TRI-BASIN NRD

Hazard Mitigation Plan 2023

JEO CONSULTING GROUP

Regional Planning Team

Name	Title	Jurisdiction
John Thorburn	General Manager	Tri-Basin NRD
Craig Lupkes	Emergency Manager	Kearney County
Roger Powell	Emergency Manager	Gosper County
Justin Norris	Emergency Manager	Phelps County
*Phil Luebbert	Project Coordinator	JEO Consulting Group Inc.
*Karl Dietrich	Planner	JEO Consulting Group Inc.
*Anthony Kohel	Planner	JEO Consulting Group Inc.
*Marisa Alvares	Planning Specialist	NEMA

**Served in an advisory or consultant role.*

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List of Acronyms

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
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
FMAG – Fire Management Assistance Grant
FR – FEMA's Final Rule
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
NRD – Natural Resources District
NWS – National Weather Service
PDM – Pre-Disaster Mitigation Program
PDSI – Palmer Drought Severity Index
PHMSA – U.S. Pipeline and Hazardous Material Safety Administration
RCP – Representative Concentration Pathways
Risk MAP – Risk Mapping, Assessment, and Planning
RMA – Risk Management Agency
SBA – Small Business Administration

SERT – State Emergency Response Team
SPIA – Sperry-Piltz Ice Accumulation Index
STAPLEE – Social, Technical, Administrative, Political, Legal, Economic, Environmental
TORRO – Tornado and Storm Research Organization
USACE – United States Army Corps of Engineers
USDA – United States Department of Agriculture
USGS – United States Geological Survey
VFD – Volunteer Fire Department
WHO – World Health Organization
WUI – Wildland-Urban Interface

Executive Summary

Introduction

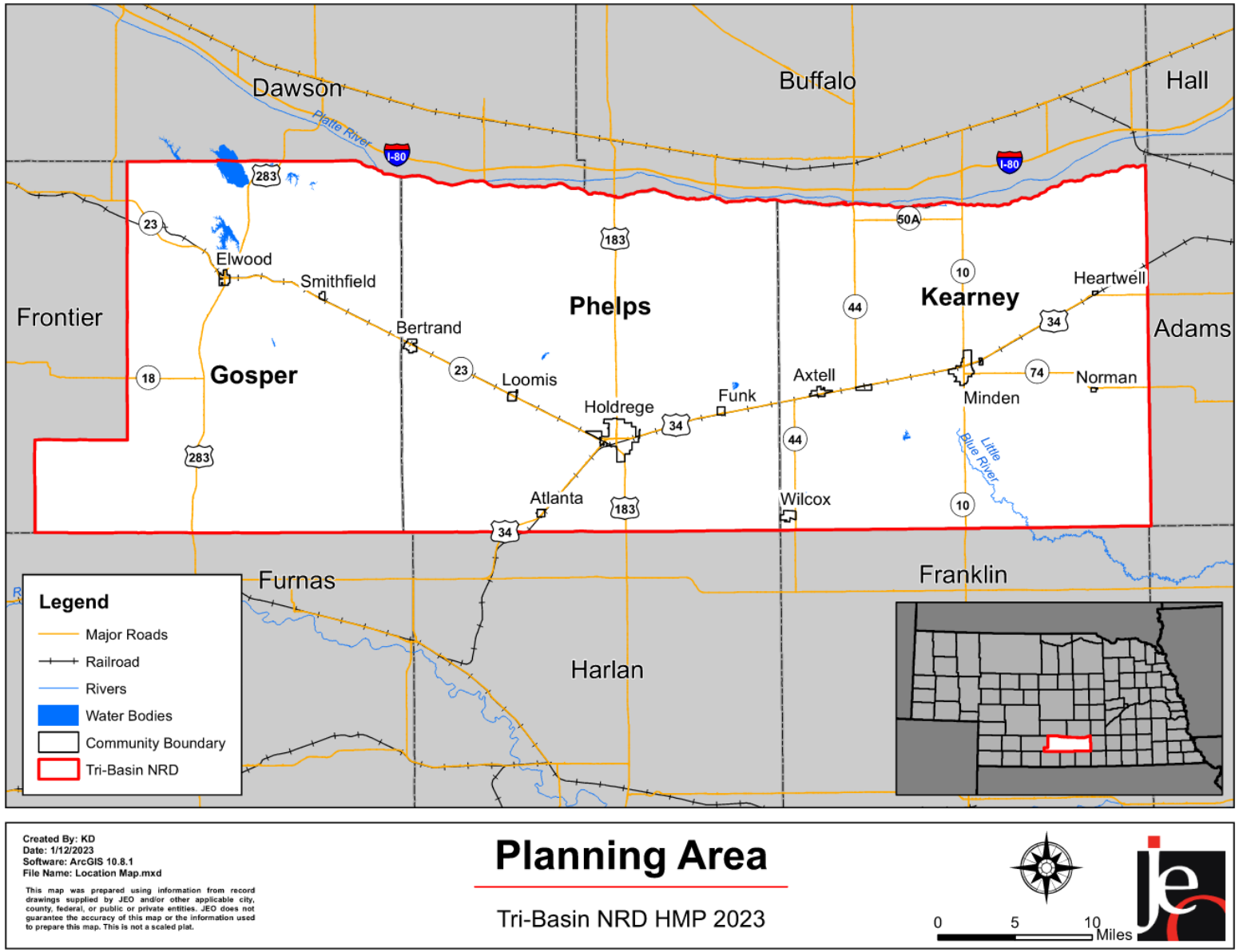
This plan is an update to the Tri-Basin Natural Resources District (NRD) Hazard Mitigation Plan (HMP) approved in 2018. The plan update was developed in compliance with the requirements of the Disaster Mitigation Act of 2000 (DMA 2000).

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 on 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
Gosper County
Village of Elwood
Village of Smithfield
Kearney County
Village of Axtell
Village of Heartwell
City of Minden
Village of Norman
Village of Wilcox
Phelps County
Village of Atlanta
Village of Bertrand
Village of Funk
City of Holdrege
Village of Loomis
Tri-Basin NRD
Axtell Community Schools
Axtell Volunteer Fire & Rescue Department
Bertrand Fire Department
Elwood Public Schools
Elwood Volunteer Fire Department
Funk Rural Fire Department
Holdrege Fire & Rescue
Holdrege Public Schools
Loomis Public Schools
Loomis Volunteer Fire & Rescue
Minden Volunteer Fire Department
Wilcox Rural Fire Protection District

Figure 1: Planning 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 2018 HMP were reviewed, and the Regional Planning Team agreed that they are still relevant and applicable for this plan update with some modifications and additions. Two additional goals (Goal 5 and Goal 6) were added along with objectives for each goal to further provide clarification. In addition, the wording of Goal 2 was updated to better reflect updated Federal Emergency Management Agency (FEMA) terms. The updated goals and objectives for this plan update are as follows.

Goal 1: Protect the Health and Safety of the Public

Objective 1.1: Reduce or prevent damage to property, loss of life, or serious injury.

Goal 2: Protect and Maintain Operation of Community Lifelines During and After a Hazard Event

Objective 2.1: Provide protection for community lifelines to the extent possible

Goal 3: Protect Existing and Future Properties and Natural Resources

Objective 3.1: Provide protection for existing structures, future development, vulnerable areas and populations, services, and natural resources to the extent possible.

Objective 3.2: Develop hazard specific plans, conduct studies or assessments, and retrofit jurisdictions to mitigate hazards and minimize their impacts.

Objective 3.3: Minimize and control the impacts of hazard events through enacting or updating ordinance, permits, laws, or regulations.

Goal 4: Promote Efficient Use of Public Funds

Objective 4.1: Identify areas and structures where public funds would be used most efficiently.

Goal 5: Increase Public Awareness and Education on Vulnerability to Hazards

Objective 5.1: Develop and provide information to residents and businesses on the types of hazards they are exposed to, what the effects may be, where they may occur, and what they can do to be better prepared.

Goal 6: Improve Emergency Management Capabilities

Objective 6.1: Develop or improve emergency response plan, procedures, and abilities.

Objective 6.2: Improve warning systems and ability to communicate with residents and businesses during and after a disaster or emergency.

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 2018 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 in-depth funding guidebook; and changes to meet updated FEMA HMP policies. The plan was also updated to reflect changing priorities for each participating jurisdiction. Top hazards of concern were reviewed and updated by each local planning team along with a review of mitigation actions. Each local planning team reviewed the mitigation actions from 2018 and updated the timeline, action priority (high, medium, low), and status. Local planning teams were also able to add new mitigation actions to better fit any changing priorities and concerns. The 2018 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: 2018 Plan Comments and Revisions

Comment/Revision from 2018 Review Tool	Location of Revision	Summary of Changes
"Any impact from expansive soils in Nebraska (and the planning area) are likely to be manifested as localized flooding and will be reported as such." The connection between expansive soils and flooding is not clear.	N/A	Expansive Soils is not discussed in this plan. It is not a hazard listed in the State HMP and was not a hazard of concern for the Regional Planning Team.
It would be helpful to indicate the approximate location of the planning area in Figure 10.	Hazard Profiles	All maps now have the approximate location of the planning area added.
At the next plan update, be sure that all jurisdictions address the NFIP mitigation strategy requirement appropriately.	Individual Participant Sections. Flooding Profile	An NFIP section discussion has been added to all individual community participant sections. The flooding profile in Section 4 also includes an NFIP discussion.

It should be noted as well that due to the ongoing 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. Meeting changes are further described in *Section Two*.

Plan Implementation

Various communities across the planning area have implemented hazard mitigation projects following the 2018 Hazard Mitigation Plan. A few examples of completed projects include new warning sirens, hazardous tree removal, mapped municipal 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 includes historic occurrences and recurrence intervals; historic losses (physical and monetary); impacts to the built environment (including privately-owned structures as well as community lifelines); 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: 20/8 Plant: 36/22	Animal: 75% Plant: 77%	Range: 1-120 animals Crop damage or loss
Dam Failure	4/127	3%	Varies by structure
Drought	489/1,531 months	32%	D1-D4
Earthquake	0/120	Less than 1%	<4.0 magnitude
Extreme Heat	Avg 6 days per year ≥100°F	80%	≥100°F
Flooding	32/26	42%	Some inundation of structures (11.5% of structures) and roads near streams. Some evacuations of people may be necessary
Grass/Wildfires	323/22	100%	Avg 10.3 acres Some homes and structures threatened or at risk
Hazardous Materials Release	Fixed Site: 60/33 Transportation: 1/52	Fixed Site: 70% Transportation: 2%	<1-4,000 gallons
Public Health Emergency	2	Unknown	Varies by extent
Severe Thunderstorms	661/26	100%	Avg: 66 mph winds Avg: 1.19-inch hail Range: 55-96 mph winds Range: 0.75-4.5-inch hail
Severe Winter Storms	307/26	100%	0.25”-1.5” Ice 30°-70° below zero (wind chill) 2-18” snow
Terrorism and Cyber Security	0/50	Less than 1%	Varies by event
Tornadoes and High Winds	High Wind: 114/26 Tornado: 29/26	High Wind: 77% Tornado: 38%	Avg: 57.5 mph wind Avg: EF0 tornado Range: 40-77 mph wind Range: EF0-EF2 tornado

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]	20	263 Animals	N/A
	Plant Disease[2]	36	N/A	$428,696
Dam Failure[5]		4	$0	N/A
Drought[6]		489 out of 1,531 Months	$0	$46,489,468
Earthquakes[11]		0	$0	$0
Extreme Heat[7]		Avg. 6 Days a Year	N/A	$7,639,951
Flooding[8]	Flash Flood	23	$6,015,000	$822,445
	Flood	9	$93,000	
Grass/Wildfires[9] *3 Injuries* *1 Fatality*		323	$141,775	$470,285
Hazardous Materials Release *Fixed Site: 3 Injuries*	Fixed Site[3]	60	$0	N/A
	Transportation[4]	1	$70,300	N/A
Public Health Emergency		2	N/A	N/A
Severe Thunderstorms[8]	Hail Range: 0.75-4.5 in Average: 1.19 in	391	$32,384,000	$86,181,183
	Thunderstorm Wind Range: 55-96 mph Average: 65.7 mph	245	$9,076,000	$6,316,617
	Heavy Rain	24	$20,000	
	Lightning	1	$500,000	
Severe Winter Storms[8] *1 Injury*	Blizzard	30	$900,000	$3,098,293
	Extreme Cold/Wind Chill	10	$0	
	Heavy Snow	14	$0	
	Ice Storm	18	$21,765,000	
	Winter Storm	119	$600,000	
	Winter Weather	116	$35,000	
Terrorism and Cyber Security[10]		0	$0	N/A
Tornadoes and High Winds[8] *High Winds: 7 Injuries* *Tornadoes: 4 Injuries*	High Winds Range: 40-77 mph Average: 57.5 mph	114	$3,396,240	$7,953,707
	Tornadoes Range: EF0-EF2 Average: EF0	29	$2,830,000	$32,779
Total		**1,589**	**$77,826,315**	**$159,433,424**

N/A: Data not available
1 - NDA, 2014 – 2021
2 - USDA RMA, 2000 – 2021
3 - NRC, 1990 – July 2022
4 - PHSMA, 1971 – July 2022
5 - DNR Communication, June 2022
6 - NOAA, 1895 – July 2022
7 - High Plains Regional Climate Center, 1897 – 2022
8 - NCEI, 1996 – April 2022
9 - NFS, 2000 - 2021
10 - University of Maryland, 1970-2020
11 - USGS, 1900 – Aug 2022

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. The top actions chosen by the plan participants include the following list.

- **Backup Generators:** The addition of backup generators to help keep community lifelines with power during a power loss event.
- **Implement Actions Identified in the CWPP:** Implement mitigation actions outlined in the Community Wildfire Protection Plans, such as creating defensible space around homes and buildings and decreasing the hazardous fuel loads.
- **Public Awareness and Education:** Better inform all plan residents of what hazards are most prevalent for the area and what things can be done to protect themselves when the next hazardous event occurs.
- **Safe Room and Storm Shelters:** Construct a safe room within the jurisdiction to be used during a severe storm event.

Section Five: Mitigation Strategy shows the full list of 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, animal and plant diseases, and grass/wildfires are part of the world around us. Human-caused hazards are a product of society and can occur with significant impacts to communities. Human-caused hazards can include dam failure, hazardous materials release, terrorism and cybersecurity, and public health emergencies. 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 Tri-Basin NRD 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 district 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 that the NRD, counties, communities, and other participating jurisdictions are eligible for federal pre-disaster funding programs and to accomplish the following goals and objectives.

Goal 1: Protect the Health and Safety of the Public

Objective 1.1: Reduce or prevent damage to property, loss of life, or serious injury.

Goal 2: Protect and Maintain Operation of Community Lifelines During and After a Hazard Event

Objective 2.1: Provide protection for community lifelines to the extent possible.

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Objective 6.1: Develop or improve emergency response plan, procedures, and abilities.

Objective 6.2: Improve warning systems and ability to communicate with residents and businesses during and after a disaster or emergency.

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[1]. 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.[2] These funds currently include the Hazard Mitigation Grant Program (HMGP)[3], Building Resilient Infrastructure and Communities Grant (BRIC)[4], the Flood Mitigation Assistance Program (FMA)[5], the Pre-Disaster Mitigation Grant (PDM)[6], and Fire Management Assistance Grant (FMAG)[7]. FEMA administers these programs under the Department of Homeland Security.[8]

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

1 Federal Emergency Management Agency, Public Law 106-390. 2000. “Disaster Mitigation Act of 2000.” https://www.fema.gov/sites/default/files/2020-11/fema_disaster-mitigation-act-of-2000_10-30-2000.pdf.
2 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/sites/default/files/documents/fema_stafford_act_2021_vol1.pdf.
3 Federal Emergency Management Agency. “Hazard Mitigation Grant Program.” Last modified December 27, 2022. https://www.fema.gov/grants/mitigation/hazard-mitigation.
4 Federal Emergency Management Agency. “Building Resilient Infrastructure and Communities.” Last modified November 21, 2022. https://fema.gov/bric.
5 Federal Emergency Management Agency. “Flood Mitigation Assistance Grant Program.” Last modified November 21, 2022. https://www.fema.gov/flood-mitigation-assistance-grant-program.
6 Federal Emergency Management Agency. “Pre-Disaster Mitigation Grant.” Last Modified March 1, 2023. https://www.fema.gov/grants/mitigation/pre-disaster.
7 Federal Emergency Management Agency. “Hazard Mitigation Grant Program Post Fire.” Last modified November 21, 2022. https://www.fema.gov/grants/mitigation/post-fire.
8 Federal Emergency Management Agency. “Hazard Mitigation Assistance.” Last modified September 30, 2021. https://www.fema.gov/grants/mitigation.

2000 (P.L. 106-390)[9] and by FEMA's Final Rule (FR)[10] 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 adopt 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 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.

- **PDM:** The PDM grant program makes federal funds available to state, local, tribal, and territorial governments to implement measures designed to reduce the risk to individuals and property from future natural hazards. The Consolidated Appropriations Act of 2023 authorizes funding for 100 projects with total funds of $233.043,782 in 2023.

- **FMAG:** Section 404 of the Stafford Act allows FEMA to provide HMGP grants to any area that received a Fire Management Assistance Grant declaration even if no major Presidential declaration was made. FMAG aids communities in implementing long-term mitigation measures after a wildfire event.

9 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.

10 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.

For more information about these grant programs and other funding opportunities to help implement identified mitigation actions see *Appendix D: Hazard Mitigation Project Funding Guidebook*.

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, the three Tri-Basin NRD 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 attendees; outreach efforts to the general public; key stakeholders and neighboring jurisdictions; and plan review and adoption.

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

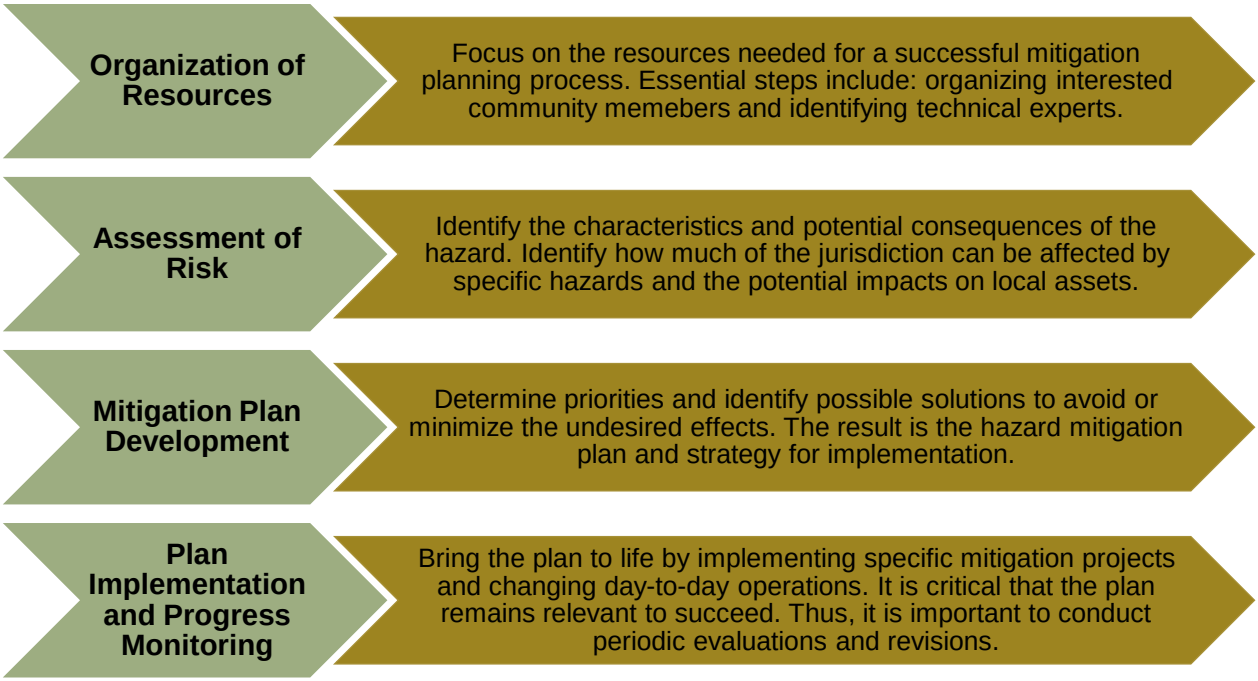
According to FEMA, “A multi-jurisdictional hazard mitigation plan is a plan jointly prepared by more than one jurisdiction.” The term ‘jurisdiction’ means ‘local government.’ Title 44 Part 201, Mitigation Planning in the CFR, defines a ‘local government’ as “any county, municipality, city, town, township, 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. The Tri-Basin NRD utilized the multi-jurisdictional planning process recommended by FEMA (Local Mitigation Planning Policy Guide[11], Local Mitigation Planning Handbook[12], and Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards[13]) 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

The NRD awarded FEMA grant funding for their multi-jurisdictional hazard mitigation plan in April 2022. JEO Consulting Group, Inc. (JEO) was contracted in July 2022 to assist, guide, and facilitate the planning process and plan assembly. For the planning area, John Thorburn with the Tri-Basin NRD 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.

11 Federal Emergency Management Agency. April 19, 2022. "Local Mitigation Planning Policy Guide." https://www.fema.gov/sites/default/files/documents/fema_local-mitigation-planning-policy-guide_042022.pdf.
12 Federal Emergency Management Agency. 2013. "Local Mitigation Planning Handbook." https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-planning-handbook_03-2013.pdf.
13 Federal Emergency Management Agency. 2013. "Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards." https://www.fema.gov/sites/default/files/2020-06/fema-mitigation-ideas_02-13-2013.pdf.

Figure 2: Project Timeline

Regional Planning Team

At the beginning of the planning process the regional 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 provided additional technical support.

Table 5: Regional Planning Team

Name	Title	Jurisdiction
John Thorburn	General Manager	Tri-Basin NRD
Craig Lupkes	Emergency Manager	Kearney County
Roger Powell	Emergency Manger	Gosper County
Justin Norris	Emergency Manager	Phelps County
Phil Luebbert*	Project Manager	JEO Consulting Group
Karl Dietrich*	Planner	JEO Consulting Group
Anthony Kohel*	Planner	JEO Consulting Group
Marisa Alvares*	Hazard Mitigation Program Specialist	Nebraska Emergency Management Agency

**Served in a consultant or advisory role.*

A kick-off meeting was held on August 1, 2022, 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
John Thorburn	General Manager	Tri-Basin NRD
Jill Harvey	(Former) Deputy Emergency Manager	Phelps County
Craig Lupkes	Emergency Manager	Kearney County
Roger Powell	Emergency Manger	Gosper County
Phil Luebbert	Project Manager	JEO Consulting Group
Karl Dietrich	Planner	JEO Consulting Group

Table 7: Kick-off Meeting Location and Time

Location and Time	Agenda Items
Tri-Basin NRD Office Holdrege, Nebraska August 1, 2022 2:30 pm	- Over of the Hazard Mitigation Plan Update - Project Schedule - Regional Planning Team Roles and Responsibilities - Goals and Objectives - Public Involvement - Hazard Identification

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 37 stakeholder groups or entities that were identified and sent letters to participate in the planning process. Representatives from All Saints Catholic School, BD Holdrege, NeDNR, Kearney County FSA, Kearney County Health Services, Phelps County FSA, and Two Rivers Public Health Department attended meetings and provided input for their respective community or county profile. 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.

The Regional Planning Team was asked to identify any underserved communities or vulnerable populations in the planning area not already identified, so they could have the opportunity to be involved in the planning process. However, none were identified during the planning process.

Table 8: Notified Stakeholder Groups

Organizations	Type
All Saints Catholic School	Private School
Allmand Bros	Major Employer
American Red Cross - Central and Western Nebraska	Red Cross
BD Holdrege	Major Employer
BD Medical	Major Employer
Bertrand Nursing Home	Assisted Living/Nursing Home
Bethany Home, Inc	Assisted Living/Nursing Home
Central Community College - Holdrege Center	College
Central Nebraska Public Power District	Power District
Chrisoma West Assisted Living	Assisted Living/Nursing Home
Christian Homes Health Care Center	Assisted Living/Nursing Home
Dawson Public Power District	Power District
NeDNR	State of Nebraska
Elwood Care Center & Assisted Living	Assisted Living/Nursing Home
Embecta	Major Employer
Gosper County Extension	County Extension
Gosper County Farm Service Agency	Farm Service Agency
Holdrege Area Chamber of Commerce	Chamber of Commerce
Holdrege Brewster Field	Airport
Holdrege Housing Authority	Development Agency
Holdrege Memorial Homes	Assisted Living/Nursing Home

Organizations	Type
Kearney County Farm Service Agency	Farm Service Agency
Kearney County Health Services	Hospital
Legacy Christian School	Private School
Minden Chamber of Commerce	Chamber of Commerce
Minden Pioneer Village Field	Airport
Nebraska VOAD	Disaster Response Association
NEMA	State Emergency Management Agency
Phelps County Extension	County Extension
Phelps County Development Corporation	Development Agency
Phelps County Farm Service Agency	Farm Service Agency
Phelps Memorial Health Center	Hospital
Royal Engineered Composites	Major Employer
Southern Public Power District	Power District
Twin Valleys Public Power District	Power District
Two Rivers Public Health Department	Health Department
Wardcraft Homes	Major Employer

Neighboring Jurisdictions

Neighboring jurisdictions were notified and invited to participate in the planning process. The following table indicates which neighboring communities, counties, and natural resources districts (NRD) were notified of the planning process. Invitation letters were sent to county emergency managers, community clerks, and NRD General Managers. A representative from the City of Hastings attended (virtually) the Round 1 Meeting in Holdrege. No comments or revisions were received from any neighboring jurisdictions.

Table 9: Notified Neighboring Jurisdictions

Notified Neighboring Jurisdictions		
Adams County	City of Cambridge	City of Kearney
Buffalo County	Village of Campbell	Village of Kenesaw
Dawson County	City of Cozad	City of Lexington
Franklin County	Village of Edison	Village of Overton
Frontier County	Village of Elm Creek	Village of Oxford
Furnas County	Village of Eustis	Village of Prosser
Harlan County	City of Gibbon	Village of Ragan
Central Platte NRD	City of Hastings	Village of Riverdale
Little Blue NRD	City of Hastings	Village of Roseland
Lower Republican NRD	Village of Hildreth	Village of Shelton
Middle Republican NRD	Village of Holbrook	Village of Upland
City of Arapahoe	Village of Holstein	
Village of Bladen	Village of Juniata	

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 plan 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, view meeting recordings, or attend a follow-up meeting with a regional planning team 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 in-person attendees and virtual attendees were able to use the chat function in Zoom or send an email to mark their attendance. Jurisdictions that were unable to attend the scheduled public meetings were able to request a meeting with a regional planning team member to satisfy the meeting attendance requirement or view 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 the overall project, meeting dates, past hazard mitigation plan, and valuable resources. It also included a comment box for individuals to provide comments on the hazard mitigation plan or planning process. (https://www.jeo.com/tri-basin-nrd-hazard-mitigation-plan).
Round 1 Meeting Letters (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 (30-day notification)	Sent to participants, stakeholders, and neighboring jurisdictions 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, participants, stakeholders, and neighboring jurisdictions 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 the ongoing COVID-19 pandemic across Nebraska, two of three Round 1 Meetings were held as hybrid meetings. Hybrid meetings were in-person public workshop meetings with additional options to join via an online or phone format. 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 community lifelines, capabilities assessment, and plan integration.	
Location and Time	**Date**
In Person Only Legion Hall at Gosper County Fairgrounds 623 Fair Ave, Elwood, NE 68937	Wednesday, October 5, at 2:00 pm
Hybrid Meeting In Person, Online, or By Phone Tri-Basin NRD Office 1723 Burlington St, Holdrege, NE 68949	Wednesday, October 5, at 7:00 pm
Hybrid Meeting In Person, Online, or By Phone Minden Fire Hall 325 N Colorado Ave, Minden, NE 68959	Thursday, October 6, at 7:00 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 hazards of concern from each jurisdiction; and reviewing and updating community profiles for demographics, capabilities, and critical facilities. Information/data reviewed include but was not limited to past identified community lifelines and their location within the jurisdiction; future development areas; and expected growth trends (refer to *Appendix B*).

The following table shows the attendees from each jurisdiction who attended a Round 1 meeting, viewed the meeting recording, or had a one-on-one meeting with a member of the regional planning team.

Table 12: Round 1 Meeting Attendees

Name	Title	Jurisdiction
Elwood Meeting – Wednesday, October 5, 2022		
Ann Hagan	Floodplain Admin / Board Chair	Village of Smithfield
Brian Brinkman	Utility Superintendent	City of Holdrege
Darren Hatch	Superintendent	Elwood Public Schools
Greg Vandell	Fire Chief	Funk Fire Department
Jason Stoddard	Utility Superintendent	Village of Axtell
John Thorburn	General Manager	Tri-Basin NRD
Katie Mulligan	Planning Section Supervisor	Two Rivers Public Health Department
Kim Parsons	Municipal Services Director / Floodplain Admin	City of Holdrege
Marcus Schwarz	Street Foreman	Village Bertrand
Roger Powell	Emergency Manager	Gosper County
Vern Barnhouse	Clerk	Village of Smithfield

Name	Title	Jurisdiction
Karl Dietrich	Hazard Mitigation Planner	JEO Consulting Group
Anthony Kohel	Hazard Mitigation Planner	JEO Consulting Group
Holdrege Hybrid Meeting – Wednesday, October 5, 2022		
Corey Young	Maintenance and Bus Driver	Holdrege Public Schools
Dallas Roemmich	Fire Chief	Holdrege Fire Department
Dennis Ostgren	County Commissioner	Phelps County
Gary Regelin	Board Member	Loomis Public Schools
Jill Harvey	Deputy Emergency Manager / Floodplain Administrator	Phelps County
John Thorburn	General Manager	Tri-Basin NRD
Marty Stange	Environmental Director	City of Hastings
MJ Pristavec	Clerk / Utility Superintendent	Village of Loomis
Nate Weaver	Principal	Loomis Public Schools
Noelle Ortgiesen	Clerk / Floodplain Administrator	Village of Atlanta
Pam Bogle	Planning/Zoning Administrator	Gosper County
Robert Gregory	Superintendent	Axtell Public Schools
Teresa Chramosta	County Executive Director	Phelps County FSA, Kearney County FSA
(Not provided)	Environmental Specialist	BD Holdrege
Marisa Alvares	Hazard Mitigation Program Specialist	NEMA
Phil Luebbert	Project Manager	JEO Consulting Group
Karl Dietrich	Planner	JEO Consulting Group
Anthony Kohel	Planner	JEO Consulting Group
Minden Hybrid Meeting – Thursday, October 6, 2022		
Bradley Butler	Chief of Police	City of Minden
Chris Klahn	Street Superintendent	City of Minden
Craig Lupkes	Emergency Manager	Kearney County
Darin Fischer	Utility Superintendent	City of Minden
Kendra Brown	CNO	Kearney County Health Services
Luke Poore	Administrator	Kearney County Health Services
Michelle Boulware	Clerk	Village of Funk
Randy Smith	Street Superintendent	Village of Norman
Teresa Chramosta	County Executive Director	Phelps County FSA, Kearney County FSA
Tom Brown	Fire Chief	Minden Volunteer Fire Department
Wayne Anderson	County Supervisor	Kearney County
Adele Phillips	Flood Mitigation Planner	Nebraska DNR
Marisa Alvares	Hazard Mitigation Program Specialist	NEMA
Karl Dietrich	Planner	JEO Consulting Group
Anthony Kohel	Planner	JEO Consulting Group
One-on-One Meeting or Recording		
Blair Johnson	Floodplain Admin/Utility Superintendent	Village of Wilcox
Dustin Clouse	Fire Chief	Elwood Volunteer Fire Department
Jeff England	Fire Chief	Axtell Volunteer Fire & Rescue Department
Kevin Stehl	Fire Chief	Bertrand Fire Department
Steven Borgman	Fire Chief	Wilcox Rural Fire Protection District

Figure 3: Elwood - Round 1 Meeting

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 2018 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 2018 HMP. Plan maintenance included identifying who would review and update 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, National Flood Insurance Program information, 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, regional planning team member, or view a recording of the meeting in order to meet plan participation requirements and complete required information.

Two of three 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 format. Table 13 shows the date and location of meetings held for Round 2 Meetings. Meeting attendees are identified in Table 14.

Table 13: Round 2 Meeting Dates and Locations

Agenda Items	
Update 2018 mitigation actions, identify new mitigation actions, update the plan review process, review updated jurisdictional profile, discuss review process, and discuss available grants and eligibility.	
Location and Time	**Date**
Hybrid Meeting In Person, Online, or By Phone Tri-Basin NRD Office 1723 Burlington St, Holdrege, NE 68949	Wednesday, January 11, at 7:00 pm
In Person Only Legion Hall at Gosper County Fairgrounds 623 Fair Ave, Elwood, NE 68937	Thursday, January 12, at 2:00 pm
Hybrid Meeting In Person, Online, or By Phone Minden Fire Hall 325 N Colorado Ave, Minden, NE 68959	Thursday, January 12, at 7:00 pm

Table 14: Round 2 Meeting Attendees

Name	Title	Jurisdiction
Holdrege Hybrid Meeting – Wednesday, January 11, 2023		
Corey Young	Maintenance and Bus Driver	Holdrege Public Schools
Dallas Roemmich	Fire Chief	Holdrege Rural Fire District
Dennis Ostgren	County Commissioner	Phelps County
Greg Vandell	Fire Chief	Funk Rural Fire Department
Janelle Pfeifer	Administrative Assistant	All Saints Catholic School
Jeff England	Fire Chief	Axtell Volunteer Fire & Rescue Department
John Thorburn	General Manager	Tri-Basin NRD
Justin Norris	Emergency Manager	Phelps County
Kevin Stehl	Fire Chief	Bertrand Fire Department
Marvin Nelson	Captain	Loomis Volunteer Fire & Rescue
Matthew Gregg	Utility Superintendent	Village of Bertrand
MJ Pristavec	Clerk/Utility Superintendent	Village of Loomis
Nate Weaver	Principal	Loomis Public Schools
Teresa Chramosta	County Executive Director	Phelps County FSA, Kearney County FSA
Tori Johnston	Floodplain Admin/Deputy EM	Phelps County
Phil Luebbert	Project Manager	JEO Consulting Group
Karl Dietrich	Planner	JEO Consulting Group
Anthony Kohel	Planner	JEO Consulting Group
Elwood Meeting – Thursday, January 12, 2023		
Ann Hagan	Floodplain Administrator/Board Chair	Village of Smithfield
Brian Brinkman	Utility Superintendent	City of Holdrege
Daren Hatch	Superintendent	Elwood Public Schools
Erica Carpenter	Emergency Response Coordinator	Two Rivers Public Health Department
Jason Stoddard	Utility Superintendent	Village of Axtell
John Thorburn	General Manager	Tri-Basin NRD
Katie Mulligan	Planning Section Supervisor	Two Rivers Public Health Department
Kim Parsons	Municipal Services Director/Floodplain Admin	City of Holdrege

Name	Title	Jurisdiction
Kirk Corder	Utility Superintendent	Village of Elwood
Laurie Jauken	Clerk/Treasurer	Village of Elwood
McKenzie Petersen	Environmental Health Specialist	Two Rivers Public Health Department
Pam Bogle	Planning/Zoning Administrator	Gosper County
Robert Gregory	Superintendent	Axtell Community Schools
Roger Powell	Emergency Manager/Floodplain Admin	Gosper County
Verna Barnhouse	Clerk/Board Member	Village of Smithfield
Phil Luebbert	Project Manager	JEO Consulting Group
Anthony Kohel	Planner	JEO Consulting Group
Minden Hybrid Meeting – Thursday, January 12, 2023		
Blair Johnson	Floodplain Admin/Utility Superintendent	Village of Wilcox
Chris Hopkins	Board Chairperson	Village of Heartwell
Chris Klahn	Street Superintendent	City of Minden
Christopher Kuehn	Clerk	Village of Heartwell
Craig Lupkes	Emergency Manager	Kearney County
Dawn Thompson	Clerk/Treasurer	Village of Norman
Jason Sinsel	County Supervisor	Kearney County
Joseph Anderson	Floodplain Admin/Zoning Admin	Kearney County
Keith Jauken	Village Chairperson	Village of Funk
Luke Poore	Administrator	Kearney County Health Services
Michelle Boulware	Clerk	Village of Funk
Phil Luebbert	Project Manager	JEO Consulting Group
Karl Dietrich	Planner	JEO Consulting Group
Anthony Kohel	Planner	JEO Consulting Group
One-on-One Meeting or Recording		
Noelle Ortgiesen	Clerk/Floodplain Administrator	Village of Atlanta
Steven Borgman	Fire Chief	Wilcox Rural Fire Protection District
Tom Brown	Fire Chief	Minden Volunteer Fire Department

Figure 4: Holdrege - Round 2 Meeting

Public Review

Once the HMP draft was completed, a public review period was opened to allow participants and community members at large to review the plan, provide comments, and request changes. The public review period was open from April 3, 2023, through May 1, 2023. Participating jurisdictions were emailed or mailed a letter notifying them of this public review period. The HMP was also made available on the project website (https://www.jeo.com/tri-basin-nrd-hazard-mitigation-plan) to download the document. Jurisdictions and the public could 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.

- **City of Kearney –** Updated governmental positions and community lifeline information.
- **Gosper County –** Updated housing information. Added additional mitigation actions for participants in the county.
- **Holdrege Public Schools –** Updated information in the location, demographics, communication, enrollment, and planning portions of their profile.
- **Kearney County –** Added additional mitigation actions for participants in the county and updated local planning team information.
- **Nebraska Department of Natural Resources, Dam Safety Section –** Reviewed the dam failure risk assessment and provided updated inspection and historical dam failure information.

- **Nebraska Department of Natural Resources, Floodplain Management Section –** Reviewed the flooding risk assessment and provided updated NFIP Policy information and information from the 2022 State Flood Hazard Mitigation Plan.
- **Nebraska Forest Service –** Reviewed the grass/wildfire risk assessment and provided comments.
- **Phelps County –** Added additional mitigation actions for the county and participants in the county.
- **Village of Elwood –** Corrected the village's area.

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

Focus Group Meeting

During the public review period, a meeting was held with the three county emergency managers and the Tri-Basin NRD. The meeting was an opportunity for emergency managers to review selected the mitigation actions of all the participants in their county. All three county emergency managers added additional mitigation actions to various communities, fire districts, and school districts based on known projects and needs. The meeting was also a chance for everyone to review and provide comments on the updated project funding guidebook. The meeting was held on April 10 at the NRD Office in Holdrege. Attendees at the focus group meeting included the following individuals.

- **John Thorburn –** Tri-Basin NRD General Manager
- **Roger Powell –** Gosper County Emergency Manager
- **Justin Norris –** Phelps County Emergency Manager
- **Tori Johnston –** Phelps County Deputy Emergency Manager
- **Craig Lupkes –** Kearney County Emergency Manager
- **Karl Dietrich –** JEO Project Planner

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 that 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, Tri-Basin NRD, or the consultant, JEO, to document updates and revise the HMP.

Additionally, the local planning teams should integrate HMP goals, objectives, and mitigation actions into local community planning documents and studies 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

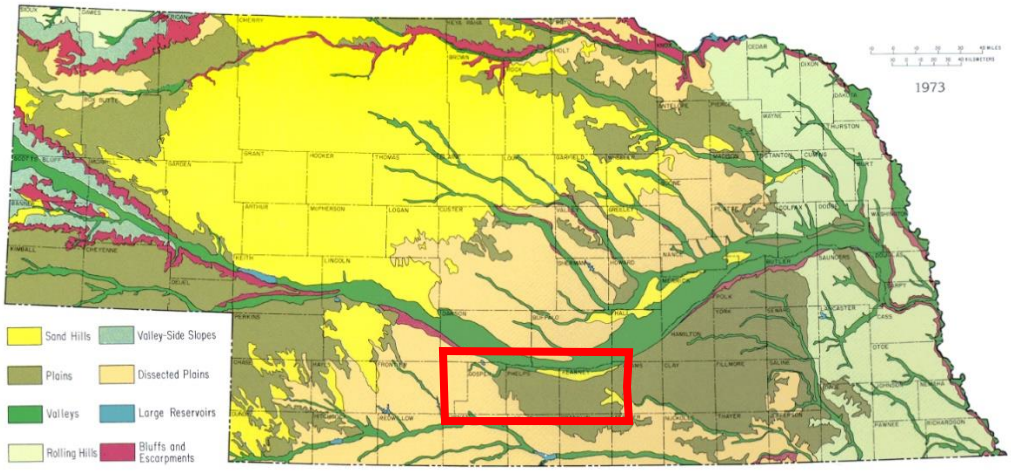
To identify jurisdictional vulnerabilities, it is vitally important to understand the people and built environment of the planning area. The following section provides an overall description of the planning area's characteristics to create a summary profile for the region. Specific characteristics are 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

The Tri-Basin NRD is located in south-central Nebraska. It includes Gosper, Kearney, and Phelps Counties, and covers 1,519 square miles. The planning area has a diverse range of topographic regions including dissected plains, large reservoirs, plains, sand hills, and valleys (Figure 5). Descriptions of these topographic regions are below.

- **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.[14]

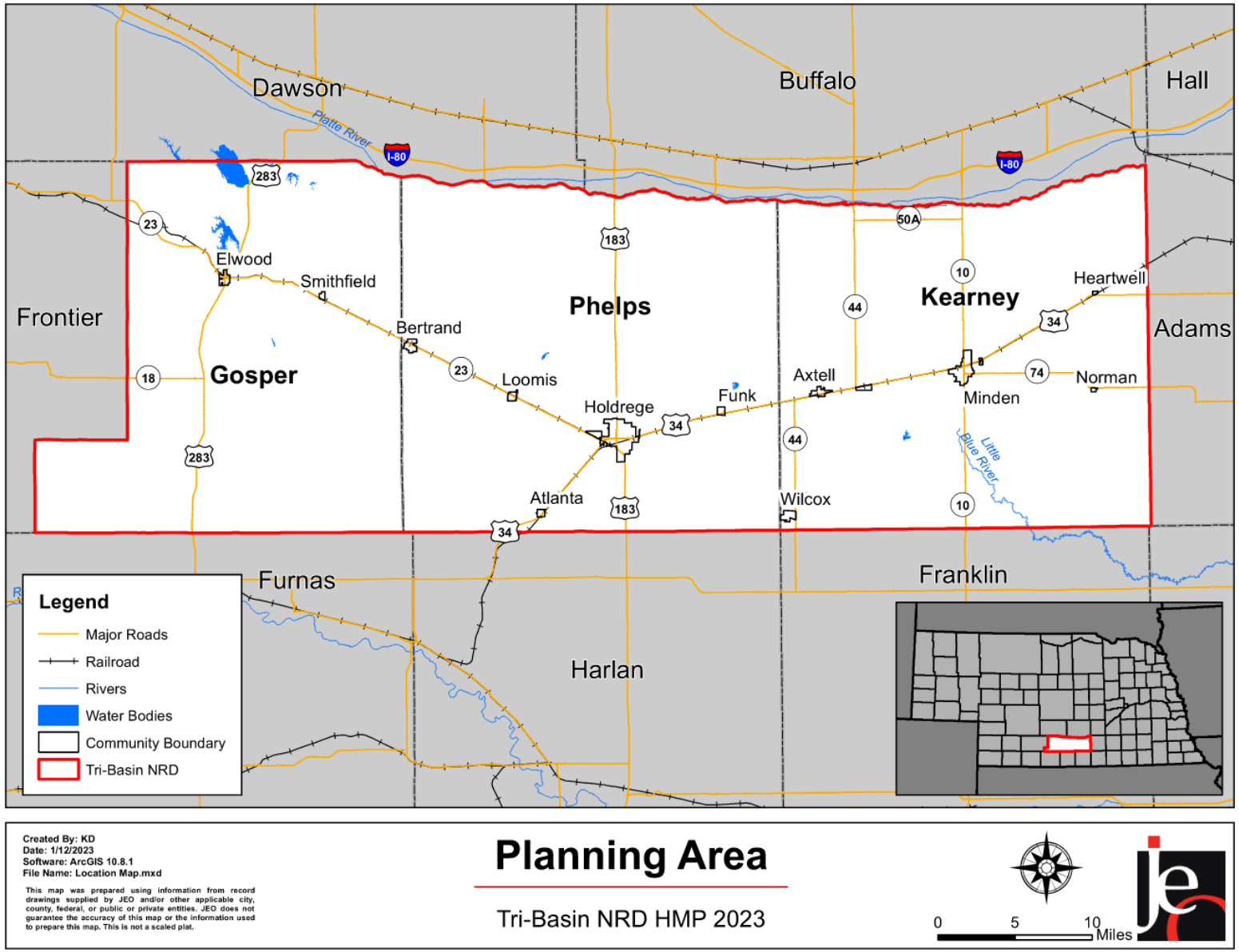
Figure 5: Topography



Source: University of Nebraska-Lincoln

14 University of Nebraska-Lincoln, 1973. "Topographic Regions Map". https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1461&context=conservationsurvey.

Figure 6: Tri-Basin NRD Planning Area

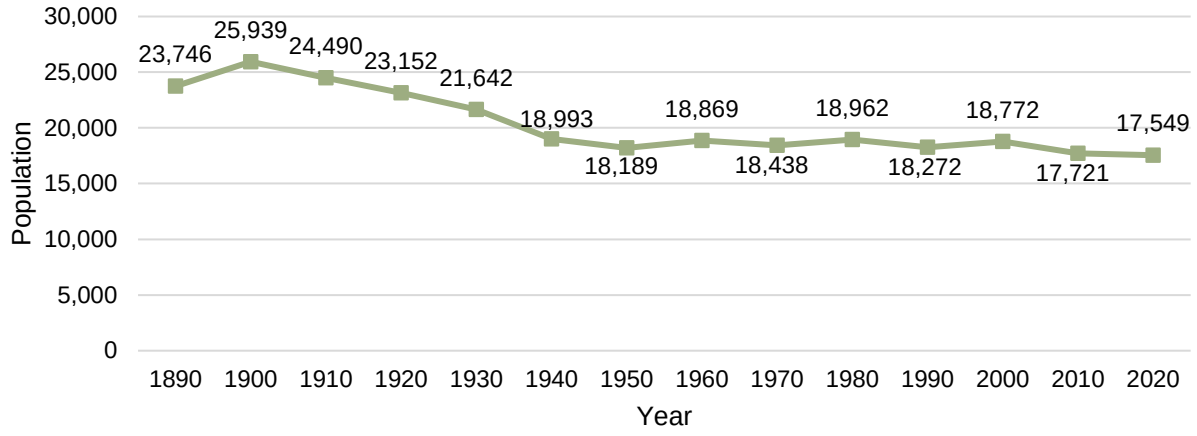


Major waterways in the district include Johnson Lake, Elwood Reservoir, Plum Creek, Turkey Creek, Muddy Creek, Deer Creek, North Dry Creek, Spring Creek, and the Platte River. The NRD includes portions of the Platte, Republican, and Little Blue River basins. Figure 6 shows the planning area, communities, major roadways, water bodies, and major waterways.

Demographics and At-Risk Populations

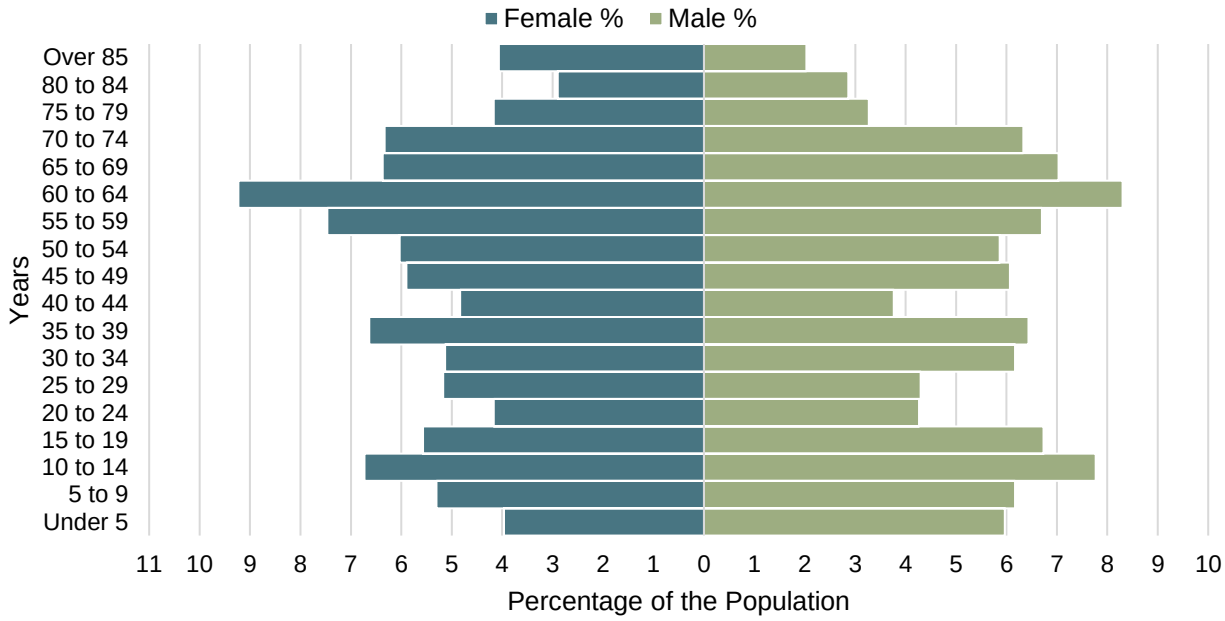
As noted above, the planning area includes all of Gosper, Kearney, and Phelps Counties. The U.S. Census Bureau collects specific demographic information for each county. The estimated population of the planning area is 17,549.[15]

Figure 7: Planning Area Population, 1890-2020



Source: U.S. Census Bureau[16]

Figure 8: Population by Age Cohort and Sex (2020)



Source: U.S. Census Bureau

15 United States Census Bureau. "2020 Census Bureau Decennial Census: P1: Race." https://data.census.gov/.
16 United States Census Bureau. "2020 Census Bureau Decennial Census: P1: Race." https://data.census.gov/.

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 are incorporated into hazard mitigation plans, as well as other planning mechanisms within the community. The planning area has displayed a relatively stable population since 1940. Most communities in the planning area have declining or steady populations.

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."[17]

Dependent children under 20 years old are one of the most vulnerable populations to disasters.[18] The majority of people in this age group do not have access to independent financial resources and transportation. They lack the 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 26% 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 Axtell Public Schools, Elwood Public Schools, Holdrege Public Schools, and Loomis Public Schools.

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

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

Figure 9: Planning Area School Districts

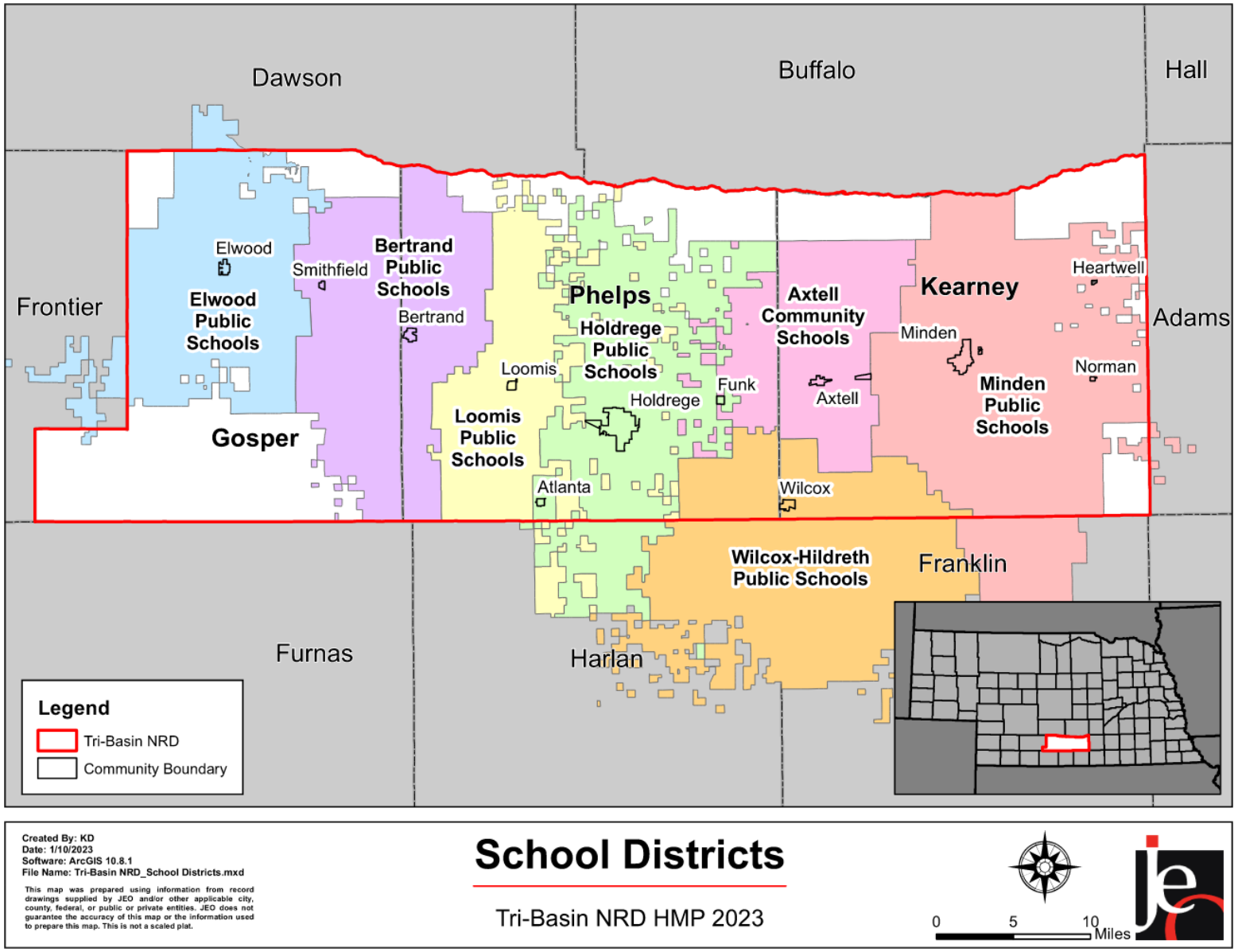


Table 15: School Inventory

School District	Total Enrollment (2020-2021)	Total Teachers
Axtell Public Schools*	304	27
Bertrand Public Schools	250	23
Elwood Public Schools*	212	23
Holdrege Public Schools*	1,038	82
Loomis Public Schools*	256	21
Minden Public Schools	821	70
Wilcox-Hildreth Public Schools*	228	25

Source: Nebraska Department of Education[19]
**Participated in the Quad Counties HMP*
***Participated in this plan update*

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.[20] 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 16 identifies the number and capacity of care facilities throughout the planning area.

Table 16: Inventory of Care Facilities

County	Hospitals	Hospital Beds	Health Clinics	Adult Care Homes	Adult Care Beds	Assisted Living Homes	Assisted Living Beds
Gosper	0	0	1	1	47	1	10
Kearney	1	10	1	1	64	1	75
Phelps	1	25	2	3	206	3	92
Total	**2**	**35**	**4**	**5**	**317**	**5**	**177**

Source: Nebraska Department of Health and Human Services[21,22,23,24]

19 Nebraska Department of Education. 2022. "Nebraska Education Profile." Accessed October 2022. http://nep.education.ne.gov/.
20 Center for Injury Research and Policy. January 2011. "Snow Shoveling Safety." Accessed October 2022. http://www.nationwidechildrens.org/cirp-snow-shoveling.
21 Department of Health and Human Services. 2022. "State of Nebraska: Assisted Living Facilities." https://dhhs.ne.gov/licensure/Documents/ALF%20Roster.pdf.
22 Department of Health and Human Services. 2022. "State of Nebraska Roster: Hospitals." https://dhhs.ne.gov/licensure/Documents/Hospital%20Roster.pdf.
23 Department of Health and Human Services. 2022. "State of Nebraska Roster: Long Term Care Facilities." https://dhhs.ne.gov/licensure/Documents/LTCRoster.pdf.
24 Department of Health and Human Services. 2022. "State of Nebraska Roster: Rural Health Clinic." https://dhhs.ne.gov/licensure/Documents/RHC_Roster.pdf.

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 17 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 17: ESL and Poverty At-Risk Populations

County	Percent That Speaks English as Second Language	Individuals Below Poverty Level
Gosper	3.2%	5.1%
Kearney	3.7%	10%
Phelps	4.7%	11.5%

Source: U.S. Census Bureau[25,26]

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 (e.g., 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 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 18).

25 United States Census Bureau. “2020 Census Bureau American Community Survey: S1601: Language Spoken at Home.” https://data.census.gov/.
26 United States Census Bureau. “2020 Census Bureau American Community Survey: DP03: Selected Economic Characteristics.” https://data.census.gov/.

Table 18: Racial Composition Trends

Race	2010		2020		%
	Number	% of Total	Number	% of Total	Change
White, Not Hispanic	17,167	96.9%	16,223	92.4%	-4.5
Black	33	0.2%	42	0.2%	0
American Indian and Alaskan Native	53	0.3%	59	0.3%	0
Asian	37	0.2%	51	0.3%	0.1
Native Hawaiian and Other Pacific Islander	6	0.0%	11	0.1%	0.1
Other Races	232	1.3%	398	2.3%	1
Two or More Races	193	1.1%	765	4.4%	3.3
Total Population	**17,721**	**-**	**17,549**	**-**	**-**

Source: U.S. Census Bureau[27,28]

Rural Capacity Index

The Rural Capacity Index developed by Headwaters Economics evaluates rural communities and counties across the country for local capacity. Capacity includes the staffing, resources, and expertise to both apply for funding and fulfill reporting requirements, as well as design, build, and maintain infrastructure products over the long term. Counties lacking local capacity often have the greatest need for infrastructure investments—particularly rural counties. The Rural Capacity Index helps identify communities and counties with limited capacity on a scale of 0 (no capacity) to 100 (high capacity). This index is based on ten variables that can function as proxies for county capacity. The following table lists out the components and scores for each of the three counties in the planning area.

Table 19: Rural Capacity Index

Components of Index	Gosper County	Kearney County	Phelps County
County is Metropolitan?	Yes	Yes	No
Has a Head of Planning?	Yes	Yes	Yes
Has a College or University?	No	No	No
Adults with Higher Education:	30%	27%	23%
Families Below Poverty Level:	3%	6%	6%
Households with Broadband:	82%	81%	79%
People without Health Insurance:	5%	6%	4%
Voter Turnout:	77%	80%	81%
Income Stability Score (0 to 100):	36	23	38
Population Change (2000 to 2019):	-153	-387	-713
Overall Rural Capacity Index Score	**78**	**76**	**68**

Source: Headwaters Economics[29]

27 United States Census Bureau. "2010 Census Redistricting Data (Public Law 94-171): P1: Race." https://data.census.gov.
28 United States Census Bureau. "2020 Census Bureau American Community Survey: DP05: ACS Demographic and Housing Estimates." https://data.census.gov/.
29 Headwaters Economics. January 2022. "Rural Capacity Map". https://headwaterseconomics.org/equity/rural-capacity-map/.

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, nearly 28 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 Phelps County has the highest percentage of renter-occupied housing units in the planning area. The City of Holdrege, the largest community in the planning area, has approximately 32 percent of housing stock occupied by renters.

Gosper County has the highest percentage of vacant housing units compared to the other two 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.

Table 20: Housing Characteristics

Jurisdiction	Total Housing Units				Occupied Housing Units			
	Occupied		Vacant		Owner		Renter	
	#	%	#	%	#	%	#	%
Gosper County	940	68.4%	435	31.6%	710	75.5%	230	24.5%
Kearney County	2,691	90.4	285	9.6%	1,969	73.2%	722	26.8%
Phelps County	3,900	91.4%	368	8.6%	2,775	71.2%	1,125	28.8%
Atlanta	34	60.7%	22	39.3%	34	100%	0	0%
Axtell	333	96.5%	12	3.5%	302	90.7%	31	9.3%
Bertrand	312	89.9%	35	10.1%	233	74.7%	79	25.3%
Elwood	319	88.1%	43	11.9%	205	64.3%	114	35.7%
Funk	73	93.6%	5	6.4%	66	90.4%	7	9.6%
Heartwell	44	100%	0	0%	23	52.3%	21	47.7%
Holdrege	2,438	95.2%	122	4.8%	1,648	67.6%	790	32.4%
Loomis	179	97.8%	4	2.2%	145	81%	34	19%
Minden	1,234	91.2%	119	8.8%	893	72.4%	341	27.6%
Norman	18	90%	2	10%	18	100%	0	0%
Smithfield	40	78.4%	11	21.6%	21	52.5%	19	47.5%
Wilcox	162	91.5%	15	8.5%	93	57.4%	69	42.6%

Source: U.S. Census Bureau[30]

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; broadband internet subscription; housing units that are mobile homes; and housing units with no vehicles.

30 United States Census Bureau. "2020 Census Bureau American Community Survey: DP04: Selected Housing Characteristics." https://data.census.gov/.

Table 21: Selected Housing Characteristics

	Gosper County	Kearney County	Phelps County	Total
Occupied Housing Units	940 (68.4%)	2,691 (90.4%)	3,900 (91.4%)	**7,531**
Lacking Complete Plumbing Facilities	0	0.5	0	**4 (0.05%)**
Lacking Complete Kitchen Facilities	1.9	2.1	0.3	**151 (2%)**
No Telephone Service Available	2.1	0.6	0.9	**126 (1.7%)**
Broadband Internet Subscription	82.6	84	82.4	**6,249 (83%)**
No Vehicles Available	1.8	5.7	3	**362 (4.8%)**
Mobile Homes	9.7	6.8	5.8	**489 (6.5%)**

Source: U.S. Census Bureau[31,32]

Just under 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 of 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 6.5 percent of housing units in the planning area are mobile homes. Gosper County has the highest rate of mobile homes in its housing stock at 9.7 percent. Mobile homes have a higher risk of sustaining damage 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 4.8 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.

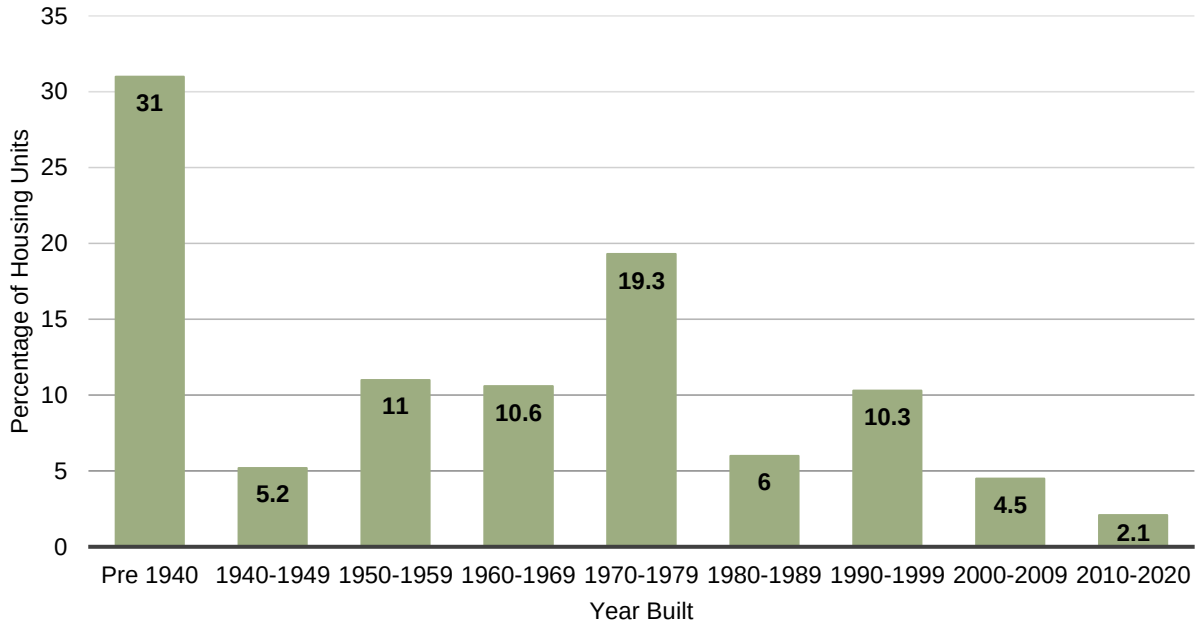
The vast majority of homes within the planning area were built prior to 1980 (77%), with 31% of homes built prior to 1939 (Figure 10). Housing age can serve as an indicator of risk, as structures built prior to the development of state building codes and prior to the identification of flood prone

31 United States Census Bureau. "2020 Census Bureau American Community Survey: DP04: Selected Housing Characteristics." https://data.census.gov/.

32 United States Census Bureau. "2020 Census Bureau American Community Survey: DP02: Selected Social Characteristics in the United States." https://data.census.gov/.

areas in the 1970s and 1980s may be more vulnerable. Residents living in these homes may be at higher risk of the impacts from flooding, high winds, tornadoes, severe winter storms, and thunderstorms.

Figure 10: Housing Age in Planning Area



Source: U.S. Census Bureau[33]

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
Gosper County	
East Phillips Canyon WMA	Elwood
Elwood Reservoir WMA	Elwood
Elley WPA	Bertrand
Johnson Lake SRA	Elwood
Peterson Basin WPA	Bertrand
Phillips Canyon Reservoir	Elwood
Victor Lakes WPA	Bertrand
Various Open Fields & Water Sites	
Kearney County	
Bluestem WPA	Axtell
Clark WPA	Hildreth, Wilcox
East Odessa WMA	Kearney

33 United States Census Bureau. "2020 Census Bureau American Community Survey: DP04: Selected Housing Characteristics". https://data.census.gov/.

Facility	Nearest Community
Fort Kearny SRA	Kearney
Gleason WPA	Axtell, Minden
Jensen WPA	Norman, Campbell
Kildeer Basin WPA	Wilcox
Lindau WPA	Hildreth, Wilcox
Northeast Sacramento WMA	Hildreth, Minden
Prairie Dog Marsh WPA	Wilcox
Youngson WPA	Norman, Campbell
Open Fields & Water Sites #6,001	Axtell
Open Fields & Water Sites #6,369	Axtell
Phelps County	
Atlanta WPA	Atlanta
Cottonwood WPA	Bertrand
Funk WPA	Funk
High Basin WMA	Bertrand
Johnson WPA	Holdrege, Funk
Jones Marsh WPA	Atlanta
Linder WPA	Bertrand, Loomis
Sacramento-Wilcox WMA	Wilcox
Sandy Channel SRA	Elm Creek
Open Fields & Water Sites #6,377	Atlanta

Source: Nebraska Game & Parks,[34] U.S National Park Service[35]

Historical Sites

According to the National Register of Historic Places for Nebraska by the National Park Service, there are 14 historic sites located in the planning area. Two of the sites are located in the 100-year floodplain.

Table 23: Historical Sites

Site Name	Date Listed	Nearest Community, County	Floodplain (Y/N)
Bethpage Mission	4/24/2013	Axtell, Kearney County	N
Brenstrom Farmstead	3/21/2012	Overton, Phelps County	N
C B & Q Holdrege Depot	2/21/1997	Holdrege, Phelps County	N
Carpenter, Eddie Eugene and Harriet Cotton, Farmstead	2/25/1993	Lowell, Kearney County	Y
Dobytown	12/16/1974	Kearney, Kearney County	Unknown
Farmers State Bank	12/21/2013	Loomis, Phelps County	N
Fort Kearney	7/2/1971	Newark, Kearney County	Y
Gosper County Courthouse	7/5/1990	Elwood, Gosper County	N
Kearney County Courthouse	1/10/1990	Minden, Kearney County	N

34 Nebraska Game and Parks. 2023. “Public Access ATLAS”. https://outdoornebraska.maps.arcgis.com/apps/webappviewer/index.html?id=71a515acd7f64a5d8245ec97eb96d976/.
35 U.S National Park Service. 2023. “Parks”. https://www.nps.gov/state/ne/index.htm.

Site Name	Date Listed	Nearest Community, County	Floodplain (Y/N)
Kinner House	4/14/2004	Holdrege, Phelps County	N
Phelps County Courthouse	1/10/1990	Holdrege, Phelps County	N
Salem Swedish Methodist Episcopal Church	7/29/1982	Axtell, Kearney County	Unknown
Thorne, W. T., Building	5/11/1992	Minden, Kearney County	N
US Post Office-Minden	9/12/1985	Minden, Kearney County	N

Source: National Park Service[36]

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

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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. Unless specifically stated otherwise, each hazard's extent scale(s) apply to all jurisdictions within the planning area.

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 damage 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 2021. 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:

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

FEMA Standard Economic Values

As part of FEMA's Benefit-Cost Analysis Toolkit, standard economic values were developed to help better estimate the avoided loss of services when implementing a hazard mitigation project. These standard economic values can also be used to help estimate potential future economic impacts from a hazard event. Table 25 gives the economic value for traffic delays for roads and bridges, loss of electric services, loss of wastewater services, loss of potable water services, and loss of communications/IT services. The assumed damages do not consider physical damage to utility equipment and infrastructure but do consider the impact on economic activity and impact on residential customers. To learn more about how these values were calculated visit https://www.fema.gov/sites/default/files/documents/fema_standard-economic-values-methodology-report_092022.pdf.

Table 25: FEMA Standard Economic Values

Service Lost	Economic Value
Traffic Delays on Roads and Bridges	$35.60/Vehicle/Hour
Loss of Electric Services	$182/Person/Day
Loss of Wastewater Services	$60/Person/Day
Loss of Potable Water Services	$116/Person/Day
Loss of Communications/IT Services	$130/Person/Day

Source: FEMA, 2022[37]

FEMA's standard economic values will not be used to determine average annual damages and average damage per event estimates for each hazard profile. Past hazard events do not list the total number of people or vehicles impacted, and thus it is impossible to retroactively calculate the total economic impact using these values. The values are provided in this plan so that participants can better estimate potential losses and determine the benefits of potential future mitigation actions.

37 FEMA. September 2022. "Benefit-Cost Analysis Sustainment and Enhancement". https://www.fema.gov/sites/default/files/documents/fema_standard-economic-values-methodology-report_092022.pdf.

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 26: Hazards Addressed in the Plan

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

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.

- **Levee Failure**: There are no known levees located in the Tri-Basin NRD. It is a possibility that there are small privately constructed levees. However, those pose a minimal threat if they were to fail and would likely result in isolated flooding on the owner's property.

- **Power Failure**: Power failure was listed in the 2021 State HMP under "Other Hazards of Concern". While power failure is not listed as a standalone hazard in this plan, it is discussed within other hazards. Specifically, it is discussed in extreme heat, severe thunderstorms, severe winter storms, and tornadoes and high winds.

Hazard Assessment Summary Tables

The following table provides an overview of the data contained in the hazard profiles. The 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 27: Regional Risk Assessment

Hazard	Previous Occurrence Events/Years	Approximate Annual Probability	Likely Extent
Animal and Plant Disease	Animal: 20/8 Plant: 36/22	Animal: 75% Plant: 77%	Range: 1-120 animals Crop damage or loss
Dam Failure	4/127	3%	Varies by structure
Drought	489/1,531 months	32%	D1-D4
Earthquake	0/120	Less than 1%	<4.0 magnitude
Extreme Heat	Avg 6 days per year ≥100°F	80%	≥100°F
Flooding	32/26	42%	Some inundation of structures (11.5% of structures) and roads near streams. Some evacuations of people may be necessary
Grass/Wildfires	323/22	100%	Avg 10.3 acres Some homes and structures threatened or at risk
Hazardous Materials Release	Fixed Site: 60/33 Transportation: 1/52	Fixed Site: 70% Transportation: 2%	<1-4,000 gallons
Public Health Emergency	2	Unknown	Varies by extent
Severe Thunderstorms	661/26	100%	Avg: 66 mph winds Avg: 1.19-inch hail Range: 55-96 mph winds Range: 0.75-4.5-inch hail
Severe Winter Storms	307/26	100%	0.25”-1.5” Ice 30°-70° below zero (wind chill) 2-18” snow
Terrorism and Cyber Security	0/50	Less than 1%	Varies by event
Tornadoes and High Winds	High Wind: 114/26 Tornado: 29/26	High Wind: 77% Tornado: 38%	Avg: 57.5 mph wind Avg: EF0 tornado Range: 40-77 mph wind Range: EF0-EF2 tornado

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

Table 28: Loss Estimation for the Planning Area

Hazard Type		Count	Property Damage	Crop Damage[2]
Animal and Plant Disease	Animal Disease[1]	20	263 Animals	N/A
	Plant Disease[2]	36	N/A	$428,696
Dam Failure[5]		4	$0	N/A
Drought[6]		489 out of 1,531 Months	$0	$46,489,468
Earthquakes[11]		0	$0	$0
Extreme Heat[7]		Avg. 6 Days a Year	N/A	$7,639,951
Flooding[8]	Flash Flood	23	$6,015,000	$822,445
	Flood	9	$93,000	
Grass/Wildfires[9] *3 Injuries* *1 Fatality*		323	$141,775	$470,285
Hazardous Materials Release *Fixed Site: 3 Injuries*	Fixed Site[3]	60	$0	N/A
	Transportation[4]	1	$70,300	N/A
Public Health Emergency		2	N/A	N/A
Severe Thunderstorms[8]	Hail Range: 0.75-4.5 in Average: 1.19 in	391	$32,384,000	$86,181,183
	Thunderstorm Wind Range: 55-96 mph Average: 65.7 mph	245	$9,076,000	$6,316,617
	Heavy Rain	24	$20,000	
	Lightning	1	$500,000	
Severe Winter Storms[8] *1 Injury*	Blizzard	30	$900,000	$3,098,293
	Extreme Cold/Wind Chill	10	$0	
	Heavy Snow	14	$0	
	Ice Storm	18	$21,765,000	
	Winter Storm	119	$600,000	
	Winter Weather	116	$35,000	
Terrorism and Cyber Security[10]		0	$0	N/A
Tornadoes and High Winds[8] *High Winds: 7 Injuries* *Tornadoes: 4 Injuries*	High Winds Range: 40-77 mph Average: 57.5 mph	114	$3,396,240	$7,953,707
	Tornadoes Range: EF0-EF2 Average: EF0	29	$2,830,000	$32,779
Total		**1,589**	**$77,826,315**	**$159,433,424**

N/A: Data not available
1 - NDA, 2014 – 2021
2 - USDA RMA, 2000 – 2021
3 - NRC, 1990 – July 2022
4 - PHSMA, 1971 – July 2022
5 - DNR Communication, June 2022
6 - NOAA, 1895 – July 2022
7 - High Plains Regional Climate Center, 1897 – 2022
8 - NCEI, 1996 – April 2022
9 - NFS, 2000 - 2021
10 - University of Maryland, 1970-2020
11 - USGS, 1900 – Aug 2022

FEMA National Risk Index

FEMA's National Risk Index is an online tool that analyzes natural hazard and community risk factors to develop a risk measurement for each county in the United States. Eighteen natural hazards are given a score from very high to very low. The table below gives the National Risk Index ratings for each county in the planning area. Risk Index scores are calculated using an equation that combines scores for expected annual loss, social vulnerability, and community resilience. All values fall between 0 (lowest possible value) and 100 (highest possible value). The national average is 10.6 and the Nebraska average is 9.43.

Table 29: National Risk Index

Hazard	Gosper County	Kearney County	Phelps County
Avalanche	Not Applicable	Not Applicable	Not Applicable
Coastal Flooding	Not Applicable	Not Applicable	Not Applicable
Cold Wave	Relatively Low (11.37)	Relatively Low (6.75)	Relatively Low (12.56)
Drought	Relatively High (21.20)	Relatively Moderate (17.92)	Relatively High (21.38)
Earthquake	Very Low (0.47)	Very Low (0.64)	Very Low (0.94)
Hail	Relatively High (27.70)	Relatively High (28.58)	Relatively High (34.27)
Heat Wave	Relatively Low (5.10)	Very Low (2.8)	Relatively Low (6.78)
Hurricane	Not Applicable	Not Applicable	Not Applicable
Ice Storm	Very Low (8.07)	Relatively Low (13.05)	Relatively Low (15.29)
Landslide	Relatively Low (14.22)	No Rating (0.0)	Very Low (2.89)
Lightning	Very Low (5.20)	Very Low (6.63)	Very Low (8.29)
Riverine Flooding	Very Low (5.61)	Very Low (7.89)	Relatively Low (7.13)
Strong Wind	Relatively Moderate (17.96)	Relatively Moderate (20.88)	Relatively Moderate (22.06)
Tornado	Relatively Low (11.14)	Relatively Low (13.28)	Relatively Low (15.61)
Tsunami	Not Applicable	Not Applicable	Not Applicable
Volcanic Activity	Not Applicable	Not Applicable	Not Applicable
Wildfire	Very Low (2.55)	Very Low (0.77)	Very Low (0.90)
Winter Weather	Relatively Moderate (21.93)	Relatively Moderate (18.62)	Relatively Moderate (19.85)
Overall Score	**Relatively Low (11.42)**	**Relatively Low (11.78)**	**Relatively Moderate (13.78)**

Source: FEMA[38]

38 FEMA. "The National Risk Index". Accessed February 2023. https://hazards.fema.gov/nri/map.

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 2017.

Table 30: SBA Declarations

Disaster Declaration Number	Declaration Date	Title	Primary Counties	Contiguous Counties
NE-00070	6/29/2018	Severe Winter Storm and Straight-line Winds	Gosper	-
NE-00073	3/21/2019	Severe Winter Storm, Straight-line Winds, and Flooding	-	Gosper, Kearney, Phelps
NE-00074	4/5/2019	Severe Winter Storm, Straight-line Winds, and Flooding	Gosper, Kearney, Phelps	-

Source: Small Business Administration, 2017-2022[39]

Presidential Disaster Declarations

Presidential disaster declarations are available via FEMA from 1953 to January 2023. 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 22 presidential disaster declarations, beginning in 1967.

Table 31: Presidential Disaster Declarations

Disaster Declaration Number	Declaration Date	Title	Affected Counties	Public Assistance (Statewide)
228	7/18/1967	Severe Storms & Flooding	Gosper, Kearney, Phelps	-
500	4/8/1976	Severe Ice Storm	Kearney	-
998	7/19/1993	Severe Storms and Flooding	Gosper, Kearney, Phelps	-
1027	5/9/1994	Severe Snow and Ice Storm	Gosper, Phelps	-
1190	11/1/1997	Severe Snowstorms, Rain, and Strong Winds	Gosper, Kearney, Phelps	-
1517	5/25/2004	Severe Storms, Tornadoes, and Flooding	Kearney	$13,351,658
1590	6/23/2005	Severe Storms and Flooding	Kearney	$1,688,474

39 Small Business Administration. 2022. “Current Declared Disasters”. https://disasterloanassistance.sba.gov/ela/s/search-declarations.

Disaster Declaration Number	Declaration Date	Title	Affected Counties	Public Assistance (Statewide)
1627	1/26/2006	Severe Winter Storm	Gosper, Kearney, Phelps	$5,444,137
1674	1/7/2007	Severe Winter Storms	Gosper, Kearney, Phelps	$124,357,843
1714	7/24/2007	Severe Storms and Flooding	Kearney	$2,306,259
1770	6/20/2008	Severe Storms, Tornadoes, and Flooding	Gosper, Kearney, Phelps	$36,258,650
1878	2/25/2010	Severe Winter Storms and Snowstorm	Gosper	$6,577,021
1924	7/15/2010	Severe Storms and Flooding	Phelps	$49,926,355
3245	9/13/2005	Hurricane Katrina Evacuees	Gosper, Kearney, Phelps	-
3483	3/13/2020	COVID-19	Gosper, Kearney, Phelps	-
4014	8/12/2011	Severe Storms, Tornadoes, Straight-Line Winds, and Flooding	Phelps	$3,362,468
4183	7/24/2014	Severe Storms, Tornadoes, Straight-Line Winds, and Flooding	Phelps	$12,420,717
4321	6/26/2017	Severe Winter Storms and Straight-line Winds	Gosper	$2,786,763
4375	6/29/2018	Severe Winter Storms and Straight-line Winds	Gosper	$7,428,072
4420	3/21/2019	Severe Winter Storm, Straight Line Winds, and Flooding	Gosper, Kearney, Phelps	$516,891,822
4521	4/4/2020	COVID-19 Pandemic	Gosper, Kearney, Phelps	$296,033,384
4641	2/23/2022	Severe Storms, Straight-line Winds, and Tornadoes	Kearney	$8,885,652

Source: Federal Emergency Management Agency, 1953-January 2023[40]

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. Changes in the regional climate can impact communities, residents, local economies, and infrastructure throughout the planning area.

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. The Fourth National Climate Assessment has provided an overview of potential impacts within the planning area.[41]

40 Federal Emergency Management Agency. 2023. “Disaster Declarations”. https://www.fema.gov/openfema-data-page/disaster-declarations-summaries-v2.
41 U.S. Global Change Research Program. 2018. “Fourth National Climate Assessment”. https://nca2018.globalchange.gov/.

- **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.

Nebraska's Changing Climate

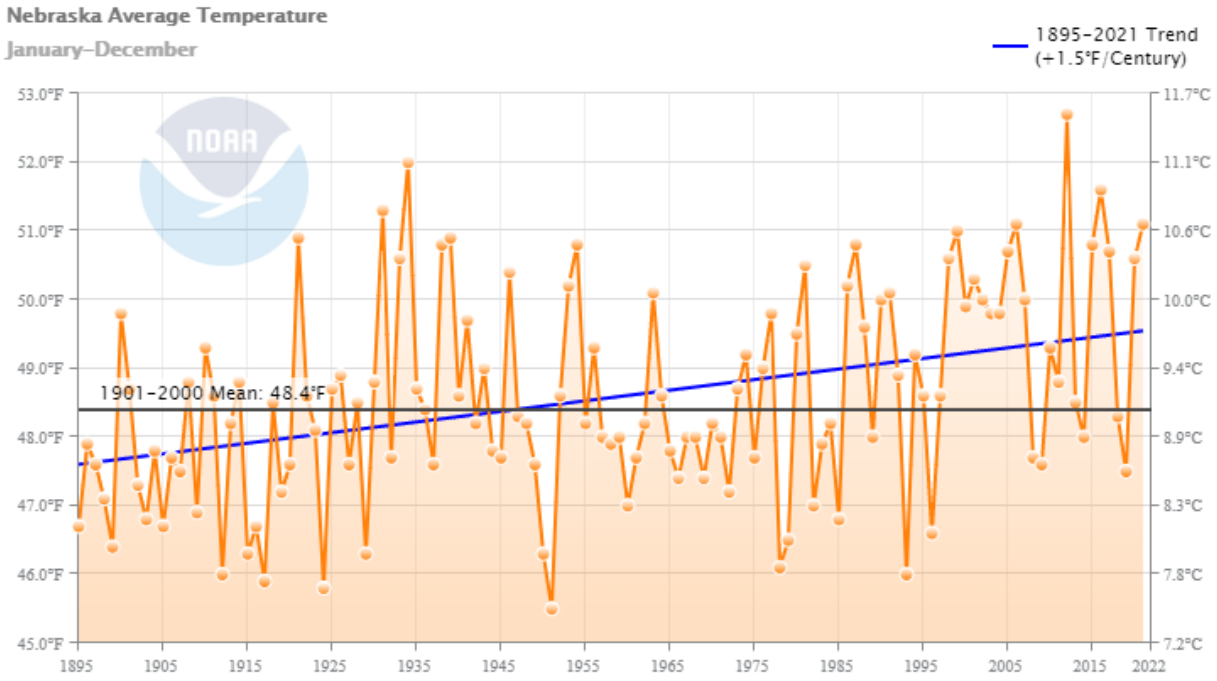
Nebraska and the United States as a whole are experiencing significant changes in temperature, precipitation, and severe weather events resulting from climate change. How individual hazards are affected by climate change will be further discussed in each individual hazard profile.

Changes in Temperature

Since 1895 Nebraska's overall average temperature has increased by almost 1.5°F (Figure 11). Climate modeling suggests warmer temperature conditions will continue in the coming decades and rise steadily into the 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 2-11°F by 2100 depending on emissions projects (Figure 12).[42]

Figure 11: Average Temperature (1895-2021)

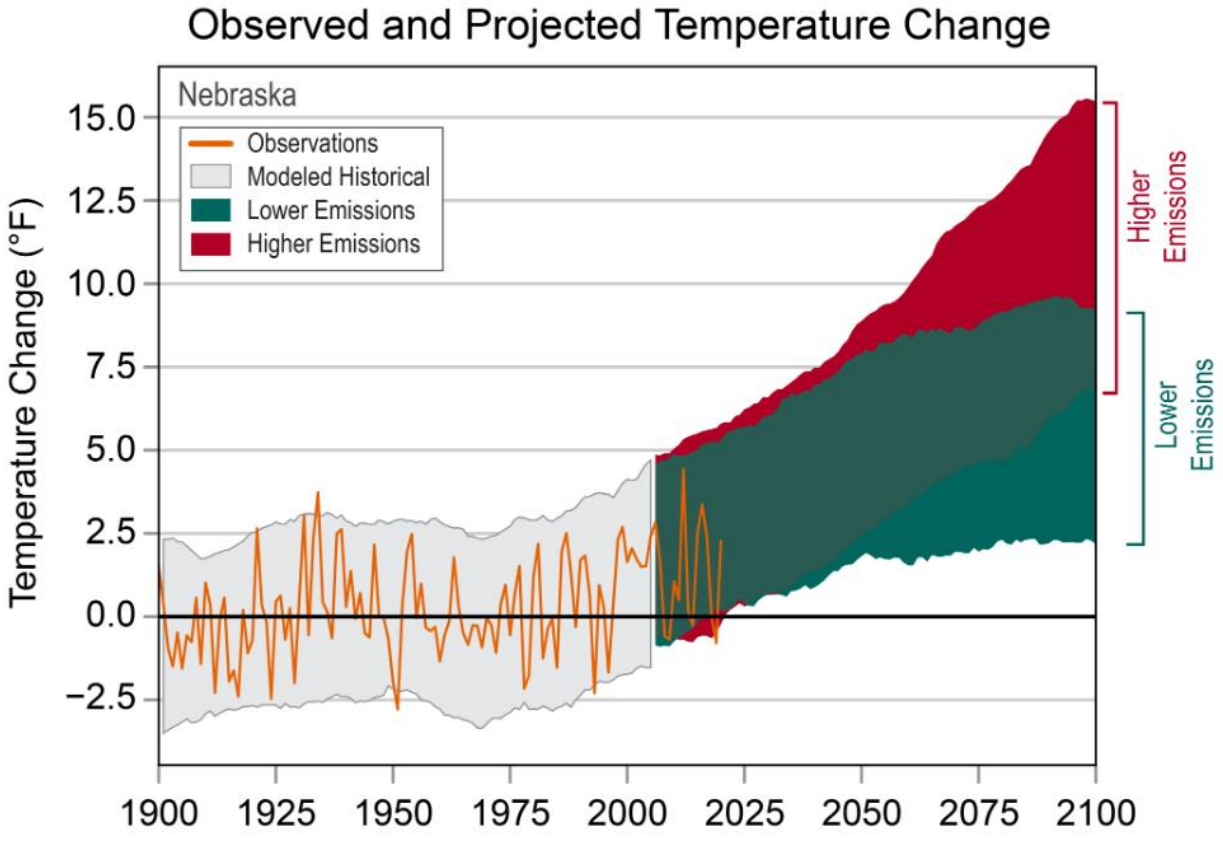


Source: NOAA, 2021[43]

42 NCEI. 2022. "State Climate Summaries – Nebraska". https://statesummaries.ncics.org/chapter/ne/#:~:text=The%20state%20is%20located%20far,(1895%E2%80%932020)%20averag.

43 NOAA. 2021. "Climate at a Glance: Statewide Time Series.". Accessed March 2022. https://www.ncdc.noaa.gov/cag/statewide/time-series/25/tavg/12/12/1895-2020?base_prd=true&begbaseyear=1901&endbaseyear=2000&trend=true&trend_base=100&begtrendyear=1895&endtrendyear=2021.

Figure 12: Observed and Projected Temperature Change - Nebraska



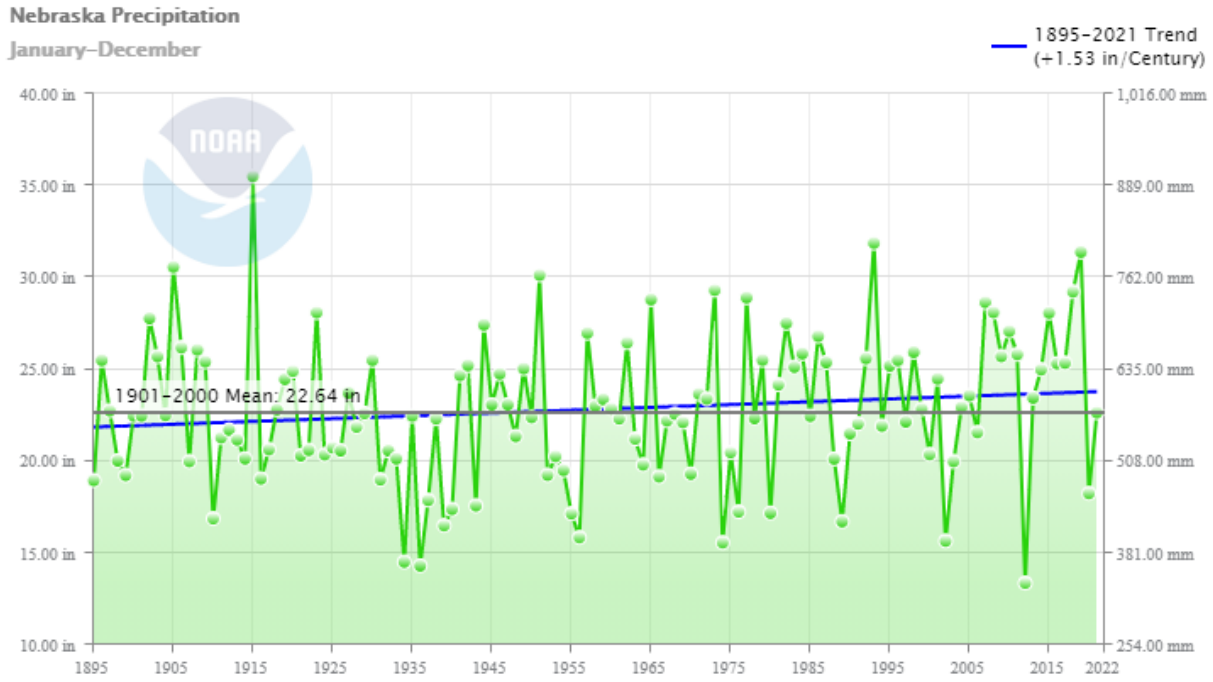
Source: NCEI

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 13). 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 of 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.[44]

44 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

Figure 13: Average Precipitation (1895-2021)



Source: NOAA, 2021[45]

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.

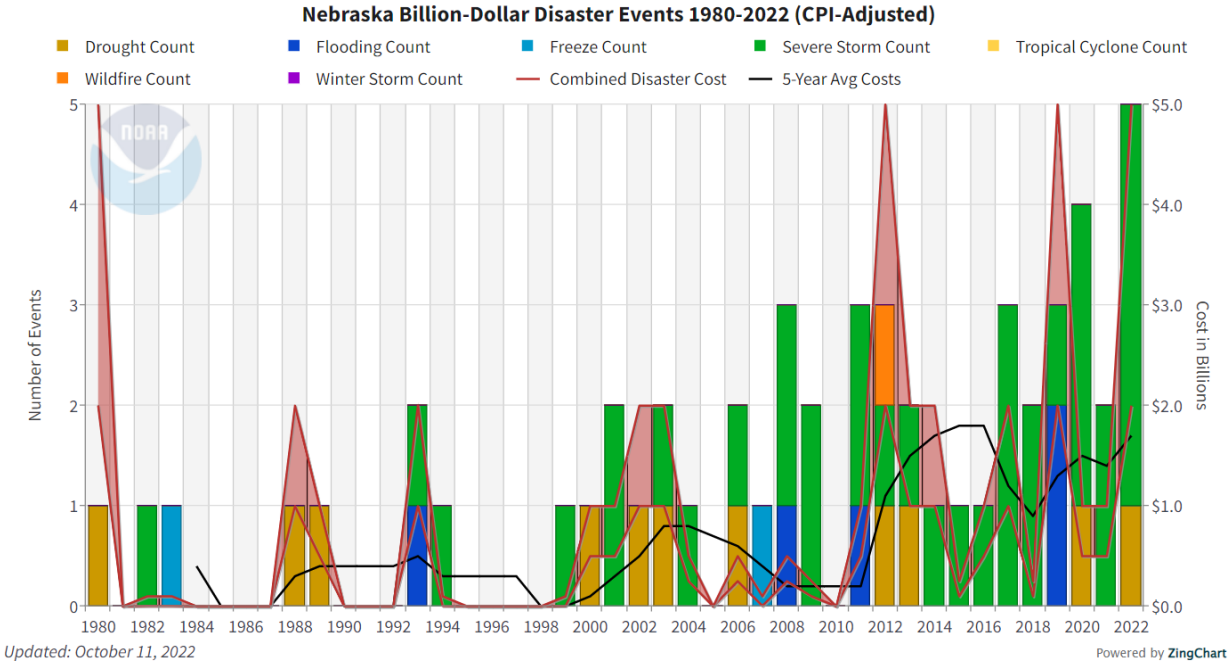
Certain groups of people may face greater difficulty when dealing with the impacts of a changing climate. Older adults, immigrant communities, and those living in poverty are particularly susceptible. Additionally, specific industries and professions tied to weather and climate, like outdoor tourism, commerce, and agriculture, are especially vulnerable.[46]

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

45 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

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

Figure 14: Nebraska Billion-Dollar Disaster Events (1980-2022)



Source: NOAA, 2022[47]

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 15), these changes have shifted the annual growing season and expected agricultural production conditions. Nebraska is vulnerable 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.

Air Quality

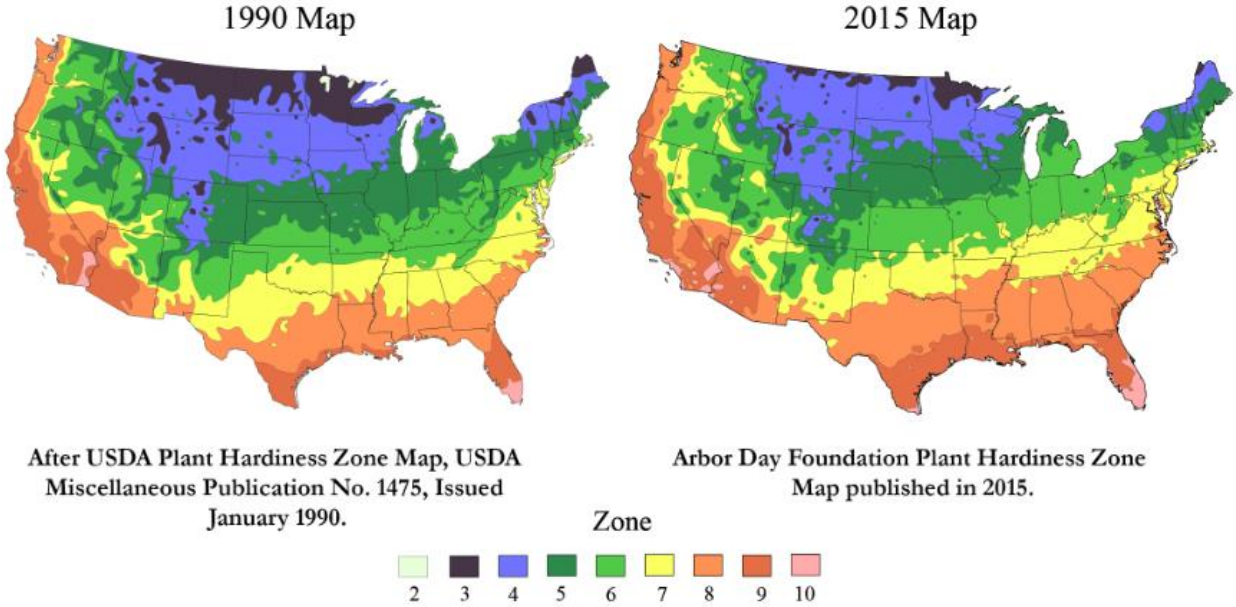
Rising temperatures will also impact air quality. Harmful air pollutants and allergens increase as temperatures increase. More extended periods of warmth contribute to longer pollen seasons that allow plant spores to travel farther and increase exposure to allergens. More prolonged exposure to allergens can increase the risk and severity of asthma attacks and worsen existing allergies in individuals.[48] 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.[49]

47 NOAA National Centers for Environmental Information. October 2022. "Nebraska Billion-Dollar Weather and Climate Disasters". https://www.ncei.noaa.gov/access/billions/time-series/NE.

48 Asthma and Allergy Foundation of America. 2010. "Extreme Allergies and Climate Change." Accessed 2022. https://www.aafa.org/extreme-allergies-and-climate-change/.

49 AirNow. 2019. "Wildfire Smoke: A Guide for Healthcare Professionals." Accessed 2022. https://www.airnow.gov/wildfire-smoke-guide-publications/

Figure 15: Plant Hardiness Zone Change



Source: Arbor Day Foundation, 2018[50]

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 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.[51]

Energy and Infrastructure

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.[52] Community lifelines and vulnerable populations that

50 Arbor Day Foundation. 2018. "Hardiness Zones." https://www.arborday.org/media/map_change.cfm

51 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.

52 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.

are not prepared to handle periods of power outages, particularly during heat waves, will be at risk.

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 damage, agricultural damage, 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. Jurisdictions in the planning area considered 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). Jurisdictional local 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. An outbreak of animal-to-animal disease would have significant economic implications that could result in a serious public health risk. Some diseases may be easily contained geographically, while others, due to longer incubation times, may spread due to transfer and sale of livestock between facilities.[53]

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 billion.[54] Table 32 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 32: Livestock Inventory

County	Market Value of 2017 Livestock Sales	Cattle and Calves	Hogs and Pigs	Poultry Egg Layers	Sheep and Lambs
Gosper	$32,391,000	23,338	(D)	0	(D)
Kearney	$212,945,000	133,553	16	0	792
Phelps	$406,016,000	249,738	(D)	0	1,169
Total	**$651,352,000**	**406,679**	**16**	**0**	**1,961**

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. Phelps County has both the highest number of farms and the largest number of farm acres in the planning area. Corn is the most prevalent crop type in the region followed by soybeans.

Table 33: Land and Value of Farms in the Planning Area

County	Number of Farms	Land in Farms (acres)	Market Value of 2017 Crop Sales
Gosper	287	282,132	$73,339,000
Kearney	342	291,307	$156,789,000
Phelps	371	341,523	$172,225,000
Total	**1,000**	**914,962**	**$402,353,000**

Source: U.S. Census of Agriculture, 2017

53 Nebraska Emergency Management Agency. 2021. "2021 Nebraska State Hazard Mitigation Plan". https://nema.nebraska.gov/sites/nema.nebraska.gov/files/doc/hazmitplan2021.pdf.
54 US Department of Agriculture, National Agricultural Statistics Server. 2021. "2017 Census of Agriculture – County Data". Accessed June 2022. https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Nebraska/.

Table 34: Crop Values

County	Corn		Soybeans		Wheat	
	Acres Planted	Value (2017)	Acres Planted	Value (2017)	Acres Planted	Value (2017)
Gosper	81,152	$50,106,000	37,175	$19,988,000	6,834	$1,321,000
Kearney	142,139	$101,255,000	75,697	$45,842,000	4,693	$735,000
Phelps	160,909	$117,091,000	88,365	$51,721,000	3,897	$661,000
Total	**384,200**	**$268,452,000**	**201,237**	**$117,551,000**	**15,424**	**$2,717,000**

Source: U.S. Census of Agriculture, 2017

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.

The primary land uses where animal and plant disease will be observed include agricultural lands, range or pasture lands, and feedlots. It is possible that animal or plant diseases will occur in domestic animals or crops in urban areas, but their impacts will be limited in scope and severity.

There are four large feedlots in Phelps County with three located near the City of Holdrege. Combined they have over 100,00 head of cattle. In Kearney County there is one large feedlot located north of the City of Minden and one smaller feedlot near the Village of Heartwell. Combined they have over 60,000 head of cattle. There are no large feedlots located in Gosper County.

Extent

There is no standard for measuring the magnitude of animal and plant disease. Historical events have impacted livestock ranging from a single animal to 120 animals. 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 20 instances of animal disease reported between 2014 and 2021 by the NDA (Table 35). These outbreaks affected 263 animals.

There is currently an ongoing Avian Influenza outbreak in the State of Nebraska; however, with no egg producers in the planning area it is not likely to have a large impact on the planning area. Egg prices may be impacted by the ongoing outbreak.

Table 35: Livestock Diseases Reported in the Planning Area

County	Year	County	Population Impacted
Avian Mycoplasmosis (M. Gallisepticum)	2018	Phelps	120
Avian Mycoplasmosis (M. Synoviae)	2018	Phelps	120
Bovine Anaplasmosis	2016	Phelps	1
Bovine Viral Diarrhea	2014	Kearney	1
	2016	Gosper	1
	2020	Phelps	1
Bovine Paratubercolis	2014	Kearney	2
	2015	Phelps	1
	2016	Kearney	1
	2016	Phelps	1
	2017	Phelps	1
	2018	Gosper	2
	2018	Phelps	2
	2020	Kearney	1
	2020	Phelps	2
Bovine Leptospirosis	2014	Kearney	1
	2017	Phelps	2
Bovine Bluetongue	2020	Kearney	1
Porcine Reproductive & Respiratory Syndrome	2014	Gosper	1
	2020	Phelps	1

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

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 36: 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

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

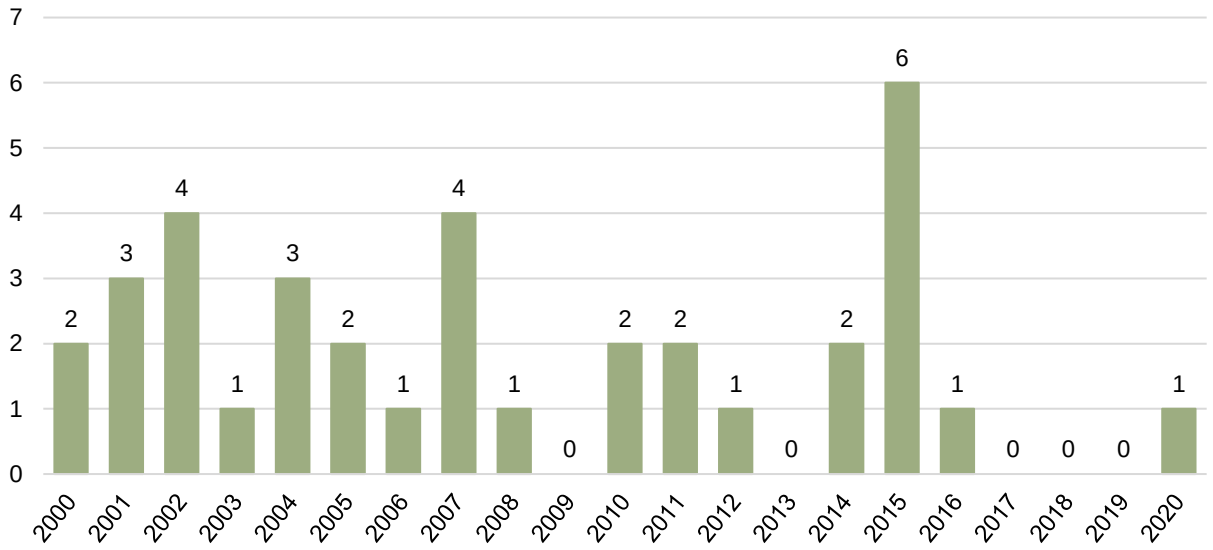
Crop Diseases		
Wheat	Barley Yellow Dwarf	Leaf Rust
	Black Chaff	Tan Spot
	Crown and Root Rot	Wheat Soy-borne Mosaic
	Fusarium Head Blight	Wheat Streak Mosaic
Sorghum	Ergot	Zonate Leaf Spot
	Sooty Stripe	
Trees	Burr Oak Blight	Dutch Elm Disease
	Powdery Mildew	Leaf Spot and Blight
	Canker (various types)	Root Rot
	Pine Wilt Disease	Crown Gall

In addition to the viral and bacterial diseases that could impact crops, pests can also result in crop loss or detract from crop quality. Possible pests include the following.

- Japanese Beetles
- Grasshoppers
- Western Bean Cutwork
- European Corn Borer
- Corn Rootworm
- Corn Nematodes
- Soybean Aphids
- Rootworm Beetles
- Emerald Ash Borer

The RMA provides data on plant disease events and plant losses in the planning area. There were 36 instances of plant diseases reported from 2000-2021 by the RMA (Figure 16). These outbreaks caused $428,696 in crop losses.

Figure 16: Plant Disease Events by Year



Source: NDA, 2000-2021

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 45 US states, primarily in the eastern, southern, and midwestern regions. Nebraska's first confirmed cases occurred on private land in Omaha and Greenwood in 2016.[56]

Figure 17 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. No counties within the planning area have reported confirmed cases of EAB; however, parts of Kearney County and Phelps County are located in a treatment consideration zone. The Nebraska Department of Agriculture regulates and monitors the sale and distribution of firewood in the state to restrict the flow of firewood from outside the state.

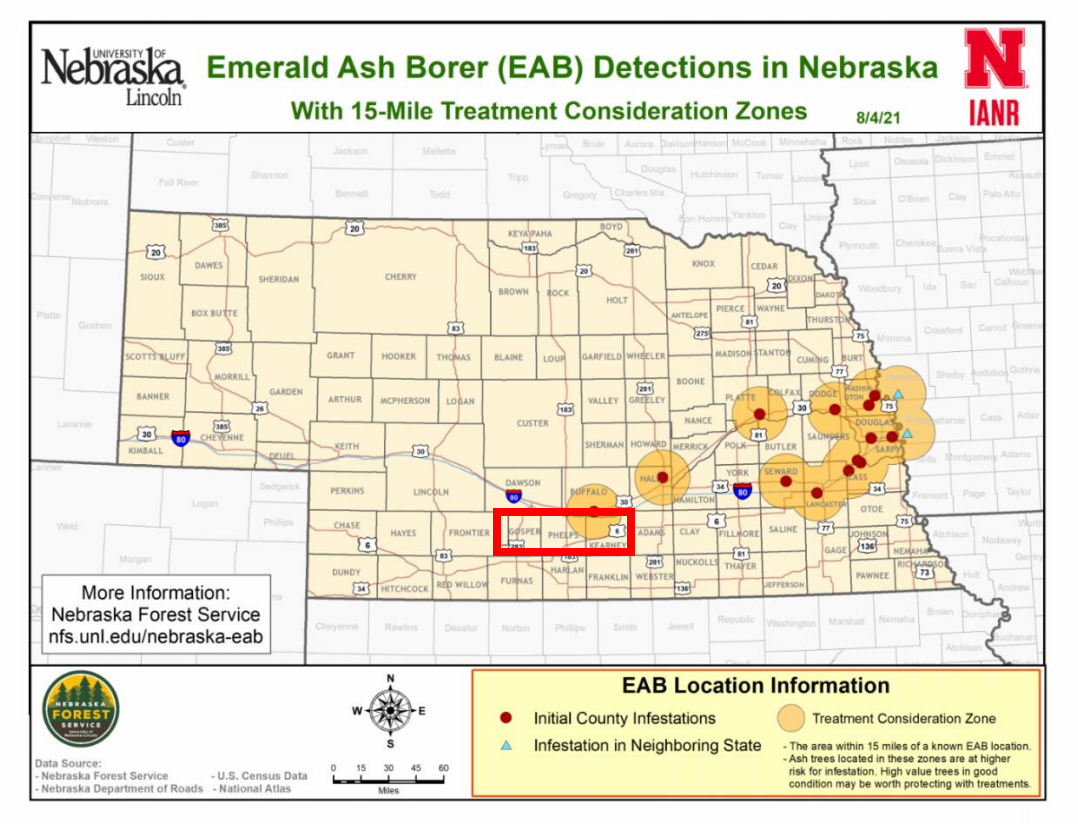
While adult beetles cause little damage, larvae damage trees by feeding on the inner bark of mature and growing trees, causing tunnels. Effects of EAB infestation include extensive damage to trees by birds, canopy dieback, bark splitting, and water sprout growth at the tree base, and eventual tree mortality. 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.

Japanese Beetles

Japanese beetles are a rising concern in Nebraska. Japanese beetles are highly destructive invasive pests found in many counties across Nebraska. The figure on the next page shows counties declared as infested by the beetles. Phelps County was declared infested prior to 2019 and Kearney County was declared infested in 2019. Gosper County has not been declared infested, but this will likely occur in the next several years. These beetles cause damage in the larval state (root damage) and adult stage (defoliation). Adult Japanese beetles can defoliate a tree quickly as other beetles are attracted to feeding sites by both the scent of the plant and pheromones sent out by other beetles. Chemical pesticides provide temporary protection however there are no long-range protection measures.

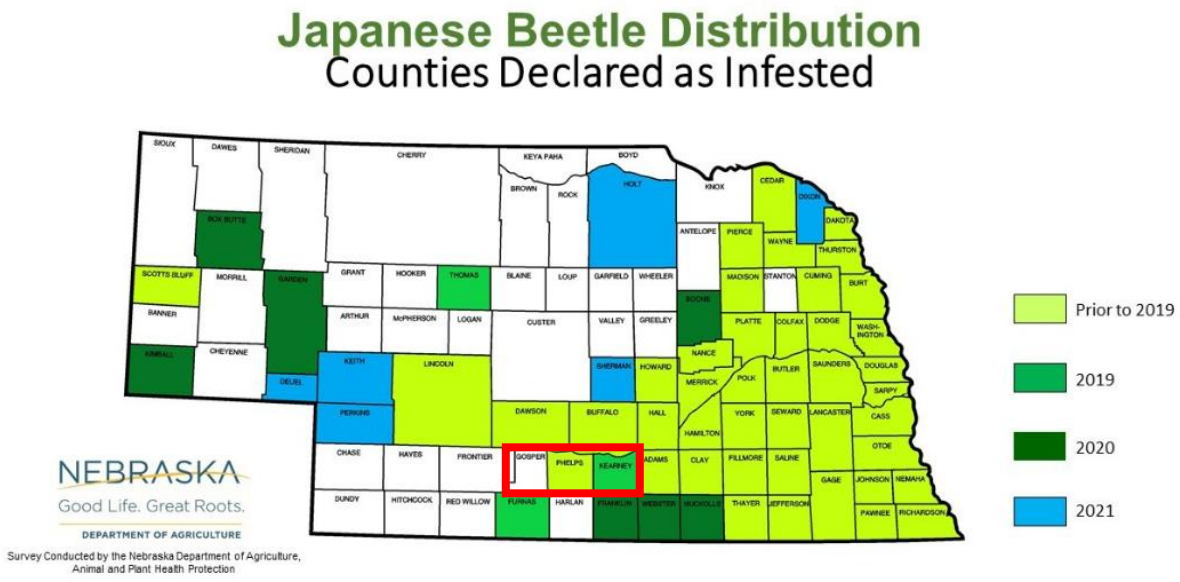
56 Emerald Ash Borer Information Network. April 2018. "Emerald Ash Borer." http://www.emeraldashborer.info/.
57 Arbor Day Foundation. 2015. "Emerald Ash Borer." https://www.arborday.org/trees/health/pests/emerald-ash-borer.cfm.
58 "Nebraska Emerald Ash Borer Response Plan." May 2015. https://nfs.unl.edu/NebraskaEABResponsePlan.pdf.

Figure 17: EAB Detections in Nebraska



Source: Nebraska Forest Service, 2022[59]

Figure 18: Japanese Beetle Distribution



Source: Nebraska Department of Agriculture, 2021[60]

59 Nebraska Forest Service. "Emerald Ash Borer (EAB) Detections in Nebraska". Accessed November 2022. https://nfs.unl.edu/documents/EAB/EABmap_2021-08-04.png.
60 Nebraska Department of Agriculture. 2021. "Japanese Beetle Survey". https://nda.nebraska.gov/plant/entomology/pest_survey/index.html.

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.[61] 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. In the planning area, Phragmites is spreading across the NRD, with the worst problem areas located in the Platte River channels. It has also started to become an issue in drainage ditches where there is standing water for much of the year.

Average Annual Losses

According to the USDA RMA (2000-2021) there were 36 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 37: Plant Disease Losses

Hazard Type	Number of Events	Events per Year	Total Crop Loss	Average Annual Crop Loss
Plant Disease	36	1.6	$428,696	$19,486

Source: RMA, 2000-2021

Table 38: Animal Disease Losses

Hazard Type	Number of Events	Events per Year	Total Animal Losses	Average Animal Losses per Event
Animal Disease	20	2.5	263	33

Source: NDA, 2014-2021

Climate Change

The distribution and severity of animal and plant disease outbreaks will likely increase alongside climate change impacts. Shifting climatic conditions will stress existing agricultural populations and plant species, creating vulnerability for new diseases to take hold. The trend toward higher average temperatures and increased periods of drought[62] increases the stress levels on animal populations, increasing the risk of disease taking hold. Additionally, uncommon diseases may return at higher amounts as changes in the environment cause the release of previously contained diseases or promote the mutation of diseases.

As noted by the Fourth National Climate Assessment: “rural communities, where economies are more tightly interconnected with agriculture than with other sectors, are particularly vulnerable to the agricultural volatility related to climate. Crop and livestock production in certain regions will be adversely impacted both by direct effects of climate change (such as increasing trends in daytime

61 Lancaster County Weed Control Authority. “Guide for Phragmites Control”. Accessed October 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.

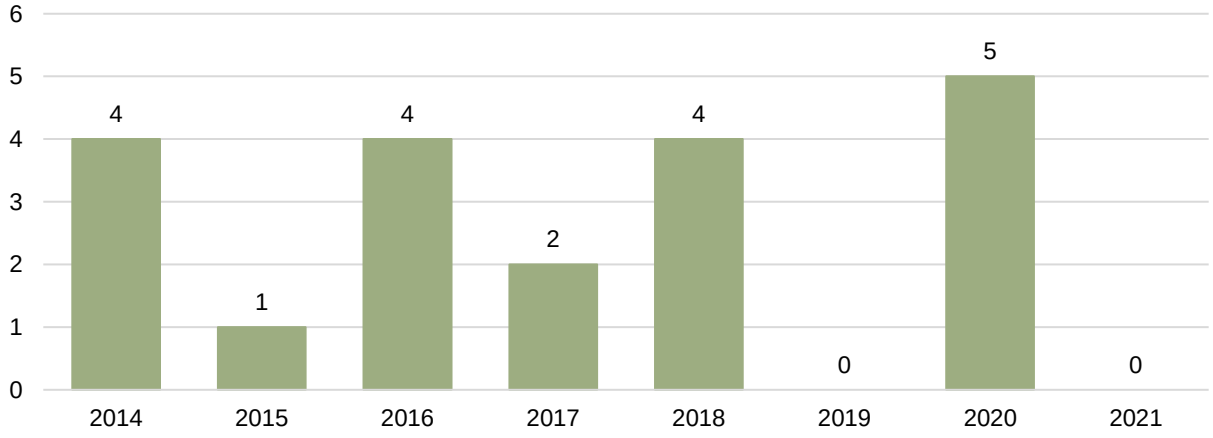
62 NCEI. 2022. “State Climate Summaries – Nebraska”. https://statesummaries.ncics.org/chapter/ne/#:~:text=The%20state%20is%20located%20far,(1895%E2%80%932020)%20averag.

and nighttime temperatures; changes in rainfall patterns; and more frequent climate extremes, flooding, and drought) and consequent secondary effects (such as increased weed, pest, and disease pressures; reduced crop and forage production and quality; and damage to infrastructure). While climate change impacts on future agricultural production in specific regions of the United States remain uncertain, the ability of producers to adapt to climate change through planting decisions, farming practices, and use of technology can reduce its negative impact on production."[63]

Probability

Given the historic record of occurrence for animal disease as show in Figure 19 (six out of eight years), for the purposes of this plan, the annual probability of animal disease occurrence is 75 percent. Given the historic record of occurrence for agricultural plant disease events (17 out of 22 years with a reported event), for the purposes of this plan, the annual probability of agricultural plant disease occurrence is 77%. Due to the anticipated impacts from climate change, the likelihood of future animal and plant disease events will increase in frequency.

Figure 19: Animal Disease Events by Year



Source: NDA, 2014-2021

Future Development

The likelihood of agricultural disease outbreaks is likely to remain consistent or increase as future development occurs; particularly if agricultural production remains the driving economic sector in the planning area. Higher production demand will lead farmers, ranchers, or other producers to increase population densities of livestock and crops. For communities, diversification of trees and other landscape vegetation will help reduce the impacts and likelihood of invasive species and plant disease outbreaks. Communities can require new developments to only have a certain percentage of trees from one specific species.

Regional Vulnerabilities

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

63 Fourth National Climate Assessment. 2018. "Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II". https://nca2018.globalchange.gov/.

Table 39: 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	-Local and 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
Community Lifelines	-Transportation routes can be closed during quarantine

Community Top Hazard Status

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

Jurisdictions and Stakeholders	
Bertrand	Phelps County
Gosper County	Phelps County Farm Service Agency
Kearney County Farm Service Agency	

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;
- canals, including the diversion structure, and levees; or
- water storage or evaporation ponds regulated by the United States Nuclear Regulatory Commission."[64]

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 40: Dam Size Classification

Size	Effective Height (feet) x Effective Storage (acre-feet)	Effective Height
Small	≤ 3,000 acre-feet[2]	and ≤ 35 feet
Intermediate	> 3,000 acre-feet[2] to < 30,000 acre-feet[2]	or > 35 feet
Large	≥ 30,000 acre-feet[2]	Regardless of Height

Source: NeDNR[65]

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. 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.

64 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.
65 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 the following.

- Reservoir inflows in excess of design flows
- Flood pools higher than previously attained
- 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

Communities or areas downstream of a dam, especially high hazard dams, are at greatest risk should a dam fail. According to USACE's National Inventory of Dams, there are a total of 95 dams located within the planning area, with classifications ranging from low to high hazard. Figure 20 maps the location of these dams in the planning area.

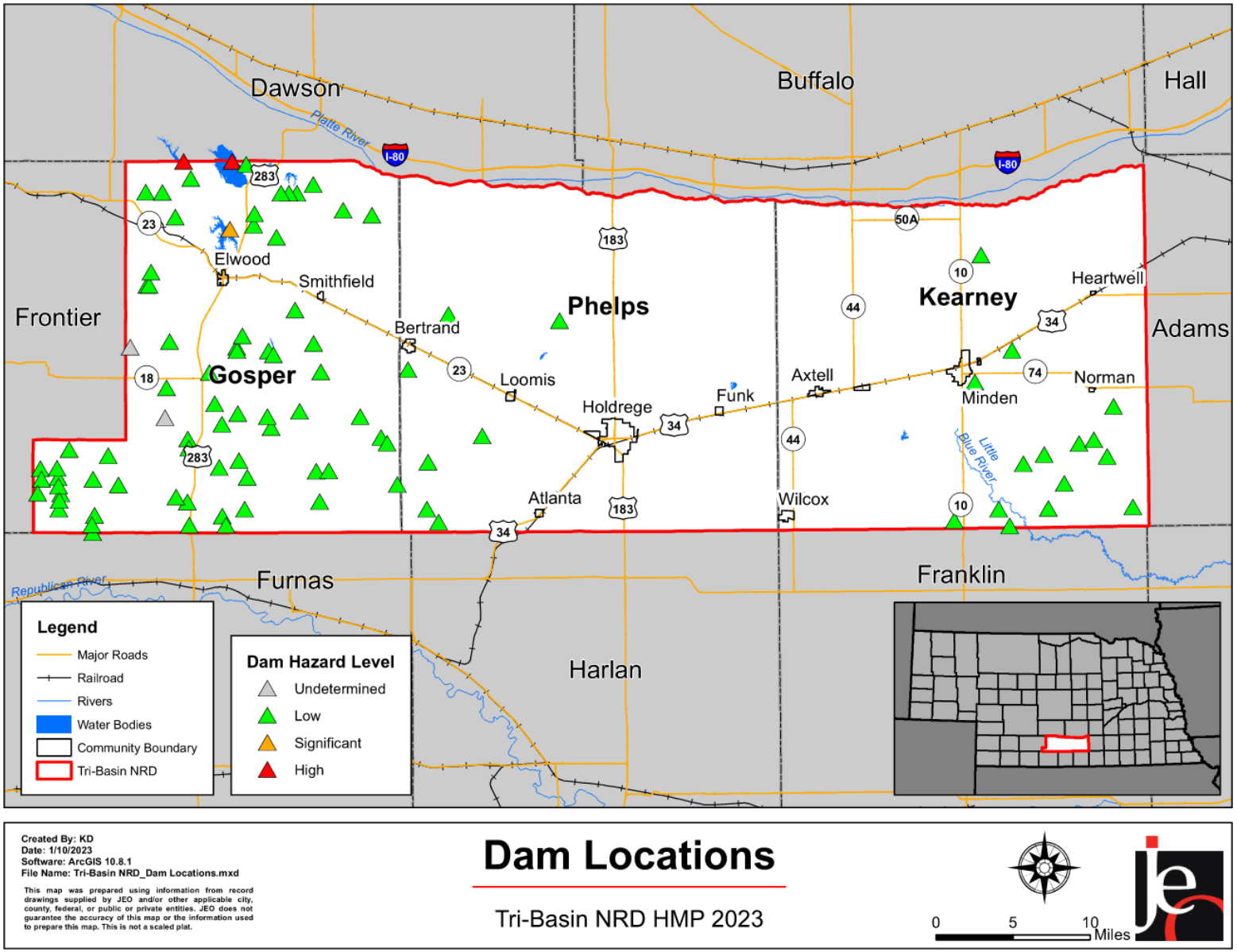
Table 41: Dams in the Planning Area

County	Undetermined Hazard	Low Hazard	Significant Hazard	High Hazard
Gosper	2	68	1	2
Kearney	0	15	0	0
Phelps	0	7	0	0
Total	**2**	**90**	**1**	**2**

Source: USACE, 2022[66]

66 United States Army Corps of Engineers. 2022. "National Inventory of Dams". https://nid.sec.usace.army.mil/ords/f?p=105:1:::::::.

Figure 20: Dam Locations



Dams classified with high hazard potential require the creation of an Emergency Action Plan (EAP). The EAP defines responsibilities and provides guidance 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. The EAP includes information regarding the efficiency of emergency response entities so that proper action can be taken to prevent the loss of life and property. Local emergency response entities generally included in an EAP include but are not limited to 911 Dispatch, County Sheriffs, Local Fire Departments, Emergency Management Agency Director, County Highway Department, and the National Weather Service (NWS). There are two high hazard dams located within the planning area, both are in Gosper County and are from the same reservoir. The Johnson Lake Reservoir has three embankments (Main Dam, West Dike, and East Dike). The Main Dam and the West Dike are classified as having high hazard potential. The East Dike is classified as having low hazard potential.

Table 42: High Hazard Dams in the Planning Area

County	Dam Name	NID ID	Dam Height (Feet)	Max Storage (Acre Ft)	Last Inspection Date
Gosper	Johnson Lake Dam	NE01025	47	71,445	10/27/2021
Gosper	Johnson Lake West Dike	NE01025	26	71,445	10/27/2021

Source: USACE, 2022

Upstream Dams Outside the Planning Area

According to the Gosper, Kearney, and Phelps Counties' Local Emergency Operations Plans, the Kingsley Dam is an upstream dam that could impact the planning area.[67,68,69]

Table 43: 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	163	2,160,970	10/28/2021

Source: USACE, 2023

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 damage 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. The City of Lexington, which is located outside of the planning area, is the closest downstream community of the Johnson Lake and Johnson Lake West Dike high hazard dams. Inundation maps are not publicly available due to concerns of vandalism and terrorism, which makes it difficult to quantify the full extent of dam failure impacts.

67 Gosper County Emergency Management Agency. 2016. "Gosper County Local Emergency Operations Plan".
68 Kearney County Emergency Management Agency. 2018. "Kearney County Local Emergency Operations Plan".
69 Phelps County Emergency Management Agency. 2021. "Phelps County Local Emergency Operations Plan".

Historical Occurrences

According to the NeDNR, there were four reported dam failures within the planning area. No damage was reported from these events.

Table 44: Dam Failures

Dam Name	Hazard Class	County	Failure Year	Failure Mode	Downstream Damage
Johnson Dam 3007	Low	Kearney	1980E	Spillway Erosion	No Damages Reported
Kuck Dam	Low	Gosper	1960E	Spillway Erosion	No Damages Reported
Maaske Dam	Low	Gosper	2006E	Unknown	No Damages Reported
Whayle Reynolds Dam 1	Low	Gosper	2019E	Headcut in Auxiliary Spillway	No Damages

E = The year of failure was estimated from best available information.
Source: NeDNR, 2022

Additionally, no dams of concern upstream of the planning area have experienced failure events. All dams should be inspected by the owner on a regular basis and after heavy rainfall events. If problems are found during an inspection, the dam should be repaired to ensure the structural integrity of the dam is preserved. NeDNR provides periodic inspections of dams and recommendations for repair to the dam owners.

Average Annual Losses

There was no reported damage 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.

Climate Change

While climate change does not directly affect dam failure events, changes in precipitation and temperature swings and extremes can affect dam failure. Increased rainfall events, either in frequency or in magnitude[70], will lead to exacerbated stress on infrastructure systems including dams. Additionally, historical streamflow records are typically used to design or determine dam construction requirements and maintenance requirements. Climate change may impact dam systems in the following ways.

- Drought: land subsidence, erosion, embankment settling, or foundation cracking.
- Flooding: increased embankment erosion, sloughing, overtopping risk, or damage from ice jams.

Probability

Based on the historic record of reported incidents, there is a three percent probability (4 out of 127 years with an occurrence) that dam failure will occur annually in the planning area. Due to the potential impacts from climate change, the likelihood of future dam failure events will increase in frequency.

70 NCEI. 2022. “State Climate Summaries – Nebraska”. https://statesummaries.ncics.org/chapter/ne/#:~:text=The%20state%20is%20located%20far,(1895%E2%80%932020)%20averag.

Future Development

Any future growth in high hazard dam inundation areas increases the impacts from dam failure. Additionally, any increase in development downstream of any existing dams may elevate these dams to a high hazard rating. As many dam inundation areas are also identified floodplain locations, developing outside these areas will reduce vulnerability to both hazards. Closer to the dam the breach inundation zone is frequently larger than the identified floodplain, so caution should be used when developing areas just downstream of a dam. Communities could implement requirements for any new development or substantial improvements in dam inundation areas similar to floodplain ordinances to minimize the number of people and property impacted during a dam failure event.

Regional Vulnerabilities

Regional vulnerabilities to dam failure vary based on surrounding development and other flood control measures. The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven* | *Community Profiles*.

Table 45: Regional Dam Failure Vulnerabilities

Sector	Vulnerability
People	-Those living downstream of any dam -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 -Gosper County: LEOP estimated a small percent of the population could be affected -Kearney County: LEOP estimated 10% of the population could be affected -Phelps County: LEOP estimated a small percent of the population could be affected
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 buildings, recreation areas, and roads
Community Lifelines	-Transportation routes could be closed for extended period of time -Any community lifelines in inundation areas are vulnerable to damages

Community Top Hazard Status

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

Jurisdictions and Stakeholders	
Elwood Volunteer Fire Department	Gosper County

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.

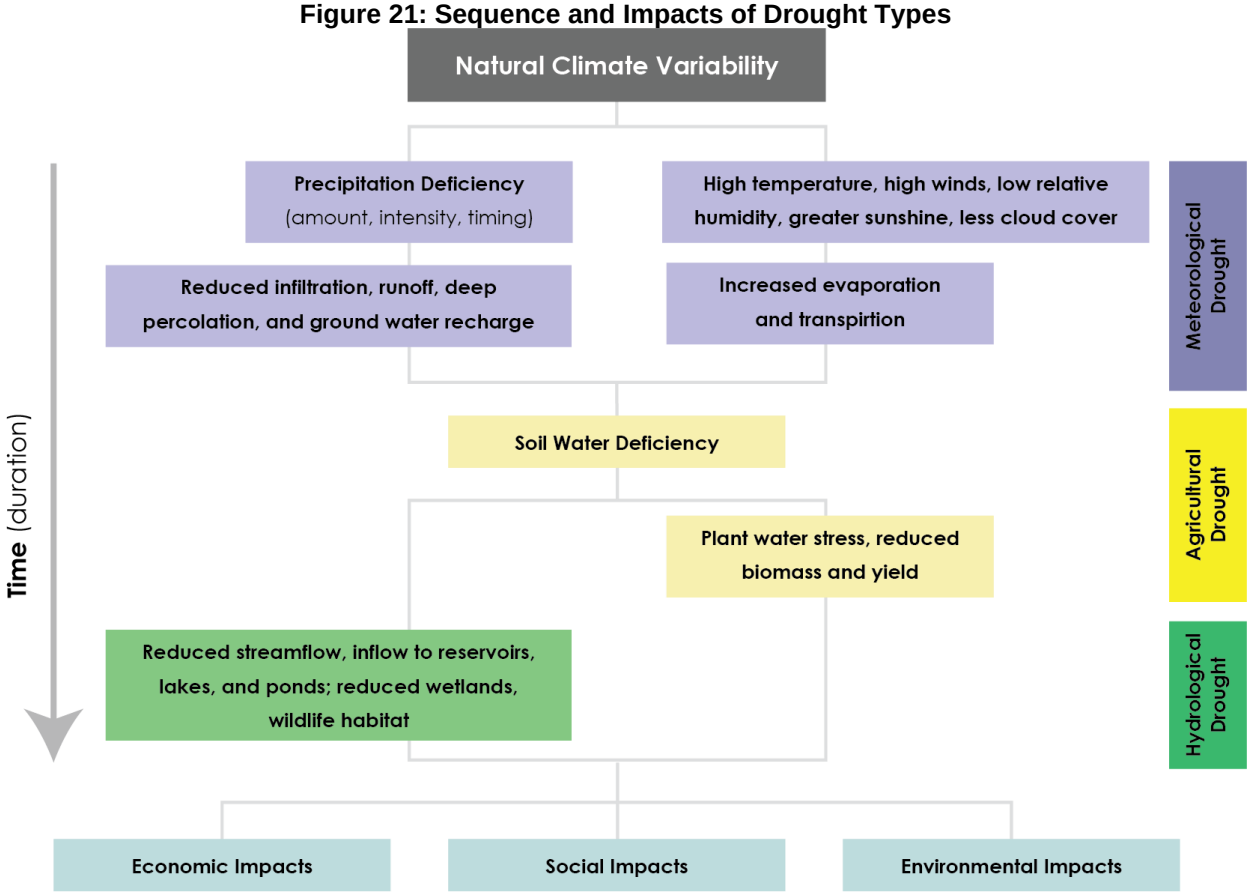
- **Hydrologic Drought** occurs when water available in aquifers, lakes, and reservoirs falls below the statistical average. This situation can arise even when the area of interest receives average precipitation. This is due to the reserves diminishing from increased water usage, usually from agricultural 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 21: Sequence and Impacts of Drought Types



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

Location

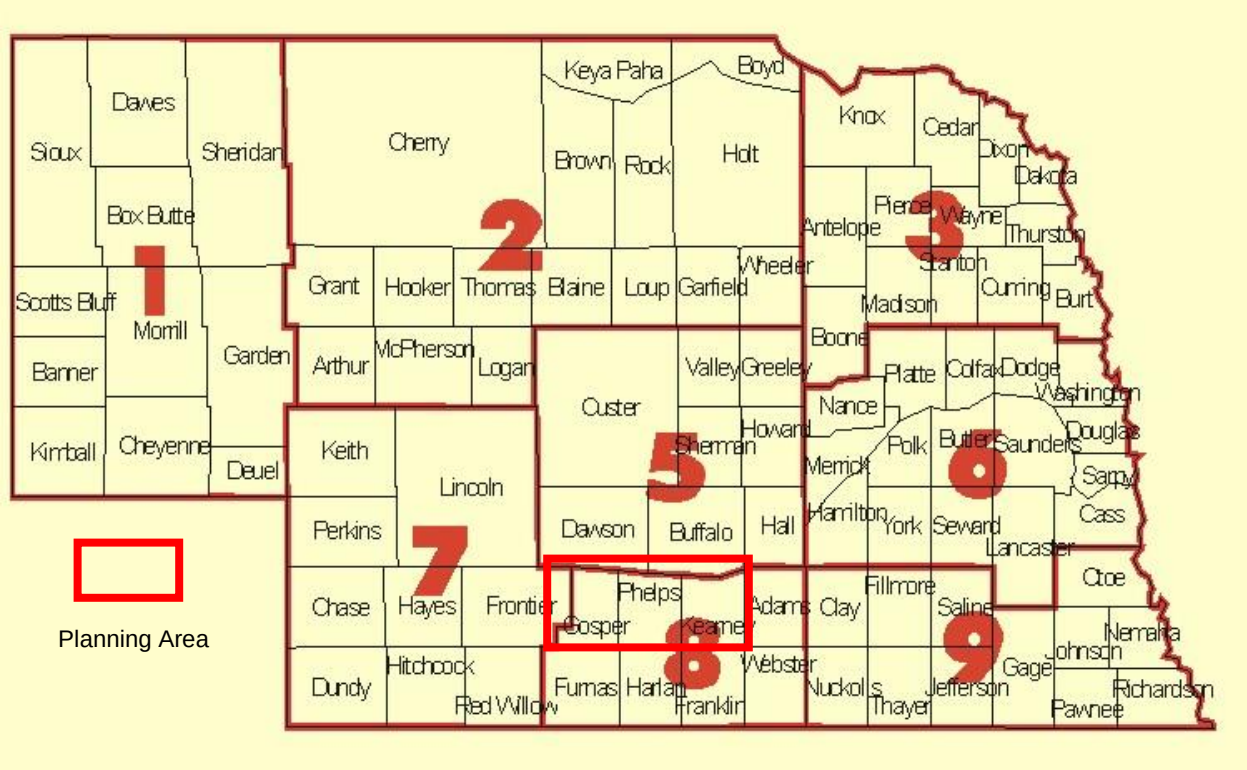
The entire planning area is susceptible to drought impacts.

Extent

The Palmer Drought Severity Index (PDSI) is utilized by climatologists to standardize global long-term drought analysis. Table 46 shows the details of the Palmer classifications. The data for the planning area was collected for Climate Division 8, which includes the planning area. The period of record at this station started in 1895. Figure 23 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. Moderate, severe, and extreme droughts are likely in the future.

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

Figure 22: Nebraska Climate Divisions



Source: National Weather Service[73]

Table 46: Palmer Drought Severity Index Classification

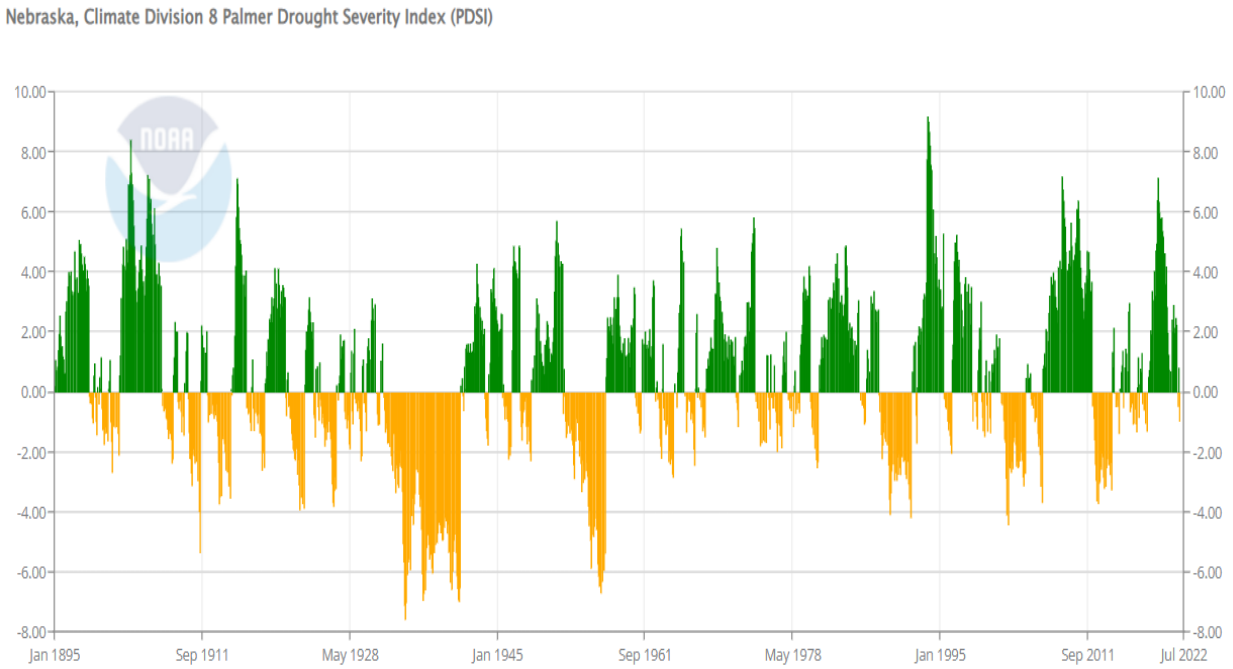
Numerical Value	Description	Numerical Value	Description
4.0 or more	Extremely wet	**-0.5 to -0.99**	Incipient dry spell
3.0 to 3.99	Very wet	**-1.0 to -1.99**	Mild drought
2.0 to 2.99	Moderately wet	**-2.0 to -2.99**	Moderate drought
1.0 to 1.99	Slightly wet	**-3.0 to -3.99**	Severe drought
0.5 to 0.99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

Source: Climate Prediction Center[74]

73 National Weather Service. 2005. "Climate Divisions w/Counties". https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/CLIM_DIVS/states_counties_climate-divisions.shtml.

74 National Weather Service. 2017. "Climate Prediction Center". https://www.cpc.ncep.noaa.gov/.

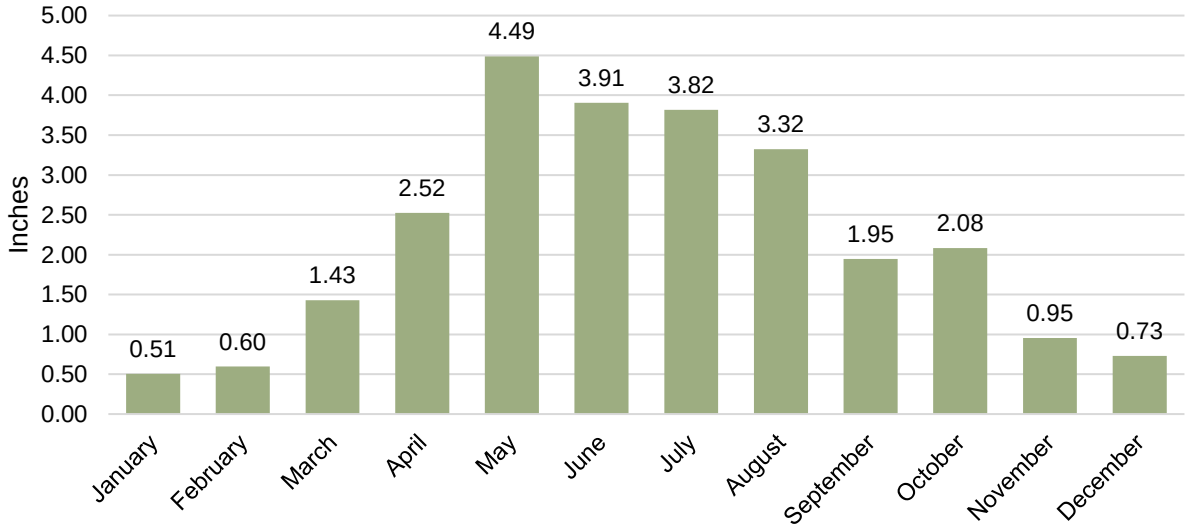
Figure 23: Historical Palmer Drought Severe Index - Planning Area



Source: NCEI, Jan. 1895-July 2022[75]

Figure 24 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.

Figure 24: Average Monthly Precipitation for the Planning Area



Source: NCEI, 1991-2020[76]

75 National Centers for Environmental Information. 1895-2022. Accessed August 2022. "Climate at a Glance". https://www.ncei.noaa.gov/cag/divisional/time-series/2508/pdsi/all/1/1895-2022.

76 NOAA National Centers for Environmental Information. January 2022. "Data Tools: 1991-2020 Normals". https://www.ncei.noaa.gov/access/us-climate-normals/.

Historical Occurrences

Table 47 indicates it is reasonable to expect extreme drought to occur 6.3% of the time for at least some portion of the planning area (96 extreme drought months in 1,531 months). Severe drought occurred in 58 months of the 1,531 months of record (3.8% of months). Moderate drought occurred in 137 months of the 1,531 months of record (8.9% of months), and mild drought occurred in 198 of the 1,531 months of record (12.9% of months). Non-drought conditions occurred in 1,042 months, or 68.1% 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 26.3 inches according to the NCEI.

Table 47: Historical Droughts

Drought Magnitude	Total Months	Percent Chance
-1 Magnitude (Mild)	198/1,531	12.9%
-2 Magnitude (Moderate)	137/1,531	8.9%
-3 Magnitude (Severe)	58/1,531	3.8%
-4 Magnitude or Greater (Extreme)	96/1,531	6.3%
Total Months in Drought	**489/1,531**	**31.9%**
Total Months not in Drought	**1,042/1,531**	**68.1%**

Source: NCEI, Jan 1895-July 2022

The 2012 drought was one of the worst recent historical droughts for the planning area and Nebraska; however, it did not warrant a presidential disaster declaration. 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 communities and water providers across the state implemented mandatory water restrictions, and some encouraged voluntarily water conservation during that timeframe. 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.[77] The images below show a general timeline of worsening drought conditions from the 2012 drought in Nebraska from the state's 2012 Annual Report.

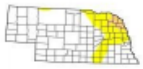
77 Nebraska Department of Health and Human Services. 2012. "Nebraska's Public Water System Program 2012 Annual Report – January 1 to December 31, 2012". https://dhhs.ne.gov/Reports/Public%20Water%20System%20Annual%20Report%202012.pdf.

Figure 25: 2012 Drought Timeline

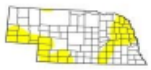
Drought Severity

- D0 - Abnormally Dry
- D1 Drought – Moderate
- D2 Drought – Severe
- D3 Drought – Extreme
- D4 Drought - Exceptional

January 2012 -- 72% of the State had no drought conditions. Drought was evident in the Northeast ¼ of the state.

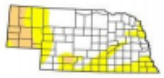


February 2012 – There was a slight improvement. 80% of the state had no signs of drought.



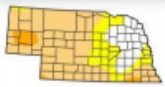
March 2012 -- Abnormally dry conditions appeared in the northeast ¼ and southwest portion of the state.

April 2012 -- Drought conditions increased to moderate in the northeast and west.

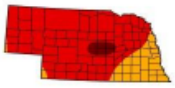


May 2012 -- The west and south parts of the state developed mostly moderate drought conditions.

Figure 26: 2012 Drought Timeline (cont.)

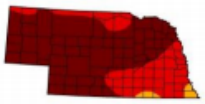


June 2012 -- Conditions continued to worsen to severe over 40% of the state, which involved the central and western parts of the state. About 7% of community water systems began asking consumers to voluntarily restrict their use of water.



July 2012 -- The entire state was under some degree of drought conditions. Throughout July, conditions deteriorated to 83% being under extreme conditions with 3.5% being defined as worst case conditions or exceptional drought. Water system restrictions showed a 65% increase. Most (78%) of those systems used voluntary restrictions while 22% went to mandatory restrictions. These restrictions ranged from allowing watering of lawns only on odd/even days to no lawn watering or vehicle washing.

August 2012 -- Exceptional drought conditions expanded to cover the central part of the state running east from Highway 281, west to Colorado and Wyoming. Another 15% of water systems began voluntary restrictions and another 12% began mandatory restrictions.



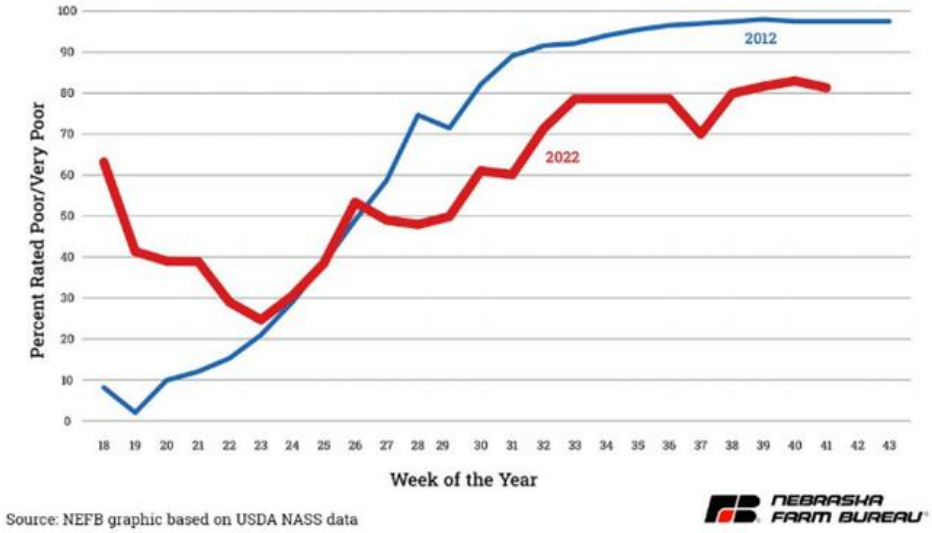
Sept 2012 -- Approximately 73% of the state experienced exceptional drought conditions. For the most part only the southeast corner of the state had severe to extreme conditions. No additional water systems were added to the list of those using restrictions.

Oct 2012 -- Exceptional drought conditions covered 77.5% of the state.

Nov & Dec 2012 – Conditions remained the same.

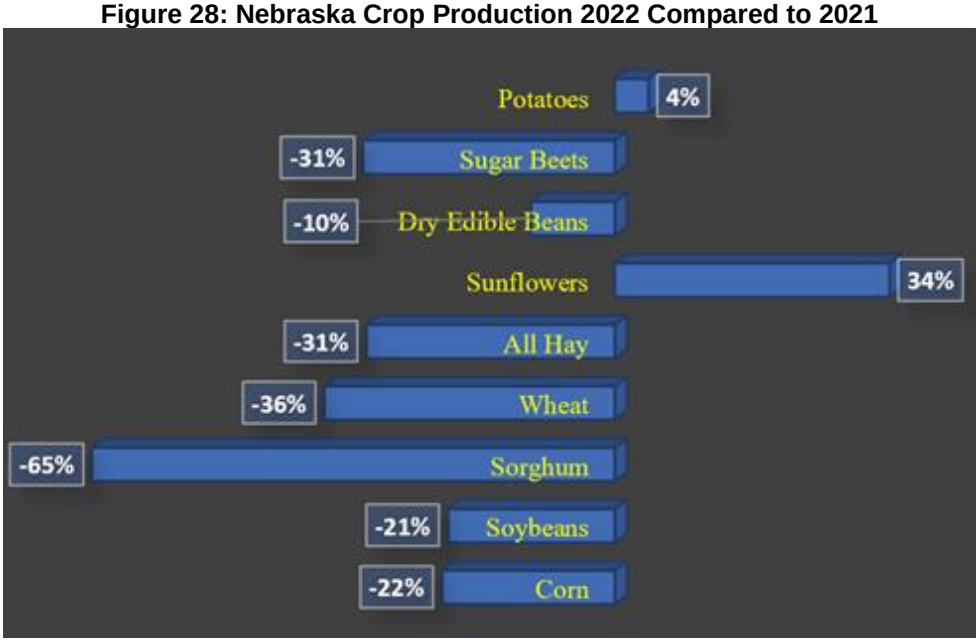
The ongoing 2021-23 drought is the worst drought to impact Nebraska since the 2012 drought. In 2022, 12 Nebraska counties received USDA Disaster Designation. When compared to the 2012 drought, the 2022 drought differed with cooler temperatures in the spring and early summer, helping alleviate and delay some of the drought impacts as shown in Figure 27.

Figure 27: Nebraska Pasture Conditions 2012 & 2022



Despite the cooler temperatures, 2022 was Nebraska's fourth driest year on record and was the driest state in the nation last year when compared to average annual precipitation, according to the NCEI Climate Monitoring database. The entire state was in a stage of drought from February to June and from August to December. In addition, over 50% of the state was in D4 (Exceptional Drought) for the last three months of 2022. The Nebraska Farm Bureau reported that, except for potatoes and sunflowers, all other crops produced in Nebraska were 10-65% lower than 2021 harvests.[78] Crop production in 2022 compared to 2021 is shown below, with sorghum having the largest drop of 65% and wheat 36%, despite the same number of acres being planted. Neither crop is typically irrigated and was heavily impacted by the drought.

Figure 28: Nebraska Crop Production 2022 Compared to 2021



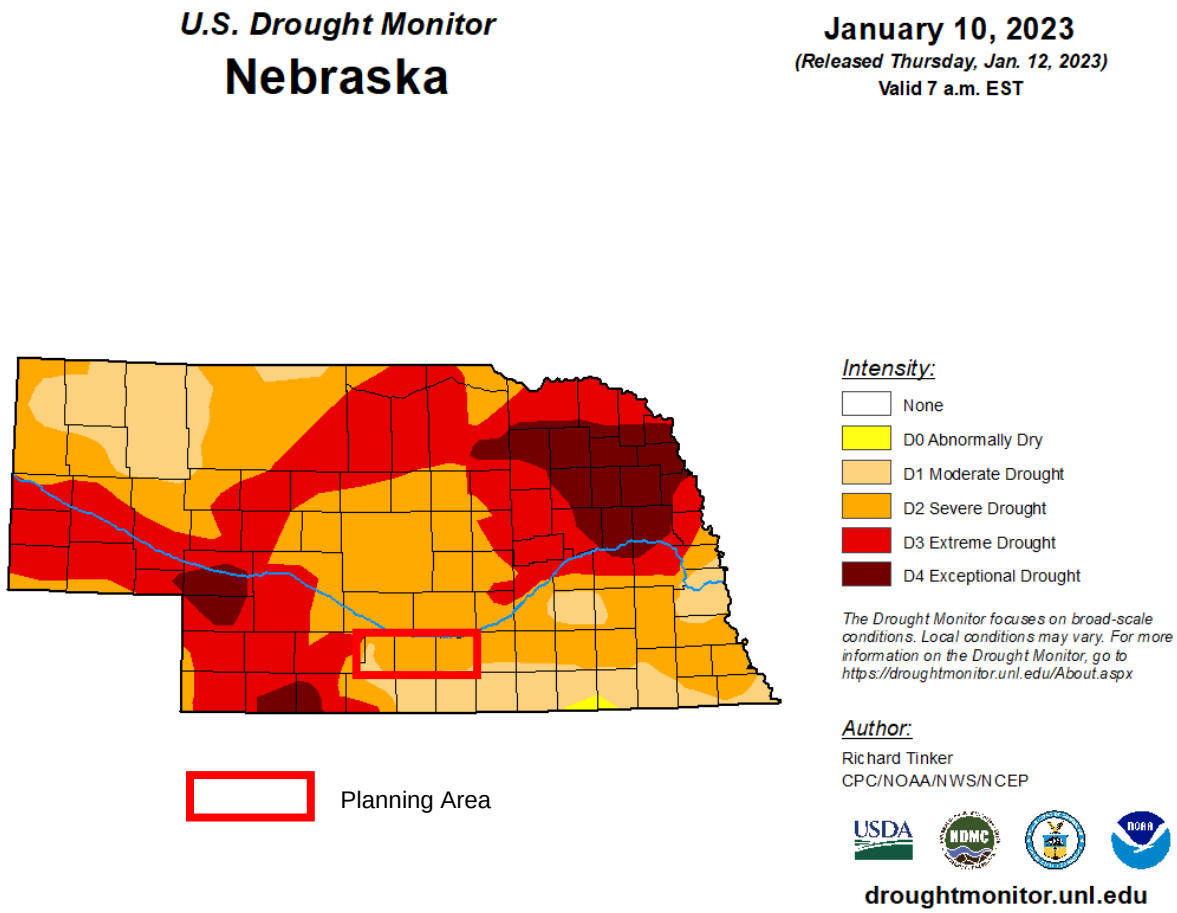
Source: USDA National Agricultural Statistics Service

78 Nebraska Farm Bureau. 2023. "Nebraska Crop Production Off". https://www.nefb.org/01/23/2023/nebraska-crop-production-off/.

According to Nebraska Public Media, in 2022 farmers have seen harvests drop by half and ranchers weaned calves early, relying on more hay and other feed for their cattle.[79] Along with significant impacts on the farming and ranching industries, the drought has also caused extremely dry vegetation leading to an increase in wildland fires. The 2022 wildfire season was Nebraska's second worst in terms of acres burned with 200,000 acres having been burned.[80]

As of January 10, 2023, the planning area is experiencing either a D2 (Severe Drought) or D1 (Moderate Drought) per the US Drought Monitor (Figure 29). At least a portion of the planning area has been in D1 Moderate Drought or higher since February 8, 2022.

Figure 29: U.S. Drought Monitor



Source: National Drought Mitigation Center, January 10, 2023

79 Nebraska Public Media. 2022. "Some of the worst I've ever seen, Nebraska ranchers, farmers struggle against 5th worst drought on record". https://nebraskapublicmedia.org/en/news/news-articles/some-of-the-worst-ive-ever-seen-nebraska-ranchers-farmers-struggle-against-5th-worst-drought-on-record/.

80 Omaha Wold-Herald. 2023. "Nebraska's drought among nation's billion-dollar weather disasters". https://omaha.com/news/state-and-regional/nebraskas-drought-among-nations-billion-dollar-weather-disasters/article_ba26ca52-8ddf-11ed-ac57-8b2fd8286d3d.html.

Average Annual Losses

The direct and indirect effects of drought 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 cause damage to infrastructure. The annual property estimates for the three-county region were determined based upon NCEI Storm Events Database since 1996. Annual crop loss for the three-county region was determined based upon the RMA Cause of Loss Historical Database from 2000-2021.

Table 48: Loss Estimate for Drought

Hazard Type	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Drought	$0	$0	$46,489,468	$2,113,158

Source: 1 Indicates data is from NCEI (Jan 1996 to April 2022); 2 Indicates data is from USDA RMA (2000 to 2021)

Climate Change

An increase in average temperatures and evaporation rates will likely contribute to the rise in the frequency and intensity of drought, especially during the summer months.[81] This will cause significant economic, social, and environmental impacts on farming and community water systems in the planning area. The increase in droughts will also lead to an increased risk of wildfire events as vegetation becomes drier. The table below shows the likelihood of a year-plus drought and year-plus extreme drought in three-county region with different warming scenarios.

Table 49: Likelihood of Drought with Different Warming Scenarios

	Warming Scenarios			
Likelihood of	0.5° C	1° C	2° C	3° C
Year-Plus Drought	11-33%	11-33%	11-50%	34-50%
Year-Plus Extreme Drought	0-10%	0-10%	0-10%	11-33%

Source: Probable Futures[82]

NOAA has created the Climate Mapping for Resilience and Adaptation tool that looks at how different emission scenarios affect climatological hazards. The table below shows that the annual number of dry days is projected to increase as time goes on in both the lower emissions and higher emissions scenario.

81 NCEI. 2022. “State Climate Summaries – Nebraska”. https://statesummaries.ncics.org/chapter/ne/#:~:text=The%20state%20is%20located%20far,(1895%E2%80%932020)%20averag.

82 Probable Futures. “Maps of Dryness”. Accessed January 2023. https://probablefutures.org/.

Table 50: Annual Number of Dry Days

County	Emission Scenario	Historical (1976-2005)	Early Century (2015-2044)	Mid Century (2035-2064)	Late Century (2070-2099)
Gosper	Lower Emissions (RCP 4.5)	246.6 Days	248.5 Days	249.8 Days	250.7 Days
	Higher Emissions (RCP 8.5)	246.6 Days	249.2 Days	250.9 Days	253.0 Days
Kearney	Lower Emissions (RCP 4.5)	249.1 Days	250.1 Days	251.3 Days	252.1 Days
	Higher Emissions (RCP 8.5)	249.1 Days	251.0 Days	252.2 Days	253.8 Days
Phelps	Lower Emissions (RCP 4.5)	247.1 Days	248.6 Days	250.0 Days	250.8 Days
	Higher Emissions (RCP 8.5)	247.1 Days	249.6 Days	251.0 Days	252.9 Days

Source: NOAA, 2023[83]

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. Due to the anticipated impacts from climate change, the likelihood of future drought events will increase in frequency and magnitude.

Table 51: Period of Record in Drought

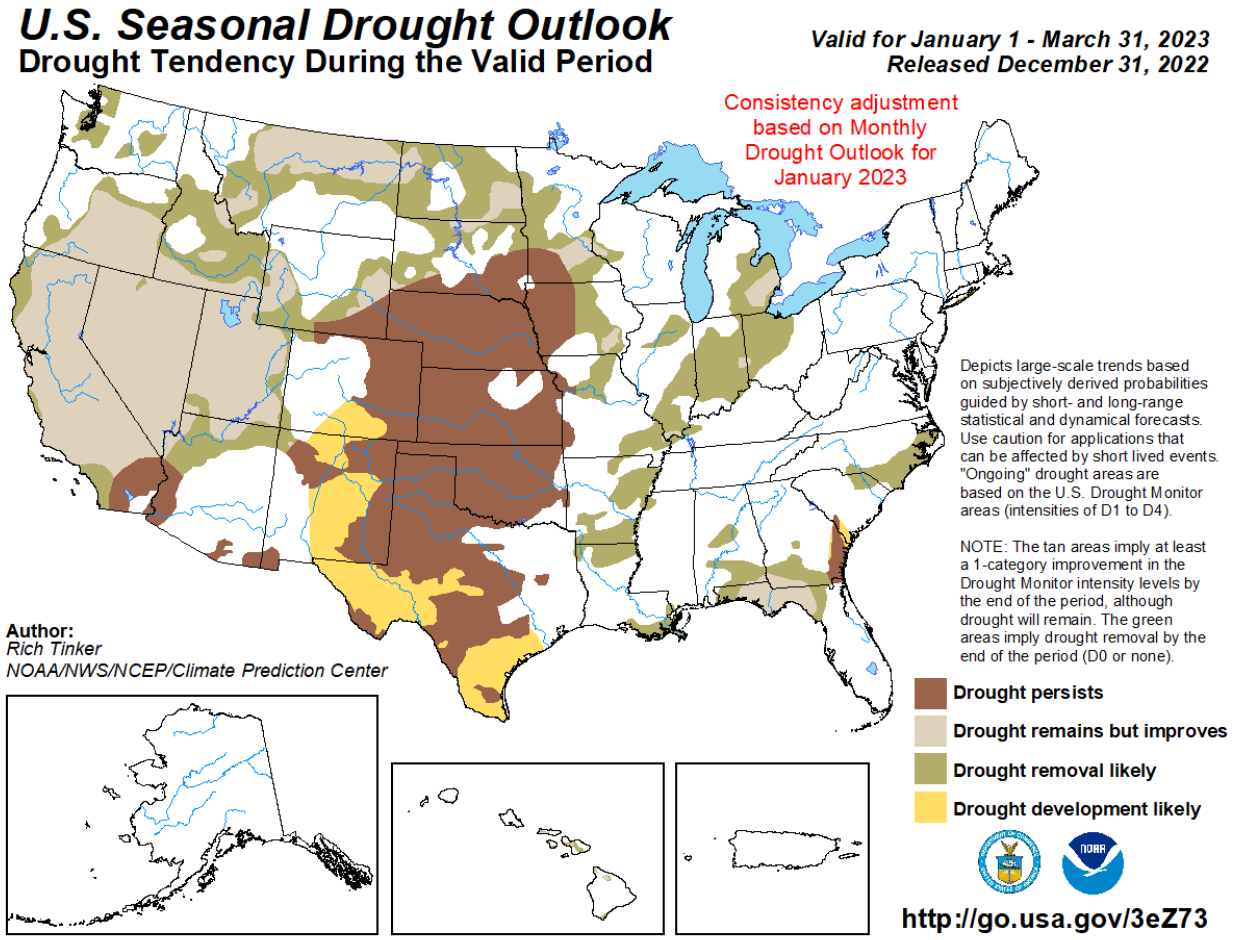
PDSI Value	Magnitude	Drought Occurrences by Month	Monthly Probability
4 or more to -0.99	No Drought	1,042/1,531	68.1%
-1.0 to -1.99	Mild Drought	198/1,531	12.9%
-2.0 to -2.99	Moderate Drought	137/1,531	8.9%
-3.0 to -3.99	Severe Drought	58/1,531	3.8%
-4.0 or less	Extreme Drought	96/1,531	6.3%

Source: NCEI, Jan 1895-July 2022

The U.S. Seasonal Drought Outlook (Figure 30) provides a short- term drought forecast that can be utilized by local officials and residents to examine the likelihood of drought developing or continuing within three months as based on existing conditions. The drought outlook is updated consistently throughout the year and should be reviewed on an ongoing basis. The following figure provides the drought outlook from January 2023 to March 2023 as an example.

83 NOAA. January 2023. “Climate Mapping for Resilience and Adaptation”. https://livingatlas.arcgis.com/assessment-tool/explore/details.

Figure 30: U.S. Seasonal Drought Outlook



Source: NOAA, 2022[84]

Future Development

Any future developments are likely to increase water demand, increase travel on local transportation routes, and influence continued growth on economic sectors at risk from the impacts of drought. Growing communities will need to adapt and account for increased water demands for residential, commercial, and industrial development.

Regional Vulnerabilities

Republican River Compact

The Republican River Compact has a large impact on drought and the planning area located in the Republican River watershed. The Republican River Compact is an agreement between the State of Nebraska, State of Colorado, and the State of Kansas that requires specific flows at stream gages near the Colorado-Nebraska border and the Nebraska-Kansas border. If flows do not me the set requirement, NeDNR can close junior surface water uses. During times of drought, surface water irrigators may be impacted in order to keep compliance with the compact.

84 NOAA. January 2023. “Climate Prediction Center”. https://www.cpc.ncep.noaa.gov/.

Drought Impact Reporter

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 51 drought-related impacts throughout the region. 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 52: Notable Drought Impacts in Planning Area

Category	Date	Affected Counties	Title
Agriculture; Plants & Wildlife	12/7/2012	Gosper County, Kearney County, Phelps County	Drought Led Ranchers in Western Nebraska to Cull Cow Herds by 25 to 60 Percent
Plants & Wildlife	6/1/2012	Gosper County	Many Trees in Western Nebraska Died from Drought, High Temperatures, and Strong Winds in 2012
Agriculture; Relief, Response & Restrictions; Water Supply & Quality	1/1/2013	Gosper County, Kearney County, Phelps County	Reduced Water Allotment for Irrigation in Central Nebraska Public Power an Irrigation District
Agriculture; Relief, Response & Restrictions	1/9/2013	Gosper County, Kearney County, Phelps County	Drought-Related USDA Disaster Declarations 2013
Plants & Wildlife; Water Supply & Quality	7/31/2013	Kearney County	Low Water, Warm Water Temperatures Killing Fishing in Platte River in South Central Nebraska
Agriculture; Relief, Response & Restrictions	1/9/2014	Gosper County, Kearney County, Phelps County	Drought-Related USDA Disaster Declarations 2014
Fire	4/7/2022	Gosper County	Wind-Driven Wildfire in Nebraska Blackened 30,000 Acres
Agriculture	8/1/2022	Gosper County, Kearney County, Phelps County	Some Crops in South Central Nebraska Likely Lost, Will Not Make Grain

Source: NDMC, 2000-January 2023[85]

The three-county planning area is largely agriculturally based, and any type of drought is likely to have large impacts on the local economy. Although agriculture and ranching are the major sectors affected, impacts on rural and municipal water supplies, fish and wildlife, water-based recreation, water quality, soil erosion, mental health and the incidence of wildland fires are also significant. Similarly, the indirect impacts of drought on personal and business incomes, tax revenues, unemployment, and other areas are also important. In general, drought produces a complex web of impacts that ripple through many sectors of the economy. This is largely due to the dependence of so many sectors on water for producing goods and providing services. The following table provides information related to regional vulnerabilities. For jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

85 National Drought Mitigation Center. January 2023. “U.S. Drought Impact Reporter”. http://droughtreporter.unl.edu/map/.

Table 53: 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
Community Lifelines	-Damages to waterlines below ground -Damages to roadways (prolonged extreme events) -Loss of power

Community Top Hazard Status

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

Jurisdictions and Stakeholders	
Elwood Volunteer Fire Department	Loomis
Holdrege	Minden
Kearney County	Tri-Basin NRD
Kearney County Farm Service Agency	

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.

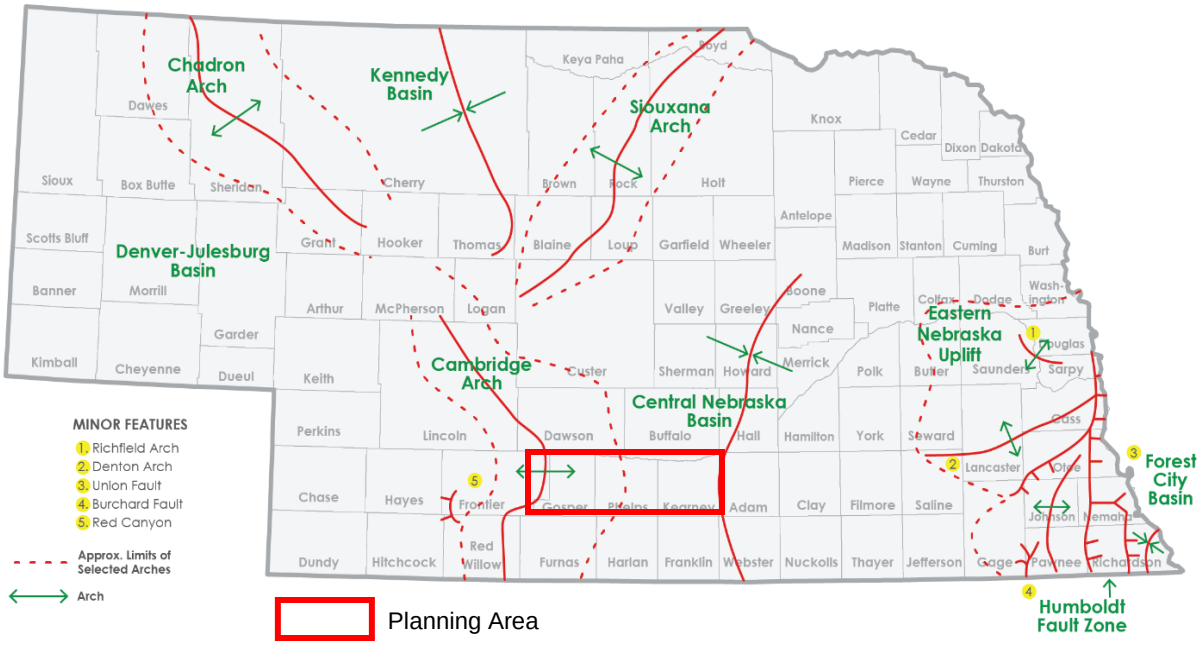
- **Liquefaction** occurs when ground shaking causes wet granular soils to change from a solid state to a liquid state. This results in the loss of soil strength and the soil's ability to support weight. Buildings and their occupants are at risk when the ground can no longer support these buildings and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

Two fault lines are located within or very near the three-county planning area. The Cambridge Arch Fault is active in Gosper County and Phelps County, and the Central Nebraska Basin fault is active in Kearney County. The following figure shows the fault lines in Nebraska.

Figure 31: 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 less than 3.5 on the Richter Scale.

Table 54: 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[86]

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

Table 55: 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

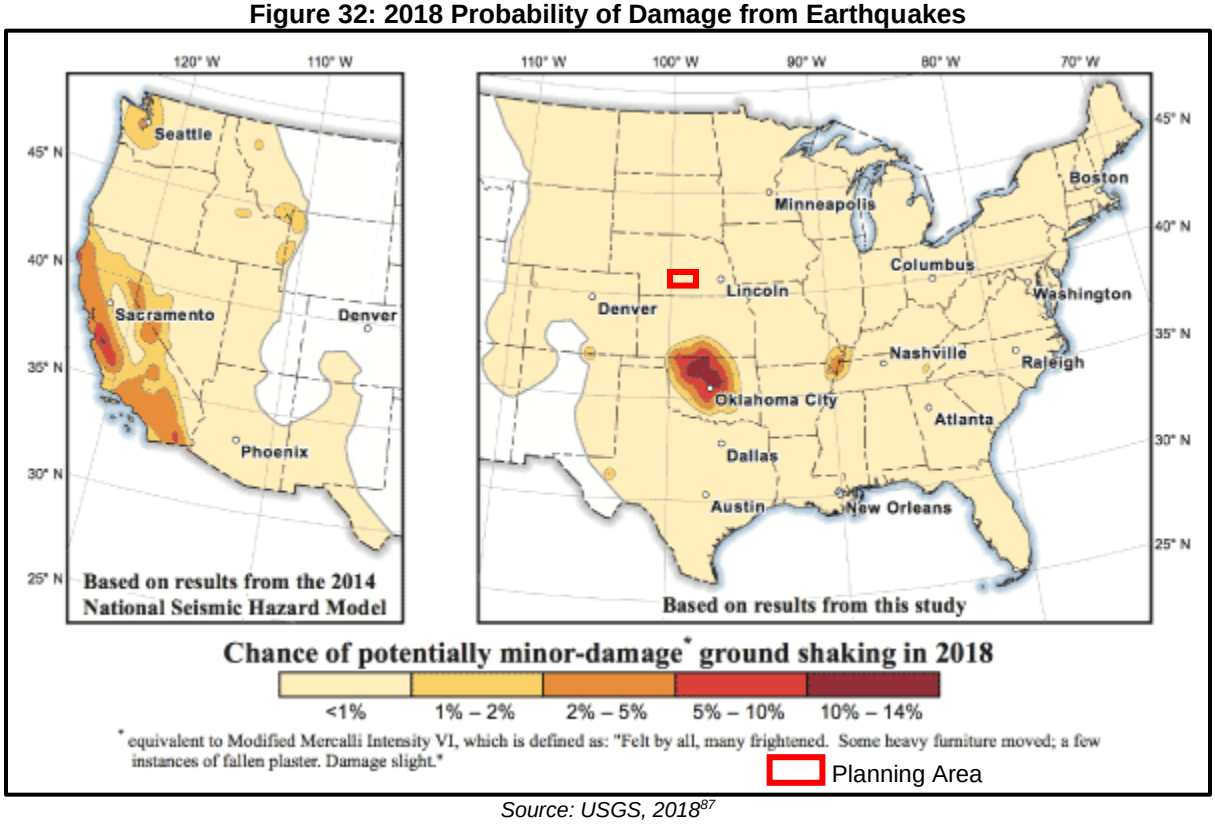
Historical Occurrences

According to the United States Geological Survey (USGS), there has been no earthquakes located in the NRD since 1900.

Average Annual Losses

Due to the lack of sufficient earthquake data, limited resources, and extremely low earthquake risk for the area, it is not feasible to utilize the 'event damage estimate formula' to estimate potential losses for the planning area. Figure 32 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 32: 2018 Probability of Damage from Earthquakes



Source: USGS, 2018[87]

Climate Change

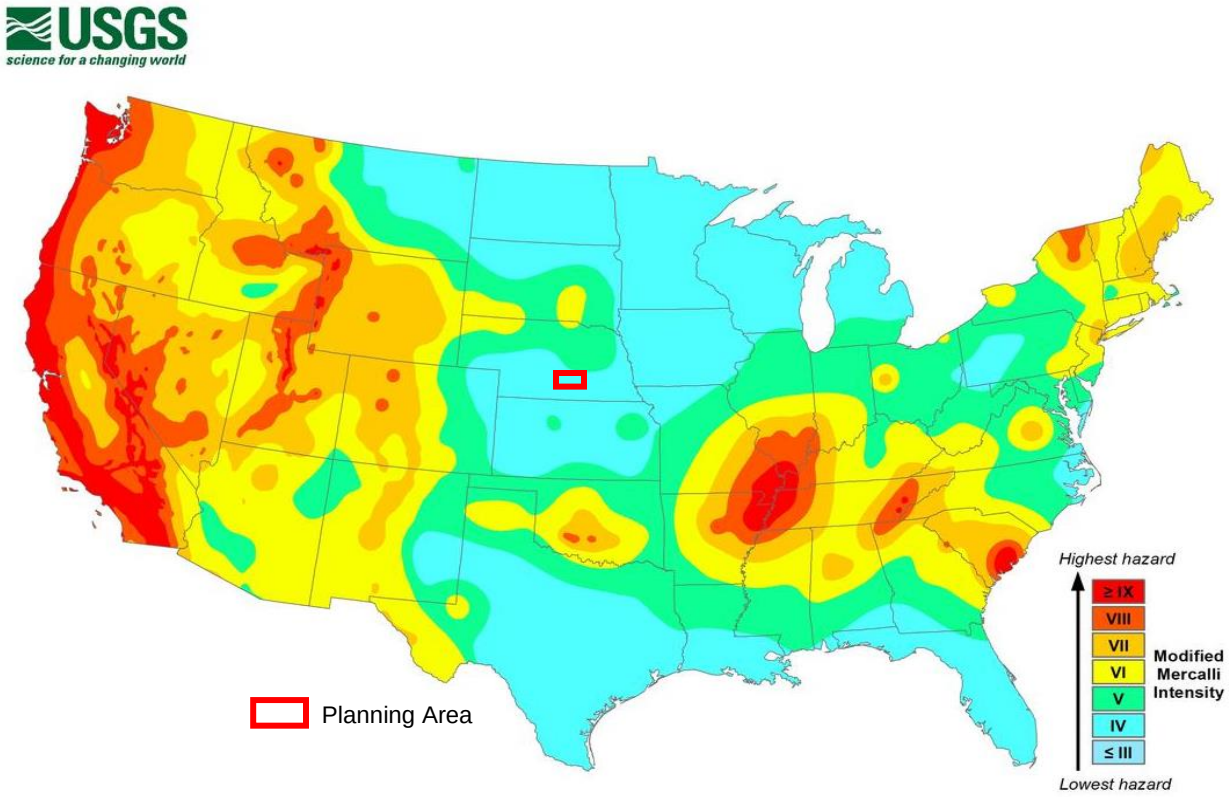
Currently, there is no known direct association with climate change and earthquake events. However, as climate change exacerbates effects on other hazard types such as drought, it may produce more frequent or greater earthquake events. A report in 2017 by NASA's Jet Propulsion Laboratory[88] found that alternating periods of drought and heavy precipitation caused the Sierra Mountain Range in California to rise and fall as the ground swelled/contracted. The study did not specifically look at potential impacts on fault lines, but such stress changes could potentially be felt on faults.

Probability

The following figure shows that a 4.0 earthquake has a two percent chance of occurring in the NRD within the next 50 years. Based on no earthquakes occurring over a 120-year period, the probability of an earthquake in the NRD in any given year is less than one percent. Climate change will likely have limited impacts on the probability of an earthquake occurring.

87 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.
88 Argus, D. et al. 2017. "Sierras lost water weight, grew taller during drought." NASA's Jet Propulsion Laboratories. https://climate.nasa.gov/news/2663/sierras-lost-water-weight-grew-taller-during-drought/.

Figure 33: 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

Future Development

Any population growth and development in the county will not likely be dictated by earthquake risk. Any new construction built to code should be able to withstand any earthquakes in the planning area, but the potential for infrastructure (underground pipes and roadways) will increase with new development.

Regional Vulnerabilities

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

Table 56: 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.
Community Lifelines	-Damage to subterranean infrastructure (i.e. waterlines, gas lines, etc.) -Damage to roadways

Community Top Hazard Status

No jurisdictions or stakeholders identified earthquakes as a top hazard of concern.

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.[89] 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 staff, 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.

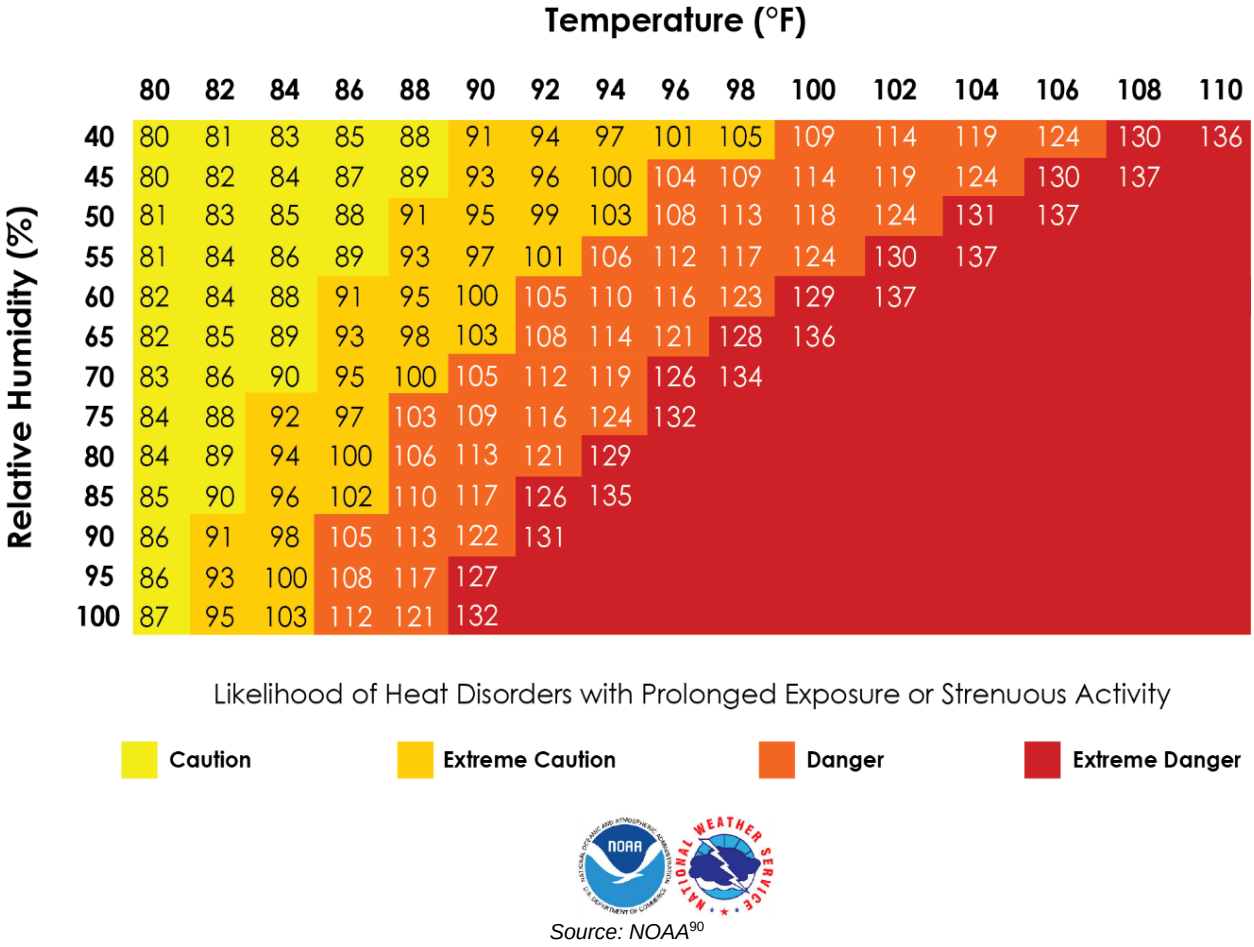
89 Yeeles, Adam. 2015. Weathering unrest: The ecology of urban social disturbances in Africa and Asia". https://journals.sagepub.com/doi/full/10.1177/0022343314557508.

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% start at 94°F. The combination of relative humidity and temperature results in a heat index as demonstrated below.

Figure 34 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 defined as temperatures of 100°F or greater. In the planning area, the months with the highest temperatures are June, July, and August.

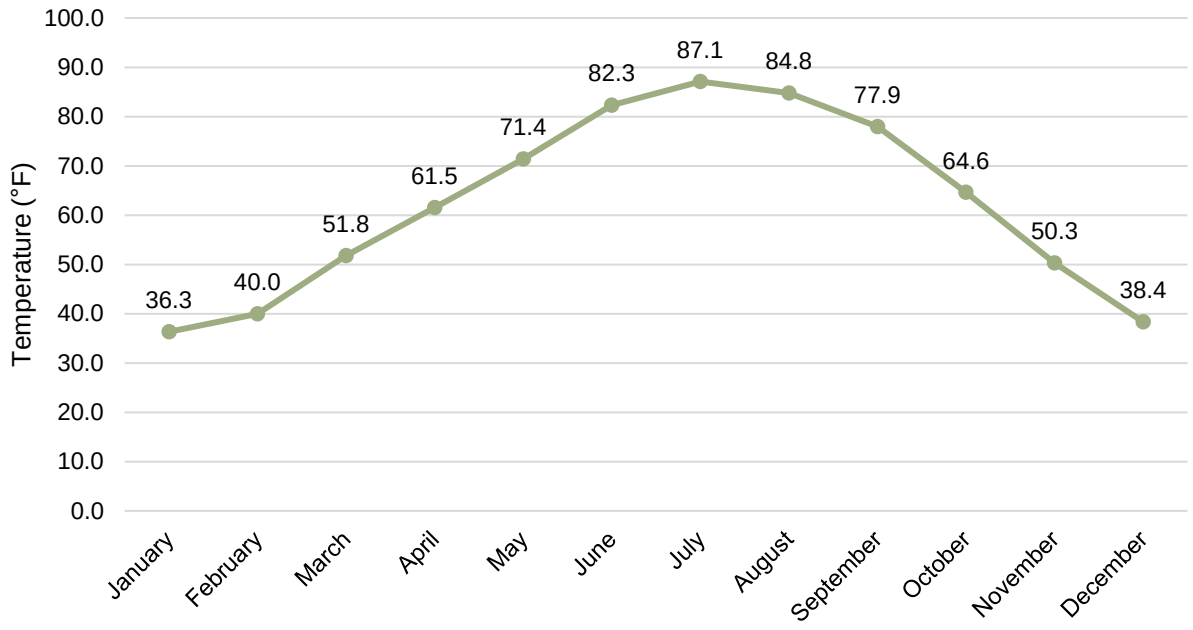
Figure 34: NOAA Heat Index



Source: NOAA[90]

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

Figure 35: Monthly Climate Normals - Max Temperature

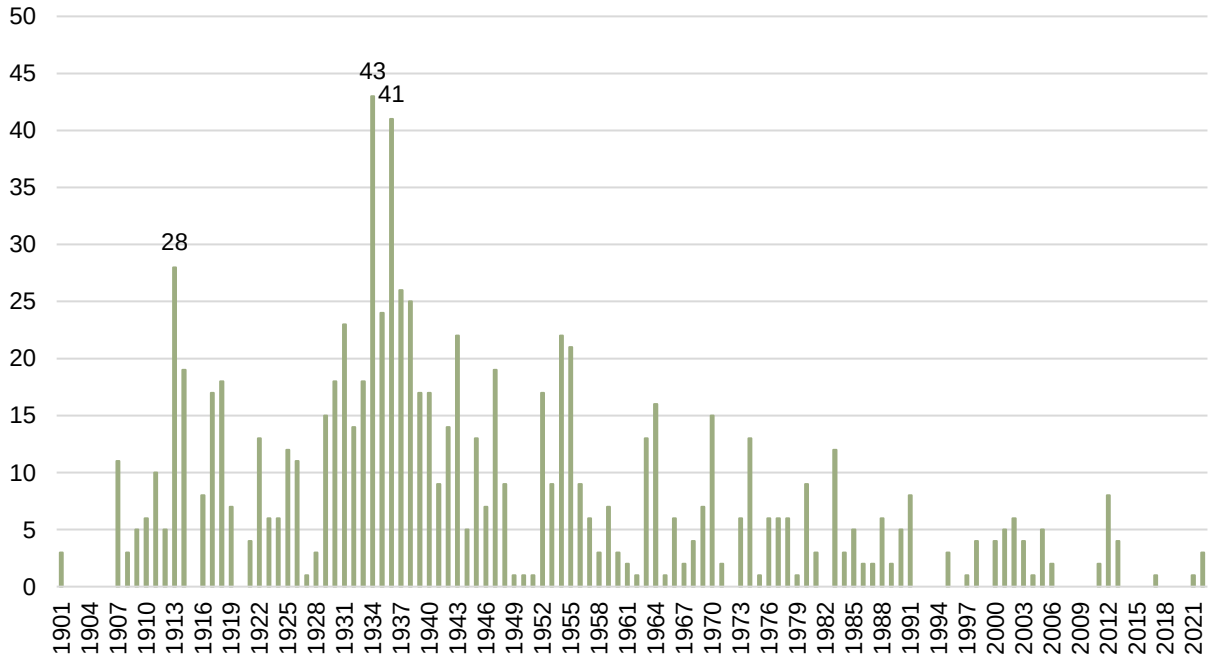


Source: NCEI, 1991-2020

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 43 days and in 1936 with 41 days. Conversely, 2020 was the most recent "coolest" year on record, with no days above 100°F.

Figure 36: Number of Days Above 100°F



Source: HPRCC, 1901-2022

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 from 2000 to 2021. 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 57: 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	$7,639,951	$347,271

Source: 1 HPRCC (1901-2022); 2 Indicates data is from NCEI (Jan 1996 to April 2022); 3 Indicates data is from USDA RMA (2000 to 2021)

Climate Change

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*[91] 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.

Table 58: Extreme Heat Predictions for Days over 100F

County	Midcentury Prediction 2036-2065 (Days per year)	Late Century Prediction 2070-2099 (Days per year)
Gosper	23	50
Kearney	30	57
Phelps	25	52

Source: Union of Concerned Scientists, 2023[92]

Impacts from climate change will significantly affect the prevalence and extent of extreme heat conditions. The Fourth National Climate Assessment noted numerous impacts including increasing health risks from extreme heat conditions or increased severe wildfire events with hot dry conditions.[93] Jurisdictions across the planning area may also experience more than one climate related impact simultaneously such as drought and extreme heat.

Probability

Extreme heat is a regular part of the climate for the planning area; with 98 years out of 122 having at least one day of 100°F. The probability that extreme heat will occur in any given year in the planning area is 80%. Due to the anticipated impacts from climate change, the likelihood of future extreme heat events will increase in frequency.

91 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.
92 Union of Concerned Scientists. 2022. "Extreme Heat and Climate Change: Interactive Tool". https://www.ucsusa.org/resources/killer-heat-interactive-tool.
93 U.S. Global Change Research Program. 2018. "Fourth National Climate Assessment". https://nca2018.globalchange.gov/.

Future Development

Any increases in population and development will elevate exposure levels to extreme heat. There are several ways for communities to minimize the impacts of extreme heat. Communities can plant trees and other vegetation to provide more natural shade and make green infrastructure improvements. Many of these options can be required during new development but can also be added to areas that are already developed.

Regional Vulnerabilities

The nonprofit First Street Foundation has developed a Risk Factor tool to help understand risks from a changing climate at the county or community level. Risk Factor provides an overview for heat risk at the county level. The following table outlines key risk factors from heat risk.

Table 59: Heat Risk

	Gosper County	Kearney County	Phelps County
Overall Heat Factor Risk	Moderate Risk	Moderate Risk	Moderate Risk
Total Properties at Risk	3,195 (67% of homes)	5,706 (97% of homes)	7,712 (84% of homes)
Likelihood of 3+ Day Heat Wave (>101°F)	52% this year 80% in 30 years	54% this year 81% in 30 years	55% this year 81% in 30 years
Health Caution Days	46 days this year 62 days in 30 years	54 days this year 69 days in 30 years	49 days this year 65 days in 30 years
Dangerous Days	6 days this year 15 days in 30 years	11 days this year 22 days in 30 years	8 days this year 18 days in 30 years
Hot Days	7 days this year 17 days in 30 years	7 days this year 16 days in 30 years	7 days this year 15 days in 30 years
Number of Cooling Days (requiring AC)	161 days this year 171 days in 30 years	163 days this year 173 days in 30 years	159 days this year 169 days in 30 years

Source: Risk Factor[94]

Note: Health Caution Days = days where "feels like" temperature exceeds 90°F; Dangerous Days = days where "feels like" temperature exceeds 100°F; Hot Days = days where "feels like" temperature exceeds 101°F.

The planning area is a mixture of rural farmland and small sized communities, which presents an added vulnerability to extreme heat events. In rural areas those suffering from an extreme heat event may be farther away from medical resources causing dangerous situations for the elderly and those with preexisting conditions. The following table provides information related to regional vulnerabilities. For jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles*.

94 Risk Factor. January 2023. "Risk Factor: Heat Factor". https://riskfactor.com/.

Table 60: 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
Community Lifelines	-Damages to roadways (prolonged extreme events) -Stressing electrical systems (brownouts during peak usage) -Loss of power

Community Top Hazard Status

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

Jurisdictions and Stakeholders	
Holdrege	

Flooding

Flooding can occur on a local level, sometimes affecting only a few streets, but can also extend throughout a large area, 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 in Nebraska: 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 are 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 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 frequently occur on wide, shallow rivers such as the Platte River, although other rivers can be impacted.

Location

The Tri-Basin NRD resides in the Republican River Basin, Platte River Basin, and Little Blue River Basin. These rivers as well as their tributaries are potential locations for flooding to occur. Table 61 shows current statuses of Flood Insurance Rate Map (FIRM) panels. Figure 37 shows the mapped floodplain for the planning area. For jurisdictional-specific maps, please refer to *Section Seven: Participant Sections.*

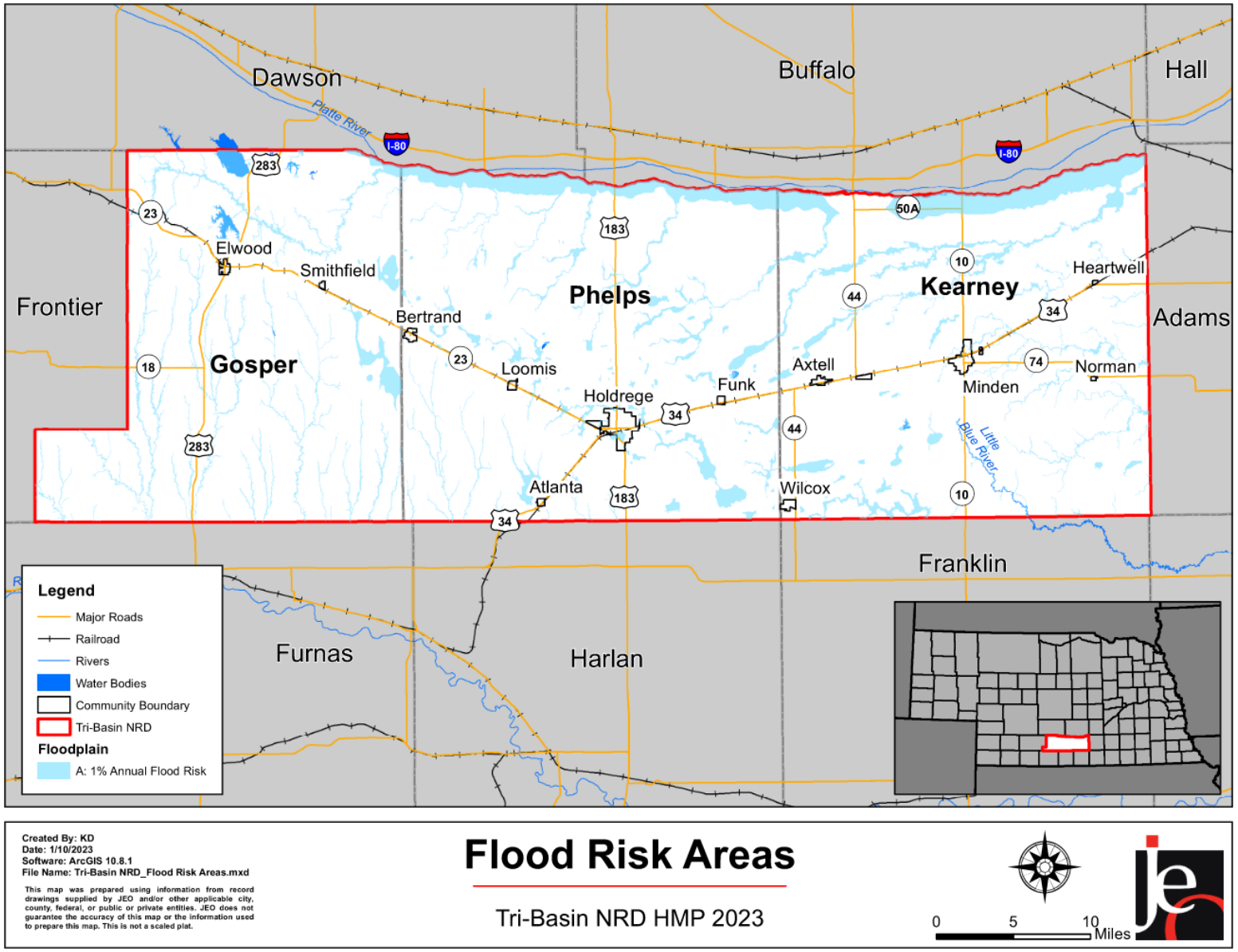
Table 61: FEMA FIRM Panel Status

Jurisdiction	Panel Number	Effective Date
Gosper County	31073CIND0A, 31073C0025A, 31073C0050A, 31073C0075A, 31073C0100A, 31073C0125A, 31073C0150A, 31073C0175A, 31073C0200A, 31073C0225A, 31073C0250A, 31073C0275A, 31073C0300A, 31073C0325A, 31073C0350A	08/04/2005
Elwood	31073CIND0A, 31073C0125A	08/04/2005
Smithfield	31073C0150A	08/04/2005
Kearney County	31099CIND0B, 31099C0025A, 31099C0040A, 31099C0045A, 31099C0075A, 31099C0100A, 31099C0125A, 31099C0150A, 31099C0175A, 31099C0190A, 31099C0200A, 31099C0225A, 31099C0250A, 31099C0260A, 31099C0275A, 31099C0300A, 31099C0305A, 31099C0325A, 31099C0350A, 31099C0375A, 31099C0380A, 31099C0385A, 31099C0425A, 31099C0450A, 31099C0475A, 31099C0500A	01/16/2004, 02/18/2005
Axtell	31099CIND0B, 31099C0260A, 31099C0300A	01/16/2004, 02/18/2005
Heartwell	31099CIND0B, 31099C0225A	01/16/2004, 02/18/2005
Minden	31099CIND0B, 31099C0190A, 31099C0305A, 31099C0325A	01/16/2004, 02/18/2005
Norman	31099CIND0B, 31099C0350A	01/16/2004, 02/18/2005
Wilcox	31099CIND0B, 31099C0275A, 31099C0380A, 31099C0385A	01/16/2004, 02/18/2005
Phelps County	31137CIND0A, 31137C0025C, 31137C0050C, 31137C0075C, 31137C0100C, 31137C0125C, 31137C0145C, 31137C0150C, 31137C0175C, 31137C0200C, 31137C0225C, 31137C0250C, 31137C0275C, 31137C0285C, 31137C0300C, 31137C0310C, 31137C0320C, 31137C0325C, 31137C0330C, 31137C0340C, 31137C0350C, 31137C0355C, 31137C0375C, 31137C0400C, 31137C0425C, 31137C0430C, 31137C0450C, 31137C0475C, 31137C0500C	01/16/2008
Atlanta	31137CIND0A, 31337C0325C, 31137C0430C	01/16/2008
Bertrand	31137CIND0A, 31137C0145C, 31137C0175C	01/16/2008
Funk	-	-
Holdrege	11331137CIN0A, 31137C0310C, 31137C0320C, 31137C0330C, 31137C0340C	01/16/2008
Loomis	31137CIND0A, 31137C0285C, 31137C0325C	01/16/2008

Source: FEMA, 2023[95]

95 Federal Emergency Management Agency. 2023. “FEMA Flood Map Service Center”. Accessed January 2023. http://msc.fema.gov/portal/advanceSearch.

Figure 37: 1% Annual Flood Risk Hazard Areas



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 better protect their citizens. A portion of Kearney County including the Village of Axtell, Village of Heartwell, City of Minden, and Village of Norman have gone through the Risk MAP process. As part of that process, a HAZUS analysis was performed for the Risk MAP areas. The figures below show the HAZUS analysis results. Figure 43 shows the boundary for the Risk MAP project. 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.

Figure 38: Kearney County - Estimated Potential Losses for Flood Event Scenarios

Type	Inventory Estimated Value	% of Total	10% (10-yr) Dollar Losses[1]	10% Loss Ratio[2]	2% (50-yr) Dollar Losses[1]	2% Loss Ratio[2]	1% (100-yr) Dollar Losses[1]	1% Loss Ratio[2]	0.2% (500-yr) Dollar Losses[1]	0.2% Loss Ratio[2]	Annualized Losses[1] ($/yr)	Ann. Loss Ratio[2]
Residential Building & Contents	$108,673,000	66%	$28,000	0%	$77,000	0%	$94,000	0%	$161,000	0%	$2,000	
Commercial Building & Contents	$11,500,000	7%	$0	0%	$0	0%	$1,000	0%	$4,000	0%	$0	
Other Building & Contents	$43,392,000	27%	$11,000	0%	$24,000	0%	$28,000	0%	$63,000	0%	$1,000	
Total Building & Contents[3]	$163,565,000	100%	$39,000	0%	$101,000	0%	$123,000	0%	$228,000	0%	$3,000	
Business Disruption[4]	N/A	N/A	$0	N/A	$1,000	N/A	$1,000	N/A	$3,000	N/A	$0	N/A
TOTAL[5]	$163,565,000		$39,000		$102,000		$124,000		$231,000		$3,000	

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

[1]Losses shown are rounded to nearest $10,000 for values under $100,000 and to the nearest $100,000 for values over $100,000.
[2]Loss ratio = Dollar Losses ÷ Estimated Value. Loss Ratios are rounded to the nearest integer percent.
[3]Total Building and Contents = Residential Building and Contents + Commercial Building and Contents + Other Building and Contents.
[4]Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.
[5]Total = Total Building and Contents + Business Disruption

The figures in this table only represent information within the Upper Little Blue.

Source: FEMA[96]

Figure 39: Village of Axtell - Estimated Potential Losses for Flood Event Scenarios

Type	Inventory Estimated Value	% of Total	10% (10-yr) Dollar Losses[1]	10% Loss Ratio[2]	2% (50-yr) Dollar Losses[1]	2% Loss Ratio[2]	1% (100-yr) Dollar Losses[1]	1% Loss Ratio[2]	0.2% (500-yr) Dollar Losses[1]	0.2% Loss Ratio[2]	Annualized Losses[1] ($/yr)	Ann. Loss Ratio[2]
Residential Building & Contents	$2,106,000	21%	$0	0%	$0	0%	$0	0%	$0	0%	$0	
Commercial Building & Contents	$2,098,000	59%	$0	0%	$0	0%	$0	0%	$0	0%	$0	
Other Building & Contents	$5,980,000	21%	$0	0%	$2,000	0%	$2,000	0%	$4,000	0%	$0	
Total Building & Contents[3]	$10,184,000	100%	$0	0%	$2,000	0%	$2,000	0%	$4,000	0%	$0	
Business Disruption[4]	N/A	N/A	$0	N/A	$0	N/A	$0	N/A	$0	N/A	$0	N/A
TOTAL[5]	$10,184,000		$0		$2,000		$2,000		$4,000		$0	

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

[1]Losses shown are rounded to nearest $10,000 for values under $100,000 and to the nearest $100,000 for values over $100,000.
[2]Loss ratio = Dollar Losses ÷ Estimated Value. Loss Ratios are rounded to the nearest integer percent.
[3]Total Building and Contents = Residential Building and Contents + Commercial Building and Contents + Other Building and Contents.
[4]Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.
[5]Total = Total Building and Contents + Business Disruption

The figures in this table only represent information within the Upper Little Blue.

Source: FEMA

96 FEMA. March 2016. "Flood Risk Report: Upper Little Blue, 10270206".

Figure 40: Village of Heartwell - Estimated Potential Losses for Flood Event Scenarios

Type	Inventory Estimated Value	% of Total	10% (10-yr) Dollar Losses[1]	10% Loss Ratio[2]	2% (50-yr) Dollar Losses[1]	2% Loss Ratio[2]	1% (100-yr) Dollar Losses[1]	1% Loss Ratio[2]	0.2% (500-yr) Dollar Losses[1]	0.2% Loss Ratio[2]	Annualized Losses[1] ($/yr)	Ann. Loss Ratio[2]
Residential Building & Contents	$8,360,000	70%	$1,000	0%	$4,000	0%	$4,000	0%	$9,000	0%	$0	
Commercial Building & Contents	$0	0%	$0	0%	$0	0%	$0	0%	$0	0%	$0	
Other Building & Contents	$3,510,000	30%	$1,000	0%	$2,000	0%	$2,000	0%	$5,000	0%	$0	
Total Building & Contents[3]	$11,870,000	100%	$2,000	0%	$6,000	0%	$6,000	0%	$14,000	0%	$0	
Business Disruption[4]	N/A	N/A	$0	N/A	$0	N/A	$0	N/A	$0	N/A	$0	N/A
TOTAL[5]	$11,870,000		$2,000		$6,000		$6,000		$14,000		$0	

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

[1]Losses shown are rounded to nearest $10,000 for values under $100,000 and to the nearest $100,000 for values over $100,000.
[2]Loss ratio = Dollar Losses ÷ Estimated Value. Loss Ratios are rounded to the nearest integer percent.
[3]Total Building and Contents = Residential Building and Contents + Commercial Building and Contents + Other Building and Contents.
[4]Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.
[5]Total = Total Building and Contents + Business Disruption

The figures in this table only represent information within the Upper Little Blue.

Source: FEMA[97]

Figure 41: City of Minden - Estimated Potential Losses for Flood Event Scenarios

Type	Inventory Estimated Value	% of Total	10% (10-yr) Dollar Losses[1]	10% Loss Ratio[2]	2% (50-yr) Dollar Losses[1]	2% Loss Ratio[2]	1% (100-yr) Dollar Losses[1]	1% Loss Ratio[2]	0.2% (500-yr) Dollar Losses[1]	0.2% Loss Ratio[2]	Annualized Losses[1] ($/yr)	Ann. Loss Ratio[2]
Residential Building & Contents	$19,133,000	47%	$5,000	0%	$13,000	0%	$18,000	0%	$43,000	0%	$1,000	
Commercial Building & Contents	$11,348,000	28%	$2,000	0%	$6,000	0%	$10,000	0%	$26,000	0%	$0	
Other Building & Contents	$10,005,000	25%	$4,00	0%	$13,000	0%	$20,000	0%	$40,000	0%	$0	
Total Building & Contents[3]	$40,486,000	100%	$11,000	0%	$32,000	0%	$48,000	0%	$109,000	0%	$1,000	
Business Disruption[4]	N/A	N/A	$0	N/A	$0	N/A	$0	N/A	$4,000	N/A	$0	N/A
TOTAL[5]	$40,486,000		$11,000		$32,000		$48,000		$113,000		$1,000	

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

[1]Losses shown are rounded to nearest $10,000 for values under $100,000 and to the nearest $100,000 for values over $100,000.
[2]Loss ratio = Dollar Losses ÷ Estimated Value. Loss Ratios are rounded to the nearest integer percent.
[3]Total Building and Contents = Residential Building and Contents + Commercial Building and Contents + Other Building and Contents.
[4]Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.
[5]Total = Total Building and Contents + Business Disruption

The figures in this table only represent information within the Upper Little Blue.

Source: FEMA

97 FEMA. March 2016. “Flood Risk Report: Upper Little Blue, 10270206”.

Figure 42: Village of Norman - Estimated Potential Losses for Flood Event Scenarios

Type	Inventory Estimated Value	% of Total	10% (10-yr) Dollar Losses[1]	10% Loss Ratio[2]	2% (50-yr) Dollar Losses[1]	2% Loss Ratio[2]	1% (100-yr) Dollar Losses[1]	1% Loss Ratio[2]	0.2% (500-yr) Dollar Losses[1]	0.2% Loss Ratio[2]	Annualized Losses[1] ($/yr)	Ann. Loss Ratio[2]
Residential Building & Contents	$17,410,000	76%	$8,000	0%	$18,000	0%	$22,000	0%	$33,000	0%	$1,000	
Commercial Building & Contents	$2,920,000	13%	$2,000	0%	$5,000	0%	$6,000	0%	$10,000	0%	$0	
Other Building & Contents	$2,470,000	11%	$2,000	0%	$4,000	0%	$7,000	0%	$10,000	0%	$0	
Total Building & Contents[3]	$22,800,000	100%	$12,000	0%	$27,000	0%	$35,000	0%	$53,000	0%	$1,000	
Business Disruption[4]	N/A	N/A	$0	N/A	$0	N/A	$0	N/A	$0	N/A	$0	N/A
TOTAL[5]	$22,800,000		$12,000		$27,000		$35,000		$53,000		$1,000	

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

[1]Losses shown are rounded to nearest $10,000 for values under $100,000 and to the nearest $100,000 for values over $100,000.
[2]Loss ratio = Dollar Losses ÷ Estimated Value. Loss Ratios are rounded to the nearest integer percent.
[3]Total Building and Contents = Residential Building and Contents + Commercial Building and Contents + Other Building and Contents.
[4]Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.
[5]Total = Total Building and Contents + Business Disruption

The figures in this table only represent information within the Upper Little Blue.

Source: FEMA[98]

Extent

The NWS has three categories to define the severity of a flood once a river reaches flood stage as indicated in Table 62. Actual impacts will vary by community depending on severity of flood event and local conditions such as total developed area in the floodplain or existing flood risk reduction structures. Floodplain maps for each community and county are located in each individual community profile.

Table 62: 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[99]

Figure 44 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 45, the most common months for flooding within the planning area are in May, June, and July.

98 FEMA. March 2016. "Flood Risk Report: Upper Little Blue, 10270206".
99 National Weather Service. 2017. "Flood Safety". https://www.weather.gov/safety/flood.

Figure 43: Flood Risk Map - Upper Little Blue Watershed

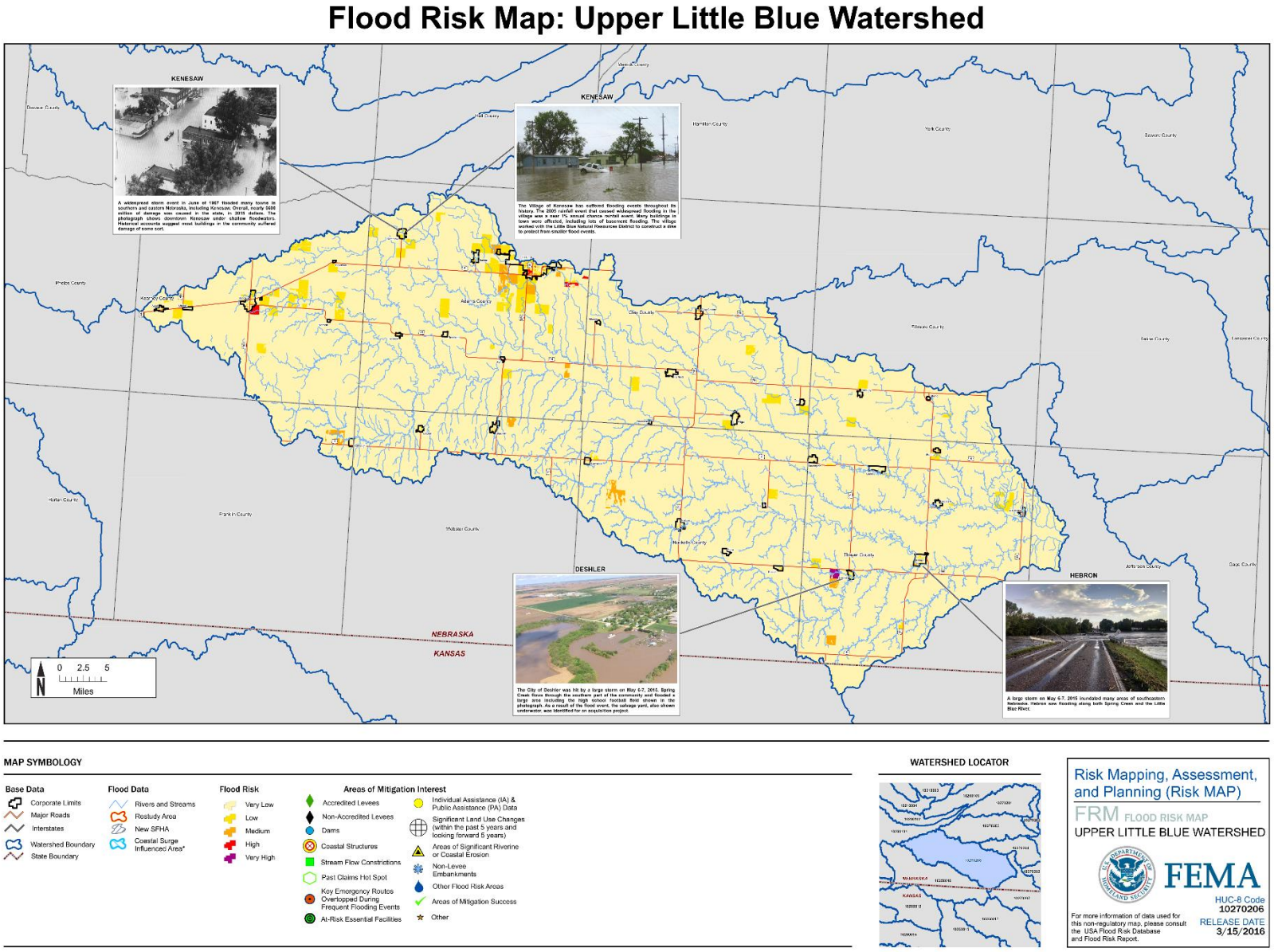
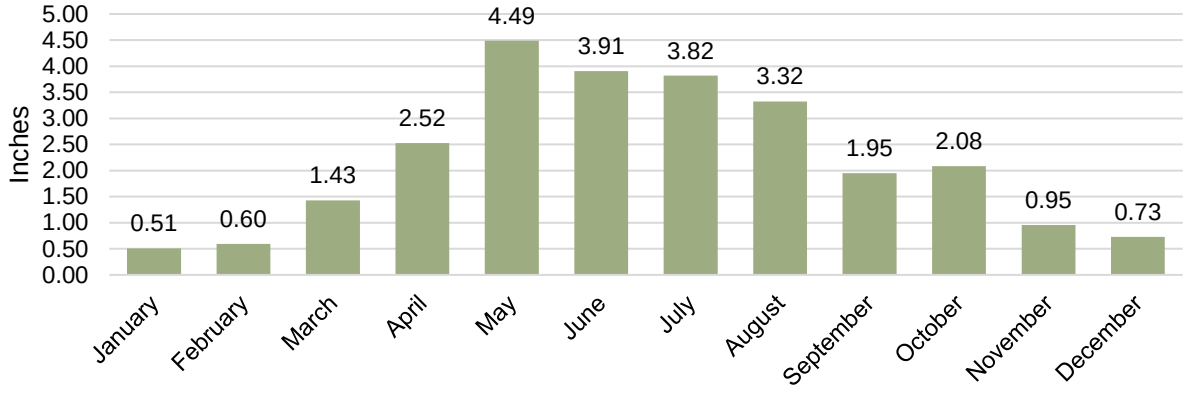
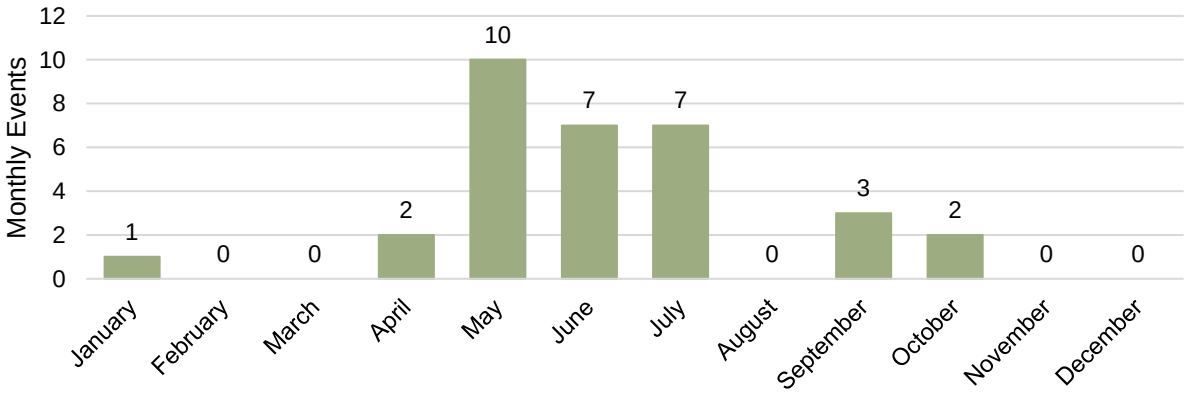


Figure 44: Average Monthly Precipitation for the Planning Area



Source: NOAA, 1991-2020[100]

Figure 45: Monthly Events for Flood/Flash Floods



Source: NCEI, 1996-April 2022

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 owners of structures located in 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. Additional information about NFIP participation, implementation, and enforcement are located in *Section 7: Community Profiles*.

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.

100 NOAA National Centers for Environmental Information. September 2022. "Data Tools: 1991-2020 Normals". https://www.ncei.noaa.gov/access/us-climate-normals/.

Table 63: NFIP Participation

Jurisdiction	Participate in NFIP	Eligible-Regular Program	Date Current Map	Sanction	Suspension	Rescinded
Gosper County	Yes	3/22/2006	8/4/2005	-	-	-
Elwood	Yes	3/31/2006	NSFHA	-	-	-
Smithfield	Yes	2/26/2008	8/4/2005	-	-	-
Kearney County	Yes	1/16/2004	2/18/2005	-	-	-
Axtell	Yes	2/24/1994	1/16/2004	-	-	-
Heartwell	No	-	1/16/2004	1/16/2005	-	-
Minden	Yes	9/24/1984	1/16/2004	-	-	-
Norman	No	-	1/16/2004	1/16/2005	-	-
Wilcox	Yes	9/24/1984	1/16/2004	-	-	-
Phelps County	Yes	2/1/1990	1/16/2008(M)	-	-	-
Atlanta	Yes	1/16/2008	1/16/2008(M)	-	-	-
Bertrand	Yes	6/24/2008	1/16/2008(M)	-	-	-
Funk	Yes	1/16/2008	NSFHA	-	-	-
Holdrege	Yes	4/2/1986	1/16/2008(M)	-	-	-
Loomis	No	-	1/16/2008	1/16/2009	-	-

Source: Federal Emergency Management Agency, National Flood Insurance Program, 2023[101]
**(M) indicates no elevation determined – All Zone A, C, and X*

Table 64: NFIP Policies in Force and Total Payments

Jurisdiction	Policies In-force	Total Coverage	Total Losses	Total Payments
Gosper County	3	$379,000	0	N/A
Elwood	0	N/A	0	N/A
Smithfield	0	N/A	0	N/A
Kearney County	17	$2,844,000	3	$6,349
Axtell	0	N/A	0	N/A
Heartwell	0	N/A	0	N/A
Minden	0	N/A	1	$357
Norman	0	N/A	0	N/A
Wilcox	0	N/A	0	N/A
Phelps County	3	$453,000	7	$41,864
Atlanta	0	N/A	0	N/A
Bertrand	0	N/A	0	N/A
Funk	0	N/A	0	N/A
Holdrege	3	$576,000	5	$70,074

101 Federal Emergency Management Agency. 2023. “Community Status Book Report”. Accessed January 2023. https://www.fema.gov/cis/NE.html.

Jurisdiction	Policies In-force	Total Coverage	Total Losses	Total Payments
Loomis	0	N/A	0	N/A

Source: FEMA - 2023

It should be noted that while the number of policies in force may change monthly and annually as representative enroll, maintain, or lapse policies, the total number of losses and payments are cumulative over time.

This plan strongly encourages each county and community to participate in the NFIP. All participating counties and communities have confirmed that they will 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 January 2023, no communities in the three-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 no repetitive loss or severe repetitive loss properties located in the planning area as of November 2022.

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 (including 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, 23 flash flooding events resulted in $6,015,000 in property damage, while nine riverine flooding events resulted in $93,000 in property damage. USDA RMA data does not distinguish the difference between riverine flooding damage and flash flooding damage. The total crop loss according to the RMA is $822,445. Descriptions of the most damaging flood events from the NCEI are listed below.

- **June 19, 2000 – Flash Flood:** Reported $250,000 in property damage in Kearney County. After weeks of little or no rain, thunderstorms unleashed a torrent of rain, hail, and high winds across much of south-central Nebraska. The thunderstorms developed west and north of Kearney and moved east and southeast throughout the evening.

- **May 11, 2005 – Flash Flood:** Reported $5,000,000 in property damages in Gosper County ($1,000,000), Kearney County ($3,000,000), and Phelps County ($1,000,000). Though well predicted, the severe weather and flooding on the night of May 11 was even worse than imagined. Thunderstorms ravaged a large part of south-central Nebraska with hail, high winds, a tornado and catastrophic flooding.

- **July 8, 2019 – Flash Flood:** Reported $300,000 in property damages in Gosper County ($100,000), Kearney County ($100,000), and Phelps County ($100,000). Excessive rainfall, flash flooding, and severe winds occurred this Monday afternoon and evening. Widely scattered thunderstorms began forming around 1:00 pm along and west of Highway 183. By 2:00 pm, a persistent line segment of thunderstorms began affecting western Dawson County. Over the following four hours, this southwest-northeast oriented line slowly crept east across Dawson County into western Buffalo County, with its southwest end moving from Gosper County into Phelps County. Between 5:00 and 9:00 pm, numerous small thunderstorms formed over Gosper, Furnas, Phelps, and Harlan

counties. Storms kept forming over these counties until a multi-county area of persistent heavy rain enveloped these counties and expanded north to include Dawson and Buffalo counties. By 9:00 pm, the heaviest rain had morphed to the southeast side of a large, expanding rain shield, with a nearly stationary band stretching from southwest to northeast across Furnas, Phelps, and Buffalo counties. After 10:00 pm, a large squall line that had developed far to the west, over the high plains, began moving into south-central Nebraska. It brought a third period of heavy rain to these counties, but its cold pool aided in shoving the training, slow-moving mass of heavy rain eastward. Severe downburst winds occurred in a few spots with this squall line. 36 power poles were snapped off over a 2-mile stretch southeast of Holdrege. Loomis had 8.88 inches of rain and Minden recorded 5.9 inches. Late in the afternoon, a few thunderstorms moved north from Kansas ahead of the storms west of Highway 183. These storms produced some spotty tree damage in Webster and Kearney counties. The excessive rainfall resulted in flash flooding in parts of Dawson, Gosper, Furnas, Harlan, Phelps, and Buffalo counties, including flooding across parts of U.S. Highways 6, 30, 183, and 283. Numerous gravel county roads were inundated by flood waters and impassible. Many of them were severely damaged.

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 $234,923 in property damage and $37,384 in crop losses per year for the planning area.

Table 65: 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	32	1.2	$6,108,000	$234,923	$822,445	$37,384

Source: 1 Indicates data is from NCEI (Jan 1996 to April 2022); 2 Indicates data is from USDA RMA (2000 to 2021)

Climate Change

In the warmer months, convective storms are common and include flash flood-producing rainstorms. 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 heavy rain events will lead to more flooding and larger magnitude flood events. NOAA has created the Climate Mapping for Resilience and Adaptation tool that looks at how different emission scenarios affect climatological hazards. Table 66 shows that the annual total precipitation is expected to increase in both low emissions and high emission scenarios. Changes will likely occur in timing and intensity. Winter and spring will be 15-25% wetter, summer will be 5-15% drier, and fall will be 5% wetter.[102] Table 67 shows the annual number of days that exceed the 99th percentile precipitation increases as time goes on in both the lower emissions and higher emissions scenario.

102 NCEI. 2022. “State Climate Summaries – Nebraska”. https://statesummaries.ncics.org/chapter/ne/#:~:text=The%20state%20is%20located%20far,(1895%E2%80%932020)%20averag.

Table 66: Average Annual Total Precipitation

County	Emission Scenario	Historical (1976-2005)	Early Century (2015-2044)	Mid Century (2035-2064)	Late Century (2070-2099)
Gosper	Lower Emissions (RCP 4.5)	21.6 Inches	21.7 Inches	21.9 Inches	22.1 Inches
	Higher Emissions (RCP 8.5)	21.6 Inches	21.5 Inches	21.9 Inches	22.1 Inches
Kearney	Lower Emissions (RCP 4.5)	24.4 Inches	24.7 Inches	24.9 Inches	25.0 Inches
	Higher Emissions (RCP 8.5)	24.4 Inches	24.5 Inches	25.1 Inches	25.4 Inches
Phelps	Lower Emissions (RCP 4.5)	23.0 Inches	23.3 Inches	23.4 Inches	23.6 Inches
	Higher Emissions (RCP 8.5)	23.0 Inches	23.0 Inches	23.6 Inches	23.8 Inches

Source: NOAA[103]

Table 67: Annual Days that Exceed 99th Precipitation

County	Emission Scenario	Historical (1976-2005)	Early Century (2015-2044)	Mid Century (2035-2064)	Late Century (2070-2099)
Gosper	Lower Emissions (RCP 4.5)	4.1 Days	4.4 Days	4.6 Days	4.8 Days
	Higher Emissions (RCP 8.5)	4.1 Days	4.3 Days	4.7 Days	5.1 Days
Kearney	Lower Emissions (RCP 4.5)	4.5 Days	4.9 Days	5.2 Days	5.5 Days
	Higher Emissions (RCP 8.5)	4.5 Days	4.9 Days	5.5 Days	6.0 Days
Phelps	Lower Emissions (RCP 4.5)	4.3 Days	4.7 Days	4.9 Days	5.2 Days
	Higher Emissions (RCP 8.5)	4.3 Days	4.6 Days	5.2 Days	5.7 Days

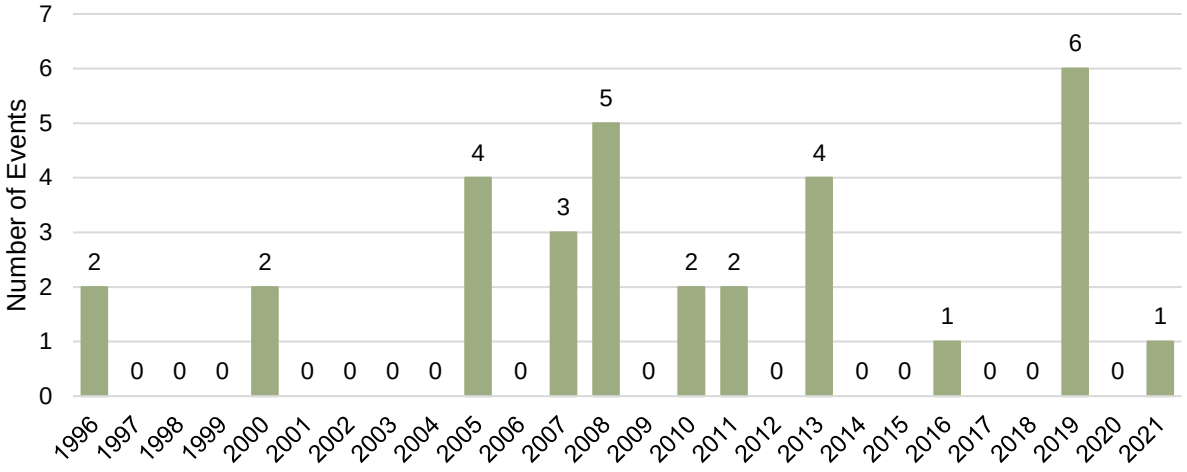
Source: NOAA

Probability

The NCEI reports 23 flash flooding and nine flooding events for a total of 32 events from January 1996 to April 2022. Some years had multiple flooding events. Figure 46 shows the events broken down by year. Based on the historic record and reported incidents by participating communities, there is a 42 percent probability that flooding will occur annually in the planning area. Due to the anticipated impacts from climate change, the likelihood of future flooding events will increase in frequency and magnitude.

103 NOAA. January 2023. “Climate Mapping for Resilience and Adaptation”. https://livingatlas.arcgis.com/assessment-tool/explore/details.

Figure 46: Year Events for Floods/Flash Floods



Source: NCEI, 1996-April 2022

Future Development

Any future development in floodplains should be discouraged to protect future assets. Land-use regulations should be used to limit development in floodplains and other flood prone areas as well as protecting natural flood mitigation features. Buyout programs can be used to eliminate properties located in floodplains, especially properties that have experienced repetitive losses. Communities may also consider incorporating "Green Infrastructure" to address flooding concerns. Examples of this would include using permeable surfaces for parking areas, using rainwater retention swales, developing rain gardens, developing green roofs, and establishing greenways. To further reduce future risk to flooding, communities can implement stormwater management plans, participate in the National Pollutant Discharge Elimination System program, or participate in the NFIP or Community Rating System programs.

Nebraska's minimum standards for floodplain management require that all new construction and substantial improvements of residential structures shall have the lowest floor (including basements) elevated at least one foot above the base flood elevation. Nebraska standards also prohibit new structures for human habitation in the floodway.[104] These requirements will help reduce flood impacts and damages by requiring a one foot "freeboard" to allow for known flood hazards and result in lower premiums for those participating in the NFIP.

Regional Vulnerabilities

An updated national study examining social vulnerability as it relates to flood events found that low-income and minority populations are disproportionately vulnerable to flood events.[105] 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.

104 Nebraska Department of Natural Resources. June 27, 2008. "Rules and regulations Concerning Minimum Standards for Floodplain Management Programs". https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/desk-reference/legal-authority/Title_455_0708.pdf.

105 Tate, E., Rahman, M.A., Emrich, C.T. et al. Flood exposure and social vulnerability in the United States. Nat Hazards (2021). https://doi.org/10.1007/s11069-020-04470-2

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 NeDNR's National Flood Insurance Coordinator 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

The website Risk Factor uses the First Street Foundation Flood Model to calculate any location's risk of flooding from rain events and waterways. Risk is calculated as an inundation of five centimeters or more to the building in the 500-year return period. To learn more about how Risk Factor calculates flood risk and the scoring system you can visit the website at: https://riskfactor.com/methodology/flood. The table below gives the flooding risk for each jurisdiction in the three-county planning area as determined by Risk Factor.

Table 68: Risk Factor - Flooding Risk

Jurisdiction	Property Risk	Number of Properties at Risk*	Road Risk	Miles of Road at Risk*
Gosper County	Minor Risk	263 (9%)	Moderate Risk	107 out of 996 Miles
Elwood	Minor Risk	19 (6%)	Minor Risk	3 out of 18 Miles
Smithfield	Minimal Risk	0 (0%)	Minimal Risk	0 out of 4 Miles
Kearney County	Minor Risk	487 (11%)	Minor Risk	146 out of 1,455 Miles
Axtell	Moderate Risk	72 (20%)	Minor Risk	2 out of 16 Miles
Heartwell	Minor Risk	4 (6%)	Minor Risk	0 out of 3 Miles
Minden	Minor Risk	46 (4%)	Minor Risk	12 out of 57 Miles
Norman	Minimal Risk	0 (0%)	Minimal Risk	0 out of 2 Miles
Wilcox	Minor Risk	11 (6%)	Minor Risk	2 out of 12 Miles
Phelps County	Moderate Risk	500 (8%)	Minor Risk	159 out of 1,680 Miles
Atlanta	Minor Risk	3 (5%)	Minor Risk	1 out of 6 Miles
Bertrand	Minor Risk	8 (2%)	Minor Risk	3 out of 15 Miles
Funk	Minor Risk	33 (29%)	Minor Risk	1 out of 5 Miles
Holdrege	Minor Risk	44 (2%)	Minor Risk	16 out of 92 Miles
Loomis	Minor Risk	1 (<1%)	Minimal Risk	0 out of 9 Miles

**At Risk: Greater than 26% change of being severely affected by flooding over the next 30 years.*
Source: Risk Factor[106]

106 Risk Factor. "Flood Factor". Accessed January 2023. https://riskfactor.com/.

To analyze the value of building improvements located in the floodplain, GIS parcel data were acquired from each County Assessor. Building improvements include any built structures on the parcel. The data did not contain the number of structures on each parcel. A summary of the results of this analysis for the three-county planning area is provided in the following table.

Table 69: Exposure in the 1% Annual Flood Risk Area

Jurisdiction	Value of Improvements[1]	Population[2]	Agriculture Value[2]
Gosper County	$51,804,567	76	$5,848,489
Elwood	$0	N/A	N/A
Smithfield	$0	N/A	N/A
Kearney County	$63,472,360	595	$40,196,475
Axtell	$0	N/A	N/A
Heartwell	$0	N/A	N/A
Minden	$140,225	N/A	N/A
Norman	$0	N/A	N/A
Wilcox	$0	N/A	N/A
Phelps County	$29,592,925	225	$53,645,943
Atlanta	$0	N/A	N/A
Bertrand	$0	N/A	N/A
Funk	$0	N/A	N/A
Holdrege	$1,501,290	N/A	N/A
Loomis	$0	N/A	N/A

Source: 1 - County Assessors, 2022, 2 – NeDNR, 2022
N/A: Data is not available.

According to Risk Factor, Axtell, Gosper County, and Phelps County have the highest risk of flooding in the planning area. Each location has at least a moderate risk to either roadways or properties from flooding. Kearney County has the highest value of improvements in the floodplain. Significant flood events would impact the economy throughout the entire planning area as structures and roadways are damaged.

For addition flooding risk information see the *2022 Nebraska State Flood Hazard Mitigation Plan* (https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/floodplain/resources/2022_SFHMP_FINAL_20220630_Ver2.pdf) The following table is a summary of regional vulnerabilities. For jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles.*

Table 70: 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 -Gosper County: LEOP estimates a very small percentage of people reside within the one percent annual chance floodplain -Kearney County: LEOP estimates a very small percentage of people reside within the one percent annual chance floodplain -Phelps County: LEOP estimates a very small percentage of people reside within the one percent annual chance floodplain
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
Community Lifelines	-Damages to roadways, bridges, and railways -Wastewater facilities are at risk, particularly those in the floodplain -Community Lifelines, especially those in the floodplain, are at risk to damage (specific community lifelines located in the floodplain are noted within individual community profiles)

Community Top Hazard Status

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

Jurisdictions and Stakeholders	
Funk	Minden Volunteer Fire Department
Gosper County	Phelps County
Holdrege	Phelps County Farm Service Agency
Kearney County Farm Service Agency	Tri-Basin NRD
Loomis	

Grass/Wildfire

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

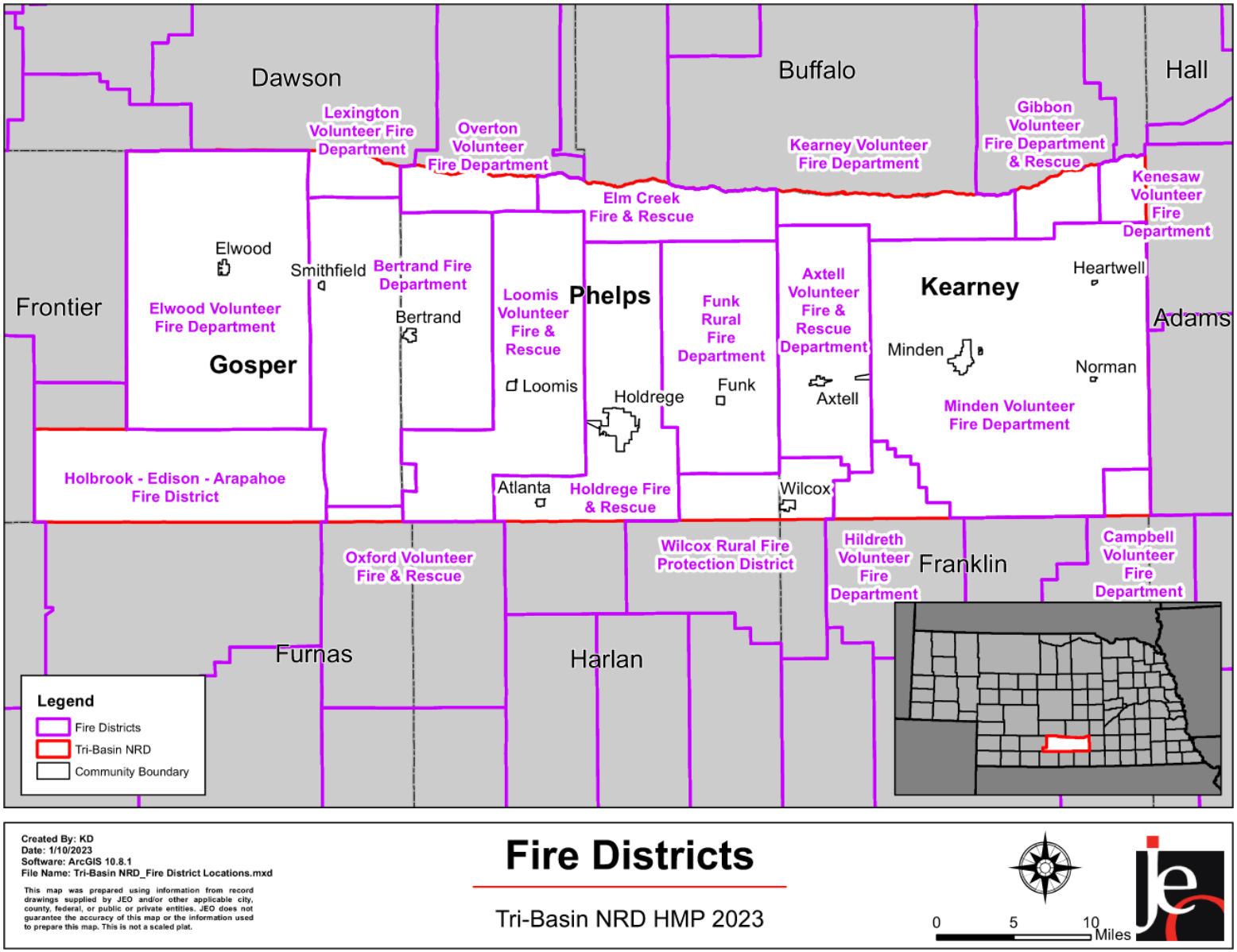
The NWS monitors the risk factors for wildfires, including high temperature, high wind speed, fuel moisture (greenness of vegetation), low humidity, and cloud cover on a daily basis. Fire danger predictions are updated regularly and should be reviewed frequently by community leaders and fire department officials.

Fire Protection

There were 18 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 47.

- Axtell Volunteer Fire & Rescue Department
- Bertrand Fire Department
- Campbell Volunteer Fire Department
- Elm Creek Fire & Rescue
- Elwood Volunteer Fire Department
- Funk Rural Fire Department
- Gibbon Volunteer Fire Department & Rescue
- Hildreth Volunteer Fire Department
- Holbrook – Edison – Arapahoe Fire District
- Holdrege Fire & Rescue
- Kearney Volunteer Fire Department
- Kenesaw Volunteer Fire Department
- Lexington Volunteer Fire Department
- Loomis Volunteer Fire & Rescue
- Minden Volunteer Fire Department
- Overton Volunteer Fire Department
- Oxford Volunteer Fire & Rescue
- Wilcox Rural Fire Protection District

Figure 47: Fire Districts in the Planning Area



Community Wildfire Protection Plans

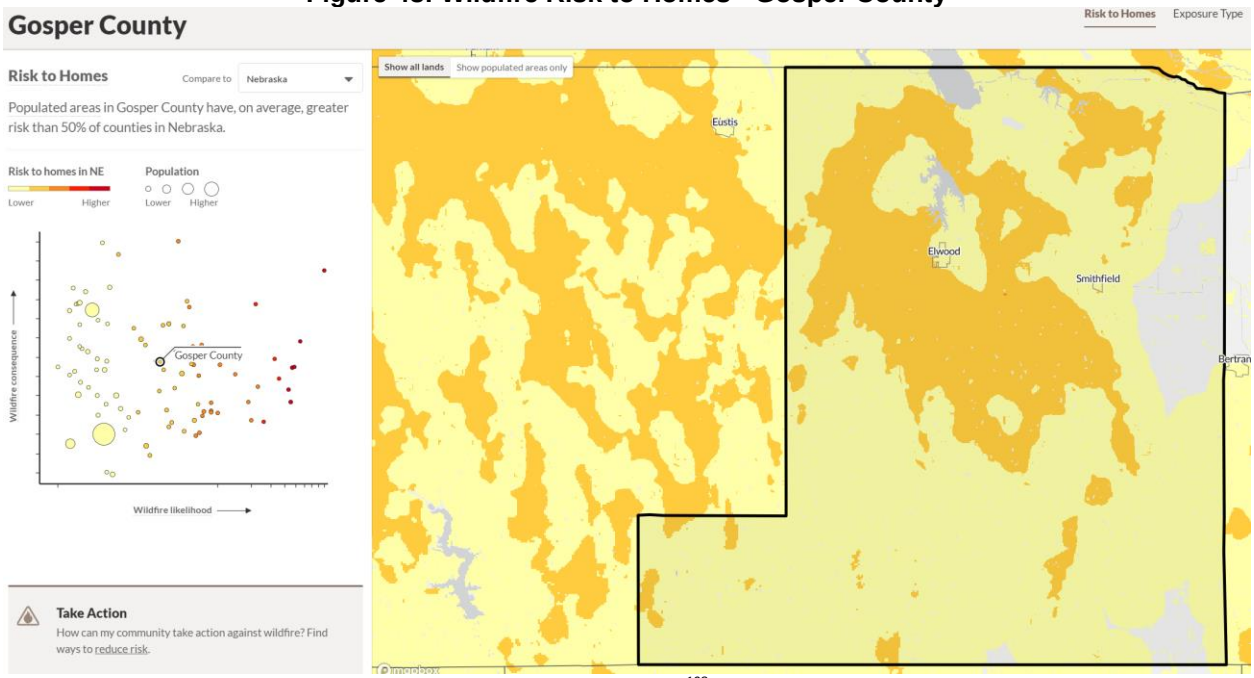
Even though grass/wildfires are a natural part of the ecosystem, they can present a substantial hazard to life and property, especially in the WUI. The planning area is covered by two Community Wildfire Protection Plans (CWPPs): 2021 Loess Canyons CWPP and 2021 South Central West Nebraska CWPP.[107] The purpose of the CWPPs is to help effectively manage wildfires and increase collaboration and communication among organizations who manage fire. The CWPPs discuss county-specific historical wildfire occurrences and impacts, identify areas most at risk from wildfires, discuss protection capabilities, and identify wildfire mitigation strategies.

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.

The figure below shows the greatest wildfire risk to homes is located primarily in the central portions of Gosper County. On average, populated areas in Gosper County have a greater risk than 50% of counties in Nebraska.

Figure 48: Wildfire Risk to Homes - Gosper County



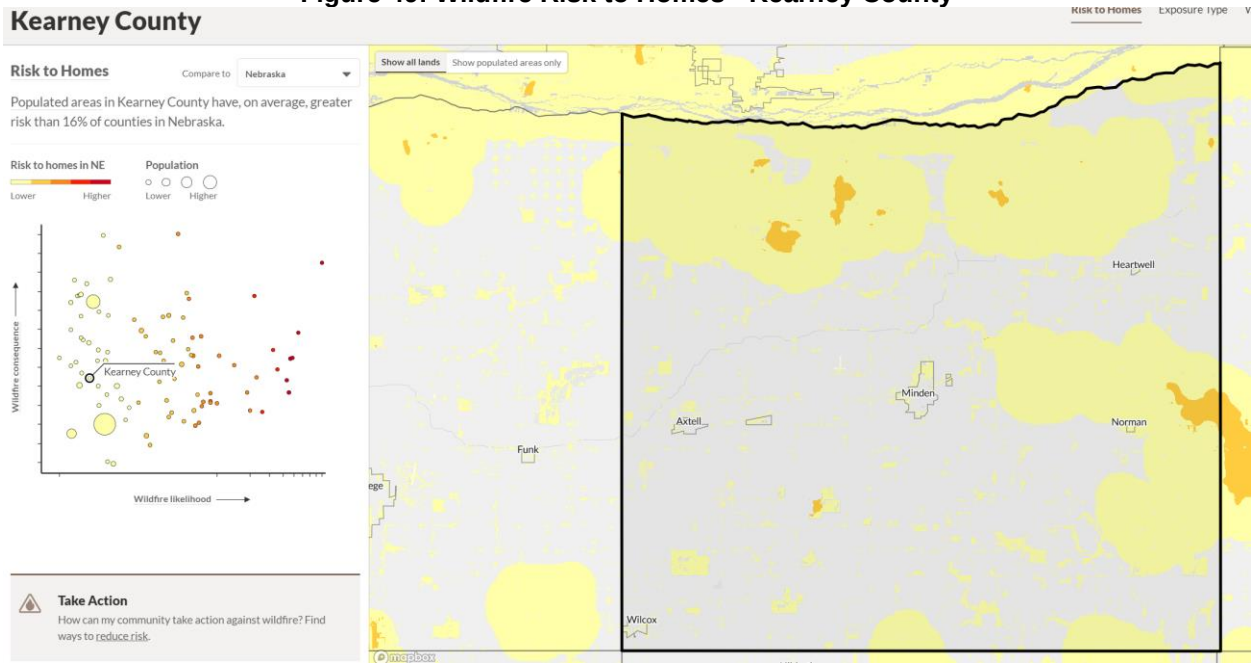
Source: USDA[108]

Figure 49 shows that the greatest wildfire risk to homes in Kearney County is located in northern and eastern boarders. Populated areas in Kearney County have, on average, a greater risk than 16% of counties in Nebraska.

107 Nebraska Forest Service. 2023. "Community Wildfire Protection Plans." https://nfs.unl.edu/publications/community-wildfire-protection-plans.

108 United States Department of Agriculture, United States Forest Service. 2023. "Wildfire Risk to Communities." https://wildfirerisk.org/.

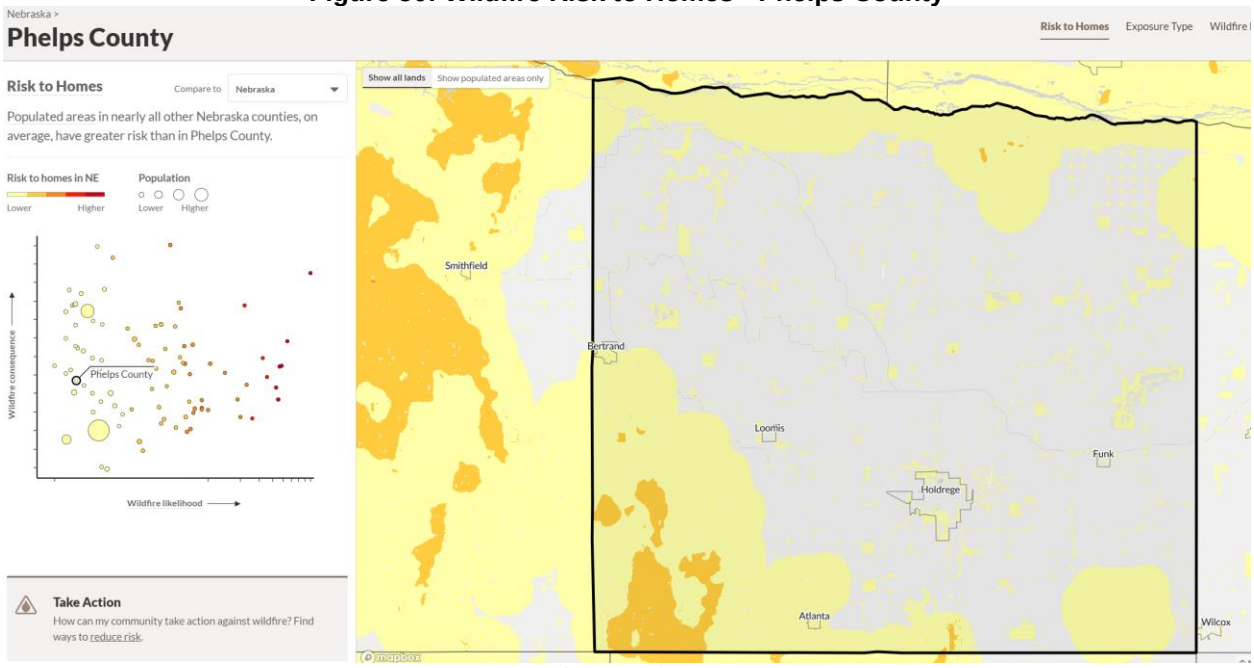
Figure 49: Wildfire Risk to Homes - Kearney County



Source: USDA

Homes that are at the greatest risk to wildfire in Phelps County are located primarily in the southwestern of the county (Figure 50). Populated areas in nearly all other Nebraska counties, on average, have greater risk than in Phelps County.

Figure 50: Wildfire Risk to Homes - Phelps County



Source: USDA

Wildland-Urban Interface

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 areas 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.

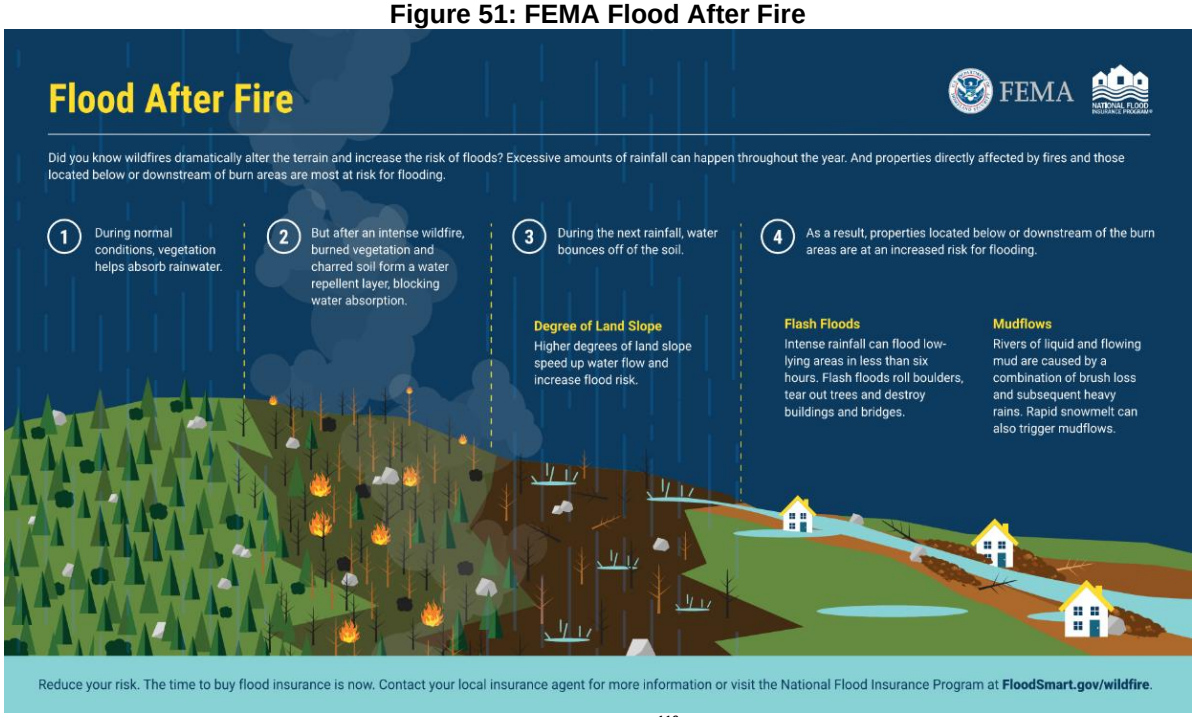
According to the 2021 Loess Canyons CWPP and 2021 South Central West Nebraska CWPP, the entire three-county planning area has been designated as WUI. This is because intense fire behavior can start in rural areas, move quickly over large areas, and threaten population centers.

Extent

From 2000-2021, 323 wildfires were reported in the planning area and burned 3,322 acres in total.[109] Of these, five fires burned 100 acres or more, with the largest wildfire burning 700 acres in Gosper County in July 2005. The average area burned per wildfire was approximately 10 acres.

Wildfire also contributes to an increased risk from other hazard events, compounding damage and straining resources. FEMA has provided additional information in recent years detailing the relationship between wildfire and flooding (Figure 51). 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 51: FEMA Flood After Fire



Source: FEMA[110]

109 Nebraska Forest Service. 2021. "Fire Incident Type Summary." Data Files 2000-2021 provided by NFS.
110 FEMA. 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.

Historical Occurrences

For the planning area, 14 different fire departments reported a total of 323 wildfires between 2000 and 2021, according to the Nebraska Forest Service. The reported events burned 3,322 acres in total, causing $141,775 in property damage and $470,285 in crop damage. Three injuries and one fatality were reported. Most fires occurred in 2002, 2017, and 2018 (Figure 53). The majority of reported wildfires were caused by debris burning or from a piece of equipment (Figure 54). Wildfires have ranged from less than one acre to 700 acres, with an average burned area of 10 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.

Road 739 Fire

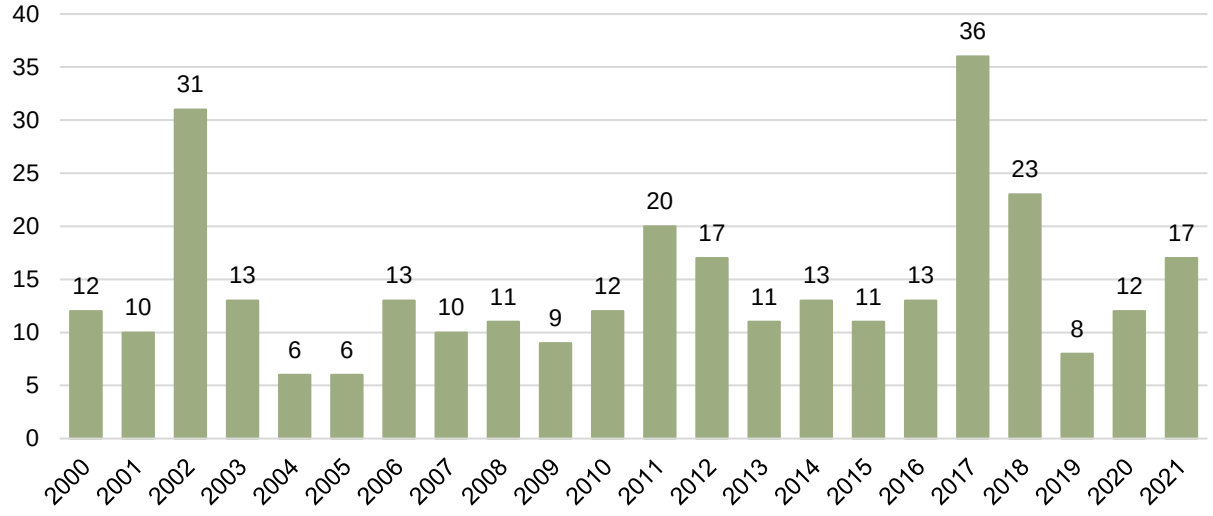
The Road 739 Fire occurred in April 2022. It burned more than 35,000 acres in Gosper County and Furnas County. Property damage for the event totaled $475,871. Eight homes and 46 structures were destroyed, and several other homes and structures received various amounts of damage. Several injuries and one fatality occurred to those responding to the fire. Agricultural impacts include loss of cattle and $12,994,403 in lost crops and land.

Figure 52: Road 739 Fire

Source: 10/11 News[111]

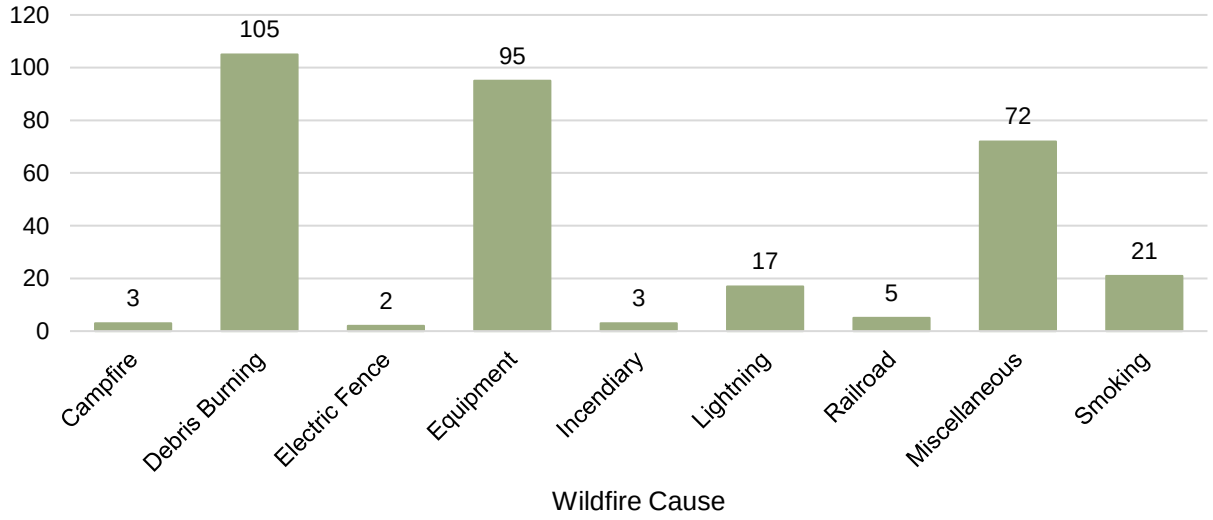
111 10/11 News. April 11, 2022. "Governor Ricketts Visits South Central Nebraska to Discuss the Road 739 Fire. https://www.1011now.com/2022/04/12/governor-ricketts-visits-south-central-nebraska-discuss-road-739-fire/.

Figure 53: Wildfire Events by Year



Source: NFS, 2000-2021

Figure 54: Wildfires by Cause in the Planning Area



Source: NFS, 2000-2021

Figure 55 shows the location and general size of wildfires provided to the Nebraska Forest Service from 2000 to 2021. As the number of reported wildfires by the county indicates, wildfire events can occur in any county within the planning area. Kearney County has reported the greatest number of fires, but Gosper County had the highest number of acres burned.

Figure 55: Wildfire Occurrences in the Planning Area

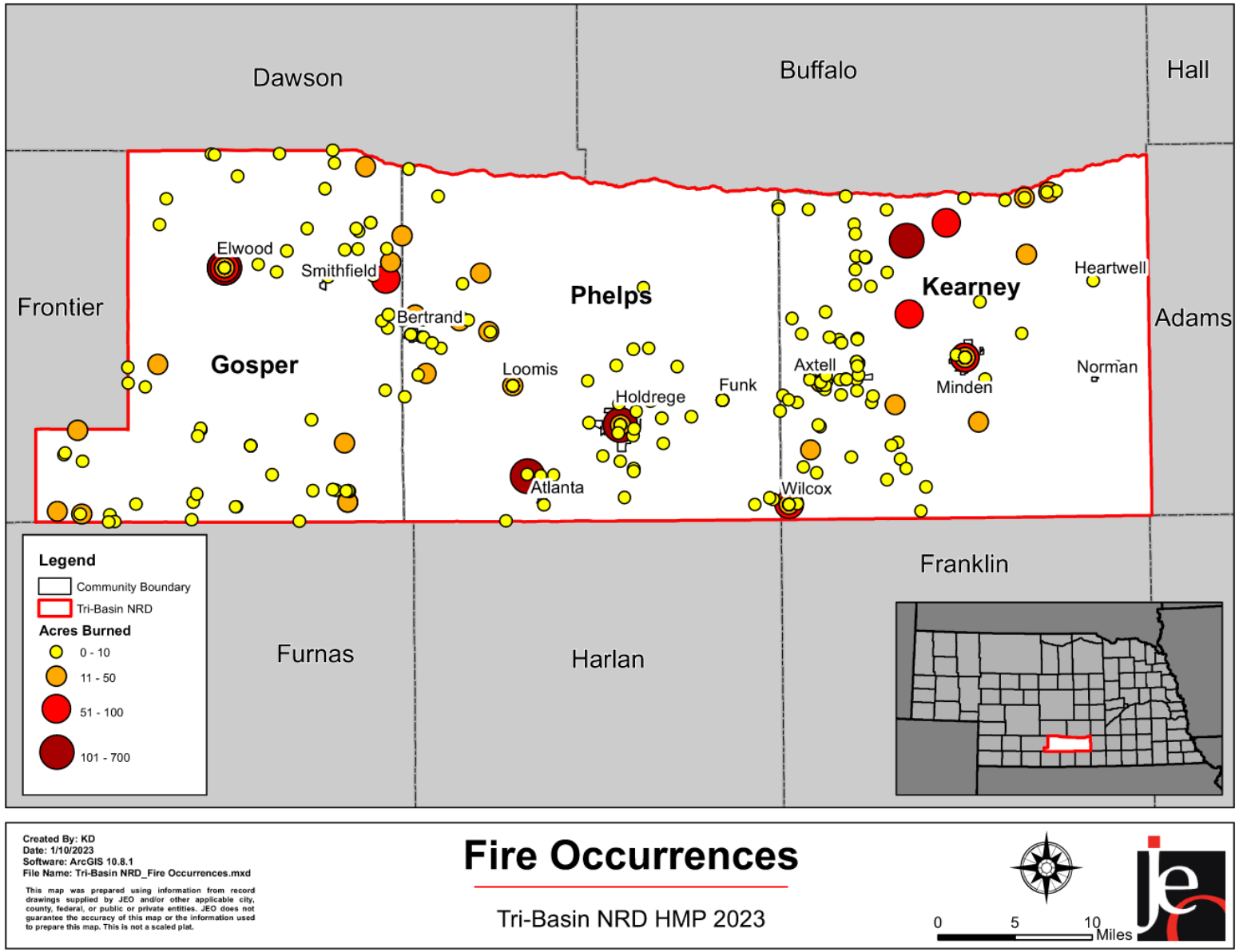


Table 71: Reported Wildfires by County

County	Reported Wildfires	Acres Burned	Other Impacts
Gosper	77	1,231	4 Homes Threatened, 2 Other Structures Threatened, 1 Other Structure Destroyed
Kearney	147	1,144	1 Fatality, 1 Injury, 8 Homes Threatened, 7 Other Structures Threatened, 8 Other Structures Destroyed
Phelps	99	947	2 Injuries, 7 Homes Threatened

Source: NFS, 2000-2021[112]

Average Annual Losses

The average damage per event estimate was determined based upon records from the Nebraska Forest Service Wildfires Database from 2000 to 2021. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. During this 22-year period, area fire departments reported 323 wildfires burned 3,322 acres and caused $470,285 in crop damage and $141,775 in property damage.

Damages caused by wildfires extend beyond 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 72: 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	323	14.7	10.3	$141,775	$6,444	$470,285	$21,377

Source: NFS, 2000-2021

Table 73: Wildfire Event Impacts and Threats

Hazard Type	Injuries	Fatalities	Homes Threatened or Destroyed	Other Structures Threatened or Destroyed
Grass/Wildfire	3	1	19	18

Source: NFS, 2000-2021

Climate Change

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 quickly and cause them to spread rapidly. Additionally, warmer nighttime temperatures contribute to the continued spread of wildfires over multiple days.[113] As mentioned in the drought section, climate change will likely contribute to the rise in the frequency and intensity of drought, especially during the summer months.[114] With increased drought conditions, grass/wildfires will also likely increase due to dry vegetation and less access to water. Additionally, changes in climate can lead to the spread of invasive species, increasing potential fuel loads in wildland areas. The table

112 Nebraska Forest Service. 2021. “Fire Incident Type Summary.” Data Files 2000-2021 provided by NFS.
113 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/.
114 NCEI. 2022. “State Climate Summaries – Nebraska”. https://statesummaries.ncics.org/chapter/ne/#:~:text=The%20state%20is%20located%20far,(1895%E2%80%932020)%20averag.

below shows the change in wildfire danger days in three-county region with different warming scenarios.

Table 74: Change in Wildfire Danger Days

	Warming Scenarios			
	1° C	1.5° C	2° C	3° C
Change in Wildfire Danger Days	-6 to 6 Days per Year	7 to 13 Days per Year	7 to 29 Days per Year	14 to 29 Days per Year

Source: Probable Futures[115]

Probability

The 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 53) there is a 100 percent annual probability of wildfires occurring in the planning area each year. Due to the anticipated impacts from climate change, the likelihood of future grass/wildfire events will increase in frequency and magnitude.

Future Development

Development across the planning area would be located within the WUI. Of most concern would be development on the edges of communities or other areas that encroach on wildland or natural areas. 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. Problems can arise if new development increases without coordinated fuels reduction and the creation of defensible space around homes.

Regional Vulnerabilities

Wildfire poses a threat to a range of demographic groups. Wildfire 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. Wildfires can cause extensive damage to both urban and rural building stock and properties including community lifelines, 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.

Another notable vulnerability is that many of the volunteer fire departments lack adequate resources and staff to respond to multi-fire complexes or events in separate areas. The utilization and development of mutual aid agreements or memorandum of understandings are an important tool for districts to share resources and coverage.

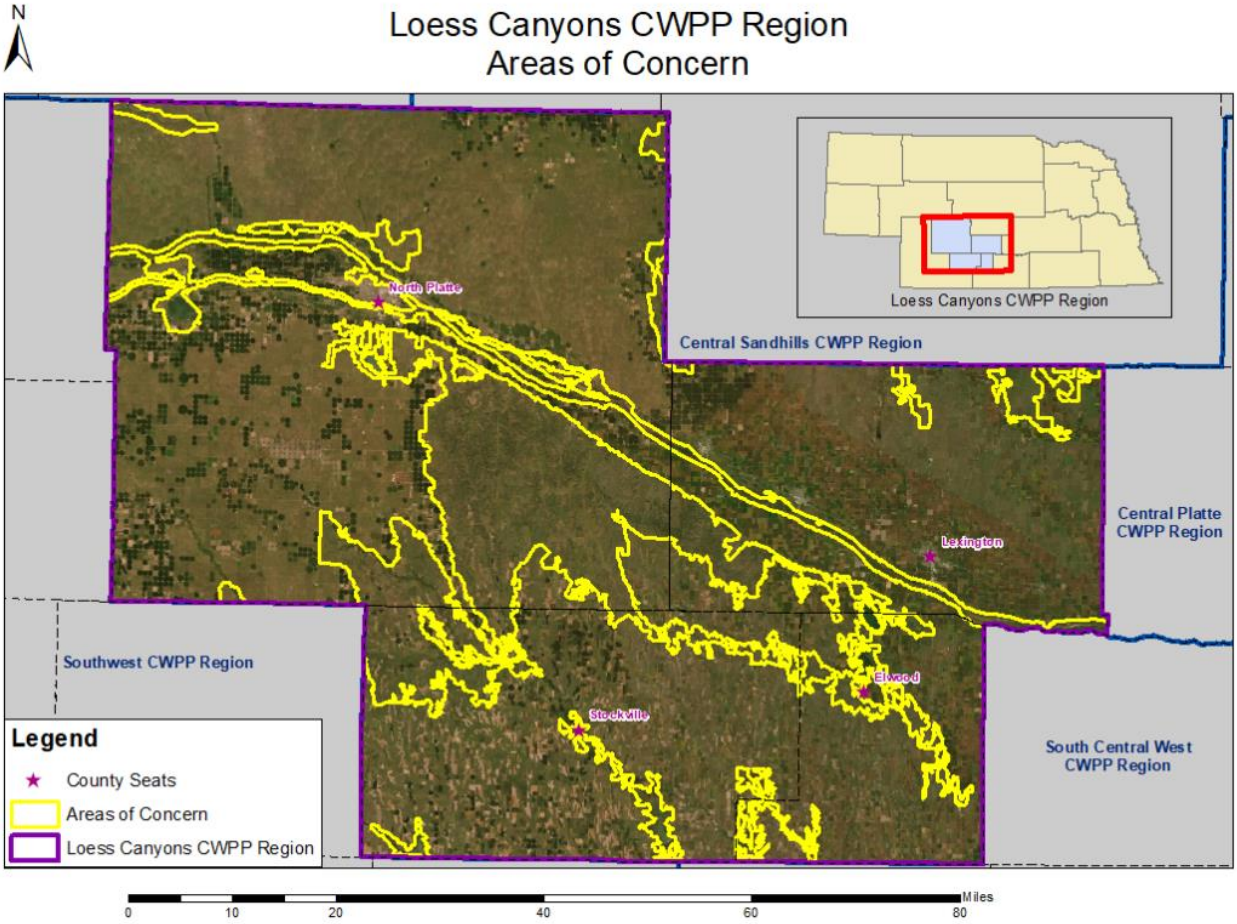
<u>Gosper County</u>

According to the 2021 Loess Canyons CWPP, locations of concern “include the northwest sections of the Holbrook-Edison-Arapaho Fire District due to grassland, trees, rough with few access points, water refill points are few and a distance away. The Edison VFD noted that all areas in their district with difficult access, rough terrain, and heavy fuels are problematic. The

115 Probable Futures. “Maps of Dryness”. Accessed January 2023. https://probablefutures.org/.

Elwood fire chief said that they have specific concerns about Elwood Reservoir and Johnson Lake due to multiple structures, difficult access, rough terrain, and heavy fuels."[116]

Figure 56: Gosper County Areas of Concern



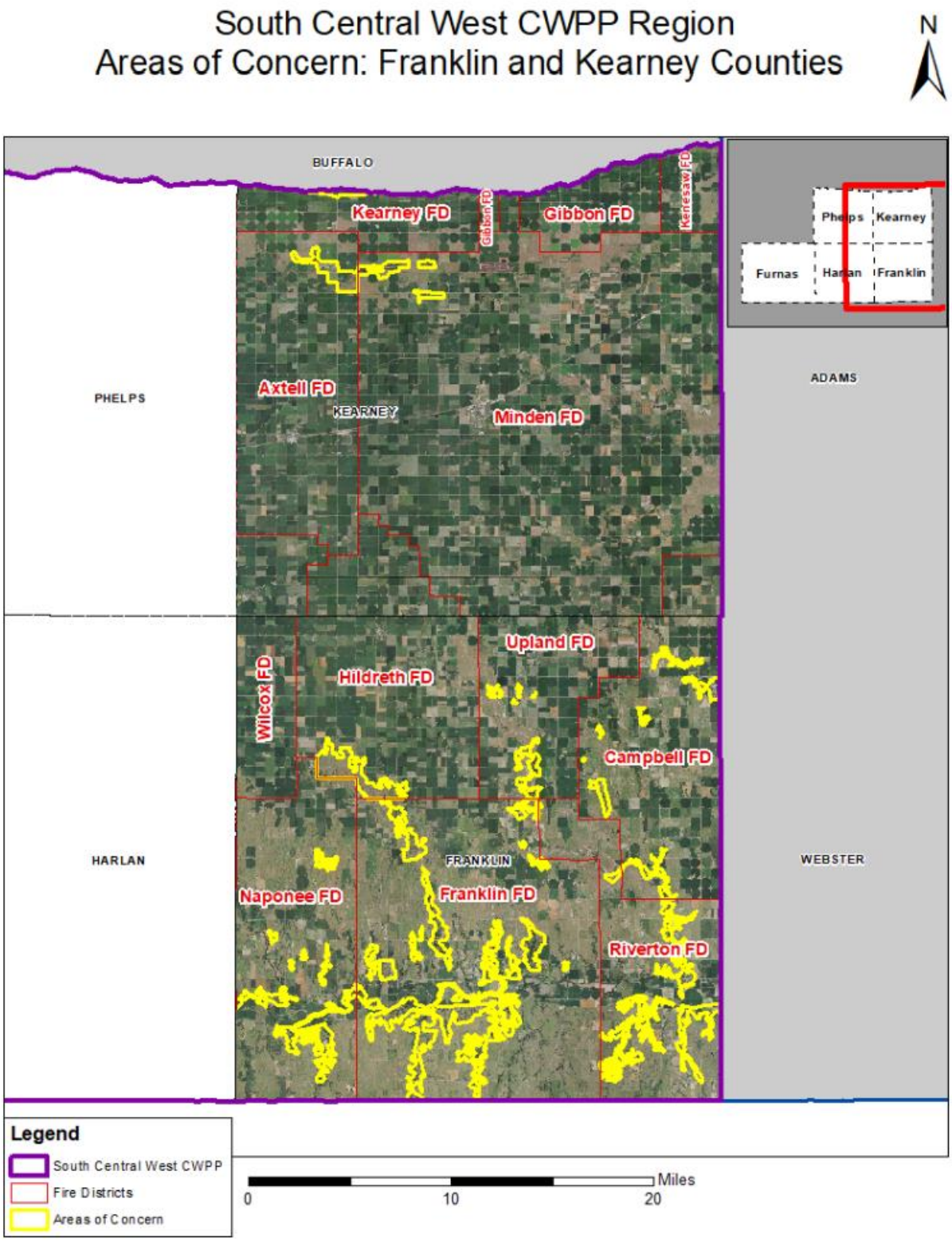
Source: Nebraska Forest Service

Kearney County

According to the 2021 South Central West CWPP, "locations of special concern include population centers adjacent to wildlands, and wooded areas along the rivers and streams. The Minden fire chief identified two sites northwest of Minden as areas of concern due to multiple structures, difficult access, heavy fuels, one way in and out, rough terrain, and lack of water within effective distance. The Hildreth fire department named the south end of their district as an area of concern, due to hills, valleys, and canyons with limited entrances."[117]

116 Nebraska Forest Service. 2021. "Loess Canyons Region Community Wildfire Protection Plan". https://nfs.unl.edu/community-wildfire-protection-plan.
117 Nebraska Forest Service. 2021. "South Central West Community Wildfire Protection Plan". https://nfs.unl.edu/community-wildfire-protection-plan.

Figure 57: Kearney County Areas of Concern

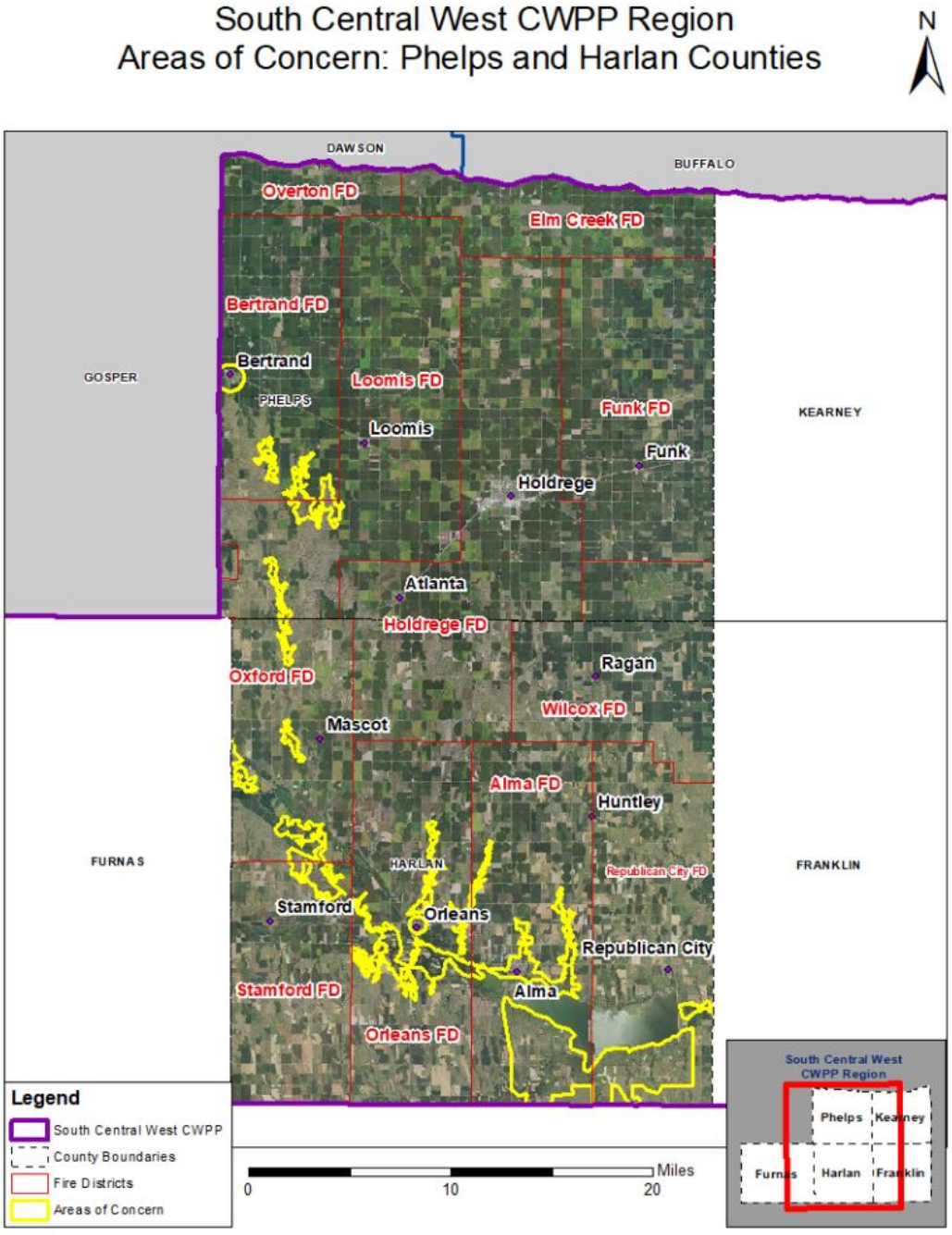


Source: Nebraska Forest Service

Phelps County

According to the 2021 South Central West CWPP, "locations of special concern include population centers adjacent to wildlands and wooded areas along the rivers and streams. The Bertrand VFD identified the Village of Bertrand as an area of concern due to multiple structures and being completely surrounded by cropland."[118]

Figure 58: Phelps County Areas of Concern



Source: Nebraska Forest Service

118 Nebraska Forest Service. 2021. "South Central West Community Wildfire Protection Plan". https://nfs.unl.edu/community-wildfire-protection-plan.

Table 75 shows the risk to homes, population exposure, and wildfire likelihood for all three counties in the planning area.

Table 75: Wildfire Vulnerabilities by County

County	Risk to Homes (Compared to NE Counties)	Population Exposure Type	Wildfire Likelihood (Compared to NE Counties)
Gosper	Greater risk than 50% of NE Counties	Directly Exposed (30%) Indirectly Exposed (67%) Not Exposed (3%)	Greater likelihood than 50% of NE Counties
Kearney	Greater risk than 16% of NE Counties	Directly Exposed (19%) Indirectly Exposed (11%) Not Exposed (70%)	Greater likelihood than 18% of NE Counties
Phelps	Greater risk than 0% of NE Counties	Directly Exposed (12%) Indirectly Exposed (11%) Not Exposed (78%)	Greater likelihood than 14% of NE Counties

Source: USDA[119]

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

Table 76: 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
Community Lifelines	-Damage to power lines and utility structures -Potential loss of firefighting equipment and resources -Risk of damages to buildings
Other	-Increase chance of landslides, erosion, and land subsidence -May lead to poor water quality -Post fire, flash flooding events may be exacerbated

Community Top Hazard Status

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

119 United States Department of Agriculture, United States Forest Service. 2023. “Wildfire Risk to Communities.” https://wildfirerisk.org/.

Jurisdictions and Stakeholders	
Axtell Volunteer Fire & Rescue Department	Gosper County
Bertrand	Holdrege Fire & Rescue
Bertrand Fire Department	Kearney County Health Services
Elwood	Loomis Volunteer Fire & Rescue
Elwood Public Schools	Minden Volunteer Fire Department
Elwood Volunteer Fire Department	Norman
Funk	Tri-Basin NRD
Funk Rural Fire Department	Wilcox Rural Fire Protection District

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.[120]

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.

Fixed sites are those that involve chemical manufacturing sites and stationary storage facilities. 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.[121]

Likewise, the U.S. Department of Transportation, through the U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA), has broad jurisdiction to regulate the transportation of hazardous materials, including the discretion to decide which materials shall be classified as hazardous. The transportation of hazardous materials is defined by 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…" These materials are placed into one of nine hazard classes based on their chemical and physical properties. The hazard schedules may be further

120 Federal Emergency Management Agency. 2017. "Hazardous Materials Incidents". https://www.ready.gov/hazardous-materials-incidents

121 Emergency Planning and Community Right-to-Know Act of 1986, Pub. L. No. 116 § 10904. (1986).

subdivided into divisions based on their characteristics. Because the properties and characteristics of materials are crucial in understanding the dynamics of a spill during a transportation incident, it is important for response personnel to understand the hazard classes and their divisions.

Table 77 demonstrates the nine classes of hazardous material according to the 2020 Emergency Response Guidebook.

Table 77: Hazardous Materials Classes

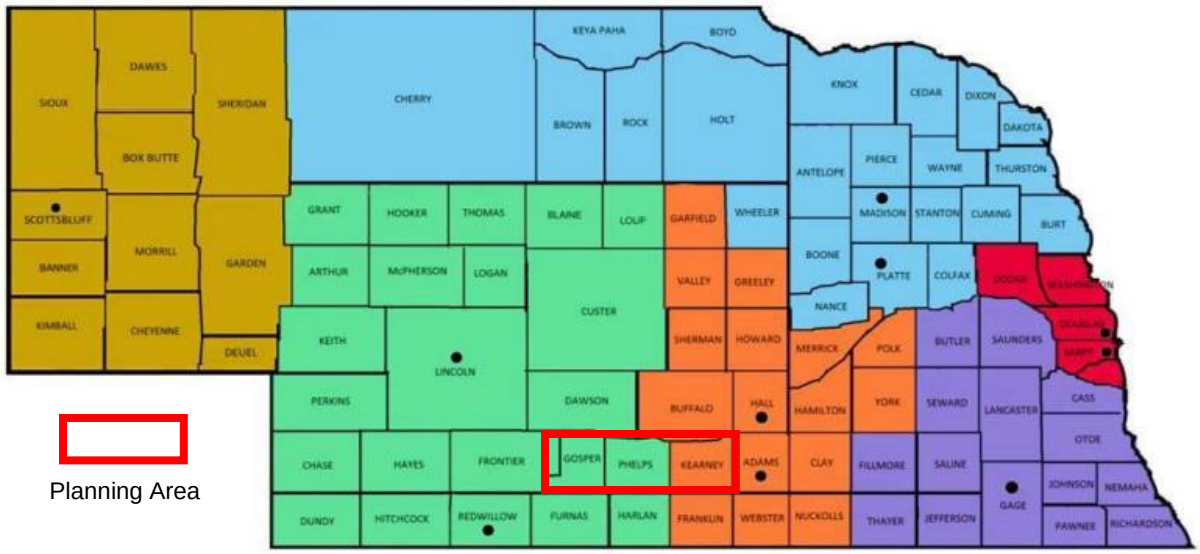
Class	Type of Material	Divisions
1	Explosives	1.1 Explosives which have a mass explosion hazard 1.2 Explosives which have a projection hazard but not a mass explosion hazard 1.3 Explosives which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion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

Source: Emergency Response Guidebook, 2020[122]

There are ten State Emergency Response Teams (SERTs) stationed across the State of Nebraska which are trained to respond to large scale hazardous material incidents. Each department includes personnel at the technical, incident commander, and safety officer levels. There is one SERT district which covers the entire planning area with the nearest team located in McCook in Red Willow County or Hastings in Adams County.

122 U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration. 2022. “2020 Emergency Response Guidebook”. https://www.phmsa.dot.gov/hazmat/erg/emergency-response-guidebook-erg.

Figure 59: Nebraska SERTs Map



Source: NEMA[123]

Location

Fixed Site

There are 58 facility locations across the planning area that submitted Tier II reports to the Nebraska Department of Environment and Energy (NDEE) in 2021. These locations are shown in Figure 60. A listing of hazardous material storage sites can be found in *Section Seven: Community Profiles* for each jurisdiction. The locations include a half mile buffer to show the potential evacuation area during a hazardous materials release. A half mile was chosen because, in the 2020 Emergency Response Guidebook, the initial evacuation area for a "Mixed Load/Unidentified Cargo" involved in a fire is a half mile in all directions.

Transportation

A large number of spills typically occur during the loading and unloading of chemicals for highway and pipeline chemical transport. Hazardous materials releases during transportation primarily occur on major transportation routes as identified in Figure 61. Participating communities specifically reported transportation along railroads and highways as having the potential to impact their communities.

Pipelines

According to PHMSA, there are multiple gas transmission and hazardous liquid pipelines located in the NRD. Maps of the pipelines can be seen in Figure 62, Figure 63, and Figure 64.

123 NEMA. June 2020. "Emergency Assistance to a Hazardous Materials Incident". https://nema.nebraska.gov/sites/nema.nebraska.gov/files/doc/hazmat-blue-book.pdf.

Figure 60: Tier II Chemical Fixed Sites

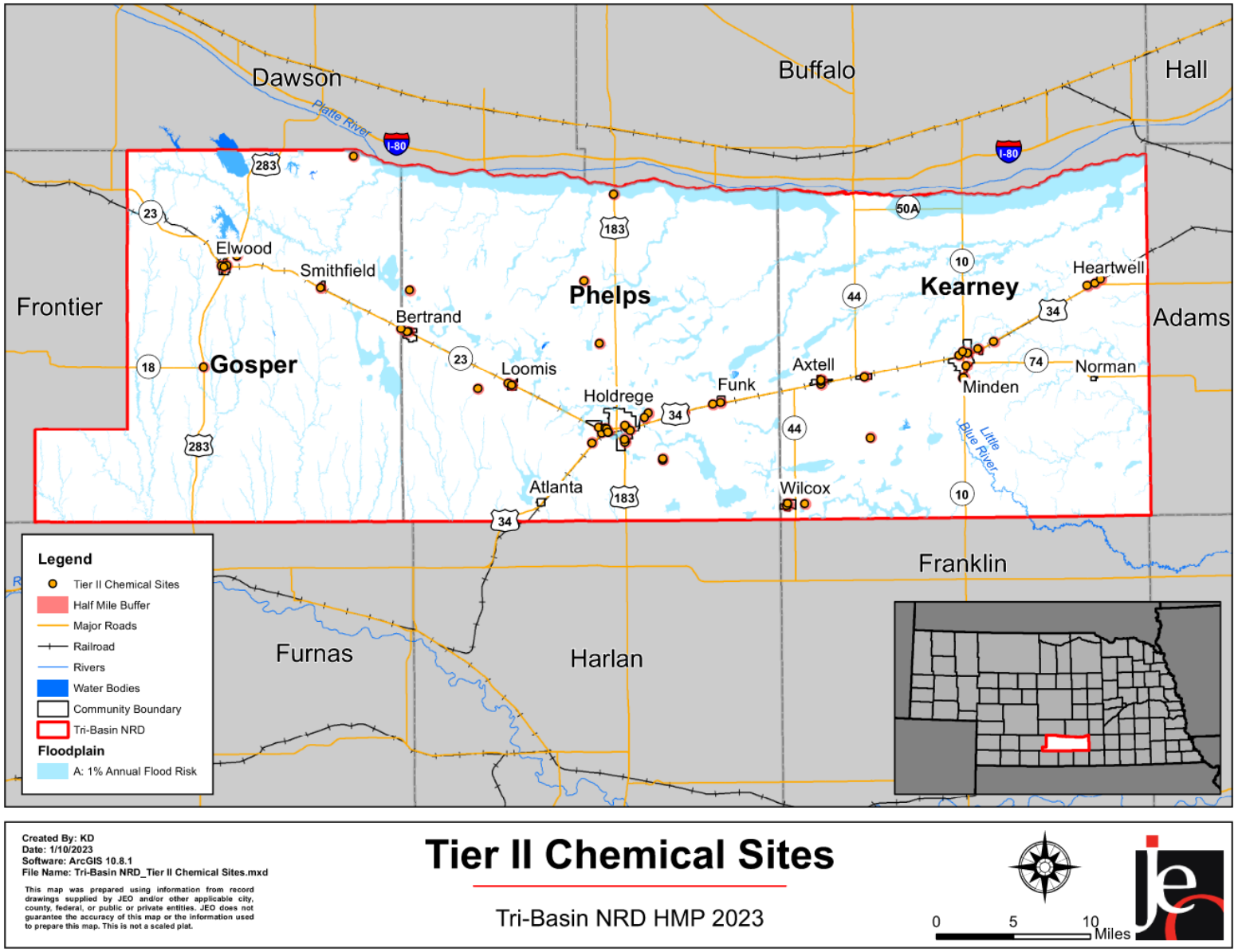


Figure 61: Major Transportation Routes

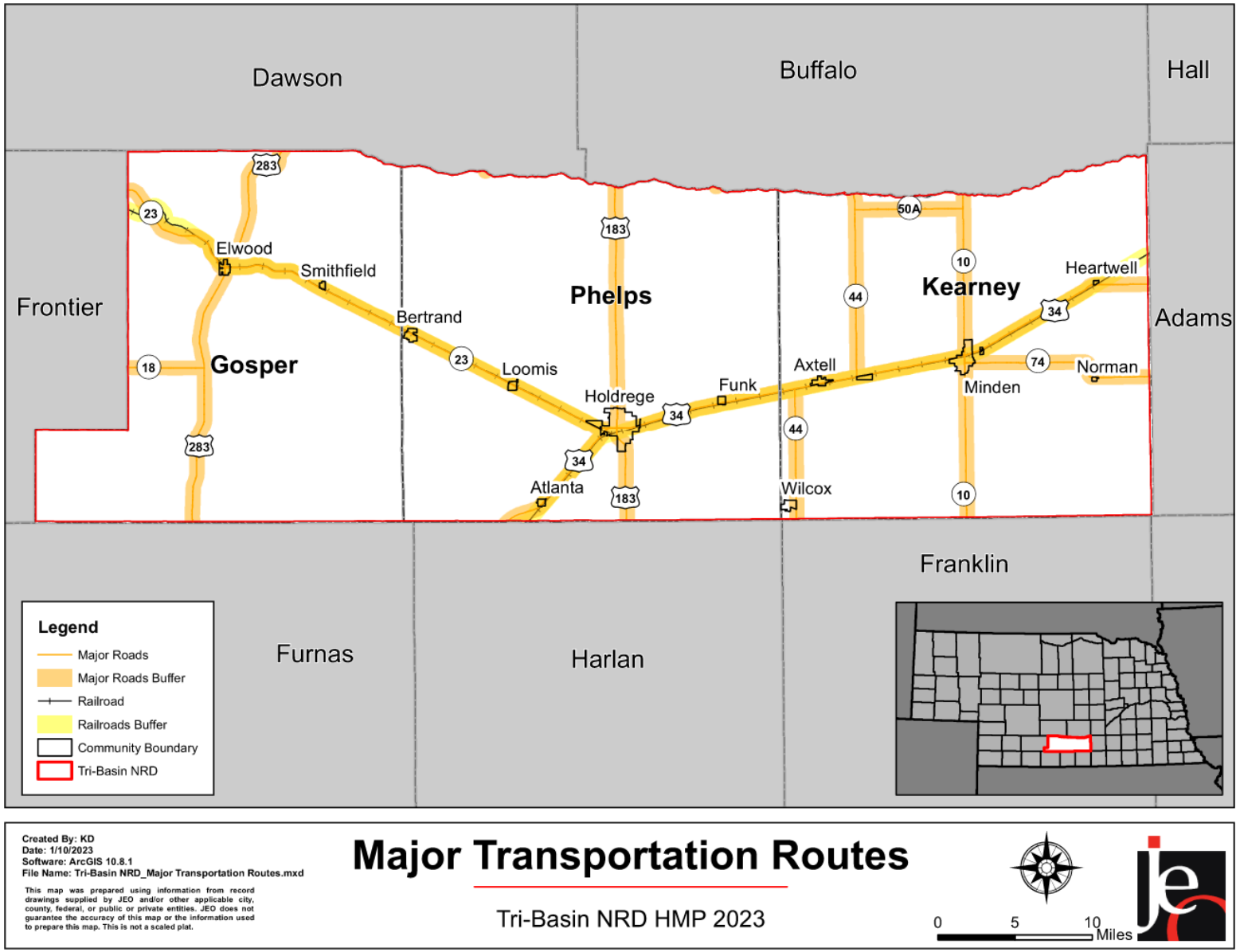
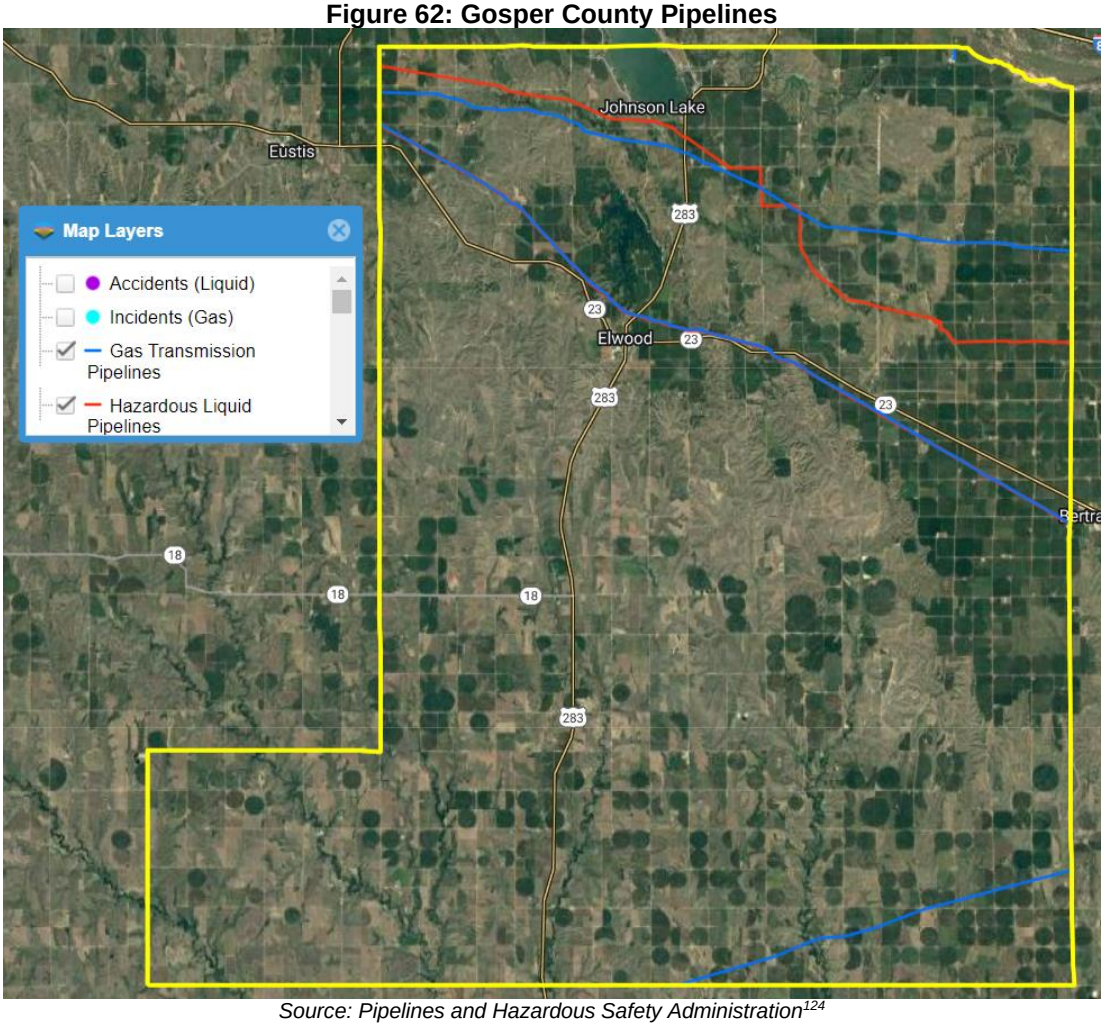


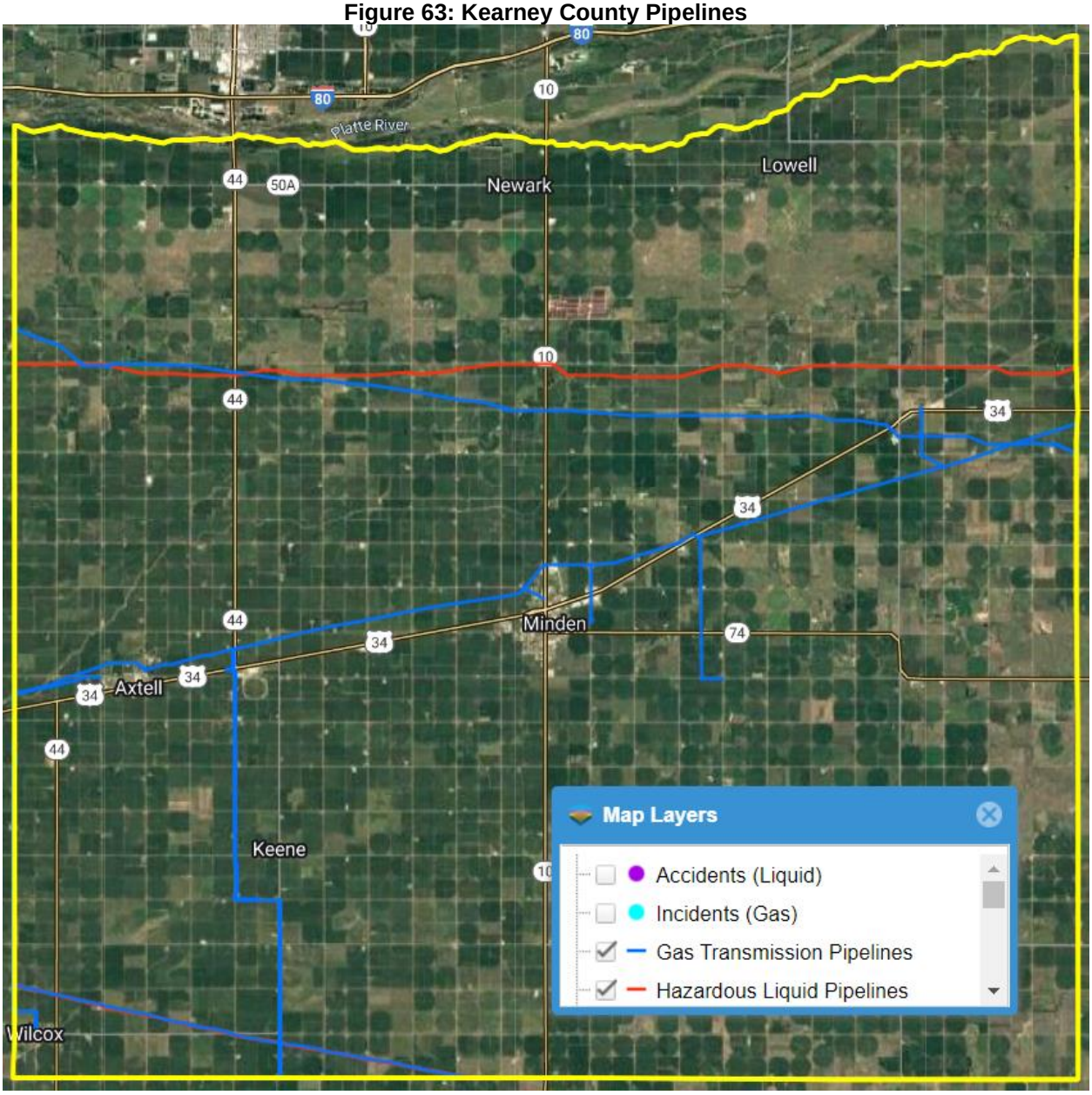
Figure 62: Gosper County Pipelines



Source: Pipelines and Hazardous Safety Administration[124]

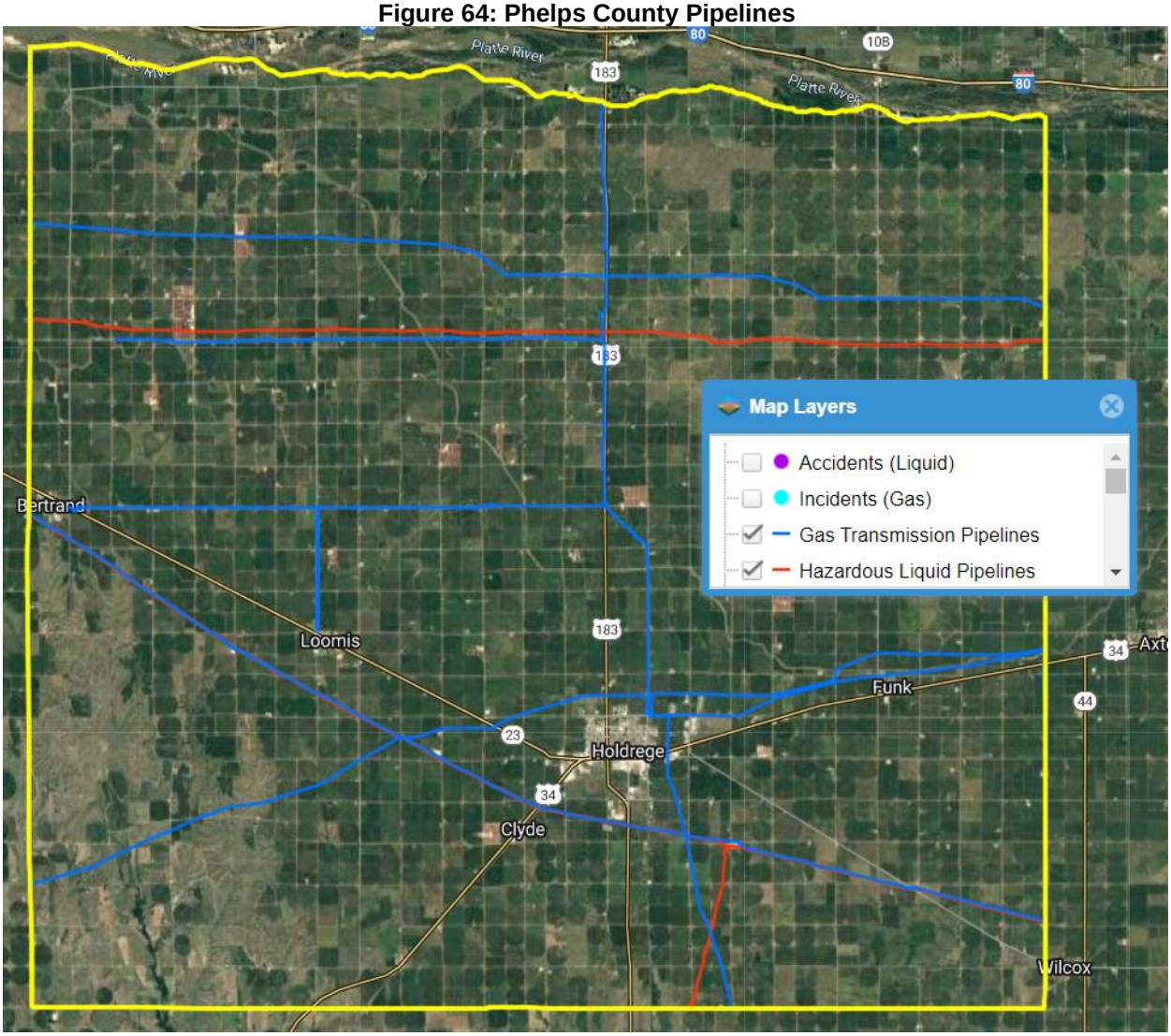
124 Pipeline and Hazardous Materials Safety Administration. 2022. "National Pipeline Mapping System". Accessed September 2022. https://www.npms.phmsa.dot.gov/.

Figure 63: Kearney County Pipelines



Source: Pipelines and Hazardous Safety Administration

Figure 64: Phelps County Pipelines



Source: Pipelines and Hazardous Safety Administration

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 60 fixed site releases have occurred in the planning area, and the total amount spilled ranged from less than 1 gallon to 4,000 gallons. Of the 60 chemical spills, two of the spills resulted in a total of three injuries and one spill resulted in 70 people being evacuated. No fatalities were reported. In total, one release has occurred during transportation in the planning area. The one transportation spill resulted in 100 liquid gallons of a flammable liquid being spilled. It did not lead to any evacuations, fatalities, or injuries. Based on historic records, it is likely that any spill involving hazardous materials will not affect an area larger than a half 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 60 hazardous materials releases at fixed sites from 1990 through July 2022 in the planning area. There was no property damage but three reported injuries and 70 people evacuated for these releases. The following table displays the more serious spills that have occurred throughout the planning area (>500 gallons, injury occurred, or evacuation).

Table 78: Hazardous Material Releases (Fixed Site)

Year of Event	Location of Release	Quantity Spilled	Material Involved	Injury	Fatality	Evacuations
1990	Atlanta	4,000 Gallons	Fertilizer	0	0	0
1994	Minden	5,000 Pounds	Anhydrous Ammonia	0	0	70
1994	Kearney County	100 Pounds	Anhydrous Ammonia	1	0	0
1998	Norman	1,700 Pounds	Anhydrous Ammonia	0	0	0
2002	Minden	650 Pounds	Anhydrous Ammonia	0	0	0
2007	Gosper County	580 Gallons	Oil	0	0	0
2008	Axtell	600 Gallons	Diesel Oil	0	0	0
2012	Kearney County	2,000 Gallons	Liquefied Nitrogen	0	0	0
2013	Funk	<1 Pound	Natural Gas	2	0	0
2018	Holdrege	2,000 Pounds	Sulfuric Acid	0	0	0
2022	Axtell	1,996 Gallons	Fertilizer	0	0	0

Source: National Response Center, 1990-July 2022[125]

Hazardous Materials Release – Transportation

According to the Pipeline and Hazardous Materials Safety Administration (PHMSA), one hazardous materials release occurred during transportation in the planning area between 1971 and July 2022. During these events, there were no injuries, no fatalities, no evacuations, and $70,300 in damages. The following table provides information about the one hazardous materials release during transportation in the planning area.

Table 79: Hazardous Materials Release (Transportation)

Date of Event	Location of Release	Material Involved	Method of Transportation	Amount	Total Damage
5/23/2015	Holdrege	Flammable Liquid	Highway	100 Liquid Gallons	$70,300

Source: PHMSA, 1971–July 2022[126]

125 U.S. Coast Guard National Response Center. July 2022. "Chemical Pollution and Railroad Incidents, 2000-2022." [datafile]. https://nrc.uscg.mil/.

126 Pipeline and Hazardous Materials Safety Administration. July 2022. "Incident Statistics: Nebraska". https://www.phmsa.dot.gov/hazmat-program-management-data-and-statistics/data-operations/incident-statistics.

Average Annual Damages

Using data from the tables above, average annual damage from hazardous materials releases can be estimated. There have been 60 fixed site spills in the planning area reported from the NRC and one transportation spill as reported by PHMSA. Neither the NRC nor PHMSA track crop losses from chemical spills. These events reported $70,300 in property damages. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life.

Table 80: 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)	60	1.8	3	0	$0	$0
Hazardous Materials Release (Transportation)	1	0.02	0	0	$70,300	$1,352

Source: National Response Center, 1990-July 2022; PHMSA, 1971-July 2022

Climate Change

Climate trends are not anticipated to have a direct impact on hazardous materials releases. However, as events continue to impact infrastructure used by and for hazardous materials, future spills will likely occur. For example, flooding is likely to increase,[127] which could damage roadways and pipelines causing more spills to occur.

Probability

Hazardous materials releases at fixed site storage areas are likely in the future. Given the historic record of occurrence 23 years with a chemical spill out of 33 years (many years had several chemical spills occur), the annual probability of occurrence for hazardous materials releases at fixed sites is 70 percent. Climate change is unlikely to impact releases from fixed sites.

Hazardous materials releases during transportation are likely in the future. Given the historic record of occurrence (one transportation releases reported in 52 years), the annual probability of occurrence for hazardous materials releases during transportation is two percent. Due to the secondary impacts from climate change, the likelihood of future transportation release events may increase in frequency.

Future Development

To reduce the risk to people and property damage, future development should encourage chemical storage and manufacturing facilities to be built away from community lifelines such as hospitals, schools, daycares, nursing homes, and other residential areas. Likewise, residential development and locations that house vulnerable populations should be built away from major transportation corridors used for chemical transportation.

127 NOAA. August 2022. “Climate Mapping for Resilience and Adaptation”. https://livingatlas.arcgis.com/assessment-tool/explore/details.

Regional Vulnerabilities

Using the half mile buffers for both the major transportation routes and fixed chemical sites, an analysis was performed to identify community lifelines that are located within those buffer areas. The half mile buffer was chosen because, in the 2020 Emergency Response Guidebook, the initial evacuation area for a "Mixed Load/Unidentified Cargo" involved in a fire is a half mile in all directions. While some of the fixed chemical sites may not house chemical types or quantities that would require a half mile evacuation area, this does give an idea of what may need to be evacuated until the impacted or spilled material is identified. This does not mean that all of the identified community lifelines will be impacted by every hazardous materials release, it merely shows the lifelines that are more vulnerable to hazardous materials release due to their proximity to these locations. In total, 370 out of 398 community lifelines are located within a half mile of a major transportation route and 248 out 398 community lifelines are located within a half mile of a fixed chemical site.

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

Table 81: 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
Community Lifelines	-Transportation routes can be closed during evacuations -Community lifelines are at risk of evacuation

Community Top Hazard Status

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

Jurisdictions and Stakeholders	
Bertrand Fire Department	Holdrege Fire & Rescue
Elwood	Holdrege Public Schools
Elwood Public Schools	Kearney County Health Services
Funk Rural Fire Department	Smithfield
Gosper County	Tri-Basin NRD
Holdrege	

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.[128]

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 sanitary 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.[129]

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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128 World Health Organization. 2008. Accessed April 2020. "Glossary of humanitarian Terms". https://www.who.int/hac/about/definitions/en/.

129 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 January 11, 2023, the CDC reported nearly 101,518,229 cases and 1,095,149 deaths attributed to COVID-19.[130] 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 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 Two Rivers Public Health Department covers the entire NRD.

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 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 between 2020-2023.

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 24% of the planning area's population is 19 years or younger, and nearly 23% 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. There are two hospitals located in the planning area.[131] These hospitals are listed in the table below.

130 Centers for Disease Control and Prevention. January 2023. "Trends in Number of COVID-19 Cases and Deaths in the US Reported to CDC, by State/Territory". https://covid.cdc.gov/covid-data-tracker/#trends_totaldeaths_select_00.
131 Department of Health and Human Services. August 2022. "Hospitals." http://dhhs.ne.gov/licensure/Documents/Hospital%20Roster.pdf.

Table 82: Hospitals in the Planning Area

County	Facility Name	Nearest Community	Total Licensed Beds
Kearney	Kearney County Health Services	Minden	10
Phelps	Phelps Memorial Health Center	Holdrege	25

Source: Nebraska Department of Health and Human Services

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 Date	Type of Care
Phelps	Rural Health Clinic	2/10/2020	Primary Care
Gosper	Rural Health Clinic	2/10/2020	Primary Care
Phelps	Rural Health Clinic	12/27/2021	Primary Care
Phelps	Rural Health Clinic	2/10/2020	Dental Health
Gosper	Rural Health Clinic	2/10/2020	Dental Health
Phelps	Rural Health Clinic	12/27/2021	Dental Health
Gosper	Geographic HPSA	2/22/2022	Mental Health
Kearney, Phelps	Geographic HPSA	7/20/1978	Mental Health
Phelps	Rural Health Clinic	2/10/2020	Mental Health
Gosper	Rural Health Clinic	2/10/2020	Mental Health
Phelps	Rural Health Clinic	12/27/2021	Mental Health

Source: Health Resources and Services Administration[132]

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.

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

County	Service Area	Designation Type	Designation Date	Type of Care
Gosper	Gosper Service Area	Medically Underserved Area	11/1/1978	Primary Care

Source: Health Resources and Services Administration[133]

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. All three counties had a lower diabetes rate than the state.

132 Health Resources and Services Administration. “HPSA Find”. Accessed January 2023. https://data.hrsa.gov/tools/shortage-area/hpsa-find.

133 Health Resources and Services Administration. “MUA Find”. Accessed January 2023. https://data.hrsa.gov/tools/shortage-area/mua-find.

Table 85: Diabetes Prevalence in the Planning Area

County	Diagnosed Diabetes Rate (Total Adults Age 20+)
Gosper	7.5%
Kearney	7.2%
Phelps	7.6%
State of Nebraska*	8.9%

Source: Centers of Disease Control and Prevention, 2019[134]
**State data is from 2020.*

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.

Historical Occurrences

Cases and fatalities associated with Public Health Emergencies vary between illness types and severity of outbreak. Past major outbreaks in Nebraska are the H1N1 Swine Flu in 2009 and COVID-19 in 2020-2023.

- 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.[135] 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 people 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.

134 Centers for Disease Control and Prevention. “Diagnosed diabetes prevalence – Nebraska”. Accessed January 2023. https://gis.cdc.gov/grasp/diabetes/DiabetesAtlas.html.
135 Centers for Disease Control and Prevention. June 2009. “Novel H1N1 Flu Situation Update”. https://www.cdc.gov/h1n1flu/updates/061209.htm.

The table below displays COVID-19 confirmed cases and vaccination rate for all three counties. This data will likely increase as time goes on until the entire population can be fully vaccinated.

Table 86: COVID-19 Cases in the Planning Area

County	Total Confirmed Cases	Fully Vaccination Rate
Gosper	372	40.7%
Kearney	1,182	47.9%
Phelps	2,326	41.3%
Total	**3,880**	**44.0%**

Source: USAFacts[136], Springfield News-Leader[137]

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.[138] However, associated costs with pandemic response are much greater. Current estimated costs for COVID-19 in the United States exceed $16 trillion.[139] Estimated costs for the State of Nebraska or the three-county planning area are unknown at this time. 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 and will vary depending on the type and spread of the virus.

Climate Change

Shifting climatic conditions 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. These types of zoonotic disease may initially spread faster as the local population is not aware of the proper steps to reduce their risk.

It is estimated that over the next 30 years, 143 million people are likely to migrate to other areas due to the effects of climate change like increasing sea levels, drought, and other climate disaster events.[140] This global migration could lead to increased public health emergencies as different population groups come more in contact with each other and are exposed to different pathogens.

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.

136 USAFacts. “Nebraska Coronavirus Cases and Deaths”. Accessed January 2023. https://usafacts.org/visualizations/coronavirus-covid-19-spread-map/state/nebraska.

137 Springfield News-Leader. January 18,2023. “Nebraska COVID-19 Vaccine Tracker”. https://data.news-leader.com/covid-19-vaccine-tracker/nebraska/31/.

138 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.

139 John Hopkins. April 21, 2022. “Weighing the Cost of the Pandemic – knowing what we know now, how much damaged did COVID-19 cause in the United States?”. https://www.centerforhealthsecurity.org/our-work/publications/weighing-the-cost-of-the-pandemic#:~:text=We%20find%20that%20the%20total,but%20more%20mental%20health%20damage.

140 Intergovernmental Panel on Climate Change. 2022. “Climate Change 2022: Impacts, Adaptation and Vulnerability”. https://www.ipcc.ch/report/ar6/wg2/.

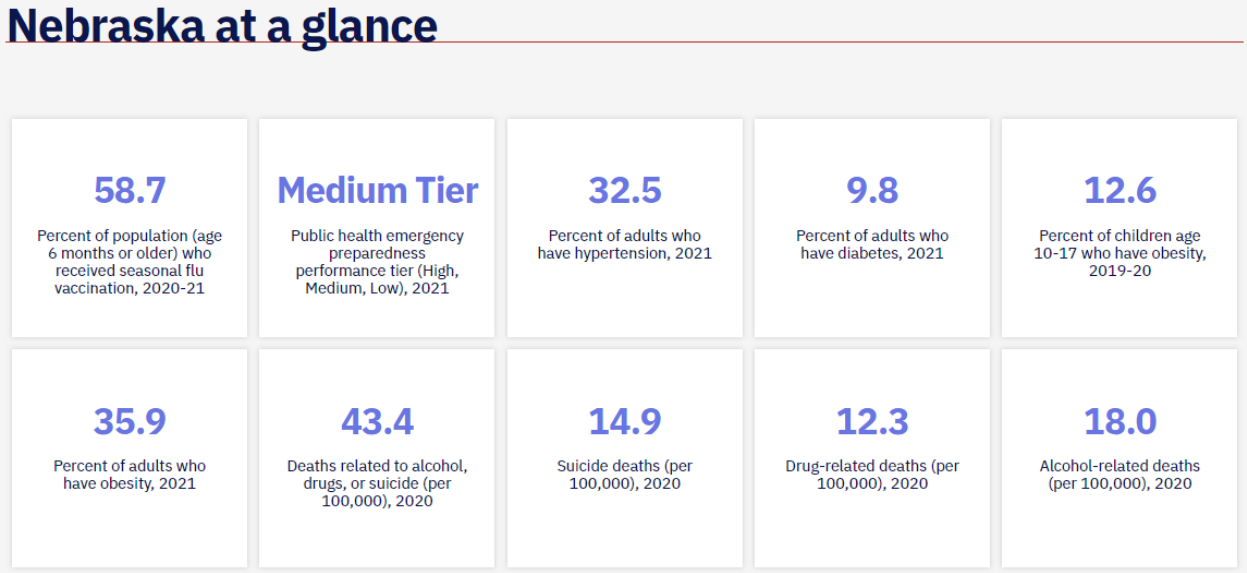
Future Development

The impacts of a public health emergency could be lessened by building and/or designating mass vaccination sites, as well as ensuring there are adequate rooms and beds at hospitals, nursing homes, and assisted living centers. Adding or replacing HVAC systems with improved filtration to these and other buildings, such as schools, would also lessen impacts from this hazard. Public health emergencies can have a drastic effect on the local economy and development. Planning for contingencies and being adaptable can minimize the negative effects.

Regional Vulnerabilities

An independent study conducted in 2019 by Trust for America's Health gave Nebraska a score of six out of ten for their efforts to reduce vulnerability to the spread of infectious diseases. The report noted: "Nebraska's public health outcomes stack up unevenly against those of the United States, but it has taken several steps that strengthened its preparedness for public health emergencies. Deaths owed to drug misuse, alcohol, or suicide trail the country as a whole. Its rates of obesity and related conditions indicate a mixed picture, with the percentage of adults with obesity higher than the U.S. median, even as rates of diabetes and hypertension rank low. Finally, the state achieved a score of six out of a possible 10 measures of public health preparedness for diseases, disasters, and bioterrorism."[141] The following figure describes Nebraska's overall statistics.

Figure 65: Trust for America Public Health Statistics



Source: Trust for America's Health

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

141 Trust for America's Health. 2019. "State Profile: Nebraska". https://www.tfah.org/state-details/nebraska/.

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
Community Lifelines	-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 -Healthcare facilities in the planning area may be overwhelmed quickly by widespread events -Community Lifelines could see suspended action or reduced resources due to sick staff
Other	-Long-term public health emergencies can have negative impacts on resident's mental health

Community Top Hazard Status

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

Jurisdictions and Stakeholders	
Elwood Public Schools	Kearney County health Services
Elwood Volunteer Fire Department	Loomis Public Schools
Gosper County	Loomis Volunteer Fire & Rescue
Holdrege Public Schools	Norman

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. Most 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 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 damage increases as the size of the hail increases. Figure 66 displays the average number of days with thunderstorms across the country each year. The planning area experiences an average of 50 thunderstorms over the course of one year.

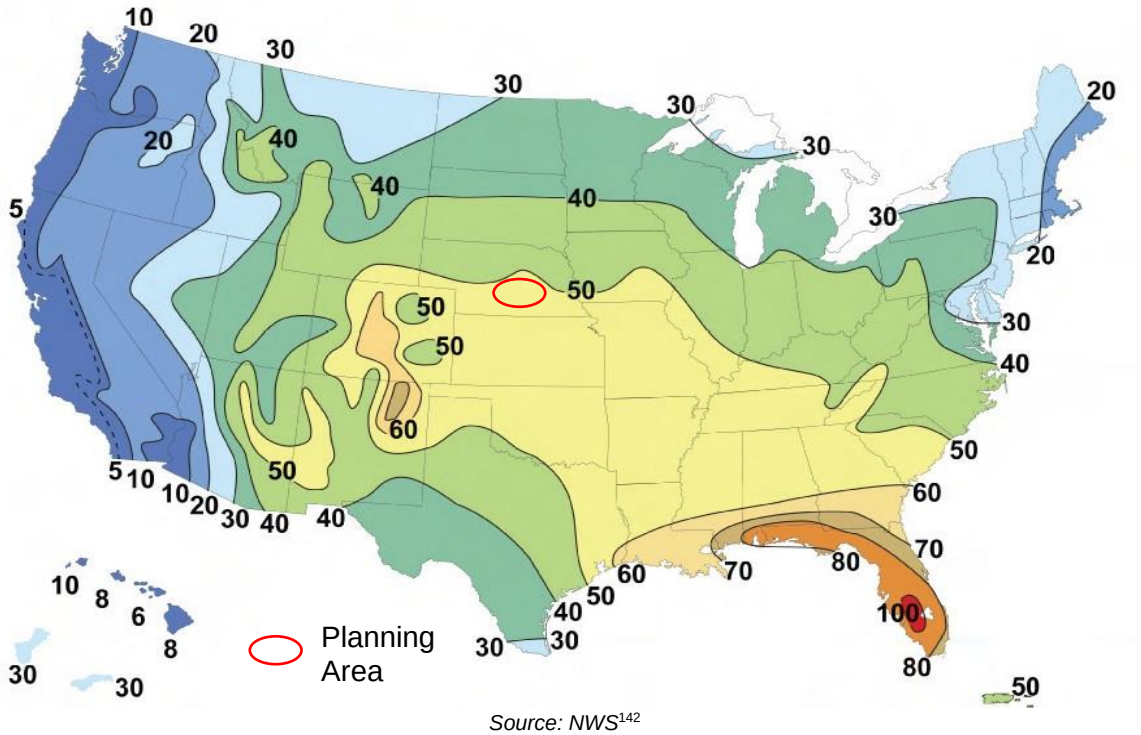
Location

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 66: Average Number of Thunderstorms



Source: NWS[142]

Table 88: TORRO Hail Scale

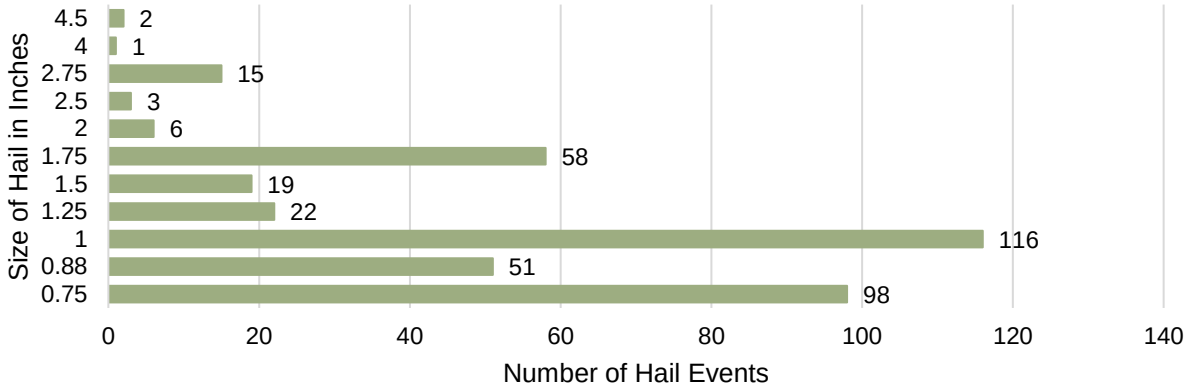
Class	Type of Material	Divisions
H0: Hard Hail	5 mm; (Pea size); 0.2 in	No damage
H1: Potentially Damaging	5 -15 mm (Marble) 0.2 – 0.6 in	Slight general damage to plants and crops
H2: Significant	10 -20 mm (Grape) 0.4 – 0.8 in.	Significant damage to fruit, crops, and vegetation
H3: Severe	20 -30 mm (Walnut) 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[143]

142 National Weather Service. 2018. “Introduction to Thunderstorms”. https://www.weather.gov/jetstream/tstorms_intro.
143 Tornado and Storm Research Organization. 2022. “Hail Scale”. https://www.torro.org.uk/research/hail/hscale.

The NCEI reported 319 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 1.19 inches. Events of this magnitude correlate to an H3 Severe classification. It is reasonable to expect H3 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 two H10 hail events (>4.0 inches) during the period of record. Figure 67 shows hail events based on the size of the hail.

Figure 67: Hail Events by Magnitude



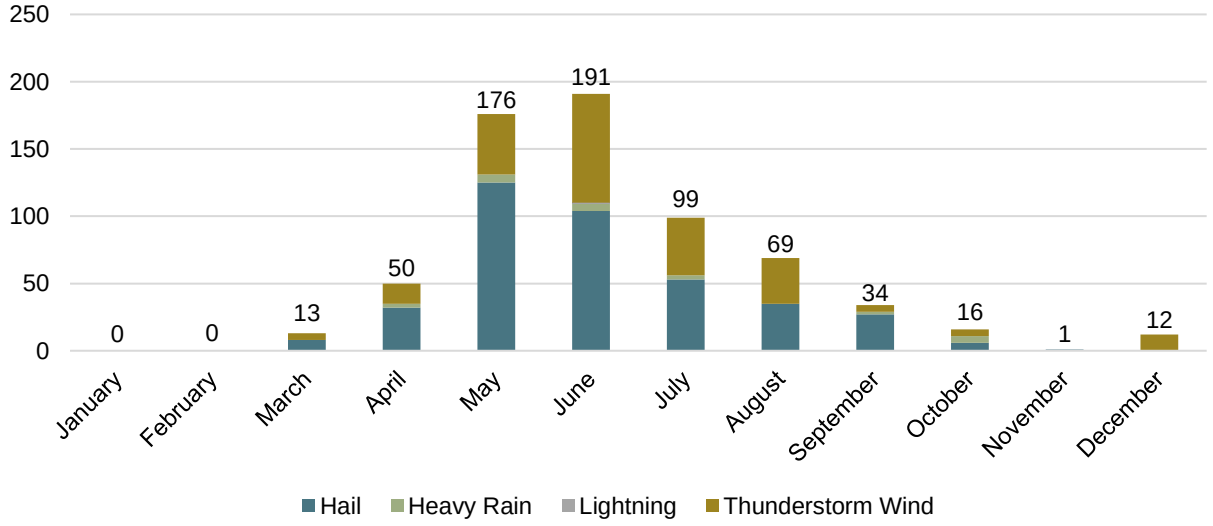
Source: NCEI, 1996-April 2022

Communities and jurisdictions across the planning area are likely to experience similar extent impacts from severe thunderstorms. However, communities or areas with poor stormwater management systems may be at higher risk during heavy rain events.

Historical Occurrences

Severe thunderstorms in the planning area usually occur in the afternoon and evening during the late spring and summer months (Figure 68).

Figure 68: Severe Thunderstorm Events by Month



Source: NCEI, 1996-April 2022

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 245 thunderstorm wind, 24 heavy rain, one lightning, and 391 hail events in the planning area from January 1996 to April 2022. In total these events were responsible for $41,980,000 in property damage. The USDA RMA data shows that severe thunderstorms caused $92,497,800 in crop damage. No injuries or fatalities were reported in association with these storms. Event descriptions from NCEI for the most damaging events are provided below.

- **5/21/1998 Hail -** $1,240,000 of property damages in Phelps County ($1,075,000), Kearney County ($75,000), and Gosper County ($90,000). The first dumped hail as large as soft balls on Holdrege and the surrounding area in the evening and early morning hours. Dozens of cars and trucks were damaged or totaled by the large hail. A fertilizer operation southwest of town sustained major damage to a storage bin as the hail went through the steel roof. Roofs and siding were damaged along with windows broken and blown in. The first round of thunderstorms also spawned two brief tornado touchdowns to the west of Minden. Both were reported by trained spotters in the area.

- **6/12/2002 Hail -** $25,000,000 in property damages in Kearney County. A wicked severe thunderstorm ripped across Buffalo and Kearney counties, dumping hail larger than softballs. In Kearney County, extensive damage was noted in the Minden area. Four and a half (4.5) inch diameter hail were reported in the city. The most extensive damage occurred at the indoor greenhouse facility which grows tomatoes. The glass structure was no match for the softball size hailstones. 2,500 panes of glass were broken, including about 60 percent of the roof panes. Shards of glass penetrated the tomatoes and forced the expulsion of the product for safety reasons. Crop damage was widespread throughout the county as over 22,000 acres of corn, soybeans and alfalfa were severely damaged or destroyed.

- **6/14/2014 Thunderstorm Wind, Hail** - $2,900,000 in property damages in Kearney County ($2,500,000), Gosper County ($100,000), and Phelps County ($300,000). Wind gusts estimated to reach near 65-80 MPH at times moved through the counties, resulting in numerous overturned irrigation pivots and downed trees. One to 1.75-inch hail was reported.

- **7/9/2014 Thunderstorm Wind** - $1,100,000 of property damage in Kearney County. A large swath of severe crop damage occurred this Wednesday evening. It was responsible for producing hail up to the size of golf balls and winds of 60 to 90 miles per hour. Combined with the severe winds, tremendous damage occurred to many homes with vinyl siding in these areas. Windows were even broken. The hail and wind caused severe crop damage as well, stripping the corn of its leaves and leaving little but shredded stalks. The scar from damaged crops remained visible, in even relatively low-resolution GOES satellite imagery, the rest of the summer. Winds were measured as high as 85 MPH in the town of Norman.

- **6/30/2018 Hail, Thunderstorm Wind** - $1,400,000 in property damage in Phelps County ($1,000,000), Gosper County ($250,000), and Kearney County ($150,000). Satellite imagery reveals a swath of golf ball size to isolated baseball size hail that stretched from extreme southeastern Gosper County to central Phelps County on the afternoon of June 30th. The path was about two to three miles wide. Within this swath, law enforcement reported baseball size hail three miles southeast of Loomis. Wind gusts were up to 81 miles per hour.

Average Annual Damages

The average damage per event estimate was determined based upon recorded damages from NCEI Storm Events Database since 1996. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Severe thunderstorms cause an average of $734,887 per year in property damage and $950,407 in crop damage.

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	391	15.0	$32,384,000	$1,245,538	$86,181,183	$3,917,327
Heavy Rain	24	0.9	$20,000	$769	$6,316,617	$287,119
Lightning	1	0.04	$500,000	$19,231		
Thunderstorm Wind	245	9.4	$9,076,000	$349,077		
Total	**661**	**25.4**	$41,980,000	**$1,614,615**	$92,497,800	**$4,204,445**

Source: 1 Indicates data is from NCEI (January 1996 to April 2022); 2 Indicates data is from USDA RMA (2000 to 2021)

Climate Change

For extreme events like severe thunderstorms there is "considerable uncertainty about how projected changes in the climate will affect these events". However, severe thunderstorms will "continue to be a normal feature for Nebraska."[144] According to the Fourth National Climate Assessment, "modeling studies consistently suggest that the frequency and intensity of severe thunderstorms in the United States could increase as climate changes."[145] There is also some suggestion in the models that the atmosphere will become more favorable to severe thunderstorm development and increased intensity.

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 661 severe thunderstorm events between 1996 and April 2022, resulting in 100% chance annually for thunderstorms. Even with the uncertainty about how climate change will impact severe thunderstorms, they are still likely to occur on an annual basis in the planning area.

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

145 Fourth National Climate Assessment. 2018. "Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Chapter 2". https://nca2018.globalchange.gov/chapter/2/.

Future Development

All future development could be impacted by severe thunderstorms. The ability to withstand major damage lies in sound land use practices and consistent enforcement of building codes and regulations for new construction. Municipalities that have adopted the current International Building Codes have a lower risk of damage as the code has sections designed to deal with the impacts of hail events. Lightning rods, protected rooftop utilities, and surge protectors, are possible steps new developments can take to reduce impacts from lightning and severe thunderstorms.

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 -Community lifelines may sustain damage from hail, lightning, and wind

Community Top Hazard Status

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

Jurisdictions and Stakeholders	
Atlanta	Holdrege Public Schools
Axtell	Kearney County
Axtell Community Schools	Kearney County Farm Service Agency
Bertrand	Loomis
Elwood	Loomis Public Schools
Elwood Public Schools	Minden
Funk	Minden Volunteer Fire Department
Funk Rural Fire Department	Norman
Gosper County	Smithfield
Heartwell	Tri-Basin NRD
Holdrege	Wilcox

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. 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 39°F.[146]

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. Blizzards 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. Ice Storm Warnings are issued when accumulation of at least 0.25 inches is expected from a storm, which controlling for high winds, would tend to classify ice storms in Nebraska as SPIA Level 2 or higher. Figure 69 shows the SPIA index.

146 NOAA National Centers for Environmental Information. September 2022. "Data Tools: 1991-2020 Normals". https://www.ncei.noaa.gov/access/us-climte-normals/.

Figure 69: 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[147]

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 70 shows the Wind Chill Index used by the NWS.

Average monthly snowfall for the planning area is shown in Figure 72, 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 30°F to 70°F below zero.

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

Figure 70: 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

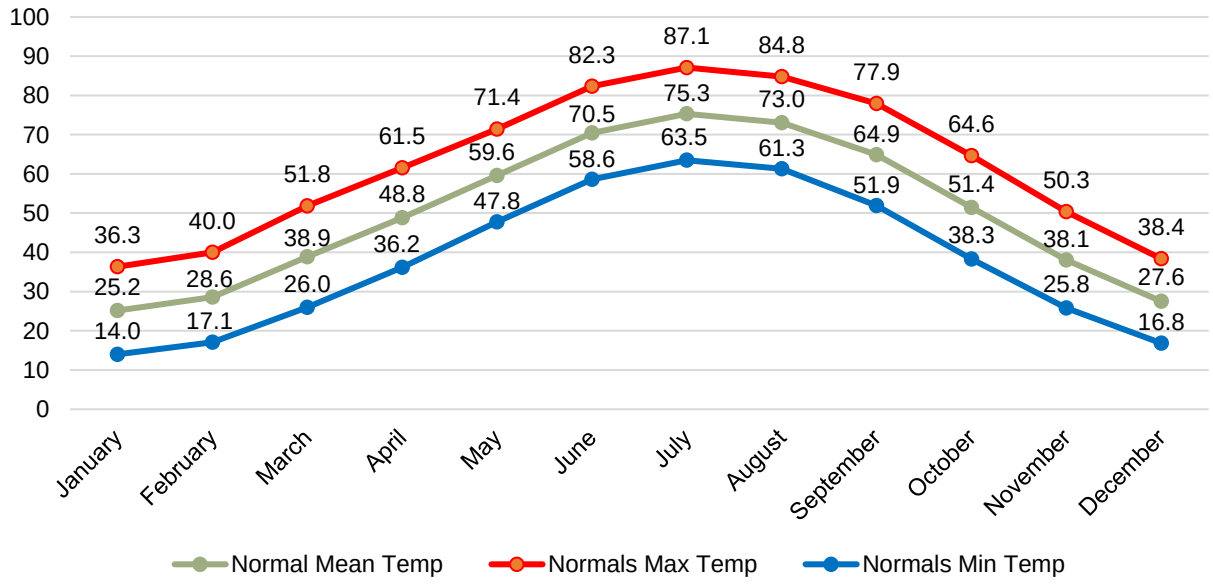
Frostbite Times — 30 Minutes — 10 MInutes — 5 Minutes

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

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

Source: NWS[148]

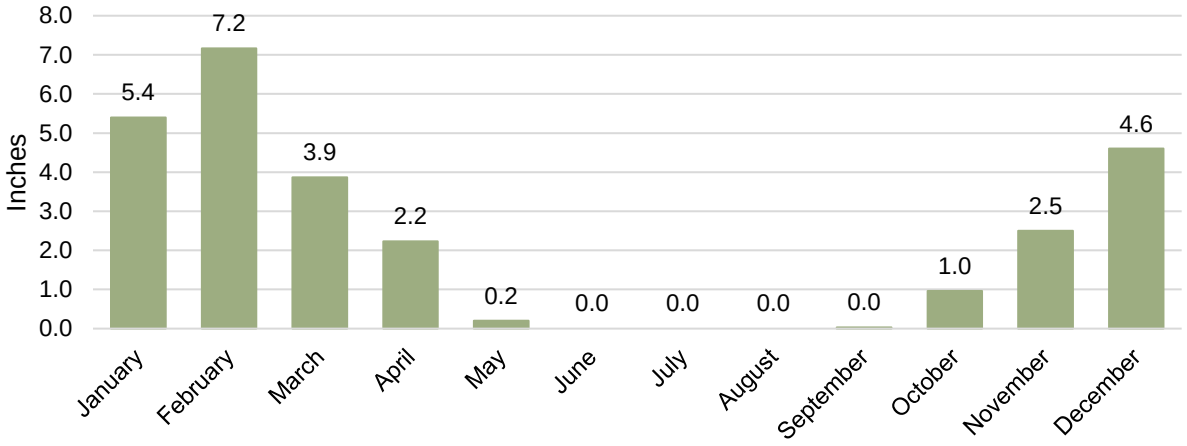
Figure 71: Monthly Climate Normals Temperature



Source: NOAA, 1991-2020[149]

148 National Weather Service. 2001. "Wind Chill Chart". http://www.nws.noaa.gov/om/cold/wind_chill.shtml.
149 NOAA National Centers for Environmental Information. September 2022. "Data Tools: 1991-2020 Normals". https://www.ncei.noaa.gov/access/us-climate-normals/.

Figure 72: Monthly Normal Snowfall in Inches



Source: NOAA, 1991-2020

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 307 severe winter storm events for the planning area from January 1996 to April 2022. These recorded events caused a total of $23,300,000 in reported property damage and $3,098,293 in crop damage. According to the NCEI, there was one injury and no deaths associated with winter storms in the planning area. Event descriptions from NCEI for the most damaging events are provided below.

- **11/27/2005 Blizzard** - $750,000 in property damages in Gosper County ($250,000), Kearney County ($250,000), and Phelps County ($250,000). A strong upper-level low pressure system intensified over the Central Plains during the day. After raining much of the day, cold air and strong winds quickly changed the rain to snow in the early evening. The winds increased rapidly, and by late evening, were gusting over 50 mph. The fierce winds continued all night and throughout the day Monday, November 28th. Winds gusted to 70 mph at times and caused white out" conditions in snow and wind.

- **3/20/2006 Winter Storm** - $300,000 in property damages in Gosper County ($100,000), Kearney County ($100,000), and Phelps County ($100,000). There was no event description given for this storm.

- **12/19/2006 & 12/20/2006 Ice Storm** - $700,000 in property damages in Gosper County ($300,000), Kearney County ($100,000), and Phelps County ($300,000). A major winter storm spun its way onto the plains. With mild temperatures in place at the start of the storm, precipitation began as rain, and pretty much stayed as rain. In fact, freezing rain blanketed the majority of south-central Nebraska on the night of the 19th and during the day on the 20th. By the end of the 20th, a fresh coat of ice resulted in broken tree limbs, power lines and power poles, especially along and west of U.S. Highway 281 across south-central Nebraska.

- **12/29/2006 Ice Storm** - $21,000,000 in damages in Gosper County ($1,000,000), Kearney County ($10,000,000), and Phelps County ($10,000,000). A wide variety of significant winter weather began impacting portions of south-central Nebraska during the day and continued the next day, before exiting the area. Many locations received at least one-half inch of ice. The deposits of ice have caused widespread tree damage, along with power outages, and damage to power lines and poles. Several communities were running via generators. The City of Holdrege was expecting to finally have the transmission lines repaired and switched from generator to commercial power on January 17, 2007.

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 $862,963 per year in property damage and $140,832 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	30	1.1	$900,000	$33,333		
Extreme Cold/Wind Chill	10	0.4	$0	$0		
Heavy Snow	14	0.5	$0	$0	$3,098,293	$140,832
Ice Storm	18	0.7	$21,765,000	$806,111		
Winter Storm	119	4.4	$600,000	$22,222		
Winter Weather	116	4.3	$35,000	$1,296		
Total	**307**	**11.4**	**$23,300,000**	**$862,963**	**$3,098,293**	**$140,832**

Source: 1 Indicates data is from NCEI (Jan 1996 to April 2022); 2 Indicates data is from USDA RMA (2000 to 2021)

Climate Change

For extreme events like severe winter storms “it is difficult to know what will happen to the frequency and intensity” of these events. However, winter storms will “continue to be a normal feature for Nebraska.”[150] Some studies indicate that atmospheric circulation patterns in the Arctic could affect winter storms in midlatitude regions, and there may be a link between arctic warming and the frequency and intensity of severe winter storms in the United States.[151] Cold temperatures are likely to be impacted by climate change. The table below shows the number of freezing days in three-county region with different warming scenarios.

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

151 Fourth National Climate Assessment. 2018. “Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Chapter 2”. https://nca2018.globalchange.gov/chapter/2/.

Table 92: Number of Freezing Days

	Warming Scenarios			
	1° C	1.5° C	2° C	3° C
Number of Freezing Days	31-90 Days per Year	8-30 Days per Year	8-30 Days per Year	8-30 Days per Year

Source: Probable Futures[152]

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 every year, resulting in 100 percent chance annually for winter storms. Even with the uncertainty about how climate change will impact severe winter storms, they are still likely to occur on an annual or nearly annual basis in the planning area.

Future Development

All future developments will be affected by winter storms. More buildings and infrastructure in the NRD create a higher probability of damage to occur from winter weather as more property is exposed to risk. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction.

Regional Vulnerabilities

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

Table 93: 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
Community Lifelines	-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 -Emergency response and recovery operations, communications, water treatment plants, and others are at risk to power outages, impassable roads, and other damages

152 Probable Futures. “Maps of Temperature”. Accessed January 2023. https://probablefutures.org/.

Community Top Hazard Status

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

Jurisdictions and Stakeholders	
Atlanta	Kearney County Farm Service Agency
Axtell	Loomis
Axtell Community Schools	Loomis Public Schools
Axtell Volunteer Fire & Rescue Department	Loomis Volunteer Fire & Rescue
Bertrand	Minden
Elwood	Norman
Elwood Public Schools	Phelps County
Funk	Phelps County Farm Service Agency
Gosper County	Smithfield
Heartwell	Tri-Basin NRD
Holdrege	Wilcox
Holdrege Public Schools	Wilcox Rural Fire Protection District
Kearney County	

Terrorism and Cyber Attack

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 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 plan, 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
- Bioterrorism
- 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.

Threat assessment, mitigation, and response to terrorism are federal and state directives that work in conjunction with local law enforcement and county emergency management. 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.

Cyber-Attack

Cyber-attack 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-attack incident can impact governmental 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, 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-attack 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-attack.

Extent

Terrorist and cyber-attacks can vary greatly in scale and magnitude, depending on the location, method, and target of the attack. They can range from an entire water system to a single building or structure.

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 no terrorist incidents since 1970 within the planning area.[153] No cyber-attacks were reported by the Regional Planning Team.

Average Annual Damages

With no past terrorist or cyber-attack events, the average annual damages are $0. If a terrorist event were to occur in the planning area, damages can range from minimal (in rural areas, <$1 million) to significant (in urban areas, >$10 million).

Climate Change

Climate change will likely have a very limited to no impact on terrorism or cyber-attacks. However, government authorities report that civil disturbances and riots are more likely to occur during heat waves.[154] With an increase in the number of 100° F days,[155] these events may be more likely to occur but are unlikely to reach the level of terrorism.

Probability

Given no reported terrorism or cyber-attack incidents over the course of 50 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. Climate change is unlikely to impact the probability of terrorist or cyber-attack incidents.

Future Development

Increased security measures at vulnerable locations such as schools will reduce the likelihood and impacts of a terroristic act. Measures can include bollards to protect from vehicles, fencing, security cameras, advanced locks, etc. Having strong cyber security can keep bad actors from taking control of municipal systems with the intent to cause harm to humans and damage to buildings.

Regional Vulnerabilities

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

153 University of Maryland and National Consortium for the Study of Terrorism and Response to Terrorism. 1970-2019. “Global Terrorism Database”. https://www.start.umd.edu/gtd/.

154 Yeeles, Adam. 2015. Weathering unrest: The ecology of urban social disturbances in Africa and Asia”. https://journals.sagepub.com/doi/full/10.1177/0022343314557508.

155 Union of Concerned Scientists. 2023. “Extreme Heat and Climate Change: Interactive Tool”. https://www.ucsusa.org/resources/killer-heat-interactive-tool.

Table 94: 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
Community Lifelines	-Water supply, power plants, utilities may be damaged -Police stations and government offices are at a higher risk

Community Top Hazard Status

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

Jurisdictions and Stakeholders	
Elwood Public Schools	Loomis Public Schools
Kearney County Farm Service Agency	Phelps County Farm Service Agency
Kearney County Health Services	

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 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.[156] 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 73 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.
- The spinning vortex of air must have caused enough damage to be classified by the Fujita Scale as a tornado.

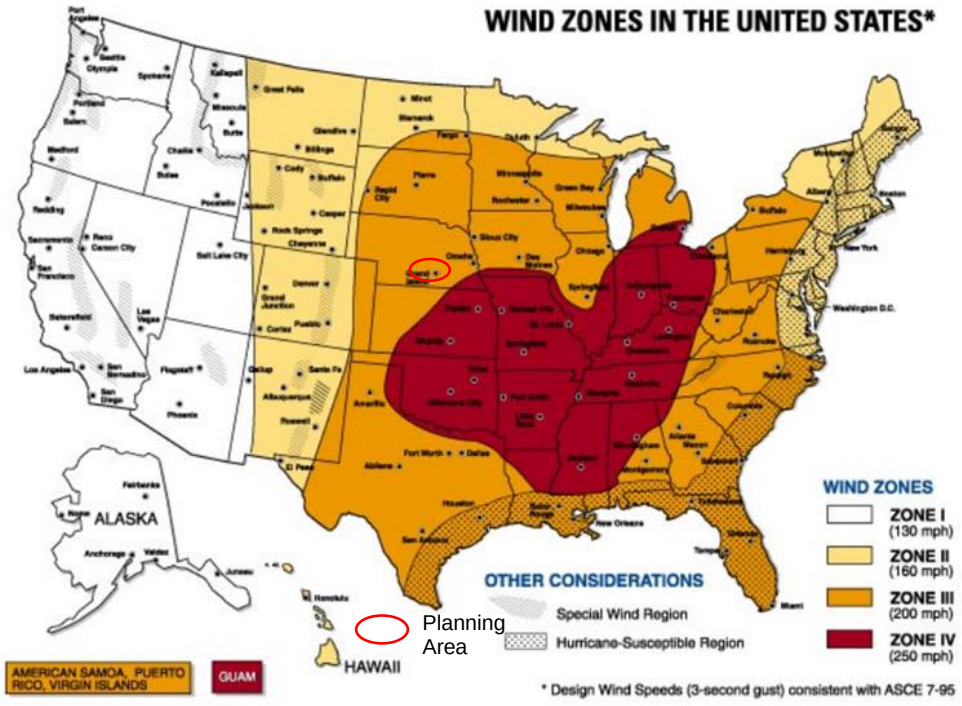
Once tornadoes are formed, they can be extremely violent and destructive. They have been recorded all over the world but are most prevalent in the American Midwest and South, in an area known as “Tornado Alley.” Approximately 1,000 tornadoes are reported annually in the contiguous United States (NOAA 2012). Tornadoes can travel distances of over 100 miles and reach over 11 miles above ground. Tornadoes usually stay on the ground for 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.[157]

Location

High winds and tornadoes can occur throughout the planning area. The impacts would be greater in more densely populated areas, such as Holdrege and Minden. Figure 75 shows the historical track locations across the planning area according to the Midwestern Regional Climate Center.

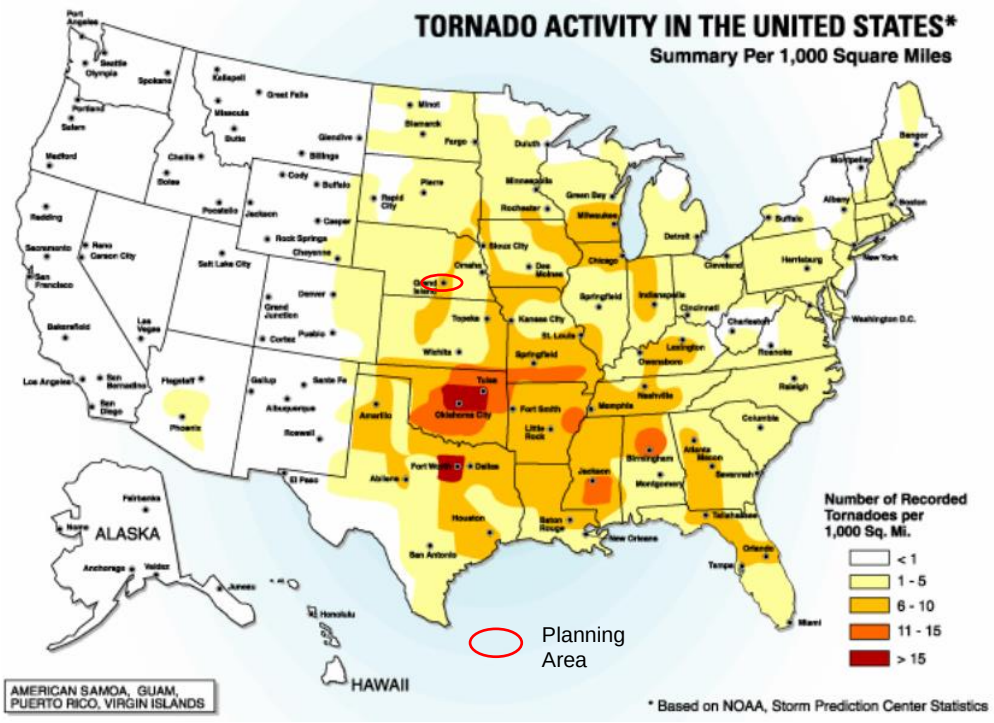
156 National Weather Service. 2017. “Glossary”. http://w1.weather.gov/glossary/index.php?letter=h.
157 NCEI. 2013. “U.S. Tornado Climatology”. https://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornadoclimatology.

Figure 73: Wind Zones in the U.S.



Source: FEMA[158]

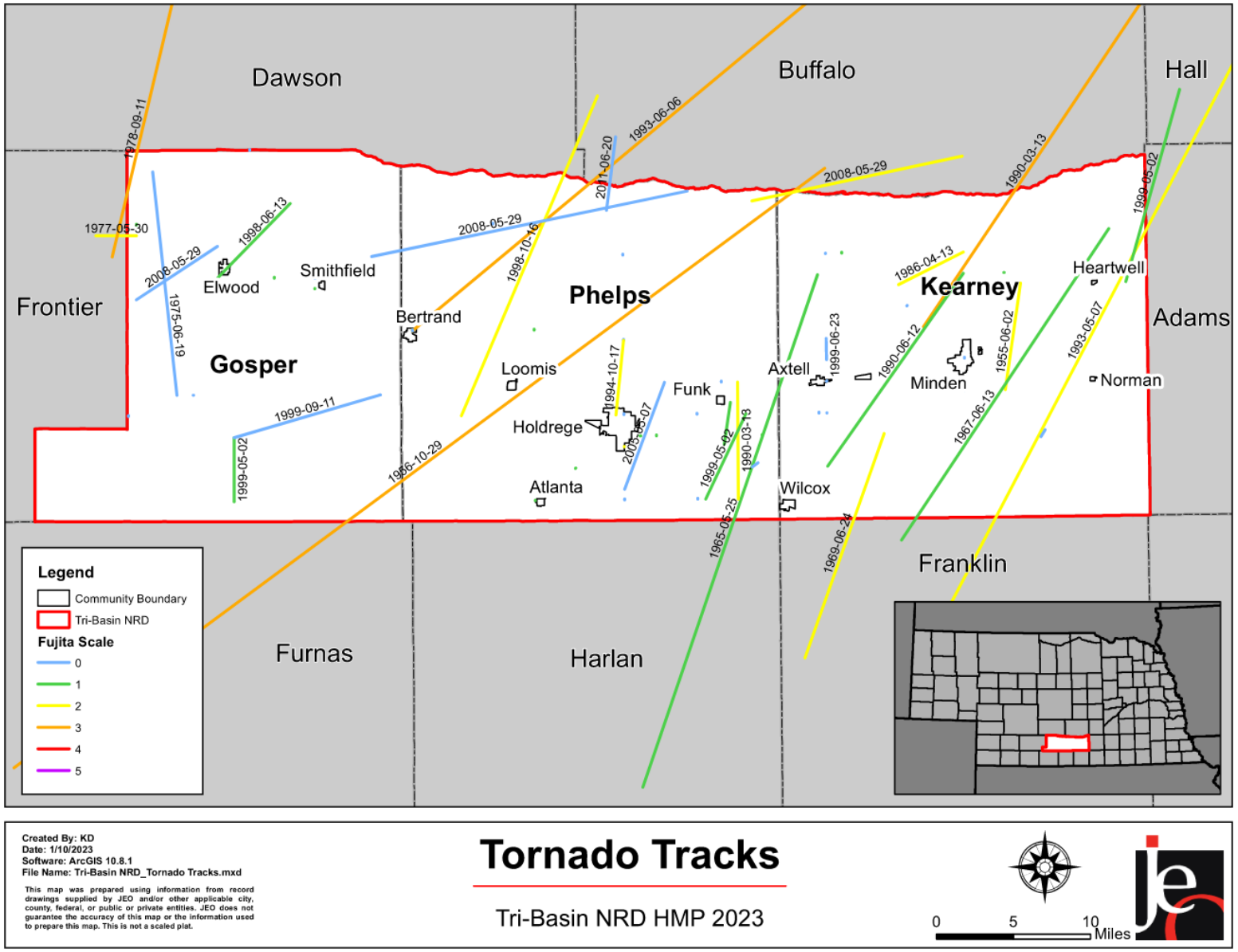
Figure 74: Tornado Activity in the United States



Source: FEMA[159]

158 FEMA. "Section 1: Understanding Hazards". Accessed December 2022. https://www.fema.gov/pdf/library/ism2_s1.pdf.
159 FEMA. July 2000. "Design and Construction Guidance for Community Shelters".

Figure 75: Tornado Tracks (1950-2019)



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 95: 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[160]

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.[161]

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

161 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 96: Enhanced Fujita Scale

Storm Category	3 Second Gust (mph)	Damage Level	Damage Description
EF0	65-85 mph	Gale	Chimneys are damaged, tree branches are broken, shallow-rooted trees are toppled.
EF1	86-110 mph	Weak	Roof surfaces are peeled off, windows are broken, some tree trunks are snapped, unanchored mobile homes are overturned, attached garages may be destroyed.
EF2	111-135 mph	Strong	Roof structures are damaged, mobile homes are destroyed, debris becomes airborne (missiles are generated), large trees are snapped or uprooted.
EF3	136-165 mph	Severe	Roofs and some walls are torn from structures, some small buildings are destroyed, non-reinforced masonry buildings are destroyed, most trees in forest are uprooted.
EF4	166-200 mph	Devastating	Well-constructed houses are destroyed, some structures are lifted from foundations and blown some distance, cars are blown some distance, large debris becomes airborne.
EF5	200+ mph	Incredible	Strong frame houses are lifted from foundations, reinforced concrete structures are damaged, automobile-sized missiles become airborne, trees are completely debarked.

Source: NOAA[162]; FEMA[163]

Table 97: 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

Using the NCEI reported events, the most common high wind event in the planning area is a level 10 on the Beaufort Wind Ranking scale. The reported high wind events ranged from 40 mph to 77 mph, with an average speed of 57.5 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 29 reported tornado events, 22 were EF/F0, four were EF/F1, two were EF/F2, and one was EFU.

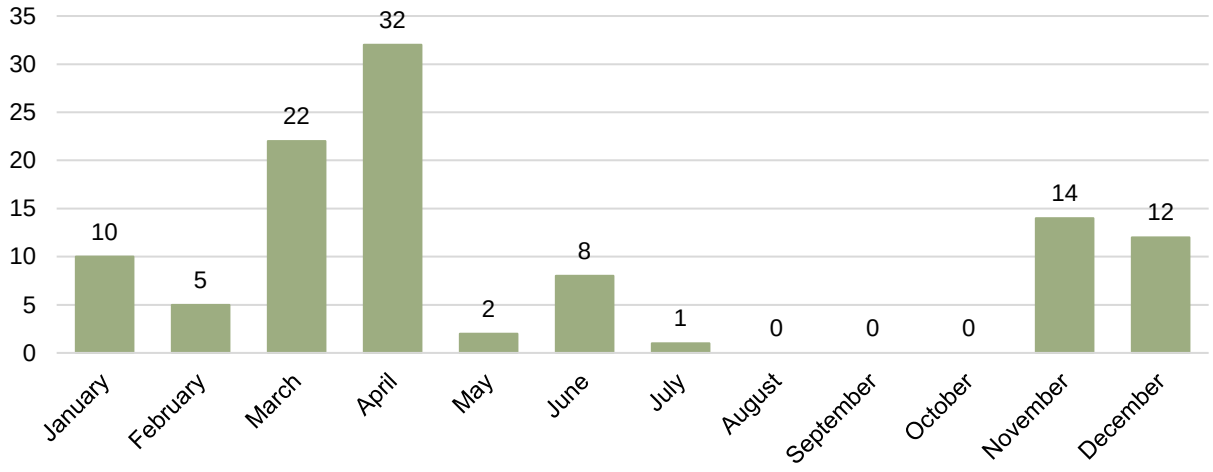
162 NOAA. 2006. “Enhanced F Scale for Tornado Damage”. https://www.spc.noaa.gov/efscale/ef-scale.html.
163 FEMA. “Section 1: Understanding Hazards”. Accessed December 2022. https://www.fema.gov/pdf/library/ism2_s1.pdf.

The extent of damage felt by high wind or tornado events will vary depending on the severity of the event and amount of infrastructure and development within a community or area. Due to the nature of how tornadic events are categorized, significant tornado events will occur in areas with more infrastructure.

Historical Occurrences

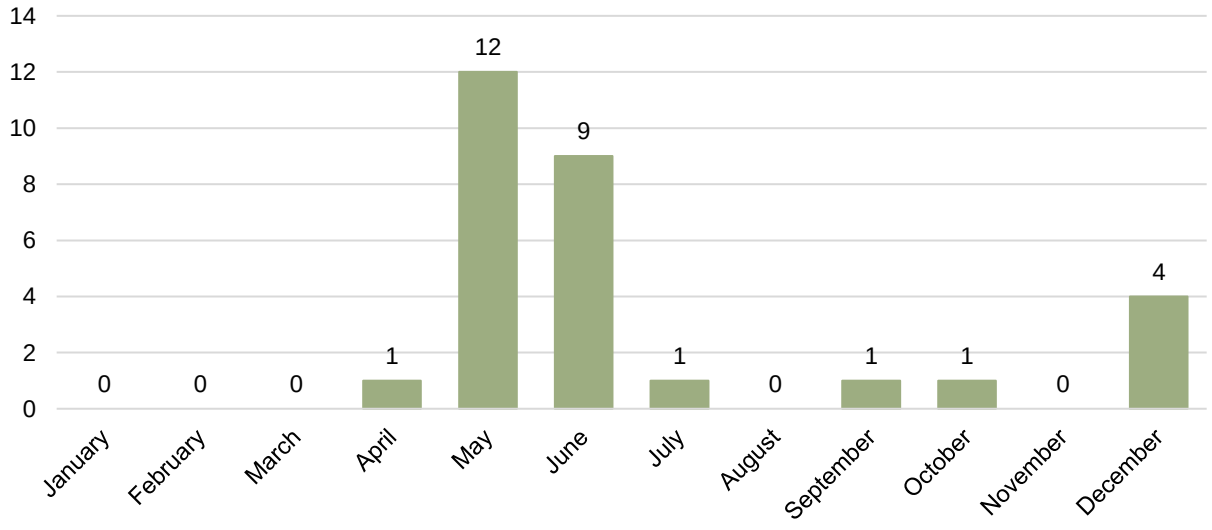
Due to the regional scale of high winds, the NCEI reports events as they occur in each county. While a single event can affect two or more counties at a time, the NCEI reports them as separate events. There were 114 high wind events that occurred between 1996 and April 2022 and 29 tornadic events ranging from a magnitude of EFU to EF2. These events were responsible for $6,226,240 in property damages and $7,986,486 in crop damages. Eleven injuries and no deaths were reported from these events. 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 late spring and early summer.

Figure 76: High Wind Events by Month



Source: NCEI, 1996-April 2022

Figure 77: Tornado Events by Month



Source: NCEI, 1996-April 2022

Event descriptions from NCEI for the events that caused the most injuries, and the most damaging events are provided below.

- **6/13/1998 Tornado** - $500,000 in property damages in Gosper County. A warm front lifting north and a strong jet stream played a key role in the eruption of severe thunderstorms in the late afternoon in south-central Nebraska. Four injuries resulted from this event.

- **5/21/2002 High Winds** - $50,000 in property damage in Phelps County. Strong winds with the passage of a cold front kicked up dust from plowed fields across Phelps County. Wind gusts to 50 MPH were common and resulted in blowing dust. A seven-vehicle accident occurred two miles east of Loomis on Highway 23 and resulted in five injuries. Dust from fields south of the highway was producing poor visibility when the chain-reaction accident occurred.

- **6/20/2011 Tornado** - $500,000 in property damages in Phelps County. This tornado touched down in northern Phelps County, approximately six miles south-southwest of Elm Creek, and moved north into southern Buffalo County, dissipating just south of Elm Creek. This tornado lifted and touched back down several times along its path, with the main damage coming from overturned irrigation pivots. The maximum wind speed of this tornado was estimated to be 80 MPH.

- **12/25/2016 High Winds** - $3,000,000 in property damages in Gosper County ($1,000,000), Kearney County ($1,000,000), and Phelps County ($1,000,000). These winds resulted in widespread, mainly minor damage to trees, power lines (prompting several power outages) and some structures, and also flipped over numerous irrigation pivots. Highest wind gusts in the three counties ranged from 56 MPH to 73 MPH with sustained winds of 40-50 MPH.

Average Annual Damages

The average damage per event estimate was determined based upon NCEI Storm Events Database since 1996. 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 $125,787 per year in property damage and $361,532 per year in crop damage. Tornadoes have caused an average of over $104,815 per year in property damage and $1,490 per year in crop damages; however, damages from tornadoes vary greatly depending on the severity or magnitude of each event.

Table 98: 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	114	4.2	$3,396,240	$125,787	$7,953,707	$361,532
Tornadoes	29	1.1	$2,830,000	$104,815	$32,779	$1,490
Total	**143**	**5.3**	**$6,226,240**	**$230,601**	**$7,986,486**	**$363,022**

Source: 1 NCEI (1996-April 2022), 2 USDA RMA (2000-2021)

Figure 78: Tornado Damage - Johnson Lake, May 5th, 2023

Source: Lori Hagan, Tri-Basin NRD

Climate Change

For extreme events like tornadoes and high winds there is "considerable uncertainty about how projected changes in the climate will affect these events". However, "tornadoes and severe storms will continue to be a normal feature for Nebraska."[164]

Probability

Given the historic record of occurrence for high wind events (20 out of 26 years with reported events), for the purposes of this plan, the annual probability of wind event occurrence is 77 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 (10 out of 26 years with reported events), for the purposes of this plan, the annual probability of tornado occurrence is 38 percent. With the uncertainty of how climate change will impact severe events like tornadoes and high winds, the probability of an event occurring will likely stay the same or have minimal changes in the future.

Future Development

Any future development and population growth elevates exposure of property and people to the impacts of tornadoes and high wind. Future development should take steps to reduce potential damage from tornadoes and high winds. Building codes for new structures can be strengthened, requiring increased rebar in foundations, enhanced nailing patterns for wall sheathing, the use of Simpson Strong Ties and Straps, and require the use of anchors and tie-downs of mobile homes. Additionally, individuals can choose to build to an option Code Plus Standard, such as Fortified for Safer Living. The installation of public shelters to protect residents caught outside or in vulnerable areas, such as mobile home parks, can increase safety of residents in those areas. Development regulations that require safe rooms, basements, warning sirens, or other structures that reduce risk to people would also help decrease vulnerability.

Regional Vulnerabilities

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

Table 99: 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
Community Lifelines	-Downed power lines and power outages -All above ground infrastructure at risk to damages -Impassable roads due to debris blocking roadways - All community lifelines are at risk to damages

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

Community Top Hazard Status

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

Jurisdictions and Stakeholders	
Atlanta	Kearney County
Axtell	Kearney County Farm Service Agency
Axtell Community Schools	Loomis
Bertrand	Loomis Public Schools
Bertrand Fire Department	Minden
Elwood	Minden Volunteer Fire Department
Elwood Public Schools	Norman
Elwood Volunteer Fire Department	Phelps County
Funk	Phelps County Farm Service Agency
Funk Rural Fire Department	Smithfield
Gosper County	Tri-Basin NRD
Holdrege	Wilcox
Holdrege Fire & Rescue	Wilcox Rural Fire Protection District
Holdrege Public Schools	

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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 options to address risk.

The establishment of goals and objectives took place during the kick-off meeting with the Regional Planning Team. 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.

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 directions to guide participants in reducing future hazard related losses.

Goal 1: Protect the Health and Safety of the Public

Goal 2: Protect and Maintain Operation of Community Lifelines During and After a Hazard Event

Goal 3: Protect Existing and Future Properties and Natural Resources

Goal 4: Promote Efficient Use of Public Funds

Goal 5: Increase Public Awareness and Education on Vulnerability to Hazards

Goal 6: Improve Emergency Management Capabilities

Selected Mitigation Actions

After establishing the goals, local planning teams evaluated 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 Mitigation Ideas document to be used as a starting point in order to review a wide range of potential mitigation actions. Participants were also encouraged to think of actions that may need FEMA grant assistance and to review their hazard prioritization section for potential mitigation actions. Members of the Regional Planning Team were also available to help local jurisdictions identify mitigation action alternatives. These suggestions helped participants determine which actions would best assist their respective jurisdiction in alleviating damage in the event of a disaster.

During the update of previous identified actions and the identification of new actions, local planning teams prioritized each identified mitigation action as high, medium, or low. Participants were informed of the STAPLEE (Social, Technical, Administrative, Political, Legal, Economic, Environmental) feasibility review process at the Round 2 Meetings and were encouraged to use it when determining priorities. The listed priority rating does not indicate which actions will be implemented first. Generally, high priority actions either address a major concern for the jurisdiction, have few to no challenges in implementation, and/or garner large support from the public and administration. Low priority actions either address a minor concern for the jurisdiction, have many challenges in implementation, and/or may not have support from the public or administration at this time. Medium priority actions may only have one or two of the items listed above. A mitigation action's priority may change very quickly as circumstances change.

These projects are the core of a hazard mitigation plan. The local planning teams were instructed that each hazard of top concern have an action that addresses it. 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.

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. 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 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.
- **Local 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).
- **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, kept, and 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 2018 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 100: Mitigation Actions Selected by Each Jurisdiction 1 of 3

Mitigation Actions	Tri-Basin NRD	Gosper County	Village of Elwood	Village of Smithfield	Kearney County	Village of Axtell	Village of Heartwell	City of Minden	Village of Norman	Village of Wilcox
Alert Sirens		X		X	X					X
Backup Generators	X	X	X	X	X	X	X	X	X	X
Bury Power and Service Lines								X		
Civil Service Improvements			X							
Code Red Participation					X					
Communication Equipment		X								
Drought Plan	X									
Drought Planning Exercise	X									
Emergency Exercise: Hazardous Materials Release			X							
Forestry Management	X									
Groundwater Recharge	X									
Ice Jam Monitoring Camera/Station	X									
Implement Actions Identified in the CWPP		X			X					
Implement Water System Improvements								X		
Improve and Revise Snow/Ice Removal Program and Resources			X			X				
Infrastructure Hardening	X									
Install Water Meters			X							
Install Vehicular Barriers			X							
Invasive Species Management	X									
Public Awareness and Education	X	X	X	X	X	X	X	X	X	X
Reduce Groundwater and Surface Water Use	X									
Remove Flow Restrictions										X

Mitigation Actions	Tri-Basin NRD	Gosper County	Village of Elwood	Village of Smithfield	Kearney County	Village of Axtell	Village of Heartwell	City of Minden	Village of Norman	Village of Wilcox
Safe Room and Storm Shelters	X	X								
Source Water Contingency Plan										X
Stormwater System and Drainage Improvements	X	X		X				X		
Stream Bank Stabilization	X									
Transportation Drainage Improvements			X							
Tree Maintenance Program						X		X		X
Weather Radios		X								
Windbreaks/Living Snow Fence	X									

Table 101: Mitigation Actions Selected by Each Jurisdiction 2 of 3

Mitigation Actions	Phelps County	Village of Atlanta	Village of Bertrand	Village of Funk	City of Holdrege	Village of Loomis	Axtell Community Schools	Axtell Volunteer Fire & Rescue Department	Bertrand Fire Department	Elwood Public Schools
Alert Sirens		X			X	X				
Acquire Updated Wildland Fire Gear									X	
Backup Generators					X		X			X
Bridge Improvements	X			X						
Bury Power and Service Lines				X	X					
Communication Equipment	X				X			X	X	
Cyber Security Planning Meeting	X									
Dump Truck						X				

Mitigation Actions	Phelps County	Village of Atlanta	Village of Bertrand	Village of Funk	City of Holdrege	Village of Loomis	Axtell Community Schools	Axtell Volunteer Fire & Rescue Department	Bertrand Fire Department	Elwood Public Schools
Electric System Looped Distribution/Redundancies					X					
Emergency Exercise: Hazardous Materials Release									X	
Evacuation Site										X
Implement Actions Identified in the CWPP	X							X	X	
Increase Floodplain Management Capabilities		X		X	X					
New Fire Hall			X						X	
Public Awareness and Education	X	X	X	X	X	X	X	X	X	X
Safe Room and Storm Shelters	X	X	X		X	X				
Safety Equipment	X				X				X	
Storm Shelter Identification						X				
Stormwater System and Drainage Improvements				X	X					
Update Community Planning Documents				X						
Water Well					X	X				
Weather Radios										X

Table 102: Mitigation Actions Selected by Each Jurisdiction 3 of 3

Mitigation Actions	Elwood Volunteer Fire Department	Funk Rural Fire Department	Holdrege Fire & Rescue	Holdrege Public Schools	Loomis Public Schools	Loomis Volunteer Fire & Rescue	Minden Volunteer Fire Department	Wilcox Rural Fire Protection District
Acquire Updated Wildland Fire Gear	X	X	X			X		
Additional Equipment							X	
Alert Sirens								
Backup Generators	X			X	X	X		X
Bridge Improvements								
Cleaning Equipment					X			
Communication Equipment	X	X	X			X		
Controlled Burns	X							
Heated Concrete Approach				X				
Implement Actions Identified in the CWPP	X	X	X			X	X	X
Metal Light Poles at Athletic Fields				X				
New Building Entrance				X				
New Rescue Unit						X		
Public Awareness and Education	X	X	X	X	X	X	X	X
Safe Room and Storm Shelters				X	X			
Safety Equipment		X	X		X	X		
Snow Removal Equipment				X				
Storm Monitoring Equipment					X			

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Section Six: Plan Implementation and Maintenance

Monitoring, Evaluating, and Updating the Plan

Each participating jurisdiction in the Tri-Basin NRD 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 position(s) that will be responsible for plan maintenance, the frequency of review, and how the public will be involved. This 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, can 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.

In addition, each local review team will be responsible for ensuring that the HMP's goals are incorporated into applicable revisions of their jurisdiction's relevant planning documents. The HMP will also consider any changes in planning documents and incorporate the information accordingly in its next update.

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. Tri-Basin NRD will start meetings to discuss mitigation plan updates at least nine months prior to the deadline for completing the plan update. The Tri-Basin NRD General Manager and individual county emergency managers 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. If deemed necessary, a private consulting firm or individual will be hired to help facilitate the plan update process.

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.

- 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 stakeholders, 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 of 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. In 2022 NeDNR completed the State of Nebraska Flood Hazard Mitigation Plan. Information in the plan can help communities and counties with mitigation ideas and resources, flood history and risk levels, NFIP information, and funding and service providers.

NeDNR plays a significant role in protecting and conserving water resources through the oversight of surface and groundwater status and integrated water management. 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.

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

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 options 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. Tri-Basin NRD, as the plan sponsor, provides an opportunity for jurisdictions to compile proposed amendments 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*[165] guidance, as well as FEMA's *2015 Plan Integration*[166] 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.

165 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/sites/default/files/2020-07/integrating-hazard-mitigation-local-plan.pdf.

166 Federal Emergency Management Agency. July 2015. "Plan Integration: Linking Local Planning Efforts." https://www.fema.gov/sites/default/files/2020-06/fema-plan-integration_7-1-2015.pdf.

Section Seven: Community Profiles

Purpose of Community Profiles

Community Profiles contain information specific to jurisdictions participating in the Tri-Basin 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
- Plans and Studies
- 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 jurisdictional identified community lifelines, 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*.