their destinations. The Burlington Northern Santa Fe rail line from Litchfield to Ravenna to York was also shut down for several days. Several miles of BNSF track were damaged between Gibbon and Alexandria due to flooding along the Little Blue River. Options for rerouting trains were limited because the flooding was so widespread over eastern Nebraska and western Iowa. Ethanol plants in Ravenna, Ord, and Central City were impacted and could not get ethanol to market because of damaged tracks. Several records were set at Turkey Creek, The Loup River, The North Loup River, and The Wood River. Despite the major flooding that occurred on The Wood River, from Gibbon to Alda, the Wood River Diversion at Grand Island worked as designed and protected the south side of Grand Island from flooding. A new record water level was set at the Wood River Diversion, with water cresting at 18.15 feet. As flood waters receded, pastureland, and fields next to rivers and creeks were covered in sand and silt inches to feet deep, which ruined many acres for grazing. This flooding occurred in the middle of calving season. Hundreds of calves perished. Due to the magnitude of the flooding in central and eastern Nebraska, the State Emergency Operations Center was activated. Emergencies were declared by most counties in south central Nebraska. Governor Ricketts applied for and received a federal disaster declaration for Buffalo, Hall, and Merrick counties. The NeDNR has collected and reviewed extensive data records from the flood event. An event-wide ArcGIS Story Map has been developed and provides an excellent resource to understand the cause, duration, impacts, and recovery efforts from this event. The ArcGIS Story Map can be viewed at: https://storymaps.arcgis.com/stories/9ce70c78f5a44813a326d20035cab95a.

- **July 8, 2019 – Flash Flood – Buffalo and Dawson Counties:** Excessive rainfall and flash flooding occurred in the afternoon and evening of July 8th in parts of Dawson and Buffalo counties. Numerous gravel county roads were inundated by flood waters and impassible. Many of them were severely damaged. Roads in the City of Kearney were flooded from one curb to the other, and in at least two separate places, water was three to four feet deep. Almost 40 vehicles were stranded in the streets of Kearney. Basements were flooded in some homes due to egress windows breaking. The student union was flooded on the University of Nebraska campus in Kearney. Two to three feet of water was reported in the lower level of the food court. In Lexington, cars were stalled in flood waters and 23 people were evacuated from an apartment building due to flooding. The Red Cross opened a shelter to care for those evacuated. In some areas, the impacts worsened the following day as creeks swelled out of their banks. Gibbon, Kearney, Elm Creek, and Lexington were all severely impacted. U.S. Highway 30 was closed due to floodwater from Shelton to Kearney to Elm Creek, as well as near Lexington. Turkey Creek drains into the North Channel of the Platte River, which runs through the south side of Kearney. Water rapidly rose on the south side of the city Tuesday morning, inundating numerous hotels, restaurants, businesses, and basements. At least 200 people had to be evacuated from hotels using construction grade front-end loaders. Approximately 100 other nearby residents needed to be evacuated as well. At its peak, water was two to four feet high inside the hotels, and four to five feet high in the parking lots. The water rose so quickly that many people staying at the hotels did not have time to move their vehicles. Most vehicles at the hotels were lost and hundreds of vehicles in the city had to be towed. Some businesses were closed for weeks, others for months, as repairs and remodeling were completed, and kitchen equipment was ruined at some restaurants. Of the 1,800 hotel rooms in Kearney, only about 600 were available for use because first floor services, such as check-in desks, laundry facilities, and kitchens were damaged. Second avenue, which

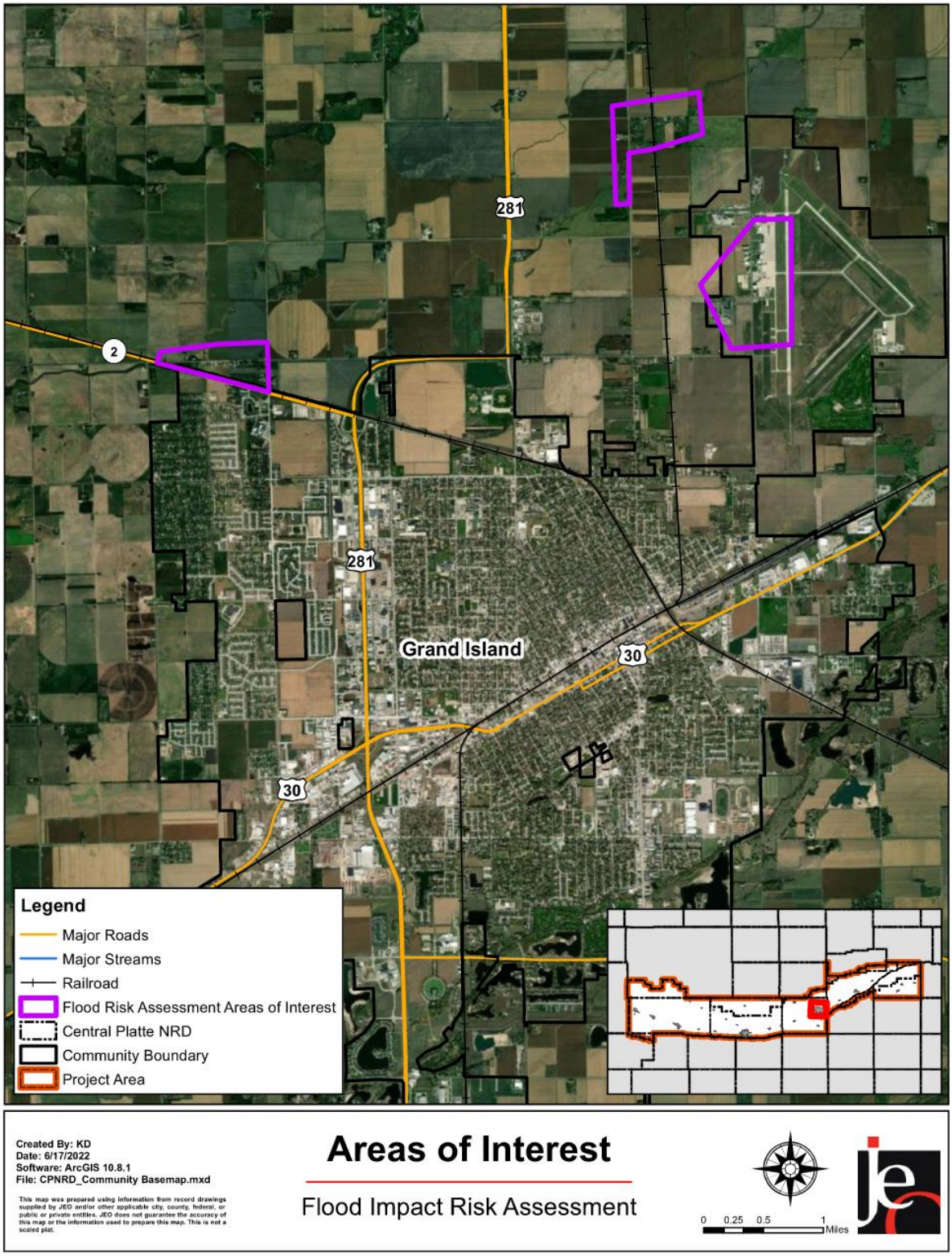
is the main north-south thoroughfare through the city, was closed from Interstate 80 to 11th avenue. The Interstate 80 off-ramp was also closed. All traffic to and from the Interstate and from the city, had to use the Kearney East Expressway. Approximately 400 Kearney homes were damaged by the flood, and many more beyond city limits. One home with an egress window gave way in a home on the southeast side of Kearney. Water rushed into the basement, filling it nearly to the ceiling. Extensive flooding resulted in the closure of Yanney Park. A power substation flooded and resulted in power outages to about 450 customers. Flood waters began to subside Wednesday, July 10th, which allowed for one lane of 2nd avenue to be reopened in each direction. The Platte River, which is very wide and shallow, rose three feet in 12 hours from 6:00 PM Monday to 6:00 AM Tuesday, and four feet in 24 hours. The Platte River has a flood stage of seven feet, but it crested at 8.3 feet at 5:15 PM Tuesday. In the town of Elm Creek, many roads and basements were flooded. A gauge on Elm Creek indicated that the water level rose eight feet in two hours Monday evening. The City of Lexington issued a disaster declaration due to the disruption of utility services. Streets and homes were flooded with sewers backing up into homes. Flooding was extensive along the Wood River. In Gibbon, water flooded streets and basements for the second time this year. The northeast side of the community was impacted the worst with at least 30 homes and several businesses inundated by floodwater. People had to sandbag their homes and businesses. It is believed that flooding on the Wood River was wider with this event, due to changes in the riverbed from the prior flood in March. Some places that did not flood in that event, flooded this time. Several businesses affected by the March flood still remained closed due to damage. Widespread flooding of low-lying areas, creeks, and rivers continued for several days following the excessive rain. Flood waters did not recede in some locations until Monday, July 15th. According to the NCEI, the event caused $30,000,000 in property damages in Buffalo County and $2,000,000 in Dawson County.

The CPNRD has several projects underway to address flooding issues in the planning area. Projects include The Wood River Watershed Flood Risk Reduction Plan, the Elm and Turkey Creeks Watershed Flood Risk Reduction Plan, and the Spring and Buffalo Creeks Watershed Flood Risk Reduction Plan. Additional information on the CPNRD flood risk reduction projects can be found at https://www.cpnrd.org/flood-reduction/projects-built/.

One recently completed project that significantly reduced damages from the 2019 floods is the Upper Prairie Silver Moores Project (UPSM). The USPM project was a multi-year flood risk reduction project designed to reduce flooding risk for northwestern Grand Island. Goals of the project included reducing flooding, updating FEMA flood maps, and educating citizens on the risks associated living near flood control structures. The project entailed the construction of a detention cell on both the east and west sides of Dannenbrog Road, construction of dry dams, and the construction of the Silver Creek RB Levee. It was estimated that Grand Island avoided $47 million in potential damages in March 2019 because of the project. In addition, 600 properties were removed from the 100-year floodplain. Additional information about the UPSM project can found on the NRD's website: https://www.floodsafe-cpnrd.org/.

Based on the flooding observations and impacts experienced during the March 2019 flood event, a Flood Risk Assessment near the City of Grand Island is underway for selected areas along Silver Creek and Moores Creek. An overview of the areas of interest is shown on Figure 33. As part the flood risk assessment for these areas, available flood risk models will be utilized to develop additional flood risk scenarios based on March 2019 flooding observations. In addition, building footprint data and field visits will identify flood impact vulnerabilities and risks in these areas.

Figure 33: Flood Impact Risk Assessment Areas of Interest



These flood impact observations and risk assessment findings will be utilized to identify potential flood risk reduction mitigation actions. The mitigation actions will be identified and prioritized based on the most at-risk buildings and property considering the risk assessment. It is anticipated the potential mitigation action alternatives considered will include but not necessarily be limited to structural mitigation actions (levees, diversion channels, floodplain storage), nonstructural mitigation actions (floodproofing, elevation, acquisition), and programmatic actions (NFIP participation, flooding studies, capital improvement programs). Once the Flood Risk Assessment is completed it will be added to this hazard mitigation plan as an appendix, and recommended mitigation actions integrated into the appropriate jurisdictional profiles.

Average Annual Damages

The average damage per event estimate was determined based upon NCEI Storm Events Database since 1996 and the number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Flooding causes an average of $1,991,269 in property damages and $207,003 in crop losses per year for the planning area.

Table 62: Flood Loss Estimate

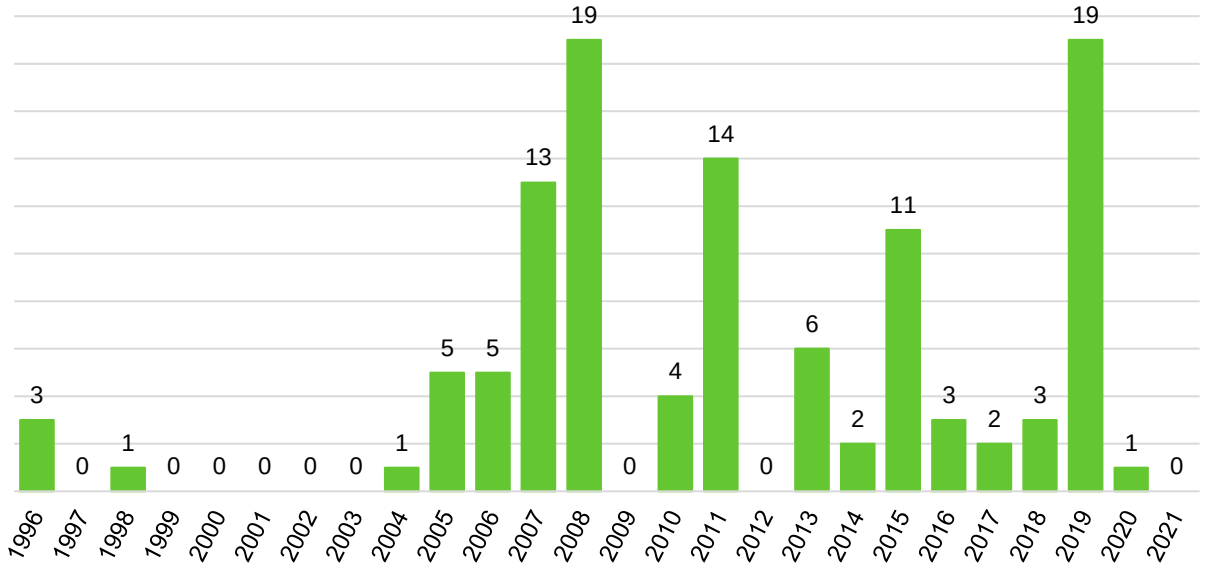
Hazard Type	Number of Events[1]	Average Events Per Year	Total Property Loss[1]	Average Annual Property Loss [1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
Flooding	84	3.2	$51,773,000	$1,991,269	$4,140,050	$207,003

Source: 1 Indicates data is from NCEI (Jan 1996 to June 2021); 2 Indicates data is from USDA RMA (2000 to 2020)

Probability

The NCEI reports 37 flooding and 47 flash flooding events for a total of 84 events from January 1996 to June 2021. Some years had multiple flooding events. Figure 34 shows the events broken down by year. Based on the historic record and reported incidents by participating communities, there is a 65 percent probability that flooding will occur annually in the planning area.

Figure 34: Yearly Events for Floods/Flash Floods



Source: NCEI, 1996-June 2021

Community Top Hazard Status

The following table lists jurisdictions which identified flooding as a top hazard of concern.

Jurisdiction	
Alda	Grand Island
Amherst	Hall County
Buffalo County	Kearney
Cairo	Lexington
Central City	Merrick County
Central Platte NRD	Osceola
Chapman	Pleasanton Fire District
Cozad	Pleasanton
Dawson County	Polk County
Dawson County Drainage District No.2	Polk
Dawson County Drainage District No.3	Ravenna
Doniphan Fire District	Riverdale
Doniphan	Shelby
Elm Creek Fire District	Shelton
Elm Creek	Silver Creek
Eustis	Stromsburg
Farnam	Two Rivers Public Health Department
Four Corners Health Department	University of Nebraska - Kearney
Gibbon Volunteer Fire District	Wood River Rural Schools
Gibbon Public Schools	Wood River
Gibbon	

Regional Vulnerabilities

Low-income and minority populations are disproportionately vulnerable to flood events.[90] These groups may lack needed resources to mitigate potential flood events as well as resources that are necessary for evacuation and response. In addition, low-income residents are more likely to live in areas vulnerable to the threat of flooding but lack the resources necessary to purchase flood insurance. The study found that flash floods are more often responsible for injuries and fatalities than prolonged flood events.

Other groups that may be more vulnerable to floods, specifically flash floods, include the elderly, those outdoors during rain events, and those in low-lying areas. Elderly residents may suffer from a decrease or complete lack of mobility and as a result, be caught in flood-prone areas. Residents in campgrounds or public parks may be more vulnerable to flooding events. Many of these areas exist in natural floodplains and can experience rapid rise in water levels resulting in injury or death.

On a state level, the Nebraska's State National Flood Insurance Coordinator's office has studied who lives in special flood hazard areas. According to the NeDNR, floodplain areas have a few unique characteristics which differ from non-floodplain areas:

- Higher vacancy rates within floodplain
- Far higher percentage of renters within floodplain
- Higher percentage of non-family households in floodplain
- More diverse population in floodplain
- Much higher percentage of Hispanic/Latino populations in the floodplain

90 Cutter, Susan and Finch, Christina. February 2008. "Temporal and Spatial Changes in Social Vulnerability to Natural Hazards".

To analyze parcels and populations located in the floodplain, GIS parcel data were acquired from each County Assessor. This data was analyzed for the location, number, and value of property improvements at the parcel level. Property improvements include any built structures such as roads, buildings, and paved lots. The data did not contain the number of structures on each parcel. A summary of the results of this analysis for the five-county planning area is provided in the following table. Specific jurisdictional parcel improvements in the floodplain can be found in the corresponding community profiles in *Section Seven*.

Table 63: Parcel Improvements and Value in the 1% Annual Flood Risk Area

County	Number of Improvements	Total Improvement Value	Number of Improvements in Floodplain	Value of Improvements in Floodplain	Percentage of Improvements in Floodplain
Buffalo	17,665	$3,634,232,115	1,868	$429,161,590	10.6%
Dawson	9,520	$1,234,924,706	1,631	$266,349,541	17.1%
Hall	22,119	$3,796,958,806	1,765	$423,220,613	8.0%
Merrick	4,064	$506,965,716	1,350	$183,232,985	33.2%
Polk	3,143	$284,566,436	846	$71,993,788	26.9%
Total	**56,511**	**$9,457,647,779**	**7,460**	**$1,373,958,517**	**13.2%**

Source: County Assessors, 2021

Table 64: Parcel Improvements and Value in the 0.2% Annual Flood Risk Area

County	Number of Improvements	Total Improvement Value	Number of Improvements in Floodplain	Value of Improvements in Floodplain	Percentage of Improvements in Floodplain
Buffalo	17,665	$3,634,323,115	682	$258,243,980	3.9%
Dawson	9,520	$1,234,924,706	2,143	$257,598,525	22.5%
Hall	22,119	$3,796,958,806	822	$126,768,583	3.7%
Merrick	4,064	$506,965,716	1,674	$177,653,596	41.2%
***Polk**	N/A	N/A	N/A	N/A	N/A
Total	**53,368**	**$9,173,172,343**	**5,321**	**$820,264,684**	**10.0%**

Source: County Assessors, 2021
**Does not have a mapped 0.2% Annual Flood Risk Area*

Phragmites

A significant concern for the planning area includes the introduction of the invasive species Phragmites or Common Reed. The species may change how water drains and demand excessive water from wetlands, reducing the efficacy of wetlands in flood prevention. Because phragmites grow so densely, they can block drainage ditches and change the hydrology of a wetland area. Additionally, these plants grow densely and create a fleet of dry stalks which dry up wetland areas. Wetlands provide a natural flood prevention method in the planning area, so protecting them against invasive species such as phragmites will help further flood mitigation.

The following table is a summary of regional vulnerabilities. For jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles.*

Table 65: Regional Flooding Vulnerabilities

Sector	Vulnerability
People	-Low income and minority populations may lack the resources needed for evacuation, response, or to mitigate the potential for flooding -Elderly or residents with decreased mobility may have trouble evacuating -Residents in low-lying areas, especially campgrounds, are vulnerable during flash flood events -Residents living in the floodplain may need to evacuate for extended periods -Buffalo County: LEOP estimates 10% of people reside within the one percent annual chance floodplain -Dawson County: LEOP estimates 75% of people reside within the one percent annual chance floodplain -Hall County: LEOP estimates 6% of people reside within the one percent annual chance floodplain -Merrick County: LEOP estimates 29% of people reside within the one percent annual chance floodplain -Polk County: No estimate given in LEOP
Economic	-Business closures or damages may have significant impacts -Agricultural losses from flooded fields or cattle loss -Closed roads and railways would impact commercial transportation of goods
Built Environment	-Buildings may be damaged
Infrastructure	-Damages to roadways, bridges, and railways
Critical Facilities	-Wastewater facilities are at risk, particularly those in the floodplain -Critical facilities, especially those in the floodplain, are at risk to damage (critical facilities are noted within individual community profiles)
Climate	-Changes in seasonal and annual precipitation normals will likely increase frequency and magnitude of flood events

Grass/Wildfire

Wildfires, also known as grassfires, brushfires, forest fires, or wildland fires, are any uncontrolled fires that occurs in the countryside or wildland. Wildland areas may include but are not limited to: grasslands; forests; woodlands; agricultural fields; pastures; and other vegetated areas. Wildfires range in size from a few acres (the most common) to thousands of acres in some cases. Fire events can quickly spread from their original source, change direction quickly, and jump gaps (such as roads, rivers, and fire breaks). Wildfire events are particularly dependent on the surrounding conditions including temperature, humidity, wind speed, wind direction, slope, and available fuel load. While some wildfires burn in remote forested regions, others can cause extensive destruction of homes and other property located in the wildland-urban interface (WUI), the zone of transition between developed areas and undeveloped land.

Wildfires are a growing hazard in most regions of the United States, posing a threat to life and property, particularly where rural or native ecosystems meet urban developed areas or where local economies are heavily dependent on open agricultural land. Although fire is a natural and often beneficial process, fire suppression can lead to more severe fires due to the buildup of vegetation, which creates more fuel and increases the intensity and devastation of future fires.

Wildfires are characterized in terms of their physical properties including topography, weather, and fuels. Wildfire behavior is often complex and variably dependent on factors such as fuel type, moisture content in the fuel, humidity, wind speed, topography, geographic location, ambient temperature, the effect of weather on the fire, and the cause of ignition. Fuel and structure durability are the primary factors can control and are the target of most mitigation efforts. The NWS monitors the risk factors including high temperature, high wind speed, fuel moisture (greenness of vegetation), low humidity, and cloud cover in the state on a daily basis. Fire danger predictions are updated regularly and should be reviewed frequently by community leaders and fire department officials.

Fire Protection

There were 34 local volunteer or rural fire districts identified in the planning area. The following is a list of fire districts located in the planning area and also illustrated on Figure 35.

- Alda Volunteer Fire Department
- Amherst Volunteer Fire Department
- Cairo Volunteer Fire Department
- Central City Volunteer Fire Department
- Chapman Fire District
- Clarks Fire District
- Cozad Fire and Rescue
- Doniphan Volunteer Fire Department
- Eddyville Volunteer Fire Department
- Elm Creek Fire and Rescue
- Farnam Volunteer Fire Department
- Gibbon Volunteer Fire Department
- Gothenburg Volunteer Fire Department
- Grand Island Fire Department
- Grand Island Rural Fire Department

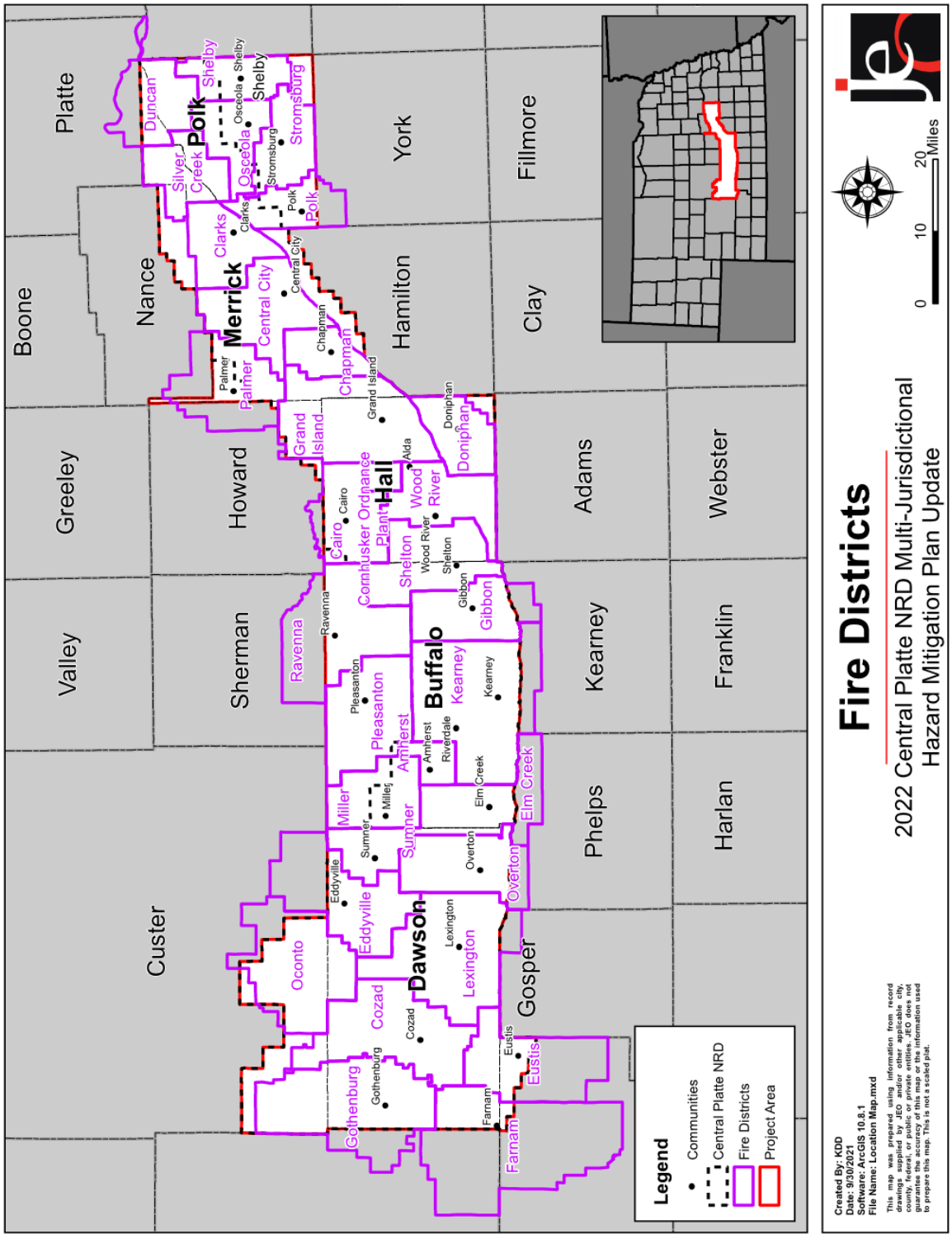
- Kearney Fire Department/Suburban Protection District #1
- Kearney Volunteer Fire Department
- Lexington Volunteer Fire Department
- Miller Volunteer Fire Department
- Osceola Fire District
- Overton Volunteer Fire Department
- Palmer Fire District
- Pleasanton Volunteer Fire Department
- Polk Fire District
- Ravenna Volunteer Fire Department
- Shelby Fire District
- Shelton Volunteer Fire and Rescue
- Silver Creek Fire District
- Stromsburg Fire District
- Sumner Volunteer Fire Department
- Wood River Volunteer Fire Department

Community Wildfire Protection Plans

Even though grass/wildfires are a natural part of the ecosystem, they can present a substantial hazard to life and property, especially along the WUI. The planning area is covered by two Community Wildfire Protection Plans (CWPPs): Loess Canyons CWPP and Central Platte CWPP.[91] The purpose of the CWPPs is to help effectively manage wildfires and increase collaboration and communication among organizations who manage fire. The CWPPs discusses county-specific historical wildfire occurrences and impacts, identifies areas most at risk from wildfires, discusses protection capabilities, and identifies wildfire mitigation strategies.

91 Nebraska Forest Service. 2020. "Community Wildfire Protection Plans." https://nfs.unl.edu/publications/community-wildfire-protection-plans.

Figure 35: Fire Districts in the Planning Area



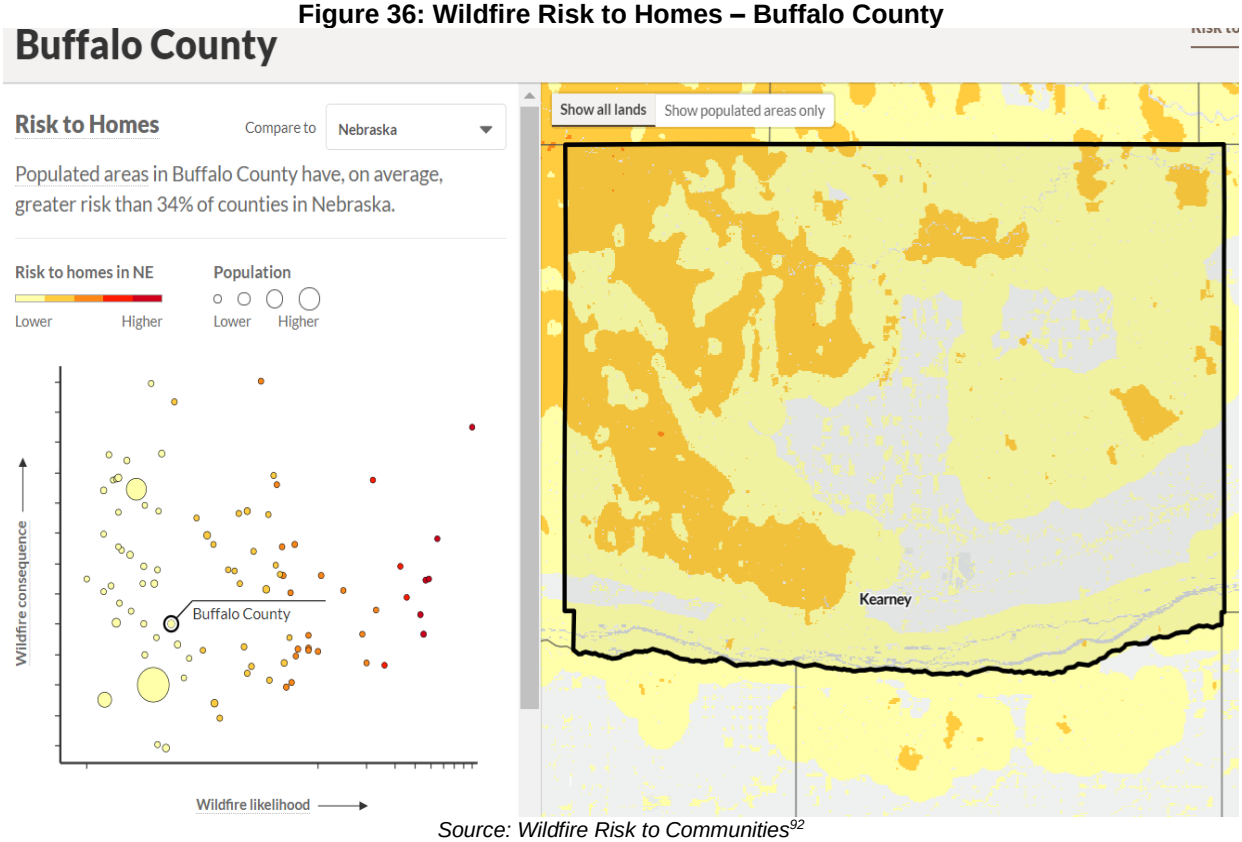
Location

Grass/wildfires can occur throughout the planning area. The United States Department of Agriculture Forest Service created the interactive web resource *Wildfire Risk to Communities* to help communities and jurisdictions understand, explore, and reduce wildfire risk. The following figures show wildfire risk to homes by county in the planning area.

In recent decades, as the population of the United States has become more decentralized and residents have moved farther away from the center of villages and cities, the area known as the WUI has developed significantly, in both terms of population and building stock. The WUI is defined as the zone of transition between developed areas and undeveloped land, where structures and other human development meet wildland. The expansion of the WUI increases the likelihood that wildfires will threaten people and homes, making it the focus of the majority of wildfire mitigation efforts.

The figure below shows the greatest wildfire risk to homes is located primarily in the west-central and northwestern portions of Buffalo County. On average, populated areas in Buffalo County have a greater risk than 34% of counties in Nebraska.

Figure 36: Wildfire Risk to Homes – Buffalo County

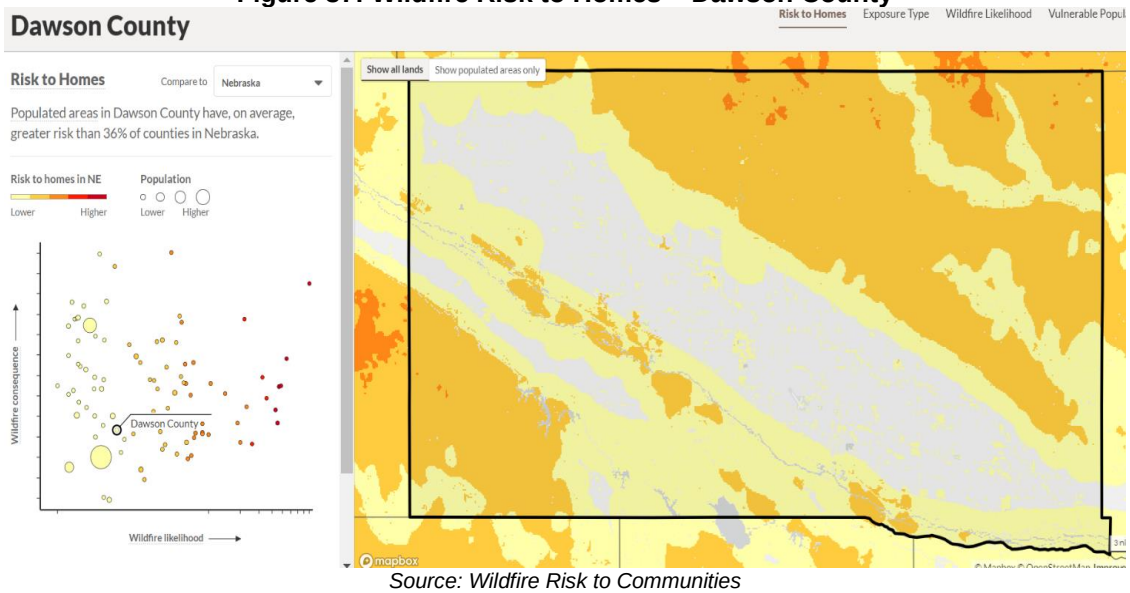


Source: Wildfire Risk to Communities[92]

92 United States Department of Agriculture, United States Forest Service. 2022. "Wildfire Risk to Communities." https://wildfirerisk.org/.

Figure 37 shows that the greatest wildfire risk to homes in Dawson County are located in the northeastern and southwestern portions of the county. Populated areas in Dawson County have, on average, a greater risk than 36% of counties in Nebraska.

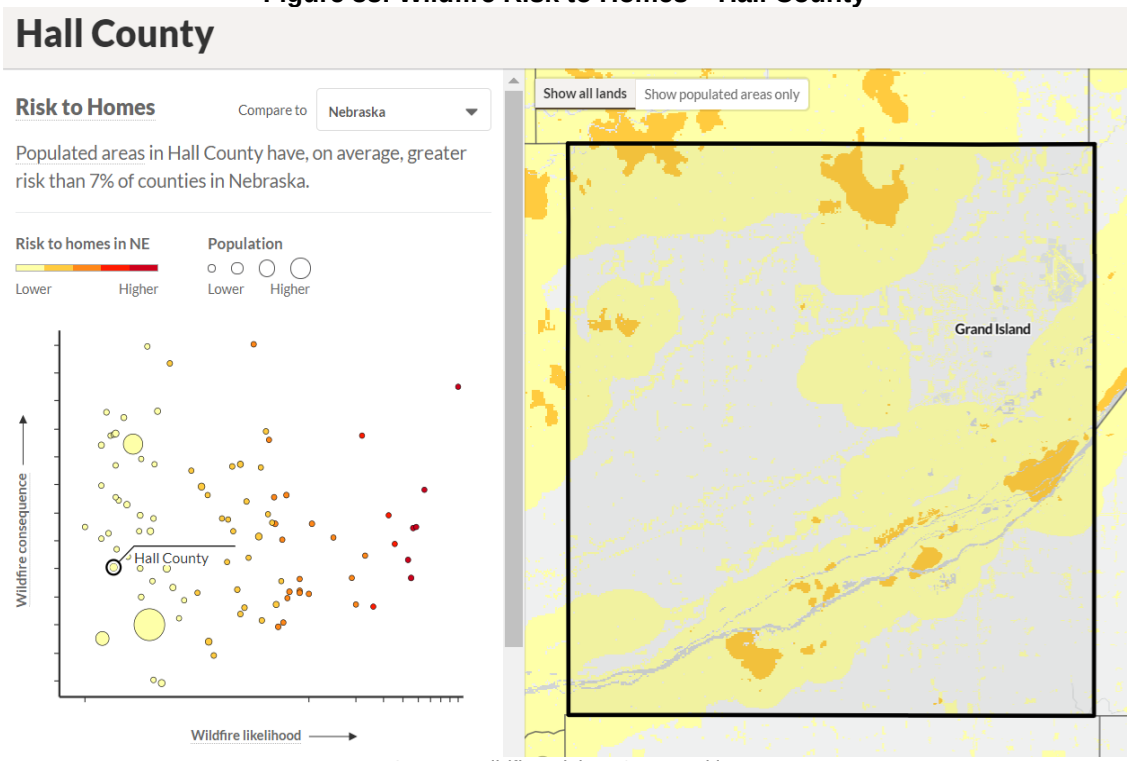
Figure 37: Wildfire Risk to Homes – Dawson County



Source: Wildfire Risk to Communities

Homes that are at the greatest risk to wildfire in Hall County are located along the Platte River and northern portions of the county (Figure 38). Populated areas in Hall County have, on average, a greater risk than 7% of counties in Nebraska.

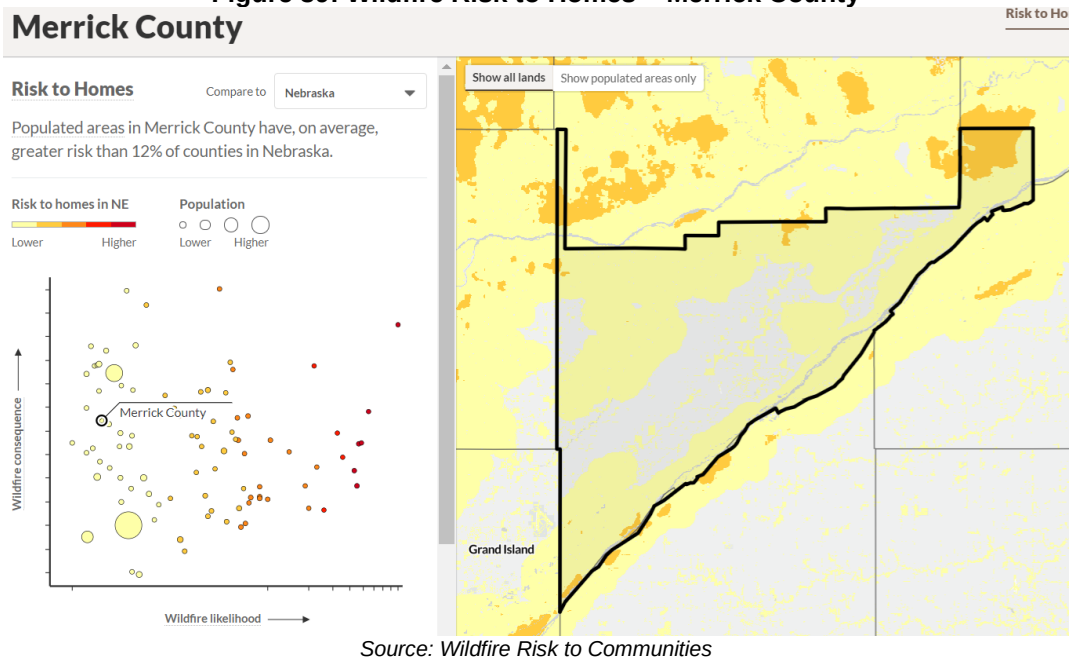
Figure 38: Wildfire Risk to Homes – Hall County



Source: Wildfire Risk to Communities

The figure below shows the greatest wildfire risk to homes is located primarily in the northern and southern portions of Merrick County. On average, populated areas in Merrick County have a greater risk than 12% of counties in Nebraska.

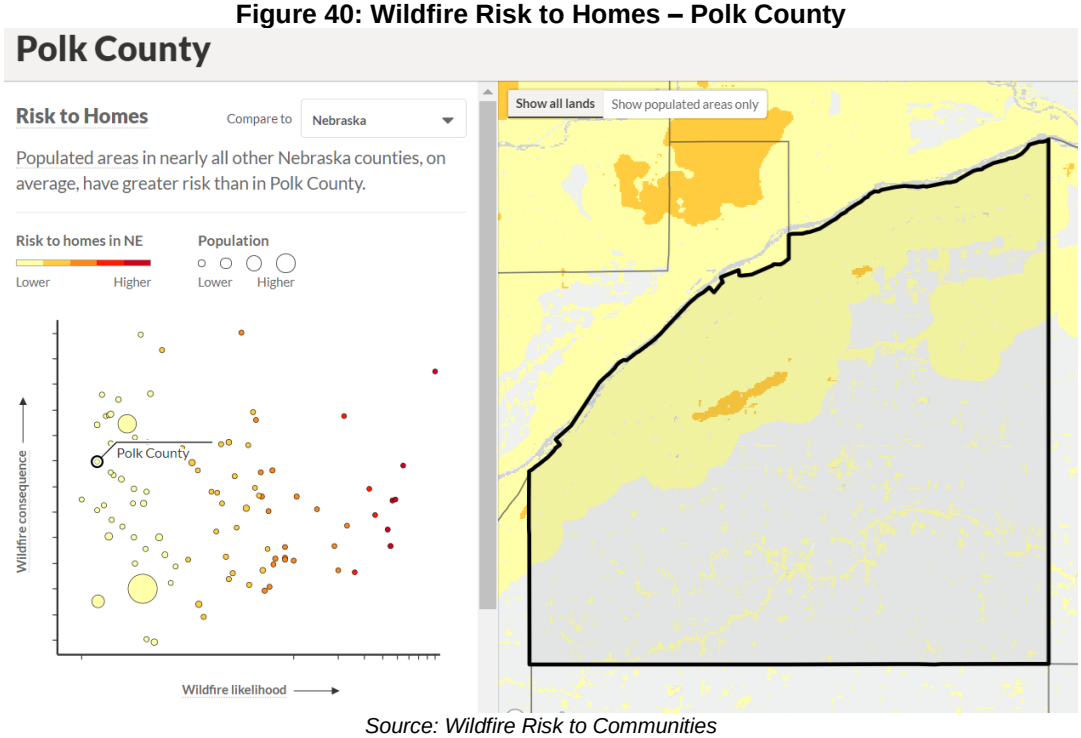
Figure 39: Wildfire Risk to Homes – Merrick County



Source: Wildfire Risk to Communities

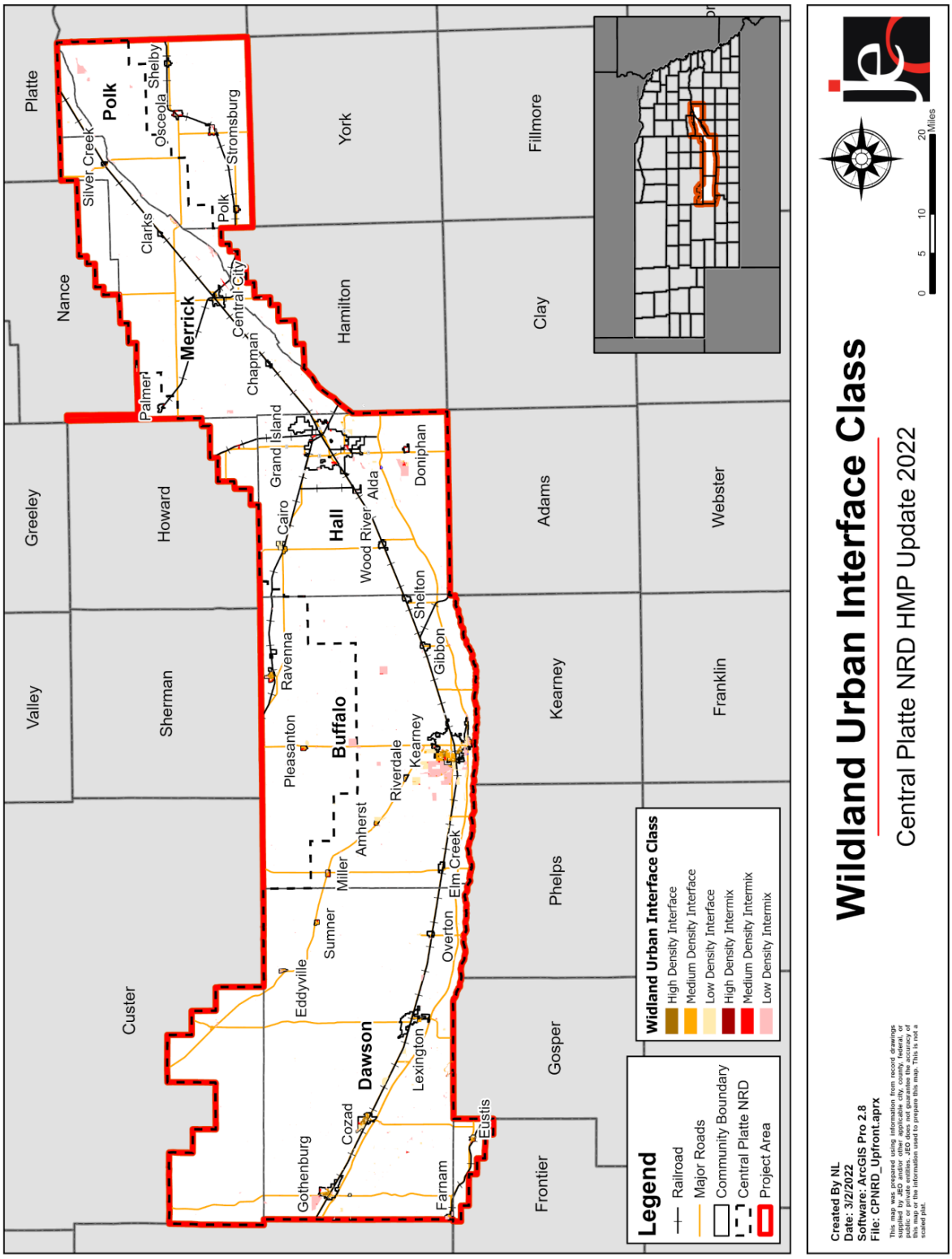
Figure 40 shows that the greatest wildfire risk to homes in Polk County are located in the northern portion of the county. Populated areas in all other Nebraska counties, on average, a have greater risk than in Polk County.

Figure 40: Wildfire Risk to Homes – Polk County



Source: Wildfire Risk to Communities

Figure 41: Planning Area Wildland Urban Interface Map



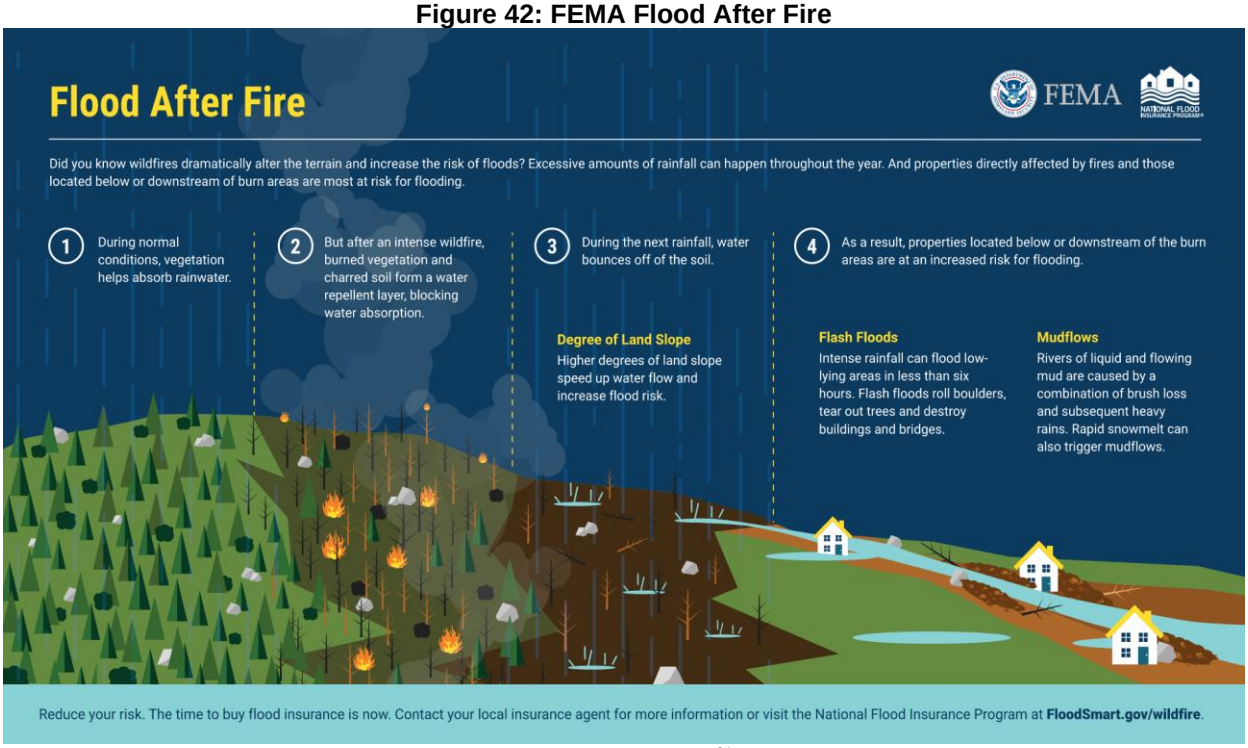
Areas that are indicated by the WUI (Figure 41 above), either interface (yellow) or intermix (orange) are primarily found in portions of Dawson, Buffalo, and Hall Counties. The rest of the planning area contains no or low-density development with a mix of vegetated, non-vegetated, and agricultural land that includes smaller WUI areas of concern.

Extent

From 2000-2020, 1,460 wildfires were reported in the planning area and burned 41,435 acres in total.[93] Of these, 24 fires burned 100 acres or more, with the largest wildfire burning 22,000 acres in Dawson County in August 2002. The average area burned per wildfire was less than 32 acres indicating while many fires may occur, they are typically small in nature and easily contained.

Wildfire also contributes to an increased risk from other hazard events, compounding damages and straining resources. FEMA has provided additional information in recent years detailing the relationship between wildfire and flooding (Figure 42). Wildfire events remove vegetation and harden soil, reducing infiltration capabilities during heavy rain events. Subsequent severe storms that bring heavy precipitation can then escalate into flash flooding, dealing additional damage to jurisdictions.

Figure 42: FEMA Flood After Fire

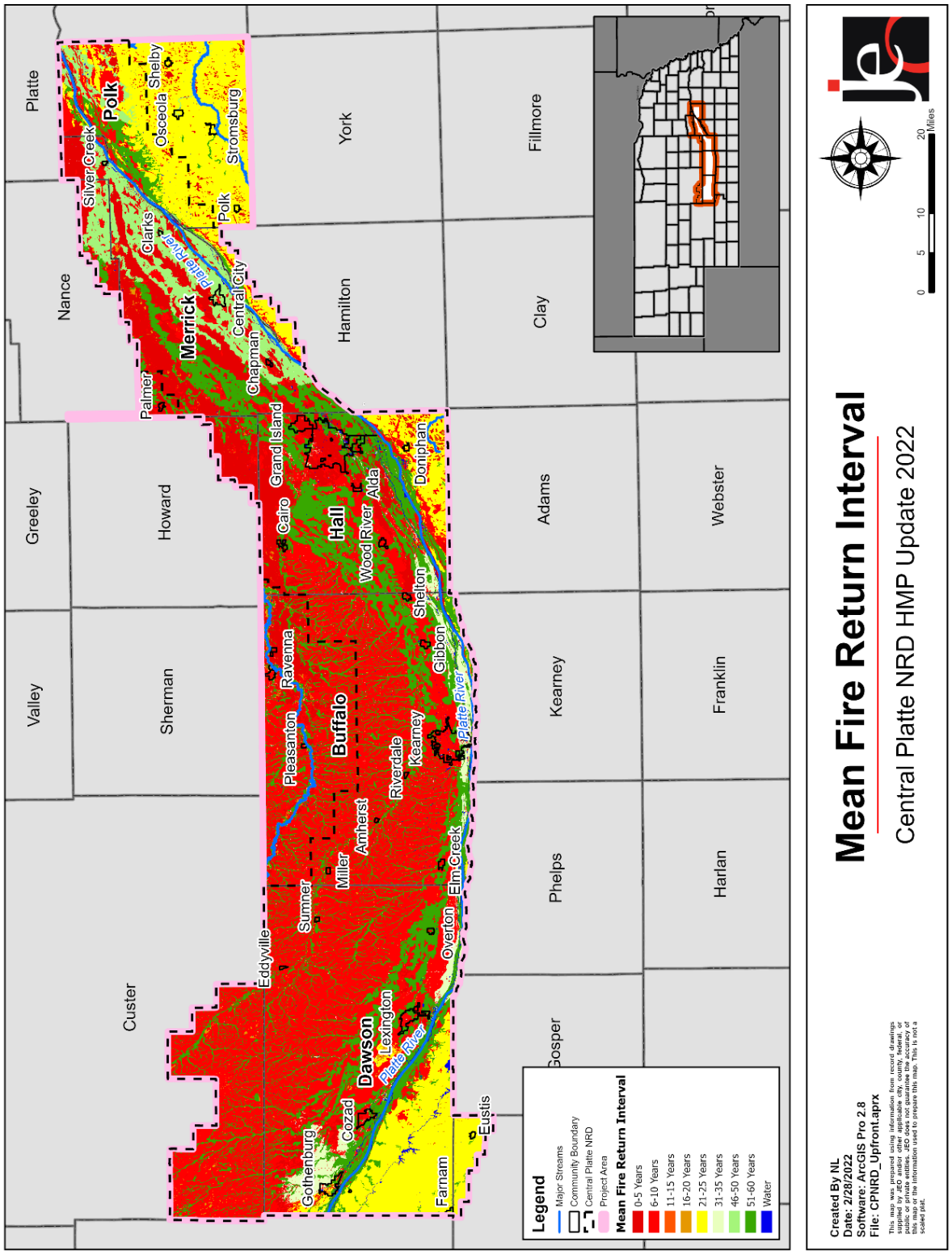


Source: FEMA, 2020[94]

Figure 43 shows the USGS' Mean Fire Return Interval. This model considers a variety of factors, including landscape, fire dynamics, fire spread, fire effects, and spatial context. These values show how often fires occur in each area under natural conditions.

93 Nebraska Forest Service. 2020. "Fire Incident Type Summary." Data Files 2000-2020 provided by NFS.
94 FEMA and NFIP. 2020. "Flood After Fire." Accessed September 2020. https://www.fema.gov/media-library-data/1573670012259-3908ab0344ff8fbf5d537ee0c6fb531d/101844-019_FEMA_FAF_Infographic-ENG-web_v8_508.pdf.

Figure 43: Mean Fire Return Interval



Historical Occurrences

For the planning area, 34 different fire departments reported a total of 1,460 wildfires between January 2000 and July 2020 according to the Nebraska Forest Service. The reported events burned 41,435 acres in total. While the RMA lists no damages from fire in the planning area, the NFS reported $248,598 in crop loss and $1,226,183 in property damages. Most fires occurred in 2006, 2012, and 2017 (Figure 45). The majority of wildfires were caused by Debris Burning or Miscellaneous causes (Figure 46). Wildfire events have ranged from less than one acre to 22,000 acres, with an average event burning 32.3 acres. It is important to note that there is no comprehensive fire event database. Fire events, magnitude, and local responses were reported voluntarily by local fire departments and local reporting standards can vary between departments. Actual fire events and their impacts are likely underreported in the available data.

Figure 44 shows the location and general size of wildfires from 2000 to 2020. Wildfire count data was provided by the Nebraska Forest Service from January 2000 to July 2020. As the number of reported wildfires by the county indicates, wildfire events can occur in any county within the planning area. Buffalo County has reported the greatest number of fires, but Dawson County had the highest number of acres burned.

Table 66: Reported Wildfires by County

County	Reported Wildfires	Acres Burned	Other Impacts
Buffalo	628	6,806	6 Injuries; 3 Fatalities; 47 structures threatened; 11 structures destroyed
Dawson	455	27,565	1 Injury; 44 structures threatened; 3 structures destroyed
Hall	68	5,349	1 structure threatened
Merrick	195	1,043	14 structures threatened; 9 structures destroyed
Polk	114	672	12 structures threatened; 1 structure destroyed

Source: NFS, 2000-2020[95]

95 Nebraska Forest Service. 2020. “Fire Incident Type Summary.” Data Files 2000-2020 provided by NFS.

Figure 44: Wildfire Occurrences in the Planning Area

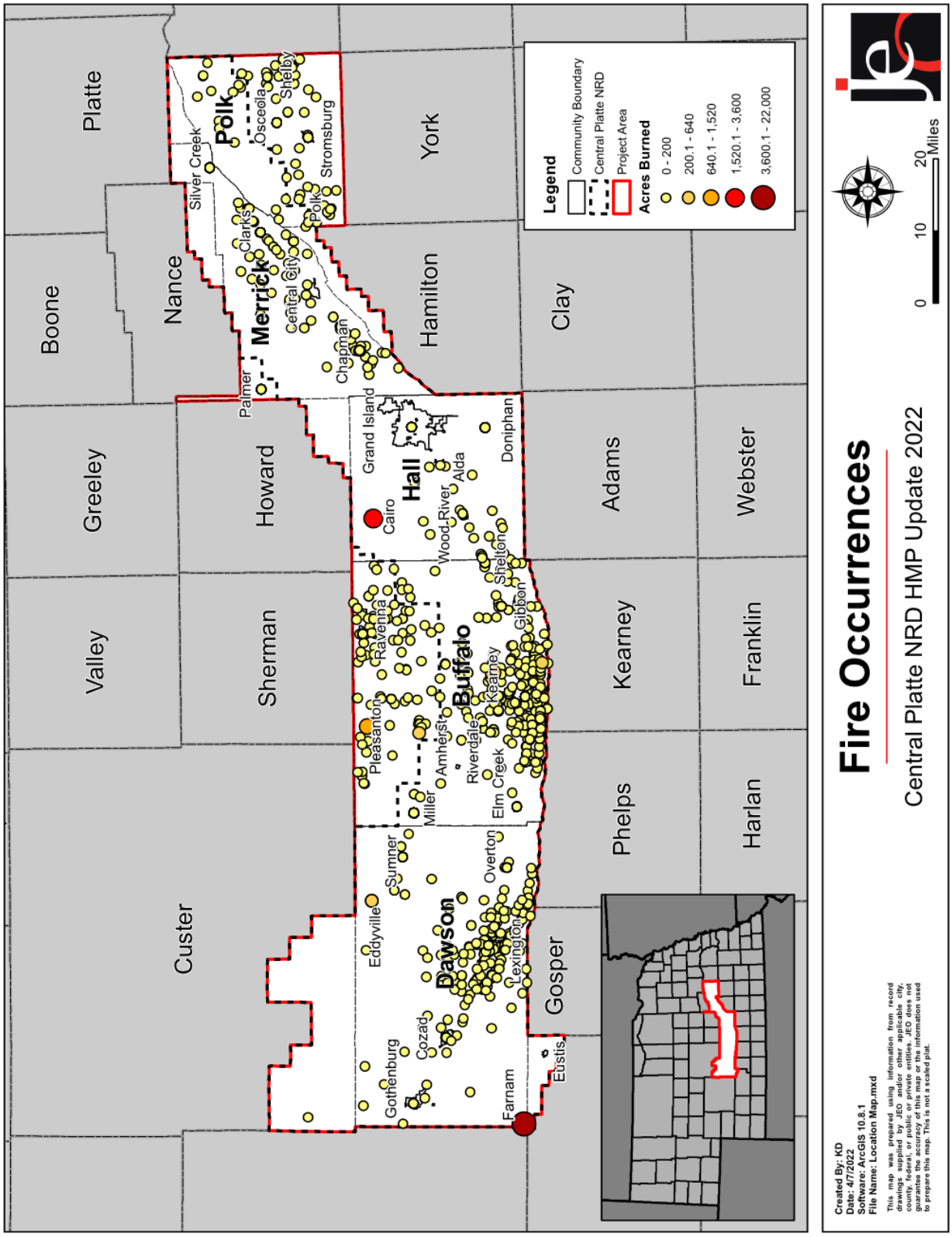
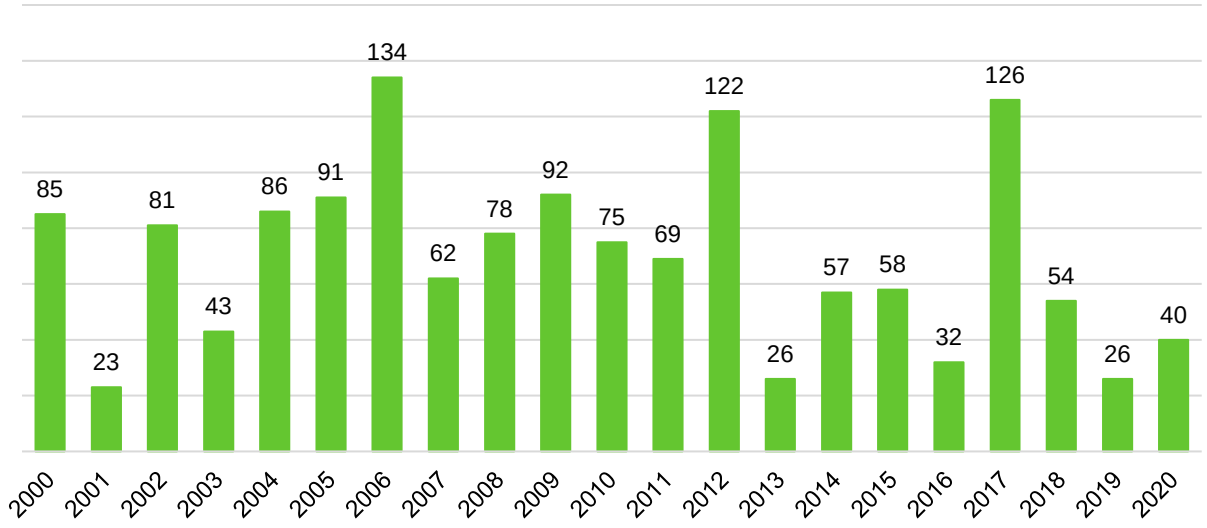
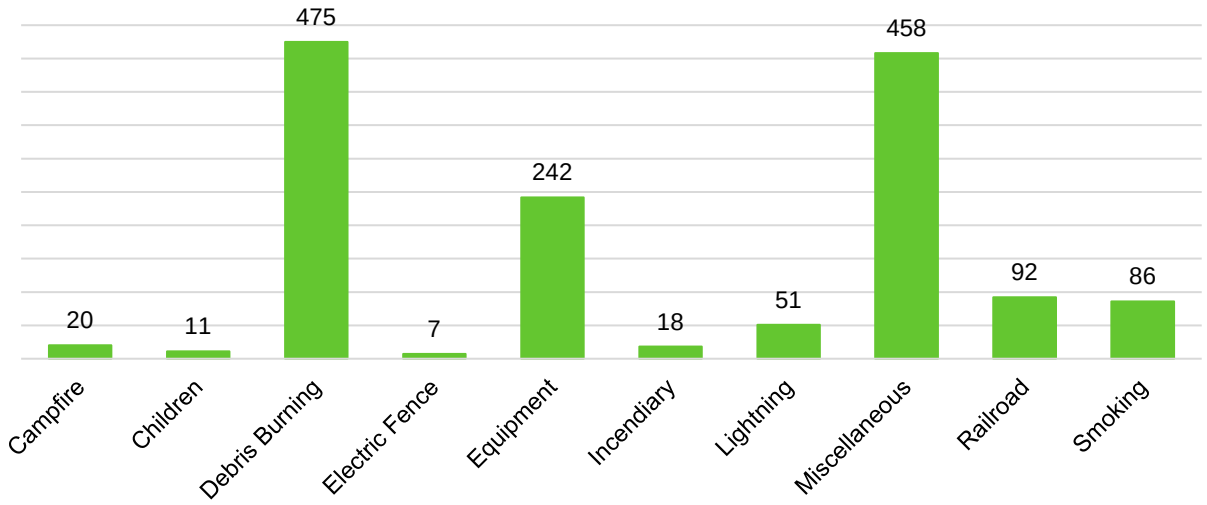


Figure 45: Wildfire Events by Year



Source: NFS, 2000-2020

Figure 46: Wildfires by Cause in Planning Area



Source: NFS, 2000-2020

Average Annual Losses

The average damage per event estimate was determined based upon records from the Nebraska Forest Service Wildfires Database from January 2000 to July 2020 and the number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. During this 20-year period, 1,460 wildfires burned 41,435 acres and caused $248,598 in crop and $1,226,183 in property damages.

Damages caused by wildfires extend past the loss of building stock, recreation areas, timber, forage, wildlife habitat, and scenic views. Secondary effects of wildfires, including erosion, landslides, introduction of invasive species, and changes in water quality, all increase due to the exposure of bare ground and loss of vegetative cover following a wildfire, and can often be more disastrous than the fire itself in long-term recovery efforts.

Table 67: Wildfire Loss Estimation

Hazard Type	Number of Events	Events Per Year	Average Acres Per Fire	Total Property Loss	Average Property Loss	Total Crop Loss	Average Annual Crop Loss
Grass/Wildfire	1,460	73	32.3	$1,226,183	$61,309	$248,598	$12,430

Source: NFS, 2000-2020

Table 68: Wildfire Event Impacts and Threats

Hazard Type	Injuries	Fatalities	Homes Threatened or Destroyed	Other Structures Threatened or Destroyed
Grass/Wildfire	7	3	77	65

Source: NFS, 2000-2020

Probability

Probability of wildfire occurrence is based on the historic record provided by the Nebraska Forest Service and reported potential by participating jurisdictions. With a grass/wildfire occurring each reported year (Figure 45) there is a 100 percent annual probability of wildfires occurring in the planning area each year.

Community Top Hazard Status

The following table lists jurisdictions which identified grass/wildfire as a top hazard of concern.

Jurisdiction	
Central City Fire District	Elm Creek Fire District
Central District Health Department	Eustis-Farnam Public Schools
Central Platte NRD	Farnam
Centura Public Schools	Gibbon Volunteer Fire District
Cozad	Pleasanton Fire District
Doniphan Fire District	Pleasanton Public Schools
Eddyville Fire District	

Regional Vulnerabilities

Periods of drought can occur throughout the year while extreme heat conditions during summer months greatly increase the potential for and magnitude of wildland fires. Drought has a high probability of occurring in the planning area and the planning area sees, on average, five days above 100°F. During a severe drought, dry conditions, and/or windy conditions, large wildfires can more easily spread.

Wildfire poses a threat to a range of demographic groups. Wildfire, wildfire within the WUI, and urban fire could result in major evacuations of residents in impacted and threatened areas. Groups and individuals lacking reliable transportation could be trapped in dangerous locations. Lack of transportation is common among the elderly, low-income individuals, and racial minorities; including on tribal reservation lands. Wildfires can cause extensive damage to both urban and rural building stock and properties including critical facilities and infrastructure, as well as agricultural producers which support the local industry and economy. Damaged homes can reduce available housing stock for residents, causing residents to leave the area. Additionally, fire events threaten the health and safety of residents and emergency response personnel. Recreation areas, timber and grazing land, wildlife habitat, and scenic views can also be threatened by wildfires.

Development across the planning area may be located within the WUI, particularly in larger metropolitan areas with a large amount of intermix overlap such as the City of Grand Island or the City of Kearney. Local officials can adopt codes and ordinances that can guide growth in ways to mitigate potential losses from wildfires. These may include more stringent building code standards, setback requirements, or zoning regulations.

According to the Central Platte and Loess Canyons CWPPs, specific concerns are located throughout the planning area. Table 69 and Table 70 describe other specific risks and vulnerabilities seen across the planning area.

Buffalo County

In Buffalo County, locations of special concern include areas surrounding municipalities, especially the area west of Kearney where there are several subdivisions with multiple structures, limited access, and areas with heavy fuels. There are several recreational and residential areas along the Platte River with heavy fuels and limited access. The entire county lies within the mixed grass prairie vegetation zone which includes agriculture crop fields, hay land, and grazing lands.

Dawson County

In Dawson County, locations of special concern include land in the northern and western parts of the county, where topography is rough and eastern redcedar has encroached into grasslands and created a high fire hazard for the area. The county lies within the mixed grass prairie vegetation zone. The northern portion is covered with hay and grazing lands and agricultural fields are widespread along the Wood River and the southeastern edge of the region.

Hall County

In Hall County, locations of special concern include population centers adjacent to grasslands and areas where eastern redcedar has encroached into grasslands, creating high fire hazard. Other areas at-risk from wildfire are located along the Platte and South Loup Rivers. The county consists of mixed-grass prairie, lowland tallgrass prairie and riparian deciduous forest and woody wetlands along the Platte River. Agriculture crop fields are prevalent across the county.

Merrick County

In Merrick County, locations of special concern include population centers adjacent to grasslands, areas with rough terrain and poor access, and wooded areas along the Platte River. The county is made up of mixed-grass prairie, lowland tallgrass prairie, and riparian deciduous forests along the Platte River.

Polk County

In Polk County, locations of special concern include Heron Point Lake, a sandpit lake with multiple large single-family dwellings and limited access, which is surrounded by wildland and pasture, population centers adjacent to grasslands, areas with rough terrain and poor access, and wooded areas along the rivers. The county lies within the upland tallgrass prairie vegetation zone with riparian deciduous woodlands along the Platte and Big Blue Rivers.

Table 69: Wildfire Vulnerabilities by County

County	Risk to Homes (Compared to NE Counties)	Exposure Type	Wildfire Likelihood (Compared to NE Counties)
Buffalo	Greater risk than 34% of NE Counties	Directly Exposed (18%) Indirectly Exposed (32%) Not Exposed (50%)	Greater risk than 36% of NE Counties
Dawson	Greater risk than 36% of NE Counties	Directly Exposed (14%) Indirectly Exposed (21%) Not Exposed (65%)	Greater risk than 38% of NE Counties
Hall	Greater risk than 7% of NE Counties	Directly Exposed (15%) Indirectly Exposed (14%) Not Exposed (71%)	Greater risk than 9% of NE Counties
Merrick	Greater risk than 12% of NE Counties	Directly Exposed (26%) Indirectly Exposed (23%) Not Exposed (51%)	Greater risk than 15% of NE Counties
Polk	Populated areas in nearly all other NE counties have greater risk than Polk County	Directly Exposed (26%) Indirectly Exposed (9%) Not Exposed (65%)	Populated areas in nearly all other NE counties have greater risk than Polk County

Source: Wildfire Risk to Communities, 2020[96]

Table 70: Wildfire Vulnerable Populations by County

County	Families in Poverty	People with Disabilities	People over 65	Difficulty with English	Households with no Vehicle	Mobile Homes
Buffalo	8.4%	11.1%	13.5%	1.7%	4.7%	7%
Dawson	10.8%	12.7%	15.4%	9.7%	6%	7.8%
Hall	10.7%	12.4%	14.4%	6.2%	4.9%	4.8%
Merrick	5.6%	15.8%	19.8%	0.3%	6.6%	5.9%
Polk	4.6%	12.6%	21.1%	1%	4.6%	3.2%

Source: Wildfire Risk to Communities, 2020[97]

The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles.*

96 United States Department of Agriculture, United States Forest Service. 2022. "Wildfire Risk to Communities." https://wildfirerisk.org/.
97 United States Department of Agriculture, United States Forest Service. 2022. "Wildfire Risk to Communities." https://wildfirerisk.org/.

Table 71: Regional Wildfire Vulnerabilities

Sector	Vulnerability
People	-Risk of injury or death for residents and firefighting personnel -Displacement of people and loss of homes -Lack of transportation poses risk to low-income individuals, families, and elderly -Transportation routes may be blocked by fire, preventing evacuation efforts
Economic	-Damages to buildings and property can cause significant losses to business owners -Loss of businesses
Built Environment	-Property damages
Infrastructure	-Damage to power lines and utility structures -Potential loss of firefighting equipment and resources
Critical Facilities	-Risk of damages
Climate	-Changes in seasonal temperature and precipitation normals can increase frequency and severity of wildfire events -Changes in climate can help spread invasive species, changing potential fuel loads in wildland areas
Other	-Increase chance of landslides, erosion, and land subsidence -May lead to poor water quality -Post fire, flash flooding events may be exacerbated

Hazardous Materials Release

The following description for hazardous materials is provided by the Federal Emergency Management Agency (FEMA):

> Chemicals are found everywhere. They purify drinking water, increase crop production and simplify household chores. But chemicals also can be hazardous to humans or the environment if used or released improperly. Hazards can occur during production, storage, transportation, use or disposal. You and your community are at risk if a chemical is used unsafely or released in harmful amounts into the environment where you live, work or play.[98]

Hazardous materials in various forms can cause fatalities, serious injury, long-lasting health effects, and damage to buildings, homes, and other property. Many products containing hazardous chemicals are used and stored in homes routinely. Chemicals posing a health hazard include carcinogens, toxic agents, reproductive toxins, irritants, and many other substances that can harm human organs or vital biological processes.

Chemical manufacturers are one source of hazardous materials, but there are many others, including service stations, hospitals, and hazardous materials waste sites. Varying quantities of hazardous materials are manufactured, used, or stored in an estimated 4.5 million facilities in the United States—from major industrial plants to local dry-cleaning establishments or gardening supply stores.

Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. Hazardous materials incidents are technological (meaning non-natural hazards created or influenced by humans) events that involve large-scale releases of chemical, biological or radiological materials. Hazardous materials incidents generally involve releases at fixed-site facilities that manufacture, store, process or otherwise handle hazardous materials or along transportation routes such as major highways, railways, navigable waterways and pipelines. A large number of spills also occur during the loading and unloading of chemicals.

The Environmental Protection Agency (EPA) requires the submission of the types and locations of hazardous chemicals being stored at any facility within the state over the previous calendar year. This is completed by submitting a Tier II form to the EPA as a requirement of the Emergency Planning and Community Right-to-Know Act of 1986.[99]

The transportation of hazardous materials is defined by the U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA) as "…a substance that has been determined to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce…"[100] According to PHMSA, hazardous materials traffic in the U.S. now exceeds 1,000,000 shipments per day.[101] Nationally, the U.S. has had 108 fatalities associated with the

98 Federal Emergency Management Agency. 2017. "Hazardous Materials Incidents." https://www.ready.gov/hazardous-materials-incidents
99 Emergency Planning and Community Right-to-Know Act of 1986, Pub. L. No. 116 § 10904. (1986).
100 Pipeline and Hazardous Materials Safety Administration. 2017. "Hazmat Safety Community FAQ." https://www.phmsa.dot.gov/about-phmsa/phmsa-faqs
101 U.S. Department of Transportation. 2015. "2012 Economic Census: Transportation." https://data.census.gov/cedsci/.

transport of hazardous materials between 2007 through 2016.[102] While such fatalities are a low probability risk, even one event can harm many people. For example, a train derailment in Crete, Nebraska in 1969 allowed anhydrous ammonia to leak from a rupture tanker. The resulting poisonous fog killed nine people and injured 53.

Table 72 demonstrates the nine classes of hazardous material according to the 2016 Emergency Response Guidebook.

Table 72: Hazardous Materials Classes

Class	Type of Material	Divisions
1	Explosives	Division 1.1 – Explosives with a mass explosion hazard Division 1.2 – Explosives with a projection hazard but not a mass explosion hazard Division 1.3 – Explosives which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard Division 1.4 – Explosives which present no significant blast hazard Division 1.5 – Very insensitive explosives with a mass explosion hazard Division 1.6 – Extremely insensitive articles which do not have a mass explosion hazard
2	Gases	Division 2.1 – Flammable gases Division 2.2 – Non-flammable, non-toxic gases Division 2.3 – Toxic gases
3	Flammable liquids (and Combustible liquids)	
4	Flammable solids; Spontaneously combustible materials	Division 4.1 – Flammable solids, self-reactive substances and solid desensitized explosives Division 4.2 – Substances liable to spontaneous combustion Division 4.3 – Substances which in contact with water emit flammable gases
5	Oxidizing substances and Organic peroxides	Division 5.1 – Oxidizing substances Division 5.2 – Organic peroxides
6	Toxic substances and infections substances	Division 6.1 – Toxic substances Division 6.2 – Infectious substances
7	Radioactive materials	
8	Corrosive materials	
9	Miscellaneous hazardous materials/products, substances, or organisms	

Source: Emergency Response Guidebook, 2016[103]

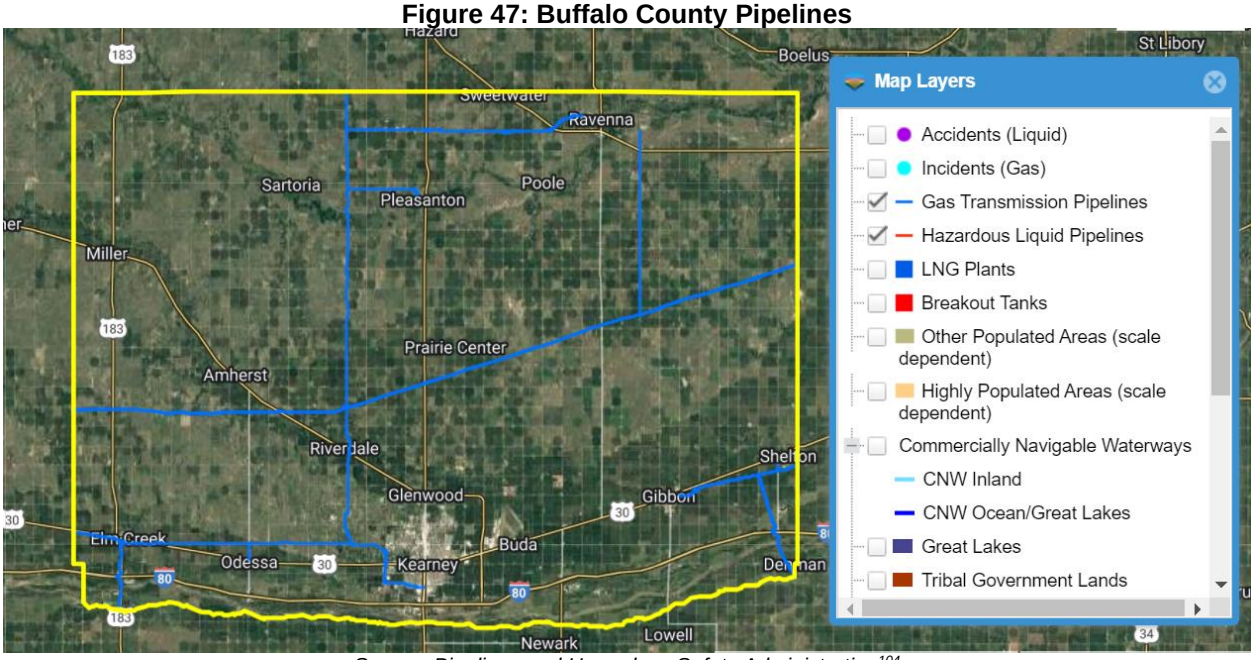
102 Pipeline and Hazardous Materials Safety Administration. 2016. "10 Year Incident Summary Reports." https://www.phmsa.dot.gov/hazmat/library/data-stats/incidents

103 U.S. Department of Transportation Pipeline and Hazardous materials Safety Administration. 2016. "2016 Emergency Response Guidebook." https://www.phmsa.dot.gov/hazmat/outreach-training/erg

Location

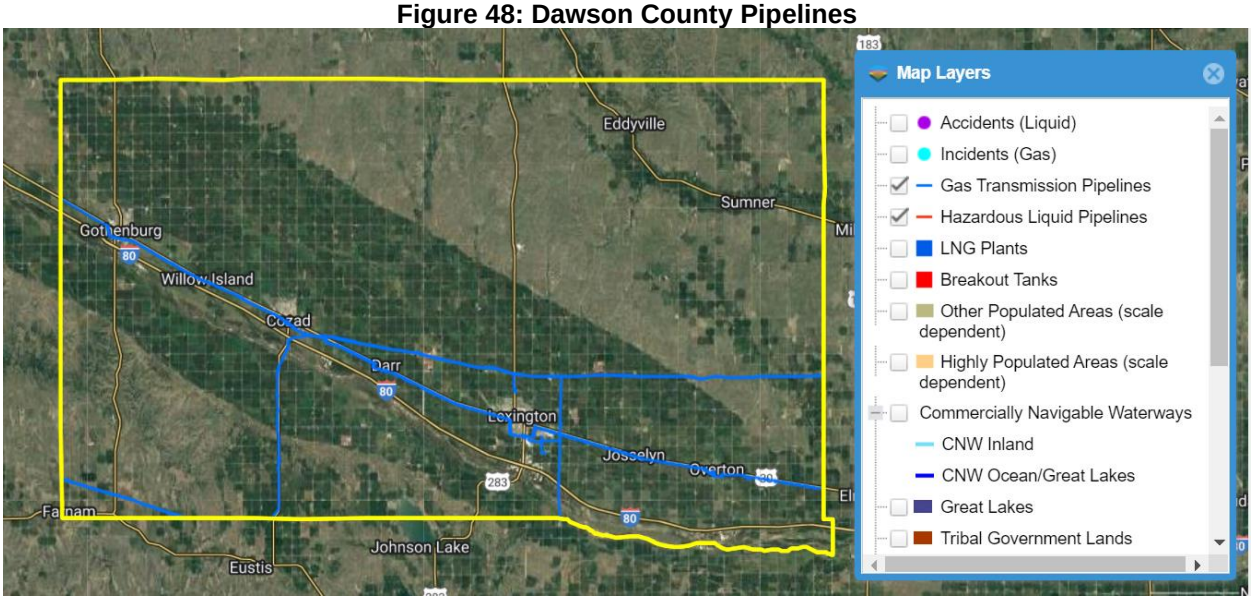
According to PHMSA, there are several gas transmission and hazardous liquid pipelines located in the planning area. A map of the pipelines and incidents from PHMSA for the five-county planning area can be seen in the following figures.

Figure 47: Buffalo County Pipelines



Source: Pipelines and Hazardous Safety Administration[104]

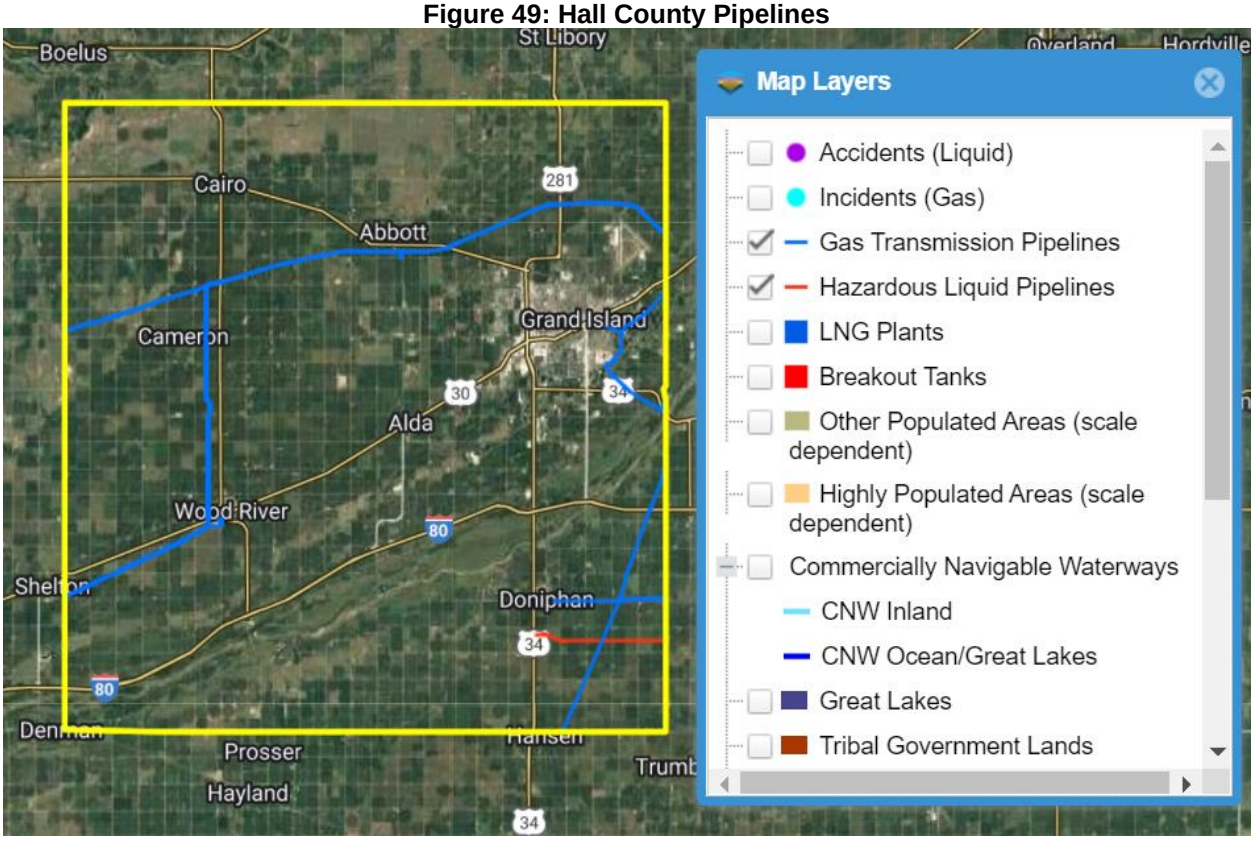
Figure 48: Dawson County Pipelines



Source: Pipelines and Hazardous Safety Administration

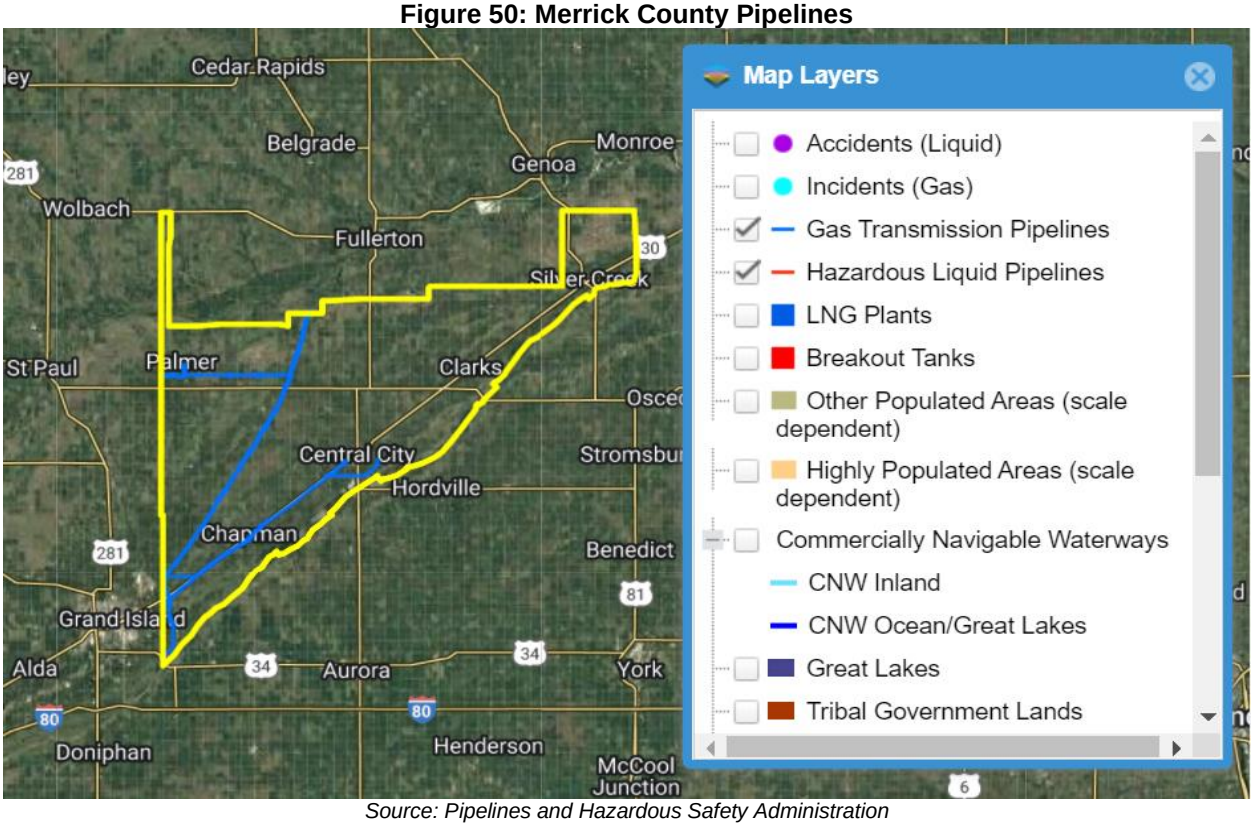
104 Pipeline and Hazardous Materials Safety Administration. 2021. "National Pipeline Mapping System." https://www.npms.phmsa.dot.gov/ .

Figure 49: Hall County Pipelines



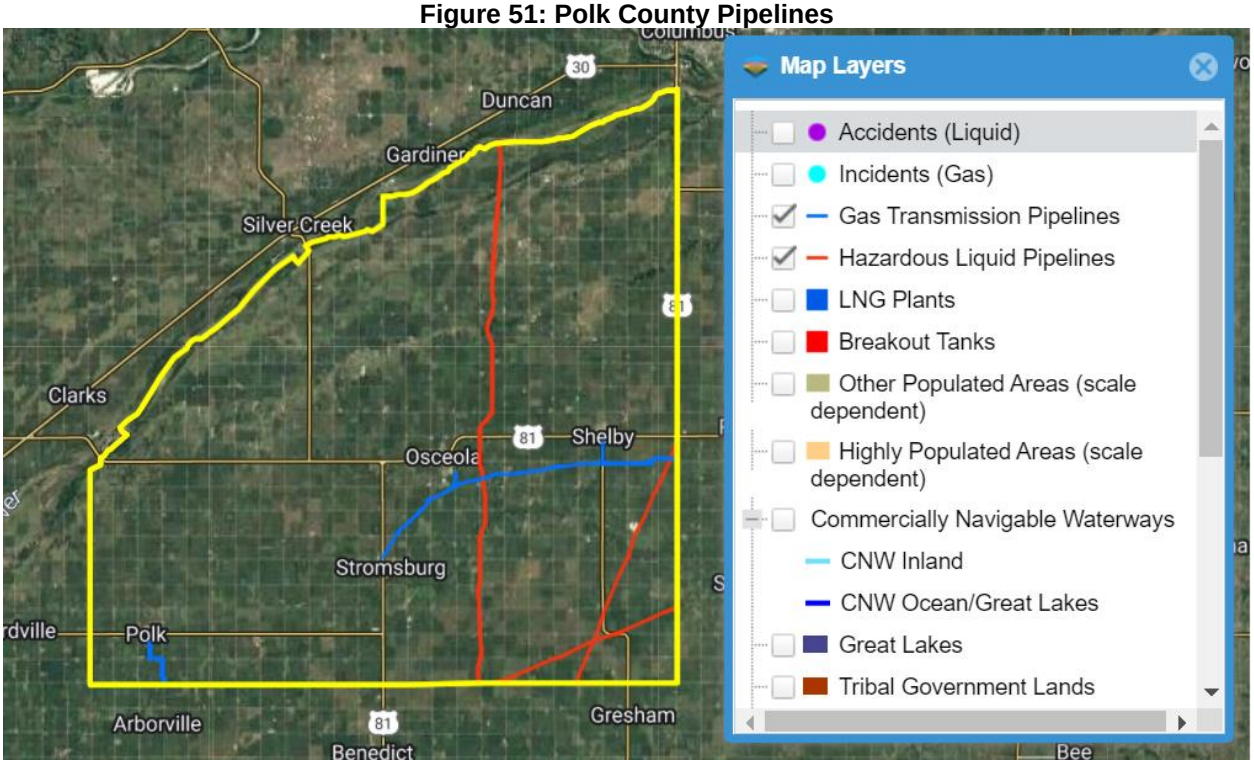
Source: Pipelines and Hazardous Safety Administration

Figure 50: Merrick County Pipelines



Source: Pipelines and Hazardous Safety Administration

Figure 51: Polk County Pipelines



Source: Pipelines and Hazardous Safety Administration

There are 238 facility locations across the planning area that submitted Tier II reports to the Nebraska Department of Environment and Energy (NDEE) in 2020. These locations are shown in Figure 52. A listing of hazardous material storage sites can be found in *Section Seven: Community Profiles* for each jurisdiction.

A large number of spills typically occur during the loading and unloading of chemicals for highway and pipeline chemical transport. Transportation corridors in the planning area are primarily US Highways, State Highways, and Interstate 80.

Hazardous materials releases during transportation primarily occur on major transportation routes as identified in Figure 53. Participating communities specifically reported transportation along railroads and highways as having the potential to impact their communities. Railroads providing service through the planning area have developed plans to respond to chemical releases along rail routes.

Figure 52: Fixed Chemical Sites

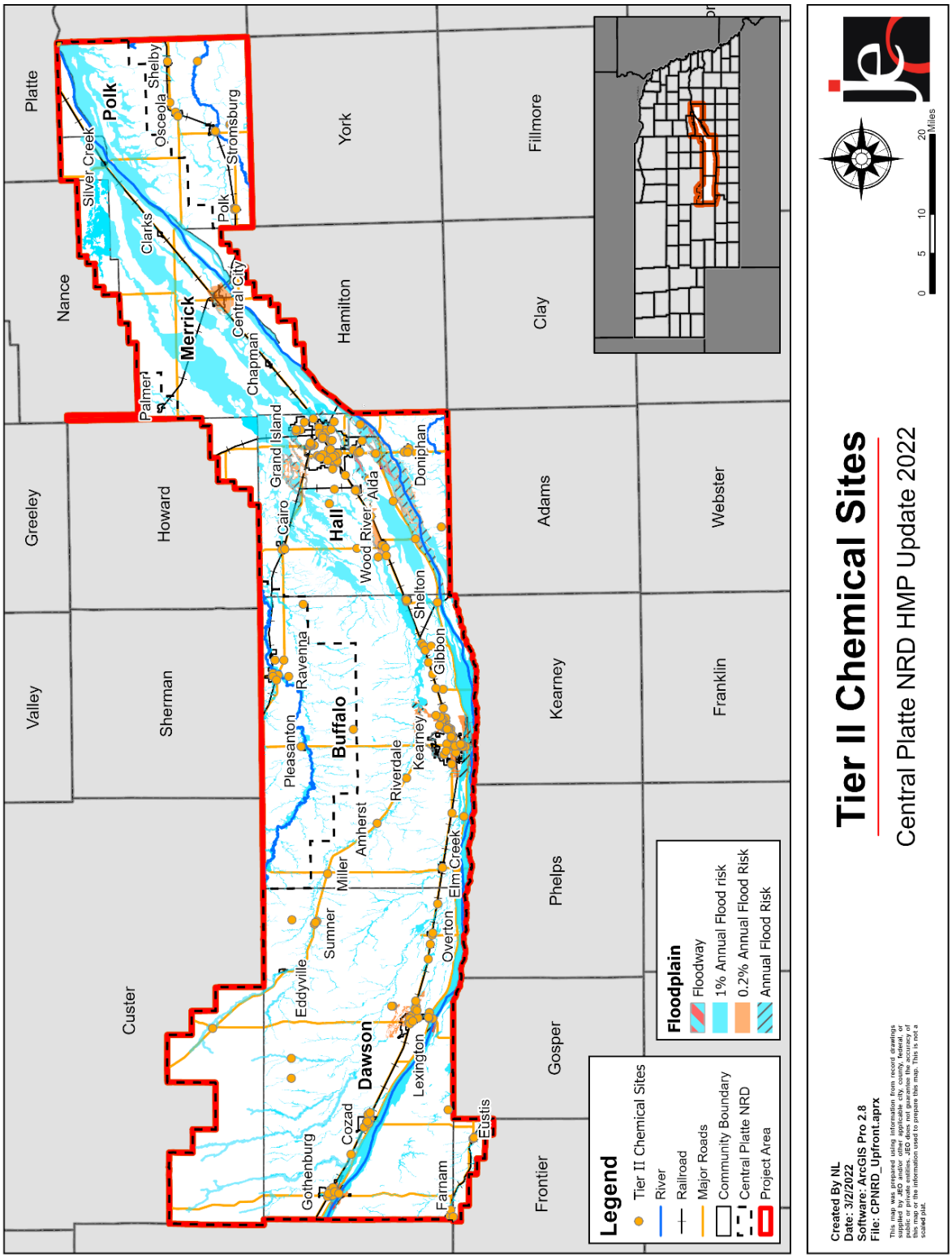
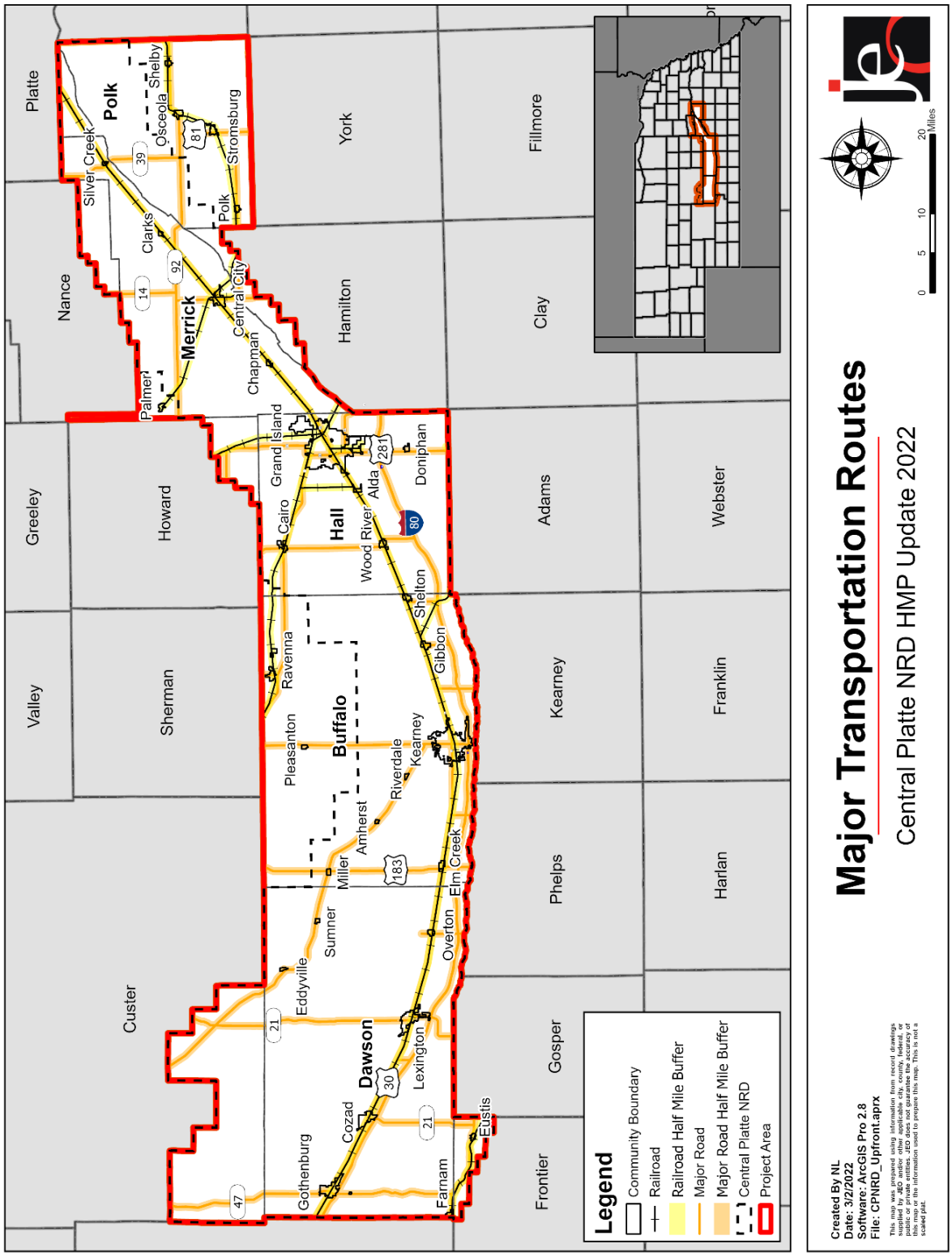


Figure 53: Major Transportation Corridors



Extent

The extent of chemical spills at fixed sites varies and depends on the type of chemical that is released with a majority of events localized to the facility. The probable extent of chemical spills during transportation is difficult to anticipate and depends on the type and quantity of chemical released. In total 176 fixed site releases have occurred in the planning area, and the total amount spilled ranged from 0 gallons to 24,000 gallons. Of the 176 chemical spills, seven spills led to evacuations, five spills led to injuries, and one spill led to one fatality. In total 183 releases have occurred during transportation in the planning area. Transportation spills ranged from no material released to over 13,789 liquid gallons of material with an average quantity spilled of 281 liquid gallons. Of the 183 chemical spills, six spills led to evacuations, and three spills resulted in injuries. Based on historic records, it is likely that any spill involving hazardous materials will not affect an area larger than a quarter mile from the spill location.

Historical Occurrences

Hazardous Materials Release – Fixed Sites

According to the U.S. Coast Guard's National Response Center database (NRC), there have been 176 hazardous materials releases at fixed sites from 1990 through February 2020 in the planning area. There were no property damages reported for these releases. The following table displays the larger spills that have occurred throughout the planning area (>500 gallons).

Table 73: Hazardous Material Releases (Fixed Site)

Year of Event	Location of Release	Quantity Spilled	Material Involved	Number of Injuries	Property Damage
1991	Grand Island	600 Gallons	Sulfuric Acid	0	$0
1993	Cozad	1,000 Gallons	Other Oil (Shock Absorber Oil)	0	$0
1995	Grand Island	2,850 Gallons	Oil, Misc: Mineral	0	$0
2004	Grand Island	7,000 Gallons	Processed Wastewater	0	$0
2006	Grand Island	24,000 Gallons	Beef Plant Wastewater	0	$0
2009	Wood River	6,000 Gallons	Sulfuric Acid	0	$0
2009	Wood River	20,000 Gallons	Ethanol	0	$0
2017	Central City	3,500 Gallons	Gasoline: Automotive (Unleaded)	0	$0

Source: National Response Center, 1990-2020[105]

105 U.S. Coast Guard National Response Center. 2020. "Chemical Pollution and Railroad Incidents, 2000-2020." [datafile]. https://nrc.uscg.mil/.

Hazardous Materials Release – Transportation

According to the Pipeline and Hazardous Materials Safety Administration (PHMSA), 183 hazardous materials releases occurred during transportation in the planning area between 1971 and June 2021. During these events, there were three injuries, no fatalities, and $1,325,150 in damages.

The following table provides a list of the most damaging hazardous materials releases during transportation in the planning area.

Table 74: Hazardous Materials Release (Transportation)

Date of Event	Location of Release	Failure Description	Material Involved	Method of Transportation	Amount	Total Damage	Evacuation (Yes/No)
5/18/1992	Willow Island	Derailment	Hazardous Substance	Rail	13,770 LGA	$212,000	Yes
1/15/2003	Wood River	Vehicular Crash	Helium, Refrigerated Liquid (Cryogenic Liquid)	Highway	0 LGA	$130,000	No
2/21/2003	Grand Island	Equipment Failure	Ferric Chloride Solution	Rail	6,500 LGA	$15,000	No
12/6/2006	Grand Island	Broken Component or Device	Liquid Ammonium Nitrate	Rail	40 LGA	$33,872	No
5/27/2012	Kearney	Fire, Temperature, or Heat	Corrosive Liquid	Highway	852.5 LGA	$82,854	No
8/2/2012	Overton	Vehicular Crash	Sodium Hydroxide Solution	Highway	84 LGA	$81,270	No
4/13/2013	Grand Island	Unknown	Hypochlorite Solutions	Highway	70 LGA	$94,000	Yes
7/13/2013	Elm Creek	Broken Component or Device	Polychlorinated Biphenyls	Highway	70 LGA	$53,000	No

Source: PHMSA, 1971– June 2021[106]

106 Pipeline and Hazardous Materials Safety Administration. May 2019. "Incident Statistics: Nebraska." https://www.phmsa.dot.gov/hazmat-program-management-data-and-statistics/data-operations/incident-statistics.

Average Annual Damages

Using data from Table 75, average annual damages from hazardous materials releases can be estimated. There have been 176 fixed site spills in the planning area reported from the NRC and 183 transportation spills as reported by PHMSA. Neither the NRC nor PHMSA track crop losses from chemical spills. These events reported $1,325,150 in property damages. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life.

Table 75: Hazardous Materials Release Loss Estimate

Hazard Type	Number of Events	Events Per Year	Injuries	Fatalities	Total Damages	Average Annual Chemical Spill Loss
Hazardous Materials Release (Fixed Site)	176	5.7	0	1	$0	$0
Hazardous Materials Release (Transportation)	183	3.6	9	0	$1,325,150	$25,983

Source: National Response Center, 1990-2020; PHMSA, 1971-June 2021

Probability

Hazardous materials releases at fixed site storage areas are likely in the future. Given the historic record of occurrence (at least one fixed site releases reported in all 31 years on record), the annual probability of occurrence for hazardous materials releases at fixed sites is 100 percent.

Hazardous materials releases during transportation are likely in the future. Given the historic record of occurrence (33 transportation releases reported in 51 years), the annual probability of occurrence for hazardous materials releases during transportation is 65 percent.

Community Top Hazard Status

The following table lists jurisdictions which identified hazardous materials release as a top hazard of concern.

Jurisdiction	
Alda	Kearney
Buffalo County	Merrick County
Central City Public Schools	Pleasanton Fire District
Clarks	Pleasanton Public Schools
Doniphan Fire District	Ravenna Public Schools
Doniphan	Ravenna
Elm Creek Fire District	Riverdale
Elm Creek	Shelton
Four Corners Health Department	Silver Creek
Gibbon Volunteer Fire District	Two Rivers Public Health Department
Gibbon	Wood River Rural Schools
Gothenburg	Wood River
Grand Island	

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 76: Regional Hazardous Materials Release Vulnerabilities

Sector	Vulnerability
People	-Those in close proximity to chemical fixed sites or transportation corridors could have minor to moderate health impacts -Possible evacuation -Hospitals, nursing homes, and the elderly at greater risk due to low mobility
Economic	-A chemical plant shutdown in smaller communities would have significant impacts to the local economy -Evacuations and closed transportation routes could impact businesses near spill
Built Environment	-Risk of fire or explosion
Infrastructure	-Transportation routes can be closed during evacuations
Critical Facilities	-Critical facilities are at risk of evacuation
Climate	-None

Levee Failure

According to FEMA:

> "The United States has thousands of miles of levee systems. These manmade structures are most commonly earthen embankments designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water to provide some level of protection from flooding. Some levee systems date back as far as 150 years. Some levee systems were built for agricultural purposes. Those levee systems designed to protect urban areas have typically been built to higher standards. Levee systems are designed to provide a specific level of flood protection. No levee system provides full protection from all flooding events to the people and structures located behind it. Thus, some level of flood risk exists in these levee-impacted areas."

Levee failure can occur several ways. A breach of a levee is when part of the levee breaks away, leaving a large opening for floodwaters to flow through. A levee breach can be gradual by surface or subsurface erosion, or it can be sudden. A sudden breach of a levee often occurs when there are soil pores in the levee that allow water to flow through causing an upward pressure greater than the downward pressure from the weight of the soil of the levee. This under seepage can then resurface on the backside of the levee and can quickly erode a hole to cause a breach. Sometimes the levee actually sinks into a liquefied subsurface below.

Another way a levee failure can occur is when the water overtops the crest of the levee. This happens when the flood waters simply exceed the lowest crest elevation of the levee. An overtopping can lead to significant erosion of the backside of the levee and can result to a breach and thus a levee failure.

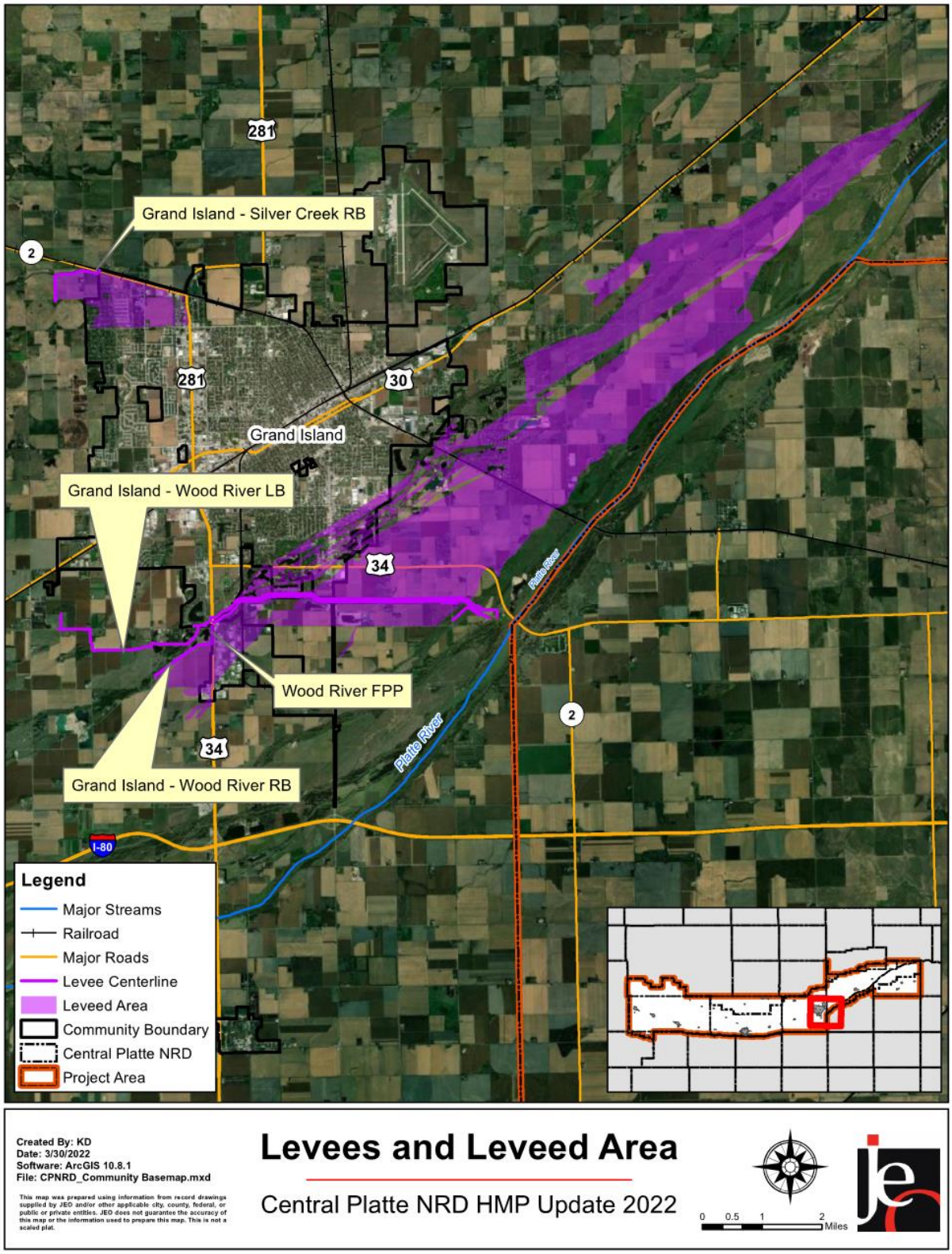
Location

There is one non-federal levee and three federal (USACE) levees located near the City of Grand Island. The four levees are located in Hall County, south of Grand Island. The Grand Island – Wood River RB levee spans 7.19 miles and protects 101 residents and 118 structures. The Grand Island – Wood River LB levee spans 8.8 miles and protects 9,327 residents and 3,715 structures. The Wood River FPP levee spans 0.31 miles and does not protect any residents or structures.

The Wood River Right Bank Levee system starts southwest of Grand Island and continues east approximately 4.7 miles where it ends at the confluence of the Platte River. The Wood River Left Bank Levee system starts southwest of Grand Island and continues east approximately 7.9 miles where it ends at the confluence of the Platte River. The Wood River FPP Levee system is 0.31 miles in length and located south of Grand Island along Tom Osbourne Expressway and southeast of Wood River. The Silver Creek Levee, a non-federal levee which was completed in the spring of 2019, is an earthen embankment approximately 6,150 feet (1.16 miles) in length located on the northwest side of Grand Island. The four levee systems are shown in the following figure.

A 2020 watershed study of Wood River conducted by the Nebraska Silver Jackets found that the 1% annual exceedance probability peak discharge is 15% less than the current design for the Grand Island diversion channel.

Figure 54: Levees in the Planning Area



The following two tables provide a list of federal and non-federal levees in the planning area.

Table 77: USACE Levees in Planning Area

Name	Sponsor	Location	Length (Miles)	Risk Level
Grand Island - Wood River LB	USACE	Grand Island	8.8	Low
Grand Island - Wood River RB	USACE	Grand Island	7.19	Low
Wood River FPP	USACE	Grand Island	0.31	Not Screened

Source: USACE Levee Database

Table 78: Other Levees in Planning Area

Name	Sponsor	Location	Length (Miles)	Risk Level
Silver Creek Levee	Central Platte Natural Resources District	Grand Island	1.16	Not Screened

Beyond the USACE's National Levee Database, there is no known comprehensive list of levees that exists in the planning area especially for private agricultural levees. Thus, it is not possible at this time to document the location of non-federal levees, the areas they provide flood risk reduction, nor the potential impact of these levees.

Extent

Given the location of the three federal levees and one non-federal levee in the planning area, the extent of levee failure is limited to the area surrounding Grand Island.

USACE, who is responsible for federal levee oversite and inspection of levees, has three ratings for levee inspections. Any levee failure events in the planning area will fall within USACE's rating system; however, it is not currently possible to determine what level of damage each levee system will experience. Non-federal levees are not inspected and thus do not have ratings.

Table 79: USACE Levee Rating Categories

Ratings	Description
Acceptable	All inspection items are rated as Acceptable
Minimally Acceptable	One or more inspection items are rated as Minimally Acceptable or one or more items are rated as Unacceptable and an engineering determination concludes that the Unacceptable inspection items would not prevent the segment/system from performing as intended during the next flood event
Unacceptable	One or more items are rated as Unacceptable and would prevent the segment/system from performing as intended, or a serious deficiency noted in past inspections has not been corrected within the established timeframe, not to exceed two years

Source: USACE

Historical Occurrences

There have been no recorded instances of levee failure in the planning area.

Potential Losses

To determine potential losses for levee failure, a parcel inventory from leveed areas was utilized. Based on the nature of the assessor's parcel data, it is not possible to do a true structural inventory with structure-specific impacts. Instead, inundated parcels were used as a proxy for structural data. The number of improvements and value of improvements were determined based on assessor data from Hall and Merrick Counties. The population in leveed areas was determined based on information from the USACE Levee Database. The following table shows the number of improvements included in the leveed areas for the four levees located near Grand Island. A population of 9,428 people resides in the leveed area. A total of 1,663 improvements are within the leveed area and are valued at $395,380,510.

Table 80: Potential Losses in Levee Breach Area

Levee	Number of Improvements in Leveed Area[1]	Value of Improvements within Leveed Area[1]	Population in Leveed Area[2]
Grand Island - Wood River LB	908	$197,996,628	9,327
Grand Island - Wood River RB	85	$50,571,365	101
Wood River FPP	0	$0	0
Silver Creek Levee	670	$146,812,517	N/A
Total	**1,663**	**$395,380,510**	**9,428**

Source: 1 Hall County and Merrick County Assessor; 2 Indicates data is from USACE Levee Database

Probability

Given no historical occurrences of federal levee failure in the planning area, the annual probability of this event occurring is considered to be less than one percent. While it is possible for levee failure to occur in the future, this is considered a low probability.

Community Top Hazard Status

The following table lists jurisdictions which identified levee failure as a top hazard of concern.

Jurisdiction	
Dawson County Drainage District No. 2 & 3	Grand Island
Hall County	Central Platte NRD

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 81: Regional Vulnerabilities

Sector	Vulnerability
People	-Those living in federal and non-federal levee protected areas -Residents with low mobility or with no access to a vehicle are more vulnerable during levee failure events -Those without adequate notification (text alerts, sirens, internet or cable access) may be at greater risk
Economic	-Businesses and industries protected by levees are at risk during failures
Built Environment	-All buildings within leveed protected areas are at risk to damages
Infrastructure	-Major transportation corridors and bridges at risk during levee failures
Critical Facilities	-Critical facilities in levee protected areas are at risk
Climate	-Changes in seasonal precipitation and temperature normals can increase strain on levee infrastructure

Public Health Emergency

According to the World Health Organization (WHO), a public health emergency is:

> "an occurrence or imminent threat of an illness or health condition, caused by bio terrorism, epidemic or pandemic disease, or (a) novel and highly fatal infectious agent or biological toxin, that poses a substantial risk of a significant number of human facilities or incidents or permanent or long-term disability" (WHO/DCD, 2001). The declaration of a state of public health emergency permits the governor to suspend state regulations and change the functions of state agencies.[107]

The number of cases that qualifies as a public health emergency depends on several factors including the illness, its symptoms, ease in transmission, incubation period, and available treatments or vaccinations. With the advent of sanitation sewer systems and other improvements in hygiene since the 19th century, the spread of infectious disease has greatly diminished. Additionally, the discovery of antibiotics and the implementation of universal childhood vaccination programs have played a major role in reducing human disease impacts. Today, human disease incidences are carefully tracked by the Centers for Disease Control and Prevention (CDC) and state organizations for possible epidemics and to implement control systems. Novel illnesses or diseases have the potential to develop annually and significantly impact residents and public health systems.

Some of the best actions or treatments for public health emergencies are nonpharmaceutical interventions (NPI). These are readily available behaviors or actions, and response measures people and communities can take to help slow the spread of respiratory viruses such as influenza. Understanding NPIs and increasing the capacity to implement them in a timely way, can improve overall community resilience during a pandemic. Using multiple NPIs simultaneously can reduce influenza transmission in communities even before vaccination is available.[108]

Pandemics are global or national disease outbreaks. These types of illnesses, such as influenza, can easily spread person-to-person, cause severe illness, and are difficult to contain. An especially severe pandemic can lead to high levels of illness, death, social disruption, and economic turmoil. Past pandemic events include:

- 1918 Spanish Flu: the H1N1 influenza virus spread world-wide during 1918 and 1919. It is estimated that at least 50 million people worldwide died during this pandemic with about 675,000 deaths alone in the United States. No vaccine was ever developed, and control efforts included self-isolation, quarantine, increased personal hygiene, disinfectant use, and social distancing.

- 1957 H2N2 Virus: a new influenza A virus emerged in Eastern Asia and eventually crossed into coastal U.S. cities in summer of 1957. In total 1.1 million people worldwide died of the flu with 116,000 of those in the United States.

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107 World Health Organization. 2008. Accessed April 2020. "Glossary of humanitarian Terms." https://www.who.int/hac/about/definitions/en/.
108 U.S. Department of Health and Human Services. 2017. "Pandemic Influenza Plan: 2017 Update." https://www.cdc.gov/flu/pandemic-resources/pdf/pan-flu-report-2017v2.pdf.

- 1968 H3N2 Virus: an influenza A virus discovered in the United States in September 1968 which killed over 100,000 citizens. The majority of deaths occurred in people 65 years and older.

- 2009 H1N1 Swine Flu: a novel influenza A virus discovered in the United States and spread quickly across the globe. This flu was particularly prevalent in young people while those over 65 had some antibody resistance. The CDC estimated the U.S. had over 60,800,000 cases and 12,469 deaths.

- 2019 COVID-19: the novel influenza A virus which originated in Wuhan China and spread globally. As of June 16, 2022, the CDC reported over 85,000,000 cases and 1,007,964 deaths attributed to COVID-19. Efforts to control and limit the virus included self-isolation, quarantine, increased cleaning measures, social distancing, and vaccinations. Significant impacts to the national and global economy have been caused by COVID-19.

The State of Nebraska Department of Health and Human Services requires doctors, hospitals, and laboratories to report on many communicable diseases and conditions to monitor disease rates for epidemic events. Additionally, regional or county health departments monitor local disease outbreaks and collect data relevant to public health. In the planning area, the Central District Health Department covers Hall and Merrick Counties, the Four Corners Health Department covers Polk County, and the Two Rivers Public Health Department covers Buffalo and Dawson Counties.

Location

Human disease outbreaks can occur anywhere in the planning area. Public heath emergencies or pandemic threshold levels are dependent on the outbreak type, transmission vectors, location, and season. Normal infectious disease patterns are changing due to increasing human mobility and climate change. Rural populations are particularly at risk for animal-related diseases while urban areas are at greater risk from community spread type illnesses. All residents throughout the planning area are at risk during public health emergencies. All areas within the planning area experienced impacts from COVID-19 specifically during 2020 and 2021.

Extent

Those most affected by public heath emergencies are typically the very young, the very old, the immune-compromised, the economically vulnerable, and the unvaccinated. Roughly 25% of the planning area's population is 18 years or younger, and 17% of the planning area is 65 years or older. These factors increase vulnerability to the impacts of pandemics. Refer to *Section Three: Planning Area Profile* for further discussion of age and economic vulnerability in the planning area. It is not possible to determine the extent of individual public health emergency events, as the type and severity of a novel outbreak cannot be predicted. However, depending on the disease type, a significant portion of residents may be at risk to illness or death.

The extent of a public health emergency is closely tied to the proximity or availability of health centers and services. The following table identifies hospitals in the planning area.

Table 82: Hospitals in the Planning Area

County	Facility Name	Nearest Community	Total Licensed Beds
Buffalo	Bryan Hospital – Kearney	Kearney	93
Buffalo	CHI Health Good Samaritan	Kearney	175
Buffalo	CHI Health Richard Young Behavioral Health	Kearney	61

County	Facility Name	Nearest Community	Total Licensed Beds
Buffalo	Kearney Ambulatory Surgical Center	Kearney	15
Dawson	Cozad Community Hospital	Cozad	20
Dawson	Gothenburg Memorial Hospital	Gothenburg	14
Dawson	Lexington Regional Health Center	Lexington	25
Hall	Grand Island Regional Medical Center	Grand Island	67
Hall	Saint Francis Medical Center	Grand Island	155
Merrick	Merrick Medical Center	Central City	20
Polk	Annie Jeffrey Memorial County Health Center	Osceola	16

Source: Nebraska Department of Health and Human Services[109]

Certain geographic areas, populations, and facilities may experience a shortage of health care professionals which results in a lack of access to health care in an area. The Health Resources and Services Administration (HRSA) assigns specific designations to shortage areas to focus limited resources on communities with the most need. Shortage designations include Health Professional Shortage Areas (HPSAs), Medically Underserved Areas (MUAs) and Medically Underserved Populations (MUPs). Health Professional Shortage Areas are designated based on shortages in primary care, dental, or mental health providers in a geographic area, facility, or population. HPSAs are determined based on the number of health professionals relative to a high need population. The following table identifies HPSA designations in the planning area.

Table 83: Health Care Professional Shortage Areas in the Planning Area

County	Designation Type	Designation ID	Designation Date	Type of Care
Buffalo, Hall, Merrick	Geographic HPSA	7315324561	7/20/1978	Mental Health
Hall	Federally Qualified Health Center	6319993106	10/31/2013	Dental Health
Hall	Federally Qualified Health Center	7319993101	10/31/2013	Mental Health
Hall	Federally Qualified Health Center	131999310A	10/31/2013	Primary Care
Dawson	Rural Health Clinic	631999311A	05/31/2017	Dental Health
Dawson	Geographic HPSA	7312770380	02/22/2022	Mental Health
Dawson	Rural Health Clinic	131999311A	05/31/2017	Primary Care
Merrick	Rural Health Clinic	6318715447	09/29/2021	Dental Health
Merrick	Rural Health Clinic	7313872577	09/29/2021	Mental Health
Merrick	Rural Health Clinic	1315965517	09/29/2021	Primary Care
Polk	Geographic HPSA	7319643086	10/21/2021	Mental Health

Source: Health Resources and Services Administration[110]

109 Department of Health and Human Services. December 2021. “Hospitals.” http://dhhs.ne.gov/licensure/Documents/Hospital%20Roster.pdf.
110 Health Resources and Services Administration. 2022. “HPSA Find.” https://data.hrsa.gov/tools/shortage-area/hpsa-find

Medically Underserved Areas and Populations are designated by the HRSA as areas or populations having high poverty rates, high infant mortality rates, high elderly populations, or an insufficient number of primary care providers. The following tables identifies MUA designations in the planning area. Dawson County is the only county in the planning area without an MUA designation.

Table 84: Medically Underserved Areas/Populations in the Planning Area

County	Service Area	Designation Type	Designation ID	Designation Date	Type of Care
Buffalo	Ravenna City - County	MUA	02056	05/31/1994	Primary Care
Hall	Low Income Population	MUA	05207	06/08/1999	Primary Care
Merrick	Clarksville Service Area	MUA	02051	5/12/1994	Primary Care
Merrick	Loup Service Area	MUA	02072	5/12/1994	Primary Care
Polk	Polk Service Area	MUA	02031	11/01/1978	Primary Care

Source: Health Resources and Services Administration[111]

Immunodeficiency disorders (such as diabetes), obesity, or other pre-existing health complications reduce the ability of the body to fight infection. Diabetes prevalence per county and for the state are listed in the table below. Dawson, Hall, and Merrick Counties had a higher diabetes rate than the state.

Table 85: Diabetes Prevalence in the Planning Area

County	Diagnosed Diabetes Rate (Total Adults Age 20+)
Buffalo	8.1
Dawson	9.3
Hall	9
Merrick	10
Polk	6.5
State of Nebraska*	8.8%

Source: Centers of Disease Control and Prevention, 2019[112]
**State data is from 2018.*

Nebraska state law (Title 173) requires all students have the following vaccinations: poliomyelitis, Diphtheria, pertussis, tetanus, measles, mumps, rubella, Hepatitis B, and varicella (chicken pox). The Vaccines for Children program is a federally funded and state-operated vaccine supply program that provides free vaccines to children under 18 who are of American Indian or Alaska Native descent, enrolled in Medicaid, uninsured, or underinsured. Additionally, the HPV vaccination series is recommended for teenagers and influenza vaccinations are recommended yearly for those over six months old. Individuals without vaccinations are at greater risk of contracting diseases or carrying diseases to others.

111 Health Resources and Services Administration. 2022. “MUA Find.” https://data.hrsa.gov/tools/shortage-area/mua-find
112 Centers for Disease Control and Prevention. 2017. “Diagnosed diabetes prevalence – Nebraska.” https://gis.cdc.gov/grasp/diabetes/DiabetesAtlas.html

Historical Occurrences

Cases and fatalities associated with Public Health Emergencies vary between illness types and severity of outbreak. Past major outbreaks in Nebraska have specifically included the H1N1 Swine Flu in 2009 and COVID-19 in 2020/21.

- H1N1 Swine Flu (2009) – outbreaks were first reported in mid-April 2009 and spread rapidly. The new flu strand for which immunity was nonexistent in persons under 60 years old was similar in many ways to typical seasonal influenza. Symptoms of H1N1 included fever greater than 100°F, cough, and sore throat. County specific counts of H1N1 are not available, however a total of 71 confirmed cases were reported by June 12, 2009.[113] Outbreaks in Nebraska were typically seen sporadically with occasional cluster outbreaks at summer camps for youth. The U.S. Public Health Emergency for the H1N1 Influenza outbreak expired on June 23, 2010. The CDC developed and encouraged all US residents to receive a yearly flu vaccination to protect against potential exposures. The H1N1 continues to appear annually and persons in the planning area are at risk of infection in the future.

- COVID-19 (2020) – In January 2020, the CDC confirmed the first case of COVID-19 in the United States, and it quickly spread across the country. By March 2020, the World Health Organization declared COVID-19 a pandemic and travel bans were instituted around the globe. Primary symptoms of the infection included cough, fever or chills, shortness of breath or difficulty breathing, fatigue, muscle and body aches, headache, loss of taste or smell, sore throat, and others. The first confirmed case of COVID-19 in the State of Nebraska was a 36-year-old Omaha resident in early March. Counties and cities throughout the planning area have instituted directed health measures to protect residents from the spread of COVID-19.

The table below displays COVID-19 confirmed cases and vaccination rate of individuals age 12 or older. This data will likely increase as time goes on until the entire population can be vaccinated.

Table 86: COVID-19 Cases in the Planning Area

County	Population	Total Confirmed Cases	Vaccination Rate
Buffalo	50,084	6,781	55%
Dawson	24,111	3,362	55%
Hall	62,895	9,254	56%
Merrick	7,668	908	48%
Polk	5,214	691	50%
Total	**149,972**	**20,088**	**55%**

Source: Nebraska Department of Health and Human Services[114]

Average Annual Losses

The national economic burden of influenza medical costs, medical costs plus lost earnings, and total economic burden was $10.4 billion, $26.8 billion, and $87.1 billion respectively in 2007.[115] However, associated costs with pandemic response are much greater. Current estimated costs

113 Centers for Disease Control and Prevention. June 2009. "Novel H1N1 Flu Situation Update." https://www.cdc.gov/h1n1flu/updates/061209.htm.

114 Nebraska Department of Health and Human Services. September 24, 2021. "COVID-19 Case Rate Last 14 Days". https://datanexus-dhhs.ne.gov/views/Covid/1_CountyStatisticsMap?%3AisGuestRedirectFromVizportal=y&%3Aembed=y.

115 Molinari, N.M., Ortega-Sanchez, I.R., Messonnier, M., Thompson, W.W., Wortley, P.M., Weintraub, E., & Bridges, C.B. April 2007. "The annual impact of seasonal influenza in the US: measuring disease burden and costs." DOI: 10.1016/j.vaccine.2007.03.046.

for COVID-19 in the United States exceed $16 trillion. Specific costs do not include losses from displacement, functional downtime, economic loss, injury, or loss of life. The direct and indirect effects of significant health impacts are difficult to quantify.

Probability

There is no pattern as to when public health emergencies will occur. Based on historical records, it is likely that small-scale disease outbreaks will occur annually within the planning area. However, large scale emergency events (such as seen with COVID-19) cannot be predicted.

Community Top Hazard Status

The following table lists jurisdictions which identified public health emergency as a top hazard of concern.

Jurisdiction	
Buffalo County	Kearney
Central City Fire District	Pleasanton Public Schools
Central District Health Department	Ravenna Public Schools
Eustis-Farnam Public Schools	Shelton Public Schools
Four Corners Health Department	Two Rivers Public Health Department
Gibbon Public Schools	University of Nebraska - Kearney
Gibbon	Wood River Rural Schools
Hall County	

Regional Vulnerabilities

The following table summarizes regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 87: Regional Vulnerabilities

Sector	Vulnerability
People	-Vulnerable populations include the very young, the very old, the unvaccinated, the economically vulnerable, and those with immunodeficiency disorders. -Institutional settings such as prisons, dormitories, long-term care facilities, day cares, and schools are at higher risk to contagious diseases -Poverty, rurality, underlying health conditions, and drug or alcohol use increase chronic and infectious disease rates
Economic	-Large scale or prolonged events may cause businesses to close, which could lead to significant revenue loss and loss of income for workers
Built Environment	-Increased number of unoccupied business structures
Infrastructure	-Transportation routes may be closed if a quarantine is put in place -Healthcare facilities in the planning area may be overwhelmed quickly by widespread events
Critical Facilities	-Healthcare facilities in the planning area may be overwhelmed quickly by widespread events -Critical facilities could see suspended action or reduced resources due to sick staff
Climate	-Climate change impacts on extreme weather, air quality, transmission of disease via insects and pests, food security, and water quality increase threats of disease

Severe Thunderstorms

Severe thunderstorms are common and unpredictable seasonal events throughout Nebraska. A thunderstorm is defined as a storm that contains lightning and thunder, which is caused by unstable atmospheric conditions. When cold upper air sinks and warm moist air rises, storm clouds or “thunderheads” develop, resulting in thunderstorms. This can occur singularly, in clusters, or in lines.

Thunderstorms can develop in fewer than 30 minutes and can grow to an elevation of eight miles into the atmosphere. Lightning, by definition, is present in all thunderstorms and can cause harm to humans and animals, fires to buildings and agricultural lands, and electrical outages in municipal electrical systems. Lightning can strike up to 10 miles from the portion of the storm depositing precipitation. There are three primary types of lightning: intra-cloud, inter-cloud, and cloud to ground. While intra and inter-cloud lightning are more common, communities are potentially impacted when lightning comes in contact with the ground. Lightning generally occurs when warm air mixes with colder air masses resulting in atmospheric disturbances necessary for polarizing the atmosphere. Additionally, hail is a common component of thunderstorms and often occurs in series, with one area having the potential to be hit multiple times in one day. Severe thunderstorms usually occur in the evening during the spring and summer months. Hail can destroy property and crops with sheer force, as some hail stones can fall at speeds up to 100 mph.

Economically, thunderstorms are generally beneficial in that they provide moisture necessary to support Nebraska’s largest industry, agriculture. The majority of thunderstorms do not cause damage, but when they escalate to severe storms and/or produce hail, the potential for damages increases. Damages can include: crop losses from wind and hail; property losses due to building and automobile damages from hail; high wind; flash flooding; death or injury to humans and animals from lightning, drowning, or getting struck by falling or flying debris; and personal injury from people without shelter during these events or standing near windows. The potential for damages increases as the size of the hail increases. Figure 55 displays the average number of days with thunderstorms across the country each year. The planning area experiences an average of 50 to 60 thunderstorms over the course of one year.

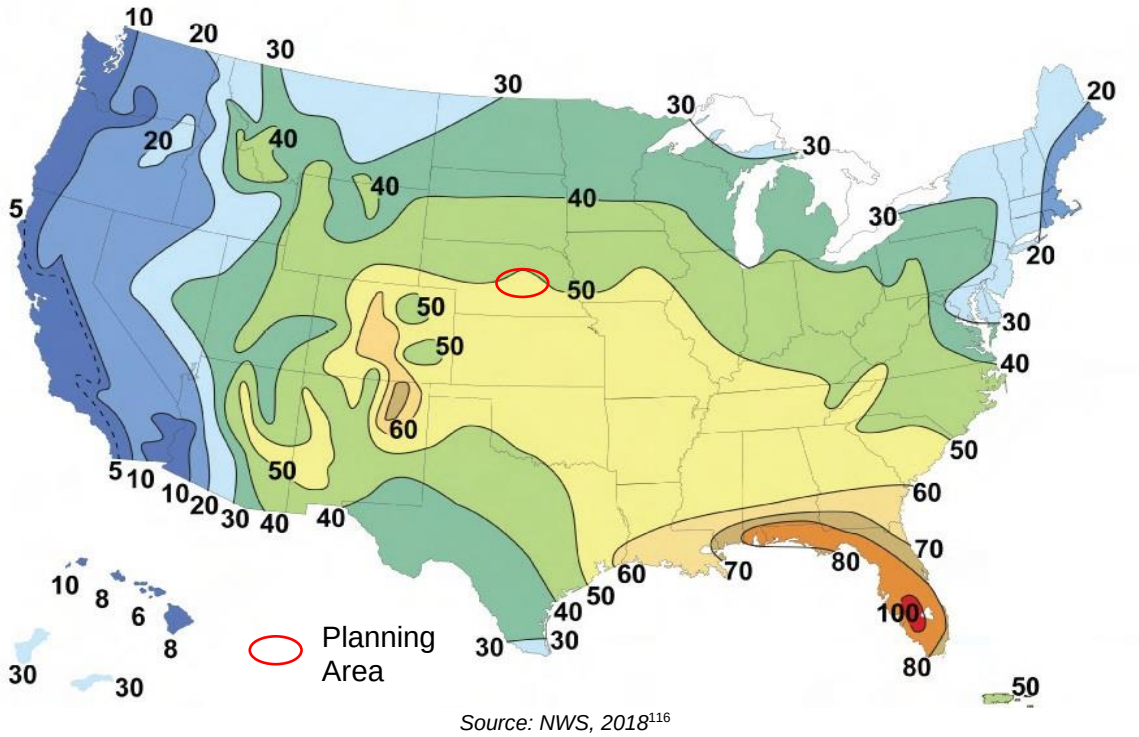
Location

The entire planning area is at risk to thunderstorms due to the regional nature of this type of event.

Extent

The geographic extent of a severe thunderstorm event may be large enough to impact the entire planning area (such as in the case of a squall line, derecho, or long-lived supercell) or just a few square miles, in the case of a single cell that marginally meets severe criteria. The NWS defines a thunderstorm as severe if it contains hail that is one inch in diameter or capable of winds gusts of 58 mph or higher. The Tornado and Storm Research Organization (TORRO) scale is used to classify hailstones and provides some detail related to the potential impacts from hail. Table 88 outlines the TORRO Hail Storm Intensity Scale.

Figure 55: Average Number of Thunderstorms



Source: NWS, 2018[116]

Table 88: TORRO Hail Scale

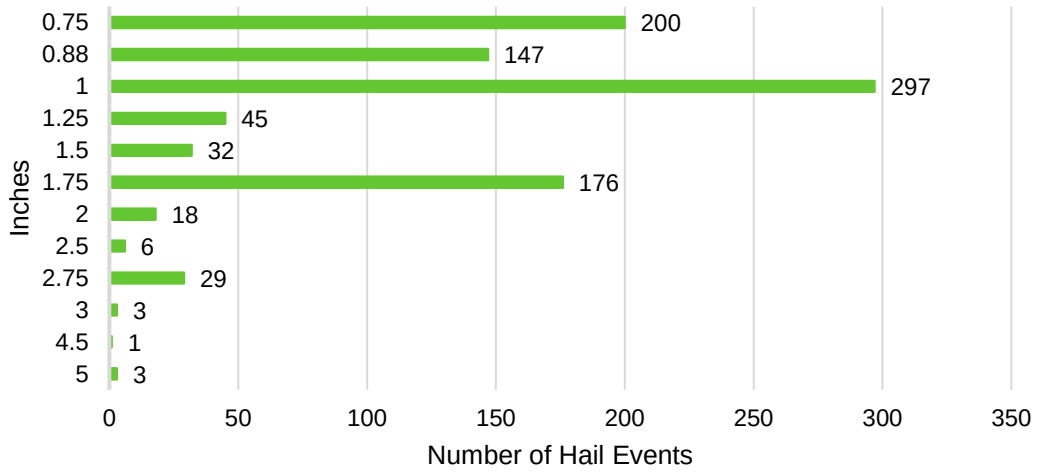
Class	Type of Material	Divisions
H0: Hard Hail	5 mm; (Pea size); 0.2 in	No damage
H1: Potentially Damaging	5 -15 mm (Marble); 0.2 – 0.6 in	Slight general damage to plants and crops
H2: Significant	10 -20 mm (Grape); 0.4 – 0.8 in.	Significant damage to fruit, crops, and vegetation
H3: Severe	20 -30 mm (Walnut); 0.8 – 1.2 in	Severe damage to fruit and crops, damage to glass and plastic structures
H4: Severe	30 -40 mm (Squash Ball); 1.2 – 1.6 in	Widespread damage to glass, vehicle bodywork damaged
H5: Destructive	40 – 50 mm (Golf ball); 1.6 – 2.0 in.	Wholesale destruction of glass, damage to tiled roofs; significant risk or injury
H6: Destructive	50 – 60 mm (chicken egg); 2.0 – 2.4 in	Grounded aircrafts damaged, brick walls pitted; significant risk of injury
H7: Destructive	60 – 75 mm (Tennis ball); 2.4 – 3.0 in	Severe roof damage; risk of serious injuries
H8: Destructive	75 – 90 mm (Large orange); 3.0 – 3.5 in.	Severe damage to structures, vehicles, airplanes; risk of serious injuries
H9: Super Hail	90 – 100 mm (Grapefruit); 3.5 – 4.0 in	Extensive structural damage; risk of severe or even fatal injuries to persons outdoors
H10: Super Hail	>100 mm (Melon); > 4.0 in	Extensive structural damage; risk or severe or even fatal injuries to persons outdoors

Source: TORRO, 2022[117]

[116] National Weather Service. 2018. "Introduction to Thunderstorms." https://www.weather.gov/jetstream/tstorms_intro.
[117] Tornado and Storm Research Organization. 2022. "Hail Scale." https://www.torro.org.uk/research/hail/hscale.

The NCEI reported 957 individual hail events across the planning area since 1996. As the NCEI reports events per county, this value overestimates the total amount of thunderstorm events. The average hailstone size was 1.20 inches. Events of this magnitude correlate to an H4 Severe classification. It is reasonable to expect H4 classified events to occur several times in a year throughout the planning area. In addition, it is reasonable, based on the number of occurrences, to expect larger hailstones to occur in the planning area annually. The planning area has endured four H10 hail events (>4.0 inches) during the period of record. Figure 56 shows hail events based on the size of the hail.

Figure 56: Hail Events by Magnitude

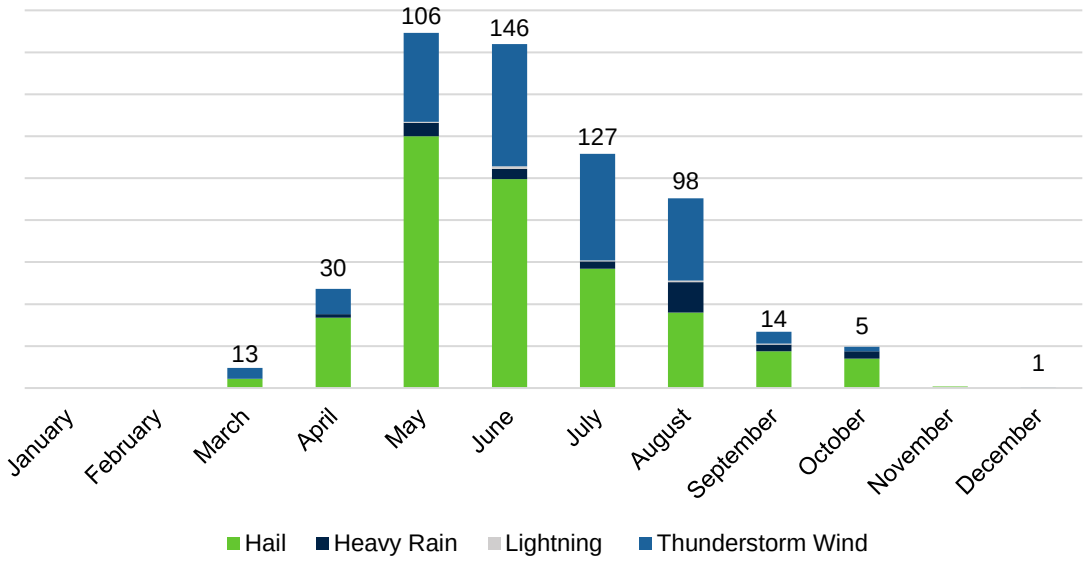


Source: NCEI, 1996-June 2021

Historical Occurrences

Severe thunderstorms in the planning area usually occur in the afternoon and evening during the summer months (Figure 57).

Figure 57: Severe Thunderstorm Events by Month



Source: NCEI, 1996-June 2021

The NCEI reports events as they occur in each community. A single severe thunderstorm event can affect multiple communities and counties at a time; the NCEI reports these large scale, multi-county events as separate events. The result is a single thunderstorm event covering the entire region could be reported by the NCEI as several events.

The NCEI reports a total of 540 thunderstorm wind, 94 heavy rain, eight lightning, and 957 hail events in the planning area from January 1996 to June 2021. In total these events were responsible for $153,813,000 in property damages. The USDA RMA data shows that severe thunderstorms caused $190,074,924 in crop damages. No injuries and 25 fatalities were reported in association with these storms.

Average Annual Damages

The average damage per event estimate was determined based upon recorded damages from NCEI Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Severe thunderstorms cause an average of $5,915,884 per year in property damages and $9,503,746 in crop damages.

Table 89: Severe Thunderstorms Loss Estimate

Hazard Type	Number of Events[1]	Average Events Per Year	Total Property Loss[1]	Average Annual Property Loss	Total Crop Loss[2]	Average Annual Crop Loss
Hail	957	37	$117,794,000	$4,530,538	$190,074,924	$9,503,746
Heavy Rain	94	3.6	$587,000	$22,577		
Lightning	8	0.3	$492,000	$18,923		
Thunderstorm Wind	540	20.8	$34,940,000	$1,343,846		
Total	**15,999**	**61.7**	**$153,813,000**	**$5,915,884**	**$190,074,924**	**$9,503,746**

Source: 1 Indicates data is from NCEI (January 1996 to June 2021); 2 Indicates data is from USDA RMA (2000 to 2020)

Probability

Based on historical records and reported events, severe thunderstorms events and storms with hail are likely to occur on an annual basis. The NCEI reported a total of 15,999 severe thunderstorm events between 1996 and June 2021, resulting in 100% chance annually for thunderstorms.

Community Top Hazard Status

The following table lists jurisdictions which identified severe thunderstorms as a top hazard of concern.

Jurisdiction	
Alda	Gibbon
Buffalo County	Gothenburg
Cairo	Grand Island
Central City Fire District	Hall County
Central City Public Schools	Kearney
Central City	Lexington
Centura Public Schools	Merrick County
Chapman	Pleasanton Public Schools
Clarks	Pleasanton
Cozad	Polk County
Dawson County	Polk
Dawson County Drainage District No.2	Ravenna Public Schools
Dawson County Drainage District No.3	Ravenna
Doniphan Fire District	Riverdale
Doniphan	Shelby
Eddyville Fire District	Shelton
Elm Creek Fire District	Shelton Public Schools
Elm Creek	Stromsburg
Eustis-Farnam Public Schools	Two Rivers Public Health Department
Farnam	University of Nebraska - Kearney
Gibbon Volunteer Fire District	Wood River
Gibbon Public Schools	

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 90: Regional Thunderstorm Vulnerabilities

Sector	Vulnerability
People	-Elderly citizens with decreased mobility may have trouble evacuating or seeking shelter -Mobile home residents are risk of injury and damage to their property if the mobile home is not anchored properly -Injuries can occur from not seeking shelter, standing near windows, and shattered windshields in vehicles
Economic	-Damages to buildings and property can cause significant losses to business owners and employees
Built Environment	-Buildings are at risk to hail damage -Downed trees and tree limbs -Roofs, siding, windows, gutters, HVAC systems, etc. can incur damage
Infrastructure	-High winds and lightning can cause power outages and down power lines -Roads may wash out from heavy rains and become blocked from downed tree limbs
Critical Facilities	-Power outages are possible -Critical facilities may sustain damage from hail, lightning, and wind
Climate	-Changes in seasonal precipitation and temperature normals can increase frequency and magnitude of severe storm events

Severe Winter Storms

Severe winter storms are an annual occurrence in Nebraska. Winter storms can bring extreme cold, freezing rain, heavy or drifting snow, and blizzards. Blizzards are particularly dangerous due to drifting snow and the potential for rapidly occurring whiteout conditions which greatly inhibit vehicular traffic. Generally, winter storms occur between the months of November and March but may occur as early as October and as late as April. Heavy snow is usually the most defining element of a winter storm. Large snow events can cripple an entire jurisdiction by hindering transportation, knocking down tree limbs and utility lines, and structurally damaging buildings.

Extreme Cold

Along with snow and ice storm events, extreme cold is dangerous to the well-being of people and animals. What constitutes extreme cold varies from region to region but is generally accepted as temperatures that are significantly lower than the region's average low temperature. For the planning area, the coldest months of the year are December, January, and February. The average low temperature for these months is below freezing (average low for the three months is 16°F). The average high temperature for the months of January, February, and December is near 38°F.[118]

Freezing Rain

Along with snow events, winter storms also have the potential to deposit significant amounts of ice. Ice buildup on tree limbs and power lines can cause them to collapse. This is most likely to occur when rain falls that freezes upon contact, especially in the presence of wind. Freezing rain is the name given to rain that falls when surface temperatures are below freezing. Unlike a mixture of rain and snow, ice pellets or hail, freezing rain is made entirely of liquid droplets. Freezing rain can also lead to many problems on the roads, as it makes them slick, causing automobile accidents, and making vehicle travel difficult at best.

Blizzards

Blizzards are particularly dangerous due to drifting snow and the potential for rapidly occurring whiteout conditions, which greatly inhibits vehicular traffic. Heavy snow is usually the most defining element of a winter storm. Large snow events can cripple an entire jurisdiction for several days by hindering transportation, knocking down tree limbs and utility lines, structurally damaging buildings, and injuring or killing crops and livestock.

Location

The entire planning area is at risk of severe winter storms.

Extent

The Sperry-Piltz Ice Accumulation Index (SPIA) was developed by the NWS to predict the accumulation of ice and resulting damages. The SPIA assesses total precipitation, wind, and temperatures to predict the intensity of ice storms. Figure 58 shows the SPIA index.

118 High Plains Regional Climate Center. 2021. "Monthly Climate Normals 1981-2010." http://climod.unl.edu/.

Figure 58: SPIA Index

ICE DAMAGE INDEX	*AVERAGE ICE AMOUNT (in inches) *Revised: Oct. 2011*	WIND (mph)	DAMAGE AND IMPACT DESCRIPTIONS
0	<0.25	<15	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	0.10 – 0.25	15 – 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
	0.25 – 0.50	>15	
2	0.10 – 0.25	25 – 35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
	0.25 – 0.50	15 – 25	
	0.50 – 0.75	>15	
3	0.10 – 0.25	> – 35	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
	0.25 – 0.50	25 – 35	
	0.50 – 0.75	15 – 25	
	0.75 –1.00	>15	
4	0.25 – 0.50	> – 35	Prolonged and widespread utility interruptions with extensive damage to main distribution feeder lines and some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
	0.50 – 0.75	25 – 35	
	0.75 –1.00	15 – 25	
	1.00 –1.50	>15	
5	0.50 – 0.75	> – 35	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeeks in some areas. Shelters needed.
	0.75 –1.00	> – 25	
	1.00 –1.50	> – 15	
	> 1.50	Any	

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

Source: SPIA-Index, 2017[119]

The Wind Chill Index was developed by the NWS to determine the decrease in air temperature felt by the body on exposed skin due to wind. The wind chill is always lower than the air temperature and can quicken the effects of hypothermia or frost bite as it gets lower. Figure 59 shows the Wind Chill Index used by the NWS.

Average monthly snowfall for the planning area is shown in Figure 61, which shows the snowiest months are between December and February. A common snow event (likely to occur annually) will result in accumulation totals between one and five inches. Often these snow events are accompanied by high winds. It is reasonable to expect wind speeds of 25 to 35 mph with gusts reaching 50 mph or higher. Strong winds and low temperatures can combine to produce extreme wind chills of 20°F to 40°F below zero.

119 SPIA-Index. 2009. "Sperry-Piltz Ice Accumulation Index." Accessed June 2017. http://www.spia-index.com/index.php

Figure 59: Wind Chill Index Chart

Temperature (°F)

Wind (mph)	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	-82	-89	-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

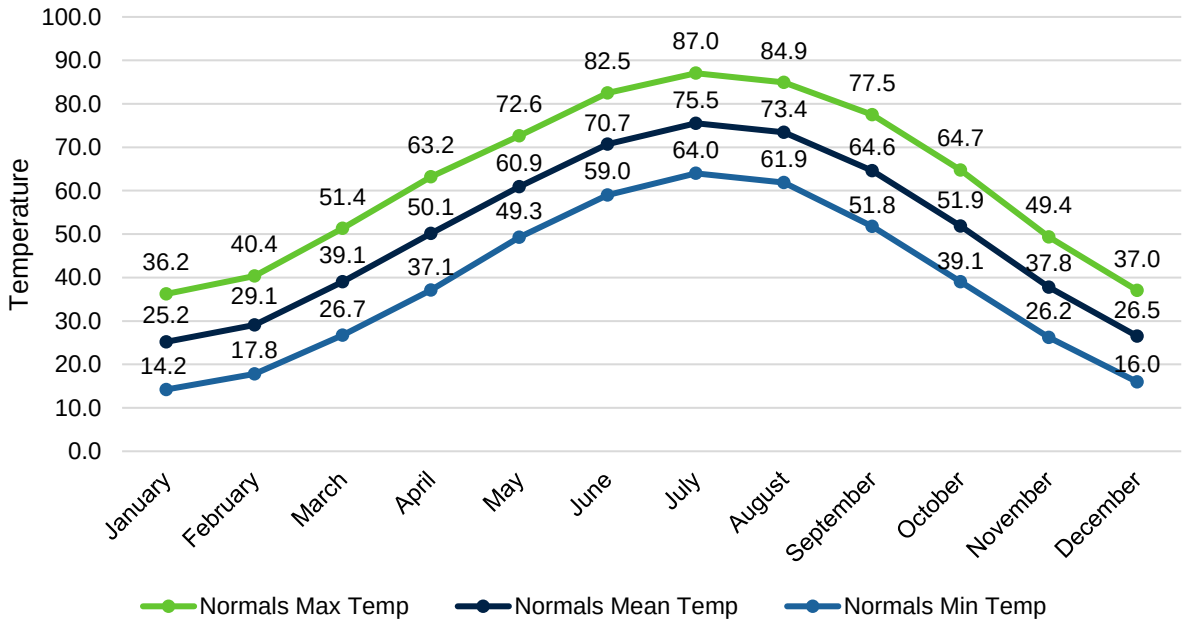
Frostbite Times — 30 Minutes — 10 MInutes — 5 Minutes

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

T = Air Tempurature (°F) **V** = Wind Speed (mph)

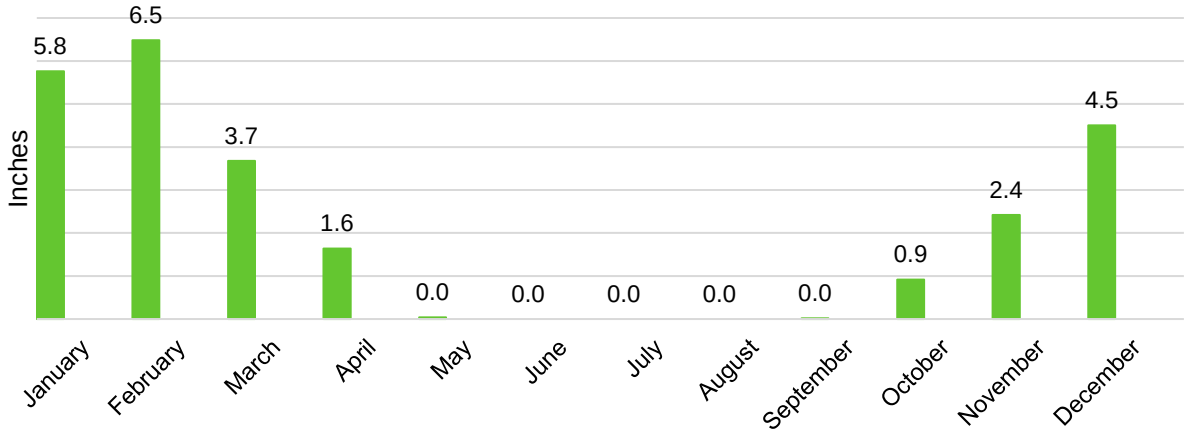
Source: NWS, 2017[120]

Figure 60: Monthly Climate Normals Temperature (1981-2010)



120 National Weather Service. 2001. "Wind Chill Chart." http://www.nws.noaa.gov/om/cold/wind_chill.shtml.

Figure 61: Monthly Normal (1981-2010) Snowfall in Inches



Source: High Plains Regional Climate Center, 2021

Historical Occurrences

Due to the regional scale of severe winter storms, the NCEI reports events as they occur in each county. According to the NCEI, there were a combined 513 severe winter storm events for the planning area from January 1996 to June 2021. February had the most recorded events for the planning area. These recorded events caused a total of $25,655,000 in reported property damages and $3,613,366 in crop damages.

According to the NCEI, there were 12 injuries and four deaths associated with winter storms in the planning area. Additional information from these events from NCEI and reported by each community are listed in *Section Seven: Community Profiles*.

Average Annual Damages

The average damage per event estimate was determined based upon NCEI Storm Events Database since 1996 and includes aggregated calculations for each of the six types of winter weather as provided in the database. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Severe winter storms have caused an average of $986,731 per year in property damage and $138,976 per year in crop damages for the planning area.

Table 91: Severe Winter Storm Loss Estimate

Hazard Type	Number of Events[1]	Average Events Per Year[1]	Total Property Loss[1]	Average Annual Property Loss [1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
Blizzard	50	1.9	$905,000	$34,808		
Extreme Cold/Wind Chill	17	0.65	$0	$0		
Heavy Snow	16	0.61	$0	$0	$3,613,366	$138,976
Ice Storm	35	1.4	$23,325,000	$897,115		
Winter Storm	216	8.3	$1,265,000	$48,654		
Winter Weather	179	6.8	$160,000	$6,154		
Total	**513**	**19.7**	**$25,655,000**	**$986,731**	**$3,613,366**	**$138,976**

Source: 1 Indicates data is from NCEI (Jan 1996 to June 2021); 2 Indicates data is from USDA RMA (2000 to 2020)

Probability

Based on historical records and reported events, severe winter storm events are likely to occur on an annual basis. The NCEI reported a severe winter storm event in every year, resulting in 100 percent chance annually for thunderstorms.

Community Top Hazard Status

The following table lists jurisdictions which identified severe winter storms as a top hazard of concern.

Jurisdiction	
Alda	Gibbon Volunteer Fire District
Amherst	Gibbon Public Schools
Buffalo County	Gothenburg
Cairo	Hall County
Central City Fire District	Kearney
Central City Public Schools	Lexington
Central City	Osceola
Chapman	Pleasanton Public Schools
Clarks	Pleasanton
Cozad	Polk County
Dawson County	Polk
Dawson County Drainage District No.2	Ravenna Public Schools
Dawson County Drainage District No.3	Ravenna
Doniphan Fire District	Riverdale
Doniphan	Shelby
Eddyville Fire District	Shelton Public Schools
Elm Creek Fire District	Shelton
Elm Creek	Stromsburg
Eustis	Two Rivers Public Health Department
Eustis-Farnam Public Schools	Wood River Rural Schools
Four Corners Health Department	

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 92: Regional Severe Winter Storm Vulnerabilities

Sector	Vulnerability
People	-Elderly citizens are at higher risk to injury or death, especially during extreme cold and heavy snow accumulations -Citizens without adequate heat and shelter at higher risk of injury or death
Economic	-Closed roads and power outages can cripple a region for days, leading to significant revenue loss and loss of income for workers
Built Environment	-Heavy snow loads can cause roofs to collapse -Significant tree damage possible, downing power lines and blocking roads
Infrastructure	-Heavy snow and ice accumulation can lead to downed power lines and prolonged power outages -Transportation may be difficult or impossible during blizzards, heavy snow, and ice events
Critical Facilities	-Emergency response and recovery operations, communications, water treatment plants, and others are at risk to power outages, impassable roads, and other damages
Climate	-Changes in seasonal precipitation and temperature normals can increase frequency and magnitude of severe winter storm events

Terrorism

According to the Federal Bureau of Investigation (FBI), there is no single, universally accepted, definition of terrorism. Terrorism is defined in the Code of Federal Regulations as “the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of a political or social objectives” (28 C.F.R. Section 0.85).

The FBI further describes terrorism as either domestic or international, depending on the origin, base, and objectives of the terrorist organization. For the purpose of this report, the following definitions from the FBI will be used:

- Domestic terrorism is the unlawful use, or threatened use, of force or violence by a group or individual based and operating entirely within the United States or Puerto Rico without foreign direction committed against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives.

- International terrorism involves violent acts or acts dangerous to human life that are a violation of the criminal laws of the United States or any state, or that would be a criminal violation if committed within the jurisdiction of the United States or any state. These acts appear to be intended to intimidate or coerce a civilian population, influence the policy of a government by intimidation or coercion, or affect the conduct of a government by assassination or kidnapping. International terrorist acts occur outside the United States or transcend national boundaries in terms of the means by which they are accomplished, the persons they appear intended to coerce or intimidate, or the locale in which their perpetrators operate or seek asylum.

There are different types of terrorism depending on the target of attack, which are:

- Political Terrorism
- Bio-Terrorism
- Cyber-Terrorism
- Eco-Terrorism
- Nuclear-Terrorism
- Narco-Terrorism
- Agro-Terrorism

Terrorist activities are also classified based on motivation behind the event such as ideology (i.e. religious fundamentalism, national separatist movements, and social revolutionary movements). Terrorism can also be random with no ties to ideological reasoning.

The FBI also provides clear definitions of a terrorist incident and prevention:

- A terrorist *incident* is a violent act or an act dangerous to human life, in violation of the criminal laws of the United States, or of any state, to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.

- Terrorism *prevention* is a documented instance in which a violent act by a known or suspected terrorist group or individual with the means and a proven propensity for violence is successfully interdicted through investigative activity.

Primarily, threat assessment, mitigation and response to terrorism are federal and state directives and work primarily with local law enforcement. The Office of Infrastructure Protection within the Federal Department of Homeland Security is a component within the National Programs and Protection Directorate.

Cyber-Terrorism

Cyber-terrorism is an incident involving the theft or modification of information on computer systems that can compromise the system or potentially disrupt essential services. A cyber-terrorism incident can impact city agencies, private utilities, or critical infrastructure/key resources like a power grid, public transportation system, and wireless networks. Cyber infrastructure includes electronic information and communications systems, and the information contained in those systems. Computer systems, control systems such as Supervisory Control and Data Acquisition systems, and networks such as the Internet are all part of cyber infrastructure.

Nation-states, criminal organizations, terrorists, and other malicious actors conduct attacks against critical cyber infrastructure on an ongoing basis. The impact of a serious cyber incident or successful cyber-attack would be devastating to state, local, tribal, and territorial governments' assets, systems, and/or networks; the information contained in those networks; and the confidence of those who trust governments to secure those systems.

A cyber incident can affect a system's:

- Confidentiality: protecting a user's private information
- Integrity: ensuring that data is protected and cannot be altered by unauthorized parties
- Availability: keeping services running and giving administration access to key networks and controls.

"Many of the Nation's essential and emergency services, as well as our critical infrastructure, rely on the uninterrupted use of the Internet and the communications systems, data, monitoring, and control systems that comprise our cyber infrastructure. A cyber-attack could be debilitating to our highly interdependent critical infrastructure and key resources and ultimately to our economy and national security."

- National Strategy for Homeland Security

Location

Terrorism can occur throughout the entire planning area. Urban areas, schools, and government buildings are more likely to see terroristic activity. However, water systems of any size could be vulnerable as well as computer systems from cyber-terrorism.

Extent

Terrorist attacks can vary greatly in scale and magnitude, depending on the location, method, and target of the attack. Previous terrorist attacks in the planning area have been limited to primarily individual private property.

Historical Occurrences

Previous accounts of terrorism in the planning area were gathered from the Global Terrorism Database, maintained by the University of Maryland and the National Consortium for the Study of Terrorism and Responses to Terrorism. This database contains information for over 140,000 terrorist attacks. According to this database, there has been one terrorist incident since 1970 within the planning area. Between May 3-7, 2002, a college student placed eighteen pipe bombs in rural mailboxes throughout five Midwestern states, causing seven injuries and widespread panic in the region. The bombs placed in mailboxes in the planning area did not detonate, and no injuries were suffered. The attacks were meant to bring attention to the perpetrator's antigovernment sentiment.

Table 93: Terrorist Incidents in the Planning Area

Date	Location	Perpetrator Group	Fatalities	Injuries	Target	Property Damage
5/4/2002	Cairo	Individual	0	0	US Mailboxes	None

Source: University of Maryland and the National Consortium for the Study of Terrorism and Response to Terrorism[121]

Threat assessment, mitigation, and response to terrorism are federal and state directives that work in conjunction with local law enforcement. Terroristic events are addressed at the federal level by the U.S. Department of Homeland Security and at the state level by the Nebraska Emergency Management Agency.

Average Annual Damages

The average damage per event estimate was determined based upon the START Global Terrorism Database information since 1970. This does not include losses from displacement, functional downtime, or economic loss. It should also be noted that none of the pipe bombs detonated, therefore there were no reported damages. If a terrorist event were to occur in the planning area, damages can range from minimal (in rural areas, <$1 million) to significant (in metropolitan areas, >$10 million).

Table 94: Terrorism Incidents Loss Estimate

Hazard Type	Number of Events	Average Number of Events Per Year	Total Property Loss	Annual Property Loss	Total Crop Loss	Annual Crop Loss
Terrorism	1	<0.1	$0	$0	$0	$0

Source: University of Maryland and the National Consortium for the Study of Terrorism and Response to Terrorism 1970-2017

121 University of Maryland National Consortium for the Study of Terrorism and Responses to Terrorism. 2017. "Global Terrorism Database." https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ne/soils/surveys/?cid=nrcs142p2_029746.

Probability

Given one year with a reported terrorism incident over the course of 48 years, the annual probability for terrorism in the planning area is reported as less than one percent annually. This does not indicate that a terrorist event will occur with that frequency within the planning area as terrorist events are typically clustered in timeframe due to extenuating circumstances.

Community Top Hazard Status

The following table lists jurisdictions which identified terrorism as a top hazard of concern.

Jurisdiction	
Central City	Wood River Rural Schools
Stromsburg	

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles.*

Table 95: Regional Terrorism Vulnerabilities

Sector	Vulnerability
People	-Police officers and first responders at risk of injury or death -Civilians at risk of injury or death -Students and staff at school facilities at risk of injury or death from school shootings
Economic	-Damaged businesses can cause loss of revenue and loss of income for workers -Agricultural attacks could cause significant economic losses for the region -Risk of violence in an area can reduce income flowing into and out of that area
Built Environment	-Targeted buildings may sustain heavy damage
Infrastructure	-Water supply, power plants, utilities may be damaged
Critical Facilities	-Police stations and government offices are at a higher risk
Climate	-None

Tornadoes and High Winds

High winds typically accompany severe thunderstorms, severe winter storms, tornadoes, and other large low-pressure systems, which can cause significant crop damage, downed power lines, loss of electricity, traffic flow obstructions, and significant property damage including to trees and center-pivot irrigation systems.

The National Weather Service (NWS) defines high winds as sustained wind speeds of 40 mph or greater lasting for 1 hour or longer, or winds of 58 mph or greater for any duration.[122] The NWS issues High Wind Advisories when there are sustained winds of 25 to 39 miles per hour and/or gusts to 57 mph. Figure 62 shows the wind zones in the United States. The wind zones are based on the maximum wind speeds that can occur from a tornado or hurricane event. The planning area is located in Zone III which has maximum winds of 200 mph equivalent to an EF4/5 tornado.

A tornado is typically associated with a supercell thunderstorm. In order for a rotation to be classified as a tornado, three characteristics must be met:

- There must be a microscale rotating area of wind, ranging in size from a few feet to a few miles wide;
- The rotating wind, or vortex, must be attached to a convective cloud base and must be in contact with the ground; and,
- The spinning vortex of air must have caused enough damage to be classified by the Fujita Scale as a tornado.

Once tornadoes are formed, they can be extremely violent and destructive. They have been recorded all over the world but are most prevalent in the American Midwest and South, in an area known as “Tornado Alley.” Approximately 1,000 tornadoes are reported annually in the contiguous United States (NOAA 2012). Tornadoes can travel distances over 100 miles and reach over 11 miles above ground. Tornadoes usually stay on the ground no more than 20 minutes. Nationally, the tornado season typically occurs between April and July. On average, 80 percent of tornadoes occur between noon and midnight. In Nebraska, 77 percent of all tornadoes occur in the months of May, June, and July.

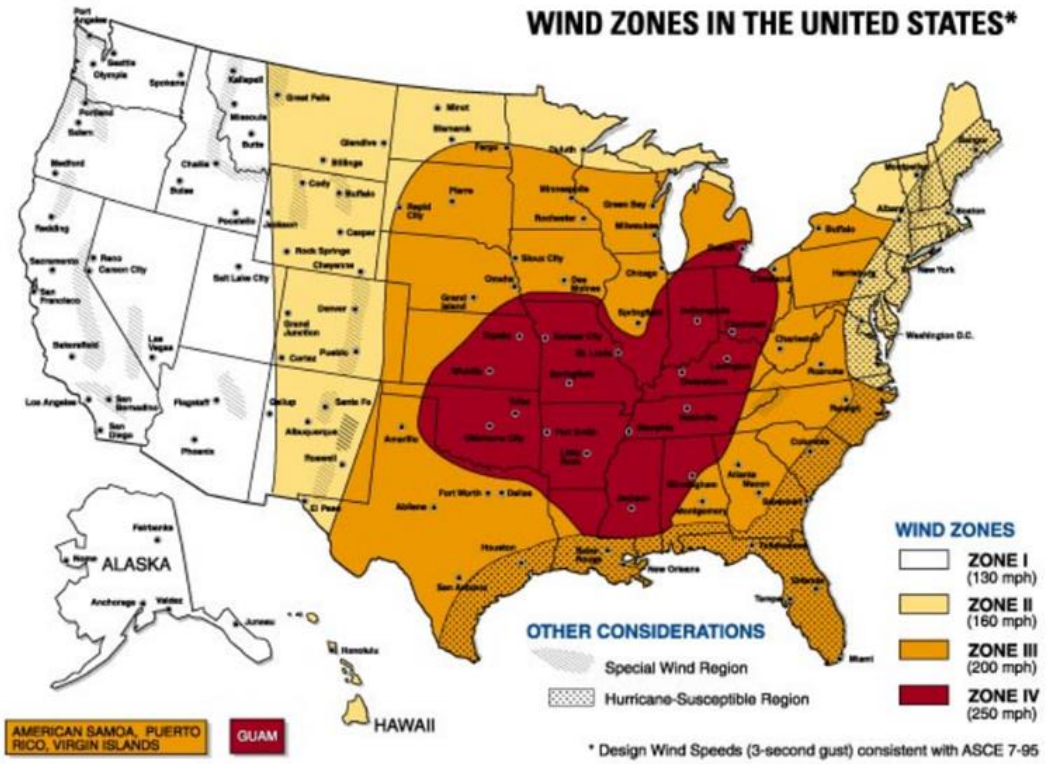
Nebraska is ranked fifth in the nation for tornado frequency with an annual average of 57 tornadoes between 1991 and 2020.

Location

High winds and tornadoes can occur throughout the planning area. The impacts would be greater in more densely populated areas, such as Grand Island or Kearney. The following map shows the historical track locations across the region according to the Midwestern Regional Climate Center. Touchdowns and tornado events can occur anywhere within the five-county planning area.

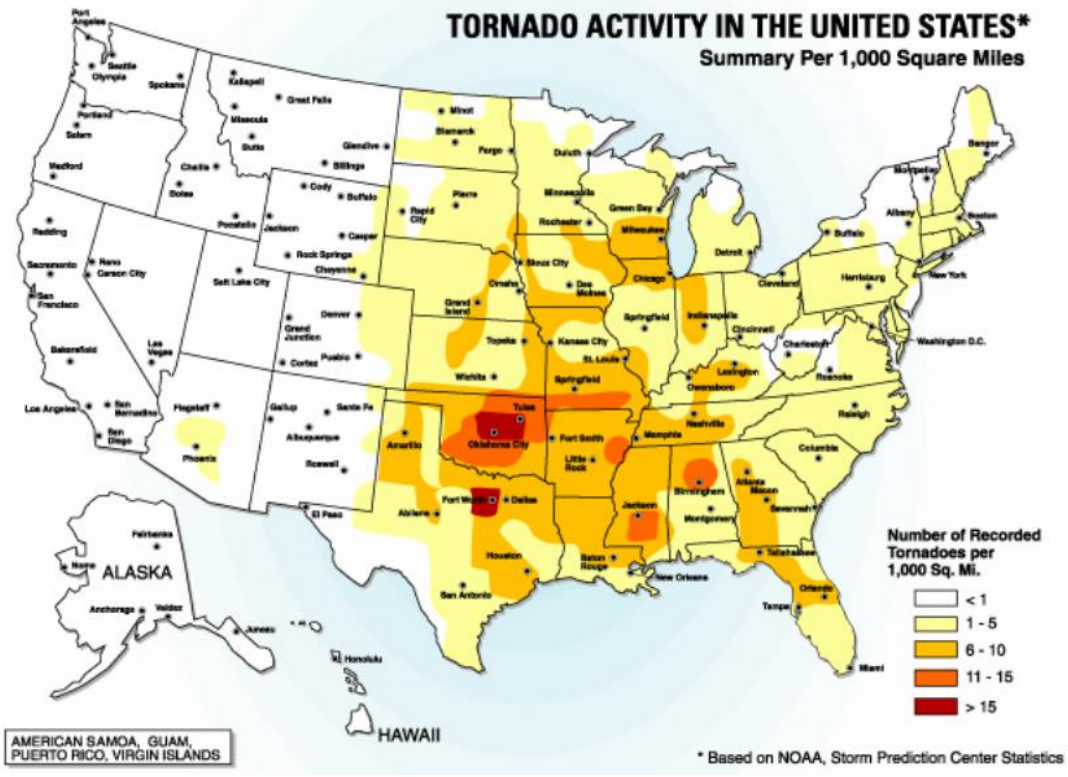
122 National Weather Service. 2017. “Glossary.” http://w1.weather.gov/glossary/index.php?letter=h.

Figure 62: Wind Zones in the U.S.



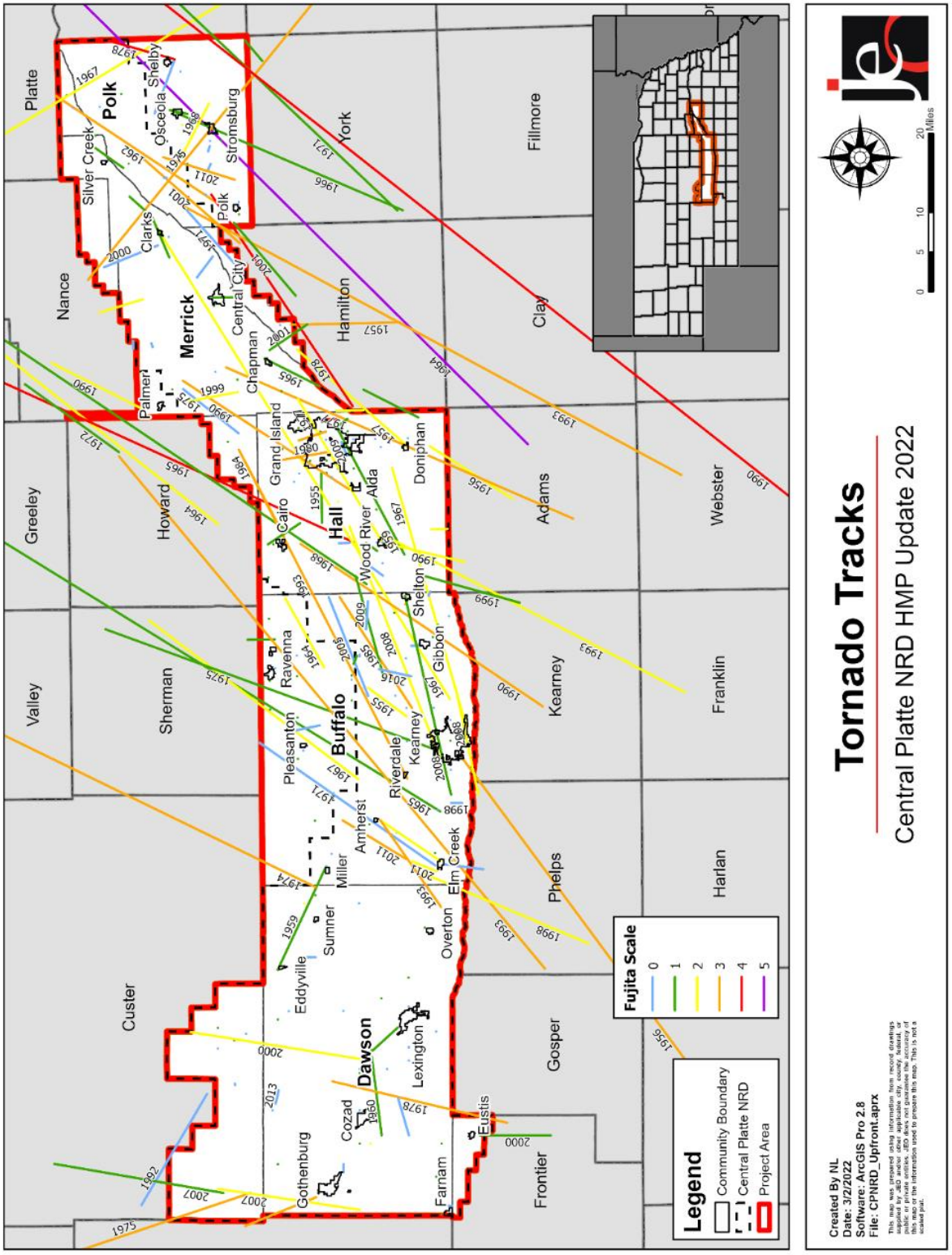
Source: FEMA

Figure 63: Tornado Activity in the United States



Source: FEMA

Figure 64: Historic Tornado Tracks



Extent

The Beaufort Wind Scale can be used to classify wind strength while the magnitude of tornadoes is measured by the Enhanced Fujita Scale. The following table outlines the Beaufort scale including wind speed ranking, range of wind speeds per ranking, and a brief description of conditions for each.

Table 96: Beaufort Wind Ranking

Beaufort Wind Force Ranking	Range of Wind	Conditions
0	<1 mph	Smoke rises vertically
1	1-3 mph	Direction shown by smoke but not wind vanes
2	4-7 mph	Wind felt on face; leaves rustle; wind vanes move
3	8-12 mph	Leaves and small twigs in constant motion
4	13-18 mph	Raises dust and loose paper; small branches move
5	19-24 mph	Small trees in leaf begin to move
6	25-31 mph	Large branches in motion; umbrellas used with difficulty
7	32-38 mph	Whole trees in motion; inconvenience felt when walking against the wind
8	39-49 mph	Breaks twigs off tree; generally, impedes progress
9	50-54 mph	Slight structural damage; chimneypots and slates removed
10	55-63 mph	Trees uprooted; considerable structural damages; improperly or mobiles homes with no anchors overturned
11	64-72 mph	Widespread damages; very rarely experienced
12 - 17	72 - > 200 mph	Hurricane; devastation

Source: Storm Prediction Center, 2017[123]

After a tornado passes through an area, an official rating category is determined, which provides a common benchmark that allows comparisons to be made between different tornadoes. The Enhanced Fujita Scale replaced the Fujita Scale in 2007. The Enhanced Fujita Scale does not measure tornadoes by their size or width, but rather the amount of damage caused to human-built structures and trees after the event. The official rating category provides a common benchmark that allows comparisons to be made between different tornadoes. The enhanced scale classifies EF0-EF5 damage as determined by engineers and meteorologists across 28 different types of damage indicators, including different types of building and tree damage. To establish a rating, engineers and meteorologists examine the damage, analyze the ground-swirl patterns, review damage imagery, collect media reports, and sometimes utilize photogrammetry and videogrammetry. Based on the most severe damage to any well-built frame house, or any comparable damage as determined by an engineer, an EF-Scale number is assigned to the tornado.

The following tables summarize the Enhanced Fujita Scale and damage indicators. According to the National Institute of Science and Technology on the Joplin Tornado, tornadoes rated EF3 or lower account for around 96 percent of all tornado damages.[124]

123 Storm Prediction Center: National Oceanic and Atmospheric Administration. 1805. “Beaufort Wind Scale.” http://www.spc.noaa.gov/faq/tornado/beaufort.html.

124 Kuligowski, E.D., Lombardo, F.T., Phan, L.T., Levitan, M.L., & Jorgensen, D.P. March 2014. “Final Report National Institute of Standards and Technology(NIST) Technical Investigation of the May 22, 2011, Tornado in Joplin, Missouri.”

Table 97: Enhanced Fujita Scale

Storm Category	3 Second Gust (mph)	Damage Level	Damage Description
EF0	65-85 mph	Gale	Some damages to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
EF1	86-110 mph	Weak	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages might be destroyed.
EF2	111-135 mph	Strong	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	136-165 mph	Severe	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
EF4	166-200 mph	Devastating	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
EF5	200+ mph	Incredible	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.
EF No rating	--	Inconceivable	Should a tornado with the maximum wind speed in excess of F5 occur, the extent and types of damage may not be conceived. A number of missiles such as iceboxes, water heaters, storage tanks, automobiles, etc. will create serious secondary damage on structures.

Source: NOAA; FEMA

Table 98: Enhanced Fujita Scale Damage Indicator

Number	Damage Indicator	Number	Damage Indicator
1	Small barns, farm outbuildings	**15**	School – 1 story elementary (interior or exterior halls)
2	One- or two-family residences	**16**	School – Junior or Senior high school
3	Single-wide mobile homes (MHSW)	**17**	Low-rise (1-4 story) buildings
4	Double-wide mobile homes (MHDW)	**18**	Mid-rise (5-20 story) buildings
5	Apartment, condo, townhouse (3 stories or less)	**19**	High-rise (over 20 stories)
6	Motel	**20**	Institutional buildings (hospital, government, or university)
7	Masonry apartment or motel	**21**	Metal building systems
8	Small retail buildings (fast food)	**22**	Service station canopy
9	Small professional (doctor office, branch bank)	**23**	Warehouse (tilt-up walls or heavy timber)
10	Strip mall	**24**	Transmission line tower
11	Large shopping mall	**25**	Free-standing tower
12	Large, isolated (“big box”) retail building	**26**	Free standing pole (light, flag, luminary)
13	Automobile showroom	**27**	Tree- hardwood
14	Automotive service building	**28**	Tree -softwood

Source: NOAA; FEMA

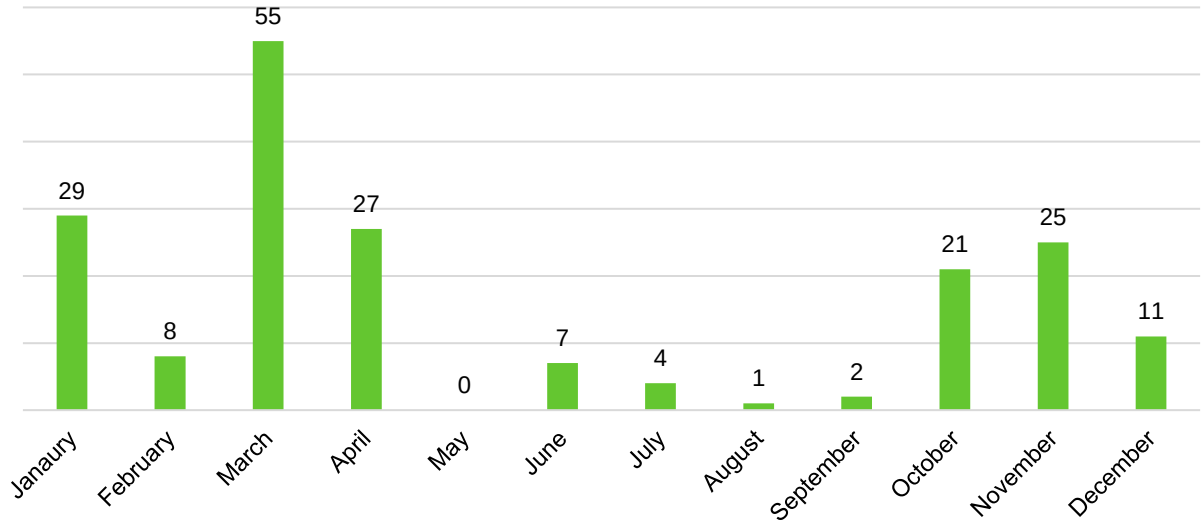
Using the NCEI reported events, the most common high wind event in the planning area is a level 9 on the Beaufort Wind Ranking scale. The reported high wind events ranged from 35 mph to 70 mph, with an average speed of 50 mph. Based on the historical record, it is most likely that tornadoes that occur within the planning area will be of EF0 strength. Of the 68 reported tornado events, 47 were EF/F0, 13 were EF/F1, five were EF/F2, and three were EF/F3.

Historical Occurrences

Due to the regional scale of high winds, the NCEI reports events as they occur in each county. While a single event can affect two or more counties at a time, the NCEI reports them as separate events. There were 190 high wind events that occurred between 1996 and June 2021 and 68 tornadic events ranging from a magnitude of EF0 to F3. These events were responsible for $36,391,400 in property damages and $30,929,112 in crop damages. No deaths were reported; however, 10 injuries were cited over two events.

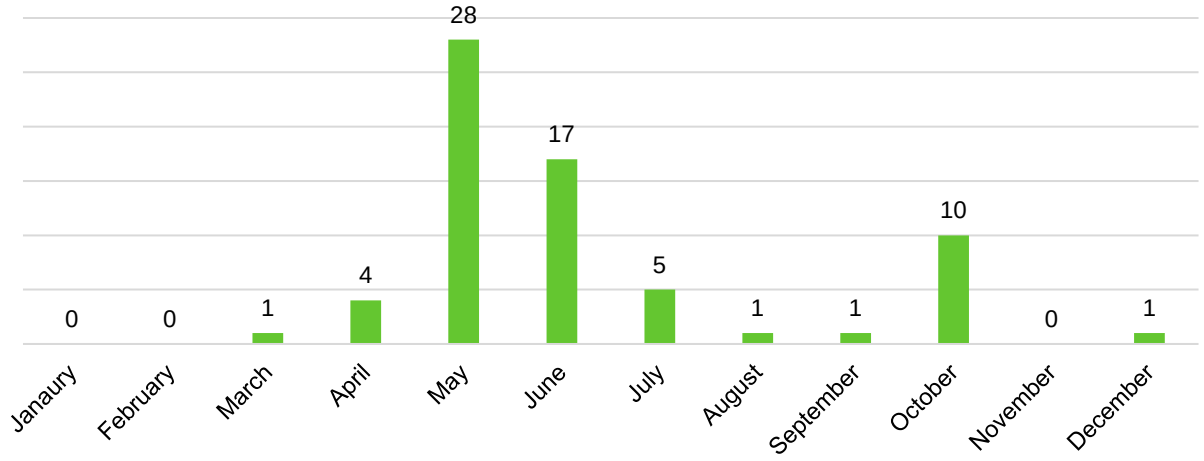
The most damaging tornado occurred in Buffalo County in 2008, causing $11 million in damages. This F2 tornado damaged an apartment complex, destroyed a hangar and cooperative jet at the Kearney Airport, caused a portion of a building to collapse at the Buffalo County fairgrounds, damaged several roofs and cars, destroyed grain bins, and downed multiple power poles and lines. As seen in the following figures, the majority of high wind events occur in the spring and winter months, while most tornado events occur in the summer.

Figure 65: High Wind Events by Month



Source: NCEI, 1996-June 2021

Figure 66: Tornado Events by Month



Source: NCEI, 1996-June 2021

Event descriptions from NCEI for the most damaging events (those including injuries, fatalities, or greatest property damage estimates) are provided below.

- **4/20/2007 Tornado -** $2,500,000 in property damages. The tornado started south of Gothenburg and moved north. It crossed Interstate 80 where several vehicles and semis were blown off the road with several injuries reported, although none were serious. At one farmstead, the twister killed nearly a dozen head of cattle. The tornado damaged or destroyed many outbuildings and farmhouses. The storm survey team rated this tornado as an EF2 based on damage to a farmhouse that lost half of its roof and had many windows blown out. This would have had an expected wind speed around 114 mph. Many wood utility poles (ETL) were also broken off at their base or snapped in half (DOD4). This would have an expected wind speed of 120 mph. The tornado had a maximum width around 3/4 mile about 5 miles north of Gothenburg. The storm also produced hail along its path in which the largest was the size of a softball.

- **5/29/2008 Tornado –** $11,000,000 in property damages. Damaged one apartment complex. Destroyed a hangar and cooperative jet at the Kearney Airport. Caused a portion of a building to collapse at the Buffalo County fairgrounds. Damaged several roofs and cars. Destroyed grain bins, and downed multiple power poles and lines.

- **6/20/2011 Tornado** - $6,000,000 in property damages. The tornado knocked down large transmission lines along Highway 40, and overturned irrigation pivots. Four homes destroyed. Significant damage to eight homes. Minor damage to 30 homes. Forty irrigation pivots overturned or damaged. As it continued to the northeast, the tornado destroyed one home directly in its path, and no walls remained standing. Tree trunks were snapped. Maximum wind speed of this tornado was estimated to be 160 miles per hour.

Average Annual Damages

The average damage per event estimate was determined based upon NCEI Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury or loss of life. It is estimated that high wind events can cause an average of $229,478 per year in property damages and $1,221,956

per year in crop damages. Tornadoes have caused an average of over $1,170,192 per year in property damages and $324,500 per year in crop damages; however, damages from tornadoes vary greatly depending on the severity or magnitude of each event.

Table 99: High Winds and Tornado Losses

Hazard Type	# of Events[1]	Average # events per year	Total Property Loss[1]	Average Annual Property Loss	Total Crop Loss[2]	Average Annual Crop Loss
High Winds	190	7.3	$5,966,400	$229,478	$24,439,112	$1,221,956
Tornadoes	68	2.6	$30,425,000	$1,170,192	$6,490,000	$324,500

Source: 1 NCEI (1996-June 2021), 2 USDA RMA (2000-2020)

Probability

Given the historic record of occurrence for high wind events (23 out of 26 years with reported events), for the purposes of this plan, the annual probability of wind event occurrence is 88 percent. However, high wind events may be more common than presented here but have simply not been reported in past years.

Given the historic record of occurrence for tornado events (24 out of 26 years with reported events), for the purposes of this plan, the annual probability of tornado occurrence is 92 percent. However, it is worth noting that data utilized during this analysis only encompassed through June 2021. Tornado events in 2021 were likely experienced in the planning area but were not reflected here.

Community Top Hazard Status

The following table lists jurisdictions which identified tornadoes and high winds as a top hazard of concern.

Jurisdiction	
Alda	Gibbon Public Schools
Amherst	Gibbon
Buffalo County	Grand Island
Cairo	Hall County
Central City Public Schools	Kearney
Central City	Lexington
Central District Health Department	Osceola
Central Platte NRD	Pleasanton Fire District
Centura Public Schools	Pleasanton Public Schools
Clarks	Pleasanton
Chapman	Polk County
Cozad	Polk
Dawson County	Ravenna Public Schools
Doniphan Fire District	Ravenna
Doniphan	Riverdale
Eddyville Fire District	Shelby
Elm Creek Fire District	Shelton Public Schools
Elm Creek	Shelton
Eustis	Silver Creek
Eustis-Farnam Public Schools	Stromsburg
Farnam	Two Rivers Public Health Department
Gothenburg	University of Nebraska - Kearney

Jurisdiction	
Four Corners Health Department	Wood River Rural Schools
Gibbon Volunteer Fire District	Wood River

Regional Vulnerabilities

The following table provides information related to regional vulnerabilities; for jurisdictional specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 100: Regional Tornado and High Wind Vulnerabilities

Sector	Vulnerability
People	-Vulnerable populations include those living in mobile homes (especially if improperly anchored), nursing homes, schools, or in substandard housing -People outside during events -Citizens without access to shelter below ground or in reinforced rooms -Elderly with decreased mobility or poor hearing may be at higher risk -Lack of multiple ways to receive weather warnings, especially at night
Economic	-Agricultural losses to both crops and livestock -Damages to businesses and prolonged power outages can cause significant impacts to the local economy, especially with EF3 tornadoes or greater
Built Environment	-All building stock is at risk of significant damages
Infrastructure	-Downed power lines and power outages -All above ground infrastructure at risk to damages -Impassable roads due to debris blocking roadways
Critical Facilities	-All critical facilities are at risk to damages and power outages
Climate	-Changes in seasonal precipitation and temperature normals can increase frequency and magnitude of events

Section Five: Mitigation Strategy

Introduction

The primary focus of the mitigation strategy is to identify action items to reduce the effects of hazards on existing infrastructure and property based on the established goals and objectives. These actions should consider the most cost effective and technically feasible manner to address risk.

The establishment of goals and objectives took place during the kick-off meeting with the Regional Planning Team. Meeting participants reviewed the goals from the 2017 HMP and discussed recommended additions and modifications. The intent of each goal and set of objectives is to develop strategies to account for risks associated with hazards and identify ways to reduce or eliminate those risks.

The Regional Planning Team made some revisions to the 2017 HMP goals and objectives. These updated goals and objectives were then shared with all planning team members at the Round 1 public meetings.

Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

Requirement: §201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program, and continued compliance with NFIP requirements, as appropriate.

Requirement: §201.6(c)(3)(iii): [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

Requirement §201.6(c)(3)(iv): For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.

Summary of Changes

The development of the mitigation strategy for this plan update includes the addition of new mitigation actions, updated status or removal of past mitigation actions, and revisions to the mitigation action selection process or descriptions of mitigation actions for consistency across the planning area.

Goals

Below is the final list of goals as determined for this plan update. These goals provide direction to guide participants in reducing future hazard related losses.

Goal 1: Protect the Health and Safety of Residents from All Hazard Events

Goal 2: Protect Existing and New Properties form All Hazard Events

Goal 3: Increase Public Awareness and Educate About All Hazard Events

Goal 4: Enhance Overall Resilience and Promote Sustainability

Selected Mitigation Actions

After establishing the goals, local planning teams evaluated and prioritized mitigation actions. These actions included: the mitigation actions identified per jurisdiction in the previous plan and additional mitigation actions discussed during the planning process. The Regional Planning Team provided each participant a link to the FEMA Handbook as a list of mitigation actions to be used as a starting point. Participants were also encouraged to think of actions that may need FEMA grant assistance and to review their hazard prioritization for potential mitigation actions. These suggestions helped participants determine which actions would best assist their respective jurisdiction in alleviating damages in the event of a disaster. The listed priority rating does not indicate which actions will be implemented first but serves as a guide in determining the order in which each action should be implemented. Participants were informed of the STAPLEE (Social, Technical, Administrative, Political, Legal, Economic, Environmental) feasibility review process and were encouraged to use it when determining priorities.

These projects are the core of a hazard mitigation plan. The local planning teams were instructed that each action must directly relate to the goals of the plan and the hazards of top concern for their jurisdiction. Actions must be specific activities that are concise and can be implemented individually. Mitigation actions were evaluated based on referencing the community's risk assessment and capability assessment. Jurisdictions were encouraged to choose mitigation actions that were realistic and relevant to the concerns identified.

A final list of alternatives was established including the following information: description of action; which hazard(s) the action mitigates; responsible party; priority; cost estimate; potential local funding sources; and estimated timeline. This information was established through input from participants and determination by the Regional Planning Team.

It is important to note that not all the mitigation actions identified by a jurisdiction may ultimately be implemented due to limited capabilities, prohibitive costs, low benefit-cost ratio, or other concerns. These factors may not be identified during this planning process. The cost estimates, priority rating, potential funding, and identified agencies are used to give communities an idea of what actions may be most feasible over the next five years. This information will serve as a guide for the participants to assist in hazard mitigation for the future. Additionally, some jurisdictions may identify and pursue additional mitigation actions not identified in this HMP.

Participant Mitigation Actions

Mitigation actions identified by participants of the CPNRD HMP are found in the Mitigation Actions Project Matrix below. Additional information about selected actions can be found in respective *Section Seven: Community Profiles.* Each action includes the following information in the respective community profile.

- **Mitigation Action:** General title of the action item.
- **Description:** Brief summary of what the action item(s) will accomplish.
- **Hazard(s) Addressed:** Which hazard the mitigation action aims to address.
- **Estimated Cost:** General cost estimate for implementing the mitigation action for the appropriate jurisdiction.
- **Funding:** A list of any potential local funding mechanisms to fund the action.
- **Timeline:** General timeline as established by planning participants.
- **Priority:** General description of the importance and workability in which an action may be implemented (high/medium/low); priority may vary between each community, mostly dependent on funding capabilities and the size of the local tax base.
- **Lead agency:** Listing of agencies or departments which may lead or oversee the implementation of the action item.
- **Status:** A description of what has been done, if anything, to implement the action item.

Implementation of the actions will vary between individual plan participants based upon the availability of existing information; funding opportunities and limitations; and administrative capabilities of communities. Establishing a cost-benefit analysis is beyond the scope of this plan and could potentially be completed prior to submittal of a project grant application or as part of a five-year update. Completed, removed, and ongoing or new mitigation actions for each participating jurisdiction can be found in *Section Seven: Community Profiles.*

Mitigation Actions Project Matrix

During public meetings, each participant was asked to review mitigation projects listed in the 2017 HMP and identify new potential mitigation actions, if needed, to reduce the effects of hazards. Selected projects varied per jurisdiction depending upon the significance of each hazard present. The information listed in the following tables is a compilation of new and ongoing mitigation actions identified by jurisdiction. Completed and removed mitigation actions can be found in respective community profiles.

Table 101: Mitigation Actions Selected by Each Jurisdiction 1 of 7

Mitigation Actions	Goal	Buffalo County	Village of Amherst	Village of Elm Creek	City of Gibbon	City of Kearney	Village of Pleasanton	City of Ravenna	Village of Riverdale	Village of Shelton
Alert/Warning Sirens	1.4			X	X					
Backup and Emergency Generators	1.2	X	X	X	X	X		X	X	X
Develop Emergency Snow/Evacuation Routes	1.6						X			
Emergency Exercise: Hazardous Spill	3.1			X						
Hazardous Fuel Reduction	2.2	X				X				
Highway/Railway Bypass	1.9					X				
Improve Electrical Service	1.5	X	X			X		X		
Improve Emergency Communication Systems	1.4				X				X	X
Improve Flood and Stormwater Detention / Retention Capacity	2.3		X							
Improve Response to Hazardous Materials Incidents	1.9	X								
Improve Sanitary and Storm Sewer System	2.3, 2.5		X							
Improve Warning Systems	1.3	X	X			X	X	X	X	
Increase Soil and Water Conservation	1.7, 3.2						X			
New Fire Hall	2.9				X					
New Wastewater Treatment Facility	1.8		X							
New Water Tower	1.8					X				
Project Scoping	4.1	X		X	X	X			X	X
Public Awareness/Education	3.1	X		X	X	X	X	X	X	
Reduce Bottlenecks / Flow Restrictions	2.1	X	X			X				

Mitigation Actions	Goal	Buffalo County	Village of Amherst	Village of Elm Creek	City of Gibbon	City of Kearney	Village of Pleasanton	City of Ravenna	Village of Riverdale	Village of Shelton
Reduce Damages from Floods, Stormwater, and Heavy Precipitation Events	2.3	X	X		X	X				
Reduce Tree Damage and Damage from Trees	2.7	X				X	X	X		
Reduce Water Demand / Improve Drought Education	1.8						X			
Repetitive Loss Property Mitigation	2.5	X		X	X	X				
Replace Fire Hydrants	1.7		X							
Storm Shelter / Safe Room	1.1	X	X		X	X	X	X	X	
Stream Channelization / Bank Stabilization	2.8					X				
Tabletop Emergency Exercises	3.1							X		
Water Meters	1.7			X						

Table 102: Mitigation Actions Selected by Each Jurisdiction 2 of 7

Mitigation Actions	Goal	Dawson County	City of Cozad	Village of Farnam	City of Gothenburg	City of Lexington
Backup and Emergency Generators	1.2	X	X	X	X	X
Backup Municipal Records	1.13			X		
Construction Standards and Building Survivability	2.9					X
Dam Updates and Improvements	2.10				X	
Database of Vulnerable Populations	1.12	X				
Develop a Drought Management Plan	1.12, 4.1	X				
Develop Emergency Snow/Evacuation Routes	1.6					X
Drainage Study	1.12		X			X

Mitigation Actions	Goal	Dawson County	City of Cozad	Village of Farnam	City of Gothenburg	City of Lexington
Evaluate Stream Channelization / Bank Stabilization	2.8				X	
Hail Resistant Roofing	2.9					X
Hazardous Materials Reduction	1.9			X		
Improve and Revise Snow/Ice Removal Program	1.6					X
Improve Drainage	2.1	X				X
Improve Electrical Service	1.5				X	X
Improve Emergency Communication Systems	1.4				X	
Improve Flood/Dam Failure Warning Systems	1.1				X	
Improve Warning Systems	1.3			X	X	X
Increase Soil and Water Conservation	1.7, 3.2			X		
Project Scoping	4.1	X				X
Public Awareness/Education	3.1	X	X			X
Reduce Bottlenecks / Flow Restrictions	2.1			X		
Reduce Damages from Flood, Stormwater, and Heavy Precipitation Events	2.3	X				
Reduce Tree Damage and Damage from Trees	2.7	X	X		X	X
Reduce Wildfire Damage	2.2			X		
Repetitive Loss Property Mitigation	2.5	X	X		X	
Storm Shelter / Safe Room	1.1	X	X	X	X	
Stormwater and Drainage Improvements	2.1				X	
Stormwater Drainage Study	2.3				X	
Stream Channelization / Bank Stabilization	2.8					X
Tree Care Ordinance	2.7					X
Tree Planting / Assistance for Tree Planting	2.7					X
Update Comprehensive Plan	4.1					X

Table 103: Mitigation Actions Selected by Each Jurisdiction 3 of 7

Mitigation Actions	Goal	Hall County	Village of Alda	Village of Cairo	Village of Doniphan	City of Grand Island	City of Wood River
Alert/Warning Sirens	1.4			X			
Backup and Emergency Generators	1.2	X		X	X		X
Emergency Exercise: Hazardous Spill	3.1		X			X	X
Ensure Adequate Water Supply for Health and Safety	3.2						X
Improve Drainage	2.1						X
Improve Electrical Service	1.5	X				X	
Improve Emergency Communication Systems	1.4					X	
Improve Flood and Stormwater Detention / Retention Capacity	2.3			X			
Phragmites Reduction	2.5, 3.2	X				X	
Project Scoping	4.1	X	X			X	X
Propane Buses							
Protect Critical Facilities and Equipment	2.6, 2.9						
Public Awareness/Education	3.1		X			X	X
Reduce Damages from Floods, Stormwater, and Heavy Precipitation Events	2.3	X	X	X	X	X	X
Reduce Tree Damage and Damage from Trees	2.7	X			X	X	X
Repetitive Loss Property Mitigation	2.5	X				X	
Storm Shelter / Safe Room	1.1	X	X		X	X	X
Storm Shelter Identification	1.1		X	X			
Tree Planting / Assistance for Tree Planting	2.7		X				

Table 104: Mitigation Actions Selected by Each Jurisdiction 4 of 7

Mitigation Actions	Goal	Merrick County	City of Central City	Village of Chapman	Village of Clarks	Village of Silver Creek
Backup and Emergency Generators	1.2		X	X	X	X
Conduct Water Supply Study	1.7		X			
Develop Emergency Snow/Evacuation Routes	1.6			X		
Develop/Update Floodplain Information	2.4		X			
Drainage Study	1.12		X	X		
Emergency Communication	1.4			X		
Emergency Exercise: Hazardous Spill	3.1				X	
Improve Drainage	2.1			X		
Improve Electrical Service	1.5			X		
Improve Flood and Stormwater Detention / Retention Capacity	2.3		X			
Improve Flood/Dam Failure Warning Systems	1.1	X				
Improve Warning Systems	1.3	X	X	X	X	
New Water Well	1.8					X
Project Scoping	4.1	X				
Public Awareness/Education	3.1	X				X
Purchase Snow Removal Equipment	1.6				X	
Reduce Bottlenecks / Flow Restrictions	2.1					X
Reduce Damages from Floods, Stormwater, and Heavy Precipitation Events	2.3	X				
Reduce Flood and Water Damage to Roads and Properties	2.3	X				
Storm Shelter / Safe Room	1.1	X	X	X		X
Stormwater and Drainage Improvements	2.1, 2.3		X			
Water Tower Improvements	1.7				X	

Table 105: Mitigation Actions Selected by Each Jurisdiction 5 of 7

Mitigation Actions	Goal	Polk County	City of Osceola	Village of Polk	Village of Shelby	City of Stromsburg
Backup and Emergency Generators	1.2	X	X	X	X	X
Develop a Drought Management Plan	1.12, 4.1		X			
Emergency Exercise: Hazardous Spill	3.1		X			
Evaluate Stream Channelization / Bank Stabilization	2.8	X				
Improve Construction Standards and Building Survivability	2.9			X		
Improve Electrical Service	1.5			X	X	
Improve Emergency Communication Systems	1.4	X		X	X	X
Improve Flood and Stormwater Detention / Retention Capacity	2.3	X				
Improve Warning Systems	1.3	X		X	X	
Public Awareness/Education	3.1		X		X	
Purchase Snow Removal Equipment	1.6			X		
Reduce Bottlenecks / Flow Restrictions	2.1	X		X		
Reduce Damages from Floods, Stormwater, and Heavy Precipitation Events	2.3	X			X	X
Reduce Tree Damage and Damage from Trees	2.7			X	X	X
Storm Shelter / Safe Room	1.1	X		X	X	

Table 106: Mitigation Actions Selected by Each Jurisdiction 6 of 7

Mitigation Actions	Goal	Central Platte NRD	Central City Public Schools	Central City Volunteer Fire Department	Central District Health Department	Centura Public Schools	Dawson County Drainage District No. 2	Dawson County Drainage District No. 3	Doniphan Fire District	Eddyville Fire District	Elm Creek Fire District	Elm Creek Public Schools	Eustis-Farnam Public Schools
Alert/Warning Sirens	1.4		X							X			
Backup and Emergency Generators	1.2	X	X		X								X
Bladder Gates	2.5	X											
Continuity Plans	1.12, 4.1		X										
Culvert and Drainage Way Maintenance and Improvements	2.1, 2.5						X	X					
Dam Updates and Improvements	2.10	X											
Emergency Communication	1.4		X										
Evaluate Stream Channelization / Bank Stabilization	2.8	X											
Flood Monitoring and Forecasting	1.3	X											
Hazard and Crisis Plan	1.12											X	
Improve Drainage	2.1												
Improve Emergency Communication Systems	1.4					X							
Improve Flood and Stormwater Detention / Retention Capacity	2.3	X											
Improve Groundwater Quality	1.7	X											
New Fire Hall	2.9									X			
New Secure Accessible Front Entrances	1.12					X							

Mitigation Actions	Goal	Central Platte NRD	Central City Public Schools	Central City Volunteer Fire Department	Central District Health Department	Centura Public Schools	Dawson County Drainage District No. 2	Dawson County Drainage District No. 3	Doniphan Fire District	Eddyville Fire District	Elm Creek Fire District	Elm Creek Public Schools	Eustis-Farnam Public Schools
Phragmites Reduction	2.5, 3.2	X											
Project Scoping	4.1	X											
Public Awareness/Education	3.1		X										X
Purchase Response Equipment	1.4			X					X				
Protected Walkways and Parking	1				X								
Reduce Water Demand / Improve Drought Education	1.8	X											
Rehabilitate Flood Control Structures	2.9	X											
Remove Invasive Species	3.2	X											
Response to New Storm Shelter	1.1			X									
Storm Shelter / Safe Room	1.1		X								X		
Update Technology Resources	4.1		X										
Upgrade Irrigation Channels	2.1	X											
Weather Radios	1.4												X
Window Updates	2.9					X							

Table 107: Mitigation Actions Selected by Each Jurisdiction 7 of 7

Mitigation Actions	Goal	Village of Eustis	Four Corners Health Department	Gibbon Public Schools	Gibbon Volunteer Fire District	Kearney Public Schools	Pleasanton Fire District	Pleasanton Public Schools	Ravenna Public Schools	Shelton Public Schools	Two Rivers Public Health Department	University of Nebraska - Kearney	Wood River Rural Schools
Alert Sirens	1.4	X											
Assist Vulnerable Populations	4.1		X										
Backup and Emergency Generators	1.2	X				X	X	X	X	X	X	X	X
Bus Barn	2												X
Improve Drainage	2.1	X											
Improve Emergency Communication Systems	1.4					X							
Increase Rural Water Supply	1.7						X						
New Fire Hall	2.9						X						
New Secure Accessible Front Entrances	1.12												X
New Water Well	1.8	X											
Propane Buses	1							X					
Protect Critical Facilities and Equipment	2.6, 2.9		X										
Public Awareness/Education	3.1	X	X							X		X	
Purchase Response Equipment	1.4				X								
Reduce Bottlenecks / Flow Restrictions	2.1				X								
Storm Shelter / Safe Room	1.1			X		X			X		X	X	
Virtualized Servers	1.12												X

Mitigation Actions	Goal	Village of Eustis	Four Corners Health Department	Gibbon Public Schools	Gibbon Volunteer Fire District	Kearney Public Schools	Pleasanton Fire District	Pleasanton Public Schools	Ravenna Public Schools	Shelton Public Schools	Two Rivers Public Health Department	University of Nebraska - Kearney	Wood River Rural Schools
Wildfire Response Training/Exercises	2.2				X								

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Section Six: Plan Implementation and Maintenance

Monitoring, Evaluating, and Updating the Plan

Each participating jurisdiction in the CPNRD HMP will be responsible for monitoring, evaluating, and updating the plan during its five-year lifespan. Hazard mitigation projects will be prioritized by each participant's governing body with support and suggestions from the public and business owners. Each participant identified the positions that will be responsible for plan maintenance, the frequency of review, and how the public will be involved. The information can be found in each community profile under the Plan Maintenance section. During the review, the lead agency (or appropriate department/staff) identified on each mitigation action, will report on the status of projects and include which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which strategies could be revised.

To assist with monitoring the plan, as each mitigation action is completed, a detailed timeline of how that project was completed will be written and attached to the plan in a format selected by the governing body. Information that will be included will address project timeline, agencies involved, area(s) benefited, total funding, etc.

In addition, each local review team will be responsible for ensuring that the HMP's goals are incorporated into applicable revisions of each participant's comprehensive plan and any new planning projects undertaken by the participant. The HMP will also consider any changes in comprehensive plans and incorporate the information accordingly in its next update.

Requirement §201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

The FEMA required update of this plan will occur at least every five years, to reduce the risk of the HMP expiring. Updates may be incorporated more frequently, especially in the event of a major hazard. Las Animas County will start meeting to discuss mitigation updates at least nine months prior to the deadline for completing the plan review. The persons overseeing the evaluation process will review the goals and objectives of the previous plan and evaluate them to determine whether they are still pertinent and current. Among other questions, they may want to consider the following. Worksheets in *Appendix C* may also be used to assist with plan updates.

- Do the goals and objectives address current and expected conditions?
- If any of the recommended projects have been completed, did they have the desired impact on the goal for which they were identified? If not, what was the reason it was not

successful (lack of funds/resources, lack of political/popular support, underestimation of the amount of time needed, etc.)?
- Have either the nature, magnitude, and/or type of risks changed?
- Are there implementation problems?
- Are current resources appropriate to implement the plan?
- Were the outcomes as expected?
- Did the plan partners participate as originally planned?
- Are there other agencies which should be included in the revision process?

Continued Public Involvement

To ensure continued plan support and input from the public and business owners, public involvement should remain a top priority for each participating jurisdiction. Every participant identified ways the public will be involved in the update process including the following.

- Social Media
- Websites
- Board/City Council Meetings
- Newsletters
- Letters

Integrating Other Capabilities

There are a number of state and federal agencies with capabilities that can be leveraged during HMP updates or mitigation action implementation. A description of some regional resources is provided below.

Nebraska Emergency Management Agency

NEMA is an agency that is a part of the Military Department in the State of Nebraska. NEMA is responsible for emergency management, which is usually divided into four phases: preparedness, response, recovery, and mitigation.

NEMA is responsible for developing the state hazard mitigation plan, which serves as a comprehensive set of guidelines for hazard mitigation across the state. The state hazard mitigation officer and other mitigation staff members play an active role in assisting in the development local hazard mitigation plans. Representatives from the state hazard mitigation program serve as technical guides to local planning teams and regularly participate in local mitigation planning meetings. The state hazard mitigation staff also oversees the hazard mitigation assistance programs: HMGP and BRIC; and works with the Governor's taskforce to prioritize projects requesting funding assistance through the HMGP and BRIC.

The main objective in NEMA's preparedness process is to develop plans and procedures to help facilitate any response that may need to occur during a hazard event. NEMA assists communities in the development of county or city/village planning documents; assists with the development of exercises for existing plans and procedures; conducts trainings for community officials, assist emergency management related groups (Citizen Emergency Response Teams, Citizen Corps, Medical Reserve Corps, Fire Corps, and other interest groups); and provide technical resources and expertise throughout the state.

NEMA's role during a response is to assist communities in responding to hazard events *when the need for assistance exceeds the local capabilities and resources*. This includes facilitating and tracking grants, coordinating local needs, providing state and federal level assistance through activation of Emergency Operation Centers, Mass Critical Shelters, Emergency Alert Systems and providing technical, logistical, and administrative resources and expertise before, during, and after incidents. The main purpose of the recovery phase is to perform actions that allow the return of normal living, or better conditions. The secondary role of the recovery phase is grant administration and tracking, project monitoring, damage assessment, collaborating with communities on effective recovery options and opportunities, serving as liaison between federal level entities and local representatives, and serving as a technical resource throughout the recovery process. For more information regarding the plans and NEMA's responsibilities as well as their ongoing projects, please go to http://www.nema.nebraska.gov/.

Nebraska Department of Natural Resources

The NeDNR is committed to providing Nebraska's citizens and leaders with the data and analyses they need to make appropriate natural resource decisions for the benefit of all Nebraskans both now and in the future. This state agency is responsible in the area of surface water, groundwater, floodplain management, dam safety, natural resource planning, integrated water management, storage of natural resources and related data, and administration of state funds.

NeDNR plays a significant role in protecting and conserving water resources through the oversight of surface and groundwater status and integrated water management. The NeDNR is also responsible for a non-structural program of floodplain management, coordination and assistance with the National Flood Insurance Program as well as the FMA grant program, reviewing and approving engineering plans for new dams, rehabilitating old dams, and high hazard dam emergency preparedness plans. NeDNR was active throughout the hazard planning process and provided extensive resources and technical support for hazard risk and vulnerability analysis such as flood and dam failure. NeDNR also works with communities in many capacities including assisting in flood mapping needs and the completion of Benefit Cost Analysis. For more information regarding NeDNR's responsibilities as well as their ongoing projects, please go to http://dnr.nebraska.gov/.

Silver Jackets Program

The Silver Jackets program is also worth mentioning for their extensive role in providing a formal and consistent strategy for an interagency approach to planning and implementing measures to reduce the risks associated with flooding and other natural hazards. It brings together multiple state, federal, and sometimes tribal and local agencies to learn from one another and apply their knowledge to reduce risk. Both NEMA and NeDNR play an active role on the Nebraska Silver Jackets team. The Silver Jackets completed the Wood River Watershed Study in 2020. The purpose of the study was to develop a 1% Annual Exceedance Probability frequency flow data for the communities of Kearney, Gibbon, Shelton, Wood River, Alda, and Grand Island.

Nebraska Forest Service

The agency's mission statement is "To enrich the lives of all Nebraskans by protecting, restoring, and utilizing Nebraska's tree and forest resources. The state agency provides resources, information, and facilitates research to promote healthy forests.

The NFS achieves these goals through a variety of programs. The Rural Forestry Assistance program aids landowners in need of forest management help. Some of these services include assistance and advice on forest and woodlot management, windbreak establishment and

management, reforestation, and other forestry related issues. The forest health program is responsible for maintaining a list of the most prominent pest problems in Nebraska along with the trees affected, control recommendations, and timing. The wildland fire protection program is responsible for protecting wildlands from fire. The state does not have a fire suppression force within the forest service like other states. They rely on local firefighters to handle the suppression of these fires. The agency does provide air support and equipment to the local firefighters if the assistance is needed. The agency also assists Nebraska's communities to be ready for wildfire by helping them prepare Community Wildfire Protection Plans. CWPPs gather local resources to enhance wildfire mitigation and preparedness. The plans identify steps for communities to take to help reduce the risk of damage from wildfires. For more information regarding the NFS's responsibilities as well as their ongoing projects, please go to http://nfs.unl.edu/.

Unforeseen Opportunities

If new, innovative mitigation strategies arise that could impact the planning area or elements of this plan, which are determined to be of importance, a plan amendment may be proposed and considered separate from the annual review and other proposed plan amendments. Central Platte NRD, as the plan sponsor, provides an opportunity for jurisdictions to compile proposed amendments annually and send them to NEMA, and subsequently to FEMA, for a plan amendment. Such amendments should include all applicable information for each proposal including description of changes, identified funding, responsible agencies, etc.

Incorporation into Existing Planning Mechanisms

The Regional Planning Team utilized a variety of plan integration tools to help communities determine how their existing planning mechanisms were related to the Hazard Mitigation Plan. Utilizing FEMA's *Integrating the Local Natural Hazard Mitigation Plan into a Community's Comprehensive Plan*[125] guidance, as well as FEMA's *2015 Plan Integration*[126] guide, each jurisdiction engaged in a plan integration discussion. This discussion was facilitated by a Plan Integration Worksheet, created by the Regional Planning Team. This document offered an easy way for participants to notify the Regional Planning Team of existing planning mechanisms, and if they interface with the HMP.

Each jurisdiction referenced all relevant existing planning mechanisms and provided information on how these did or did not address hazards and vulnerability. Summaries of plan integration are found in each participant's *Community Profile*. For jurisdictions that lack existing planning mechanisms, especially smaller villages, the HMP may be used as a guide for future activity and development in the jurisdiction.

125 Federal Emergency Management Agency. November 2013. "FEMA Region X Integrating the Local Natural Hazard Mitigation Plan into a Community's Comprehensive Plan." https://www.fema.gov/media-library-data/1388432170894-6f744a8afa8929171dc62d96da067b9a/FEMA-X-IntegratingLocalMitigation.pdf.

126 Federal Emergency Management Agency. July 2015. "Plan Integration: Linking Local Planning Efforts." https://www.fema.gov/media-library-data/1440522008134-ddb097cc285bf741986b48fdcef31c6e/R3_Plan_Integration_0812_508.pdf.

Section Seven: Community Profiles

Purpose of Community Profiles

Community Profiles contain information specific to jurisdictions participating in the Central Platte NRD planning effort. Community Profiles were developed with the intention of highlighting each jurisdiction's unique characteristics that affect its vulnerability to hazards. Community Profiles may serve as a short reference of identified vulnerabilities and mitigation actions for a jurisdiction as they implement the mitigation plan. Information from individual jurisdictions was collected at public and one-on-one meetings and used to establish their section of the plan. Community Profiles may include the following elements:

- Local Planning Team
- Location and Geography
- Demographics
- Employment and Economics
- Housing
- Governance
- Capability Assessment
- Plan Integration
- Future Development Trends
- Community Lifelines
- Parcel Improvements and Valuation
- Historical Occurrences
- Hazard Prioritization
- Mitigation Strategy
- Plan Maintenance

In addition, maps specific to each jurisdiction are included, such as jurisdiction identified critical facilities, flood-prone areas, and a future land use map (when available). The hazard prioritization information, as provided by individual participants, varies due in large part to the extent of the geographical area, the jurisdiction's designated representatives (who were responsible for completing meeting worksheets), identification of hazards, and occurrence and risk of each hazard type.

The overall risk assessment for the identified hazard types represents the presence and vulnerability to each hazard throughout the entire planning area. A discussion of certain hazards selected for each Community Profile was prioritized by the local planning team based on the identification of hazards of greatest concern, hazard history, and the jurisdiction's capabilities. The hazards not examined in depth can be found in *Section Four: Risk Assessment*.