Hazard Mitigation Plan Regional Planning Team

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List of Acronyms

ACS – American Community Survey
CFR – Code of Federal Regulations
CRS – Community Rating System
DHS – Department of Homeland Security
DMA 2000 – Disaster Mitigation Act of 2000
EAB – Emerald Ash Borer
EAP – Emergency Action Plan
EPA – Environmental Protection Agency
ESL – English as Second Language
FEMA – Federal Emergency Management Agency
FIRM – Flood Insurance Rate Map
FMA – Flood Mitigation Assistance Program
FR – FEMA's Final Rule
GIS – Geographic Information Systems
HMA – Hazard Mitigation Assistance
HMGP – Hazard Mitigation Grant Program
HMP – Hazard Mitigation Plan
HPRCC – High Plains Regional Climate Center
IP – Office of Infrastructure Protection
JEO – JEO Consulting Group, Inc.
LEOP – Local Emergency Operations Plan
LGA – Liquid Gallon
LIP – Livestock Indemnity Program
MHSW – Mobile Home Single Wide
MPH – miles per hour
NCEI – National Centers for Environmental Information
NDA – Nebraska Department of Agriculture
NDEE – Nebraska Department of Environment and Energy
NDMC – National Drought Mitigation Center
NDOT – Nebraska Department of Transportation
NeDNR – Nebraska Department of Natural Resources
NEMA – Nebraska Emergency Management Agency
NFIP – National Flood Insurance Program
NFS – Nebraska Forest Service
NIPP – National Infrastructure Protection Plan
NOAA – National Oceanic and Atmospheric Administration
NPS – National Park Service
NRC – National Response Center
NRD – Natural Resources District
NWS – National Weather Service
PDSI – Palmer Drought Severity Index
PHMSA – U.S. Pipeline and Hazardous Material Safety Administration
RMA – Risk Management Agency
SBA – Small Business Administration
SFHA – Special Flood Hazard Area
SPIA – Sperry-Piltz Ice Accumulation Index
SURE – Supplemental Revenue Assistance Payments
TORRO – Tornado and Storm Research Organization
USACE – United States Army Corps of Engineering
USDA – United States Department of Agriculture
USGS – United States Geological Survey
WUI – Wildland Urban Interface

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EXECUTIVE SUMMARY

Introduction

This plan is an update to the previously FEMA approved Multi-Hazard, Multi-Jurisdictional Mitigation Plan (HMP) for Antelope, Holt, and Knox Counties in 2017. The plan update was developed in compliance with the requirements of the Disaster Mitigation Act of 2000 (DMA 2000).

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

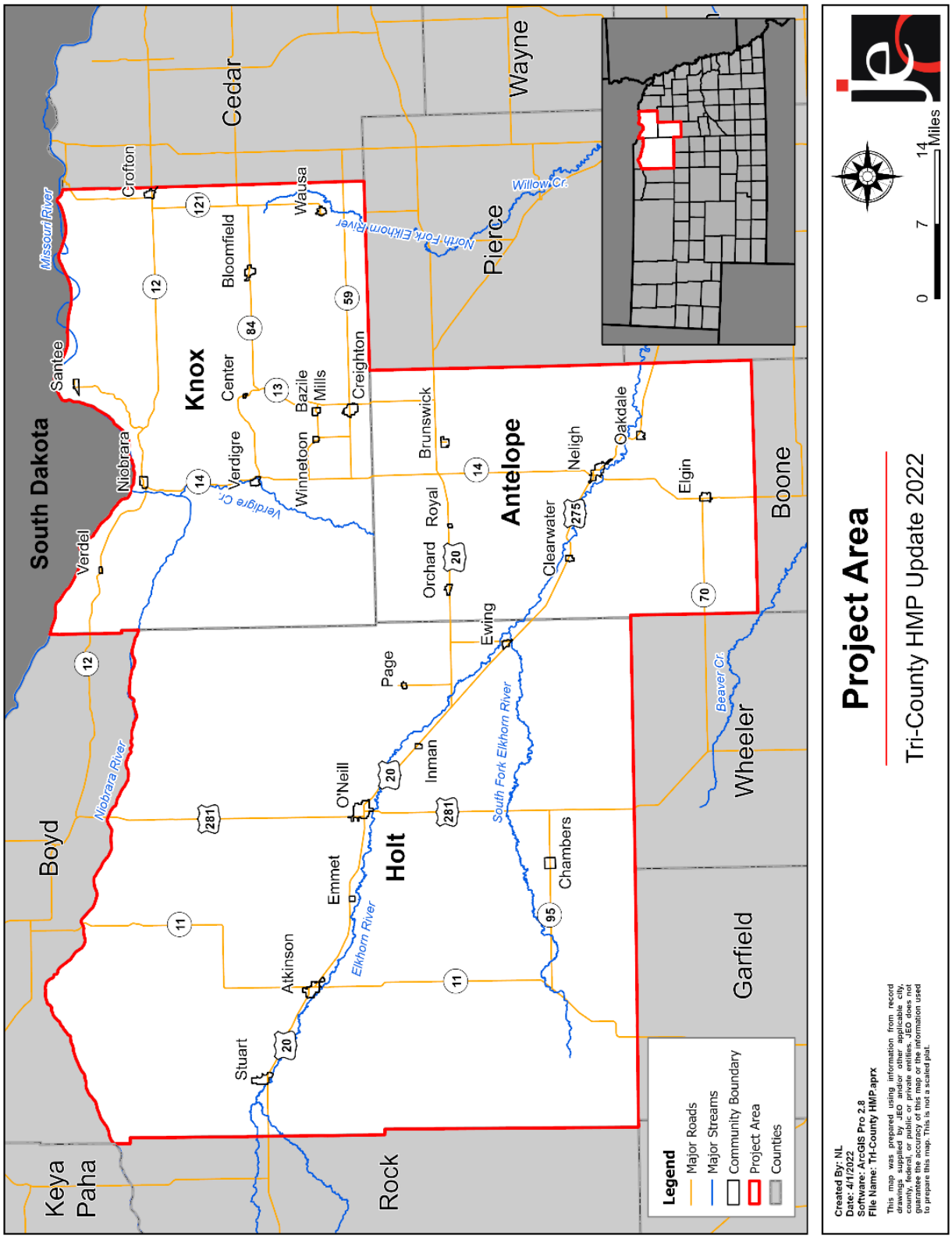
Many communities and jurisdictions during this 2023 update were new to this HMP planning process. The 2017 Tri-County HMP included the jurisdictions of Antelope County, Holt County, Village of Ewing, Village of Stuart, Knox County, Village of Center, City of Creighton, and Village of Niobrara as full participants (defined as communities who attended meetings, conducted a risk assessment, and identified one mitigation action at minimum).

The following table lists counties, communities, and special districts who participated in the 2023 Tri-County Hazard Mitigation Plan. All identified special districts in the three-county planning area were invited and encouraged to participate in the plan update as new participants and included districts such as school districts, fire districts, local health departments, or natural resource districts (see *Section Two* for a full list of special jurisdictions invited). Jurisdictions who participated in this planning effort are noted in the table below. The communities of Bazile Mills, Chambers, Emmet, Santee, Tilden, Wausa, and Winnetoon are located within the planning area but did not participate in this HMP. Tilden and Wausa participated in the Lower Elkhorn NRD HMP. For a full discussion of the planning process and those encouraged to participate in the planning process, see *Section Two: Planning Process.*

Table 1: Participating Jurisdictions

PARTICIPATING JURISDICTIONS		
Antelope County	**Holt County**	**Knox County**
Brunswick	Atkinson	Bloomfield
Clearwater	Ewing	Center
Elgin	Inman	Creighton
Neligh	O'Neill	Crofton
Oakdale	Page	Niobrara
Orchard	Stuart	Verdel
Royal		Verdigre
Special Jurisdictions		
Chambers Public School	Crofton Public Schools	Elgin Public Schools
Neligh-Oakdale Public Schools	Niobrara Public Schools	Santee Public Schools
Summerland Public School	Verdigre Public School	Wausa Public Schools
Brunswick Volunteer Fire Department	Creighton Volunteer Fire Department	Elgin Volunteer Fire Department
Orchard Volunteer Fire and Rescue	Verdigre Rural Fire District	North Central District Health Department

Figure 1: Map of Planning Area



Summary of Changes

The 2023 Tri-County Hazard Mitigation Plan underwent significant changes from the previous plan to reflect shifting priorities, new requirements, or improvements to the overall HMP. A list of key changes is provided below; however, the entirety of this plan has been reformatted for easier readability and to meet new federal regulations which went into effect since the previous plan. The plan review tool from the previously FEMA approved HMP was not available during this plan development and thus was not available to review for plan changes and updates to this plan.

A list of major changes to the plan are listed below:

- Greater efforts to reach and include stakeholder groups and include all taxing authorities as participants;
- Utilization and analysis of various new data resources, plans, studies, and databases for a more specific hazard risk assessment applicable to the planning area;
- Addition of new hazards in the regional hazard risk assessment;
- Included analysis of hazard impacts from climate change and on future development; and,
- Inclusion of community specific profiles with specific hazards of concern, mitigation actions, local capabilities, community lifelines, plan integration, and plan maintenance sections.

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 communities participating in this plan update. The driving motivation behind the update of 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 and participating jurisdictions reviewed, updated, and approved goals and objectives 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.

These goals and objectives were reviewed by the Regional Planning Team at the kick-off meeting and revised to reflect experiences from the past HMP process and newly identified priorities. The goals and objectives for this plan update are as follows:

Goal 1: Protect Health and Safety of Residents

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

Goal 2: Reduce Future Losses from Hazard Events

Objective 2.1 – Provide protection for existing structures, future development, critical facilities, vulnerable areas and populations, services, and utilities to the greatest extent possible.

Objective 2.2 – Develop hazard specific plans, conduct studies or assessments, and retrofit jurisdictions to mitigate for hazards and minimize their impacts

Objective 2.3 – Minimize and control the impacts of hazard events through enacting or updating ordinances, permits, laws, or regulations.

Goal 3: Increase Public Awareness and Education on Vulnerability to Hazards

Objective 3.1 – 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 4: Improve Emergency Management Capabilities

Objective 4.1 – Develop or improve emergency response plan, procedures, and abilities.

Objective 4.2 – Develop or improve evacuation plan and procedures.

Goal 5: Pursue Multi-Objective Opportunities

Objective 5.1 – When possible, utilize existing resources, agencies, programs, and funding mechanisms to implement projects.

Objective 5.2 – When possible, implement projects that achieve several goals.

Hazard Profiles

The hazard mitigation plan includes a description of the hazards considered, including a risk and vulnerability assessment. Data considered during the risk assessment process include: historic occurrences and recurrence intervals; historic losses (physical and monetary); impacts to the built environment (including privately-owned structures as well as 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 2: Regional Risk Assessment

Hazard	Previous Occurrences	Approximate Annual Probability	Likely Extent
Agricultural Animal Disease	86	9/9 = 100%	Mean ~51 animals per event; Median ~2 animals per event
Agricultural Plant Disease	57	21/22 = 95%	Unavailable
Dam Failure	12	9/88 = 10%	Varies by structure, inundation of floodplain downstream from dam
Drought	483/1,512 months	32%	Mild Drought (D1)
Earthquakes	4	4/122 = 3%	<4.0 magnitude
Extreme Heat	Avg. 3 days per year	81/130 = 62%	>100°F
Flooding (flash and riverine)	87	22/27 = 81%	Inundation of structures and roads near waterways likely. Some evacuations of people may be necessary. Minimal to moderate flooding extent anticipated.
Hazardous Materials – Fixed Site	17	11/33 = 33%	Avg. ~ 759 LGA Localized to the facilities and adjacent surroundings.
Hazardous Materials – Transportation	8	7/52 = 13%	Avg. ~289 LGA Limited (<0.5 mile) from release site
High Winds	55	12/27 = 44%	9 BWF (Avg 47-54mph)
Landslides	86	Unkown	Avg. Length ~203”

Hazard	Previous Occurrences	Approximate Annual Probability	Likely Extent
			Avg. Width ~325”
Public Health Epidemic	2	>1%	Varies by event; >1 fatality
Severe Thunderstorms (includes hail, heavy rain, lightning, and thunderstorm wind)	1,194	27/27 = 100%	>1” rainfall Avg 1.19 hail Wind 50-75 mph
Severe Winter Storms (includes blizzards, extreme cold, ice storms, winter storms)	252	27/27 = 100%	0.25-0.5” ice 30°-40° below zero (wind chill) 4-8” snow 25-40 mph winds
Tornadoes	111	24/42 = 57%	Range EF0-EF3 Avg. F0
Wildfire	1,205	22/22 = 100%	Avg. Fire <100 acres Moderate homes and structures threatened or at risk

The following table provides loss estimates for hazards with sufficient data. Detailed descriptions of major events are included in either *Section Four: Risk Assessment* or *Section Seven: Community Profiles* as appropriate per jurisdiction.

Table 3: Hazard Loss Estimates for the Planning Area

Hazard		Count	Property	Crop	Other Impacts
Agricultural Disease	Animal Disease	86	4,375 animals	N/A	
	Plant Disease	57	N/A	$2,176,447	
Dam Failure		12	$0	N/A	
Drought		483/1,512 months	$50,000,000	$125,296,676	
Earthquakes		4	$0	$0	
Extreme Heat		Avg. 3 days per year	$0	$38,452,710	
Flooding	Flash Flood	47	$1,089,000	$1,512,674	
	Flood	40	$6,505,000		
Hazardous Materials	Fixed Site	17	$5,000	N/A	2 injuries
	Transportation	8	$50,000		181 evacuated
Landslides		86	$0	N/A	
Public Health Epidemic		2 outbreak events	>6,926 cases	N/A	
Severe Thunderstorms	Hail	872	$3,798,500	$68,254,470	
	Heavy Rain	8	$0	$67,283,772	
	Lightning	5	$15,500	N/A	1 fatality
	Thunderstorm Wind	309	$2,298,400	N/A	1 fatality, 2 injuries
Severe Winter Storms	Blizzards	40	$5,441,000	$6,507,635	
	Extreme Cold	27	$0		
	Heavy Snow	31	$0		
	Ice Storms	8	$0		
	Winter Storms	125	$8,603,000		
	Winter Weather	21	$0		
	High Winds	55	$166,000	$6,045,886	

Hazard		Count	Property	Crop	Other Impacts
Tornadoes & High Winds	Tornadoes	111	$15,719,590	$10,608	8 injuries
Wildfire		1,205	55,663 acres $507,572	$215,112	9 injuries 7 fatalities 51 Structures threatened 5 Structures destroyed
Total		**1,371**	**$93,690,990**	**$315,755,990**	**21 injuries 9 fatalities 181 evacuated 51 structures threatened 5 structures destroyed**

N/A – Data not available

Many of the natural hazards can be expected to occur annually within the planning area. Events like agricultural disease, landslides, severe thunderstorms, severe winter storms, and wildfires will occur annually. Other hazards like drought, earthquakes, or flooding will occur less often. What is not known regarding hazard occurrences is the scope of events and how they will manifest themselves locally. Historically, drought, tornadoes, severe winter storms, and flooding have caused the most devastating damage in the planning area.

Mitigation Strategies

There are a wide variety of strategies that can be used to reduce the impacts of hazards for the built environment and planning area residents. *Section Five: Mitigation Strategy* shows the mitigation actions chosen by the participating jurisdictions to prevent future losses. The most common mitigation actions chosen by the participants are listed below.

- Backup Generators
- Public Awareness and Education
- Snow Removal Equipment
- Storm Shelter
- Stormwater System and Drainage Improvements

Plan Implementation

Various communities across the planning area have implemented hazard mitigation projects following the 2017 Hazard Mitigation Plan. A few examples of completed projects include civil service improvements, warning sirens, NFIP participation, and drainage studies.

In order to build upon these prior successes and to continue implementing mitigation projects, despite limited resources, communities will need to continue relying upon multi-agency coordination as a means of leveraging resources. Potential partners for future project implementation include but are not limited to: University of Nebraska-Lincoln (UNL), Nebraska Forest Service (NFS), Nebraska Department of Transportation (NDOT), Nebraska Department of Natural Resources (NeDNR); Nebraska Emergency Management Agency (NEMA), United States Department of Agriculture (USDA), and Federal Emergency Management Agency (FEMA).

SECTION ONE
INTRODUCTION

Hazard Mitigation Planning

Severe weather and hazardous events are becoming a more common occurrence in our daily lives. Pursuing mitigation strategies reduces risk and is a socially and economically responsible action 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."

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. Natural hazards, such as severe winter storms, tornadoes and high winds, severe thunderstorms, flooding, extreme heat, drought, agricultural diseases (plant and animal), earthquakes, and 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 include dam failure or hazardous chemical spills (either fixed sites or transportation). These hazard events can occur as a part of normal operations or because of human error.

The Tri-County planning area includes all of Antelope, Holt, and Knox Counties and has prepared this multi-jurisdictional multi-hazard mitigation plan to identify potential impacts from natural and human-caused hazards and to better protect the people and property of the region from the effects of these hazards. This plan demonstrates a regional commitment to reducing risks from hazards and serves as a tool to help decision makers establish mitigation activities and resources. Further, this plan was developed to make the Tri-County area and the participating jurisdictions herein eligible for federal funding programs under the Hazard Mitigation Assistance (HMA) program. This plan was also developed to accomplish the following objectives:

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

Disaster Mitigation Act of 2000

The U.S. Congress passed the Disaster Mitigation Act of 2000 to amend the Robert T. Stafford Disaster Relieve 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 include the Hazard Mitigation Grant Program (HMGP)[3], Flood Mitigation Assistance (FMA)[4], and the newly released Building Resilient Infrastructure and Communities (BRIC)[5]. BRIC replaced the Pre-Disaster Mitigation (PDM) Program in 2020. The Federal Emergency Management Agency (FEMA) administers these programs under the Department of Homeland Security (DHS).[6] At the state level, NEMA administers HMGP and BRIC grants and NeDNR administers FMA.

FEMA MITIGATION DIRECTORATE

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.

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, minimally every five years, to maintain compliance with the legislature per Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as enacted by Section 104 of the DMA 2000 (P.L. 106-390)[7] and by FEMA's Final Rule (FR)[8] published in the Federal Register on November 30, 2007, and 44 Code of Federal Regulations (CFR) Part 201.

Hazard Mitigation Assistance

On June 1, 2009, FEMA initiated the 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. All three grant programs require jurisdictions to have participated in and adopted a FEMA-approved mitigation plan.

- **HMGP:** This program provides funds to states, territories, tribal governments, local governments, and other eligible participants 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 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.

[1] Federal Emergency Management Agency, Public Law 106-390. 2000. "Disaster Mitigation Act of 2000." Last modified September 26, 2013. https://www.fema.gov/media-library/assets/documents/4596.
[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/pdf/about/stafford_act.pdf.
[3] Federal Emergency Management Agency. "Hazard Mitigation Grant Program." Last modified July 8, 2017. https://www.fema.gov/hazard-mitigation-grantprogram.
[4] Federal Emergency Management Agency. "Flood Mitigation Assistance Grant Program." Last modified July 11, 2017. https://www.fema.gov/flood-mitigationassistance-grant-program.
[5] Federal Emergency Management Agency. "Building Resilient Infrastructure and Communities." Last modified September 8, 2020. https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities.
[6] Federal Emergency Management Agency. "Hazard Mitigation Assistance." Last modified March 29, 2017. https://www.fema.gov/hazard-mitigation-assistance.
[7] 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.
[8] 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.

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

Plan Financing and Preparation

Regarding plan financing and preparation, the Tri-County planning area applied for a BRIC grant from FEMA in 2020 which was awarded and obligated in April 2022. For the purposes of the grant, Antelope County was listed as the "sub-applicant" that is the eligible entity which submits applications for FEMA assistance to the "Applicant". The "Applicant", in this case is the State of Nebraska. If HMA funding is awarded, the sub-applicant becomes the "sub-grantee" and is responsible for managing the sub-grant and complying with program requirements and other applicable federal, state, territorial, tribal, and local laws and regulations. Antelope County served as the owner of the sub-application as the representative for Tri-County and Knox County is the fiscal agent for the grant through a mutual agreement with the three counties.

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SECTION TWO
PLANNING PROCESS

Introduction

The process utilized to develop a hazard mitigation plan is often as important as the final planning document. For this planning process the Tri-County Planning Area adapted the four-step hazard mitigation planning process outlined by FEMA to fit the needs of the participating jurisdictions. The following section describes the planning process including: the development and establishment of both the Regional and Local Planning Teams; the function of each type of planning team; project meeting times, dates, agendas, and attendees; outreach efforts to the general public, neighboring jurisdictions, and available stakeholders; general information relative to the risk assessment process; general information relative to local/regional capabilities; plan review and adoption; and a brief discussion of plan maintenance.

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; and
- 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. Tri-County utilized the multi-jurisdictional planning process recommended by FEMA resources (Local

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

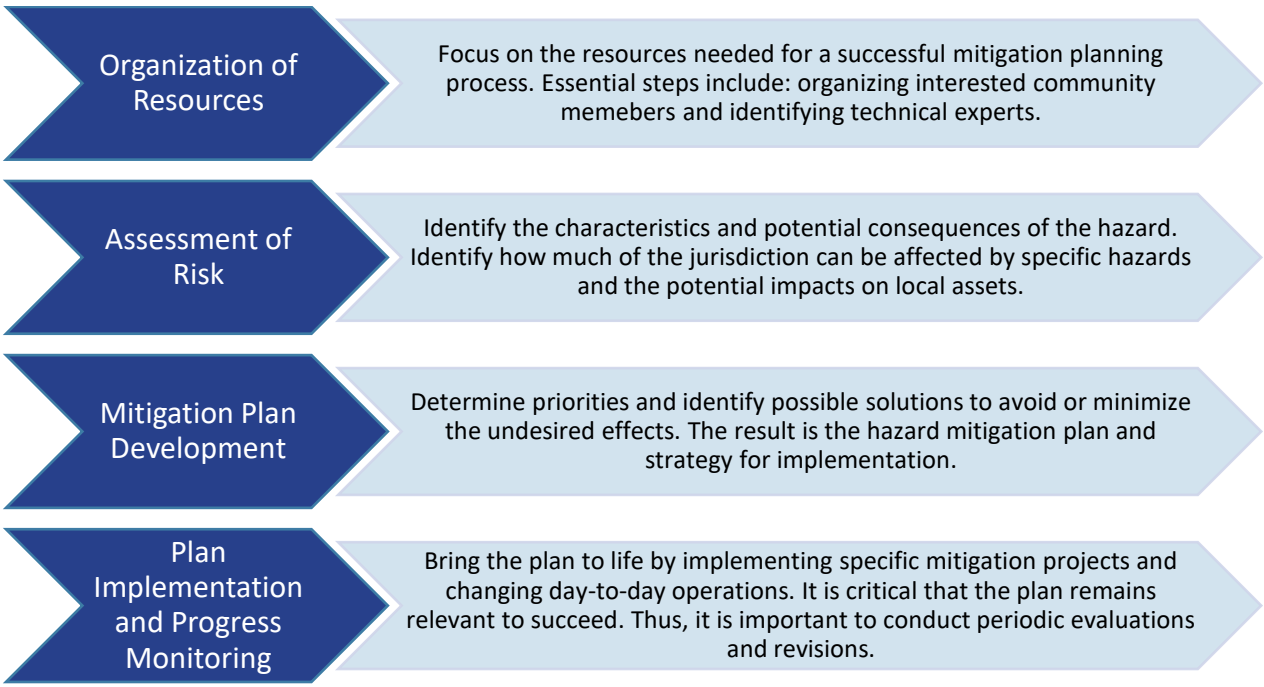
(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

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.

Mitigation Plan Review Guide[9], Local Mitigation Planning Handbook[10], and Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards[11]) 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 process. It's common that ideas developed during the initial assessment of risks may need revision later in the process, or that additional information may be identified while developing the mitigation plan or during the implementation of the plan that results in new goals or additional risk assessments. The four-step approach is described in the figure below.



Plan Update Schedule

The Tri-County Planning Area secured BRIC grant funding for their multi-jurisdictional hazard mitigation plan (HMP) during the 2020 fiscal year. JEO Consulting Group (JEO), was contracted in May 2021 to guide and facilitate the planning process and assemble the HMP. The grant funding became effective in April 2022. For the planning area sponsors, Bobbi Risor, Laura Hintz, and Deb Hilker (the Antelope, Knox, and Holt County Emergency Managers respectively) served as the primary points of contact throughout the project. A clear timeline of this plan update process is provided in Figure 2.

[9] Federal Emergency Management Agency. 2011. "Local Mitigation Plan Review Guide." https://www.fema.gov/media-library-data/20130726-1809-25045-7498/plan_review_guide_final_9_30_11.pdf

[10] Federal Emergency Management Agency. 2013. "Local Mitigation Planning Handbook." https://www.fema.gov/media-library-data/20130726-1910-25045-9160/fema_local_mitigation_handbook.pdf.

[11] Federal Emergency Management Agency. 2013. "Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards." https://www.fema.gov/media-librarydata/20130726-1904-25045-0186/fema_mitigation_ideas_final508.pdf.

Figure 2: Project Timeline

Regional Planning Team Establishment

At the beginning of the planning process, a Regional Hazard Mitigation Planning Team was formed to lead the plan update. This Regional Planning Team, comprised of county emergency management, JEO Consulting Group, and Nebraska Emergency Management, was established to guide the planning process, review the 2017 HMP, discuss planning process changes, and plan requirements. Regional Planning Team Members can be found in Table 4.

Table 4: Regional Planning Team Members

NAME	TITLE	JURISDICTION
Bobbi Risor	Emergency Manager	Region 11 Emergency Management Agency (Antelope County)
Laura Hintz	Emergency Manager (former)	Knox County
Deb Hilker	Emergency Manager	Holt County
Kelsy Jelinek	Emergency Manager	Knox County
Brooke Seachord*	Project Manager	JEO Consulting Group
Claire Patton*	Project Intern	JEO Consulting Group
Mary Baker*	Resiliency Strategist	JEO Consulting Group
Marisa Alvares*	Hazard Mitigation Program Specialist	Nebraska Emergency Management Agency

**Served as a consultant or advisory role*

A virtual project kick-off meeting was held on July 27, 2022, with the Regional Planning Team and JEO to discuss an overview of the planning process. Discussion at this meeting included participation requirements for eligible jurisdictions, HMP update project description, updates and changes to the HMP, establishment of goals and objectives, identify hazards for risk assessment, identifying all potential plan participants and key stakeholders, and general schedule for the planning process. This meeting also assisted in clarifying roles and responsibilities of Regional Planning Team and Local Planning Teams members, strategies for public engagement throughout the process, and additional requirements and tasks to be completed for the three CRS communities in the planning area. The following table shows the date, location, and attendees from the Kick-off Meeting.

Table 5: Kick-off Meeting Information

MEETING DATE AND LOCATION	AGENDA ITEMS
Virtual Meeting July 27, 2022 1:00pm	-Introductions -Hazard Mitigation Plan Overview -Planning Team Establishment and Public Involvement -Hazard Mitigation Plan Structure and Data -Goals and Objectives/Hazard Identification -Planning Process

Public Outreach and Engagement

Project Announcement – Stakeholders

At the beginning of the planning process, the Regional Planning Team worked to identify stakeholder groups that could provide other key information or provide additional public input to the planning process. Stakeholders can provide valuable information to regional risk assessment and community mitigation strategy implementation, while not directly eligible to participate in the HMP as a 'Participant'. A wide range of potential stakeholders were contacted and encouraged to participate which included local and regional agencies, agencies that regulate development, nonprofit organizations, airports, hospitals, assisted living facilities, economic development districts, and state agencies.

Table 6 lists stakeholder groups encouraged to participate in the planning process. A copy of the Project Announcement letter was mailed to each listed stakeholder and stakeholder agencies were invited via letter to Round 1 and Round 2 meetings. Comments and information provided by stakeholders were incorporated into applicable community profiles. Stakeholders who attended meetings and reviewed materials included:

- Lower Niobrara NRD
- Niobrara Valley Electric
- Catholic Parishes in Partnership
- North Central Public Power District
- Elkhorn Rural Public Power District
- Black Hills Energy
- Ponca Tribe of Nebraska
- Avera Creighton Care Center and Hospital
- NEMA
- NeDNR

Table 6: Notified Stakeholder Groups

Organizations		
Alpine Village of Verdigre (Assisted Living)	Creighton Municipal Airport (Airport)	North Central Public Power District (Regional Public Utility)
American Red Cross (Non-profit Organization)	Elkhorn Public Power District (Regional Public Utility)	Northeast Nebraska Economic Development District (Regional Economic District)
Antelope County Airport (Airport)	Good Samaritan Society – Atkinson (Assisted Living)	O'Neill Muni-John L. Baker Field Airport (Airport)
Antelope Memorial Hospital (Hospital)	Good Samaritan Society -Bloomfield (Assisted Living)	Parkside Manor (Assisted Living)
Arbor Care Centers-Neligh (Long Term Care Facility)	Good Samaritan Society -Prairie Winds (Assisted Living)	Ponca Tribe of Nebraska (Tribal Nation)
Arbor Care Center-O'Neil (Long Term Care Facility)	Good Samaritan Society -Sunset View (Assisted Living)	Santee Sioux Tribe (Tribal Nation)

Organizations		
Avera Creighton Care Center (Long Term Care Facility)	Holt County Economic Development (Regional Economic District)	Silver Jackets (State Agency)
Avera Creighton Hospital (Hospital)	Koinzan Airport (Airport)	Stuart-Atkinson Municipal Airport (Airport)
Avera St. Anthony's Hospital (Hospital)	Lewis and Clark NRD (Regional Agency)	The Evergreen Assisted Living (Assisted Living)
Bloomfield Municipal Airport (Airport)	Lower Niobrara NRD (Regional Agency)	The Willows Assisted Living (Assisted Living)
Cedar-Knox Public Power District (Regional Public Utility)	Nebraska Indian Community College-Santee Campus (College)	Upper Elkhorn NRD (Regional Agency)
Central Nebraska Economic Development District (Regional Economic District)	Nebraska Department Natural Resources (State Agency)	United States Forest Service (Federal Agency)
Country Lane Retirement Village (Assisted Living)	Nebraska Emergency Management Agency (State Agency)	West Holt Memorial Hospital (Hospital)
Countryside Villa Assisted Living (Assisted Living)	Niobrara Valley Electric Membership Corporation (Regional Public Utility)	

The Regional Planning Team was also 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. Several small communities were identified as underserved or vulnerable due to their limited capabilities of staff including Center, Inman, Bazile Mills, and Emmet. The applicable Emergency Manager per county attempted to contact each community individually to assist them in the planning process. The Village of Inman underwent a new election with new board members participating in the planning process and a local resident helped serve on the local planning team for the Village of Center. Additionally, the Ponca Tribe of Nebraska and the Santee Sioux Tribe (Santee Reservation) were identified as vulnerable populations in the planning area. JEO reached out to each tribal nation to receive feedback on the planning process.

Project Announcement - Neighboring Jurisdictions

Neighboring jurisdictions were notified of the Tri-County HMP update and invited to participate in the planning process. The following table lists the neighboring communities or entities notified of the planning process. Project Announcement letters and emails were sent to county/city/village clerks, county emergency managers, and NRDs, at their respective jurisdictions and disseminated appropriately in August 2022. Each neighboring jurisdiction was invited to attend Round 1 and Round 2 meetings with participating jurisdictions to provide other key information. Neighboring jurisdictions were also sent follow up emails to notify them of information regarding the planning process on the project website.

Community representatives from the Lower Niobrara NRD held a one-on-one meeting discussion with JEO staff to review applicable hazard information and potential mitigation actions within the planning area.

The Lower Niobrara NRD is a full participant in the FEMA-approved Region 24 Emergency Management Agency Hazard Mitigation Plan (approved June 2021).

No other comments or revisions were received or incorporated from other neighboring jurisdictions.

Table 7: Notified Neighboring Jurisdictions

NOTIFIED NEIGHBORING JURISDICTIONS		
Boone County	Boyd County	Cedar County
Garfield County	Lewis and Clark NRD	Lower Elkhorn NRD
Lower Loup NRD	Lower Niobrara NRD	Lower Platte North NRD
Madison County	Pierce County	Rock County
Santee Sioux Tribe	Wheeler County	

Participant Involvement

Participants play a key role in reviewing information, identifying hazards of top concern, providing a record of historical disaster occurrences and descriptions of localized impacts from hazard events, identification and prioritization of potential mitigation projects and strategies, and the development of plan maintenance procedures.

To be a participant in the development of this HMP update, jurisdictions were required to:

- Attend Round 1 and Round 2 meetings or a one-on-one meeting with JEO staff,
- Provide relevant information throughout the plan update process, and
- Pass an *Adoption Resolution* for the approved HMP.

Jurisdictions had to have at least one representative present at meetings. Some jurisdictions sent multiple representatives to meetings. For jurisdictions who only had one representative at meetings, they were encouraged to take materials back to their governing bodies and include a diverse input on the meeting documents. Sign-in sheets from all public meetings can be found in *Appendix A.* Jurisdictions that were unable to attend the scheduled public meetings were able to watch a recording of the first public meeting or request a meeting with JEO staff to satisfy the meeting attendance requirement. This effort enabled jurisdictions that could not attend a scheduled meeting to participate in the planning process.

Outreach to eligible jurisdictions included notification prior to all public meetings, phone calls, emails, and calendar meeting invitations. Table 8 provides a summary of outreach activities utilized in this process.

Table 8: Outreach Activity Summary

ACTIVITY	INTENT
Project Website	To inform the public and local/planning team members of past, current, and future activities (https://www.jeo.com/2023-tri-county-hazard-mitigation-plan) Links to the project website were included on all meeting invitations, flyers, email invitations, and plan sponsors websites.
Project Announcement	Project announcement letter mailed and emailed to potential participants, neighboring jurisdictions, and stakeholders
Meeting Invitations (Round 1 and Round 2)	Letters, electronic calendar invitations, emails and phone calls were used to notify participants of meeting agenda/data/time/locations for Round 1 and Round 2 meetings. Round 1 and Round 2 meetings were held in-person with a virtual attendance option.

ACTIVITY	INTENT
Letters, Emails and Phone Calls	Potential participants were sent letters, emails, and called to remind them about upcoming meetings. Correspondence was provided to remind and assist participating jurisdictions with the collection and submission of required local data
Project Flyer	A fact sheet flyer was developed and shared with all planning team members to post locally. Information included why and how to be involved in the process. Project flyer was posted at key locations including local gas stations, post office, local libraries, and schools.
Local Outreach	Project sponsors and members of Regional Planning Team provided follow up to jurisdictions on an as needed basis. JEO staff followed up with missing jurisdictions to arrange one-on-one meetings as needed.
Social Media	The local sponsors, county Emergency Management Agencies, and local communities were encouraged to share updates on HMP process via local social media channels and websites.

Assessment of Risk

Round 1 Meetings: Capabilities Assessment and Plan Integration

Round 1 Meetings are an opportunity to familiarize participating jurisdictions with the HMP update process, review information from the previous HMP, and update the general overview of the community's capabilities. The following table shows the dates and times for Round 1 Meetings. All meetings were held in-person with an option for participants to join via Zoom. For jurisdictions who were not able to attend in person, a recording of the Round 1 meeting was also made available online on the project website for them to watch and catch up on covered information.

Table 9: Round 1 Meetings

AGENDA ITEMS		
General overview of the HMP planning process; discussion of participation requirements; review jurisdiction profile draft; update and detail demographic trends; update capability assessment and plan integration; review and identification of critical facilities.		
COUNTY MEETING	**DATE AND TIME**	**LOCATION**
KNOX COUNTY	Tuesday, September 20 at 2:00pm	Knox County Courthouse Conference Room - Center, NE
ANTELOPE COUNTY	Thursday, September 22 at 6:00pm	Antelope County Courthouse County Commissioner's Room – Neligh, NE
HOLT COUNTY	Thursday, October 6 at 6:00pm	Holt County Courthouse – O'Neill, NE

The intent of these meetings was to familiarize the jurisdictional representatives with an overview of the work to be completed over the next year as the plan progressed, discuss the responsibilities of being a participant, and to collect preliminary information to update the HMP. Data collected at these meetings included updated demographic and built environment statistics, review/updating the list of critical facilities and to begin reviewing community capabilities. Round 1 meetings are also used as an opportunity to discuss Plan Integration components. Each participating jurisdiction was asked to either describe or provide a copy of other planning mechanisms which support the goals and intent of the HMP for inclusion.

These included Local Emergency Operations Plans, Comprehensive Plans, 1- & 6-Year Plans, Zoning Ordinances, Floodplain Ordinances, Building Codes, or other plans used by the jurisdiction.

The following table shows the attendees for each jurisdiction who attended a Round 1 meeting. Communities who did not attend Round 1 meetings had follow up efforts with JEO staff or their respective County Emergency Manager.

Table 10: Round 1 Meeting Attendees

Name	Title	Jurisdiction
Knox County Meeting – Tuesday, September 20		
Bobbi Risor	Region 11 Emergency Manager	Region 11 (Antelope County) Emergency Management
Brenda Harrison	Village Clerk	Village of Orchard
Chelsey Chohon	School Nurse	Niobrara Public Schools, Santee Public Schools
Chris Look	Superintendent	Crofton Community Schools
Colette Panning	City Administrator	City of Bloomfield
Connie McCarthy	Program Assistant	Lower Niobrara NRD
Cora L Calkins	Village Clerk/Lead Water Operator	Village of Page
Daniel Wiuhet	Village Board Chairman	Village of Verdigre
Don Henery	Sheriff	Knox County
Heidi Ruzicka	Village Clerk	Village of Verdigre
Jeff Holtz	Paramedic	Bloomfield Paramedic
Jim Meuret	Village Board Chairman	Village of Brunswick
Karla Faehnrich	Assistant Principal	Verdigre Public School
Kristin Childers	City Clerk	City of Elgin
Laura Hintz	Knox County Emergency Manager	Knox County
Lindsay Nelson	City Administrator/Clerk/Treasurer	City of Creighton
Loren Hintz	Resident of Center	Village of Center
Mark Stracke	Village Clerk	Village of Stuart
Michael T Chase	Planning and Zoning Administrator	City of Crofton
Mona Weatherwax	Village Clerk/Treasurer	Village of Niobrara
Brooke Seachord	Project Coordinator	JEO Consulting Group
Claire Patton	Planning Intern	JEO Consulting Group
Antelope County Meeting – Thursday, September 22		
Angie Hupp	Village Clerk	Village of Clearwater
Ann Kurpgeweit	Administrative Assistant CPP	Catholic Parishes – Office Elgin
Bob Moore	Antelope County Sheriff	Antelope County
Carl Dobras	Fireman	Verdigre Volunteer Fire Department
Dan Donaldson	City Superintendent	City of Neligh
Dana Klabenes	City Clerk	City of Neligh
Dennis L Bridge	Village Board Member	Village of Royal
Jeff Schlecht	Village Board Member	Village of Clearwater
Lisa Payne	County Clerk	Antelope County
Liz Doerr	Zoning Administrator	Knox County
Mat Hieter	Village Board Member	Village of Royal
Megan Wingate	Antelope County Zoning Admin	Rural Antelope County
Michael Krick	Fire Chief	Tilden Fire

Name	TITLE	JURISDICTION
Michelle Bolling	Firefighter	Brunswick Volunteer Fire Department
Philip Pierce	Verdigre Rural Firer	Verdigre Rural Fire Department
Sharon Kinnan	Village Board	Village of Oakdale
Steve Simonsen	Antelope Hospital Ambulance Captain	Neligh Hospital
Brooke Seachord	Project Coordinator	JEO Consulting Group
Claire Patton	Planning Intern	JEO Consulting Group
Holt County Meeting – Thursday, October 6		
Adele Philips	Flood Mitigation Planner	Nebraska DNR
Colton Hahn	EMS Captain	Orchard Fire and Rescue Department
Daniella Rossler	Emergency Response Coordinator	North Central District Health Department
Deb Hilker	Emergency Manager	Holt County
Jeff Bartling	Fire Chief	Verdigre Volunteer Fire Department
Jon Hansen	Fire Department President	Verdigre Volunteer Fire Department
Karen Kleinschmit	Village Clerk	Village of Wausa
Matt Fritz	General Manager	Niobrara Valley Electric Membership Corporation
Mitch Mastalir	Rescue Captain	Verdigre Volunteer Fire Department
Patrick Bergman	Fire Chief	Orchard Fire and Rescue Department
Ryan L Schrunk	Fire Chief	Ewing Fire and Rescue Department
Sharon Swails	Clerk/Treasurer	Village of Ewing
Shelly Wieneke	Deputy Clerk-Treasurer	City of Atkinson
Terry Julesgard	General Manager	Lower Niobrara NRD
Brooke Seachord	Project Coordinator	JEO Consulting Group
Claire Patton	Planning Intern	JEO Consulting Group

Mitigation Plan Development

Round 2 Meetings: Hazard Identification, Mitigation Strategy, and Maintenance

The identification and prioritization of top hazards of concern and respective mitigation measures is an essential component in developing effective hazard mitigation plans. At these meetings, the local jurisdictional representatives serve as the Local Planning Team Members to review the hazards to be profiled in this HMP update (as established by the Regional Planning Team at the Kick-off Meeting) and provide information about local impacts, historical occurrences, and overall community exposure to the various hazards. For a complete list of hazards reviewed in the 2023 Tri-County HMP, see *Section Four Risk Assessment.* Round 2 meetings are designed to allow participating jurisdictions an opportunity to identify which hazards pose the most local risks; update mitigation actions from the previous Tri-County HMP (as applicable); and identify and describe new mitigation strategies to address prioritized hazards or identified gaps in planning, response, or resiliency from Round 1 meetings.

Participating jurisdictions were also asked to review the information collected from Round 1 meetings related to their community through this planning process. The local planning team members were asked to ensure all information included was up-to-date and accurate. Information/data reviewed included but was not limited to identified critical facilities and their location within the community; future development areas; and overall growth trends. Newly added to Round 2 meetings also included a discussion of plan maintenance by the Local Planning Team and the importance of updating local profiles as priorities change, mitigation actions are completed, or after a disaster event.

A brief status update on project schedule, public review period, final local adoption, and the approval and grant opportunities available once the plan is approved by NEMA and FEMA was also provided to all participants. The following table shows the attendees for each jurisdiction who attended a Round 2 meeting. Follow up one-on-one meetings were held for communities who had additional questions, did not attend public meetings, or requested assistance.

Table 11: Round 2 Meetings

AGENDA ITEMS		
Review of the HMP planning process; review of Round 1 collected and integrated information; identify hazards of top concern; identify and evaluate mitigation actions to address hazards; and discussion of plan maintenance requirements.		
COUNTY MEETING	**DATE AND TIME**	**LOCATION**
KNOX COUNTY	Monday, January 23 at 2:00pm	Knox County Courthouse Conference Room - Center, NE
ANTELOPE COUNTY	Tuesday, January 24 at 9:00am	Antelope County Courthouse County Commissioner's Room – Neligh, NE
HOLT COUNTY	Tuesday, January 24 at 6:00pm	Holt County Courthouse – O'Neill, NE

Table 12: Round 2 Meeting Attendees

Name	TITLE	JURISDICTION
Knox County Meeting – Monday, January 23		
Adele Phillips	Flood Mitigation Planner	NeDNR
Christine Minarik	Village Clerk	Village of Verdel
Dave Mroczek	Superintendent	Santee Schools
David Wickett	Chairman	Village of Verdigre
Heidi Ruzicka	Clerk	Village of Verdigre
Jeff Holz	Paramedic	Village of Bloomfield
Joann Fischer	County Clerk	Knox County
Karla Faehnrich	Assistant Principal	Verdigre Public Schools
Loren Hintz	Community Residential Representative	Village of Center
Margaret Sandoz	Superintendent	Niobrara Public Schools
Marisa Alvarez	Hazard Mitigation Program Specialist	NEMA
Mark Stracke	Village Clerk	Village of Stuart
Michael Chase	Community Residential Representative	Village of Crofton
Misha Mazurkewya	Environmental Manager	Ponca Tribe of Niobrara

Name	Title	Jurisdiction
Mona Weatherwax	Clerk	Village of Niobrara
Sarah Sidak	City Clerk	City of O'Neill
Tim Hoffman	Assistant Operations Manager	North Central PPD
Todd Schimelfenig	Safety and Risk Specialist	Ponca Tribe of Nebraska
Brooke Seachord	Project Coordinator	JEO Consulting Group
Claire Patton	Hazard Mitigation Planning Intern	JEO Consulting Group
Antelope County Meeting – Tuesday, January 24		
Aaron Boggs	Highway Superintendent	Antelope County
Angie Hupp	Village Clerk	Village of Clearwater
Bobbi Risor	Emergency Manager	Antelope County
Chris Look	Superintendent	Crofton Community Schools
Colette Panning	City Administrator	City of Bloomfield
Dan Donaldson	City Superintendent	City of Neligh
Dana Klabenes	City Clerk	City of Neligh
Dennis Bridge	Village Trustee	Village of Royal
Frank Jesse	Superintendent	Chambers Public Schools
Jim Meuret	Village Board Member	Village of Brunswick
Johnnie Ostermeyer	Secondary Principal	Crofton Community Schools
Josh Stelling	Fire President	Orchard Fire and Rescue
Kristin Childers	City Clerk	City of Elgin
Kyle Guggenmos	Chairman	Village of Oakdale
Kyle Finke	Superintendent	Summerland Public Schools
Leigh Kluthe	Road Foreman	Antelope County
Lisa Payne	County Clerk	Antelope County
Marisa Alvarez	Hazard Mitigation Program Specialist	NEMA
Mark Wragge	Principal	Crofton Community Schools
Matt Hieter	Village Board	Village of Royal
Mike Brockhaus	Superintendent	Elgin Public Schools
Sharon Kinnan	Trustee	Village of Oakdale
Shelly Wienekek	Deputy Clerk	City of Atkinson
Tom Rudloff	General Manager	Elkhorn Rural Public Power District
Brooke Seachord	Project Coordinator	JEO Consulting Group
Claire Patton	Hazard Mitigation Planning Intern	JEO Consulting Group
Holt County Meeting – Tuesday, January 24		
Andrew Huber	Firefighter	Verdigre Fire Dept
Carl Dobras	Firefighter	Verdigre Rural Fire
Danielle Roessler	Emergency Response Coordinator	North Central District Health Department
Deb Hilker	Emergency Manager	Holt County
Jeff Bartling	Fire Chief	Verdigre Fire Dept
Jennifer Fiscus	Principal	St. Rose School and Church
Kelsy Jelinek	Emergency Manager/Floodplain Administrator	Knox County
Kyle Campbell	Board Member	Village of Inman
Larry Potts	BOE President	Crofton Community Schools

Name	Title	Jurisdiction
Mitch Mastalir	Rescue Captain	Verdigre Fire Dept
Philip Pierce	Fire Chief	Verdigre Rural Fire
Roger Miller	O'Neill Fire Chief	O'Neill Fire Dept
Brooke Seachord	Project Coordinator	JEO Consulting Group
Claire Patton	Hazard Mitigation Planning Intern	JEO Consulting Group

Table 13: Round 2 One-on-One Meeting Attendees

Name	Title	Jurisdiction
Monday, January 30, 2023		
Wade Ellwanger	General Manager	Lower Niobrara NRD
Brooke Seachord	Project Coordinator	JEO Consulting Group
Karl Dietrich	Hazard Mitigation Planner	JEO Consulting Group

Data Sources and Information

Effective hazard mitigation planning requires the review and inclusion of a wide range of data, documents, plans, and studies. The following table identifies many of the sources utilized during this planning process. Individual examples of plan integration documents are identified in their respective *Section Seven: Community Profiles.* Additionally, sources and references are included throughout the document.

Table 14: Data, Plans, and Information used in HMP Development

Documents	
Disaster Mitigation Act of 2000 https://www.congress.gov/bill/106th-congress/house-bill/707#:~:text=Requires%20the%20President%2C%20in%20determining,future%20natural%20disasters%3B%20(3)	Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (2013) https://www.fema.gov/sites/default/files/2020-06/fema-mitigation-ideas_02-13-2013.pdf
Comprehensive Economic Development Strategy and Hazard Mitigation Plan Alignment Guide (2022) https://www.fema.gov/sites/default/files/documents/fema_ceds-hmp-alignment-guide_2022.pdf	Mitigation Planning and the Community Rating System Key Topics Bulletin (2018) https://www.fema.gov/sites/default/files/2020-06/fema-mitigation-planning-and-the-community-rating-system-key-topics-bulletin_10-1-2018.pdf
Hazard Mitigation Assistance Guidance and Addendum (2015) https://www.fema.gov/sites/default/files/2020-07/fy15_hma_addendum.pdf	National Flood Insurance Program Community Rating System https://www.fema.gov/floodplain-management/community-rating-system
Local Mitigation Plan Review Guide (2011) https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-plan-review-guide_09_30_2011.pdf	National Flood Insurance Program Community Status Book (2022) https://www.fema.gov/flood-insurance/work-with-nfip/community-status-book
Local Mitigation Planning Handbook (2013) https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-planning-handbook_03-2013.pdf	National Response Framework (2019) https://www.fema.gov/emergency-managers/national-preparedness/frameworks/response
Local Mitigation Planning Policy Guide (2022) https://www.fema.gov/sites/default/files/documents/fema_local-mitigation-planning-policy-guide_042022.pdf	Robert T. Stafford Disaster Relief and Emergency Assistance Act (2021) https://www.fema.gov/sites/default/files/documents/fema_stafford_act_2021_vol1.pdf
Plans and Studies	
Nebraska State Flood Hazard Mitigation Plan (2022)	Public Power in Nebraska (2018) https://nebraskalegislature.gov/pdf/reports/research/public_power_2018.pdf

https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/floodplain/resources/2022_SFHMP_FINAL_20220630_Ver2.pdf	
Flood Insurance Studies https://msc.fema.gov/portal/home	State of Nebraska Flood Hazard Mitigation Plan (2022) https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/floodplain/resources/2022_SFHMP_Draft_Published04112022.pdf
Fourth National Climate Assessment (2018) https://nca2018.globalchange.gov/	State of Nebraska Hazard Mitigation Plan (2021) https://nema.nebraska.gov/sites/nema.nebraska.gov/files/doc/hazmitplan2021.pdf
National Climate Assessment (2014) https://nca2014.globalchange.gov/	State of Nebraska Hazard Mitigation Plan (2019) https://nema.nebraska.gov/sites/nema.nebraska.gov/files/doc/hazmitplan2019.pdf
Nebraska State Drought Plan (2000) https://carc.nebraska.gov/docs/NebraskaDrought.pdf	
TECHNICAL AND DATA RESOURCES	
Arbor Day Foundation – Tree City Designation (2021) https://www.arborday.org/programs/treecityusa/directory.cfm	Nebraska Department of Natural Resources – Dam Inventory https://gis.ne.gov/portal/apps/webappviewer/index.html?id=2aab04a13817421992dc5398ad462e22
CDC Social Vulnerability Index https://www.atsdr.cdc.gov/placeandhealth/svi/index.html	Nebraska Department of Transportation http://dot.nebraska.gov/
Federal Emergency Management Agency https://www.fema.gov/	Nebraska Emergency Management Agency http://www.nema.ne.gov
FEMA Disaster Declarations https://www.fema.gov/openfema-data-page/disaster-declarations-summaries-v1	Nebraska Flooding: March 2019 (Storymap) https://storymaps.arcgis.com/stories/9ce70c78f5a44813a326d20035cab95a
FEMA Flood Map Service Center https://msc.fema.gov/portal/advanceSearch	Nebraska Forest Service (NFS) http://www.nfs.unl.edu/
FEMA Hazard Mitigation Plan Status https://fema.maps.arcgis.com/apps/webappviewer/index.html?id=ec2fb023df744cf480da89539338c386	Nebraska Forest Service – Wildland Fire Protection Program http://nfs.unl.edu/fire
High Plains Regional Climate Center http://climod.unl.edu/	Nebraska Local Health Departments http://dhhs.ne.gov/Pages/Local-Health-Departments.aspx
Midwest Regional Climate Center https://mrcc.purdue.edu/	Nebraska Power Review Board https://nprb.gworks.com/
National Agricultural Statistics Service http://www.nass.usda.gov/	Nebraska Rural Electric Association https://www.nrea.org/nrea-member-systems
National Centers for Environmental Information https://www.ncei.noaa.gov/	NOAA – Billion Dollar Weather and Climate Disasters https://www.ncdc.noaa.gov/billions/overview
National Drought Mitigation Center – Drought Impact Reporter http://droughtreporter.unl.edu/map/	NWS – Seasonal Drought Outlook https://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php
National Drought Mitigation Center – Drought Monitor http://droughtmonitor.unl.edu/	PHMSA Incident Statistics https://www.phmsa.dot.gov/hazmat-program-management-data-and-statistics/data-operations/incident-statistics
National Environmental Satellite, Data, and Information Service http://www.nesdis.noaa.gov/	Small Business Administration – Disaster Loan Assistance https://disasterloan.sba.gov/ela/Declarations/Index
National Flood Insurance Program https://www.fema.gov/flood-insurance	Storm Prediction Center Statistics http://www.spc.noaa.gov
National Historic Registry https://www.nps.gov/subjects/nationalregister/index.htm	The Census of Agriculture (2012) https://www.nass.usda.gov/Publications/AgCensus/2012/
National Interagency Fire Center https://www.nifc.gov/fireInfo/fireInfo_statistics.html	The Census of Agriculture (2017) https://www.nass.usda.gov/Publications/AgCensus/2017/index.php

National Oceanic Atmospheric Administration (NOAA) http://www.noaa.gov/	Union of Concerned Scientists – Killer Heat Interactive Tool https://www.ucsusa.org/resources/killer-heat-interactive-tool?location=lancaster-county--ne
TECHNICAL AND DATA RESOURCES	
National Weather Service http://www.weather.gov/	United States Army Corps of Engineers – National Levee Database https://levees.sec.usace.army.mil/#/
National Weather Service StormReady and TsunamiReady https://www.weather.gov/stormready/communities	United States Census Bureau https://data.census.gov/cedsci/
Natural Resources Conservation Service www.ne.nrcs.usda.gov	United States Department of Agriculture http://www.usda.gov
NE DHHS Rosters of Facilities and Services http://dhhs.ne.gov/licensure/Pages/Rosters-of-Facilities-and-Services.aspx	United States Department of Agriculture – Risk Management Agency http://www.rma.usda.gov
Nebraska Association of Resources Districts http://www.nrdnet.org	United States Department of Transportation – Pipeline and Hazardous Materials Safety Administration https://www.phmsa.dot.gov/
Nebraska Climate Assessment Response Committee http://carc.agr.ne.gov	United States Geological Survey http://www.usgs.gov/
Nebraska Department of Agriculture – Livestock Disease https://nda.nebraska.gov/animal/reporting/index.html	United States National Response Center http://www.nrc.uscg.mil/
Nebraska Department of Education http://nep.education.ne.gov/	UNL IANR – Nebraska Landslides http://snr.unl.edu/data/geologysoils/landslides/landslidedatabase.aspx
Nebraska Department of Environment and Energy http://www.deq.state.ne.us/	USACE National Inventory of Dams https://nid.sec.usace.army.mil/ords/f?p=105:1
Nebraska Department of Health and Human Services http://dhhs.ne.gov/Pages/default.aspx	USDA – Disaster Assistance Programs https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/index
Nebraska Department of Natural Resources http://www.dnr.ne.gov	USGS – Landslide Inventory https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=ae120962f459434b8c904b456c82669d
Wildfire Risk to Communities: https://wildfirerisk.org/	

Public Review Period

Once the draft of the HMP was completed, a public review period was opened to allow for participants and community members at large to review the plan and provide comments and changes, if any at that time. The public review period was open from April 12, 2023, to May 10, 2023. Participating jurisdictions, neighboring jurisdictions, and identified stakeholders 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/2023-tri-county-hazard-mitigation-plan) to download the document.

Communities were encouraged to share or post information about the public review period to local websites and through local news media. Communities including Atkinson, Bloomfield, Center, Clearwater, Ewing, Inman, Neligh, Niobrara, Oakdale, O'Neill, and Holt County all brought and discussed the HMP at

board meetings to adopt the plan prior to plan approval. All meetings were open to the public. No comments from the public were received during such meetings to be incorporated into the HMP.

Additionally, specific hazard profiles from Section Four were sent to state technical experts for review. These sections included:

- Wildfire sent to Nebraska Forest Service
- Dam Failure sent to NeDNR Dam Safety Section
- Drought sent to NeDNR – Drought Division
- Flooding sent to NeDNR – Floodplain Management Section

Received comments and suggested changes were incorporated into the plan. Examples of such revisions are listed in the table below.

Table 15: Public Review Revisions

NAME, TITLE, AND/OR AGENCY	PLAN SECTION	COMMENT/REVISION
Mike Brockaus, Superintendent, Elgin Public Schools	Elgin Public Schools Profile	Updated cost information for the identified mitigation action.
Angie Hupp, Clerk/Treasurer, Village of Clearwater	Village of Clearwater Profile	Updated historical hazard information.
Sandy Benson, CWPP/Communications Liaison, Nebraska Forest Service	Wildfire Risk Assessment	Grammatical and information updates.
Tom Schuerman, Dam Safety Engineer, Nebraska Department of Natural Resources	Dam Failure Risk Assessment	Wording and information updates.
Adele Phillips, Flood Mitigation Planner, Nebraska Department of Natural Resources	Flooding Risk Assessment	Wording and information updates.
Sarah Sidak, Clerk, City of O'Neill	City of O'Neill Profile	Updated flood damage numbers and added a new mitigation action.
Dana Klabenes, Clerk/Treasurer City of Neligh	City of Neligh Profile	Updated new businesses information.
Kelsy Jelinek, Emergency Manager, Knox County	Knox County Profile	Added critical facilities.
Colette Panning, City Administrator, City of Bloomfield	City of Bloomfield Profile	Updated local planning team participation.
Mona Weatherwax, Clerk/Treasurer, Village of Niobrara	City of Niobrara Profile	Updated community lifelines and spelling mistakes.
Tyler Martin, Integrated Water Management Coordinator Nebraska Department of Natural Resources	Drought Risk Assessment	Information updates.

Funding Workshop

As part of hazard mitigation process, the three counties wanted to add a funding workshop to educate and discuss potential mitigation measures that jurisdictions could implement along with possible funding mechanisms. Subject matter experts from Nebraska Emergency Management Agency, Nebraska Department of Environment and Energy, Nebraska Forest Service, U.S. Army Corps of Engineers, Holt County Farm Service Agency, Holt County Economic Development, and JEO were available to discuss projects and funding with participating jurisdictions. The meeting was held on May 11, 2023 from 3pm – 6pm at the Holt County Courthouse Annex in O'Neill. A list of attendees can be found with the sign in sheets located in Appendix A.

Plan Adoption

Based on FEMA requirements, this multi-jurisdictional hazard mitigation plan must be formally adopted by each participant's governing body through the approval of an *Adoption Resolution.* The approval creates 'individual ownership' of the plan by each participating entity. 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 jurisdiction is in Appendix A. Copies of community specific adoption resolutions may be requested from the 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.*

Hazard mitigation plans are 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. Those who participated directly in the planning process would be logical champions during reviews between and during the five-year cycle update of the plan. It is critical that the plan be reviewed at regular intervals and 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. Participants are encouraged to work alongside their local County Emergency Management departments or the consultant, JEO, to document updates and revise the HMP as needed. See *Section Six: Plan Implementation and Maintenance* for additional information on plan amendments.

Additional implementation of the mitigation plan should include integrating HMP goals and mitigation and strategic actions into county and local comprehensive or capital improvement plans as they are developed or updated. *Section Six* describes the system that jurisdictions participating in the HMP have established to monitor the plan; provides a description of how, when, and by whom the HMP process and mitigation and strategic 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 is meant to provide a description of the characteristics of the planning area to create an overall profile. Many characteristics are covered in each jurisdiction's community profile including demographics, transportation routes, and structural inventory. Therefore, this section highlights at-risk populations and characteristics of the built environment that add to regional vulnerabilities.

Planning Area Geographic Summary

The Tri-County planning area is located in the northeastern portion of the State of Nebraska with Knox County bordering South Dakota to the north. The planning area covers 4,416 square miles. The planning area includes three counties: Antelope, Holt, and Knox. The planning area is composed of several topographic regions including plains, sandhills, dissected plains, and rolling hills. Plains are flat-lying land that lies above the valley made of sandstone or stream-deposited silt, clay, sand, and gravel overlain by wind-deposited silt (Figure 3). Sandhills are hilly land composed of low to high dunes of sand stabilized by a grass cover. Dissected plains are hilly land with moderate to steep slopes, sharp ridge crests and remnants of the old, nearly level plain eroded by water and wind. Lastly, rolling hills are hilly lands with moderate to steep slopes and rounded ridge crests. In eastern Nebraska, including the planning area, are mostly glacial till that has been eroded and mantled by loess. [12]

The planning area rests within the watersheds of the Niobrara River, Elkhorn River, and Missouri River. There are also several creeks in the planning area including Verdigre Creek. Much of the planning area is comprised of small to moderate sized communities, agricultural land, and rivers or water bodies.

Demographics

Demographic and asset information can be used to determine differing levels of vulnerability via population and housing, structural inventories and valuations, critical facilities, and vulnerable areas analysis. In general, the planning area is a mixture of rural and incorporated areas. The U.S. Census Bureau collects specific demographic information for counties with a total estimated population of 24,813. This population includes a range of demographic cohorts and people at risk to natural and human-caused disasters. The following table depicts the estimated population per county in 2000, 2010, and 2020.

Table 16: Estimated Population for the Planning Area

County	2000 Population	2010 Population	2020 Population
Antelope	7,452	6,685	6,315
Holt	11,551	10,435	10,123
Knox	9,374	8,701	8,400
TOTAL	28,377	25,821	24,838

Source: U.S. Census Bureau[13]

[12] Center for Applied Rural Innovation. August 2001. "Topographic Regions Map of Nebraska." https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1062&context=caripubs.
[13] U.S. Census Bureau. 2000/2010/2017. "Age and Sex: 2017 American Community Survey (ACS) 5-year estimates." https://data.census.gov/cedsci/.

Figure 3: Planning Area Topography

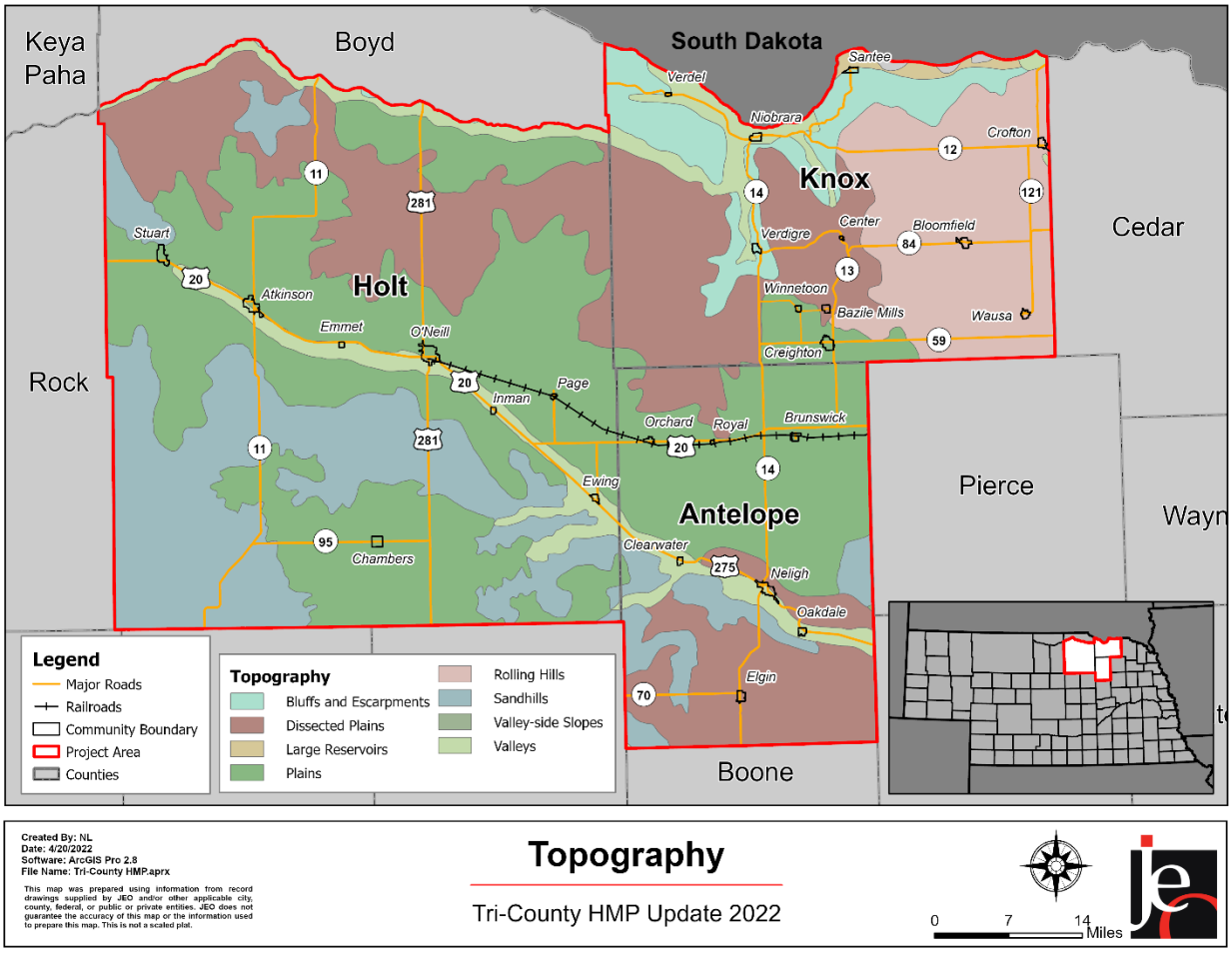


Table 17: Estimated Population for the Planning Area by Cohort

AGE	PLANNING AREA	STATE OF NEBRASKA
<5	6.5%	6.8%
5 – 19	19.2%	20.7%
20 – 64	51.0%	56.8%
>64	23.3%	15.6%
Median	44.5	36.6

Source: U.S. Census Bureau

The population for the planning area has been declining since the 2000 regional population census. The region accounts for approximately 1.3% of the total population for the state in 2020.

At-risk Populations

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

- Not all people who are considered "at-risk" are at risk;
- 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."[14]

Dependent children under 19 years old are one of the most vulnerable populations to disasters.[15] The majority of people in this age group do not have access to independent financial resources, transportation, or cellular telephones. They also lack the practical knowledge necessary to respond appropriately during a disaster. As a result, this demographic group experiences increased vulnerability to the following list of hazards: tornadoes (especially daytime events), severe thunderstorms, severe winter storms, extreme heat, water shortage created by drought, and chemical releases. Lack of awareness can at times be a concern for people in this age range as well as an inability to recognize and respond to environmental stimuli, which could lead to increased vulnerability to flooding (especially flash flooding), severe thunderstorms, tornadoes, and severe winter storms. Despite this vulnerability, children are generally overlooked in disaster planning because the presence of a caretaker is assumed. With over a quarter of the planning area's total population younger than 19 (25.7%), children are a key vulnerable group to address in the planning process. Over a quarter of this subset are additionally children are under the age of five, further exacerbating their vulnerability.

Schools house a high number of children 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 three-county planning area, and Figure 4 is a map of the school district boundaries. This list is comprehensive and does not represent only the school districts participating in this plan.

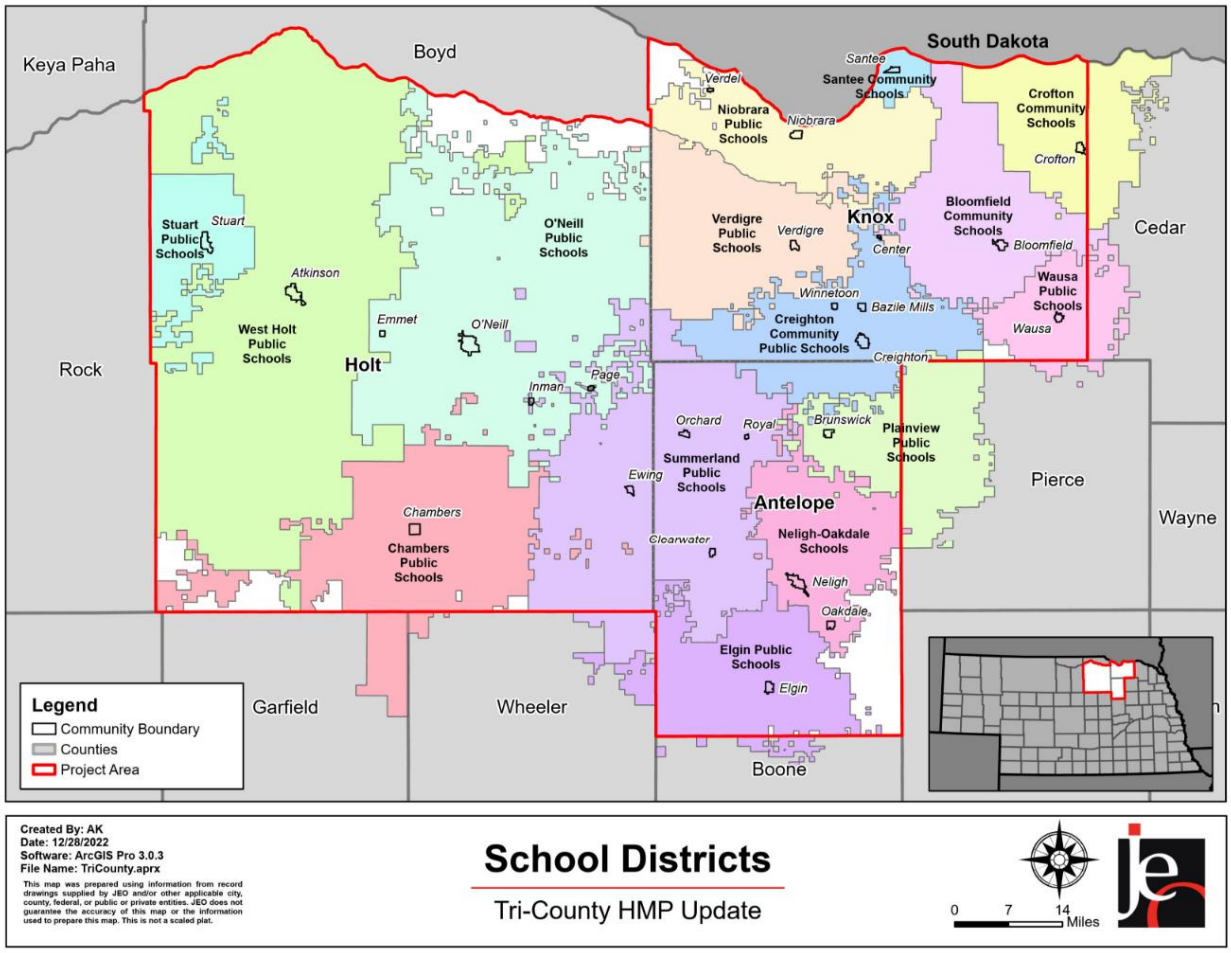
Table 18: School Inventory

SCHOOL DISTRICT	TOTAL ENROLLMENT (2021-2022)
Nebraska Unified District 1	N/A
Bloomfield Community Schools	274
Chambers Public Schools	132
Creighton Public Schools	281
Crofton Community Schools	338
Elgin Public Schools	198
Neligh-Oakdale Schools	364
Niobrara Public Schools	182
O'Neill Public Schools	807
Plainview Public Schools	344
Santee Community Schools	258
Stuart Public Schools	187
Summerland Public Schools	401
Verdigre Public Schools	138
Wausa Public Schools	239
West Holt Public Schools	437

Source: Nebraska Department of Education[16]

[14] United States Department of Homeland Security. June 2016. "National Response Framework Forth Edition." https://www.fema.gov/media-librarydata/1572366339630-0e9278a0ede9ee129025182b4d0f818e/National_Response_Framework_4th_20191028.pdf.
[15] Flanagan, Gregory, Hallisey, Heitgerd, & Lewis. 2011. "A Social Vulnerability Index for Disaster Management." Journal of Homeland Security and Emergency Management, 8(11): Article 3.
[16] Nebraska Department of Education. 2020. "Nebraska Education Profile: District and School Data." Accessed August 2020. http://nep.education.ne.gov/

Figure 4: Regional School Districts



Like minors, seniors (age 65 and greater) are often more significantly impacted by temperature extremes. During prolonged heat waves, 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 for proper bodily functions. 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.[17] The study found that on average there are 11,500 injuries and 100 deaths annually related to snow removal. Males over the age of 55 are 4.25 times more likely to experience cardiac symptoms during snow removal.

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

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. The following table provide statistics per county regarding households with English as a second language (ESL) and population reported as in poverty within the past 12 months.

[17] Center for Injury Research and Policy. January 2011. "Snow Shoveling Safety." Accessed July 2017. http://www.nationwidechildrens.org/cirp-snow-shoveling.

Table 19: Care Facility Inventory

COUNTY	HOSPITALS	HOSPITAL BEDS	ASSISTED LIVING	ASSISTED LIVING BEDS	NURSING HOMES	NURSING HOME BEDS	RURAL HEALTH CLINICS
Antelope	1	23	2	58	1	70	5
Holt	2	40	3	102	3	185	5
Knox	2	70	3	55	3	175	4
Total	**5**	**133**	**8**	**215**	**7**	**430**	**14**

Source: Nebraska Department of Health and Human Services[18]

Table 20: ESL and Poverty At-risk Populations

COUNTY	PERCENT THAT SPEAK ENGLISH AS A SECOND LANGUAGE	FAMILIES BELOW POVERTY LEVEL
Antelope	5.0%	6.5%
Holt	3.7%	4.2%
Knox	4.4%	5.8%

Source: U.S. Census Bureau[19],[20]

Residents below the poverty line may lack resources to prepare for, respond to, or recover from hazard events. Residents with limited economic resources will 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 near known hazard sites (i.e. chemical storage areas), or older poorly maintained structures. Residents below the poverty line will be more vulnerable to all hazards within the planning area.

Residents who speak English as a second language may struggle with a range of issues before, during, and after hazard events. General vulnerabilities revolve around what could be an inability to effectively communicate with others or an inability to comprehend materials aimed at notification and/or education. 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 reacting 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. The planning area is primarily White, non-Hispanic, with little change in diversity since 2010. Small changes in racial inequity will likely not significantly affect the region's overall vulnerability to hazards. However, it is important to note the Santee Sioux Reservation is in northern Knox County and constitutes a significant portion of the county population.

[18] Department of Health and Human Services. June 2022. "License Information System Search." https://www.nebraska.gov/LISSearch/search.cgi.
[19] U.S. Census Bureau. 2022. "Language Spoken at Home: 2020 American Community Survey (ACS) 5-year estimates." https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#.
[20] U.S. Census Bureau. 2022. "Selected Economic Characteristics: 2020 ACS 5-year estimate." https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#.

Table 21: Racial Composition in the Planning Area

RACE	2010		2020		% CHANGE
	NUMBER	% OF TOTAL	NUMBER	% OF TOTAL	
White, Non-Hispanic	24,402	94.5%	23,197	93.4%	-1.1%
Black	43	0.2%	120	0.5%	+0.3%
American Indian and Alaskan Native	826	3.2%	876	3.5%	+0.3%
Asian	55	0.2%	88	0.4%	+0.2%
Native Hawaiian & Other Pacific Islander	8	0.0%	5	0.0%	0.0%
Other Races	279	1.1%	140	0.6%	-0.5%
Two Or More Races	208	0.8%	412	1.2%	+0.4%
Total Population	25,821	-	24,838	-	-

Source: U.S. Census Bureau[21,22]

Native American and Tribal Populations

The planning area includes the entirety of the Santee Sioux Reservation and properties and facilities for the Ponca Tribe. Indigenous populations have historically been underrepresented in large scale planning efforts while also experiencing severe impacts from hazard events and climate change at the local level. Indian reservations present specific vulnerabilities to hazard events. Many homes and traditional structures in reservations were built prior to the adoption of local building codes and/or pre-FIRM development. Increased poverty rates are common on tribal lands and many residents lack adequate funds to implement household mitigation actions. Other local vulnerabilities may include lack of adequate warning systems for tribal residents who do not live in incorporated areas, lack of adequate means of transportation for evacuation, language barriers for elders who may only speak native language, and access issues during hazard events due to poorly maintained or unpaved roads.

Santee Sioux Reservation

The Santee Sioux Reservation is in Knox County while the tribal government seat is in Niobrara NE. The Santee Sioux Reservation comprises a small portion of the overall area's population. The Santee Sioux Tribe was invited to participate in this Hazard Mitigation Planning process; however, due to other ongoing priorities at the local level including staffing restrictions, they chose not to participate as an eligible jurisdiction in this plan. Moving forward, it is recommended the tribe pursue a Tribal specific HMP to address local concerns and capabilities, particularly as tribal plans have different regulatory requirements to meet than traditional multi-jurisdictional plans. For an overview of tribal specific requirements, see Title 44 Code of Federal Regulations (CFR) Chapter I, Subchapter D, Part 201.7.

Ponca Tribe of Nebraska

The Ponca Tribe of Nebraska is a decentralized federally recognized tribe. The Tribe does not have a reservation, but rather has established a fifteen-county service delivery area across Nebraska, Iowa, and South Dakota as established under the Ponca Restoration Act. Within the planning area the Ponca Tribe has several facilities, properties, cultural sites, and tribal members who live in Knox and Holt Counties. The Ponca Tribal Headquarters is in Niobrara, NE.

21 U.S. Census Bureau. 2022. "Race: 2020 ACS 5-year estimates." https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#.
22 U.S. Census Bureau. 2022. "Race: 2010 ACS 5-year estimate." https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#.

Other tribal facilities and areas of concern within the planning area:

- Powwow grounds – outside city limits of Niobrara
- Grocery store, Gym, and Tribal housing/apartments – Niobrara
- Smoke shack – Crofton
- Buffalo herd lands – Niobrara
- Other cultural sites – locations withheld

The tribe noted several concerns from hazard events which have been profiled in this HMP, specifically flooding and water quality issues in Niobrara. The tribe is planning several new developments and projects in the coming years including expanding or upgrading existing trails and roads (including passages for buffalo), building a Cultural Center in Niobrara, and improving stock dam infrastructure across the planning area. There are currently 12 to 15 stock and agricultural dams along natural springs in the planning area, as well as a number of agricultural pivot systems, trail bridges, and leased property the tribe maintains. The tribe indicated a desire to pursue a hydraulic survey with a soil analysis around the Powwow Grounds to help identify seepage and flood related risks.

These locations and facilities should be considered when pursuing future mitigation efforts by both the tribe and the communities they are located within. While the Ponca Tribe did not engage in this HMP as a full participant, as of January 2023 the tribe was pursuing grant funding to develop their own Tribal specific HMP but recognizes the importance of engaging with other planning efforts across their service areas.

Built Environment and Structural Inventory

Data related to the built environment is an important component of a hazard mitigation plan. It is essential that during the planning process communities and participating jurisdictions display an understanding of their built environment and work to identify needs that may exist within their planning area. The US Census provides information related to housing units and potential areas of vulnerability. The selected characteristics examined below include lacking complete plumbing facilities, lacking complete kitchen facilities, housing units that are mobile homes, and housing units with no vehicles.

Table 22: Selected Housing Characteristics

	ANTELOPE	HOLT	KNOX	TOTAL
Occupied housing units	**2,725 (81.6%)**	**4,390 (83.4%)**	**3,605 (73.0%)**	**10,720**
Lacking complete plumbing facilities	1 (0.1%)	12 (0.3%)	6 (0.2%)	**19 (0.2%)**
Lacking complete kitchen facilities	23 (0.8%)	49 (1.1%)	33 (0.9%)	**105 (1.0%)**
Housing unit with no vehicles available	87 (3.2%)	164 (3.7%)	163 (4.5%)	**414 (3.9%)**
Mobile homes	157 (4.7%)	380 (7.2%)	332 (6.7%)	**869 (8.1%)**

Source: U.S. Census Bureau[23]

Approximately eight percent of housing units in the planning area are mobile homes. Holt County has the largest shares of mobile homes. 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.

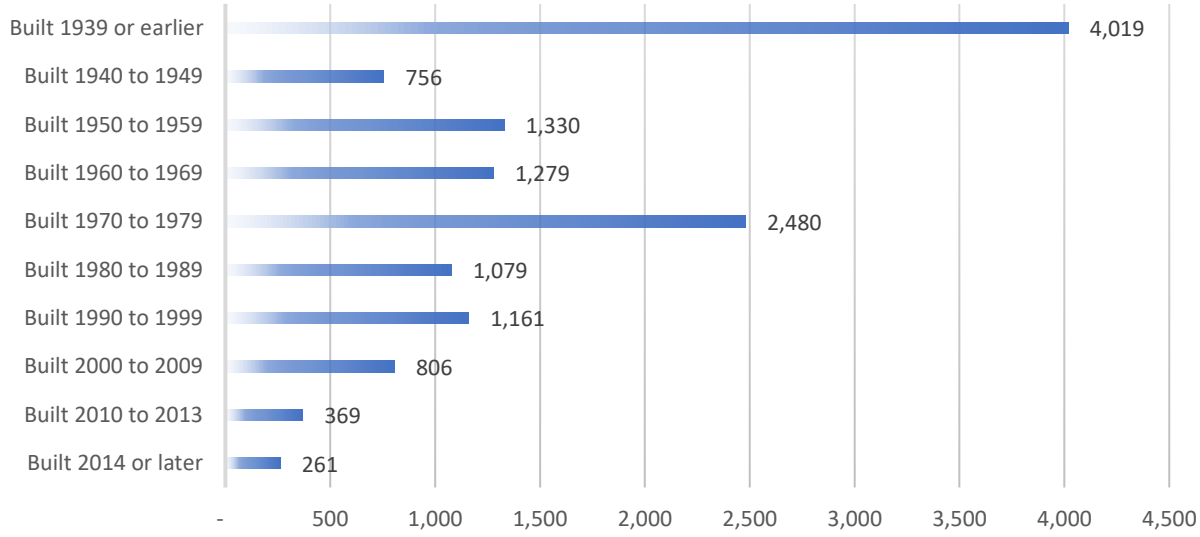
Knox County has the highest percentage of unoccupied housing units. Unoccupied homes may not be maintained as well as occupied housing, thus adding to their vulnerability. Furthermore, approximately

23 U.S. Census Bureau. 2022. "Selected Housing Characteristics: 2020 ACS 5-year estimates." https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#.

four 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 time of need.

The majority of homes in the planning area were built prior to 1939, with the number of homes constructed since 1990 declining each decade (Figure 1). Housing age can serve as an indicator of risk, as structures built prior to state building codes being developed may be more vulnerable. According to the Department of Housing and Urban Development (HUD), older homes are at greater risk of poor repair and dilapidation resulting in blighted or substandard properties. Residents living in these homes may be at higher risk to impacts from high winds, tornadoes, severe winter storms, and thunderstorms. Over half of the housing units within the planning area were constructed before the 1980s. Across the state, the first building codes were adopted in 1987, but prior to this time, codes and building standards were established (or not) by each county and community. The State of Nebraska later adopted the International Building Code (IBC) 2000 codes (adopted in 2003), the IBC 2009 codes (adopted in 2010), and the IBC 2018 codes as of 2020.

Figure 5: Housing Age in Planning Area



Source: U.S. Census Bureau

Communications

Access to various communication methods is a key component for residents to receive, interpret, and share information regarding mitigation activities taking place in their community as well as hazard events as they unfold. Two of the primary ways to receive such communications are through local cell coverage and internet access. Internet and cellular services have become critical resources to share and receive information regarding hazardous events and disseminate important information including storm warnings, evacuation orders, or weather updates.

Most homes have access to landline phones (less than two percent of housing units lack access to landline telephone service); however, cellular telephones are increasingly a primary form of telephone service. However, homes without either landlines or cellphones do represent a population at increased risk to disaster impacts. Reverse 911 systems are designed to contact households via landline services and as a result, some homes in hazard prone areas may not receive notification of potential impacts in time to take protective actions. Emergency managers should continue to promote the registration of cell phone

numbers with emergency alert systems and utilize systems which automatically ping cellphones by triangulating cell towers.

Table 23: Selected Communications

	ANTELOPE	HOLT	KNOX	TOTAL
No telephone service available	28 (1.0%)	58 (1.3%)	56 (1.6%)	**142 (1.3%)**
No computer in household	378 (13.9%)	544 (12.4%)	462 (12.8%)	**1,384 (12.9%)**

Source: U.S. Census Bureau[24],[25]

Social Vulnerability Index

All communities have some vulnerability to natural and human-caused hazard events. Various social conditions such as poverty rates, vehicle access, language, or housing stock contribute to a community's overall social vulnerability. The Center for Disease Control (CDC) has developed a Social Vulnerability Index to help public health officials and emergency responders identify communities at greater risk before, during, and after major hazardous events. The index evaluates 15 social factors and breaks down vulnerability into four domains: socioeconomic status; household composition and disability; minority status and language; housing and transportation. Several of these factors have been discussed in more depth earlier in this section. The following table lists the overall Social Vulnerability Index score for counties in the planning area.

An additional tool used to identify social vulnerability is FEMA's National Risk Index. Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:

$$\frac{Expected\ Annual\ Loss\ x\ Social\ Vulnerability}{Community\ Resilience} = Risk\ Index$$

Risk Index scores are presented as a composite score for the 18 hazard types evaluated, as well as individual scores for each hazard type.

Table 24: Social Vulnerability Index Score by County

COUNTY	CDC SVI	FEMA NRI			
	VULNERABILITY LEVEL	EXPECTED ANNUAL LOSS	SOCIAL VULNERABILITY	COMMUNITY RESILIENCE	RISK INDEX
Antelope	Low Vulnerability	Relatively Low	Relatively Moderate	Relatively High	Relatively Low
Holt	Low Vulnerability	Very Low	Relatively High	Relatively Moderate	Relatively Low
Knox	Moderate Vulnerability	Relatively Low	Relatively High	Relatively Moderate	Relatively Low

Source: CDC Social Vulnerability Index, 2018[26], FEMA National Risk Index, 2020

Hazard specific vulnerabilities from FEMA's National Risk Index for the three counties in the planning area are included in the regional vulnerabilities section of each hazard profile (*Section Four)*. Community specific information about social vulnerabilities and rural capabilities is discussed in *Section Seven's* individual jurisdictional profiles.

24 U.S. Census Bureau. 2022. "Selected Housing Characteristics: 2020 ACS 5-year estimates." https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#.
25 U.S. Census Bureau. 2022. "Families and Household Characteristics: 2020 ACS 5-year estimates. (S2801)" https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#.
26 Center for Disease Control Social Vulnerability Index. 2018. "CDC's Social Vulnerability Index (SVI): SVI Interactive Map" https://svi.cdc.gov/map.html

State and Federally Owned Properties

The following table provides an inventory of state and federally owned properties within the planning area by county. Note that this list does not include federally or state-owned highway systems or specific buildings within each community.

Table 25: State and Federally Owned Facilities

FACILITY	
Antelope County	
Bazile Creek WMA	Open Fields and Water Sites – 3463
Bohemia Prairie WMA	Open Fields and Water Sites – 3472
Deep Water Wildlife Area	Open Fields and Water Sites – 3474
Devils Nest Wildlife Area	Open Fields and Water Sites – 3475
Gavins Point Project, Lewis and Clark Lake (USACE)	Open Fields and Water Sites – 3479
Lewis and Clark Lake SRA	Open Fields and Water Sites – 3481
Niobrara Confluence WMA	Open Fields and Water Sites – 3483
Niobrara State Park	Open Fields and Water Sites – 3492
Open Fields and Water Fishing Spot	Open Fields and Water Sites – 3496
Open Fields and Water Sites – 3331	Open Fields and Water Sites – 3500
Open Fields and Water Sites – 3332	Open Fields and Water Sites – 3509
Open Fields and Water Sites – 3336	Open Fields and Water Sites – 3510
Open Fields and Water Sites – 3343	Open Fields and Water Sites – 3511
Open Fields and Water Sites – 3393	Open Fields and Water Sites – 3530
Open Fields and Water Sites – 3411	Open Fields and Water Sites – 3540
Open Fields and Water Sites – 3416	Open Fields and Water Sites – 3541
Open Fields and Water Sites – 3433	Verdel Landing WMA
Open Fields and Water Sites – 3455	
Holt County	
8 Open Fields and Water Sites – 3407	Open Fields and Water Sites – 2035
Dry Creek WMA	Open Fields and Water Sites – 3352
Goose Lake WMA	Open Fields and Water Sites – 3524
O. John Emerson WMA	Open Fields and Water Sites – 3527
Open Fields and Water Sites – 2025	Open Fields and Water Sites – 3528
Open Fields and Water Sites – 2027	Redbird WMA
Open Fields and Water Sites – 2030	Swan Lake
Knox County	
Grove Lake WMA	Open Fields and Water Sites – 3461
Hackberry Creek WMA	Open Fields and Water Sites – 3464
Open Fields and Water Sites – 3330	Open Fields and Water Sites – 3465
Open Fields and Water Sites – 3364	Open Fields and Water Sites – 3467
Open Fields and Water Sites – 3370	Open Fields and Water Sites – 3468
Open Fields and Water Sites – 3370	Open Fields and Water Sites – 3470
Open Fields and Water Sites – 3390	Open Fields and Water Sites – 3478
Open Fields and Water Sites – 3437	Open Fields and Water Sites – 3504
Open Fields and Water Sites – 3438	Open Fields and Water Sites – 3507
Open Fields and Water Sites – 3439	Open Fields and Water Sites – 3536
Open Fields and Water Sites – 3442	Open Fields and Water Sites – 3544

FACILITY	
Open Fields and Water Sites – 3451	Red Wing WMA

Source: Nebraska Game and Parks[27]

Historical Sites

According to the National Register of Historic Places for Nebraska by the National Park Service (NPS), there are 37 historic sites located in the planning area. Structures identified as cultural or historic resources represent assets that are unique to the planning area and are, in many situations, irreplaceable and have local significance.

Table 26: Historical Sites

SITE NAME	DATE LISTED	NEAREST COMMUNITY	COUNTY	IN FLOODPLAIN?
Antelope County Courthouse	12/3/1980	Neligh	Antelope	N
Argo Hotel	5/5/1999	Crofton	Knox	N
Commercial Hotel, The	4/5/1990	Verdigre	Knox	Y
Congregational Church and Manse	3/16/1972	Santee	Knox	N
Downtown Neligh Historic District	11/9/2017	Neligh	Antelope	N
Eagle Creek Archeological Site	10/1/1974	O'Neill	Holt	Unknown - Address Restricted
Elkhorn River Bridge	6/29/1992	Clearwater	Antelope	Y
Episcopal Church	3/16/1972	Santee	Knox	N
Gates College Gymnasium	4/20/1981	Neligh	Antelope	N
Golden Hotel	11/27/1989	O'Neill	Holt	N
Gross State Aid Bridge	6/29/1992	Verdigre	Knox	Y
Holt County Courthouse	7/5/1990	O'Neill	Holt	N
Kester Planing Mill	7/28/2014	Neligh	Antelope	N
Knox County Courthouse	7/5/1990	Center	Knox	N
Maybury-McPherson House	3/14/1996	Neligh	Antelope	N
Neligh Mill	10/15/1969	Neligh	Antelope	N
Neligh Mill (Boundary Increase)	4/2/2010	Neligh	Antelope	N
Neligh Mill Bridge	6/29/1992	Neligh	Antelope	Y
Neligh Mill Elevators (Boundary Increase)	12/15/1983	Neligh	Antelope	N
Niobrara River Bridge	11/12/1992	Niobrara	Knox	Y
Old Nebraska State Bank Building	10/1/1974	O'Neill	Holt	N
O'Neill Carnegie Library	7/13/2018	O'Neill	Holt	N
Ponca Agency Archeological District	7/12/2006	Niobrara	Knox	Unknown - Address Restricted
Ponca Fort Site	4/3/1973	Verdel	Knox	Unknown - Address Restricted
Ponca Tribal Self-Help Community Building Historic District	3/13/2003	Niobrara	Knox	N

[27] Nebraska Game and Parks. 2020. "Public Access ATLAS." [Web Map]. Accessed July 2022. http://outdoornebraska.gov/publicaccessatlas/.

SITE NAME	DATE LISTED	NEAREST COMMUNITY	COUNTY	IN FLOODPLAIN?
Rad Sladkovsky	6/29/1982	Verdigre	Knox	Unknown - Address Restricted
Redbird I Site	11/21/1974	Redbird	Holt	Unknown - Address Restricted
Rouse Ranch	9/4/2013	O'Neill	Holt	N
St. Patrick's Catholic Church	7/1/2020	O'Neill	Holt	N
St. Peter's Episcopal Church	12/3/1980	Neligh	Antelope	N
St. Rose of Lima Catholic Church and School Complex	3/21/2011	Crofton	Knox	N
Sturdevant, Brantly, House	3/25/1999	Atkinson	Holt	N
US Post Office-O'Neill	5/11/1992	O'Neill	Holt	N
Verdigris Creek Bridge	6/29/1992	Royal	Antelope	Y
Winnetoon Jail	2/27/1995	Winnetoon	Knox	N
Winnetoon Public School	3/13/2020	Winnetoon	Knox	N
Z.C.B.J. Opera House	7/6/1988	Verdigre	Knox	Y

Source: National Parks Service[28]

[28] National Park Service. Accessed June 2022. "National Register of Historic Places NPGallery Database." https://npgallery.nps.gov/nrhp.

SECTION FOUR
RISK ASSESSMENT

Introduction

The ultimate purpose of this hazard mitigation plan is to minimize the loss of life and property across the planning area. This section contains a regional and local risk assessment including descriptions 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 27: Term Definitions

TERM	DEFINITION
Hazard	A potential source of injury, death, or damage
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 consequences 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

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 (NFIP) 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.*

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 appropriate data available have been considered. Further discussion relative to each hazard is discussed in the hazard profile portion of this section.

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 is 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 for which there is robust historic record and for which monetary damages are recorded. There are three main pieces of data used in this formula.

- **Total Damages in Dollars:** This is the total dollar amount of all property or 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 on Record:** This is the span of years there is data available for recorded events. During this planning process, vetted and cleaned up National Centers for Environmental Information (NCEI) was primarily used between January 1996 and January 2022. Although some data is available back to 1950, this plan update only utilizes the more current and accurate data available. Other periods of record for data are supplied where appropriate.
- **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 tornado event can have a widespread effect on a city.

The event damage estimate formula is provided:

$$Annual\ Damages\ (\$) = \frac{Total\ Damages\ in\ Dollars\ (\$)}{Total\ Period\ of\ Record\ (\#)}$$

Each hazard will be included, 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 2022. 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. The annual probability estimate formula is provided:

$$Annual\ Probability\ (\%) = \frac{Total\ Years\ with\ an\ Event\ Occurring\ (\#)}{Total\ Years\ Recorded\ (\#)}\ x\ 100$$

The annual probability percentage was then categorized into one of four categories as described in the table below.

Table 28: Probability Rating and Categories

RATING	LIKELIHOOD	FREQUENCY OF OCCURRENCE
1	Unlikely	0%-5% probability to occur based on historical record
2	Possible	6%-49% probability to occur based on historical record
3	Likely	50%-79% probability to occur based on historical record
4	Highly Likely	80%-100% probability to occur based on historical record
5	Unknown	No data available for determination

FEMA Standard Economic Values

As part of FEMA's Benefit-Cost Analysis Toolkit, standard economic values were developed to better help 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 29 shows the economic value for traffic delays on 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 29: 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[29]

Also included in FEMA's Benefit-Cost Analysis Toolkit are life safety economic values. Life safety is the value of lives saved and injuries prevented resulting from mitigation measures. Table 30 shows the six different severity levels, their economic value, and common injuries associated with each level.

Table 30: FEMA Life Safety Economic Values

INJURY SEVERITY LEVEL	SELECTED COMMON INJURIES	ECONOMIC VALUE
Minor	Superficial abrasion or laceration of skin; digit sprain; first degree burn; head trauma with headache or dizziness (no other neurological signs).	$35,000
Moderate	Major abrasion or laceration of skin; cerebral concussion (unconscious less than 15 minutes); finger or toe crush/amputation; closed pelvic fracture with or without dislocation.	$545,000
Serious	Major nerve laceration; multiple rib fracture (but without flail chest); abdominal organ contusion; hand, foot, or arm crush/amputation.	$1,218,000
Severe	Spleen rupture; leg crush; chest-wall perforation; cerebral concussion with other neurological signs (unconscious less than 24 hours).	$3,086,000
Critical	Spinal cord injury (with cord transection); extensive second- or third-degree burns; cerebral concussion with severe neurological signs (unconscious more than 24 hours).	$6,879,000
Un-Survivable	Injuries, which although not fatal within the first 30 days after an accident, ultimately result in death.	$11,600,000

Source: FEMA, 2022

FEMA's standard economic values and life safety 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. While injuries and fatalities may be given it is not known the severity of those injured during the event. The values are provided in this plan so that participants can better estimate potential losses and determine the benefits of potential future mitigation actions.

[29] 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 hazards included in the 2017 Tri-County Hazard Mitigation Plan and those identified in the 2021 State of Nebraska Hazard Mitigation Plan. The Regional Planning Team reviewed, discussed, and determined the list of hazards to be profiled in this HMP update at the kick-off meeting based on hazards experienced throughout the planning area. The hazards for which a risk assessment was completed are listed in the table below.

Table 31: Hazards Addressed in the Plan

HAZARDS ADDRESSED IN THE 2023 TRI-COUNTY HMP		
Agricultural Plant and Animal Disease	Flooding	Severe Winter Storms
Dam Failure	Hazardous Materials	Tornadoes and High Winds
Drought	Landslides	Wildfire
Earthquakes	Public Health Epidemic	
Extreme Heat	Severe Thunderstorms	

Due to the development of new events, impacts to the planning area, and overall response capabilities associated per hazard, several new hazards were included in the 2023 Tri-County Hazard Mitigation Plan upon the recommendation of the consultant and the Regional Planning Team. New hazards to this HMP plan include Agricultural Plant and Animal Disease, Earthquakes, Hazardous Materials, Landslides, Public Health Emergency, High Winds, and Wildfire.

Hazard Assessment Summary Tables

The following table provides an overview of the data contained in the hazard profiles. Hazards listed in this table and throughout the section are in alphabetical order. This table is intended to be a quick reference for people using the plan and does not contain source information. Source information and full discussion of individual hazards are included later in this section.

Table 32: Regional Risk Assessment

HAZARD	PREVIOUS OCCURRENCES	APPROXIMATE ANNUAL PROBABILITY	LIKELY EXTENT
AGRICULTURAL ANIMAL DISEASE	86	9/9 = 100%	Mean ~51 animals per event; Median ~2 animals per event
AGRICULTURAL PLANT DISEASE	57	21/22 = 95%	Unavailable
DAM FAILURE	12	9/88 = 10%	Varies by structure, inundation of floodplain downstream from dam
DROUGHT	483/1,512 months	32%	Mild Drought (D1)
EARTHQUAKES	4	4/122 = 3.3%	<4.0 magnitude
EXTREME HEAT	Avg. 3 days per year	81/130 = 62%	>100°F
FLOODING (FLASH AND RIVERINE)	87	22/27 = 81%	Inundation of structures and roads near waterways likely. Some evacuations of people may be necessary. Minimal to moderate flooding extent anticipated.
HAZARDOUS MATERIALS – FIXED SITE	17	11/33 = 33%	Avg. ~ 759 LGA Localized to the facilities and adjacent surroundings.
HAZARDOUS MATERIALS – TRANSPORTATION	8	7/52 = 13%	Avg. ~289 LGA Limited (<0.5 mile) from release site
HIGH WINDS	55	12/27 = 44%	9 BWF (Avg 47-54mph)
LANDSLIDES	86	86 events/60 years = 100%	Avg. Length ~203” Avg. Width ~325”
PUBLIC HEALTH EPIDEMIC	2	>1%	Varies by event; >1 fatality
SEVERE THUNDERSTORMS (INCLUDES HAIL, HEAVY RAIN, LIGHTNING, AND THUNDERSTORM WIND)	1,194	27/27 = 100%	>1” rainfall Avg 1.19 hail Wind 50-75 mph
SEVERE WINTER STORMS (INCLUDES BLIZZARDS, EXTREME COLD, ICE STORMS, WINTER STORMS)	252	27/27 = 100%	0.25-0.5” ice 30°-40° below zero (wind chill) 4-8” snow 25-40 mph winds
TORNADOES	111	24/42 = 57%	Range EF0-EF3 Avg. F0
WILDFIRE	1,205	22/22 = 100%	Avg. Fire <100 acres Moderate homes and structures threatened or at risk

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

Table 33: Hazard Loss Estimates for the Planning Area

HAZARD		COUNT	PROPERTY	CROP	OTHER IMPACTS
Agricultural Disease	Animal Disease	86	4,375 animals	N/A	
	Plant Disease	57	N/A	$2,176,447	
Dam Failure		12	$0	N/A	
Drought		483/1,512 months	$50,000,000	$125,296,676	
Earthquakes		4	$0	$0	
Extreme Heat		Avg. 3 days per year	$0	$38,452,710	
Flooding	Flash Flood	47	$1,089,000	$1,512,674	
	Flood	40	$6,505,000		
Hazardous Materials	Fixed Site	17	$5,000	N/A	2 injuries
	Transportation	8	$50,000		181 evacuated
Landslides		86	$0	N/A	
Public Health Epidemic		2 outbreak events	>6,926 cases	N/A	
Severe Thunderstorms	Hail	872	$3,798,500	$68,254,470	
	Heavy Rain	8	$0	$67,283,772	
	Lightning	5	$15,500	N/A	1 fatality
	Thunderstorm Wind	309	$2,298,400	N/A	1 fatality, 2 injuries
Severe Winter Storms	Blizzards	40	$5,441,000	$6,507,635	
	Extreme Cold	27	$0		
	Heavy Snow	31	$0		
	Ice Storms	8	$0		
	Winter Storms	125	$8,603,000		
	Winter Weather	21	$0		
Tornadoes & High Winds	High Winds	55	$166,000	$6,045,886	
	Tornadoes	111	$15,719,590	$10,608	8 injuries
Wildfire		1,205	55,663 acres $507,572	$215,112	9 injuries 7 fatalities 51 Structures threatened 5 Structures destroyed
Total		**1,371**	**$93,690,990**	**$315,755,990**	**21 injuries 9 fatalities 181 evacuated 51 structures threatened 5 structures destroyed**

N/A – Data not available

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 in the last decade.

Table 34: SBA Declarations

Disaster Declaration Number	Declaration Year	Description	Primary Counties	Contiguous Counties
NE-00005	2006	Severe Winter Storm.	Antelope, Holt, Knox	
NE-00011	2007	Severe Winter Storms.	Antelope, Holt, Knox	
NE-00013	2007	Severe Storms, Flooding, and Tornadoes	Knox	
NE-00020	2008	Severe Storms, Tornadoes, and Flooding	Antelope, Knox	
NE-00021	2008	Severe Storms, Tornadoes, and Flooding	Holt	
NE-00033	2010	Severe Winter Storms and Snowstorm	Antelope, Holt, Knox	
NE-00035	2010	Severe Storms, Ice Jams, and Flooding.	Antelope, Holt	
NE-00038	2010	Severe Storms, Flooding, and Tornadoes	Antelope, Holt, Knox	
NE-00041	2001	Flooding	Knox	Antelope, Holt
NE-00042	2011	Flooding	Knox	Antelope, Holt
NE-00043	2011	Flooding	Knox	
NE-00049	2006	Drought	Antelope, Holt, Knox	
NE-00053	2007	Drought	Antelope, Holt, Knox	
NE-00063	2014	Tornadoes, Straight-line Winds, and Flooding	Holt	

Source: Small Business Administration, 2001-2022[30]

[30] Small Business Administration. 2001-2018. "SBA Disaster Loan Data." Accessed December 2019. https://www.sba.gov/loans-grants/see-what-sba-offers/sba-loan-programs/disaster-loans/disaster-loan-data.

Presidential Disaster Declarations

The presidential disaster declarations involving the planning area from 1962 to March 2022 are summarized in the following table. While data is available from 1953, declarations prior to 1962 are not designated by county, so they are not included in the table.

Table 35: Presidential Disaster Declarations

Disaster Declaration Number	Declaration Date	Title	Declared County/Areas	Total Public Assistance	Total Individual Assistance
DR-228-NE	7-18-1967	Severe Storms & Flooding	Antelope Knox	-	-
DR-303-NE	2-23-1971	Floods	Knox	-	-
DR-308-NE	7-7-1971	Floods	Knox	-	-
DR-552-NE	3-24-1978	Storms, Ice Jams, Snowmelt, & Flooding	Knox	-	-
DR-1480-NE	7-21-2003	Severe Storms and Tornadoes	Holt, Knox	$3,891,329.31	-
DR-1517-NE	5-25-2004	Severe storms, Tornadoes, & Flooding	Antelope	$13,351,657.77	$829,908.94
EM-3245-NE	9-19-2005	Hurricane Katrina Evacuees	Antelope, Holt, Knox	$393,813.27	-
DR-1627-NE	1-26-2006	Severe Winter Storms	Antelope, Holt, Knox	$5,444,137.27	
DR-1674-NE	1-7-2007	Severe Winter Storms	Antelope, Holt, Knox	$124,357,843.32	
DR-1706-NE	6-6-2007	Severe storms, Flooding, & Tornadoes	Knox	$6,109,252.52	
DR-1770-NE	6-20-2008	Severe Storms, Tornadoes, & Flooding	Holt	$36,258,650.19	$1,560,229.95
DR-1878-NE	2-25-2010	Severe Winter Storms & Snowstorm	Antelope, Holt, Knox	$6,577,021.37	-
DR-1902-NE	4-21-2010	Severe Storms, Ice Jams, & Flooding	Antelope, Holt	$3,112,391.72	-
DR-1924-NE	7-15-2010	Severe Storms & Flooding	Antelope, Holt, Knox	$49,926,354.50	-
EM-3323-NE	6-18-2011	Flooding	Knox	-	-
DR-4013-NE	8-12-2011	Flooding	Knox	$4,311,497.50	$62,808,331.04
DR-4185-NE	7-28-2014	Severe Storms, Tornadoes, Straight-line Winds, & Flooding	Holt	$3,937,963.86	-
DR-4321-NE	6-26-2017	Severe Winter Storm & Straight-Line Winds	Holt	$2,786,762.51	-

DISASTER DECLARATION NUMBER	DECLARATION DATE	TITLE	DECLARED COUNTY/AREAS	TOTAL PUBLIC ASSISTANCE	TOTAL INDIVIDUAL ASSISTANCE
DR-4375-NE	6-29-2018	Severe Winter Storm & Straight-Line Winds	Antelope, Holt, Knox	$7,428,072.28	-
DR-4420-NE	3-21-2019	Severe Winter Storm, Straight-Line Winds, & Flooding	Antelope, Holt, Knox	$490,473,038.38	$27,279,186.25
EM-3483-NE	3-13-2020	COVID-19	Antelope, Holt, Knox	-	-
DR-4521-NE	4-4-2020	COVID-19 Pandemic	Antelope, Holt, Knox	$271,286,458.31	$13,199,178.20

Source: FEMA, 1953-2022[31]

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 is a growing concern impacting communities, Indian tribes, residents, local economies, and infrastructure throughout the planning area. Discussions on temperature, precipitation, and climate impacts are included below.

Figure 6: Great Plains Region

The planning area is in the Northern Great Plains region of the United States, which stretches from Montana and North Dakota southward to Wyoming and Nebraska. A large elevation change across the region contributes to high geographical, ecological, and climatological variability, including a strong gradient of decreasing precipitation moving from east to west across the region. Significant weather extremes impact this area, including winter storms, extreme heat and cold, severe thunderstorms, drought, and flood producing rainfall.

The Fourth National Climate Assessment has provided an overview of potential impacts within the planning area.[32]

- **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

[31] Federal Emergency Management Agency. 2022. "Disaster Declarations." Accessed July 2022. https://www.fema.gov/openfema-dataset-disaster-declarationssummaries-v1.

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

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. 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

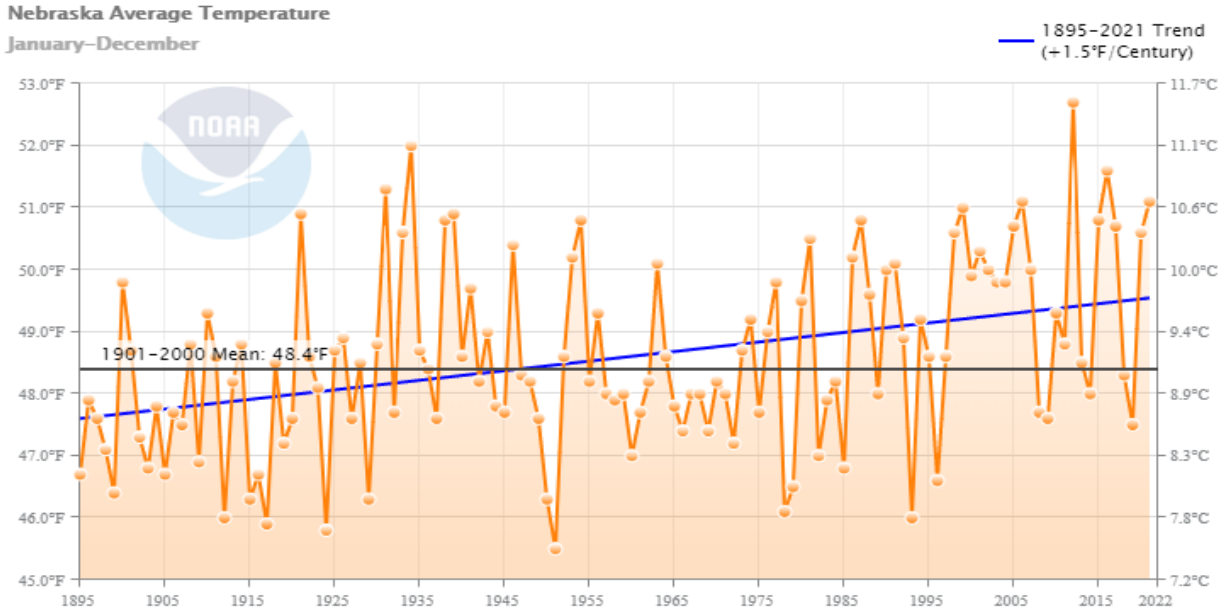
The United States is experiencing significant changes in temperature, precipitation, and severe weather events resulting from climate change. Long term climate trends will lead to an increase in the frequency and intensity of hazardous events, which will cause several significant economic, social, and environmental impacts on Nebraskans.

Changes in Temperature

Since 1895, Nebraska's overall average temperature has increased by about 1.5°F. Climate modeling suggests warmer temperature conditions will continue in the coming decades and rise steadily into mid-century. Warming has increased the most in winter and spring months with winter minimum temperatures rising 2-4°F. In addition, there is greater warming for nighttime lows than for daytime highs. Since 1985, the length of the frost season has increased by an average of more than one week across Nebraska, with the length likely to continue to increase in the future. Projected temperature changes range from 2-11°F by 2100 depending on emissions projects (Figure 8).[33]

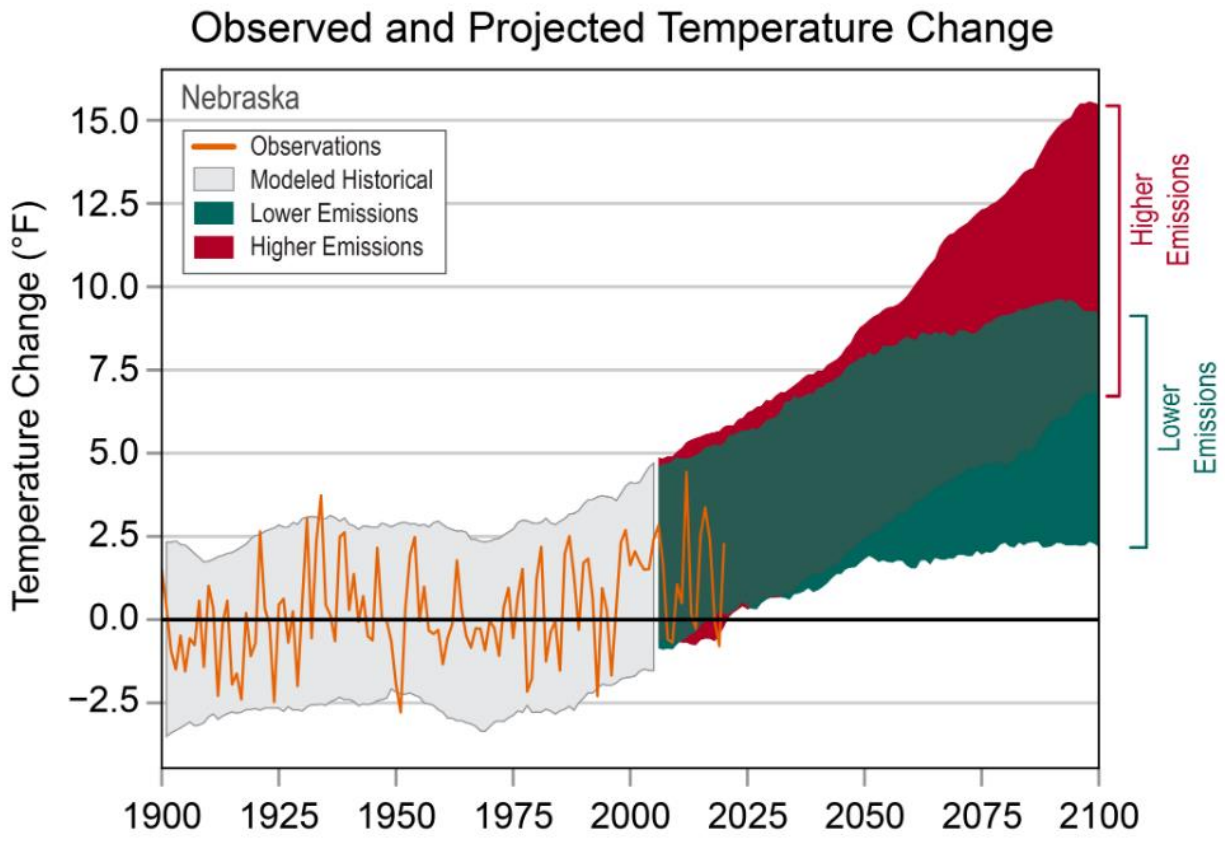
[33] NCEI. 2022. "State Climate Summaries – Nebraska". https://statesummaries.ncics.org/chapter/ne/#:~:text=The%20state%20is%20located%20far,(1895%E2%80%932020)%20averag.

Figure 7: Average Temperature (1895-2021)



Source: NOAA, 2021[34]

Figure 8: Observed and Projected Temperature Change - Nebraska

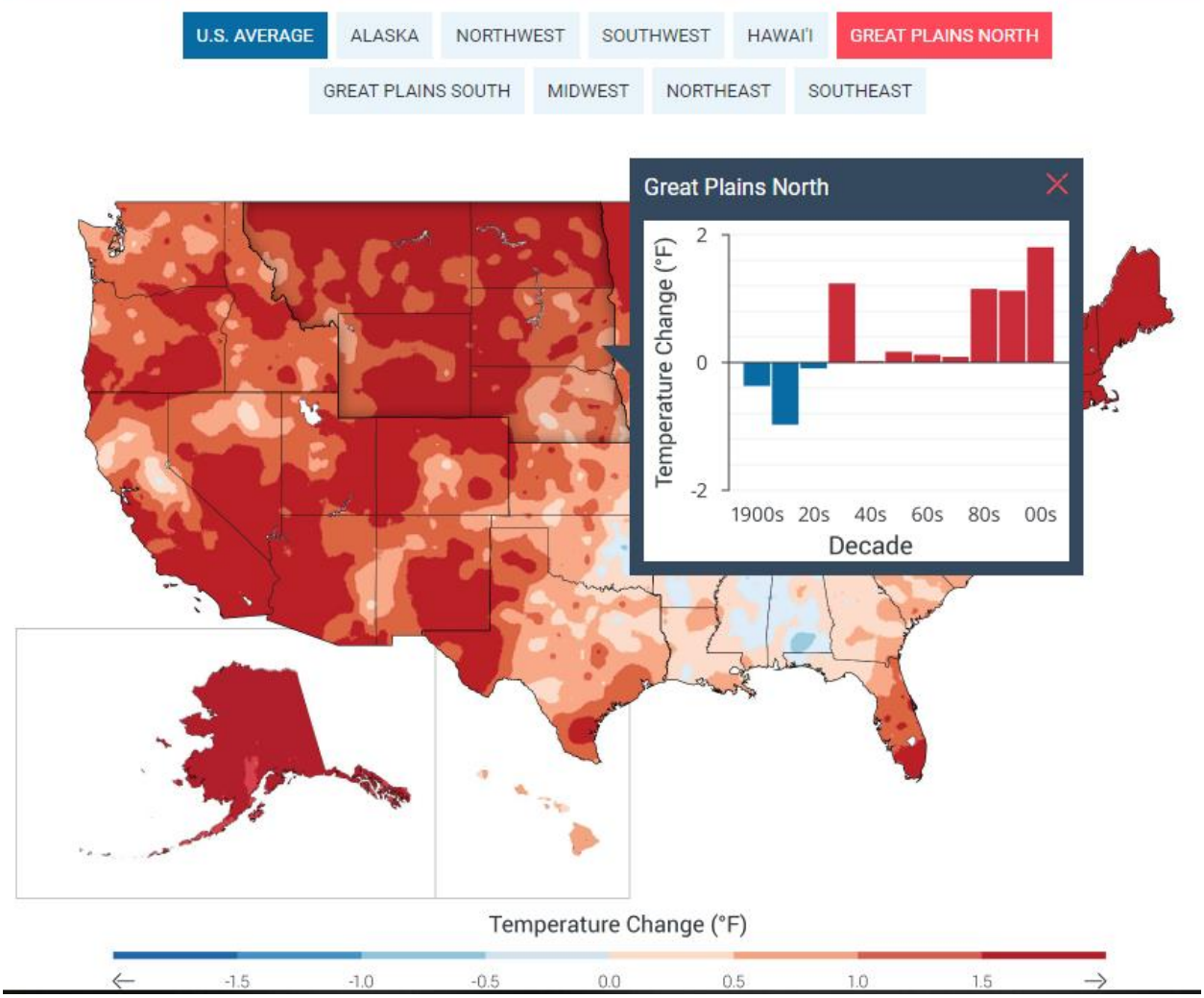


Source: NCEI

[34] 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.

Additionally, the length of the frost-free season (i.e., growing season) has been increasing nationally since the 1980s. While a longer growing season may provide some benefit for heavily agricultural areas, concurrent changes in temperature, water availability, and pest pressures may cause additional impacts. For instance, longer growing seasons coinciding with periods of drought and extreme heat can indicate lower production from increased plant mortality and increased risk to wildfire ignition probability and fuel load potentials. On average, the Great Plains has seen an increase of ten days to the annual growing season.[35]

Figure 9: Observed U.S. Temperature Change



Source: National Climate Assessment, 2014[36]

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

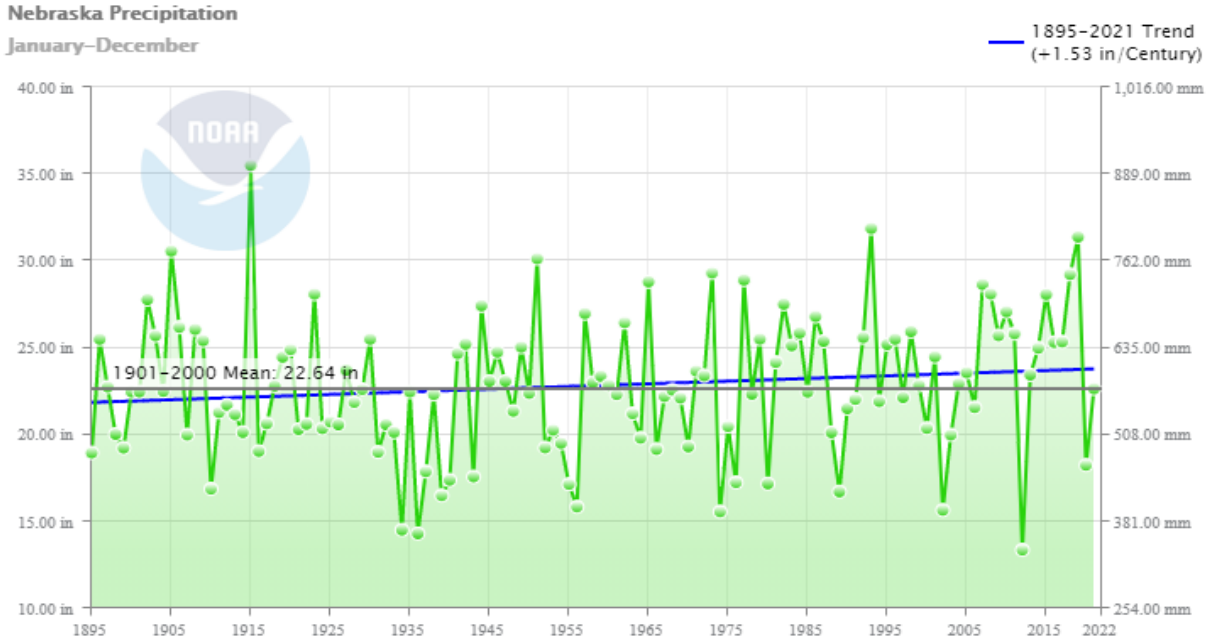
[35] U.S. Global Change Research Program. "2014 National Climate Assessment: Frost-free Season." Accessed 2020. https://nca2014.globalchange.gov/report/our-changing-climate/frost-free-season#tab2-images

[36] U.S. Global Change Research Program. "2014 National Climate Assessment." Accessed 2020. https://nca2014.globalchange.gov/

summer. Since 1895, yearly annual precipitation for Nebraska has increased slightly. With a changing climate, winter and spring precipitation is projected to increase across Nebraska. According to climate projections, winter and spring will likely become 20 percent wetter, with summers becoming 10 percent drier.

Climate modeling may show only moderate precipitation and streamflow changes; however, most of the Northern Great Plains region is already at risk to large annual and seasonable variability as seen by flooding and drought events occurring in concurrent years. There will likely be more days with a heavy precipitation event (rainfall of greater than one inch per day) across the region and subsequent impacts to riverine flooding events or overwhelmed local stormwater management systems. Groundwater and reservoir water sources are increasingly important to communities and residents in the planning area to meet water needs during periods of shortage. Precipitation varies significantly across the state and moves in a longitudinal gradient. The east receives twice as much precipitation (35 inches annually) as the Nebraska Panhandle (15 inches) on average.[37] The planning area is located on the northeastern side of the state with a lower overall precipitation total than the southeastern portion. Winter precipitation is projected to increase in intensity and may benefit Nebraska's agricultural economy by improving soil moisture but could potentially delay crop planting in the summer. Increased spring precipitation may lead to heightened runoff and flooding, reducing water quality and eroding soils.[38]

Figure 10: Nebraska Average Precipitation (1895-2021)



Source: NOAA, 2022[39]

37 North Central Climate Collaborative. January 2020. "NC3 Nebraska Climate Summary." Accessed December 2022. https://northcentralclimate.org/files/2020/01/nc3-Nebraska-Climate-Summary-FINAL_2.12.pdf?x24082

38 NOAA NCEI. 2017. "Nebraska State Climate Summary." Accessed 2021. https://statesummaries.ncics.org/chapter/ne/

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

Impacts from Climate Change

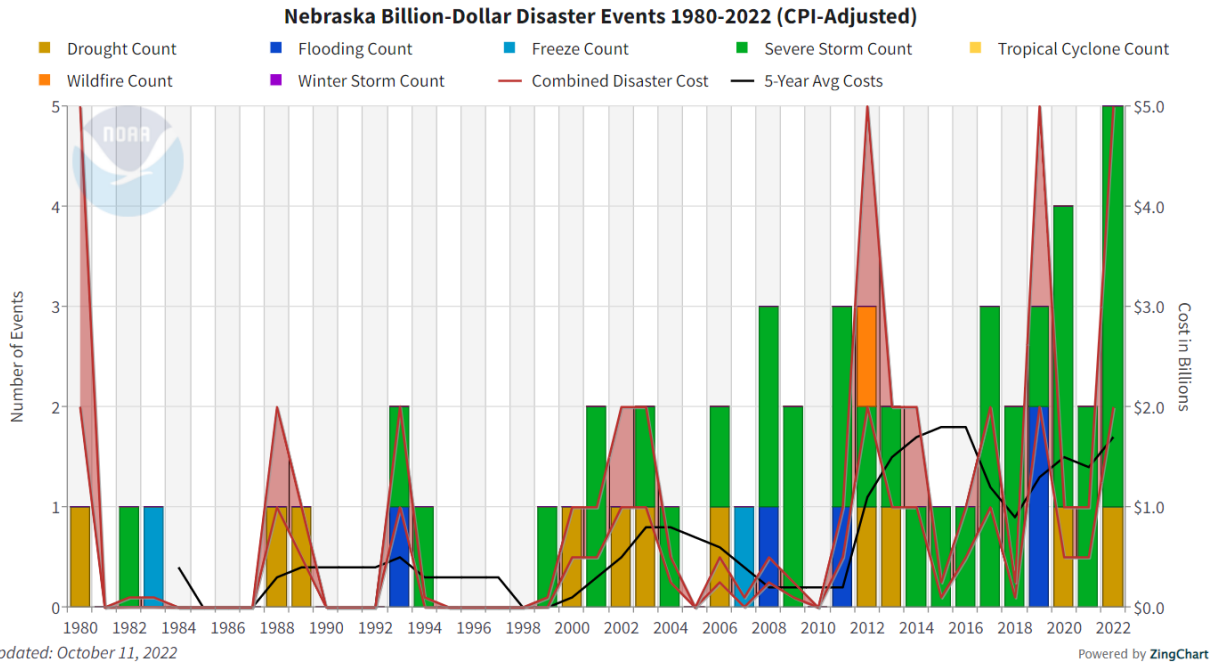
Observed changes in the intensity and frequency of extreme events are a significant concern now and in the future because of the social, environmental, and economic costs associated with their impacts. Challenges that are expected to affect communities, environments, and residents because of climate 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.[40]

As seen in the figure below, Nebraska is experiencing an increase in the number of billion-dollar natural disasters.

Figure 11: Nebraska Billion Dollar Disasters (1980-2022)



Source: NOAA, 2021[41]

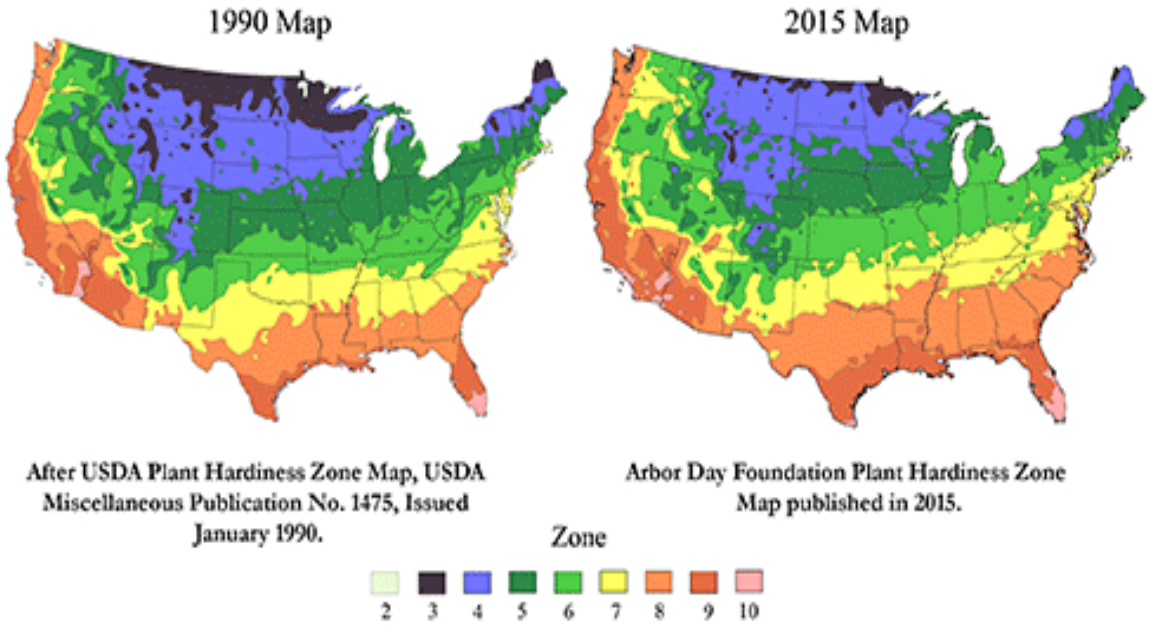
[40] U.S. Environmental Protection Agency. "Climate Impacts on Society." Accessed April 2021. https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-society_.html

[41] 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.

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 (Figure 12) available for the United States, 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.

Figure 12: Plant Hardiness Zone Change



Source: Arbor Day Foundation, 2018[42]

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.[43] An increase in air pollutants can occur from the growing number of grass and 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. [44]

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

[43] Asthma and Allergy Foundation of America. 2010. "Extreme Allergies and Climate Change." Accessed 2021. https://www.aafa.org/extreme-allergies-and-climate-change/

[44] AirNow. 2019. "Wildfire Smoke: A Guide for Healthcare Professionals." Accessed 2021. https://www.airnow.gov/sites/default/files/2020-10/wildfire-smoke-guide-revised-2019-chapters-1-3_0.pdf

Water Quality

Increasing temperatures, shifting precipitation patterns, and extreme weather events impact water quality throughout the state. As average temperatures increase, water temperatures also rise and put water bodies at risk for eutrophication and excess algal growth that reduce water quality. Extreme weather events and shifting precipitation can lead to fluctuating river flows, erosion, sediment accumulation, and morphological changes to water bodies and surrounding landscapes. In agricultural landscapes, major storm events can cause sediment and nutrients such as phosphorous and nitrogen to runoff into nearby water sources. 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.[45]

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. Flooding impacts property, infrastructure, economies, and the ecology of water bodies.

Energy

Shifting climate trends will have a direct impact on water and energy demands. 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 energy 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.[46] Critical facilities and vulnerable populations that 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 loss, property damage, agricultural damage, and loss of life. The magnitude of expected changes will exceed those experienced in the last century. Past events have typically informed HMPs to be more resilient to future events. Existing adaptation and planning efforts are inadequate to respond to these projected impacts. This HMP includes strategies for the planning area to address these changes and increase resilience. However, each iteration and update of this HMP or other planning efforts should consider including adaptation as a core strategy to be better informed by "future" projections on the frequency, intensity, and distribution of hazards. Communities that are already the most vulnerable to weather and climate extremes will be stressed even further by more frequent extreme events occurring within an already highly variable climate system. Jurisdictions in the planning area should consider past and future climate changes and impacts when incorporating mitigation actions into local planning processes.

[45] USGS. "Nutrients and Eutrophication". Accessed February 2021. https://www.usgs.gov/mission-areas/water-resources/science/nutrients-and-eutrophication?qt-science_center_objects=0#qt-science_center_objects

[46] 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.

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. The following table identifies the top hazards of concern for participating jurisdictions.

Table 36: Top Hazards of Concern by Jurisdiction

JURISDICTION	Agricultural Disease	Dam Failure	Drought	Earthquakes	Extreme Heat	Flooding	Hazardous Materials	Landslides	Public Health Epidemic	Severe Thunderstorms	Severe Winter Storms	Tornadoes and High Winds	Wildfires
Antelope County						X				X	X	X	X
Village of Brunswick										X	X	X	
Brunswick Fire District							X						X
Village of Clearwater						X				X	X		
City of Elgin						X			X		X		
Elgin Public Schools										X	X	X	
Elgin Fire District										X	X	X	X
City of Neligh						X					X	X	
Village of Oakdale						X				X		X	
Neligh-Oakdale Public Schools										X			
Village of Orchard											X		X
Orchard Fire District													X
Summerland Public Schools											X	X	
Holt County						X				X			X
City of Atkinson	X		X							X	X	X	
Village of Ewing						X							
Village of Inman						X				X	X	X	
City of O'Neill						X				X	X	X	
Village of Page							X			X	X		
Village of Stuart						X					X		
Chambers Public Schools										X	X		
Knox County						X				X	X		
City of Bloomfield	X												
Village of Center					X	X					X	X	
City of Creighton						X						X	
Creighton Fire District							X			X			X
City of Crofton						X							

JURISDICTION	Agricultural Disease	Dam Failure	Drought	Earthquakes	Extreme Heat	Flooding	Hazardous Materials	Landslides	Public Health Epidemic	Severe Thunderstorms	Severe Winter Storms	Tornadoes and High Winds	Wildfires
Crofton Community Schools										X	X	X	
Village of Niobrara						X					X	X	
Niobrara Public Schools						X							
Village of Verdel						X			X				
Village of Verdigre						X						X	X
Verdigre Public Schools					X	X	X				X		
Verdigre Fire Department													X
Santee Public Schools						X	X						
Wausa Public Schools										X	X		
North Central District Health Department							X		X		X		

As identified by the participating jurisdictions, the overall top hazards of concern in the planning area from greatest concern to least concern are:

- Severe Winter Storms
- Severe Thunderstorms
- Flooding
- Tornadoes and High Winds
- Wildfire
- Hazardous Materials
- Extreme Heat
- Agricultural Animal and Plant Disease
- Public Health Epidemic
- Drought
- Dam Failure
- Earthquakes
- Landslides

Agricultural Plant and Animal Disease

Agricultural diseases include 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 (Nebraska SHMP, 2021).

The economy of the State of Nebraska is heavily invested in both livestock and crop sales. According to the Nebraska Department of Agriculture (NDA) in 2017, the market value for Nebraska of agricultural products sold was estimated at $22 billion; this total is split between crops (estimated $9.3 billion) and livestock (estimated $12.7 billion). For the planning area, the market value of sold agricultural products exceeded $1.2 billion ($747 million animal sales and $524 million crop sales).[47] The following table 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 37: Livestock Inventory

County	Market Value of 2017 Livestock Sales	Cattle and Calves	Hogs and Pigs	Poultry Egg Layers	Sheep and Lambs
Antelope	$337,484,000	138,341	143,214	652	259
Holt	$229,713,000	220,729	(D)	1,901	1,256
Knox	$180,283,000	140,970	61,909	(D)	3,421
Total	**$747,480,000**	**500,040**	**205,123**	**2,553**	**4,936**

Source: U.S. Census of Agriculture, 2017; (D) – data not available

According to the NDA, the primary crops grown throughout the state include alfalfa, corn, sorghum, soybeans, and wheat. The following tables provide the value and acres of land in farms in the planning area.

Table 38: Land and Value of Farms in the Planning Area

County	Number of Farms	Land in Farms (acres)	Market Value of 2017 Crop Sales
Antelope	704	491,922	$192,018,000
Holt	1,142	1,393,478	$223,826,000
Knox	956	600,822	$108,207,000
Total	**2,802**	**2,486,222**	**$524,051,000**

Source: U.S. Census of Agriculture, 2017

Table 39: Crop Values

County	Corn		Soybeans		Wheat	
	Acres Harvested	Value	Acres Harvested	Value	Acres Harvested	Value
Antelope	167,586	$108,598,000	121,928	$63,943,000	345	(D)
Holt	185,409	$223,826,000	99,289	$53,102,000	6,614	1,097,000
Knox	122,054	$62,740,000	76,708	$36,114,000	1,052	188,000
Total	**475,049**	**$395,164,000**	**267,925**	**$153,159,000**	**8,011**	**$1,285,000**

Source: U.S. Census of Agriculture, 2017

[47] US Department of Agriculture, National Agricultural Statistics Server. 2022. "2017 Census of Agriculture – Nebraska." https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Nebraska/

Location

Given the strong agricultural presence in the planning area, animal and plant diseases have the potential to occur in any of the three counties. If a major outbreak were to occur, the economy in the entire planning area would likely be affected, including urban areas. Antelope County has the smallest amount of land used for agriculture and number of agricultural farms; however, many residents work in industries closely tied to surrounding agriculture producers which could be impacted by disease outbreaks.

The primary land uses where animal and/or plant diseases will be observed include agricultural lands, range or pasture lands, forests, and concentrated animal feeding operations (CAFOs). 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.

Historical Occurrences

Animal Disease

The NDA provides reports on diseases occurring in the planning area. There were 86 instances of animal diseases reported between January 2014 and August 2022 by the NDA. These outbreaks affected a total of 4,375 animals and impacted all three counties.

Table 40: Livestock Diseases Reported in the Planning Area

DISEASE	YEAR	COUNTY	POPULATION IMPACTED
Anaplasmosis	2015	Holt; Knox	50; 51
	2016	Antelope; Holt; Knox	1; 1; 1
	2017	Holt	201
	2018	Holt	61
	2019	Holt	14
	2020	Holt	7
	2022	Holt	2
Bluetongue Disease	2014	Holt	2
	2015	Holt	100
	2016	Holt; Knox	2; 1
	2018	Holt	1
	2019	Knox	1
Bovine Viral Diarrhea	2014	Holt	3
	2015	Holt	400
	2016	Holt	1
	2017	Holt	1
	2018	Antelope	4
	2020	Antelope	1
	2022	Antelope	1
Dyfonate Toxicity	2014	Knox	1
Enzootic Bovine Leukosis	2014	Antelope; Holt; Knox	1; 4; 1
	2016	Antelope	3
	2017	Holt	2
	2018	Holt	3
	2019	Antelope; Holt	2; 3
	2020	Holt; Knox	4; 1
Leptospirosis	2016	Holt	1
	2020	Holt	42

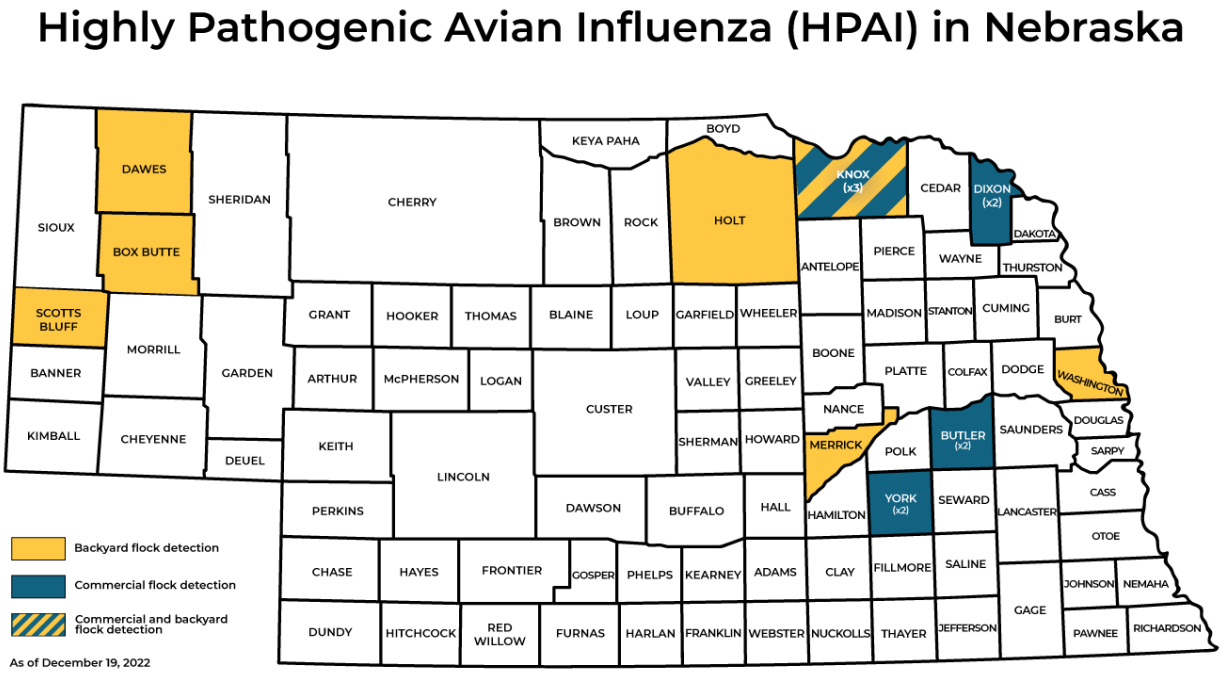
DISEASE	YEAR	COUNTY	POPULATION IMPACTED
Paratuberculosis	2014	Holt; Knox	10; 3
	2015	Antelope; Holt	2; 400
	2016	Antelope; Holt; Knox	2; 19; 1
	2017	Antelope; Holt; Knox	3; 19; 4
	2018	Antelope; Holt	2; 516
	2019	Holt; Knox	35; 4
	2020	Holt; Knox	16; 4
	2021	Holt	1
	2022	Antelope; Holt; Knox	1; 6; 1
Porcine Circovirus	2017	Antelope	1
Porcine Delta Coronavirus	2018	Antelope	1
Porcine Epidemic Diarrhea	2014	Holt; Knox	2; 3
	2017	Knox	1
	2018	Holt	2
	2019	Antelope; Holt	1; 400
Porcine Reproductive and Respiratory Syndrome	2014	Knox	2
	2015	Knox	1700
	2016	Holt; Knox	21; 2
	2017	Holt; Knox	17; 50
	2018	Antelope	73
	2019	Antelope; Knox	27; 39
	2020	Antelope; Knox	4; 1
	2022	Antelope; Holt	2; 1
Sapelovirus (Formerly Porcine Enterovirus-8)	2016	Holt	1
Seneca Valley Virus	2017	Antelope; Holt; Knox	1; 2; 6
	2020	Holt	1
Trichomoniasis	2016	Antelope	3
	2022	Antelope	1
Teschovirus Encephalomyelitis	2016	Holt	1
West Nile Fever	2020	Holt	1

Source: U.S. Census of Agriculture, 2014-August 2022[48]

There is currently an ongoing Avian Influenza outbreak in the State of Nebraska. As of December 2022, Holt County had a "backyard flock detection" and Knox County had three commercial and backyard flock detections.[49] Avian Influenza is a viral disease that affects chickens, turkeys, pheasants, quail, waterfowl, swans, peafowl, and guinea fowl. The virus is highly transferable between birds and can cause decreased egg production, respiratory issues, and death within the bird population. Avian Influenza was first detected in Nebraska in a non-commercial backyard flock in March 2022.

[48] Nebraska Department of Agriculture. 2022. "Livestock Disease Reporting." http://www.nda.nebraska.gov/animal/reporting/index.html.
[49] Nebraska Department of Agriculture. October 20, 2022. "Avian Influenza". Accessed October 28, 2022. https://nda.nebraska.gov/animal/avian/index.html .

Figure 13: Avian Flu in Nebraska (December 2022)



Source: Nebraska Department of Agriculture, 2022

Plant Disease

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

Table 41: Common Crop Diseases by Crop Type

CROP	DISEASE	
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	Pot and Stem Blight
	Bacterial Blight	Purple Seed Stain
	Bean Pod Mottle	Rhizoctonia Root Rot
	Brown Spot	Sclerotinia Stem Rot
	Brown Stem Rot	Soybean Mosaic Virus
	Charcoal Rot	Soybean Rust
	Frogeye Leaf Spot	Stem Canker
	Phytophthora Root and Stem Rot	Sudden Death Syndrome
Wheat	Barley Yellow Dwarf	Leaf Rust
	Black Chaff	Tan Spot
	Crown and Root Rot	Wheat soy-borne Mosaic
	Fusarium Head Plight	Wheat Streak Mosaic
Sorghum	Ergot	Zonate Leaf Spot

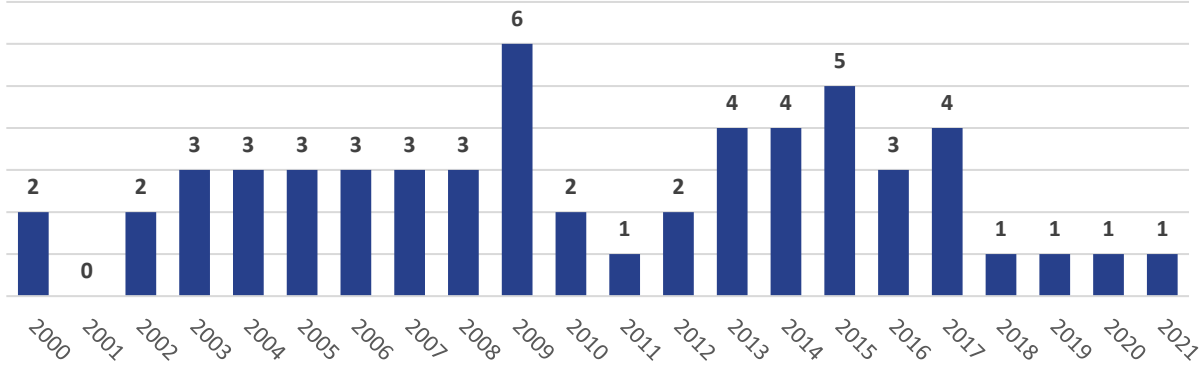
CROP	DISEASE	
	Sooty Stripe	
Trees	Burr Oak Blight	Dutch Elm Disease
	Powdery Mildew	Leaf Spot and Blight
	Canker (various types)	Root Rot
	Pine Wilt Disease	Crown Gall

In addition to the viral and bacterial diseases that could impact crops, pests can also result in crop loss or detract from crop quality. Pests present in the planning area include:

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

The RMA provides data on plant disease events and plant losses in the planning area. There are 57 instances of plant diseases reported from 2000-2021 by the RMA (Figure 14). These outbreaks caused $2,176,448 in crop losses.

Figure 14: Plant Disease Events by Year



Source: NDA, 2000-2020

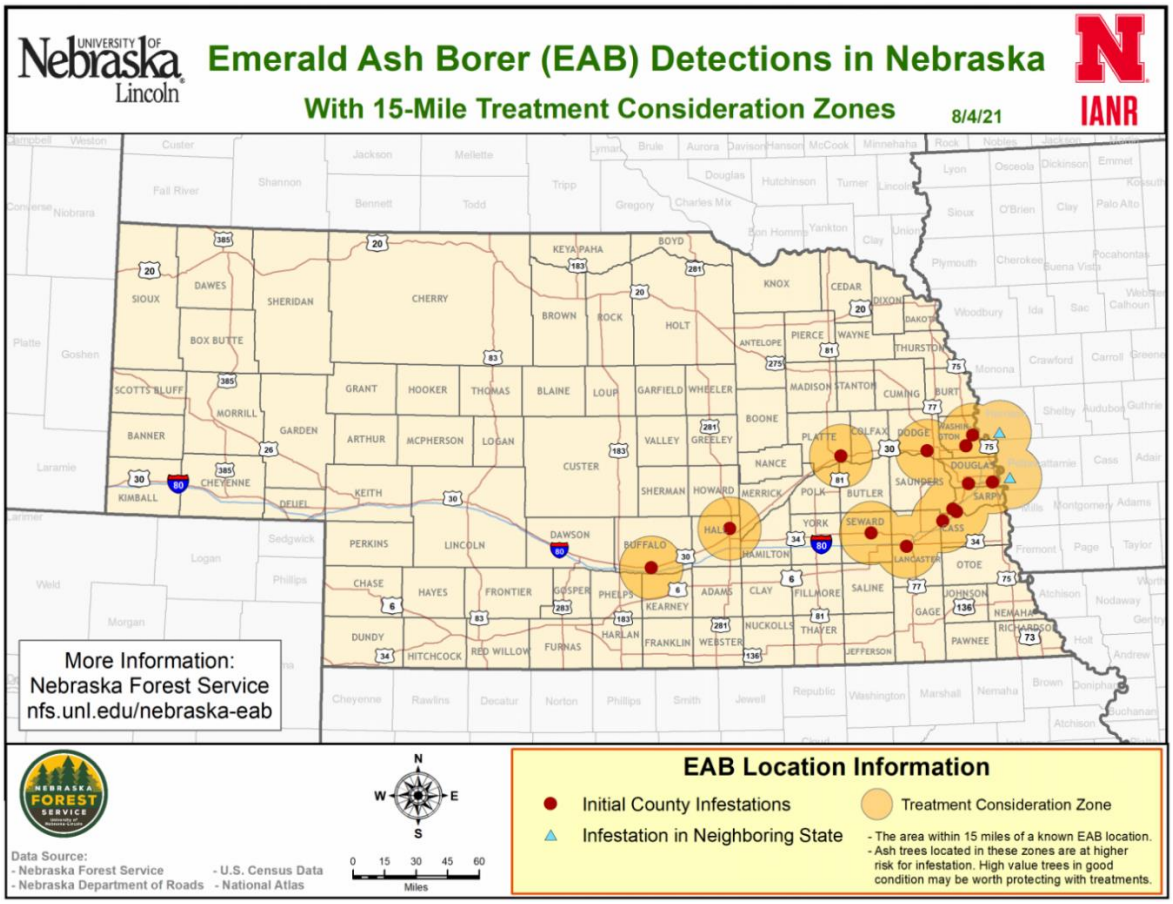
Emerald Ash Borer

The spread and presence of the Emerald Ash Borer (EAB) has become a 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 in three Canadian provinces and 35 U.S. states, primarily in the eastern, southern and midwestern regions. The following figure shows the locations of Nebraska's confirmed EAB cases as of August 2021. Additional confirmed cases have likely occurred since then and many communities across the state and planning area are prioritizing the removal of ash trees to help curb potential infestations and tree mortality.

While adult beetles cause little damage, larvae damage trees by feeding on the inner bark of mature and growing trees, causing tunnels. Effects of EAB infestation include extensive damage to trees by birds, canopy dieback, bark splitting, and water sprout growth at the tree base, and eventual tree mortality. EAB has impacted millions of trees across North America, killing young trees one to two years after infestation and mature trees three to four years after infestation.[50] Estimated economic impacts to Nebraska's 44 million ash trees exceeds $961 million.[51] 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. The Nebraska Forest Service estimates that across the state communities will be forced to commit over $275 million to protect themselves from infested, publicly owned ash trees.

Because of the Nebraska infestations, a quarantine order was established in Cass, Dodge, Douglas, Otoe, Sarpy, Saunders, Lancaster, and Washington Counties that restricted the movement of ash trees and lumber to further mitigate the spread of EAB. The quarantine was rescinded on October 29, 2020. No counties within the planning area have reported confirmed cases of EAB; however, it is a rising concern in the planning area. 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.

Figure 15: EAB Confirmation in Nebraska



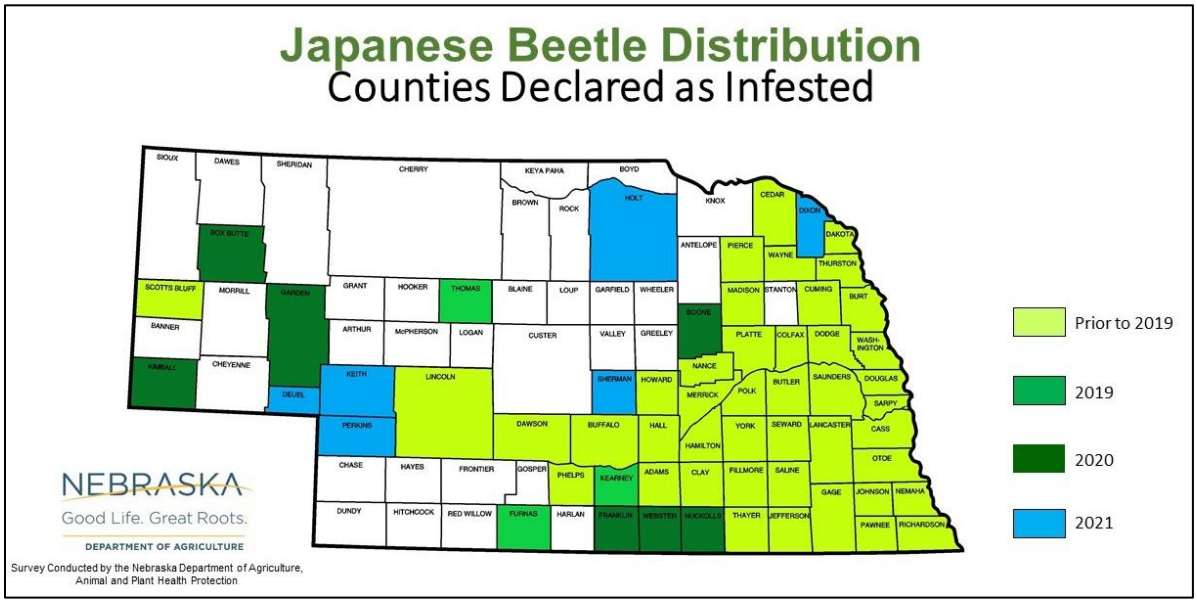
Source: NDA, 2022[52]

[50] Arbor Day Foundation. 2015. "Emerald Ash Borer." https://www.arborday.org/trees/health/pests/emerald-ash-borer.cfm.
[51] Nebraska Department of Agriculture. 2022. "Emerald Ash Borer." https://nda.nebraska.gov/plant/entomology/eab/index.html.
[52] Nebraska Department of Agriculture. 2022. "Emerald Ash Borer." https://nfs.unl.edu/documents/EAB/EABmap_2021-08-04.png.

Japanese Beetles

Japanese beetles are a rising concern in the state and planning area. Japanese beetles are highly destructive invasive pests found in many counties across Nebraska. The figure shows counties declared as infested by the beetles. Holt County declared infestation in 2021. 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.

Figure 16: Japanese Beetle Distribution in Nebraska



Average Annual Losses

According to the USDA RMA (2000-2019) there have been 57 plant disease events in the planning area. The RMA does not track losses for livestock, but annual crop losses from plant disease can be estimated. The USDA RMA also does not include losses associated with ash tree mortality from EAB. According to the NDA, there have been 86 animal disease outbreaks affecting over 4,000 animals in the planning area between 2014 and 2022. With the lack of reporting and data gathering, it is hard to determine an accurate account of disease and pests that occur in livestock and plants.

Table 42: Agricultural Disease Losses

HAZARD TYPE	NUMBER OF EVENTS	EVENTS PER YEAR	TOTAL LOSS	AVERAGE ANNUAL LOSS
Plant Disease	57	2.59	$2,176,447	$98,929
Animal Disease	86	9.5	4,375 animals	486 animals/yr

Source: RMA, 2000-2021; NDA, 2014-2022

Extent

There is no standard for measuring the magnitude of agricultural disease. Historical events have impacted livestock ranging from a single animal to 1,700 animals. The planning area is heavily dependent on the agricultural economy and the extent scale for this hazard applies the same to each jurisdiction in the plan. Any severe plant or animal disease outbreak which may impact this sector would negatively impact the entire planning area. Some jurisdictions may be more highly impacted by significant agricultural disease outbreaks than others. For example, Holt County has one of the highest cattle inventories in the state

(over 200,000 head) and holds increased vulnerability during periods of bovine disease outbreak. Antelope and Knox Counties also hold a significantly higher proportion of cattle inventory (between 105,001 and 190,000 head) and would likewise be impacted during bovine disease outbreaks.

Probability

Given the historical record of agricultural plant disease (at least one plant disease outbreak occurring in 21 out of 22 years) the annual probability of plant disease is stated at 95%. Given the historical record for animal disease events (at least one animal disease outbreak reported in all 9 years), for the purposes of this plan, the annual probability of animal disease occurrence is 100 percent. 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. Higher production demand will lead farmers, ranchers, or other producers to increase population densities of livestock and crops.

Future Development

The likelihood of agricultural disease outbreaks is likely to remain consistent or increase as future development occurs; particularly if agricultural production remains a 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.

Climate Change Impacts

The distribution and severity of agricultural 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 perceived trend toward higher average temperatures and increased periods of severe drought 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 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*."[53]

Changes to crop growth cycles due to warming winters and alterations in the timing and magnitude of rainfall events have already been observed as these trends continue, they will require new agriculture and livestock management practices.

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

Community Top Hazard Status

The following jurisdiction identified Agricultural Plant and Animal Disease as a top hazard of concern:

- City of Atkinson
- City of Bloomfield

Regional Vulnerabilities

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

Table 43: Regional Agricultural 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 economic power tied to the agricultural industry -Large scale or prolonged events may impact tax revenues and local capabilities -Land values may largely drive population changes within the planning area
Built Environment	-None
Infrastructure	-Transportation routes can be closed during quarantine
Critical Facilities	-None
Climate	-Changes in seasonal normals can promote spread of invasive species and agricultural disease

Dam Failure

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

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

Dams do not include:

- an obstruction in a canal used to raise or lower water;
- a fill or structure for highway or railroad use, but if such structure serves, either primarily or secondarily, additional purposes commonly associated with dams it shall be subject to review by the department;
- canals, including the diversion structure, and levees; or
- water storage or evaporation ponds regulated by the United States Nuclear Regulatory Commission."[54]

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 44: Dam Size Classification

SIZE	EFFECTIVE HEIGHT (FT) X EFFECTIVE STORAGE (ACRE-FT)	EFFECTIVE HEIGHT
Small	≤ 3,000 acre-ft^2	And ≤ 35 feet
Intermediate	> 3,000 acre-ft^2 to < 30,000 acre-ft^2	Or > 35 feet
Large	≥ 30,000 acre-ft^2	Regardless of height

Source: NeDNR, 2013[55]

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.

[54] 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.

[55] 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 water impounding structure. Structural failure can occur during extreme conditions, which include but are not limited to:

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

NeDNR regulates dam safety and has classified dams by the potential hazard each poses to human life and economic loss. The following are classifications and descriptions for each hazard class:

- **Minimal Hazard Potential** - failure of the dam expected to result in no economic loss beyond the cost of the structure itself and losses principally limited to the owner's property.
- **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 of dam failure. In total, there are 111 dams located within the planning area with classifications ranging from minimal hazard to high hazard. Of these, 95 dams are rated low, 13 are minimal, three are significant, and there are no high hazard dams. Figure 17 maps the location of these dams in the planning area.

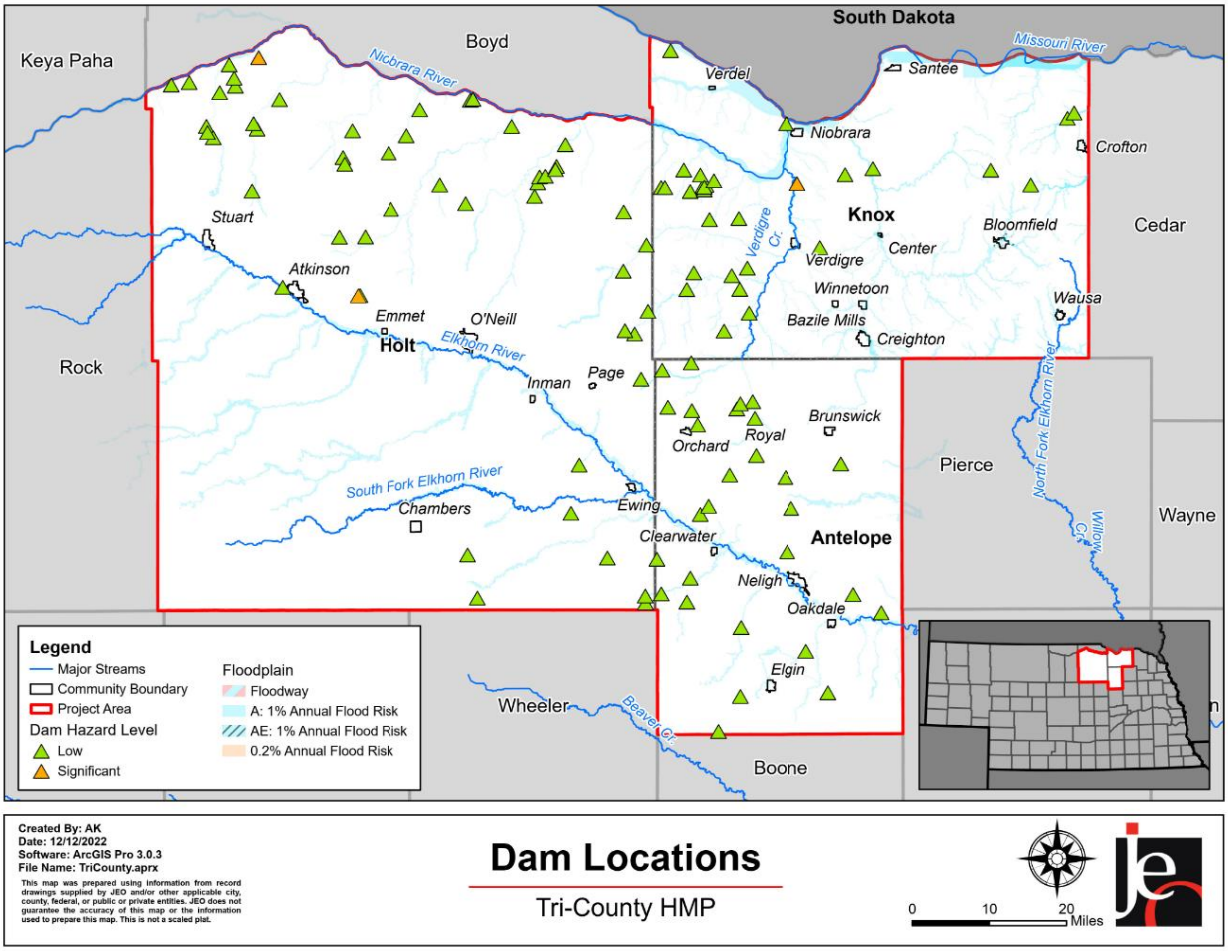
Dam owners and the NeDNR have opted, at this time, to not include dam breach maps or inundation maps in hazard mitigation plans due to the sensitive nature of this information. Requests can be made of the dam owner or the Dam Safety Division of NeDNR to view an inundation to view an inundation map specific to a dam. As there are no high hazard dams in the planning area, it is not possible to provide the results of recent inspection reports for dams of concern.

Table 45: Dams in the Planning Area

COUNTY	MINIMAL HAZARD	LOW HAZARD	SIGNIFICANT HAZARD	HIGH HAZARD	TOTAL
Antelope	1	28	0	0	**29**
Holt	9	41	2	0	**52**
Knox	3	26	1	0	**30**
Total	**13**	**95**	**3**	**0**	**111**

Source: NeDNR, 2022[56]

Figure 17: Dam Locations in the Planning Area



Gavins Point Dam is a high hazard dam located on the border of Knox County and Cedar County on the Missouri River; however, no participating jurisdiction within the planning area is located near the dam. There are no dams classified as "High Hazard" within the planning area.

If a high hazard dam is built or a significant dam is reclassified as high hazard, then the dam would 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).

[56] Nebraska Department of Natural Resources. 2022. "Nebraska Dam Inventory." https://dnr.nebraska.gov/dam-safety/nebraska-dam-inventory .

Table 46: Significant Hazard Dams in the Planning Area

DAM NAME	NID ID	DAM HEIGHT (FEET)	DAM LENGTH (FEET)	CONDITION	INSPECTION DATE
Christensen Secondary Finish Lagoon Dam	NE06898	10.5	2,460	Satisfactory	**6/18/2020**
Paesl Dam	NE00500	25	420	Poor	**8/14/2020**
Sandy Ridge Lagoon 1 Dam	NE09681	39.9	2,240	Satisfactory	**5/20/2020**

Source: NeDNR, 2022[57]

Upstream Dams Outside the Planning Area

According to the Dam Safety Section of the Nebraska DNR, there are currently no high hazard upstream dams (upstream of the planning area) which could affect the planning area.

Historical Occurrences

According to the NeDNR, there were nine reported dam failure events within the planning area between 1935 and 2022. However, the Dam Failure Investigation Report by the Association of State Dam Safety Officials for Spencer Dam reported an additional three failure events (see discussion below) for a total of 12 dam failure events in the planning area. The following table describes dam failure events in the planning area.

Table 47: Dam Failure Events in the Planning Area

NID	COUNTY	DAM NAME	HAZARD CLASS	YEAR OF FAILURE	DESCRIPTION OF FAILURE
NE00628	Holt	SPENCER DAM	Significant	1935	River flow scoured away upstream slope after upstream ice jam broke loose
NE00628	Holt	SPENCER DAM	Significant	1936^	Spillway sliding dam failure
NE00628	Holt	SPENCER DAM	Significant	1960^	Ice-related incident (damage only, no failure)
NE00628	Holt	SPENCER DAM	Significant	1966^	Flood and Ice Jam damage
NE02982	Antelope	SELTING DAM	Low	1976	Unknown breach
NE01235	Antelope	HANNEMAN DAM	Low	1991	Overtopped
NE00419	Holt	WATERMAN DAM	Low	1994E	Emergency spillway
NE02761	Knox	LIGHTNER DAM (BIG L)	Low	2010	Internal erosion
NE01230	Holt	OLBERDING DAM	Minimal	2010E	Breach thru auxiliary spillway
NE00628	Holt	SPENCER DAM	Significant	2019	Overtopped, ice run
NE01835	Holt	VONASEK DAM 1835	Low	2019	Overtopped
NE01792	Knox	DOBIAS DAM	Low	2019	Overtopped

*Source: NeDNR private correspondence, 2022; *E indicates year of failure is estimated; ^Association of State Dam Safety Officials*

[57] Nebraska Department of Natural Resources. 2022. "Nebraska Dam Inventory." https://nid.usace.army.mil/#/.

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.

Spencer Dam Failure

The Spencer Dam was a hydro-electric facility located on the Niobrara River between Holt and Boyd Counties directly west of the Highway 281 bridge. The dam owner, Nebraska Public Power District (NPPD) was responsible for all maintenance and operations on the structure. This dam experienced a failure event during the March 2019 bomb-cyclone and had impacts on the planning area. In March 2019 warm weather and heavy precipitation caused ice jams along the Niobrara River to be released. Large ice blocks weighing between two and 20 tons were carried downstream and helped lead to the complete failure of the Spencer Dam. All structures immediately below the dam were washed away. This included Highway 281, campsites, a house, and resulted in one fatality. For a detailed report on the Spencer Dam Failure, see the Spencer Dam Failure Investigation Report by the Association of State Dam Safety Officials (https://damsafety.org/SpencerDamReport).

Average Annual Losses

Due to a lack of data and the sensitive nature of this hazard, potential losses are not calculated for this hazard. Community members in the planning area that wish to quantify the threat of dam failure should contact their County Emergency Management or the NeDNR.

Extent

While a breach of a high hazard dam would certainly impact those in inundation areas, the total number of people and property exposed to this threat would vary based on the dam location. Since inundation maps are not made publicly available for security reasons, it is difficult to quantify the full extent of dam failure impacts across the planning area. However, as there are no high hazard dams located in the planning area, the likely extent of damages from dam failure to all communities in the planning area is minimal.

Probability

According to the 2021 Nebraska State Hazard Mitigation Plan and Tim Gokie, Chief Dam Safety Section at NeDNR, "*The probability of failure of a well-maintained, well-designed dam is low. Nevertheless, with over 2,900 dams in Nebraska of varying age and condition, there is typically at least one dam failure in the State each year. Large storm systems that result in regional flooding, like the widespread flood events of 2010 and 2019, often result in several dam failures. The majority of the dams that fail are small, low hazard potential dams located in rural areas where the resulting damage is mostly limited to the dam itself and the dam owners' property. Low and minimal hazard potential dams are typically designed to safely pass either a 50-year or 100-year design flood event, so larger events will overtop the dam, which can result in dam failure. Dams that are classified as significant and high hazard potential are required to meet higher standards and failure of these dams is rare*."

The NeDNR has stated that there is typically at least one dam failure in the State of Nebraska each year. In the planning area, there have been nine years with a reported dam failure out of 88 years (1935-2022), so for the purpose of this plan, the probability of dam failure will be stated as 10% annually. However, it should be noted that dam failure events are more likely to occur concurrently with extensive flooding or

other dam failure events as systems are stressed by consecutive failures. As excessive rainfall events are likely increase due to the impacts of climate change in the coming decades, the probability of future dam failure events is also likely to increase.

Future Development

Any future growth in significant 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 or counties 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. As of January 2023, Spencer Dam remains a failed dam structure. If repairs or reconstruction efforts occur in the future to this structure, it will likely impact downstream vulnerabilities.

Climate Change Impacts

While climate change does not directly affect dam failure events, changes in precipitation and temperature swings and extremes are highly likely to impact the planning area. Increased rainfall events, either in frequency and/or in magnitude, will lead to exacerbated stress on infrastructure systems including dams. Additionally, past 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/Extreme Heat – land subsidence, erosion, embankment settling, or foundation cracking
- Flooding – increased embankment erosion, sloughing, overtopping risk, or damage from ice jams

Community Top Hazard Status

No participating jurisdictions identified Earthquakes as a top hazard of concern.

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Regional Vulnerabilities

Regional vulnerabilities to dam failure vary based on surrounding development and other flood control measures. As communities and the region develop, considerations should be made to a variety of local vulnerabilities. The following table provides information related to regional vulnerabilities; for jurisdictional-specific vulnerabilities, refer to *Section Seven: Community Profiles.*

Table 48: Regional Dam Failure Vulnerabilities

SECTOR	VULNERABILITY
People	-Those living downstream of any dam -Evacuations likely with high hazard dams -Hospitals, nursing homes, children, and the elderly at greater risk due to low mobility
Economic	-Businesses located in the inundation areas would be impacted and closed for an extended period of time -Employees working in the inundation area may be out of work for an extended period of time
Built Environment	-Damage to homes and buildings
Infrastructure	-Transportation routes could be closed for extended periods of time -Utilities and utility infrastructure could be damaged or destroyed
Critical Facilities	-Critical facilities in inundation areas are vulnerable to damages
Climate	-Increased annual precipitation contributes to sustained stress on systems -Changes in water availability and supply can constrain energy production and reservoir stores

Drought

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

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

~National Drought Mitigation Center

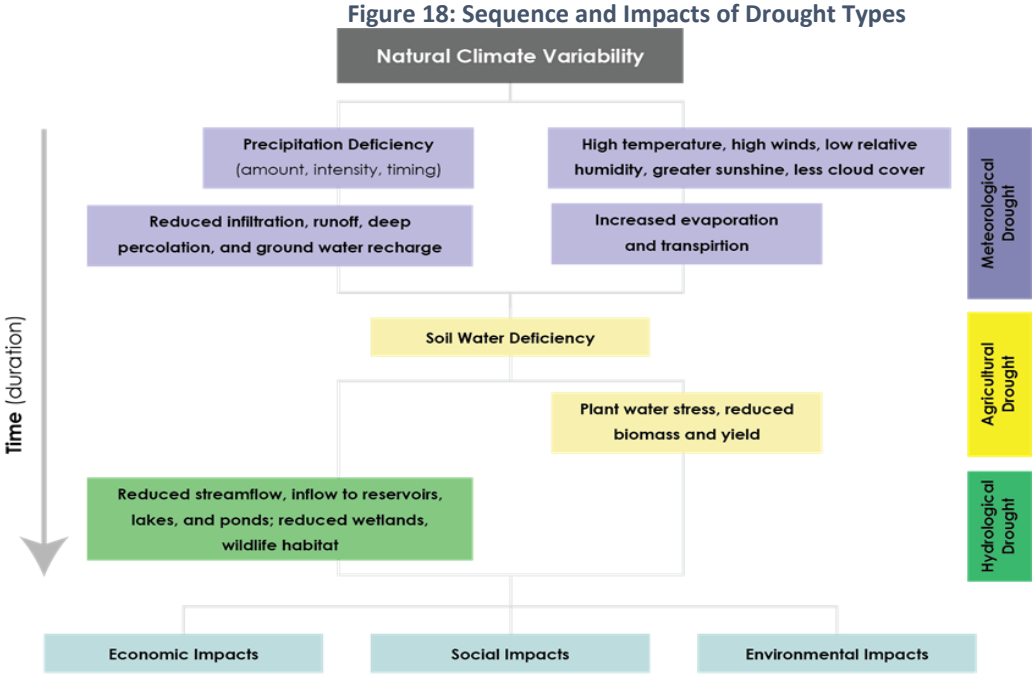
Drought is typically a slow onset, creeping phenomenon that can affect a wide range of people, livestock, and industries. However, in some cases "flash droughts" can occur quickly and last for shorter periods of time as seen in 2012-2013 across Nebraska. While many impacts of these hazards are non-structural,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

- **Meteorological Drought** is defined based on the degree of dryness and the duration of the dry period. Meteorological drought is often the first type of drought to be identified and should be defined regionally as precipitation rates, frequencies (norms), and winds vary.
- **Agricultural Drought** occurs when there is deficient moisture that hinders planting germination, leading to low plant population per hectare and a reduction of final yield. Agricultural drought is closely linked with meteorological and hydrological drought, as agricultural water supplies are contingent upon the two sectors. Livestock can also become stressed during a prolonged drought.
- **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.[58]

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

[58] National Drought Mitigation Center. 2017. "Drought Basics." https://drought.unl.edu/.

Figure 18: Sequence and Impacts of Drought Types



Source: National Drought Mitigation Center, University of Nebraska-Lincoln, 2017[59]

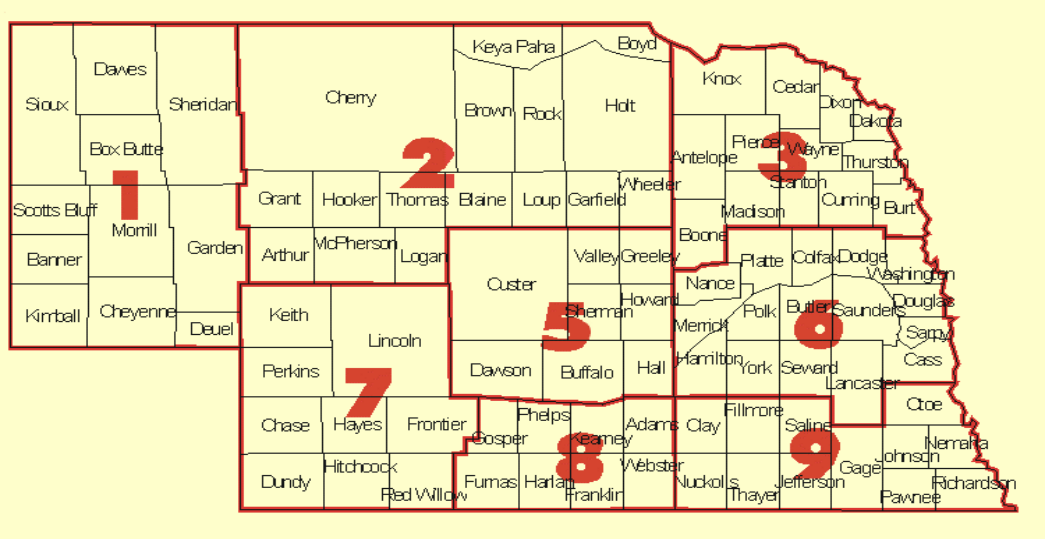
Location

The entire planning area is susceptible to the impacts resulting from drought.

Historical Occurrences

The Palmer Drought Severity Index (PDSI) is utilized by climatologists to standardize global long-term drought analysis. Table 48 shows the details of the Palmer classifications. The data for the planning area was collected for Climate Division 3, which includes two of the three counties in the planning area (Figure 19).

Figure 19: Nebraska Climate Divisions

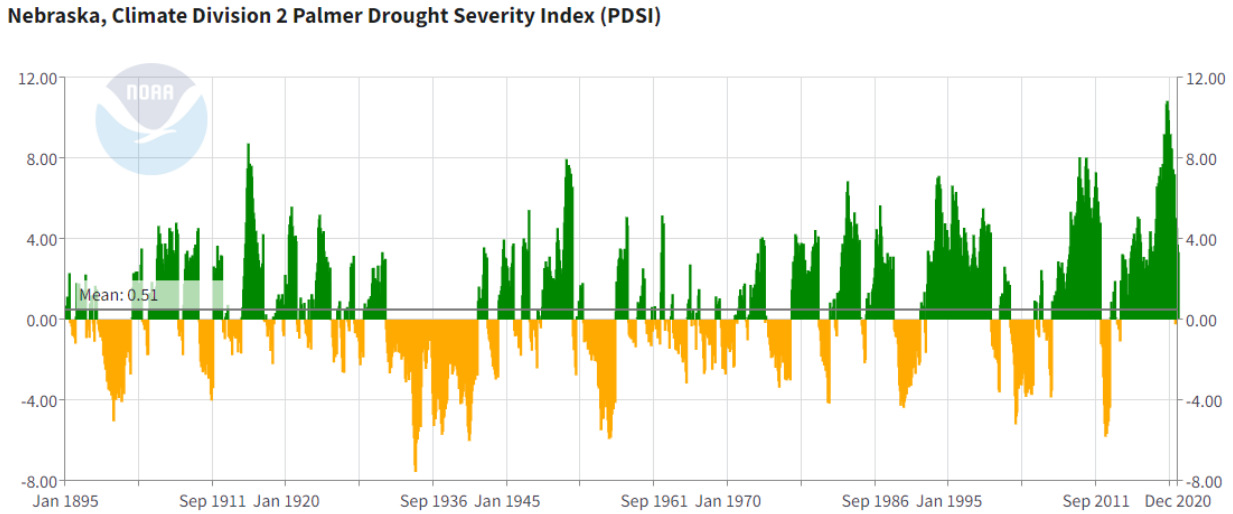


Source: Climate Prediction Center

[59] National Drought Mitigation Center. 2017. "Types of Drought." https://drought.unl.edu/Education/DroughtIn-depth/TypesofDrought.aspx.

This climate division's period of record started in 1895 and Figure 20 showcases the historical trend for drought or non-drought conditions for this division. The negative Y axis represents a drought, for which '-1' indicates a mild drought, '-2' a moderate drought, '-3' a severe drought, and '-4' an extreme drought.

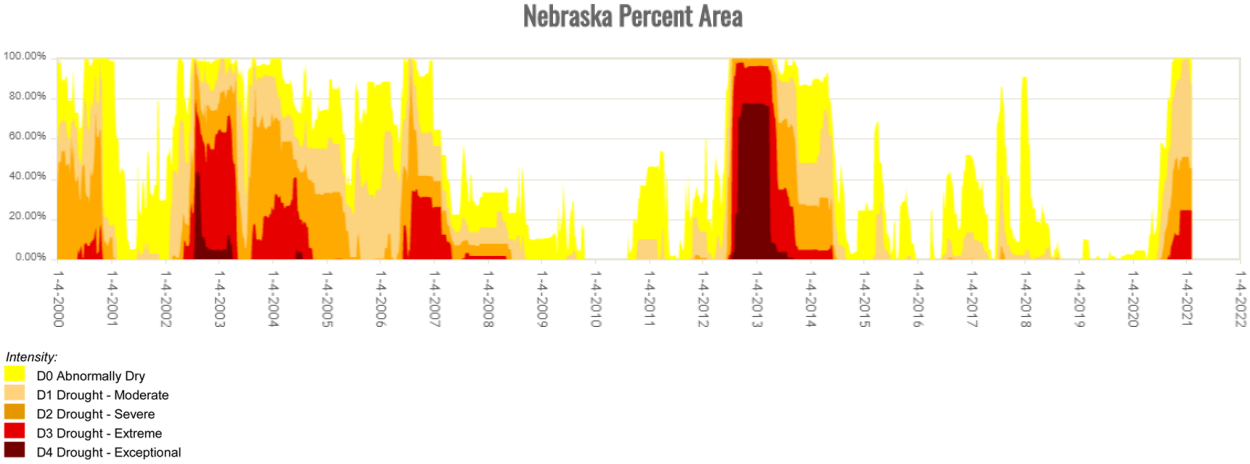
Figure 20: Palmer Drought Severity Index



Source: NCEI, Climate Division 2

Changes in precipitation are tied to changes in drought patterns. The following figure shows the percent of Nebraska's area that experienced significant increases in moderate (D1) to exceptional drought (D4) from 2000 to January 2021.

Figure 21: Drought Severity 2000-January 2021



Source: NOAA, 2021

As the figures above show, drought is a cyclical event with periods of drought followed by periods of wet or non-drought conditions. Table 49 shows the data quantitatively (i.e., number of months in drought by PDSI classification) for the same time period shown in Figure 20. The planning area has experienced several extreme droughts and moderate, severe, and extreme droughts are likely in the future.

Table 49: Historical Months in Drought

DROUGHT MAGNITUDE	DROUGHT CLASSIFICATION	MONTHS IN DROUGHT	PERCENT CHANCE
-1 Magnitude	Mild Drought	183/1,512	12.1%
-2 Magnitude	Moderate Drought	133/1,512	8.8%
-3 Magnitude	Severe Drought	87/1,512	5.8%
-4 Magnitude	Extreme Drought	80/1,512	5.3%

Source: NCEI

The 2012 drought event is the most recent significant event for the planning area; however, the overall event did not warrant a presidential disaster declaration within Nebraska. The whole state of Nebraska was in severe drought conditions from the middle of July in 2012 to the end of May in 2013 and over 70% of the state was in exceptional drought conditions for over eight months. Numerous 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.[60]

The images on the next pages show a general timeline of worsening drought conditions from the 2012 drought in Nebraska from the state's 2012 Annual Summary Report. The planning area finally emerged from drought conditions with normal precipitation levels in winter of 2014.

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 estimate provided here was determined based upon NCEI Storm Events Database since 1996 while the annual crop loss was determined based upon the RMA Cause of Loss Historical Database since 2000. These losses do not include losses from displacement, functional downtime, economic loss, injury, or loss of life. The NCEI database reported $50,000,000 in property damage and over $125,000,000 in crop damage from drought.

Table 50: 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	$50,000,000	$1,851,851	$125,296,676	$5,447,682

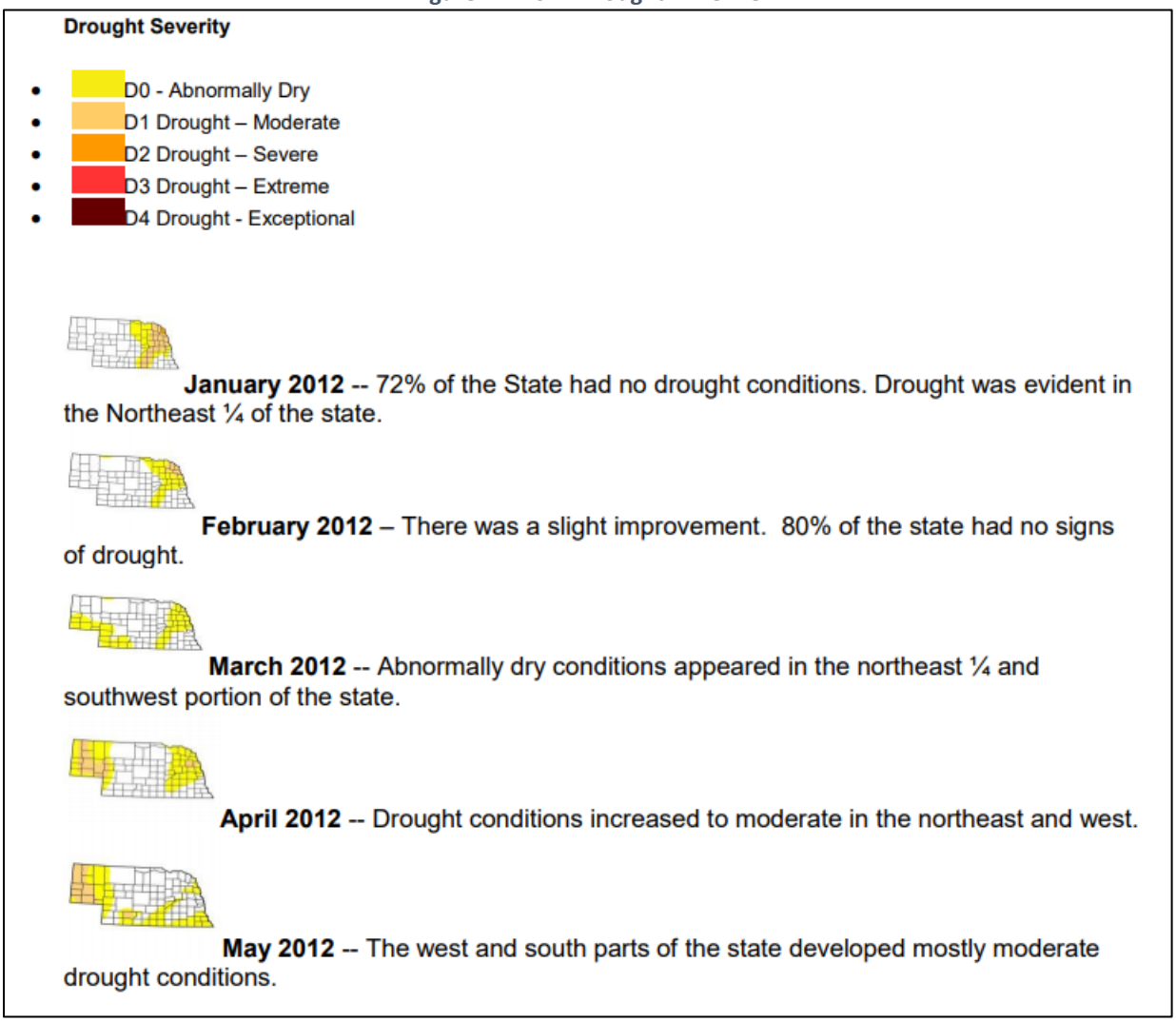
1 Indicates the data is from NCEI (1996 to 2022); 2 Indicates data is from USDA RMA (2000 to 2022)

The extreme drought in 2012 significantly affected the agricultural sector across the State of Nebraska and for the planning area. According to the PDSI index, 2012's average severity calculation was ranked at a -4.47, with extremes in August and September of -7.35 and -7.57 respectively. The Farm Credit Services reported total indemnity payments across the State of Nebraska totaling $1.49 billion from crop loss from this year of drought. Cattle ranching is a large driver of the local planning area's economy. The 2012 drought forced ranchers to cull herds by as much as 60% to cope with reduced forage production with an estimated loss of $200 per head by taking cattle to market earlier than normal. Neighborhood plots and small organic farms up to large-scale corn and soybean productions and ranches all faced agricultural

[60] 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.

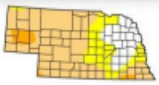
declines during 2012 and in the subsequent years. Hay production was down 28%, corn was down 16%, and soybean production dropped by 21% in 2012.[61]

Figure 22: 2012 Drought Timeline



[61] Fuchs, Brian & Wood, Deborah & Ebbeka, Dee & Bergantino, Antony. (2015). From Too Much to Too Little: How the central U.S. drought of 2012 evolved out of one of the most devastating floods on record in 2011. https://www.researchgate.net/publication/319542349_From_Too_Much_to_Too_Little_How_the_central_US_drought_of_2012_evolved_out_of_one_of_the_most_devastating_floods_on_record_in_2011

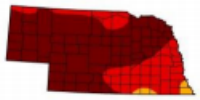
Figure 23: 2012 Drought Timeline (cont.)



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.

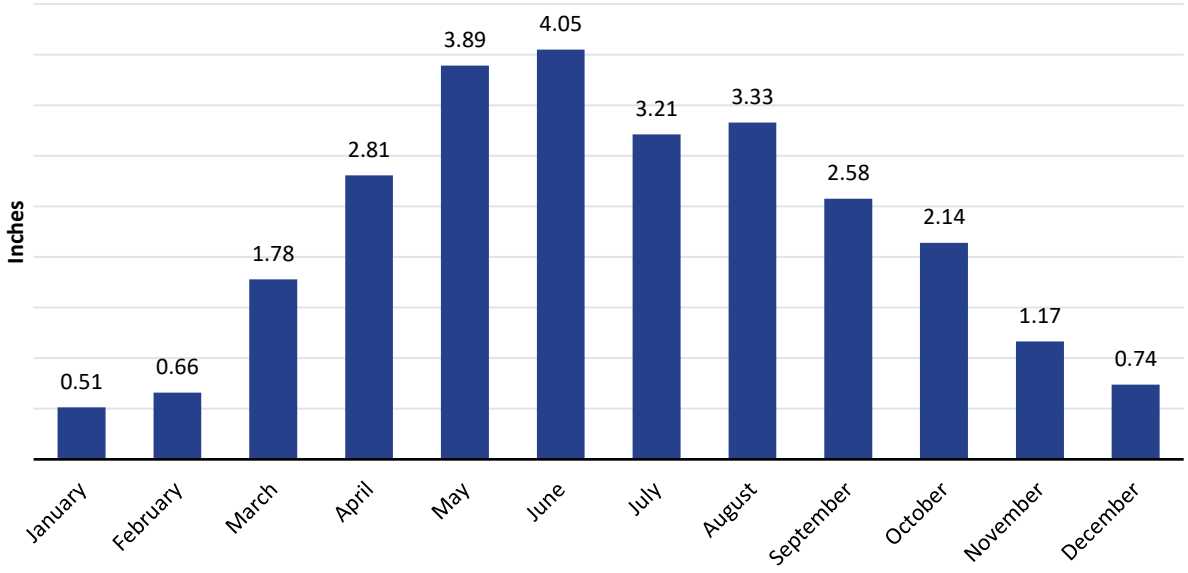
Nov & Dec 2012 – Conditions remained the same.

Nebraska in 2012 had the driest year on record with record dryness occurred in Nebraska between June through August of 2012. The area will remain vulnerable to periodic drought as most projected increases in precipitation are anticipated to occur during the winter months, while increasing temperatures lead to increased soil drying.

Extent

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 2021

Based upon the available historical PDSI data (Table 49), it is reasonable to expect extreme drought to occur in 5.3 percent of total months for the planning area (80 extreme drought months in 1,512 months). Severe drought occurred in 87 months of the 1,512 months of record (5.8 percent of months). Moderate drought occurred in 133 months of the 1,512 years of record (8.8 percent of months), and mild drought occurred in 183 of the 1,512 months of record (12.1 percent of months). Non-drought conditions (incipient dry spell, near normal, or wet spell conditions) occurred in 1,029 months, or 68.1 percent of months. These statistics show that the drought conditions of the planning area are highly variable.

Table 51: Palmer Drought Severity Index Classification

Numerical Value	Description	Historical Percentage	Numerical Value	Description	
4.0 or more	Extremely wet	14.6%	-0.5 to -0.99	Incipient dry spell	8.1%
3.0 to 3.99	Very wet	10.1%	-1.0 to -1.99	Mild drought	12.1%
2.0 to 2.99	Moderately wet	11.5%	-2.0 to -2.99	Moderate drought	8.8%
1.0 to 1.99	Slightly wet	10.0%	-3.0 to -3.99	Severe drought	5.8%
0.5 to 0.99	Incipient wet spell	5.4%	-4.0 or less	Extreme drought	5.3%
0.49 to -0.49	Near normal	8.5%	--	--	

Source: NCEI

The overall extent of impact from drought on communities in the planning area is anticipated to be consistent. Communities with limited water resources may be at greater vulnerability to drought impacts such as those with only one well or those with water quality issues, which require well blending such as Niobrara.

Probability

The following table summarizes the magnitude of drought and monthly probability of occurrence as summarized and calculated using the PDSI index. Nearly 30% of the time, a part or all of the planning area is likely to be experiencing drought.

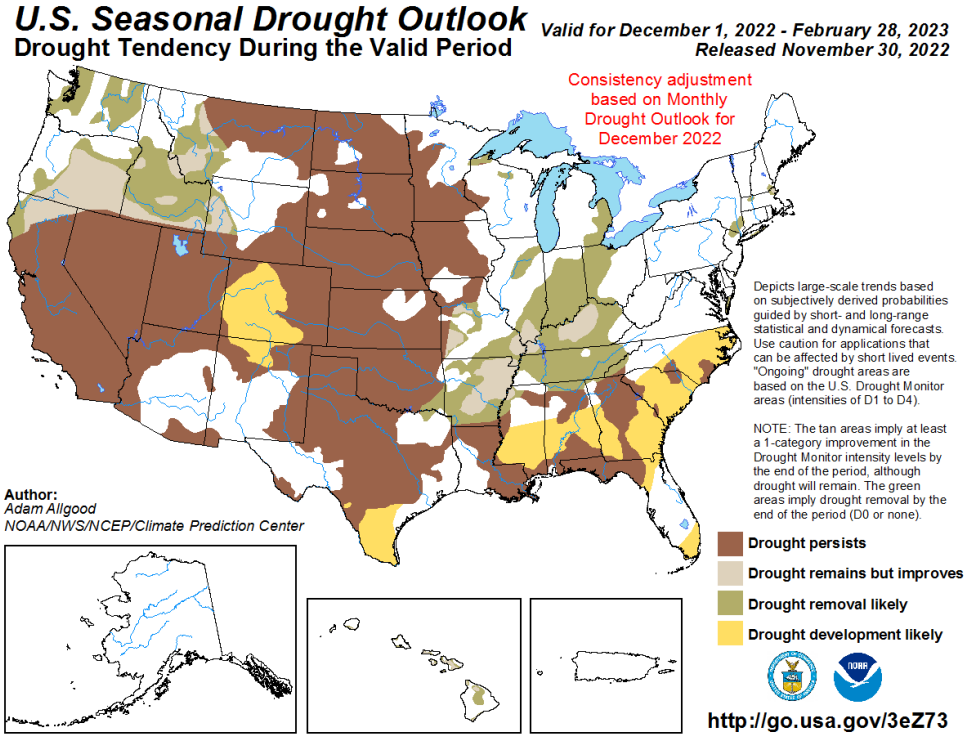
Table 52: Period of Record in Drought

MAGNITUDE	DROUGHT OCCURRENCES BY MONTH	MONTHLY PROBABILITY
No Drought	1,029/1,512	68.1%
Mild Drought	183/1,512	12.1%
Moderate Drought	133/1,512	8.8%
Severe Drought	87/1,512	5.8%
Extreme Drought	80/1,512	5.3%

Source: NCEI, 1895-2022

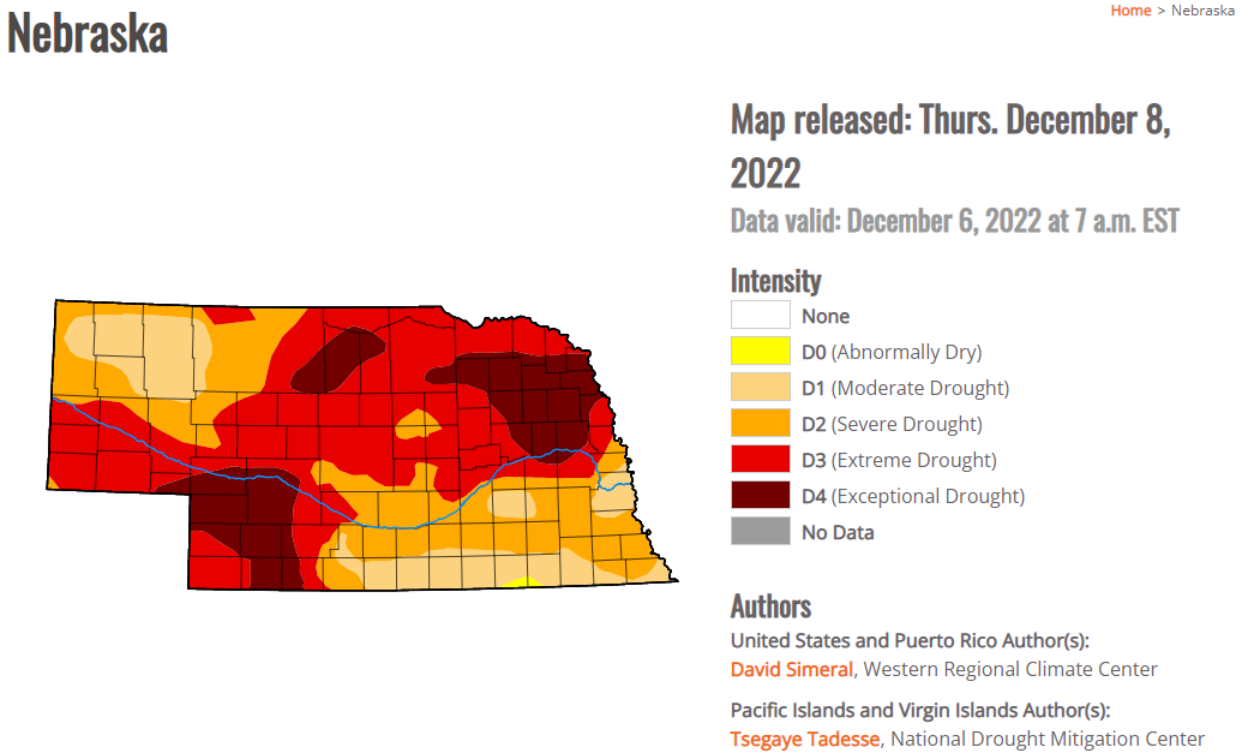
The U.S. Seasonal Drought Outlook (Figure 25) provides a short-term drought forecast that can be utilized by local officials and residents to examine the likelihood of drought developing or continuing within three months as based on existing conditions. The drought outlook is updated consistently throughout the year and should be reviewed on an ongoing basis. The following figure provides the drought outlook from December 2022 to February 2023 as an example. The U.S. Drought Monitor also provides a state overview of drought conditions (Figure 26). As of December 2022, the planning area was experiencing either D3 (Extreme Drought) or D4 (Exceptional Drought) conditions.

Figure 25: U.S. Seasonal Drought Outlook



Source: NCEI, December 2022

Figure 26: U.S. Drought Monitor – Nebraska



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.

Climate Change Impacts

An increase in average temperatures will contribute to the rise in the frequency and intensity of hazardous events like drought, which will cause significant economic, social, and environmental impacts on Nebraskans. Although drought is a natural part of the climate system, increasing temperatures will increase evaporation rates, decrease soil moisture, and lead to more intense droughts in the future, having negative impacts on dryland farming. 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 become drier. [62] Increasing temperatures and drought may reduce the potential for aquifers to recharge, which has long-term implications for the viability of agriculture in Nebraska.

The table below shows the likelihood of a year-plus drought and year-plus extreme drought in the three-county region with different warming scenarios.

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

Table 53: 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%	0-20%	21-33%

Source: Probable Futures[2]

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.

Table 54: Annual Number of Dry Days

EMISSION SCENARIO	HISTORICAL (1976-2005)	EARLY CENTURY (2015-2044)	MID CENTURY (2035-2064)	LATE CENTURY (2070-2099)
Lower Emissions (RCP 4.5)	210.5 Days	212.7 Days	213.4 Days	214.0 Days
Higher Emissions (RCP 8.5)	210.5 Days	213.7 Days	214.6 Days	217.6 Days

Source: NOAA[3]

Community Top Hazard Status

The following table lists jurisdictions which identified Drought as a top hazard of concern:

- City of Atkinson

Regional Vulnerabilities

The Drought Impact Reporter is an interactive database of drought impacts in the U.S., by location, data, type, and cost built from stakeholder, government, media, and other reports. The Drought Impact Reporter was developed with funding from the National Oceanic and Atmospheric Administration and from the U.S. Department of Agriculture's Risk Management Agency. The Drought Impact Reporter has recorded a total of 20 drought-related impacts throughout the region. This is not a comprehensive list of droughts which may have impacted the planning area, but only those with reported impacts. These impacts are summarized in the following table.

Table 55: Drought Impact Reports in Planning Area

CATEGORY	DATE	AFFECTED COUNTIES	TITLE
Agriculture, Relief, Response & Restrictions, Water Supply & Quality	7/20/2012	Antelope County, Holt County, Knox County	Low flow in several Nebraska rivers brought surface irrigation closures
Business & Industry, Relief, Response & Restrictions	11/13/2012	Knox County	The American Waterways Operators, Waterways Council Inc. and Missouri governor urged action to prevent Mississippi River shutdown between St. Louis and Cairo, Illinois
Agriculture, Plants & Wildlife	12/17/2012	Holt County	Drought led ranchers in western Nebraska to cull cow herds by 25 to 60 percent

[2] Probable Futures. "Maps of Dryness". Accessed December 2022. https://probablefutures.org/ .
[3] NOAA. August 2022. "Climate Mapping for Resilience and Adaptation". https://livingatlas.arcgis.com/assessment-tool/explore/details.

CATEGORY	DATE	AFFECTED COUNTIES	TITLE
Relief, Response & Restrictions, Water Supply & Quality	4/10/2013	Knox County	Water releases from Gavins Point dam on the South Dakota-Nebraska border kept at a minimum
Agriculture, Relief, Response & Restrictions, Water Supply & Quality	4/24/2013	Knox County	Water use restrictions for irrigators in the Lower Elkhorn Natural Resources District in northeastern Nebraska
Relief, Response & Restrictions, Water Supply & Quality	4/24/2013	Knox County	More than $100,000 paid to assist those with dry domestic wells in northeastern Nebraska
Agriculture, Relief, Response & Restrictions	5/17/2013	Antelope County, Holt County, Knox County	Drought-related USDA disaster declarations in 2013
Plants & Wildlife	6/6/2013	Knox County	Grass planted on new levees along the Missouri River in eastern Nebraska was slow to grow
Relief, Response & Restrictions, Water Supply & Quality	9/11/2013	Knox County	Water releases from Gavins Point Dam on the Missouri River will be at a minimum, due to ongoing drought in the northern Great Plains
Agriculture, Relief, Response & Restrictions	2/7/2014	Holt County	Drought-Related USDA Disaster Declarations in 2014
Agriculture, Water Supply & Quality	5/5/2014	Knox County	Drought led to uptick in new wells in the Lewis and Clark Natural Resources District in northeastern Nebraska
Relief, Response & Restrictions, Water Supply & Quality	5/7/2014	Knox County	Flows from Gavins Point Dam on South Dakota/Nebraska border increased to compensate for low flow in Kansas River
Agriculture	7/7/2017	Knox County	Pastures drying up, alfalfa crop affected in Knox County, Nebraska
Agriculture	8/1/2017	Knox County	Hay, pasture affected in Knox County, Nebraska
Agriculture	8/11/2017	Knox County	Crops affected, producer feeding hay to cattle in Knox County, Nebraska
Fire, Relief, Response & Restrictions	2/22/2018	Holt County, Knox County	Nebraskans urged to leave the fireworks to the professionals
Agriculture	4/22/2019	Knox County	Corn chopped for silage in eastern Nebraska
Agriculture, Water Supply & Quality	4/23/2019	Holt County, Knox County	Nebraska ranchers hauling water to livestock
Relief, Response & Restrictions, Water Supply & Quality	2/6/2022	Knox County	Minimum releases from Gavins Point Dam on South Dakota/Nebraska border

CATEGORY	DATE	AFFECTED COUNTIES	TITLE
Fire, Relief, Response & Restrictions	2/11/2022	Antelope County, Knox County	Burn bans in eastern Nebraska

The following tables provide information related to regional vulnerabilities and FEMA's National Risk Index values for Drought. For jurisdictional specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 56: National Risk Index Drought Vulnerabilities

RISK INDEX FACTOR	ANTELOPE COUNTY	HOLT COUNTY	KNOX COUNTY
Risk Index	Relatively Moderate (19.67)	Relatively Moderate (13.14)	Relatively High (21.51)
Expected Annual Loss	Relatively Moderate (18.26)	Relatively Moderate (11.47)	Relatively Moderate (14.96)

Source: FEMA National Risk Index, 2022

Table 57: 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.) -Loss of tourism dollars -Decrease of land prices→ jeopardizes educational funds -Livestock loss
Built Environment	-Cracking of foundations (residential and commercial structures) -Damages to landscapes
Infrastructure	-Damages to waterlines below ground -Damages to roadways (prolonged extreme events) -Stressing of electrical systems (brownouts during peak usage)
Critical Facilities	-None
Climate	-Increased risk of wildfire events, damaging buildings and agricultural land -Wildlife and species loss

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. Although rather uncommon, earthquakes do occur in Nebraska and are usually small, generally not felt, and cause little to no damage. 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 figure shows the fault lines in Nebraska and the following tables summarize the Richter Scale and Modified Mercalli Scale.

Table 58: 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, 2016[63]

Table 59: 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
VII	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

[63] Federal Emergency Management Agency. 2020. "Earthquake Risk." https://www.fema.gov/emergency-managers/risk-management/earthquake

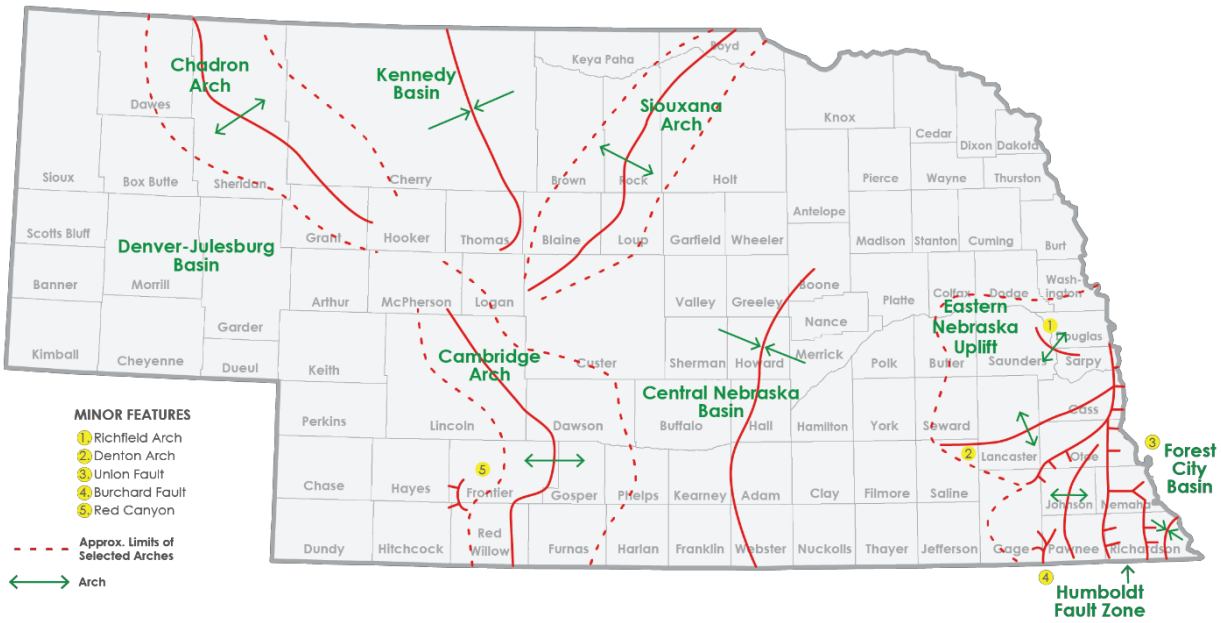
SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER SCALE MAGNITUDE
XI	Very Disastrous	Most Buildings and bridges collapse; roads, railways, pipes, and cables destroyed; general triggering of other hazards	< 8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves	> 8.1

Source: FEMA, 2020

Location

The most likely locations in the planning area to experience an earthquake are near a fault line (Figure 27). Antelope and Knox Counties are least likely to experience an earthquake as they are not located near a fault line. The Siouxana Arch could impact Holt County if an earthquake were to occur in Nebraska. Additionally, it is important to note there are no major fault lines located in South Dakota near the planning area.

Figure 27: Fault Lines in Nebraska

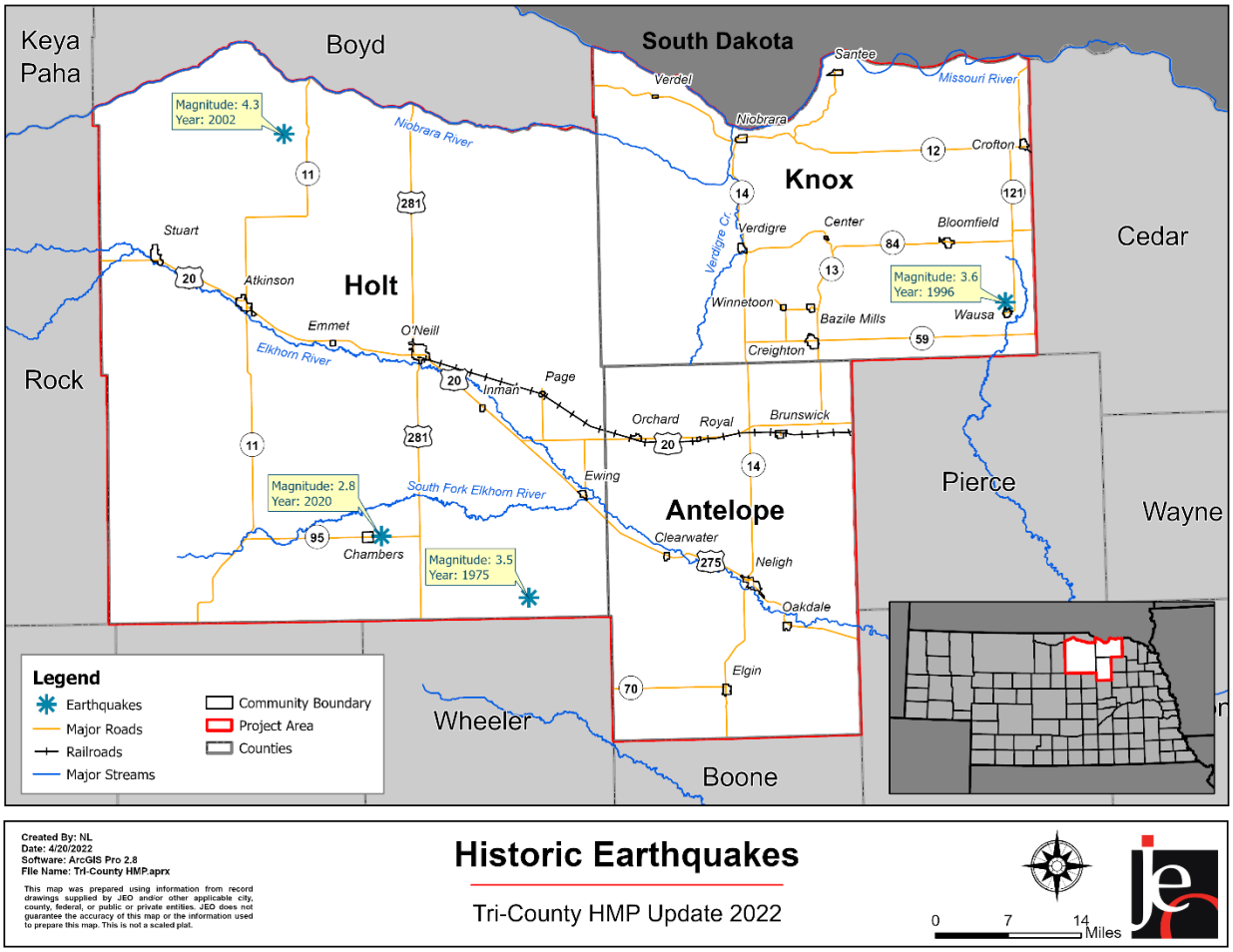


Historical Occurrences

According to the United States Geological Survey (USGS), there have been four reported earthquakes within the planning area since 1900.[64] The next figure shows past earthquake locations and magnitudes. The strongest earthquake felt was a magnitude 4.3 in 2002 in northwestern Holt County. There was no reported damage from any historical earthquake events.

[64] United States Geological Survey. 2020. "Information by Region – Nebraska." https://earthquake.usgs.gov/earthquakes/byregion/nebraska.php.

Figure 28: Earthquake Events in the Planning Area



Of note, the State of Nebraska Hazard Mitigation Plan does not include Earthquakes as a profiled hazard with the following discussion:

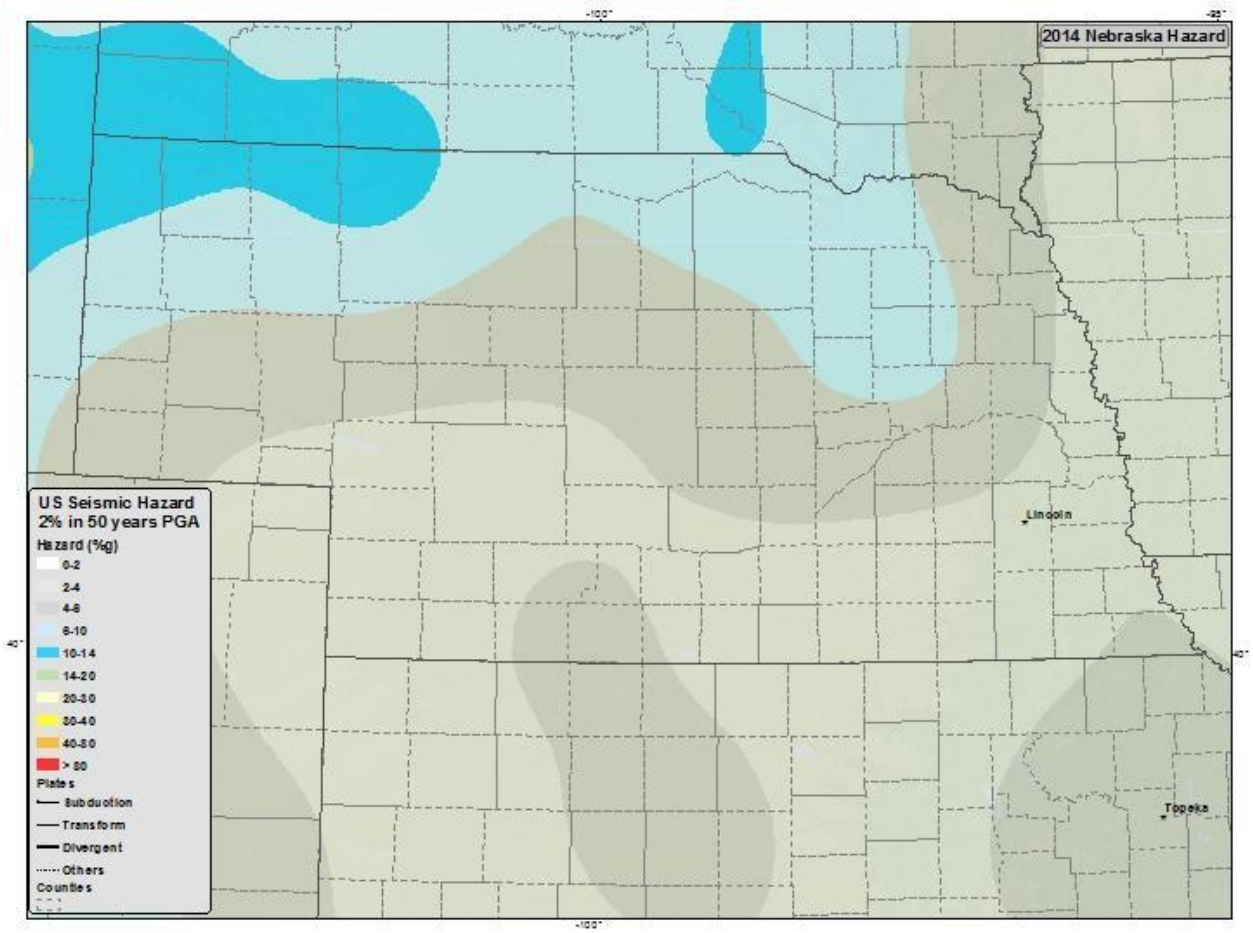
> *Historically, Nebraska has seen less than one earthquake per year between 1866 and 1990. However, from 1990 to December 2018, Nebraska had experienced a total of 60 earthquakes. The majority of them, 29 or 48%, happened in 2018 alone in the area around Arnold, NE. The magnitudes range from 2.1-4.1, based on the Richter scale, with an average of 2.96 for these 28 quakes. The average magnitude for the 59 quakes from 1990 to 2018 is 3.1.*
>
> *While this is a large increase in the number of earthquakes, it is too early to tell whether the trend will continue. What is clear is the fact that in 43 years (1975 - 2018), Nebraska has experienced only 3 quakes that were a 4.0 or larger. This is only 4% of earthquakes for that period and occurring once per 14.33 years. Earthquakes with magnitudes 4.0- 4.9 are described to cause minimal damage and unlikely to cause moderate/significant damage. Nearly all earthquakes in Nebraska, 96%, have been weak with many not able to be felt by residents. Only a couple have produced minor damage to buildings.*
>
> *The most recent earthquake reported was a minor tremor registered as 2.9 in magnitude, located about 18 miles south-southwest of O'Neill, in Holt County. Despite this most recent event, the most*

likely earthquake situation that would impact Nebraska would be a strong earthquake on the New Madrid Seismic Zone. However, the majority of current activity is on the Humboldt Fault that extends from Kansas into the southeastern region of Nebraska. These impacts would not be in the form of damages but in assisting impacted states and residents. Given the low chance of impact to the state, earthquakes were not further profiled.

Average Annual Losses

Due to the lack of sufficient earthquake data, limited resources, low earthquake risk for the area, and no recorded damages, it is not feasible to utilize the 'event damage estimate formula' to estimate potential losses for the planning area. Figure 29 shows the State of Nebraska's seismic hazard risk across the state. According to the USGS, the planning area has a less than 0.2 percent change of damages from earthquakes.

Figure 29: 2014 Seismic Hazard Map - Nebraska



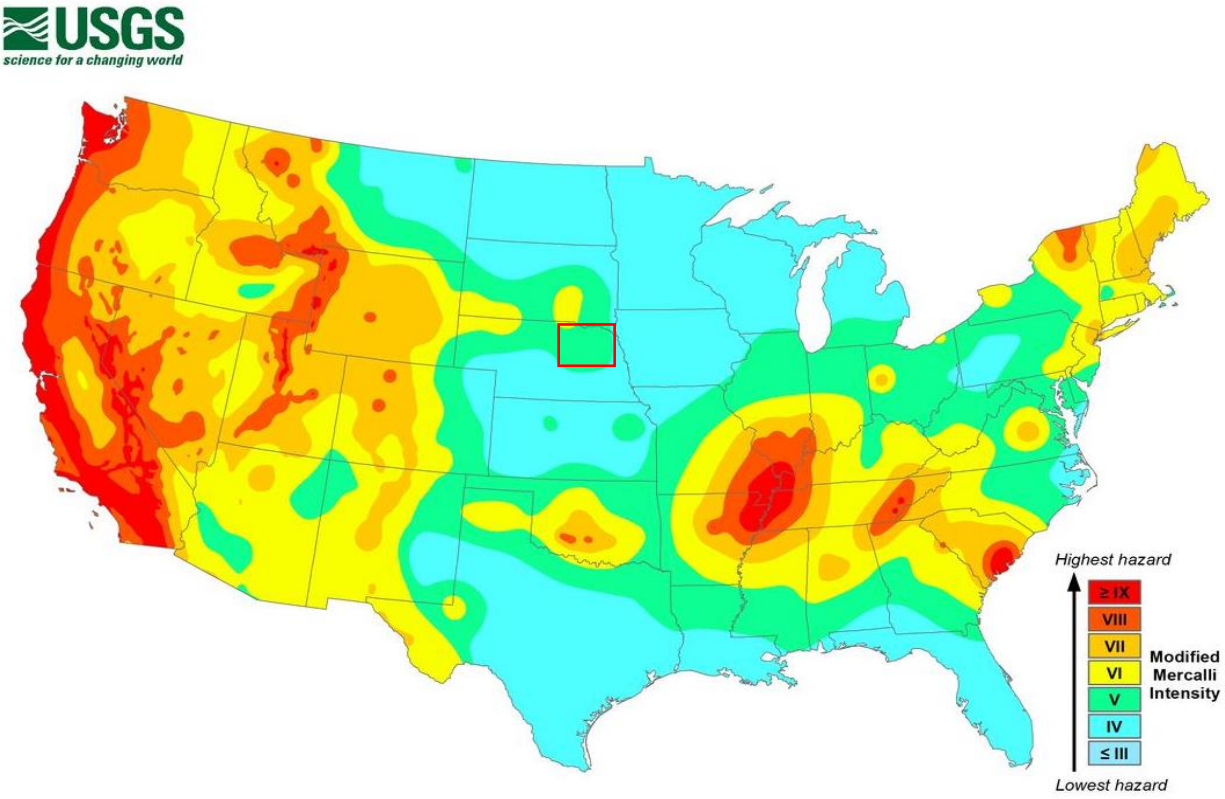
Source: USGS, 2020[65]

[65] USGS. 2014. "2014 Seismic Hazard Map – Nebraska." Accessed September 2020. https://www.usgs.gov/media/images/2014-seismic-hazard-map-nebraska.

Extent

The extent of damage from earthquakes is often limited to areas near fault lines. If an earthquake were to occur in the planning area, it would likely measure 5.0 or less on the Richter Scale as shown by the figure below from USGS. Based on past historical events the likely extent of earthquakes in the planning area are likely to measure 4 or less on the Richter Scale. Jurisdictions closest to the earthquake epicenter are the most likely to be impacted by earthquake events. The overall extent of damage cannot be determined for earthquakes; however, very little to no damage is anticipated from events of these magnitudes.

Figure 30: Earthquake Extent



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

Source: USGS, 2016

Probability

Based on the reported four earthquake events occurring in the planning area across the 122-year period of record (1900-2021), for the purposes of this plan the annual probability of an earthquake occurring in the planning area in any given year is stated at 3.3%.

However, as recently stated by the USGS during the 7.8 magnitude earthquake which impacted Turkey and Syria in February 2023, it is not possible to fully predict when an earthquake will occur. Rather, "USGS scientists can only calculate the probability that a significant earthquake will occur (shown on our hazard mapping) in a specific area within a certain number of years."[66]

[66] USGS. N.d. "Can you predict earthquakes?" https://www.usgs.gov/faqs/can-you-predict-earthquakes.

Future Development

Any future developments which occur near or alongside fault lines are likely to be at increased risk to earthquake events. Growing communities at risk should adapt and adopt stricter building requirements for new developments or substantial improvements to infrastructure.

Climate Change Impacts

At this time, there is no scientific consensus on the correlation between climate change and frequency or magnitude of earthquakes. According to the U.S. Geological Survey, Statistically, there is approximately an equal distribution of earthquakes in cold weather, hot weather, rainy weather, etc. Very large low-pressure changes associated with major storm systems (typhoons, hurricanes, etc.) are known to trigger episodes of fault slip (slow earthquakes) in the Earth's crust and may also play a role in triggering some damaging earthquakes. However, the numbers are small and are not statistically significant.[67]

Community Top Hazard Status

No participating jurisdictions identified Earthquakes as a top hazard of concern.

Regional Vulnerabilities

Particularly vulnerable populations for earthquake include, but are not limited to:

- *Low-income individuals*
  - Often, low-income individuals and families live in lower cost homes (older homes, mobile homes) that are less able to withstand disaster.
- *Older homes and mobile homes*
  - These may not have been constructed using the most advanced building codes or have received updates and retrofits that would have increased their stability and ability to withstand seismic events. Damages resulting from the 1994 Northridge earthquake in California were disproportionately focused on low- and moderate- income rental housing units that were older and thus more vulnerable to seismic damages.
- *Elderly citizens*
  - Senior citizens living on a fixed income may lack the disposable income necessary to upgrade their homes to withstand seismic events. In addition, senior citizens may lack the mobility required to implement low-cost mitigation measures. A 2006 Census Bureau report found that 20-percent of the US Population age 65 and older report some level of disability.

Future development and growth would likely increase the intensity of earthquake impacts across the planning area. Future development and growth would have impacts including increased development near dams, increased density in urban areas, and new structures built without reinforcements.

The following tables provide information related to regional vulnerabilities and FEMA's National Risk Index values for earthquakes. For jurisdictional specific vulnerabilities, refer to *Section Seven: Community Profiles*.

[67] USGS. N.d. "Is there earthquake weather?" Accessed November 2022. https://www.usgs.gov/faqs/there-earthquake-weather?qt-news_science_products=0#qt-news_science_products.

Table 60: National Risk Index Earthquake Vulnerabilities

RISK INDEX FACTOR	ANTELOPE COUNTY	HOLT COUNTY	KNOX COUNTY
Risk Index	Very Low (1.00)	Very Low (1.53)	Very Low (1.45)
Expected Annual Loss	Very Low (1.13)	Very Low (1.63)	Very Low (1.23)

Source: FEMA National Risk Index, 2022

Table 61: Regional Earthquake Vulnerabilities

SECTOR	VULNERABILITY
People	-Risk of injury or death from falling objects and structures
Economic	-Short-term to long-term interruption of business
Built Environment	-Cracking of foundations (residential and commercial structures) -Damage to structures
Infrastructure	-Damages to subterranean infrastructure (e.g., waterlines, gas lines, etc.) -Damages to roadways
Critical Facilities	-Same as all other structures
Climate	-None

Extreme Heat

Extreme heat is often associated with periods of drought but can also be characterized by long periods of high temperatures in combination with high humidity. During these conditions, the human body has difficulties 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 highly 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. For instance, 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. The hotter the animal is, the more it will begin to shut down body processes not vital to its survival, such as milk production, reproduction, or muscle building.

Other secondary concerns that are 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 also more likely to occur during heat waves.

The 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 3 to 7 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.

Along with humans, animals also can be affected by high temperatures, drought conditions, and humidity levels. For instance, 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.

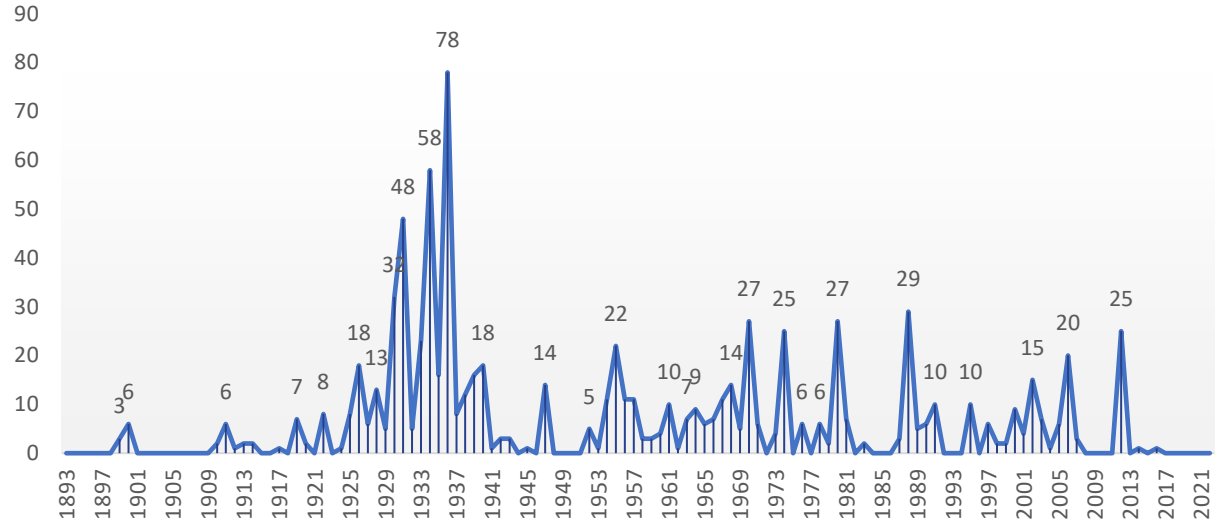
Location

The entire three-county planning area is susceptible to extreme heat events.

Historical Occurrences

According to the High Plains Regional Climate Center (HPRCC), on average, the planning area experiences 3 days above 100°F per year. The planning area experienced the most days on record above 100°F in 1936 with 78 days and 1934 with 58 days. Conversely, 2020 was the most recent 'coolest' year on record with no reported days above 100°F. However, this is likely attributed to a lack of reported data.

Figure 31: Number of Days Above 100°F



Source: NOAA, HPRCC

Average Annual Losses

The direct and indirect effects of extreme heat are difficult to quantify. There is no way to place a value on the loss of human life. Potential losses such as power outages could affect businesses, homes, and critical facilities. High demand and intense use of air conditioning can overload the electrical systems and cause damage to infrastructure. The NCEI database did not report any property damage due to extreme heat events.

Table 62: Extreme Heat Loss Estimation

Hazard Type	Avg. # Days over 100°F[1]	Total Property Loss[2]	Average Annual Property Loss	Total Crop Loss[3]	Average Annual Crop Loss
Extreme Heat	3	$0	$0	$38,452,710	$1,747,850

Source: 1 indicates the data is from HPRCC; 2 NCEI; 3 USDA RMA (2000-2021)

Estimated Loss of Electricity

According to the FEMA publication "What is a Benefit: Guidance on Benefit-Cost Analysis of Hazard Mitigation Project (June 2009)", if an extreme heat event occurred within the planning area, the following table assumes the event could potentially cause a loss of electricity for 10 percent of the population at a cost of $126 per person per day. In rural areas, the percentage of the population affected, and duration may increase during extreme events. The assumed damages do not consider physical damages to utility equipment and infrastructure.

Table 63: Loss of Electricity - Assumed Damage by Jurisdiction

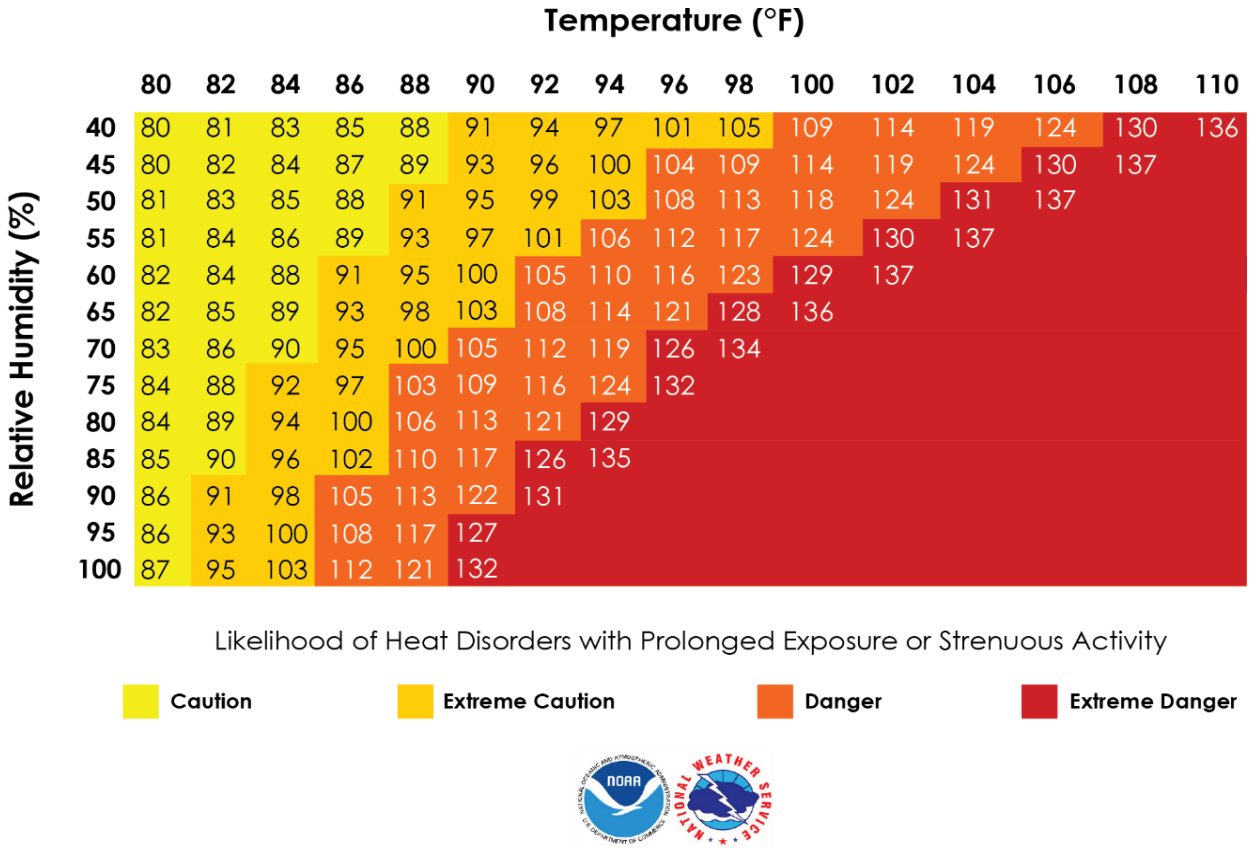
County	2020 (est) Population	Population Affected (assumed 10%)	Electric Loss of Use Assumed Damage Per Day
Antelope	6,315	632	$79,632
Holt	10,123	1,012	$127,512
Knox	8,400	840	$105,840
Total	**24,838**	**2,484**	**$312,984**

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% requires 94°F. The combination of relative humidity and temperature result in a heat index as demonstrated below:

$$100\%\ Relative\ Humidity + 86°F = 112°F\ Heat\ Index$$

Figure 32: NOAA Heat Index

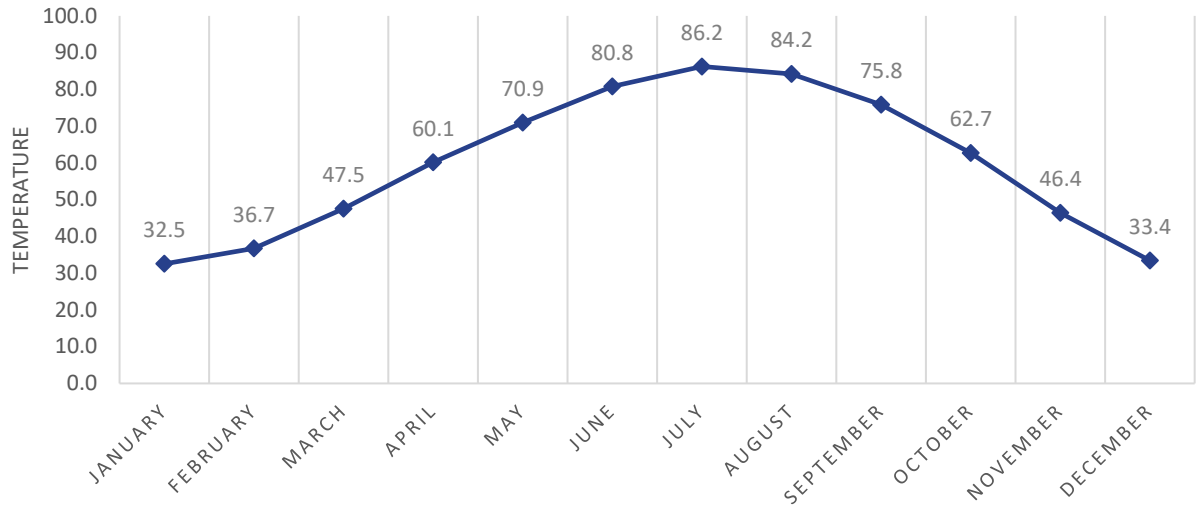


Source: NOAA, 2020[68]

The figure above is designed for shady and light wind conditions. Exposure to full sunshine or strong hot 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. For the planning area the months with the highest average temperatures are June, July, and August. The extent scale for this hazard applies the same to each jurisdiction in the plan.

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

Figure 33: Monthly Climate Normals Max Temperatures



Source: NCEI, 2022

Probability

Extreme heat is a regular part of the climate; with 81 years out of 130 having at least one day over 100°F. The probability that extreme heat will occur in any given year in the planning area is 62 percent. On average the planning area experiences three days over 100°F. Due to the anticipated impacts from climate change, the likelihood of future extreme heat events will increase in frequency and magnitude.

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.

Climate Change Impacts

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*[69] 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 64: Extreme Heat Predictions for Days over 100F

County	Midcentury Prediction 2036-2065 (Days per year)			Late Century Prediction 2070-2099 (Days per year)		
	Historical	Slow Action	No Action	Slow Action	No Action	Rapid Action
Antelope	4	18	26	22	51	18
Holt	3	16	24	20	48	16
Knox	5	21	29	25	54	21

Source: Union of Concerned Scientists, 2022[70]

[69] 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.

[70] Union of Concerned Scientists. 2022. "Extreme Heat and Climate Change: Interactive Tool". https://www.ucsusa.org/resources/killer-heat-interactive-tool.

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. Jurisdictions across the planning area may also experience more than one climate related impact simultaneously such as drought and extreme heat. The season length of heat waves in many U.S. cities has increased by over 40 days since the 1960s. Extreme heat poses a significant risk to human health and labor productivity in the agricultural, construction, and other outdoor sectors. The elderly, pregnant women, and children are most vulnerable to negative health impacts during extreme heat conditions. Heatwaves may also impact plant health, with negative effects on crops during essential growth stages. Increasing temperatures and drought may reduce the potential for aquifers to recharge, which has long-term implications for the viability of agriculture in Nebraska.

More frequent and severe heat waves are also expected to increase stresses on the energy systems and local resources; rising temperatures are expected to reduce electricity generation capacity while increasing energy demands and costs, which can in turn lead to power outages and blackouts. Rising temperatures are leading to increased demand for water and energy. In parts of the region, this will constrain development, stress natural resources, and increase competition for water among communities, agriculture, energy production, and ecological needs.

Community Top Hazard Status

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

- Village of Center
- Verdigre Public School District

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 each county's heat factor risk.

Table 65: County Heat Factor Risk

	ANTELOPE COUNTY	HOLT COUNTY	KNOX COUNTY
Overall Heat Factor Risk	Minor Heat Factor	Moderate Heat Factor	Minor Heat Factor
Total Properties at Risk	7,666	13,648	12,646
Likelihood of 3+ day heat wave (>101F)	-55% likelihood this year -82% likelihood in 30 years	-57% likelihood this year -81% likelihood in 30 years	-53% likelihood this year -81% likelihood in 30 years
Health Caution Days	-43 days this year -58 days in 30 years	-42 days this year -57 days in 30 years	-47 days this year -62 days in 30 years
Dangerous Days	-9 days this year -18 days in 30 years	-9 days this year -17 days in 30 years	-12 days this year -21 days in 30 years
Hot Days	-7 days this year -15 days in 30 years	-7 days this year -15 days in 30 years	-7 days this year -15 days in 30 years
Number of cooling days (requiring AC)	-151 days this year -160 days in 30 years	-149 days this year -159 days in 30 years	-281 days this year -290 days in 30 years

Source: Risk Factor, 2022[71]

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

[71] First Street Foundation. "Risk Factor: Heat Factor." Accessed November 2022. https://riskfactor.com/.

The following tables provide information related to regional vulnerabilities and FEMA's National Risk Index values for Heat Waves. For jurisdictional specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 66: National Risk Index Heat Wave Vulnerabilities

RISK INDEX FACTOR	ANTELOPE COUNTY	HOLT COUNTY	KNOX COUNTY
Risk Index	Relatively Low (5.52)	Relatively Low (4.97)	Relatively Low (6.88)
Expected Annual Loss	Relatively Low (5.95)	Relatively Low (5.04)	Relatively Low (5.55)

Source: FEMA National Risk Index, 2022

Table 67: Regional Extreme Heat Vulnerabilities

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

Flooding

Flooding has been and will continue to be a significant hazard of concern for communities across the Tri-County planning area. Many of the communities in the area were settled and developed alongside or within proximity to water resources. Flooding due to rainfall can occur on a local level, sometimes affecting only a few streets, but can also extend throughout an entire region, affecting whole drainage basins and impacting property in multiple states. Heavy accumulations of ice or snow can also cause flooding during the melting stage. These events are complicated by the freeze/thaw cycles characterized by moisture thawing during the day and freezing at night. There are five main types of flooding in the planning area: riverine flooding, flash flooding, sheet flooding (otherwise called Urban Flooding), and ice jam flooding.

Riverine Flooding

Riverine flooding, typically more slowly 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 draining to a river and its tributaries.

Flash Flooding, including from Levee or Dam Failure

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 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 as a result of this shorter timescale. Flooding from excessive rainfall in Nebraska usually occurs between late spring and early fall.

Sheet Flooding or Urban 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. 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 sheet flooding, is becoming increasingly prevalent as development exceeds the capacity of the drainage infrastructure, therefore limiting its ability to properly carry and disburse the water flow. Flooding also occurs due to combined storm and sanitary sewers being overwhelmed by the tremendous flow of water that often accompanies storm events. Typically, the result is water backing into 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. Ice formation in streams occurs during periods of cold weather when finely divided colloidal particles called "frazil ice" form. These particles combine to form what is commonly known as “sheet ice.” This type of ice covers the entire river. 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, rivers frequently become clogged with this winter accumulation of ice. Because of relatively low stream banks and channels blocked with ice, rivers overtop existing banks and flow overland. This type of flooding tends to more frequently occur on wide, shallow rivers such as the Platte, although other rivers can be impacted.

Location

The major waterways in the planning area include the Niobrara River along northern Holt and Knox Counties; Elkhorn River and South Fork Elkhorn River through Holt and Antelope Counties; Verdigre Creek through Village of Verdigre in Knox County, and the North Fork Elkhorn River near Wausa in Knox County.

Table 68 shows the current status of Flood Insurance Rate Map (FIRM) panels within the study areas while Figure 34 through Figure 36 show the flood risk hazard areas for each county. Many jurisdictions throughout the planning area have FIRMS at the municipal level. However, effective Digital Flood Insurance Rate Maps (DFIRM) were not available for all jurisdictions within the planning area. Specifically, countywide digital FIRMs are only available for Knox County, paper FIRMs are available for Antelope County, and Holt County does not have countywide FIRMs. Therefore, the best available digital data for depicting the flood hazard for these counties is a modeled floodplain using Hazards United States Multi-Hazard (HAZUS-MH). In the absence of DFIRM data, HAZUS-MH Level 1 analysis was used to generate a 1 percent annual flood event for major rivers and creeks (those with a 10-square mile minimum drainage area). HAZUS does not provide a perfect reflection of the situation on the ground. There may be rivers or streams which cause flooding damage but have drainages areas smaller than 10 square miles: these streams will not be included for analysis. A USGS 30-meter resolution digital elevation model (DEM) was used as the terrain base in the model; features smaller than 30 square meters may not be included in analysis. The Special Flood Hazard Areas shown in this plan are not regulatory and are only approximations of vulnerability. For jurisdictional-specific maps as well as an inventory of structures in the floodplain, please see *Section Seven: Community Profiles.* For additional details on localized flood risk such as flood zone types, please refer to the official FIRM available from FEMA's Flood Map Service Center.

Table 68: FEMA FIRM Panel Status

JURISDICTION	PANEL NUMBER	EFFECTIVE DATE
Antelope County	**310412IND0A; 3104129999A, 3104120001B, 3104120002B, 3104120003B, 3104120004B, 3104120005B, 3104120006B, 3104120007B, 3104120008B**	**08/01/2009**
Brunswick	310254	04/02/1976
Clearwater	3102629999A, 3102620001B	09/01/1986
Elgin	310002B	06/17/1986
Neligh	310003B	08/05/1986
Oakdale	3100049999A, 310004B	09/01/1986
Orchard	None	-
Royal	None	-
Holt County	**None**	**-**
Atkinson	3103439999A, 310343A	07/01/2015
Chambers	None	-
Emmet	None	-
Ewing	None	-
Inman	None	-
O'Neill	310116IND0, 3101160001C, 3101160003C, 3101160004C	09/22/1999

JURISDICTION	PANEL NUMBER	EFFECTIVE DATE
Page	None	-
Stuart	3104009999A, 310400A	09/01/1986
Knox County	**31107CIND0B, 31107C0375D, 31107C0400D, 31107C0560D, 31107C0575D, 31107C0600D** **31107C0025C, 31107C0050C, 31107C0075C, 31107C0100C, 31107C0125C, 31107C0150C, 31107C0175C, 31107C0200C, 31107C0225C, 31107C0250C, 31107C0275C, 31107C0300C, 31107C0325C, 31107C0425C, 31107C0450C, 31107C0475C, 31107C0500C, 31107C0525C, 31107C0550C, 31107C0625C, 31107C0650C, 31107C0675C, 31107C0700C, 31107C0725C, 31107C0750C, 31107C0775C, 31107C0800C, 31107C0825C**	**10/02/2015** **08/18/2005**
Bazile Mills	31107CIND0B, 31107C0525C	10/02/2015, 08/18/2005
Bloomfield	31107CIND0B, 31107C0560D, 31107C0600D	10/02/2015
Center	31107CIND0B, 31107C0525C, 31107C0550C	10/02/2015, 08/18/2005
Creighton	31107CIND0B, 31107C0725C	10/02/2015, 08/18/2005
Crofton	31107CIND0B, 31107C0400D, 31107C0425C	10/02/2015, 08/18/2005
Niobrara	31107CIND0B, 31107C0100C, 31107C0300C	10/02/2015, 08/18/2005
Santee	31107CIND0B, 31107C0150C	10/02/2015, 08/18/2005
Verdel	31107CIND0B, 31107C0075C	10/02/2015, 08/18/2005
Verdigre	31107CIND0B, 31107C0500C	10/02/2015, 08/18/2005
Wausa	31107CIND0B, 31107C0600D, 31107C0800C	10/02/2015, 08/18/2005
Winnetoon	31107CIND0B, 31107C0525C	10/02/2015, 08/18/2005

Source: FEMA[72]

[72] Federal Emergency Management Agency. Accessed December 2022. "FEMA Flood Map Service Center." http://msc.fema.gov/portal/advanceSearch .

Figure 34: Antelope County Flood Risk Hazard Areas

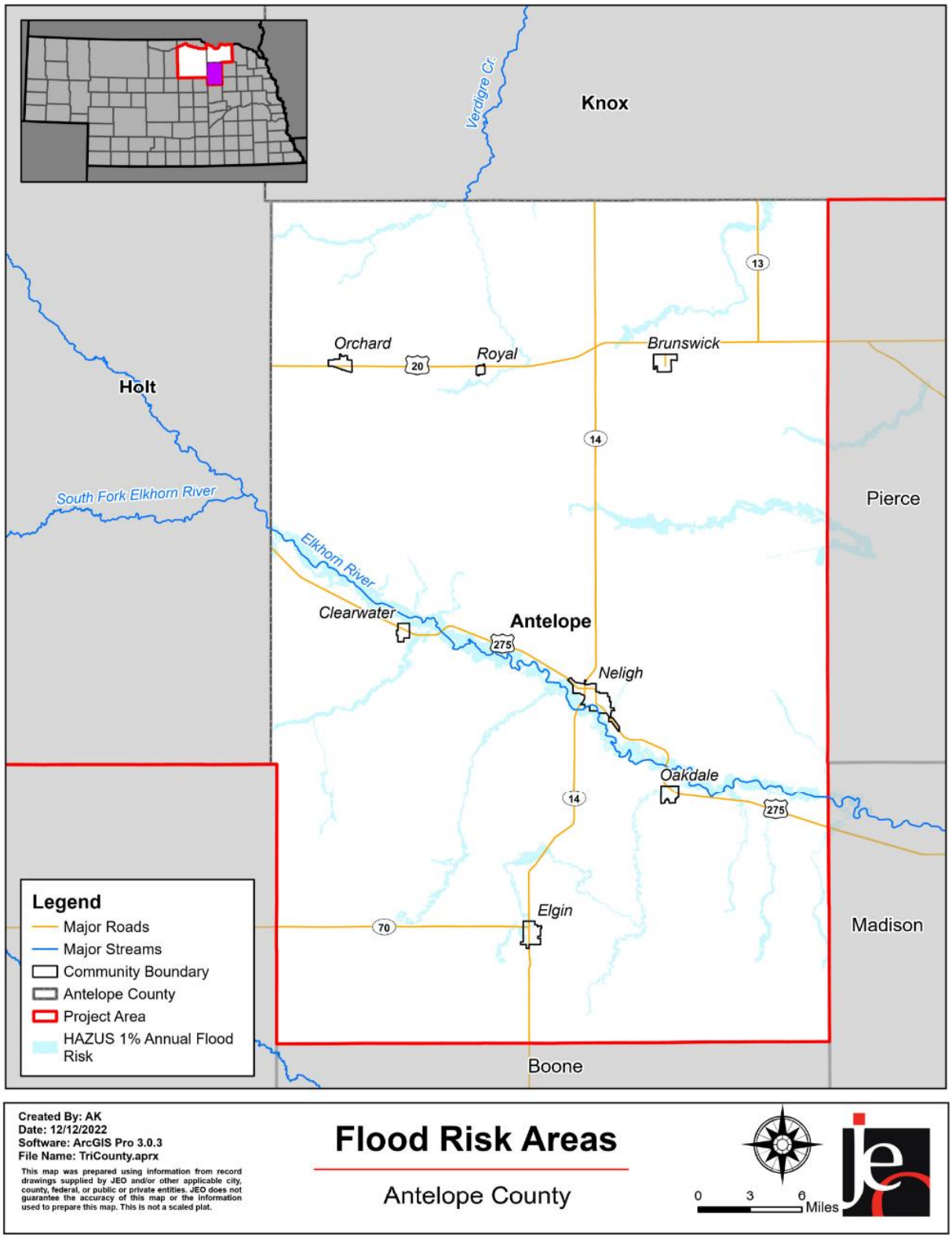


Figure 35: Holt County Flood Risk Hazard Areas

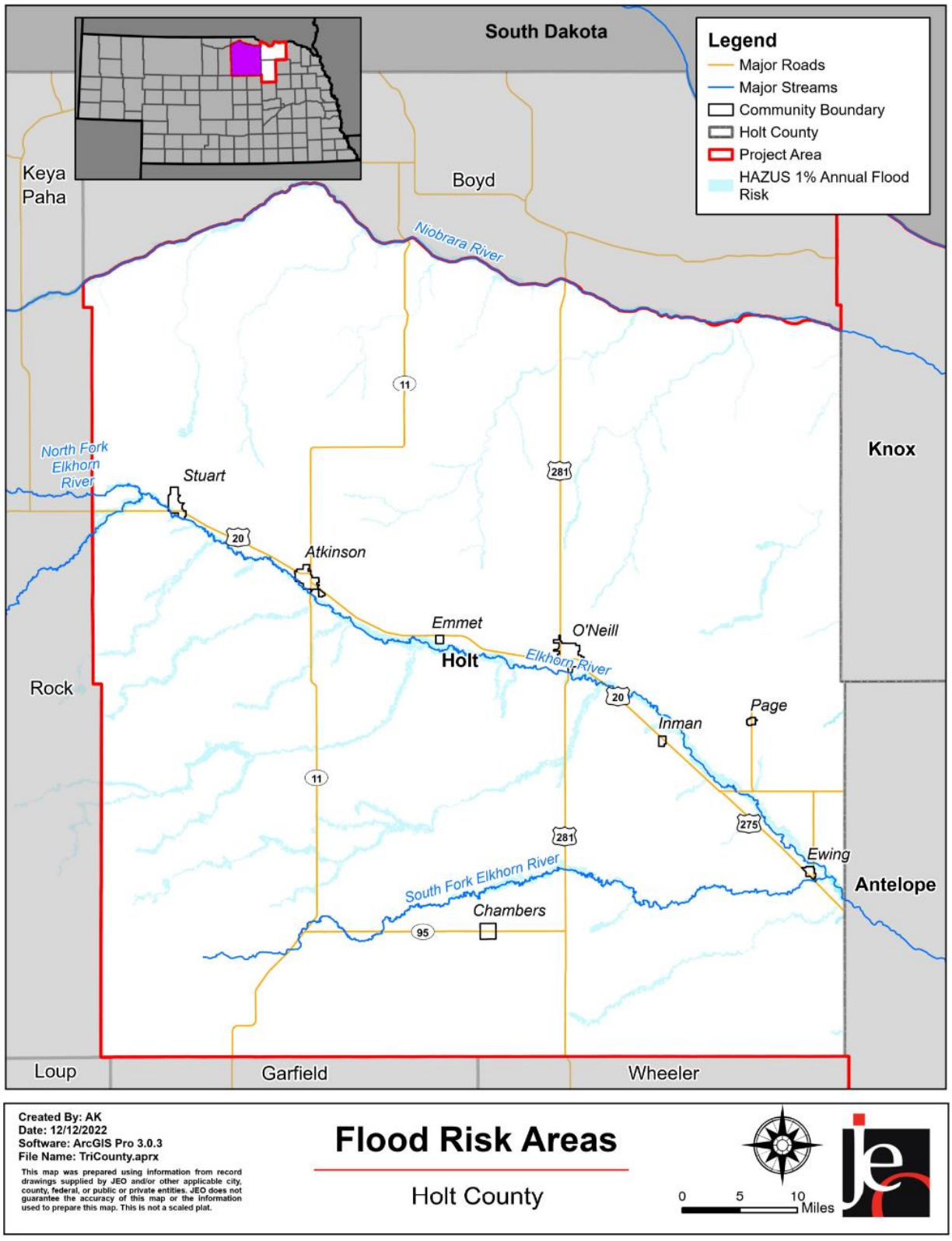
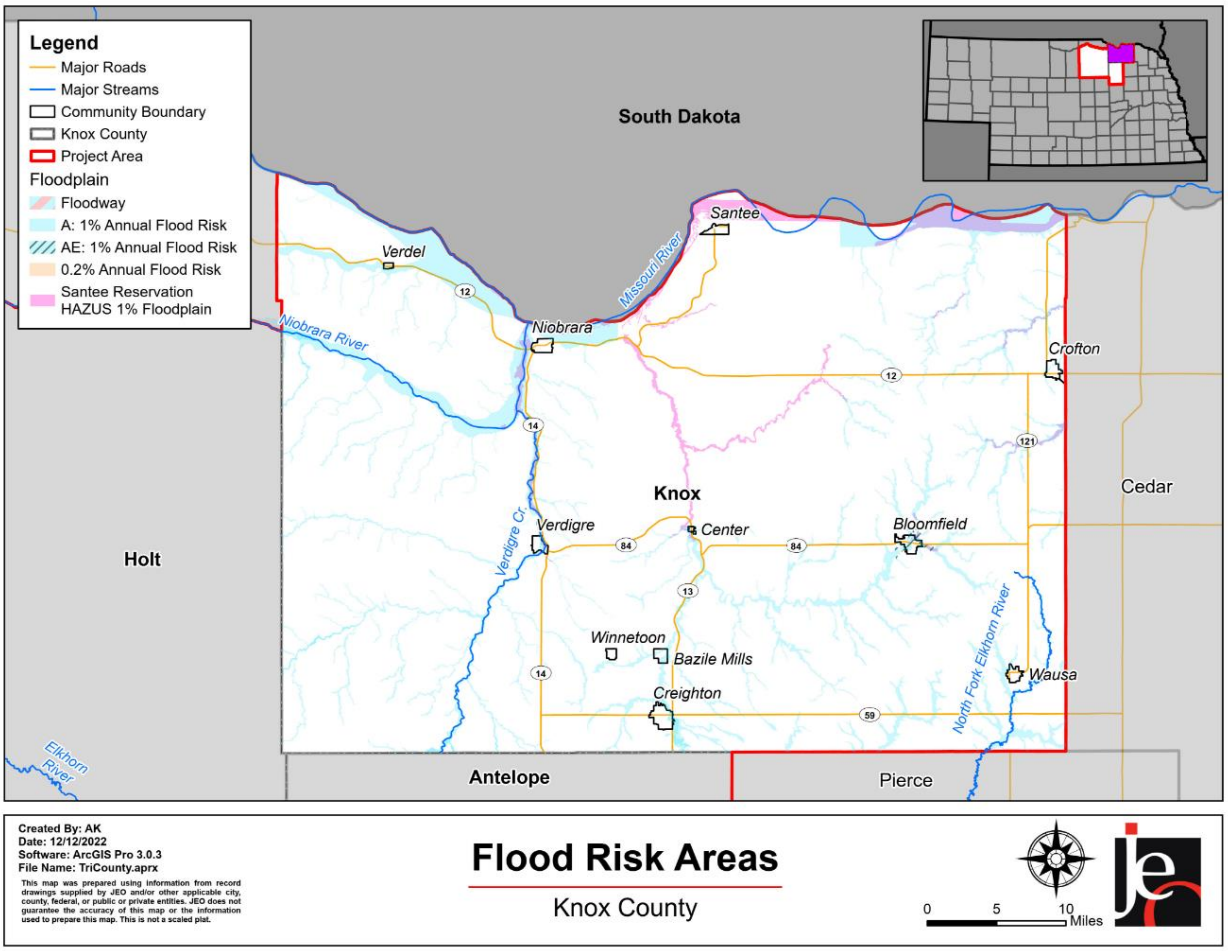


Figure 36: Knox County Flood Risk Hazard Areas



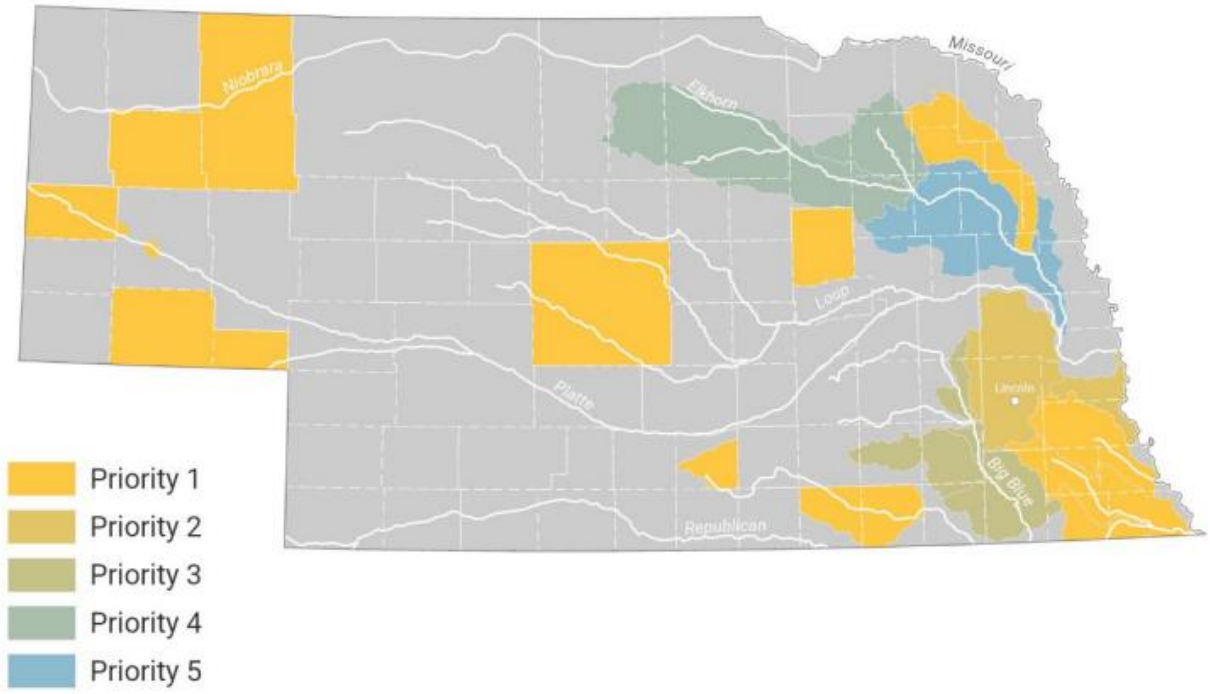
Risk Map Products

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, etc.) that can be used to enhance their mitigation plans and take action to better protect their citizens. As data becomes available, NeDNR hosts the Risk Map products on an interactive web map, which can be viewed here: https://dnr.nebraska.gov/floodplain/interactive-maps. This data can also be obtained from the FEMA Flood Map Service Center.

According to the 2022 Nebraska State Flood Hazard Mitigation Plan, the Upper Elkhorn Watershed has been identified as a Priority 4 level by NeDNR (Figure 37).

Other regulatory products reviewed and utilized in this planning process include Letter of Map Amendments (LOMAs), Letter of Map Revisions (LOMR), and Flood Insurance Studies (FIS) as available and applicable for each of the three counties in the planning area. Specific LOMAs as identified in the planning process are described in their appropriate community profiles in *Section Seven.*

Figure 37: Flood Risk Mapping Project Priority Areas



Source: 2022 Nebraska State Flood Hazard Mitigation Plan

Historical Occurrences

The NCEI reports events as they occur in each community. A single flooding event can affect multiple communities and counties at a time; the NCEI reports these large scale, multi-county events as separate events. The result is a single flood event covering a large portion of the planning area could be reported by the NCEI as several events. According to the NCEI, 47 flash flooding events resulted in $1,089,000 in property damage, while 40 riverine flooding events caused $6,505,000 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 $1,512,674.

March 2019 Flood Event

The March 2019 flood event led to significant impacts across the planning area, particularly along the Niobrara River due to the failure of Spencer Dam between Holt and Boyd Counties. Winter Storm Ulmer developed on March 12th and slowly moved across the Midwest including Nebraska. Due to heavy precipitation on frozen ground and melting snowpack, numerous water systems (rivers and watersheds) were overwhelmed and failed. In other areas, floodwater released by ice jams breaking up destroyed roads, bridges, and levees. In total, 104 cities, 81 counties, and 5 tribal nations in Nebraska received State or Federal Disaster Declarations due to the flood events. The NeDNR has collected and reviewed extensive data records from the flood event. An event-wide storymap has been developed and provides an excellent resource to understand the cause, duration, impacts, and recovery efforts from this event. The storymap can be viewed at: https://storymaps.arcgis.com/stories/9ce70c78f5a44813a326d20035cab95a.

Some of the impacts reported in the NCEI across the planning area from this event included:

- *O'Neill: Water overtopped several streets. The Elkhorn River is out of its banks and water is covering county road 494 for a quarter of a mile. Reports of low land flooding along the Elkhorn River just east of O'Neill.*

- *Atkinson: Roads 877 and 876 are closed due to water over the roadway. Flooding also reported at the Golf Course.*
- *Clearwater: An ice jam along the banks of the Elkhorn River was causing lowland flooding and closed County Road 519th Avenue.*
- *Elgin: Roads in Elgin flooded up to a foot in some locations, but still passable to traffic.*
- *St. Edward: Beaver Creek rose out of its banks causing substantial flooding of the town of St. Edward. Several buildings in downtown were flooded with 1 to 2 feet of water.*
- *Ewing: Highway 45B near Ewing crossing the Elkhorn River is closed due to water over the road.*
- *Inman: reports of sandbagging in several locations*
- *Knox County: Highway 12 was closed between 537th and 539th due to flooding over the highway.*
- *Verdel: This is for flooding along the Niobrara River. The river gauge at Verdel, operated by the USGS, peaked at 19.38 feet at 6 pm on March 13th. Major flood stage is 10 feet. This peak is the highest on record. This gauge was destroyed by ice and floodwaters during the event. The high water value was obtained post-flood by the USGS. This historic flooding along the Niobrara River was the result of rain, snowmelt and the failure of the upstream Spencer Dam. The dam failed due to overtopping with some estimates of 3 to 5 feet of water going over the dam. The resulting wave of water from this dam failure caused substantial damage in low-lying areas of the town of Niobrara. Damage was somewhat isolated in regards to the whole town, but what was affected was absolutely devastated. Major damage sustained to the Country Cafe, and farm buildings next door. Thick river ice slabs 2-3 ft thick also contributed to damage, with the Country Cafe having most of its walls lost due to ice. The owner said when they arrived, the ice piles left behind from the flood were close to 10 ft high and completely surrounded the Cafe up to the roof. Measured a 6.4 ft high water mark in the cafe. The Highway 12 bridge was washed out in two sections on the west side of the river channels.*
- *Verdel: This is for flooding along the Ponca Creek. The river gage at Verdel, operated by the USGS, peaked at 18.2 feet at 4 am on March 14th. Major flood stage is 17 feet. Preliminarily this peak is the highest on record. Water damaged 3 homes on the outskirts of Verdel and there were some people that had to be evacuated via tractor.*
- *Verdigre: An NWS flood survey showed water depths in portions of town reach 1 to 3 feet. The flooding most affected the east portions of town, closest to the Verdigre Creek. Farm homes were flooded out. One was a fifth-generation farm home.*

Overall, the event caused significant damage to homes, commercial buildings, agriculture, bridges, and roads. Agriculturally, hundreds of acres of pastureland and fields were destroyed by several inches to feet of sand and silt left behind by receding flood waters. The flooding event also occurred in the midst of calving season, resulting in the loss of hundreds of calves for ranchers across the state. Roads, bridges, and critical transportation routes across the state were blocked by flood waters or washed out entirely, including the Highway 281 bridge that crosses the Niobrara River from Holt County into Boyd County. At least three fatalities occurred during the flood event while the Nebraska National Guard performed dozens of rescues in inundated areas. No fatalities were reported within the three-county planning area during this event.

Average Annual Losses

The average damage per event estimate was determined based upon the NCEI Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury or loss of life. Flooding caused a total average of over $281,000 in property damage and $65,768 in crop losses per year for the planning area.

Table 69: Flooding 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
Flash Flood	47	1.7	$1,089,000	$40,333	$1,512,674	$65,768
Flood	40	1.5	$6,505,000	$240,926		

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

Extent

The NWS has three categories to define the typical severity of a flood once a river reaches flood stage as indicated in Table 70. 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).

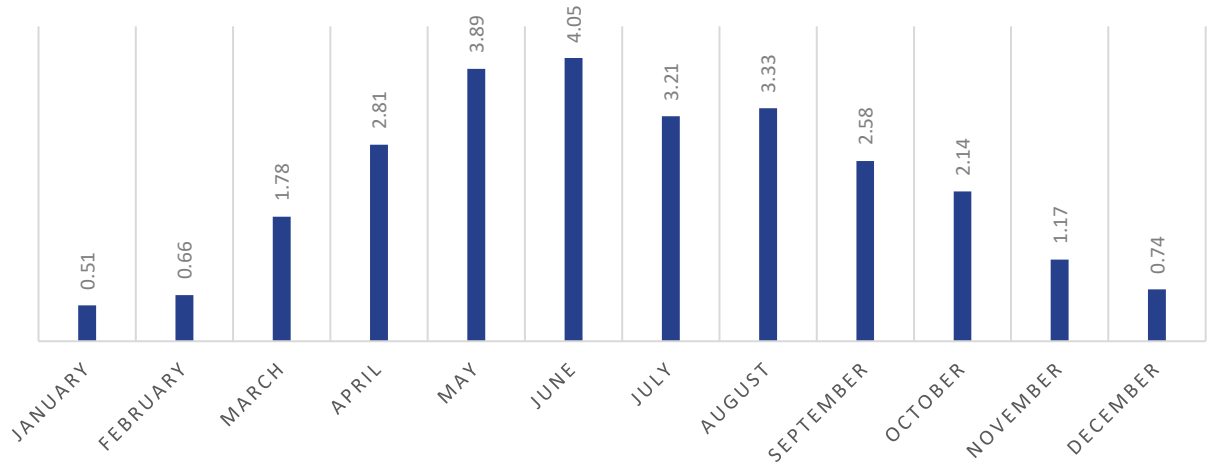
Table 70: Flooding Stages

FLOOD STAGE	DESCRIPTION OF TYPICAL FLOOD IMPACTS
Minor Flooding	Minimal or no property damage, but possibly some public threat or inconvenience
Moderate Flooding	Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary
Major Flooding	Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations

Source: NOAA, 2017[73]

The following figure 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 39, the most common month for flooding within the planning area is in June; however, flood events are distributed across early spring and summer months.

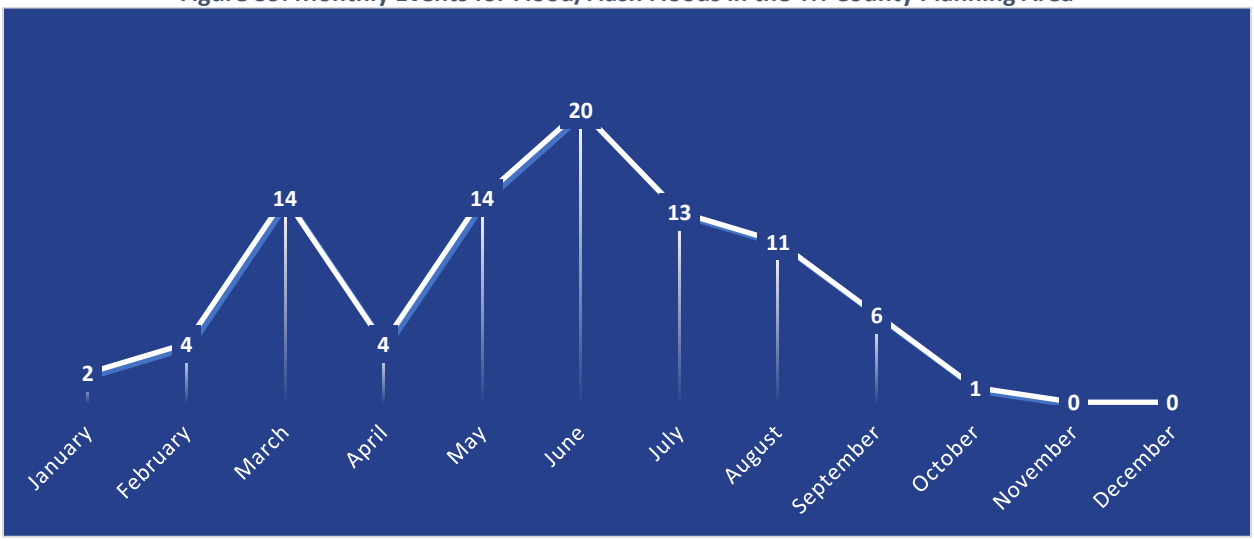
Figure 38: Average Monthly Precipitation



Source: NCEI

[73] National Weather Service. 2017. "Flood Safety." http://www.floodsafety.noaa.gov/index.shtml.

Figure 39: Monthly Events for Flood/Flash Floods in the Tri-County Planning Area



Source: NCEI

Several communities in the planning area are more likely to see severe extent impacts from flooding due to their location near waterways and the mapped flood risk hazard areas. Specific concerns and vulnerabilities are discussed in more detail in applicable *Community Profiles.* Examples of such communities at increased risk include Verdigre, Bloomfield, Center, or Elgin.

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 resident of floodplains through flood insurance premiums. In return for availability of federally backed flood insurance, jurisdictions participating in the NFIP must agree to adopt and enforce floodplain management standards to regulate development in special flood hazard areas (SFHA) as defined by FEMA's flood maps. 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.

The following tables summarize NFIP participation and active policies within the planning area as of December 2022.

Table 71: NFIP Participants

JURISDICTION	PARTICIPATE IN NFIP?	ELIGIBLE-REGULAR PROGRAM	DATE CURRENT MAP	SANCTION	SUSPENSION	RESCINDED
Antelope County	Yes	8/1/2009	08/01/09(L)	-	-	-
Brunswick	No	-	-	-	-	-
Clearwater	Yes	9/1/1986	09/01/86(L)	-	-	-
Elgin	Yes	6/17/1986	6/17/1986	-	-	-
Neligh	Yes	8/5/1986	08/05/86(M)	-	-	-
Oakdale	Yes	9/1/1986	09/01/86(L)	-	-	-
Orchard	Yes		(NSFHA)	-	-	-
Royal	No	-	-	-	-	-

JURISDICTION	PARTICIPATE IN NFIP?	ELIGIBLE-REGULAR PROGRAM	DATE CURRENT MAP	SANCTION	SUSPENSION	RESCINDED
Holt County	No	-	-	-	-	-
Atkinson	Yes	7/1/2015	07/01/15(L)	-	-	-
Chambers	No	-	-	-	-	-
Emmet	No	-	-	-	-	-
Ewing	No	-	-	-	-	-
Inman	Yes		(NSFHA)	-	-	-
O'Neill	Yes	9/29/1986	9/22/1999	-	-	-
Page	No	-	-	-	-	-
Stuart	Yes	9/1/1986	09/01/86(L)	-	-	-
Knox County	Yes	8/18/2005	10/2/2015	-	-	-
Bazile Mills	No	-	-	-	-	-
Bloomfield	Yes	8/18/2005	10/2/2015	-	-	-
Center	Yes	8/18/2005	8/18/2005	-	-	-
Creighton	Yes	9/1/1996	8/18/2005	-	-	-
Crofton	Yes	9/1/1986	10/2/2015	-	-	-
Niobrara	Yes	8/18/2005	8/18/2005	-	-	-
Santee	No	-	-	-	-	-
Verdel	Yes	8/18/2005	08/18/05(M)	-	-	-
Verdigre	Yes	9/1/1986	8/18/2005	-	-	-
Wausa	No	-	-	-	-	-
Winnetoon	Yes	8/18/2005	(NSFHA)	-	-	-

Source: FEMA, NFIP Community Status Book Report[74]

Note: (M) – No elevation determined – All Zone, A, C, and X; (L) – Original FIRM by Letter – All Zone A, C, and X

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

Table 72: NFIP Policies in Force and Total Payments

JURISDICTION	POLICIES IN-FORCE	TOTAL COVERAGE	CLOSED LOSSES*	TOTAL PAYMENTS*
Antelope County	9	$1,780,800	14	$388,413
Clearwater	2	$228,000	1	$17,835
Inman	1	$35,000	1	$4,126
O'Neill	7	$1,000,000	5	$773
Knox County	51	$11,734,000	14	$643,982
Bloomfield	14	$2,300,000	4	$22,875
Center	2	$72,000	0	$0
Creighton	1	$59,000	0	$0
Crofton	1	$280,000	1	$125
Niobrara	6	$1,473,000	1	$39,707
Verdigre	12	$670,000	6	$75,218

Source: FEMA, 2023

**Note Only jurisdictions with reported policies and claim statistics included in the table here.*

[74] Federal Emergency Management Agency. 2023. "The National Flood Insurance Program Community Status Book." https://www.fema.gov/cis/NE.html.

This plan strongly encourages plan participants to enroll, participate, and remain in good standing 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, such as those described in the Community Rating System (CRS) Coordinator's Manual (FIA-15/2017).[75] Currently, no communities in the planning area participate in the CRS program.

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. As of November 2022, there were no repetitive loss structures or severe repetitive loss properties in the planning area.

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

[75] Federal Emergency Management Agency. May 2017. "National Flood Insurance Program Community Rating System: Coordinator's Manual FIA-15/2017." Accessed October 2020. https://www.fema.gov/media-library-data/1493905477815-d794671adeed5beab6a6304d8ba0b207/633300_2017_CRS_Coordinators_Manual_508.pdf.

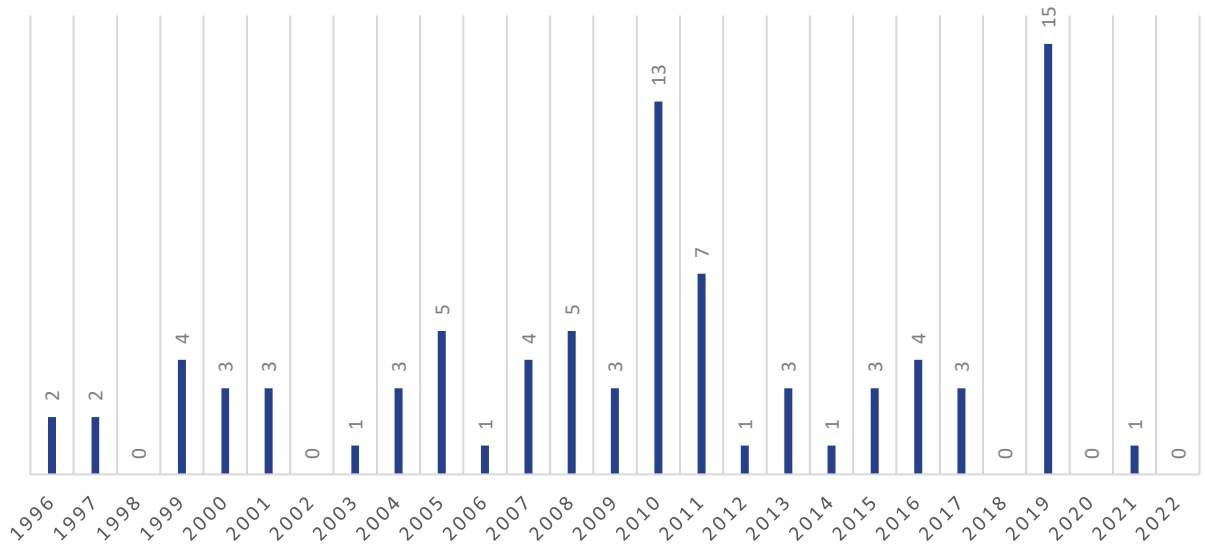
(b) For which at least two separate claims payments (includes only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

Purpose of the HMA definitions: The HMA definitions were allowed by the Biggert-Waters Flood Insurance Reform Act of 2012 to provide an increased federal cost share under the FMA grant when a property meets the HMA definition.

Probability

The NCEI reports 47 flooding and 40 flash flooding events from January 1996 to December 2020. Some years had multiple flooding events. The following figure shows the events broken down by year. Based on the historic record and reported incidents by participating communities with 22 out of 27 years with a reported flood event, there is an 81 percent probability that flooding will occur annually in the planning area. It is worth noting that while no events were reported for 2022, flood events likely occurred during 2022 but were not reported here.

Figure 40: Flood Events by Year



Source: NCEI, 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 prohibit new structures for

human habitation in the floodway.[76] 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.

Climate Change Impacts

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 73 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.[77] Table 74 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.

Table 73: Average Annual Total Precipitation

County	Emission Scenario	Historical (1976-2005)	Early Century (2015-2044)	Mid Century (2035-2064)	Late Century (2070-2099)
ANTELOPE COUNTY	Lower Emissions (RCP 4.5)	24.9	25.5	25.7	25.9
	Higher Emissions (RCP 8.5)	24.9	25.3	25.8	26.3
HOLT COUNTY	Lower Emissions (RCP 4.5)	23.4	23.7	23.9	24.1
	Higher Emissions (RCP 8.5)	23.4	23.7	24.1	24.4
KNOX COUNTY	Lower Emissions (RCP 4.5)	24.7	25.3	25.5	25.7
	Higher Emissions (RCP 8.5)	24.7	25.2	25.7	26.2

Source: NOAA[78]

Table 74: Annual Days that exceed 99th Percentile Precipitation

County	Emission Scenario	Historical (1976-2005)	Early Century (2015-2044)	Mid Century (2035-2064)	Late Century (2070-2099)
ANTELOPE COUNTY	Lower Emissions (RCP 4.5)	4.4	4.9	5.1	5.3
	Higher Emissions (RCP 8.5)	4.4	4.8	5.3	5.8
HOLT COUNTY	Lower Emissions (RCP 4.5)	4.1	4.6	4.7	4.9
	Higher Emissions (RCP 8.5)	4.1	4.5	4.9	5.5
KNOX COUNTY	Lower Emissions (RCP 4.5)	4.3	4.9	5.0	5.2

[76] 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.

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

[78] NOAA. August 2022. "Climate Mapping for Resilience and Adaptation". https://livingatlas.arcgis.com/assessment-tool/explore/details .

County	Emission Scenario	Historical (1976-2005)	Early Century (2015-2044)	Mid Century (2035-2064)	Late Century (2070-2099)
	Higher Emissions (RCP 8.5)	4.3	4.8	5.2	5.8

Source: NOAA

Community Top Hazard Status

The following jurisdictions identified Flooding as a hazard of top concern:

- Antelope County
- Village of Center
- Village of Clearwater
- City of Creighton
- City of Crofton
- City of Elgin
- Village of Ewing
- Holt County
- Village of Inman
- Knox County
- City of Neligh
- Village of Niobrara
- Village of Oakdale
- City of O'Neill
- Village of Stuart
- Village of Verdel
- Village of Verdigre
- Niobrara Public Schools District
- Santee Community Schools District
- Verdigre Public Schools District

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.[79] 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 and renters are more likely to live in areas vulnerable to the threat of flooding yet lack the resources necessary to purchase flood insurance. And finally flash floods are more often responsible for injuries and fatalities than prolonged flood events.

Other groups that may be more vulnerable to floods, specifically flash floods, include the elderly, children, 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.

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

[79] 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

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, and examples of this would include using permeable surfaces for parking areas, using rainwater retention swales, developing rain gardens, developing green roofs, and establishing greenways.

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 to or above one foot above the base flood elevation. Nebraska standards also require that new structures for human habitation are not permitted in the floodway. These requirements will help reduce flood impacts and damages by requiring a one foot "freeboard" to allow for known flood hazards and also result in lower premiums for those participating in the NFIP.

On a state level, the NeDNR's National Flood Insurance Coordinator has done some interesting work, studying 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

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

Table 75: Planning Area Parcel Improvements and Value in the Floodplain

County	Number of Improvements	Total Improvement Value	Number of Improvements in Floodplain	Value of Improvements in Floodplain	Percentage of Improvements in Floodplain
Antelope	3,572	$391,427,335	396	$48,956,790	11.1%
Holt	6,055	$545,661,715	492	$28,872,774	8.1%
Knox	4,893	$423,460,890	1,210	$98,042,360	24.7%
Totals	**14,520**	**$1,360,549,940**	**2,098**	**$175,871,924**	**14.4%**

Source: GIS Workshop/Vanguard (Holt County Data), 2022

Knox County has the largest percentage of parcel improvements located in the floodplain at 24.7 percent, which indicates that the county, particularly along waterways, has the greatest flood vulnerability to people and infrastructure. Significant flood events would impact the economy throughout the entire planning area as structures and roadways are damaged.

The following tables provide information related to regional vulnerabilities and FEMA's National Risk Index values for Riverine Flooding. For jurisdictional specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 76: National Risk Index Riverine Flooding Vulnerabilities

RISK INDEX FACTOR	ANTELOPE COUNTY	HOLT COUNTY	KNOX COUNTY
Risk Index	Relatively Low (7.35)	Relatively Low (6.29)	Relatively Low (9.29)
Expected Annual Loss	Relatively Low (7.14)	Relatively Low (5.75)	Relatively Low (6.76)

Source: FEMA National Risk Index, 2022

Table 77: 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
Economic	-Business closures or damages may have significant impacts -Agricultural losses from flooded fields or cattle loss -Closed roads and railroads would impact commercial transportation of goods
Built Environment	-Building may be damaged
Infrastructure	-Damages to roadways and railways
Critical Facilities	-Wastewater facilities are at risk, particularly those in the floodplain -Critical facilities, especially those in the floodplain, are at risk to damage (critical facilities are noted within individual community profiles)
Climate	-Changes in seasonal and annual precipitation normals will likely increase frequency and magnitude of flood events

Hazardous Materials

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

> *Chemicals are found everywhere. They purify drinking water, are used in agriculture and industrial production, fuel our vehicles and machines, 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. The community is at risk if a chemical is used unsafely or released in harmful amounts.*

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 at 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 material 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.

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 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.

According to PHMSA, hazardous materials traffic in the U.S. now exceeds 1,000,000 shipments per day. Nationally, the U.S. has had 108 fatalities associated with the transport of hazardous materials between 2007 through 2016. While such fatalities are a low probability risk, even one event can harm many people.

For example, a train derailment in Crete, Nebraska in 1969 allowed anhydrous ammonia to leak from a ruptured tanker. The resulting poisonous fog killed nine people and injured 53.

Table 78 demonstrates the nine classes of hazardous material according to the 2016 Emergency Response Guidebook.

Table 78: Hazardous Material Classes

CLASS	TYPE OF MATERIAL	DIVISIONS
1	Explosives	Division 1.1 – Explosives with a mass explosion hazard Division 1.2 – Explosives with a projection hazard Division 1.3 – Explosives predominantly a fire hazard Division 1.4 – Explosives with no significant blast hazard Division 1.5 – Very insensitive explosives with a mass explosion hazard Division 1.6 – Extremely insensitive articles
2	Gases	Division 2.1 – Flammable gases Division 2.2 – Non-flammable, non-toxic gases Division 2.3 – Toxic gases
3	Flammable liquids (and Combustible liquids)	
4	Flammable solids; Spontaneously combustible materials	Division 4.1 – Flammable solids Division 4.2 – Spontaneously combustible materials Division 4.3 – Water-reactive substances/Dangerous when wet materials
5	Oxidizing substances and Organic peroxides	Division 5.1 – Oxidizing substances Division 5.2 – Organic peroxides
6	Toxic substances and infections substances	Division 6.1 – Toxic substances Division 6.2 – Infectious substances
7	Radioactive materials	
8	Corrosive materials	
9	Miscellaneous hazardous materials/products, substances, or organisms	

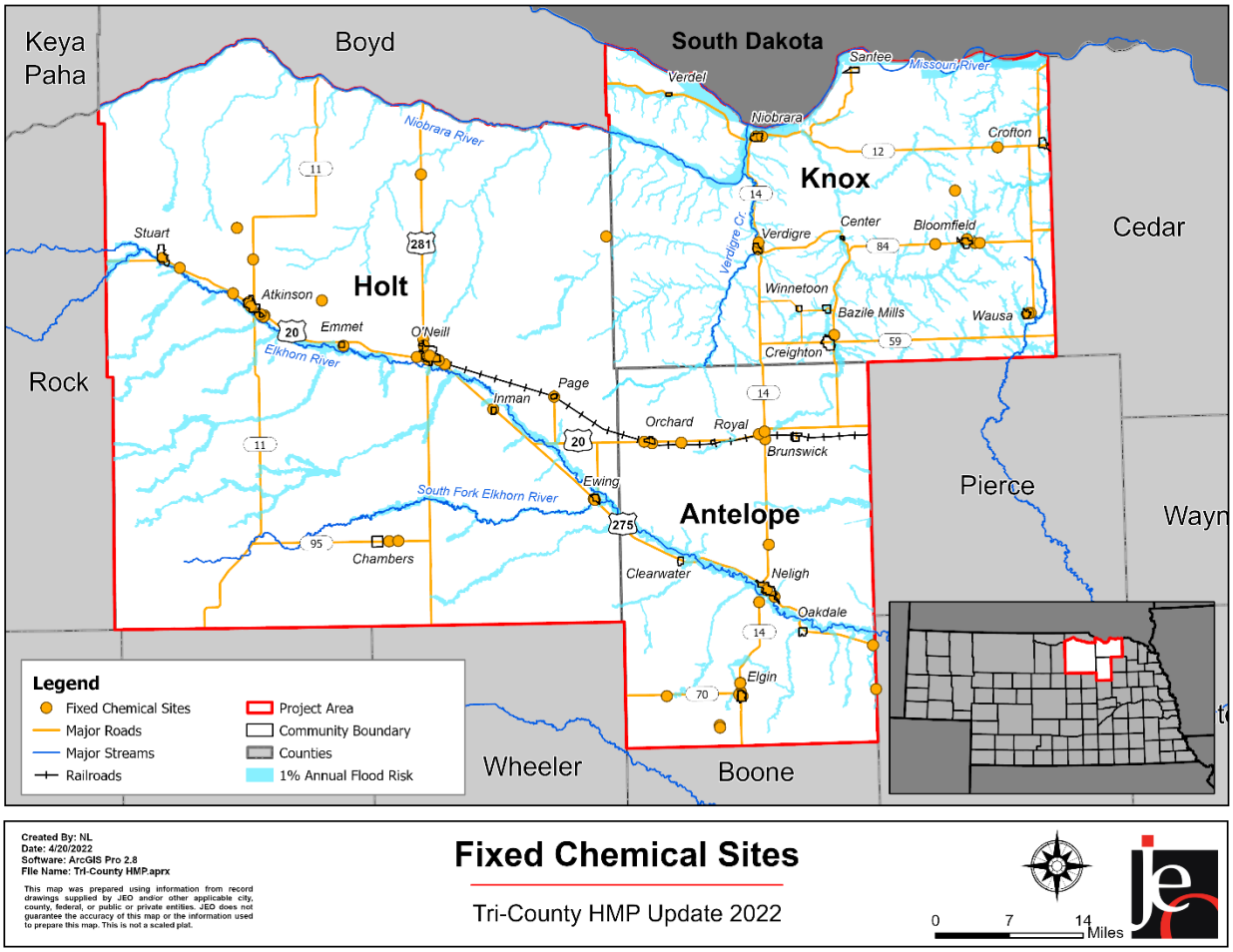
Source: Emergency Response Guidebook, 2016[80]

Location

Nebraska has approximately 2,781 facilities across the state that house hazardous materials according to the Tier II reports submitted to the Nebraska Department of Environment and Energy (NDEE) in 2022. Of those, 64 locations are located in the planning area. These locations are shown in the following figure. A listing of hazardous material storage sites can be found in *Section Seven: Community Profiles* for each jurisdiction.

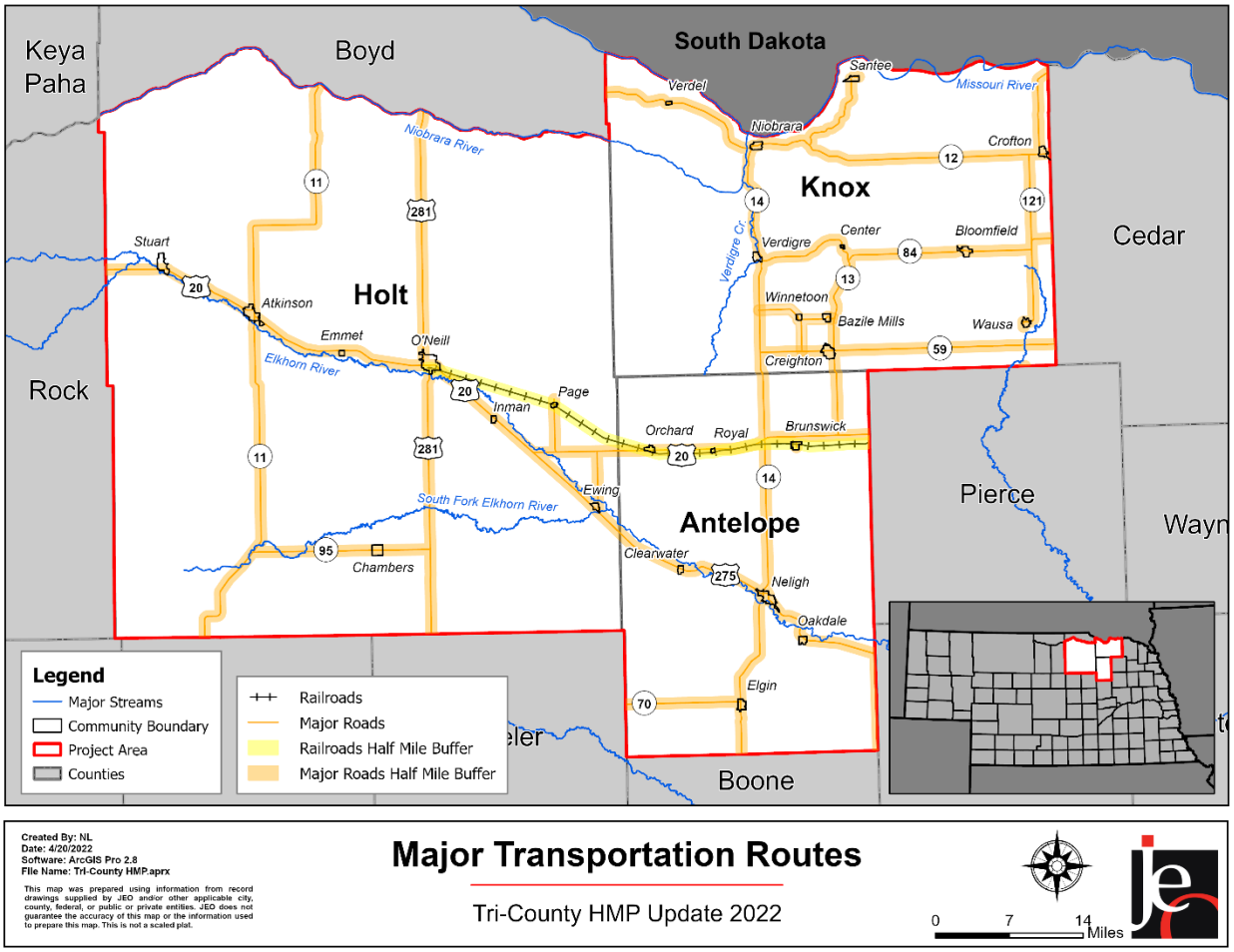
[80] U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration. 2016. "2016 Emergency Response Guidebook." https://www.phmsa.dot.gov/hazmat/outreach-training/erg.

Figure 41: Fixed Chemical Sites in the Planning Area



Hazardous material releases during transportation primarily occur on major transportation routes as identified in Figure 42. Railroads providing service through the planning area have developed plans to respond to chemical releases along rail routes. A large number of spills also typically occur during the loading and unloading of chemicals for highway and pipeline chemical transport. Transportation corridors in the planning area are primarily US Routes and County Highways throughout each county. No interstates are located in the planning area.

Figure 42: Major Transportation Routes with Half Mile Buffer



According to PHMSA, there are several gas transmission and hazardous liquid pipelines located in the planning area. Maps of pipelines and incidents from PHMSA for each of the three counties in the planning area can be seen below (Figure 43 through Figure 45).[81]

[81] Pipeline and Hazardous Materials Safety Administration. 2020. "National Pipeline Mapping System." https://www.npms.phmsa.dot.gov/ .

Figure 43: Antelope County Public Map Viewer Map

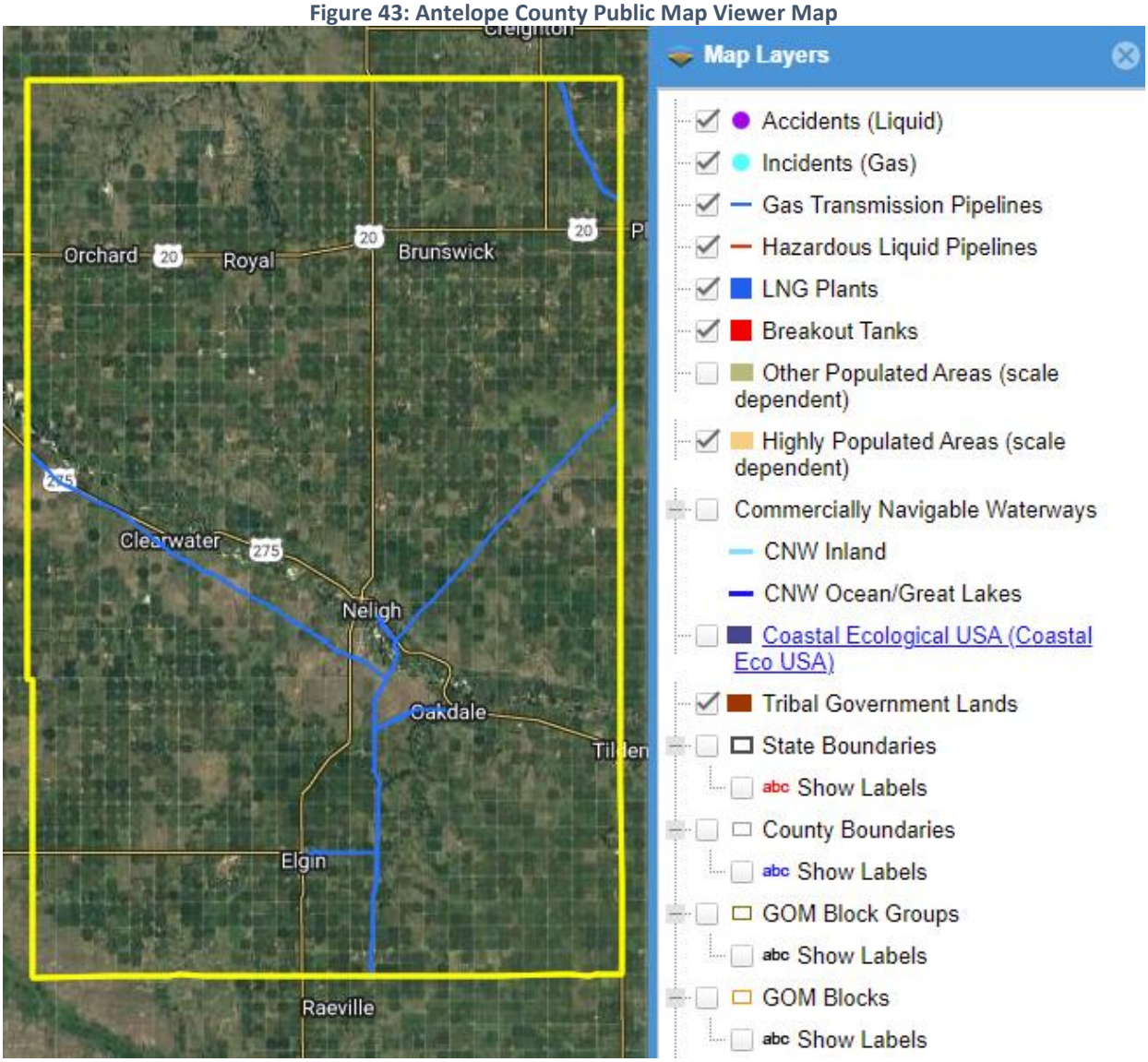


Figure 44: Holt County Public Map Viewer Map

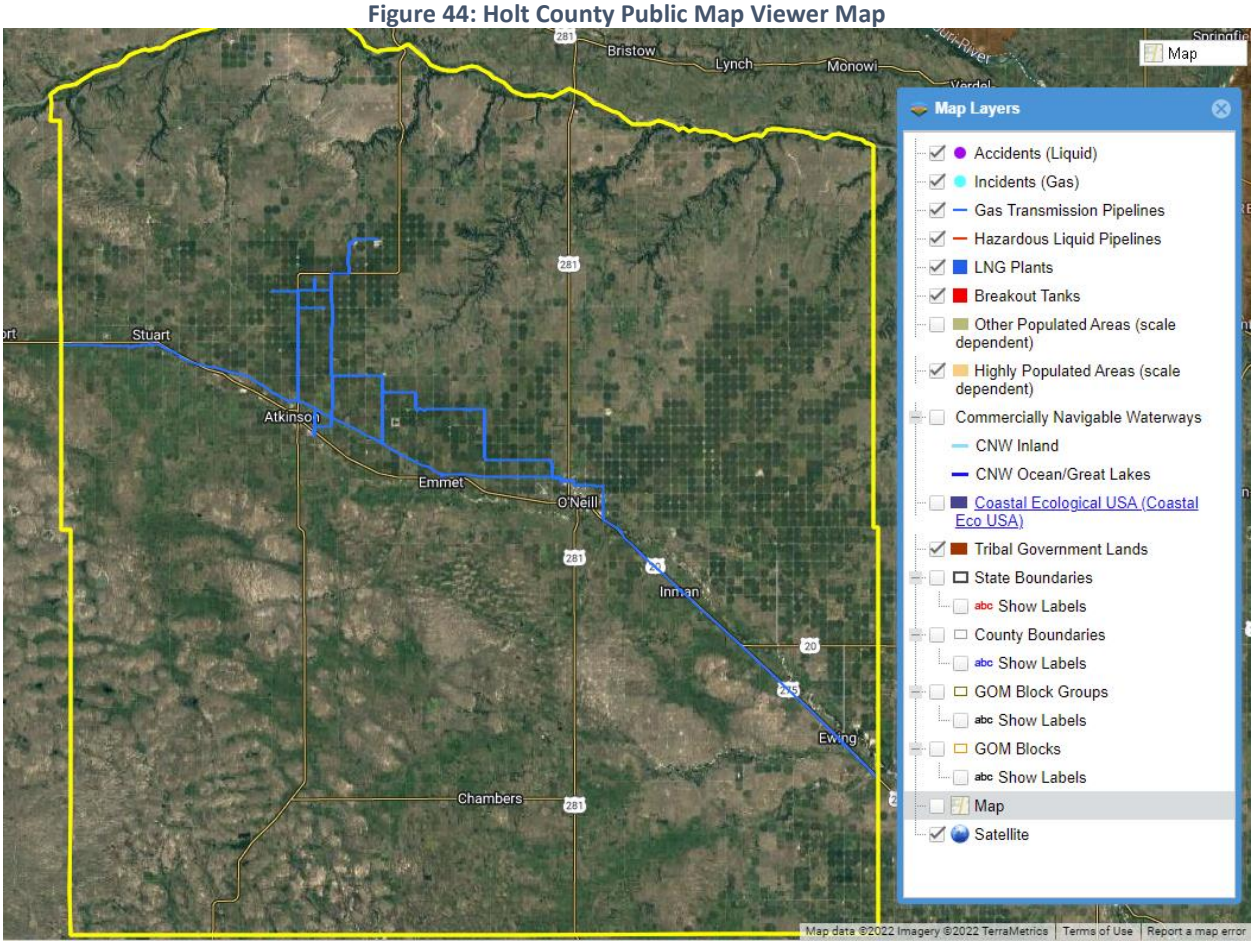
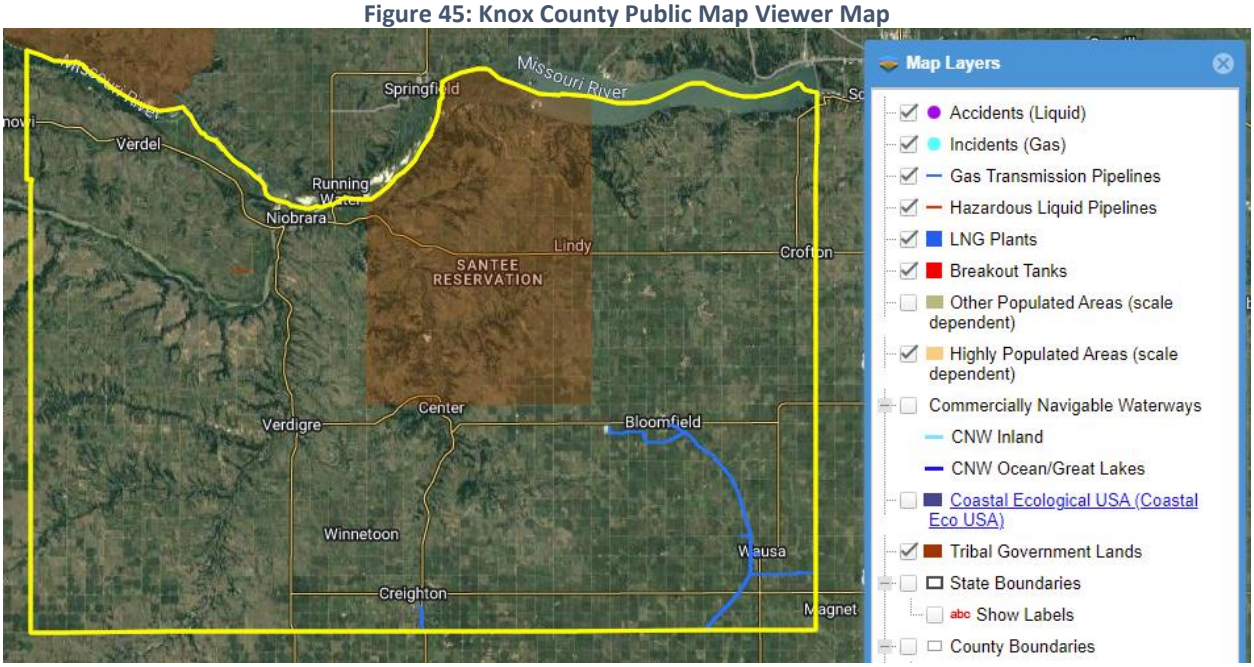
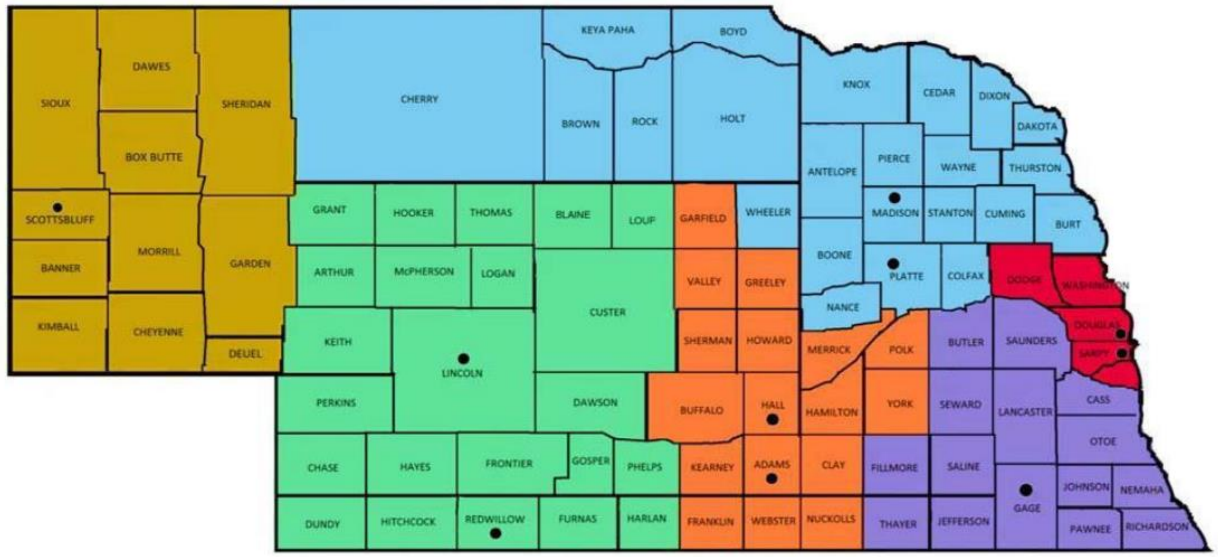


Figure 45: Knox County Public Map Viewer Map



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 Norfolk in Madison County.[82]

Figure 46: Nebraska SERTs Map



Historical Occurrences

Fixed Site Spills

According to the U.S. Coast Guard's National Response Center database (NRC), there have been 17 fixed site chemical spills from 1990 – 2022 in the planning area. There was $5,000 in property damage reported for these chemical spills and two injuries. The following table displays the larger spills that have occurred throughout the planning area (>500 gallons), those with injuries, or with damages.

Table 79: Fixed Site Chemical Spills

Date of Event	Location of Release	Quantity Spilled	Material Involved	Number of Injuries	Property Damage
1993	Orchard (Antelope County)	500 gallons	Unknown Acid	0	$0
1993	Orchard (Antelope County)	Unknown	Unknown	1	$0
1995	Verdigre (Knox County)	5,200 gallons	Gasoline	0	$0
1995	O'Neill (Holt County)	1,000 gallons	Diesel Oil	0	$0
2008	Neligh (Antelope County)	Unknown	Natural Gas	1	$5,000
2020	O'Neill (Holt County)	6,000 gallons	Anhydrous Ammonia	0	$0

Source: National Response Center, 1990-2022

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

Transportation Spills

According to the Pipeline and Hazardous Materials Safety Administration (PHMSA), eight hazardous materials releases occurred during transportation in the planning area between 1971 and April 2022. During these events, there were no injuries, no fatalities, and $50,000 in damages. The following table provides a list of the hazardous materials releases during transportation in the planning area.

Table 80: Historical Chemical Transportation Spills, 1990-2022

DATE	LOCATION OF RELEASE	FAILURE DESCRIPTION	MATERIAL INVOLVED	METHOD OF TRANSPORTATION	QUANTITY SPILLED	TOTAL DAMAGES	EVACUATION (Y/N)
5/26/1999	Creighton	Vehicular Accident	Diesel, and Gasoline	Highway	870 LGA	$23,570	N
3/4/2009	West of Crofton	Vehicular Accident	Liquid Petrol Gas	Highway	2,000 LGA	$26,430	Y
7/6/2011	O'Neill	Loose Closure	Pesticide	Highway	2,000 LGA	$0	N
7/1/2013	O'Neill	Undeclared	Fire Extinguishers	Highway	0.25 LGA	$0	N
11/4/2013	O'Neill	Package Damage	ENVR Haz substances, solid NOS	Highway	10 SLB	$0	N
10/7/2014	O'Neill	Closure leakage	Corrosive Liquids	Highway	1 LGA	$0	N
1/26/2016	O'Neill	Human Error	Hydrogen Peroxide	Highway	0.13 LGA	$0	N
11/6/2019	O'Neill	Human Error	Isopropyl	Highway	0.08 LGA	$0	N

Source: PHMSA, 1971-2022

Average Annual Damages

There have been 17 chemical fixed site spills in the planning area reported from the NRC and eight transportation spills as reported by PHMSA. Neither the NRC nor PHMSA track crop losses from chemical spills. These events reported a total of $55,000 in property damage. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life.

Table 81: Chemical Fixed Site Average Annual Losses

HAZARD TYPE	NUMBER OF EVENTS	EVENTS PER YEAR	INJURIES	TOTAL EVACUATED	TOTAL DAMAGES	AVERAGE ANNUAL LOSS
Chemical Spills	17	0.7	2	181	$5,000	$152
Transportation Spills	8	0.2	0	0	$50,000	$1,515

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

Extent

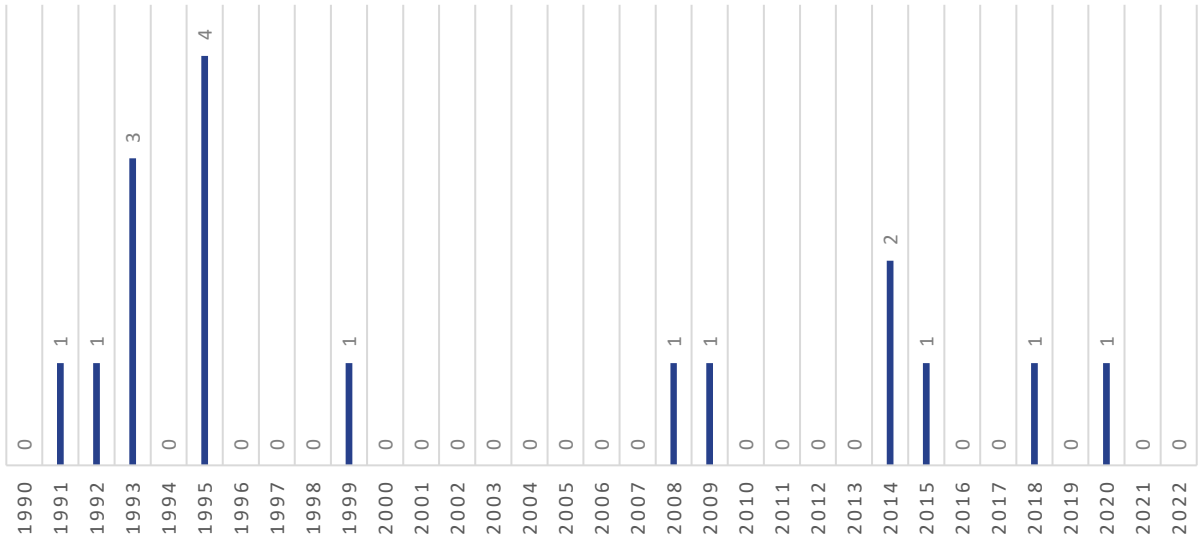
The extent of chemical spills at fixed sites varies and depends on the type of chemical that is released with a majority of events localized to the facility. The probable extent of chemical spills during transportation is difficult to anticipate and depends on the type and quantity of chemical released. In total 17 fixed site releases have occurred in the planning area, and the total amount spilled ranged from 0 gallons to 6,000 gallons with an average spill volume of 759 gallons. Of the 17 chemical spills, two spills led to injuries and four events led to evacuations. The evacuations were minor; involving 181 people total.

Transportation spills ranged from no material released to over 2,000 liquid gallons of material with an average quantity spilled of 289 liquid gallons. 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. The extend scale for this hazard applies the same to all communities in the planning area which have a fixed chemical site or major transportation corridor used for hazardous material transport. The communities of Atkinson and O'Neill contain the most fixed chemical sites in the planning area which may increase overall vulnerability of spill events occurring more frequently.

Probability

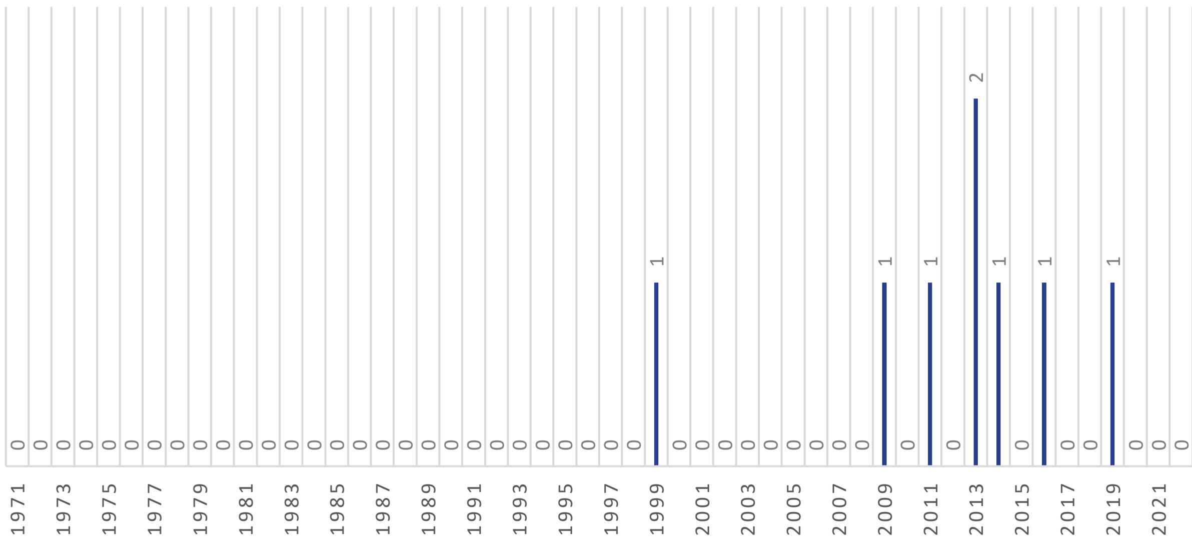
Given the historic record of occurrence for fixed chemical spill events (at least one chemical spill reported in 11 of 33 years), for the purposes of this plan, the annual probability of a fixed chemical spill is 33%. Given the historic record of occurrence for chemical transportation spill events (7 out of 52 years with a reported event), for the purposes of this plan, the annual probability of chemical transportation occurrence is 13%.

Figure 47: Chemical Fixed Site Events by Year



Source: National Response Center, 1990-2022

Figure 48: Chemical Transportation Events by Year



Source: PHMSA, 1971-2022

Future Development

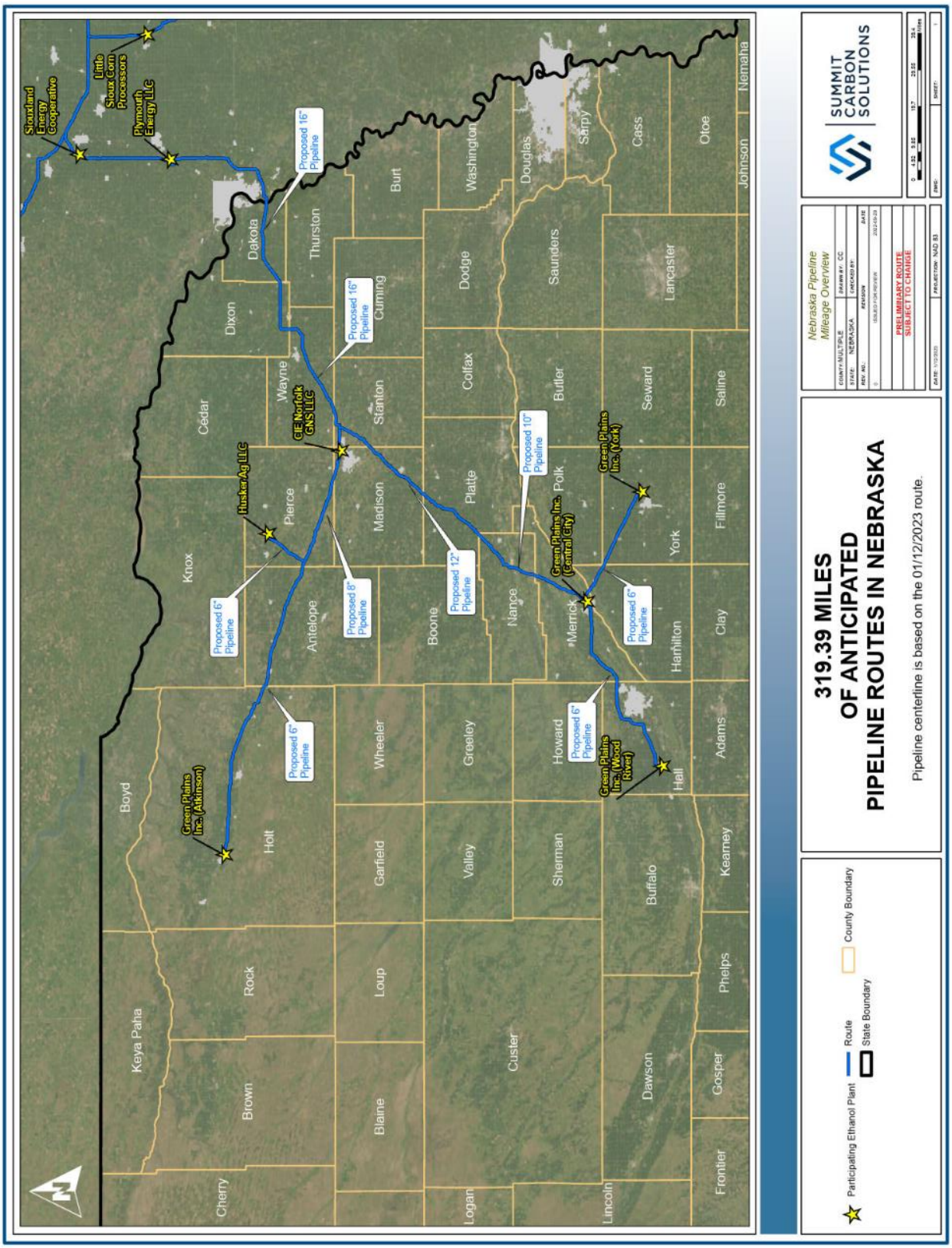
There is a proposed carbon dioxide transport pipeline project which bisects both Antelope and Holt Counties which is anticipated to be constructed in fall 2023 through 2024. The project is managed by Summit Carbon Solutions which describes the endeavor as:

> "Summit Carbon Solutions is partnering with more than 30 ethanol plants across a five-state region. Located in Iowa, Minnesota, North Dakota, South Dakota, and Nebraska, this meaningful investment in the future of agriculture will capture carbon dioxide from the fermentation process of biorefineries such as ethanol plants, compress the captured CO2, and channel it to North Dakota where it will be permanently and safely stored underground in deep geologic storage locations. Doing so will drastically reduce the carbon footprint of ethanol production and enhance the long-term economic viability of the ethanol and agriculture industries. As one of the largest private investments in the region, Summit Carbon Solutions' project will generate thousands of jobs during construction and hundreds of full-time jobs once operational."

There is one participating ethanol plant in the planning area located in Atkinson, the Green Plains Inc. plant. There is a proposed 6" pipeline which will travel from Atkinson across eastern Holt County, across all of Antelope County before branching into neighboring Pierce County to Plainview and Norfolk. A map of the Nebraska project area for the pipeline project is below. More information about the project, milestones, and contacts are found at https://summitcarbonsolutions.com/.

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.

Figure 49: Summit Carbon Pipeline Footprint



Source: Summit Carbon Solutions, 2023

Climate Change Impacts

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,[83] which could damage roadways and pipelines causing more spills to occur.

Community Top Hazard Status

The following table lists jurisdictions which identified Hazardous Material spills as a top hazard of concern:

- Village of Page
- Santee Community Schools District
- Verdigre Public Schools District
- Brunswick Volunteer Fire District
- Creighton Volunteer Fire Department
- North Central District Health Department

Regional Vulnerabilities

To reduce the risk to people and property damage, future development should encourage chemical storage and manufacturing facilities to be built away from critical facilities such as hospitals, schools, daycares, nursing homes, and other residential areas. Likewise, development and critical facilities should be built away from major transportation corridors used for chemical transportation. Specific vulnerabilities exist for critical facilities or vulnerable population centers (schools, daycares, hospital, etc.) which are most heavily populated during the daytime as most chemical transportation incidents occur during the weekday daytime hours.

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

Table 82: Regional Hazardous Materials Vulnerabilities

SECTOR	VULNERABILITY
People	-Those in close proximity could have minor to moderate health impacts -Possible evacuations -Hospitals, nursing homes, and the elderly at greater risk due to low mobility
Economic	-A chemical plant shutdown in smaller communities would have significant impacts to the local economy -Evacuations and closed transportation routes could impact businesses near spill
Built Environment	-Risk of fire or explosion
Infrastructure	-Transportation routes can be closed during evacuations or cleanup
Critical Facilities	-Risk of fire, explosion, or other damages -Risk of evacuation
Climate	-More extreme weather events and flood events put sites at risk of flooding at greater risk

[83] NOAA. August 2022. "Climate Mapping for Resilience and Adaptation". https://livingatlas.arcgis.com/assessment-tool/explore/details.

Landslides

Landslides are downhill or lateral movements of rock, debris, or soil mass. The size of a landslide usually depends on the geology and the landslide triggering mechanism. Landslides are typically triggered by periods of heavy rainfall or rapid snowmelt. Earthquakes, changes to hydrology, removal of vegetation, and excavations may also trigger landslides. Landslides initiated by rainfall tend to be smaller, while those initiated by earthquakes may be very large. Slides associated with volcanic eruptions can include as much as one cubic mile of material. Certain geologic formations are more susceptible to landslides than others. Human activities, including locating development near steep slopes, can increase susceptibility to landslide events. Landslides on steep slopes are more dangerous because movements can be rapid.

Some characteristics that determine the type of landslide are slope of the hillside, moisture content, and the nature of the underlying materials. Landslides are given different names depending on the type of failure, their composition, and characteristics. Types of landslides include slides, rock falls, and flows.

Landslides are the downward and outward movement of slopes with debris. These events include names such as slumps, rockslides, debris slides, lateral spreading, debris avalanche, earth flow, and soil creep. Slow moving landslides can occur on relatively gentle slopes and can cause significant property damage. However, slow moving landslides are far less likely to result in serious injuries than rapidly moving landslides that can leave little time for evacuation.

Rock falls occur when blocks of material come loose on steep slopes. Weathering, erosion, or excavations, such as those along highways, can cause falls where the road has been cut through bedrock. They are fast moving with the materials free falling or bouncing down the slope. The volume of material involved could be large or small, and the velocity of the fall may cause significant damage.

Mud and debris flows are plastic or liquid movements in which land mass (e.g., soil and rock) breaks up and flows during movement. Mud and debris flows are defined as flood events with sediment concentrations that range between approximately 20 and 55 percent by volume. Debris flows normally occur when a landslide moves downslope as a semi-fluid mass scours soils from the slope along its path. When more than half of the materials are larger than sand grains, the event is classified as a debris flow. Flows are typically rapidly moving and can occur during heavy rainfall or are triggered by earthquakes. They can occur on gentle slopes, move rapidly for large distances, and increase in size as they move. Due to their density and sediment, mudflows have significantly slower velocities compared to water floods on the same slope. The fine sediments increase the density of the fluid matrix, which increases the buoyancy of sediments thereby creating conditions that allow gravel to boulder-sized material to be transported near the flow surface by mudflows. [84]

Location

According to Professor Duane Eversoll from the University of Nebraska at Lincoln, "the three elements needed for a landslide to occur are geological formations susceptible to landslide, a slope and precipitation… landslides have occurred throughout Nebraska, they are more common in the eastern and northeastern parts of the state." The area's most vulnerable to this hazard are the rural sections of the planning area, used primarily for ranching. Area in the planning area that have development near land slopes may be more susceptible to this hazard.

[84] Mussetter Engineering Inc. May 2009. "Cornet Creek Watershed and Alluvial Fan Debris Flow Analysis." https://www.sanmiguelcountyco.gov/DocumentCenter/View/273/Telluride-2009-Cornet-Creek-Debris-Flow-Report-PDF.

In addition, post-wildfire burn areas are highly susceptible to mud and debris flow events. After a wildfire, the probability of mud and debris flow increases significantly. The loss of vegetative cover in burn areas increases run-off rates. The burned and barren slopes are more prone to erosion, resulting in increased peak discharge and bulking rates.[85] Relatively frequent storm events of high intensity, and short durations, have the potential to cause unusually large mudflow events in post-wildfire conditions.[86] The burning of organic material matter on the ground can:

(1) create high temperatures on the ground causing hydrophobicity, which is the tendency of the soil to resist wetting or infiltration of moisture;

(2) decrease the roughness of the ground; and

(3) increase the erosive capacity of the soil.

Historical Occurrences

The University of Nebraska's Collection of Nebraska Landslides reports events as they occur in each county. There were 86 landslide events that occurred between 1960 and 2020. Five events occurred in Holt County with the rest occurring in Knox County. There was no reported damage from these events. Figure 50 shows the locations of the landslides.

Average Annual Losses

The average damage per event estimated was determined based upon the University of Nebraska's Collection of Nebraska Landslides from 1960 to 2020 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. There was no reported property or crop damage from these events.

Table 83: Agricultural Disease Losses

HAZARD TYPE	NUMBER OF EVENTS	EVENTS PER YEAR	TOTAL PROPERTY LOSS	AVERAGE ANNUAL PROPERTY LOSS	TOTAL CROP LOSS	AVERAGE ANNUAL CROP LOSS
Plant Disease	86	1.4	$0	$0	$0	$0

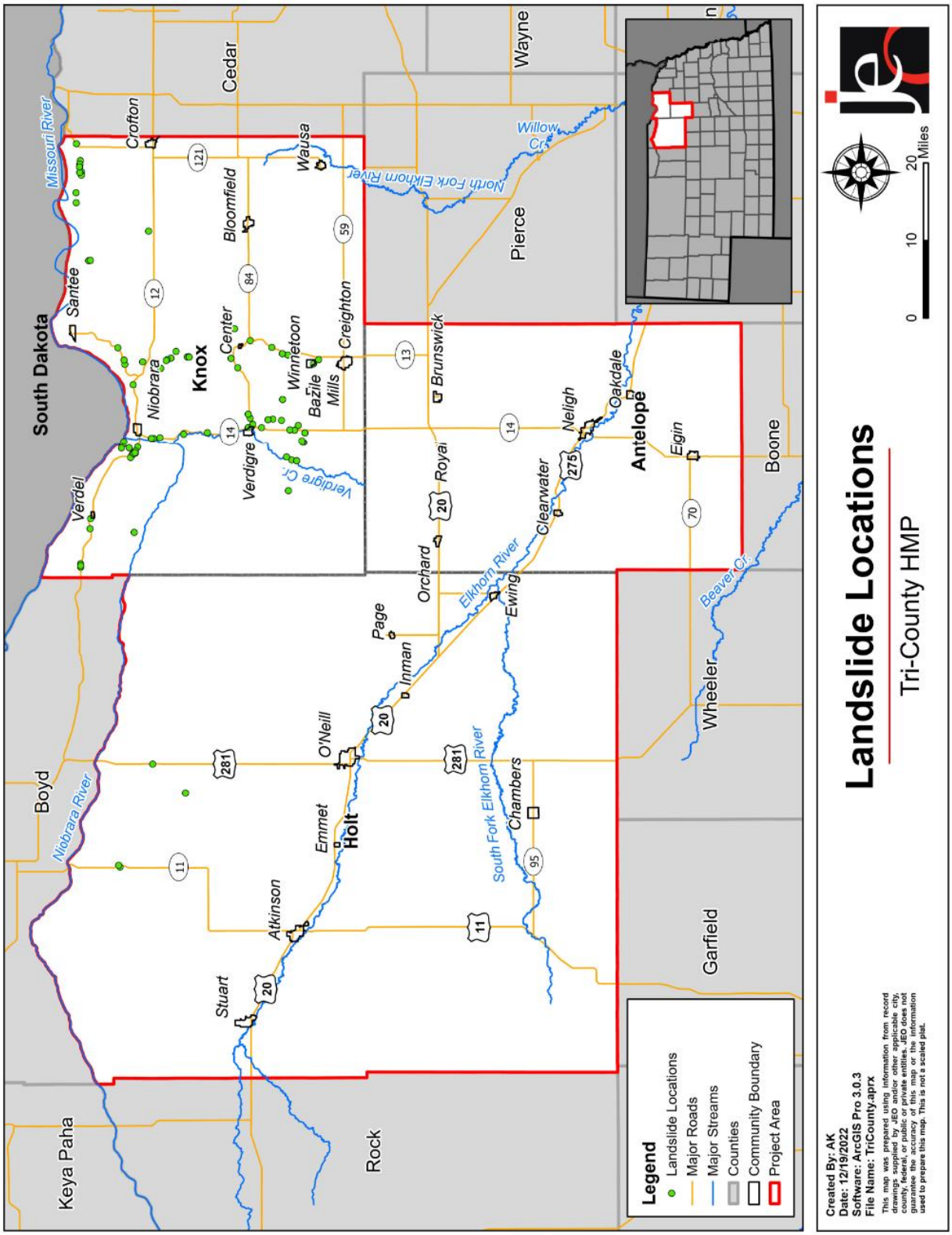
Source: University of Nebraska, 1960-2020

Extent

Rapidly moving landslides (debris flows and earth flows) present the greatest risk to human life. Landslides can be massive, or they may disturb only a few cubic feet of material. The majority of events in the planning area are likely to cause limited property damage; limited or no deaths and injuries; and little or no impacts to critical facilities and infrastructure. However, single events near populated areas or key infrastructure may have significant impacts. Persons living in or traveling through areas prone to rapidly moving landslides should take caution. Slow moving landslides can cause significant property damage but are less likely to result in serious human injuries.

[85] White, J. L., Wait, TC, and Morgan M.L. 2008. "Geologic Hazards Mapping Project for Montrose County, Colorado." Colorado Geological Survey Department of Natural Resources.
[86] Rosgen, D. and Rosgen, B. 2013. "Restoring Alluvial Fan Connectivity for Post-Fire Flood Alleviation and Sediment Reduction."

Figure 50: Landslides in the Planning Area



Given the unique geographical landscape of the planning area, there are many large slopes which are conducive for landslides to occur. Given a lack of reported landslide impacts, no reported economic damages, and the rural nature of this region, the extent of a landslide event is likely minimal. Further, the most vulnerable locations for landslides in Knox County are in non-developed, rural areas. Communities in the planning area are located away from areas most vulnerable to landslides. The average length of the reported landslides was 203 feet, and the average width was 325 feet. Lengths ranged from 30 to 2,640 feet and widths ranged from 25 to 1,700 feet.

Probability

The University of Nebraska reports 86 landslide events from 1960 to 2020. However, many events did not provide a date of occurrence. Thus, it is not possible to determine annual probability.

Future Development

Any future developments which occur near, or alongside steep slopes are likely to be at increased risk of landslides events. Growing communities near bluffs can either adopt stricter building requirements for new developments or substantial improvements to infrastructure or implement landslide mitigation measures such as mesh netting or slope stabilization activities.

Climate Change Impacts

While specific projections related to landslide events from climate change cannot be made, certain assumptions can be made based on weather/climatic phenomenon that influence landslides. Climate reports indicate there will likely be an increase in drought and wildfire events across the state, as previously stated drought and wildfire events increase the probability and intensity of landslides. In the case of a post-wildfire condition and in combination of heavy precipitation, it is likely landslides, debris flows, and mudslides may occur more frequently.

The connection between drought, fire and flood are all likely to influence the occurrence of landslides. For the purposes of this plan, it is assumed that as current climate trends continue to develop it is probable that landslide events will increase in frequency for the planning area. Large mudflows can occur when a relatively common rainfall event (for example, a two-year event) happens over a watershed that has been exposed to wildfire. As the vegetation and soil in a burned area recover and the watershed returns to its pre-burn hydrologic condition, the depth and intensity of rainfall necessary to generate a mudflow will generally increase for a given location.

Community Top Hazard Status

No jurisdictions identified Landslides as a top hazard of concern:

Regional Vulnerabilities

Although landslides are a natural geologic process, the incidence of landslides and their impacts on people can be exacerbated by human activities. Grading for road construction and development can increase slope steepness and decrease the stability of a hill slope by adding weight to the top of the slope, removing support at the base of the slope, and increasing water content. Other human activities affecting landslides include excavation, drainage and groundwater alterations, and changes in vegetation. Development sites with the greatest risk from landslides are against the base of very steep slopes, in confined stream channels (small canyons), and on fans (rises) at the mouth of these confined channels.

Landslides can affect utility services, transportation systems, and critical lifelines. Communities may suffer immediate damage and loss of service. Disruption of infrastructure, roads, and critical facilities may also have a long-term effect on the economy. Utilities, including potable water, wastewater, telecommunications, natural gas, and electric power are all essential community needs. Loss of electricity

has the most widespread impact on other utilities and on the whole community. Natural gas pipes may also be at risk of breakage from landslide movements as small as one to two inches.

Roads and bridges are subject to closure during landslide events. Because many rural residents are dependent on roads and bridges for travel to work, delays and detours are likely to have an economic impact. Lifelines and critical facilities should remain accessible, if possible, during a natural hazard event. The impact of closed transportation arteries may increase if the closed road or bridge is a critical lifeline to hospitals or other emergency facilities. Therefore, inspection and repair of critical transportation facilities and routes are essential and should receive high priority. Losses of power and phone service are also potential consequences of landslide events. Due to heavy rains, soil erosion in hillside areas can be accelerated, resulting in loss of soil support beneath high voltage transmission towers in hillsides and remote areas. Flood events can also cause landslides, which can have serious impacts on gas lines.

The following tables provide information related to regional vulnerabilities and FEMA's National Risk Index values for Landslides. For jurisdictional specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 84: National Risk Index Landslides Vulnerabilities

RISK INDEX FACTOR	ANTELOPE COUNTY	HOLT COUNTY	KNOX COUNTY
Risk Index	Very Low (7.3)	Very Low (5.79)	Relatively Moderate (15.52)
Expected Annual Loss	Very Low (9.03)	Very Low (6.74)	Relatively Low (14.39)

Source: FEMA National Risk Index, 2022

Table 85: Regional Landslides Vulnerabilities

SECTOR	VULNERABILITY
People	-Potential injury to people nearby
Economic	-Agricultural losses -Damages to infrastructure could impact businesses and the local economy
Built Environment	-Minimal risk to buildings and foundations
Infrastructure	-damage to roads, power lines, and water lines
Critical Facilities	-Potential damage to infrastructure
Climate	-Increases in other weather events (flood, fire, drought, heavy rain) could lead to additional or more severe landslide events

Public Health Epidemic

According to the World Health Organization, 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, change the functions of state agencies.[87]

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

Some of the best actions or treatments for public health emergencies are nonpharmaceutical interventions (NPI). These are readily available behaviors or actions, and response measures people and communities can take to help slow the spread of respiratory viruses such as influenza or coronavirus. 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.[88] Pandemics are global or national disease outbreaks. These types of illnesses, such as influenza, can spread easily 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 public health emergency 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 (H2N2) 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.
- 1968 H3N2 Virus: an influenza A virus discovered in the United States in September 1968 which killed over 100,000 citizens. Most 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 60.8 million cases and 12,469 deaths.
- 2019 Mumps: a highly contagious illness spread by coughing, sneezing, and or sharing saliva. Mumps outbreaks can still occur in areas which have received the MMR vaccine. Symptoms of

[87] World Health Organization. 2008. Accessed April 2020. "Glossary of humanitarian Terms." https://www.who.int/hac/about/definitions/en/.
[88] 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

mumps can include fever, headache, loss of appetite with other complications extending to inflammation of the testicles, ovaries, pancreas, and/or brain and deafness.

- 2019 COVID-19: the coronavirus disease 2019 is a contagious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which originated in Wuhan China and spread globally. As of November 28, 2022, the CDC reported in the U.S. over 98 million total cases and over one million deaths attributed to COVID-19. Efforts to control and limit the virus included face coverings, self-isolation, quarantine, increased cleaning measures, social distancing, and vaccinations. Significant impacts to the national and global economy have been caused by COVID-19.

The State of Nebraska Department of Health and Human Services (DHHS) 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. The North Central District Health Department covers all three counties in the planning area.[89]

Location

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

Historical Occurrences

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

- 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 100F, 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.[90] 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

[89] Nebraska Department of Health and Human Services. Accessed December 2020. "Local Health Departments." http://dhhs.ne.gov/Pages/Local-Health-Departments.aspx

[90] CDC. June 2009. "Novel H1N1 Flu Situation Update." https://www.cdc.gov/h1n1flu/updates/061209.htm.

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 instituted mask mandates and other directed health measures to protect residents from the spread of COVID-19.

The table below displays COVID-19 confirmed cases and vaccination rates for the planning area. However, available data for total cases, fatalities, and vaccination rates is limited due to a lack of reporting or access. These rates will likely increase as time goes on until the entire population can be fully vaccinated.

Table 86: COVID-19 in the Planning Area

COUNTY	TOTAL CASES	% OF PEOPLE VACCINATED
Antelope	1,765	37.68%
Holt	2,783	43.23%
Knox	2,378	51.03%

Source: Mayo Clinic[91], Springfield News-Leader[92]

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.[93] However, associated costs with pandemic response are much greater. Current estimated costs for COVID-19 in the United States exceed $16 trillion (as of December 2020). 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.

Extent

Those most affected by public heath emergencies are typically the very young, the very old, the immune-compromised, the economically vulnerable, and the unvaccinated. Roughly 25% of the planning area's population is 19 years or younger, and approximately 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 five hospitals and 14 rural health clinics located in the planning area. Facilities are listed in the table below.

[91] Mayo Clinic. "Nebraska COVID-19 map: What do the trends mean for you?". Accessed November 2022. https://www.mayoclinic.org/coronavirus-covid-19/map/nebraska .
[92] Springfield News-Leader. November 9,2022. "Nebraska COVID-19 Vaccine Tracker". https://data.news-leader.com/covid-19-vaccine-tracker/nebraska/31/
[93] 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.

Table 87: Health Facilities in the Planning Area

COUNTY	FACILITY NAME	NEAREST COMMUNITY	TOTAL LICENSED BEDS
Antelope	Antelope Memorial Hospital	Neligh	23
Holt	Avera St. Anthony's Hospital	O'Neill	25
Holt	West Holt Memorial Hospital	Atkinson	15
Knox	Sacred Heart Health Services Care Center	Creighton	47
Knox	Sacred Heart Health Services Hospital	Creighton	23
Antelope	AMH Clearwater Clinic	Clearwater	-
Antelope	AMH Elgin Clinic	Elgin	-
Antelope	AMH Family Practice	Neligh	-
Antelope	AMH Tilden Clinic	Tilden	-
Antelope	Orchard Medical Clinic	Orchard	-
Holt	Elkhorn Valley Family Medicine Pc	O'Neill	-
Holt	Greater Sandhills Family Healthcare	Atkinson	-
Holt	Greater Sandhills Family Healthcare	Stuart	-
Holt	St. Anthony's Hospital	O'Neill	-
Holt	West Holt Medical Clinic	Atkinson	-
Knox	Sacred Heart Health Services	Niobrara	-
Knox	Sacred Heart Health Services	Verdigre	-
Knox	Sacred Heart Health Services	Crofton	-
Knox	Wausa Medical Clinic	Wausa	-

Source: Nebraska Department of Health and Human Services[94]

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 88: Health Care Professional Shortage Areas in the Planning Area

COUNTY	DESIGNATION TYPE	DESIGNATION DATE	TYPE OF CARE
Antelope, Holt, and Knox	Geographic HPSA	7/20/1978	Mental Health
Holt County	Rural Health Clinic	12/21/2020	Primary Care
Holt County	Rural Health Clinic	8/4/2009	Primary Care
Holt County	Rural Health Clinic	8/4/2009	Primary Care
Holt County	Rural Health Clinic	8/5/2021	Primary Care
Holt County	Rural Health Clinic	12/21/2020	Dental health
Holt County	Rural Health Clinic	8/4/2009	Dental Health
Holt County	Rural Health Clinic	8/4/2009	Dental Health
Holt County	Rural Health Clinic	8/5/2021	Dental Health
Holt County	Rural Health Clinic	12/21/2020	Mental Health
Holt County	Rural Health Clinic	8/4/2009	Mental Health

[94] Department of Health and Human Services. September 2020. "Hospitals." http://dhhs.ne.gov/publichealth/Documents/Hospital%20Roster.pdf.

COUNTY	DESIGNATION TYPE	DESIGNATION DATE	TYPE OF CARE
Holt County	Rural Health Clinic	8/4/2009	Mental Health
Holt County	Rural Health Clinic	8/5/2021	Mental Health
Knox County	Indian Health Service, Tribal Health, and Urban Indian Health Organizations	10/25/2002	Primary Care
Knox County	Indian Health Service, Tribal Health, and Urban Indian Health Organizations	4/2/2012	Dental Health
Knox County	Indian Health Service, Tribal Health, and Urban Indian Health Organizations	4/2/2021	Mental Health
Knox County	Federally Qualified Health Center	7/31/2008	Primary Care
Knox County	Federally Qualified Health Center	7/31/2008	Dental Health
Knox County	Federally Qualified Health Center	7/31/2008	Mental Health

Source: Health Resources and Services Administration[95]

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 89: Medically Underserved Areas/Populations in the Planning Area

COUNTY	SERVICE AREA	DESIGNATION TYPE	DESIGNATION DATE	TYPE OF CARE
Antelope	Antelope Service Area	Medically Underserved Area	11/1/1978	Primary Care
Holt	Holt Service Area	Medically Underserved Area	11/1/1978	Primary Care
Knox	Knox Service Area	Medically Underserved Area	11/1/1978	Primary Care

Source: Health Resources and Services Administration[96]

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.[97]

Table 90: Diabetes Prevalence in the Planning Area (2017)

COUNTY	DIAGNOSED DIABETES RATE (TOTAL ADULTS AGE 20+)	SOCIAL VULNERABILITY INDEX (SVI) PERCENTILE
Antelope	8.2%%	0.1032
Holt	7.8%	0.0981
Knox	8.0%	0.3277
State of Nebraska	8.9%	-

Source: Centers of Disease Control and Prevention, 2019[98]*; State data is from 2020*

The extent to which populations are affected by communicable diseases depends greatly on the attack rate and duration of the disease, and the extent to which herd immunity has been established by the community through effective vaccination programs. Nebraska state law (Title 173) requires all students have the following vaccinations: tetanus, diphtheria, pertussis, measles, mumps, rubella, varicella, and hepatitis B, with the option to wave the requirements for religious objections. Nebraska state law also requires that postsecondary educational institutions recommend meningococcal vaccination. Diphtheria, tetanus, pertussis, poliovirus, haemophilus influenza type b, measles, hepatitis B and varicella vaccination rates in are recommended for children 19-35 months. Influenza vaccinations are recommended yearly for those over 6 months old. The Vaccines for Children (VFC) program is a federally funded and state-operated

[95] Health Resources and Services Administration. "HPSA Find". Accessed November 2022. https://data.hrsa.gov/tools/shortage-area/hpsa-find.
[96] Health Resources and Services Administration. "MUA Find". Accessed November 2022 https://data.hrsa.gov/tools/shortage-area/mua-find
[97] Centers for Disease Control and Prevention. 201y. "Diagnosed diabetes prevalence – Nebraska." https://gis.cdc.gov/grasp/diabetes/DiabetesAtlas.html.
[98] Centers for Disease Control and Prevention. "Diagnosed diabetes prevalence – Nebraska". Accessed November 2022. https://gis.cdc.gov/grasp/diabetes/DiabetesAtlas.html.

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.

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.

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.

Climate Change Impacts

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.[99] 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.

Community Top Hazard Status

The following jurisdictions identified Public Health Emergency as a top hazard of concern:

- City of Elgin
- Village of Verdel
- North Central District Health Department

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

[99] Intergovernmental Panel on Climate Change. 2022. "Climate Change 2022: Impacts, Adaptation and Vulnerability". https://www.ipcc.ch/report/ar6/wg2/.

of public health preparedness for diseases, disasters, and bioterrorism." The following figure describes Nebraska's overall statistics.

Figure 51: Trust for America Public Health Statistics

Source: Trust for America's Health, 2019

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

Table 91: Regional Public Health Emergency Vulnerabilities

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

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 the cold upper air sinks and the 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, 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; and death or injury to humans and animals from lightning, drowning, or getting struck by falling or flying debris. Figure 52 displays the average number of days with thunderstorms across the country each year. The planning area experiences an average of 36 to 45 thunderstorms over the course of one year.

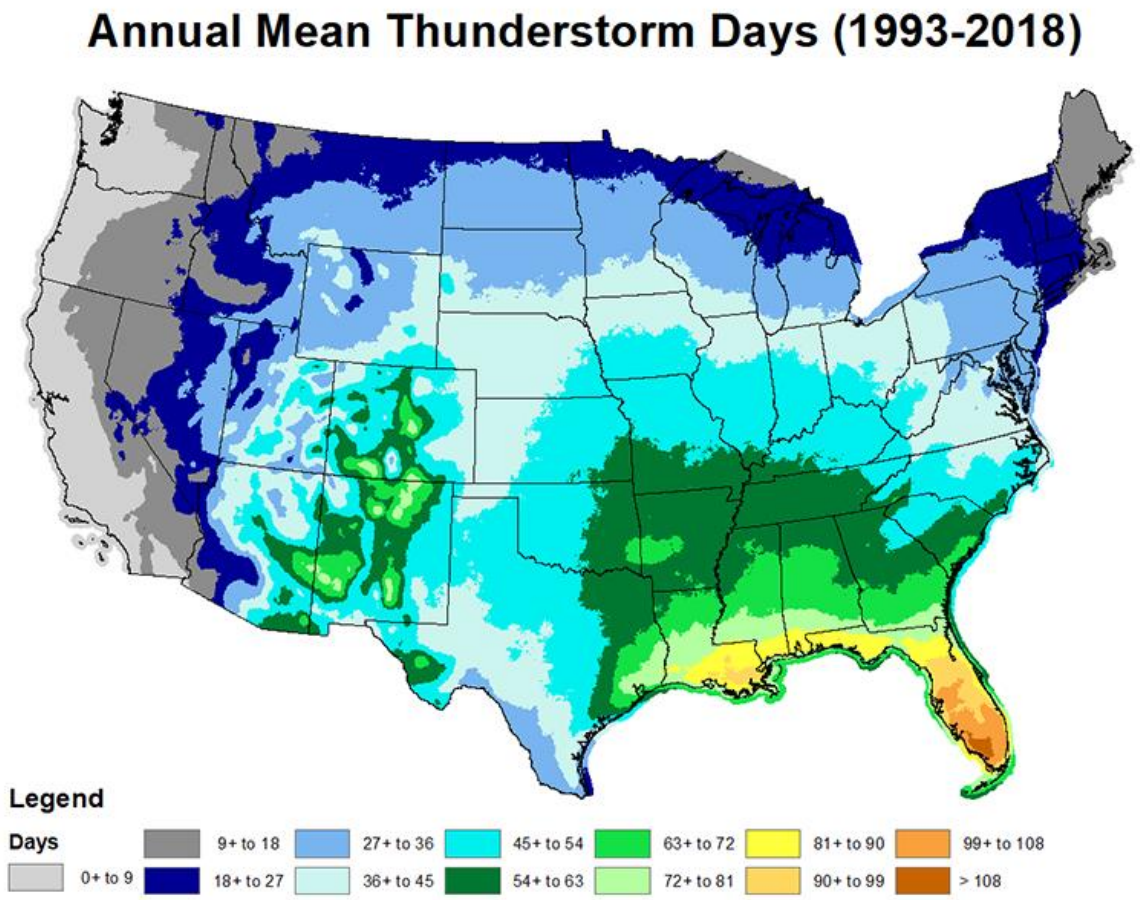
Location

The entire three-county planning area is at risk to thunderstorms and associated damages from heavy rain, lightning, hail, and thunderstorm level winds.

Historical Occurrences

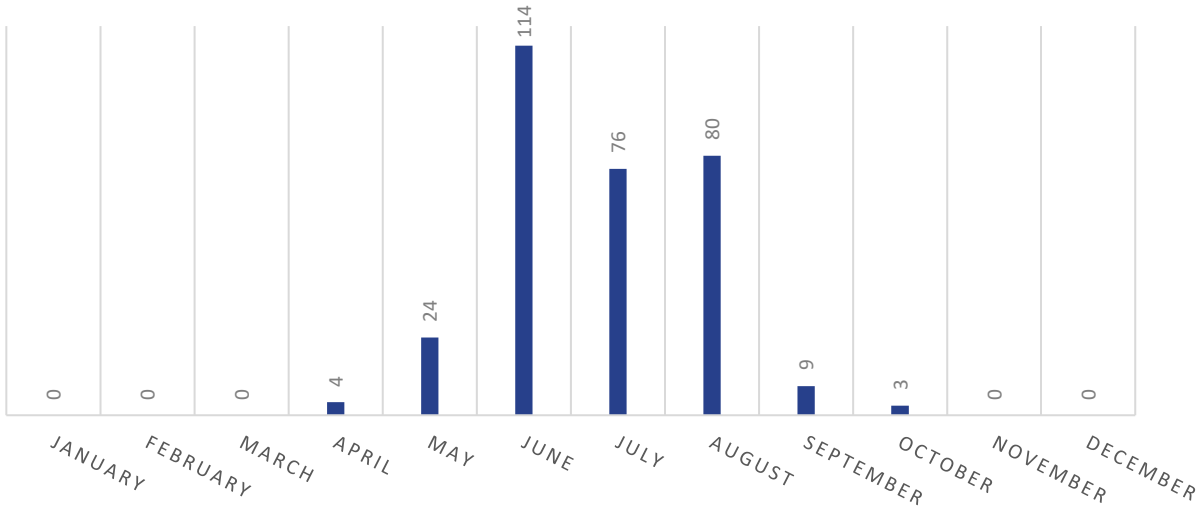
Severe thunderstorms in the planning area usually occur in the afternoon and evening during the summer months.

Figure 52: Average Annual Thunderstorms



Source: NWS, 2019[100]

Figure 53: Thunderstorm Wind Events by Month



Source: NCEI, 1996-202022

[100] National Weather Service. 2019. "Global Weather: Introduction to Thunderstorms." https://www.weather.gov/jetstream/tstorms_intro.

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 1,194 total severe thunderstorm events. Of those there were:

- Hail 872 events
- Heavy Rain 8 events
- Lightning 5 events 1 fatality
- Thunderstorm Wind 309 events 1 fatality, 2 injuries

In total these events were responsible for $6,112,400 in property damage. The USDA RMA data does not specify severe thunderstorms as a cause of loss, however heavy rains and hail which may be associated with severe thunderstorms caused $135,538,242 in crop damages. There were two injuries and two fatalities reported in association with these storm events.

Average Annual Losses

The average damage per event estimate was determined based upon recorded damages from NCEI Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Severe thunderstorms cause an average of $226,385 per year in property damage.

Table 92: Severe Thunderstorm 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
Hail	872	32.3	$3,798,500	$140,685	$68,254,470	$2,967,585
Heavy Rain	8	0.3	$0	$0	$67,283,772	$2,925,381
Lightning	5	0.2	$15,500	$574	-	-
Thunderstorm Winds	309	11.4	$2,298,400	$85,126	-	-
Totals	**1,194**	**44.2**	**$6,112,400**	**$226,385**	**$135,538,242**	**$5,892,967**

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

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. Thunderstorm wind events in the planning area ranged from 50mph to 75mph with an average wind speed of 58mph.

The NCEI reported 872 individual hail events across the planning area. As the NCEI reports events per county, this value overestimates the total amount of thunderstorm events. 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 93outlines the TORRO Hail Scale. The average hailstone size was 1.19 inches. Events of this magnitude correlate to an H4 Severe classification. It is reasonable to expect hail events between H0 and H4 to occur several times in a year throughout the planning area. In addition, it is

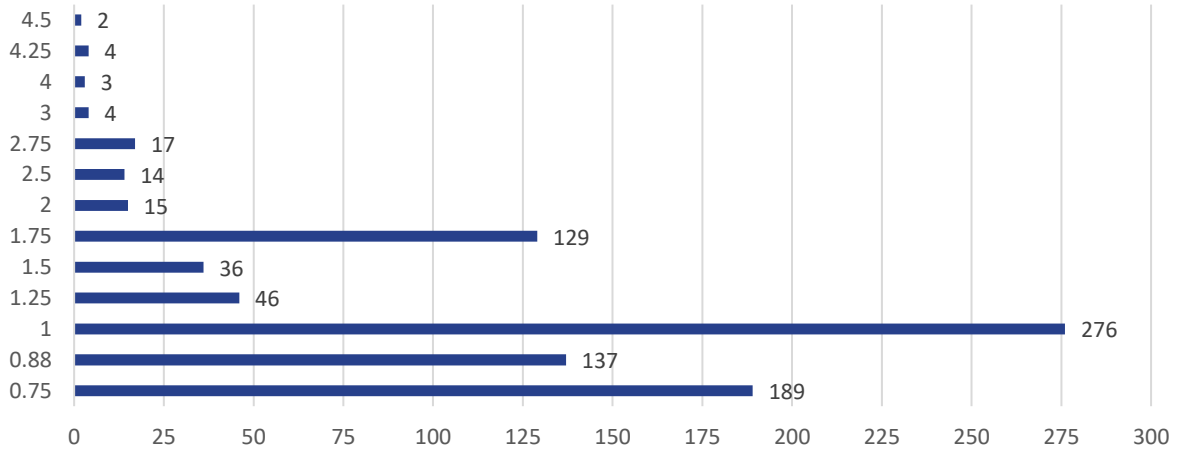
reasonable, based on the number of occurrences, to expect larger hailstones to occur in the planning area annually. The planning area has endured six H10 hail events (>4.0 inches) during the period of record. Figure 54 shows hail events based on the size of the hail.

Table 93: TORRO Hail Ranking

Class	Type of Material	Divisions
H0: Hard Hail	5 mm; 0.2 in (pea size)	No damage
H1: Potentially Damaging	5-15 mm; 0.2-0.6in (marble)	Slight general damage to plants and crops
H2: Significant	10-20 mm; 0.4-0.8 in (grape)	Significant damage to fruit, crops, and vegetation
H3: Severe	20-30 mm; 0.8-1.2 in (walnut)	Severe damage to fruit and crops, damage to glass and plastic structures
H4: Severe	30-40mm; 1.2-1.6 in (squash ball)	Widespread damage to glass, vehicle bodywork damaged
H5: Destructive	40-50 mm; 1.6-2.0 in (golf ball)	Wholesale destruction of glass, damage to tiled roofs; significant risk of injury
H6: Destructive	50-60 mm; 2.0-2.4 in (chicken egg)	Grounded aircrafts damaged, brick walls pitted; significant risk of injury
H7: Destructive	60-75 mm; 2.4-3.0 in (tennis ball)	Severe roof damage; risk of serious injuries
H8: Destructive	75-90 mm; 3.0-3.5 in (large orange)	Severe damage to structures, vehicles, airplanes, risk of serious injuries
H9: Super Hail	90-100 mm; 3.5-4.0 in (grapefruit)	Extensive structural damage, risk of severe or even fatal injuries to persons outdoors
H10: Super Hail	>100 mm; >4 in (melon)	Extensive structural damage; risk of severe or even fatal injuries to persons outdoors.

Source: TORRO, 2017[101]

Figure 54: Hail Events by Magnitude



Source: NCEI, 1996-2022

[101] Tornado and Storm Research Organization. 2017. "Hail Scale." http://www.torro.org.uk/hscale.php.

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.

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 1,194 severe thunderstorm events between 1996 and 2022 and at least one event occurring each year within the period of record. Thus, resulting in a 100 percent chance annually for thunderstorms.

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 for 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.

Climate Change Impacts

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."[102] Projected trends for precipitation and temperature indicate more favorable conditions for severe thunderstorms to develop more readily and grow larger. 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."[103] There is also some suggestion in the models that the atmosphere will become more favorable to severe thunderstorm development and increased intensity.

Community Top Hazard Status

The following jurisdictions identified Severe Thunderstorms as a top hazard of concern:

- Antelope County
- City of Atkinson
- Village of Brunswick
- Village of Clearwater
- Holt County
- Village of Inman
- Knox County
- Village of Oakdale
- City of O'Neill
- Village of Page
- Village of Royal
- Chambers Public Schools District
- Crofton Public Schools District
- Elgin Public Schools District
- Neligh-Oakdale Public Schools District
- Summerland Public Schools District
- Wausa Public School District
- Creighton Volunteer Fire Department
- Elgin Volunteer Fire District

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

[103] 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/.

Regional Vulnerabilities

The following tables provide information related to regional vulnerabilities and FEMA's National Risk Index values for Severe Thunderstorms. For jurisdictional specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 94: National Risk Index Severe Thunderstorms Vulnerabilities

HAZARD TYPE	RISK INDEX FACTOR	ANTELOPE COUNTY	HOLT COUNTY	KNOX COUNTY
Hail	Risk Index	Relatively Low (9.13)	Relatively Moderate (15.69)	Relatively High (26.95)
	Expected Annual Loss	Relatively Low (9.65)	Relatively Moderate (15.6)	Relatively Moderate (21.34)
Lightning	Risk Index	Very Low (7.01)	Relatively Low (10.68)	Relatively Low (10.04)
	Expected Annual Loss	Very Low (10.19)	Relatively Low (14.61)	Very Low (10.94)

Source: FEMA National Risk Index, 2022

Table 95: Regional Severe Thunderstorm Vulnerabilities

SECTOR	VULNERABILITY
People	-Elderly citizens with decreased mobility may have trouble evacuating or seeking shelter -Mobile home residents are at risk of injury and damage to their property if the mobile home is not properly anchored -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 lighting can cause power outages and down power lines -Roads may wash out from heavy rains and become blocked from downed tree limbs
Critical Facilities	-Power outages are possible -Critical facilities may sustain damage from hail, lightning, and wind
Climate	-Changes in seasonal precipitation and temperature normals can increase frequency and magnitude of severe storm events
Other	-High winds, hail, lightning, heavy rain, and possibly tornadoes can occur with this hazard

Severe Winter Storms

Severe winter storms are an annual occurrence in Nebraska. Winter storms can bring extreme cold, freezing rain, heavy or drifting snow, and blizzards. Blizzards are particularly dangerous due to drifting snow and the potential for rapidly occurring whiteout conditions which greatly inhibit vehicular traffic. Generally, winter storms occur between eh 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, freezing rain, and blizzards also occur alongside many severe winter storms.

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 average low temperature. For the planning area, the coldest months of the year are January, February, and December. The average low temperature for these months are all below freezing (average low for the three months in the planning area is 12.4°F). The average high temperatures for the months of January, February, and December are near 34.2°F in the planning area.[104]

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 and 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.

Blizzards

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

Location

The entire three-county planning area is at risk to severe winter storms and associated damages from blizzards, heavy snow, extreme cold, ice storms, winter weather, and winter storms.

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 252 severe winter storm events for the planning area from January 1996 to January 2022. These recorded events caused a total of $14,044,000 in property damage and $6,507,635 in crop damages. The most damaging event was a heavy snow event which impacted Holt

[104] High Plains Regional Climate Center. 2020. "Monthly Climate Normals 1981-2010." http://climod.unl.edu/.

County on November 27th, 2005, which caused $5,410,000 in property damages. No storm events led to injuries or fatalities.

Average Annual Losses

The average damages 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 $520,148 per year in property damage to the planning area.

Table 96: Severe Winter Storms 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
Blizzard	40	1.5	$5,441,000	$201,519	$6,507,635	$295,802
Extreme Cold	27	1	$0	$0		
Heavy Snow	31	1.1	$0	$0		
Ice Storm	8	0.3	$0	$0		
Winter Storms	125	4.6	$8,603,000	$318,629		
Winter Weather	21	0.8	$0	$0		
Totals	**252**	**9.3**	**$14,044,000**	**$520,148**	**$6,507,635**	**$295,802**

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

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

- ***Winter Storm, 12/29/2006 ($5,000,000 in property damages)-*** *Freezing rain accumulated at least 1/2 inch and over 1 inch in some locations on trees, power lines, vehicles and other untreated objects. With temperatures below freezing for most of the event in sections of northeast Nebraska, much of this rain fell as freezing rain, except over the northern half of Knox County where the precipitation started as moderate snow. The weight of the ice, and a mix of light sleet and snow that also fell, caused widespread tree damage and also felled numerous power lines and power poles throughout the county. At least 550 power poles were downed in Antelope County, mainly on east-west roads, with over 1,000 either needing repair or replacement. This caused widespread power outages that continued for at least several days after the event. Fallen trees also caused damage to cars and houses over the area. It was estimated that every tree in Neligh was damaged and 40 to 50 percent of them were damaged so much that they would need to be removed according to the Neligh City Superintendent. An estimated 5 million dollars in damage was done to utility companies from this storm.*
- ***Winter Storm, 12/6/2005 ($3,000,000 in property damages) -*** *An intense low-pressure system that tracked from Kansas into Iowa brought a major winter storm to much of Nebraska and adjacent sections of Colorado, Kansas and the Dakotas Sunday and Monday November 27th and 28th. The storm caused blizzard conditions across a large part of central and northeast Nebraska and shut down a 220-mile stretch of Interstate 80 much of Monday. The Interstate remained*

closed into Tuesday morning. In addition, many, if not most, other roads in central and northeast Nebraska were closed for at least a time during the storm. Many vehicles were stranded on roads or slid or drove into ditches. In northeast Nebraska the precipitation began as rain Sunday afternoon, changing over to freezing rain Sunday evening. Significant ice accumulations began after midnight on the 28th, mainly from Albion and Neligh north and northeast into Knox, Madison and Pierce counties. Ice accumulations of 1/4 to 1/2 inch or even more were common from Neligh through Pierce, Bloomfield and Niobrara. Some locations in Antelope and Boone counties reported over 1 inch ice accumulations on power line equipment. When winds picked up Sunday night, many tree branches and power lines and poles were downed because of the ice accumulations. Heavier snow accumulations from the storm included 13 inches in Bloomfield, 12 inches in Niobrara, 10 inches in Crofton, 9 inches at Neligh, 7 inches in Madison and 6 inches at Stanton and Norfolk. In addition to the snow, very strong winds were reported throughout the region, with sustained winds of 40 mph or more and frequent gusts over 50 mph common. The strong winds caused some 5 to 15 foot drifts, especially north of an Albion to Norfolk line. Some gusts of 50 knots or greater (58 mph) were also recorded. At least one indirect fatality was recorded from the storm in northeast Nebraska. A head-on collision occurred Monday morning near Humphrey, near the junction of Highways 81 and 91 north of Columbus, when a driver crossed the center line in near white-out conditions and was struck by a semi-tractor trailer. Overall, damage from the storm in Nebraska was estimated at $5.3 million, a large part to public and private utility companies.

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. The most common accumulation during ice storms was a quarter of an inch. The following figure shows the SPIA index.

Figure 55: SPIA Index

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index"

Copyright, February, 2009

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	

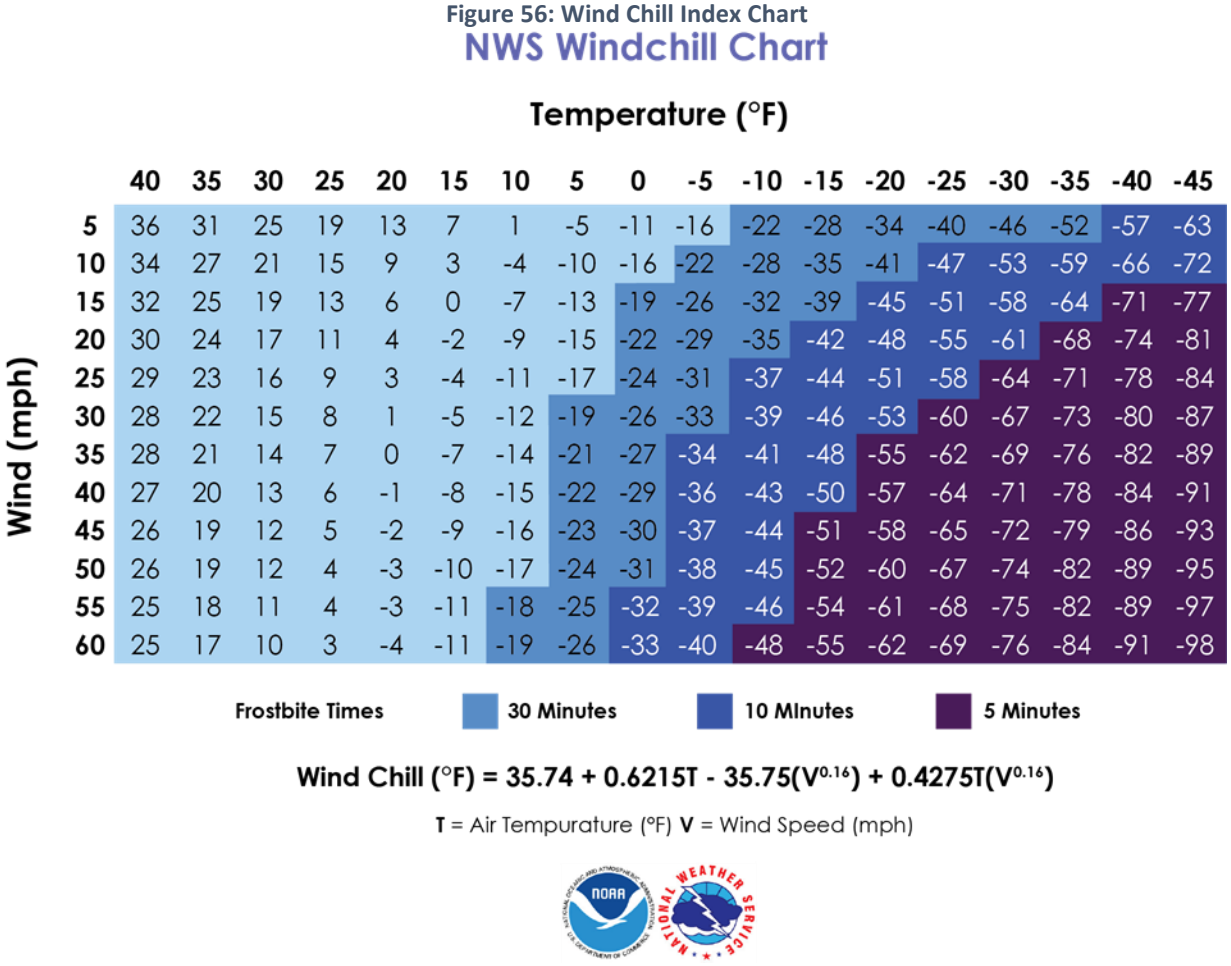
(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Source: SPIA-Index[105]

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. The following figure shows the Wind Chill Index used by the NWS.

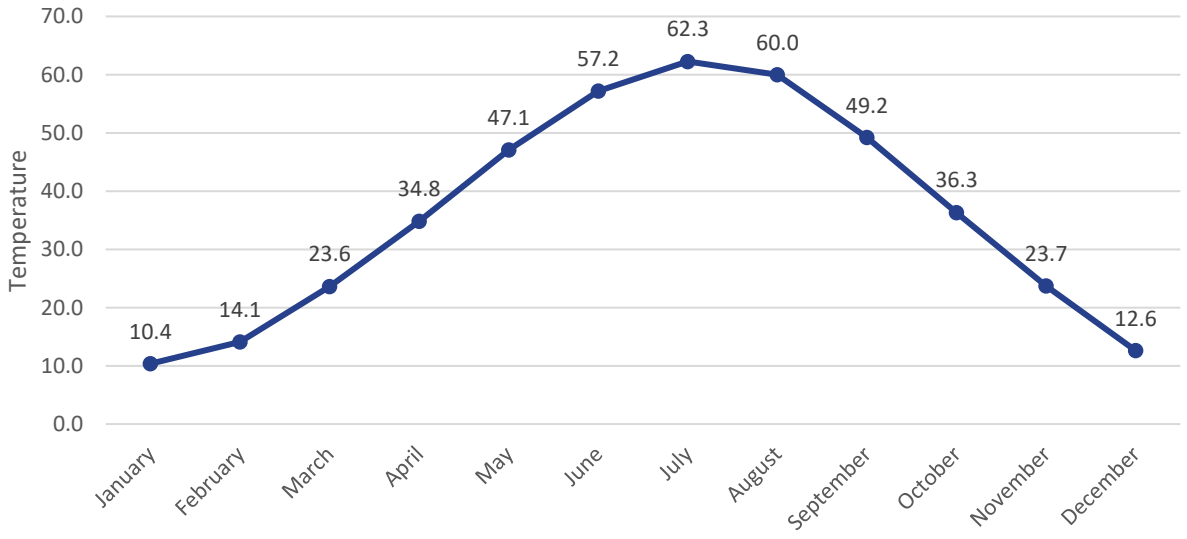
[105] SPIA-Index. 2009. "Sperry-Piltz Ice Accumulation Index." https://www.spia-index.com/.

Figure 56: Wind Chill Index Chart



Source: NWS

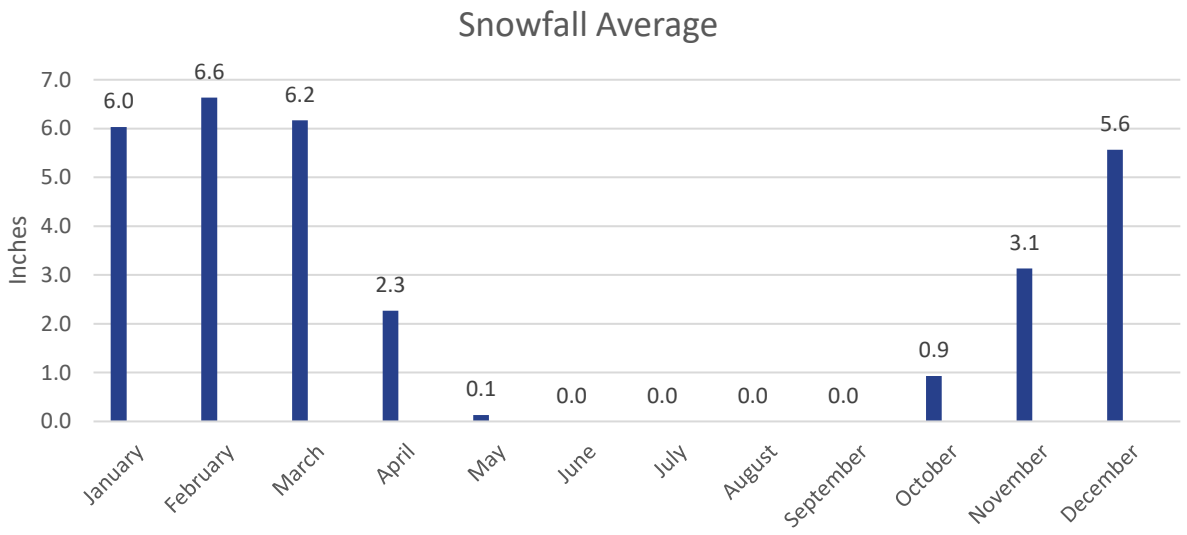
Figure 57: Monthly Climate Normals Min Temperature (1981-2010)



Source: NCEI

Average monthly snowfall for the planning area is shown in Figure 58, which shows the snowiest months are between December and March. A common snow event (likely to occur annually) will result in accumulation totals between one and six inches. Often these snow events are accompanied by high winds. It is reasonable to expect wind speeds of 25 to 35 mph with gusts reaching 50 mph or higher. Strong winds and low temperatures can combine to produce extreme wind chills of 20°F to 40°F below zero.

Figure 58: Monthly Normal Snowfall in Inches (1981-2010)



Source: High Plains Regional Climate Center

The likely extent from severe winter storms would apply the same to each jurisdiction in the planning area as each individual event will have different impacts.

Probability

Based on the historical record and reported events, severe winter storms are likely to occur on an annual basis. The NCEI reported 252 severe winter storms between 1996 and 2022, with at least one hazard event occurring in each year resulting in a 100 percent chance annually for severe winter storms.

Future Development

All future development will be affected by severe winter storms. Increased development or infrastructure in the three-county planning area creates 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.

Climate Change Impacts

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."[106] 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.[107] Cold temperatures are likely to be impacted by

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

[107] 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/.

climate change. The table below shows the number of freezing days in three-county region with different warming scenarios.

Table 97: Number of Freezing Days

	Warming Scenarios			
	1° C	1.5° C	2° C	3° C
NUMBER OF FREEZING DAYS	31-90 Days per Year Avg. 26	31-90 Days per Year Avg. 34	31-90 Days per Year Avg. 40	31-90 Days per Year Avg. 55

Source: Probable Futures[108]

Community Top Hazard Status

The following jurisdictions identified Severe Winter Storms as a top hazard of concern:

- Antelope County
- City of Atkinson
- Village of Brunswick
- Village of Center
- Village of Clearwater
- City of Elgin
- Village of Inman
- Knox County
- City of Neligh
- Village of Niobrara
- City of O'Neill
- Village of Orchard
- Village of Page
- Village of Stuart
- Chambers Public Schools District
- Crofton Public Schools District
- Elgin Public Schools District
- Elgin Volunteer Fire District
- North Central District Health Department
- Summerland Public Schools District
- Verdigre Public Schools District
- Wausa Public Schools District

Regional Vulnerabilities

The following tables provide information related to regional vulnerabilities and FEMA's National Risk Index values for Severe Winter Storms. For jurisdictional specific vulnerabilities, refer to *Section Seven: Community Profiles*.

[108] Probable Futures. "Maps of Temperature". Accessed December 2022. https://probablefutures.org/ .

Table 98: National Risk Index Severe Winter Storms Vulnerabilities

HAZARD TYPE	RISK INDEX FACTOR	ANTELOPE COUNTY	HOLT COUNTY	KNOX COUNTY
Cold Wave	Risk Index	Relatively Low (16.77)	Relatively Moderate (18.53)	Relatively Moderate (23.75)
	Expected Annual Loss	Relatively Low (17.00)	Relatively Low (17.68)	Relatively Low (18.05)
Ice Storm	Risk Index	Relatively Low (14.15)	Relatively Moderate (17.57)	Relatively Moderate (23.42)
	Expected Annual Loss	Relatively Low (17.80)	Relatively Low (20.79)	Relatively Moderate (22.08)
Winter Weather	Risk Index	Relatively Moderate (23.49)	Relatively High (29.68)	Relatively High (33.24)
	Expected Annual Loss	Relatively Moderate (28.4)	Relatively High (33.77)	Relatively High (30.11)

Source: FEMA National Risk Index, 2022

Table 99: Regional Severe Winter Storm Vulnerabilities

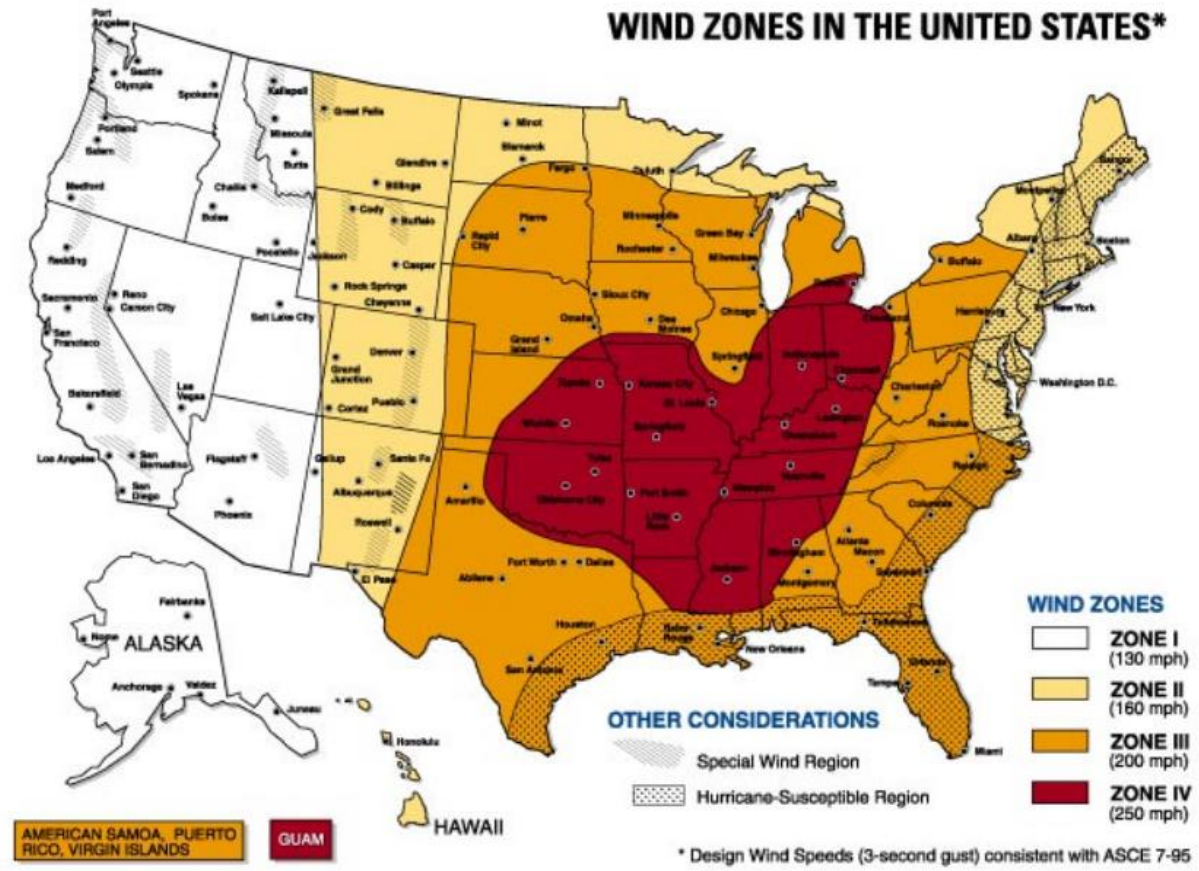
SECTOR	VULNERABILITY
People	-Elderly citizens are at higher risk to injury or death, especially during extreme cold and heavy snow accumulations -Citizens without adequate heat and shelter at higher risk of injury or death
Economic	-Closed roads and power outages can cripple a region for days, leading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

Tornadoes and High Winds

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

The National Weather Service (NWS) defines high winds as sustained wind speeds of 40 mph or greater lasting for 1 hour or longer, or winds of 58 mph or greater for any duration.[109] The NWS issues High Wind Advisories when there are sustained winds of 25 to 39 miles per hour and/or gusts to 57 mph. The figure below 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.

Figure 59: Wind Zones in the U.S.



Source: FEMA

[109] National Weather Service. 2017. "Glossary." http://w1.weather.gov/glossary/index.php?letter=h.

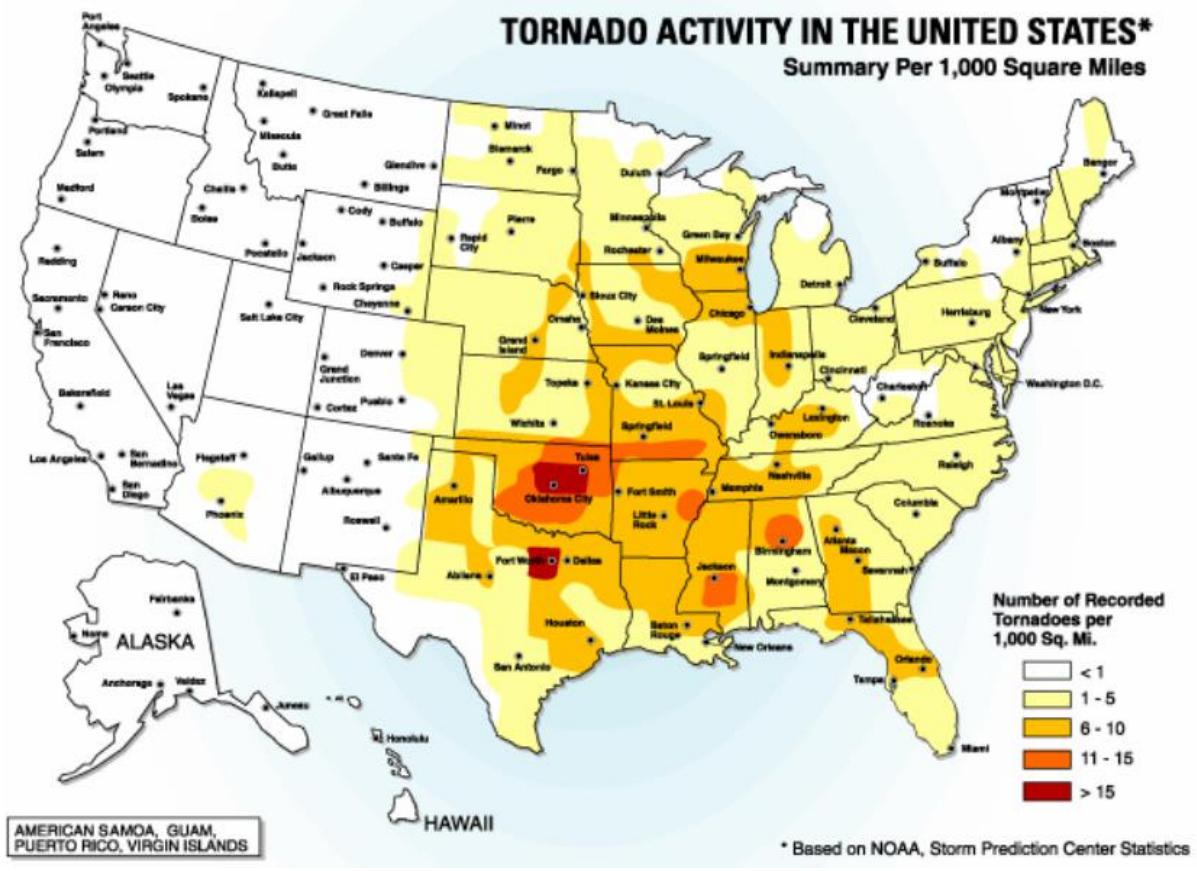
High winds are a critical component of tornado formation. A tornado is typically associated with a supercell thunderstorm. For a rotation to be classified as a tornado, three characteristics must be met:

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

Once tornadoes are formed, they can be extremely violent and destructive. They have been recorded all over the world but are most prevalent in the American Midwest and South, in an area known as "Tornado Alley." Approximately 1,250 tornadoes are reported annually in the contiguous United States. 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 2010.[110]

Figure 60: Tornado Activity in the United States



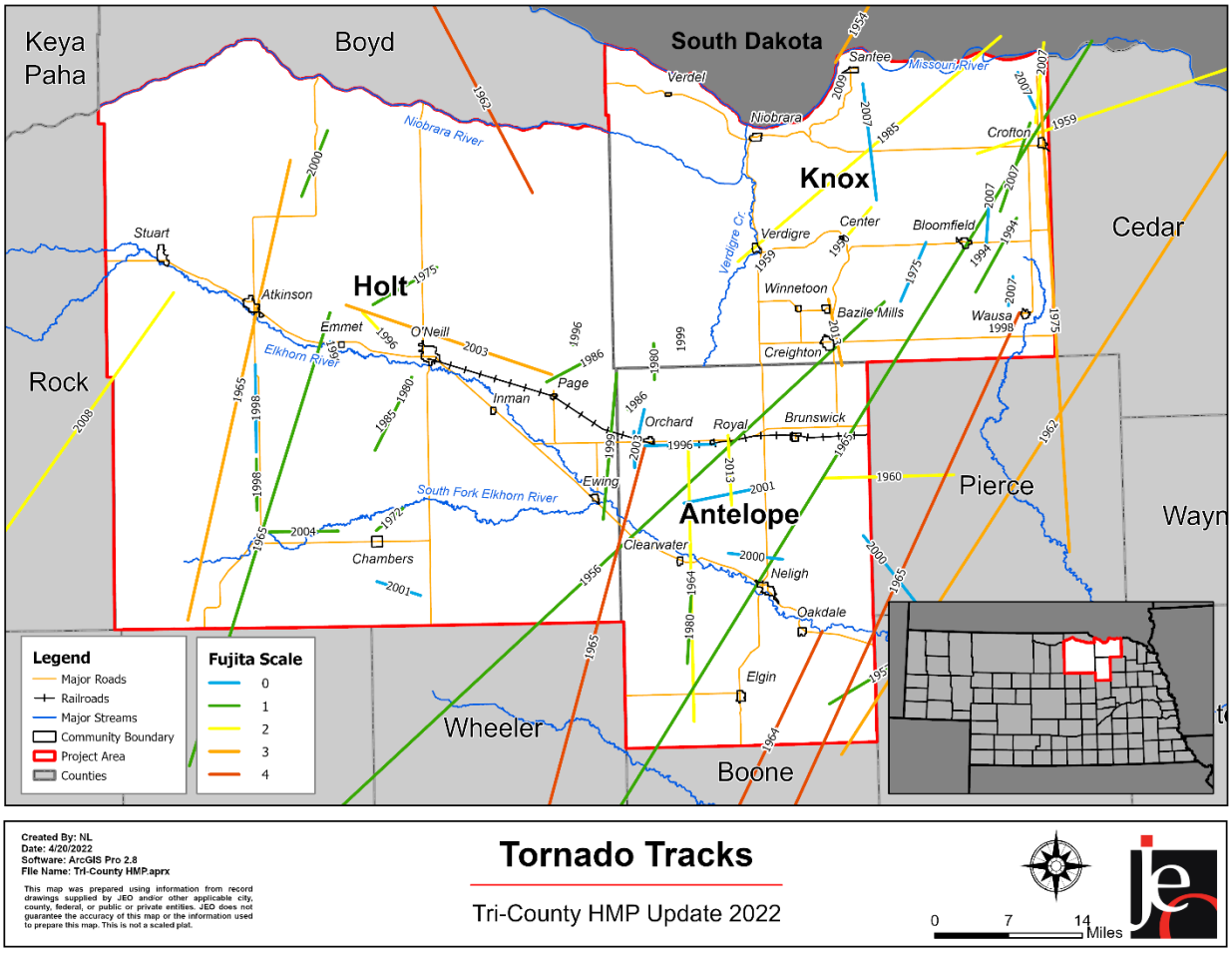
Source: FEMA

[110] National Centers for Environmental Information. 2013. "U.S. Tornado Climatology." https://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornadoclimatology.

Location

High winds and tornadoes can occur throughout the planning area. The impacts on residents would be greater in more densely populated areas with the greatest impacts to the local economy occurring in the surrounding agricultural areas. The following map shows the historical track locations across the region according to the Midwestern Regional Climate Center. Few significant tornado events have directly impacted communities located in the planning area, but touchdowns and tornado events can occur anywhere within the three-county planning area.

Figure 61: Tornado Tracks in the Planning Area

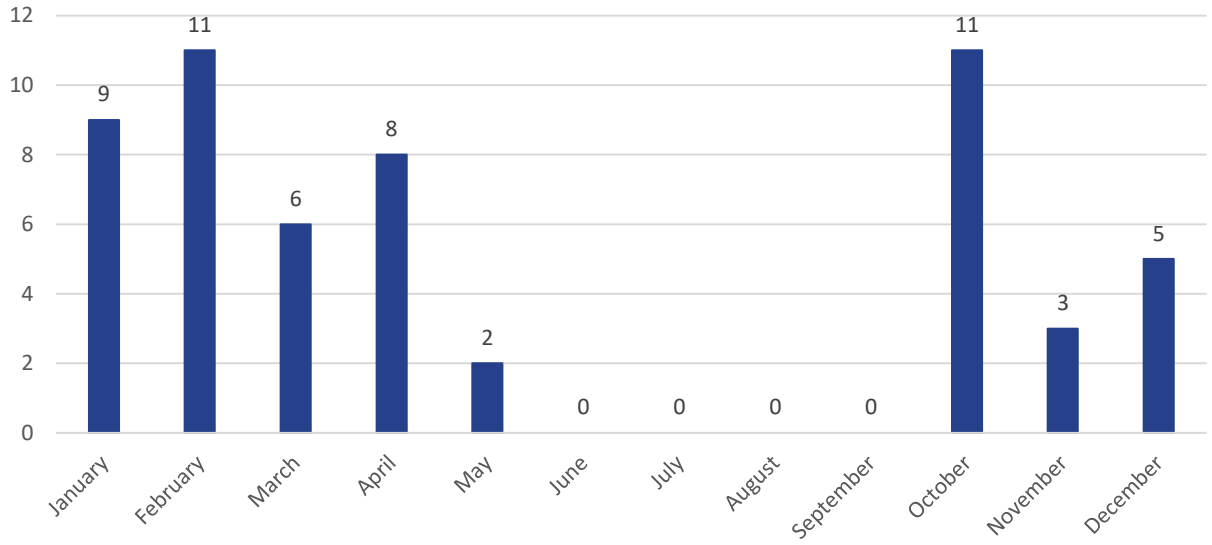


Historical Occurrences

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 55 high wind events that occurred between 1996 and 2022 and 111 tornadic events ranging from a magnitude of E/EF0 to E/EF3 between 1981 and 2022. These events were responsible for $15,885,590 in property damages and $6,056,494 in crop damages. No deaths were reported; however, eight injuries were cited over four events. The most damaging tornado occurred in Holt County in 2003, causing over $5.7 million in damages.

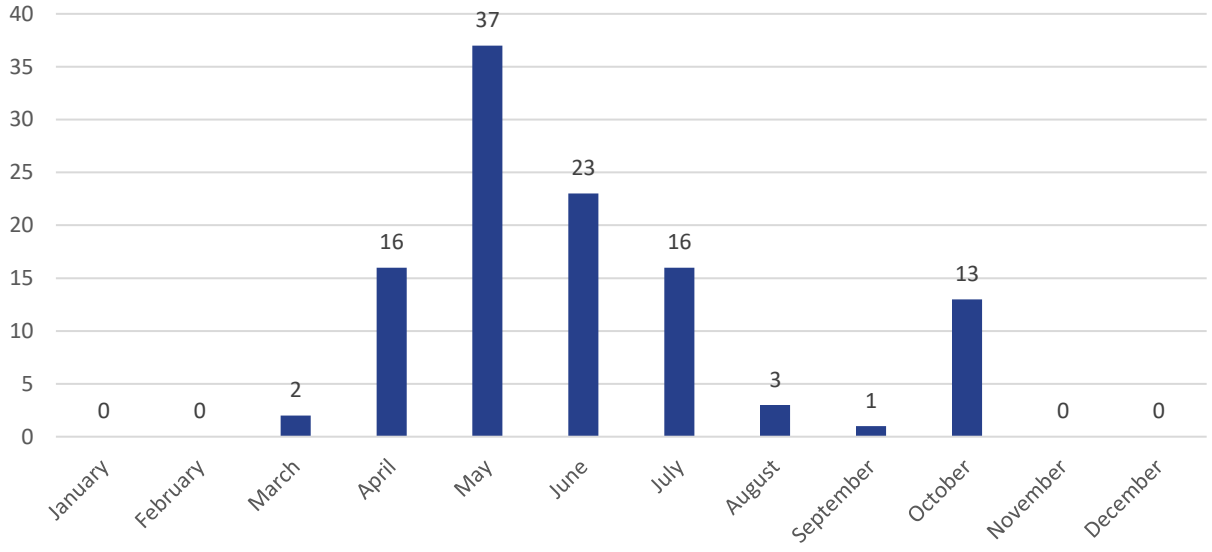
As seen in the following figures, the majority of high wind events occur in the spring and winter months, while most tornado events occur in the summer. Significant hazard events with direct impacts to communities are discussed in more detail in the applicable *Community Profiles.*

Figure 62: High Wind Events by Month



Source: NCEI, 1996-2022

Figure 63:Tornadoes by Month in the Planning Area



Source: NCEI, 1981-2022

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

- **F2 Tornado 4/20/1985 - $2,500,000 in property damages.** *No description provided.*
- **F1 Tornado 4/25/1994 – one injury, $500,000 in property damages.** *A small tornado touched down about four and a half miles south of Bloomfield. One person was injured as he took cover in a ditch as the tornado approached. Debris from a building fell on him and broke his leg. There was damage to outbuildings and irrigation systems on more than a dozen farms.*
- **F2 Tornado 6/19/1996 - $1,000,000 in property damages.** *Tornado on the ground for 3 miles. Three farmsteads were heavily damaged. Three head of livestock killed. Heavy damage to large power transmission line. Center Pivot Irrigation system destroyed.*
- **F1 Tornado 10/26/1996 – four injuries, $150,000 in property damages.** *The tornado produced roof damage to a house sitting on bluff overlooking Niobrara River. The tornado crossed Hwy 281 and began uprooting trees in Valley before striking Angels Fishing Camp partially tearing roof off of the house, destroyed bait house 20 yards north of house, and destroyed or heavily damaged four trailer homes and campers.*
- **F3 Tornado 6/9/2003 - $5,700,000 in property damages.** *As the tornado initially touched down, it encountered a farmstead and destroyed three barns, a detached garage, and 3 large metal grain binds, and also ripped off a portion of the house roof, broke windows, and uprooted and snapped off 90% of the trees around the farmstead. As the tornado moved southeast, it hit two more farmsteads where it completely overturned a modular home, destroyed barns, snapped off nearly all trees. Further along the path to the southeast, the tornado threw farm machinery one quarter mile into a grove of trees. Then it hit another farm where it ripped off an attached garage on a house, broke most windows in the house, moved an old home off its foundation 2 feet, and killed one cow and extensively injured 14 other cows. A barn was also destroyed at a dairy farm across the road to the southeast. The tornado then moved southeast mainly across farmland destroying fields of corn and soybeans, overturning 200 hundred center pivot irrigation systems, snapping off 1,000 power poles, and breaking off numerous large trees. As the tornado passed 3 miles north of O'Neill, it destroyed storage sheds at numerous homesteads. Baseball size hail associated with the storm punctured holes in vinyl siding and broke windows and skylights in homes. Finally, just before dissipating 2 miles north of Page, the tornado lifted the front porch on a home which then took off the roof and one exterior wall of the home.*
- **EF2 Tornado 5/5/2007 – three injuries, $1,000,000 in property damages.** *A grain bin was damaged as this tornado initially touched down along with two or three large power line support structures northwest of Crofton. The tornado tracked toward Lewis and Clark Lake taking the roof off of a house and destroying a garage. The tornado also caused other roof damage as it continued tracking toward Lewis and Clark Lake. When it reached the lake, it caused significant damage to a recreation area and marina. The tornado also caused 3 minor injuries when it apparently lifted a large SUV off the ground and carried it a hundred feet or so before setting it down with the windows blown in. Numerous campers and boats were flipped or missing at the recreation area, along with vehicle damage. About $1 million in damage was estimated to have occurred at the recreation area. Many trees were also toppled. This tornado and others in Knox County downed 30 to 40 power poles. A Storage building in the area was also severely damaged. This tornado started as one tornado to the southwest was lifting and a weaker one to the northeast was forming. There were several reports by the public of multiple tornadoes in the area, either from the three tornadoes mentioned here, or from multiple vortexes within this tornado. The tornado crossed Lewis and Clark Lake and did f1 damage in South Dakota.*

Average Annual Losses

The average damage per event estimate was determined based upon NCEI Storm Events Database number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury or loss of life. It is estimated that high wind events can cause an average of $6,148 per year in property damage and $262,864 per year in crop damages. Tornadoes have caused an average of $374,276 per year in property damages; however, damages from tornadoes vary greatly depending on the severity or magnitude of each event.

Table 100: 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	55	2.0	$166,000	$6,148	$6,045,886	$262,864
Tornadoes	111	2.6	$15,719,590	$374,276	$10,608	$461
Total	**166**	**4.6**	**$15,885,590**	**$380,424**	**$6,056,494**	**$263,325**

Source: 1 NCEI (high winds 1996-2022, tornadoes 1981-2022), 2 USDA RMA (2000-2022)

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 101: 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	39-46 mph	Breaks twigs off tree; generally, impedes progress
9	47-54 mph	Slight structural damage; chimneypots and slates removed
10	55-63 mph	Trees uprooted; considerable structural damages; improperly or mobiles homes with no anchors overturned
11	64-72 mph	Widespread damages; very rarely experienced
12 - 17	72 - > 200 mph	Hurricane; devastation

Source: Storm Prediction Center, 2017[111]

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

[111] Storm Prediction Center: National Oceanic and Atmospheric Administration. 1805. "Beaufort Wind Scale." http://www.spc.noaa.gov/faq/tornado/beaufort.html.

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 a recent report from 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.[112]

Table 102: Enhanced Fujita Scale

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

Source: NOAA; FEMA

[112] 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 103: Enhanced Fujita Scale Damage Indicator

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

Source: NOAA; FEMA

Using the NCEI reported events, the most common high wind event in the planning area is a level 9 on the Beaufort Wind Ranking scale. The reported high wind events ranged from 35 mph to 63 mph, with an average speed of 50 mph. Based on the historical record, it is most likely that tornadoes that occur within the planning area will be of F0 strength. Of the 111 reported tornado events, 73 were EF/F0, 25 were EF/F1, 11 were EF/F2, and two were EF/F3. The extent of damage felt by high wind or tornado events will vary depending on the severity of event and the amount of infrastructure and development within a community. Due to the nature of how tornadic events are categorized, significant tornado events will occur in areas with more infrastructure.

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. Communities such as O’Neill, Atkinson, or Creighton would have greater extent of impacts if a tornado or high wind event were to occur; however, small communities with limited staff and fiscal capability are more likely to have a prolonged recovery period and the extent of damages would be felt more severely.

Probability

Based on historical records and reported events, it is likely that high winds and tornadic events will occur within the planning area regularly. Given the historic record of occurrence for high wind events (12 out of 27 years with reported events), for the purposes of this plan, the annual probability of wind event occurrence is 44 percent. However, high wind events may be more common than presented here but have simply not been reported in past years.

Given the historic record of occurrence for tornado events (24 out of 42 years with reported events), for the purposes of this plan, the annual probability of tornado occurrence is 57 percent. However, it is worth noting that the NCEI did not report any tornado events between 2016 and 2022, thus tornado events were likely experienced in the planning area but were not reflected here.

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.

Climate Change Impacts

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."[113]

Community Top Hazard Status

The following jurisdictions identified High Winds and Tornadoes as a top hazard of concern:

- Antelope County
- City of Atkinson
- Village of Brunswick
- Village of Center
- City of Creighton
- Village of Inman
- City of Neligh
- Village of Niobrara
- Village of Oakdale
- City of O'Neill
- Village of Stuart
- Village of Verdigre
- Crofton Community School District
- Elgin Public School District
- Elgin Volunteer Fire District

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

Regional Vulnerabilities

The following tables provide information related to regional vulnerabilities and FEMA's National Risk Index values for Tornadoes and High Winds. For jurisdictional specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 104: National Risk Index Tornadoes and High Winds Vulnerabilities

HAZARD TYPE	RISK INDEX FACTOR	ANTELOPE COUNTY	HOLT COUNTY	KNOX COUNTY
Strong Wind	Risk Index	Relatively Low (8.94)	Relatively Low (13.67)	Relatively Low (13.43)
	Expected Annual Loss	Very Low (14.98)	Relatively Low (21.55)	Relatively Low (16.86)
Tornadoes	Risk Index	Relatively Low (15.34)	Relatively Low (14.88)	Relatively Moderate (20.94)
	Expected Annual Loss	Relatively Low (14.9)	Relatively Low (13.6)	Relatively Low (15.24)

Source: FEMA National Risk Index, 2022

Table 105: Regional Tornadoes and High Winds Vulnerabilities

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

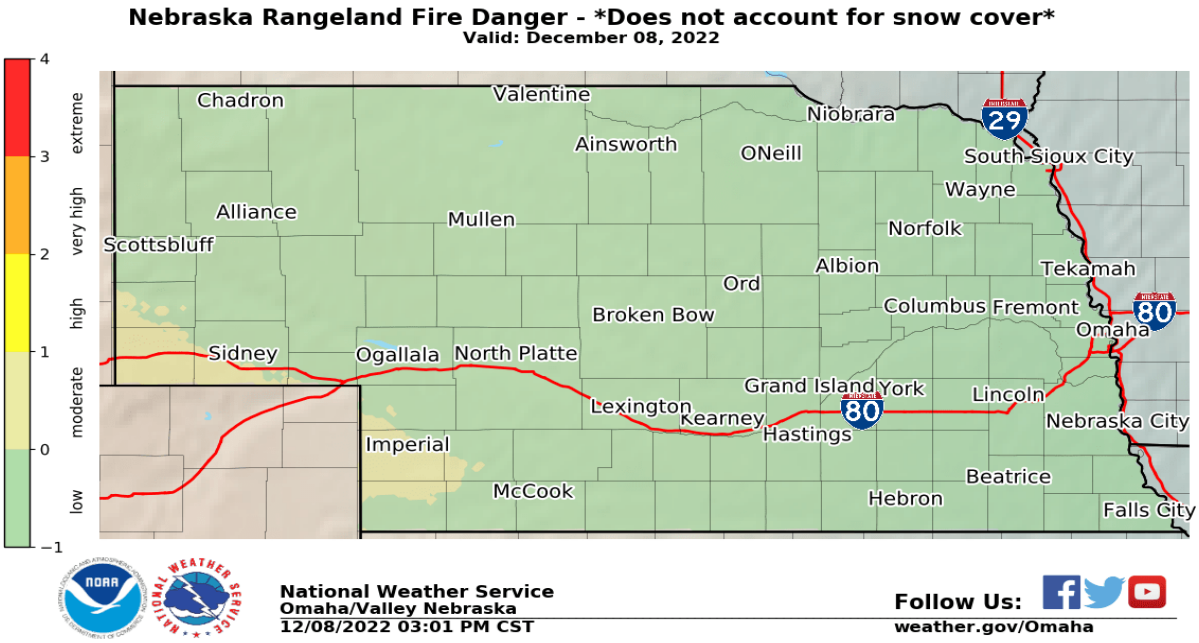
Wildfires

Wildfires, also known as grassfires, brushfires, forest fires, or wildland fires, are any uncontrolled fires that occur in the countryside or wildland. Wildland areas may include but are not limited to grasslands, forests, woodlands, agricultural fields, pastures, and other vegetated areas. Wildfires range in size from a few acres (the most common) to thousands of acres in some cases. Fire events can quickly spread from their original source, change direction quickly, and jump gaps (such as roads, rivers, and fire breaks). Wildfire 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 where local economies are heavily dependent on open agricultural land. 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.

Wildfire behavior is often complex and variably dependent on factors such as fuel type, moisture content in the fuel, humidity, wind speed, topography, geographic location, ambient temperature, and weather. Most mitigation efforts target fuels reduction and structure hardening. The NWS monitors the risk factors including high temperature, high wind speed, fuel moisture (greenness of vegetation), low humidity, and cloud cover in the state on a daily basis. Fire danger predictions are updated regularly and should be reviewed frequently by community leaders and fire department officials (Figure 64).

Figure 64: Rangeland Fire Danger Example

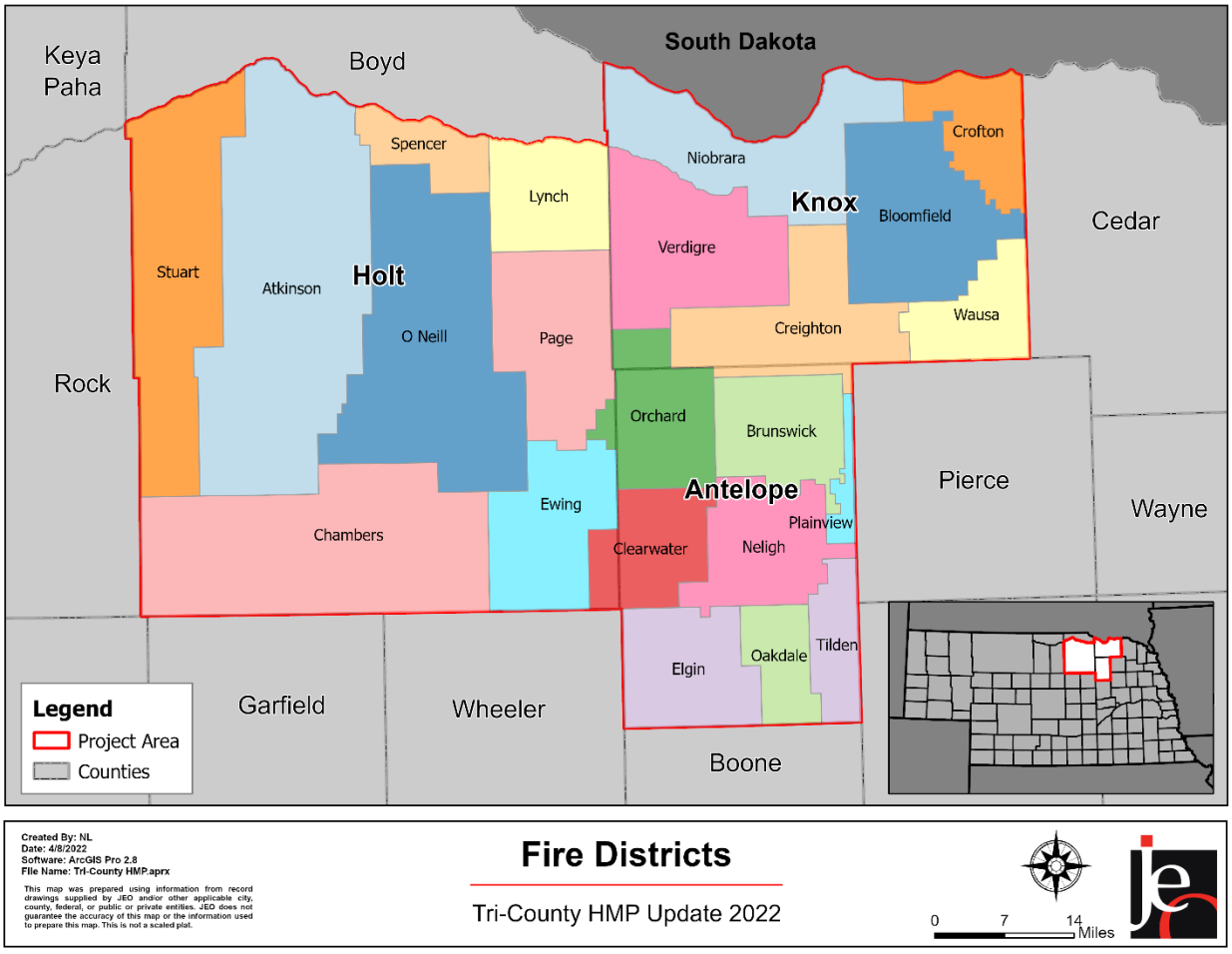


Fire Protection

There are 22 local volunteer or rural fire districts identified in the planning area. The following is a list of fire districts located in the planning area (Figure 65).

- Atkinson Fire and Rescue
- Bloomfield Volunteer Fire Department
- Brunswick Volunteer Fire Department
- Chambers Fire & Rescue
- Clearwater Volunteer Fire Department
- Creighton Volunteer Fire Department
- Crofton Volunteer Fire Department
- Elgin Volunteer Fire Department
- Ewing Fire & Rescue Department
- Lynch Volunteer Fire Department
- Neligh Volunteer Fire Department
- Niobrara Volunteer Fire Department
- Oakdale Volunteer Fire Department
- O'Neill Volunteer Fire Department
- Orchard Volunteer Fire & Rescue
- Page Volunteer Fire Department
- Plainview Volunteer Fire Department
- Stuart Fire & Rescue
- Spencer Volunteer Fire Department
- Tilden Volunteer Fire Department
- Verdigre Rural Fire District
- Wausa Volunteer Fire Department

Figure 65: Fire Districts in the Planning Area

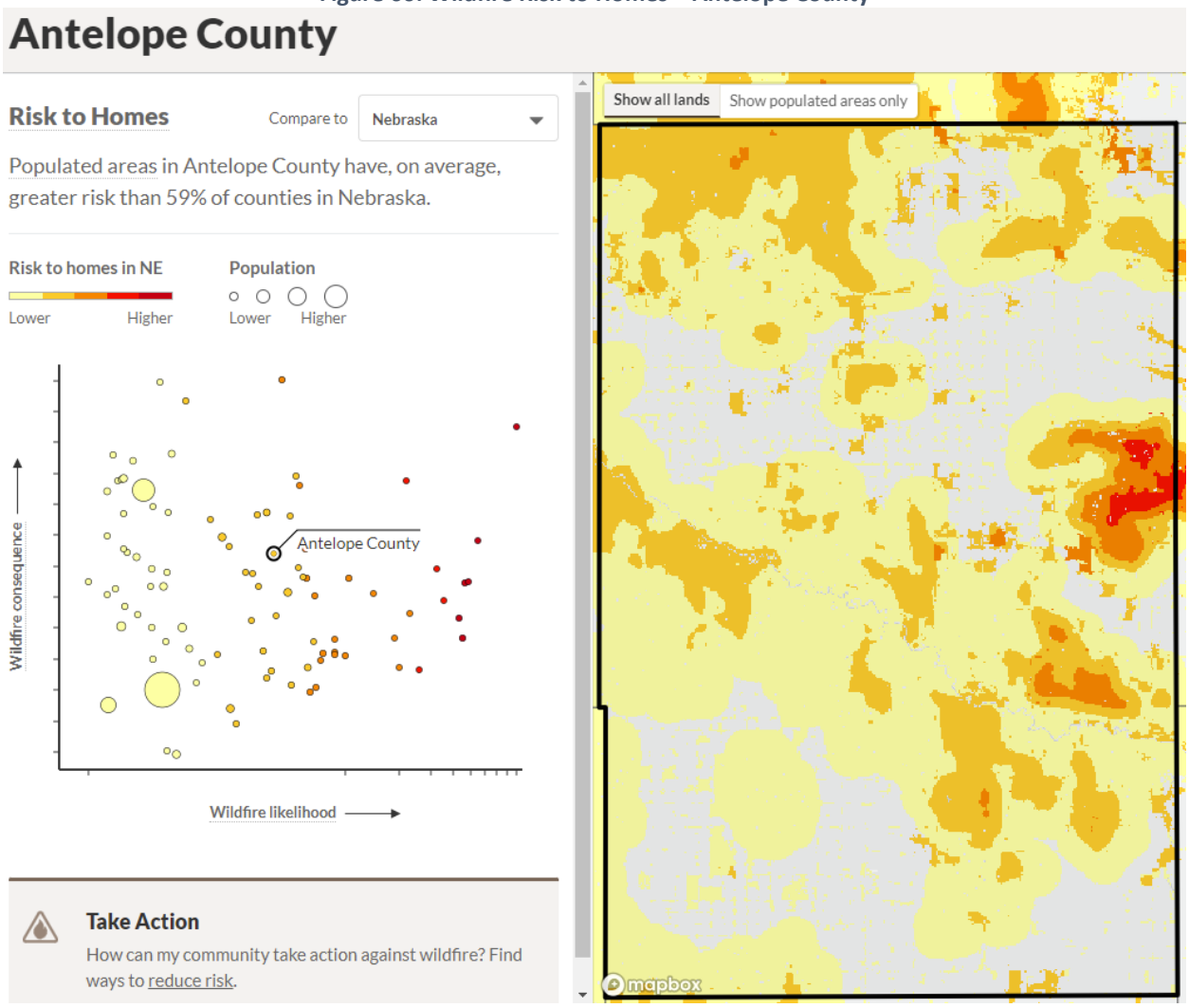


Location

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

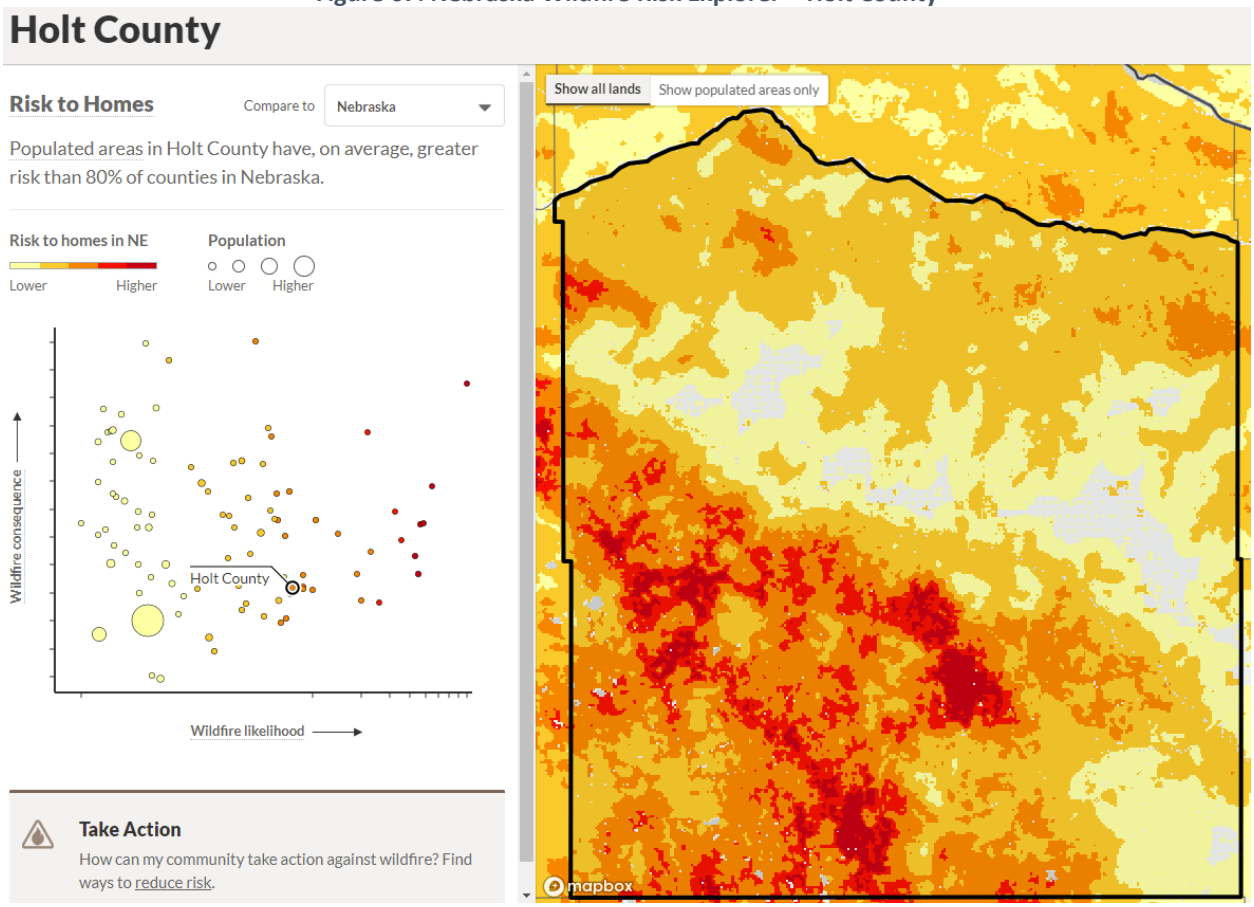
The figures below show the greatest wildfire risk to homes is located primarily in the southwestern portion of Holt County. On average, populated areas in Antelope County have a greater risk than 59% of counties in Nebraska, populated areas in Holt County have a greater risk than 80% of counties in Nebraska, and populated areas in Knox County have a greater risk than 79% of counties in Nebraska.

Figure 66: Wildfire Risk to Homes – Antelope County



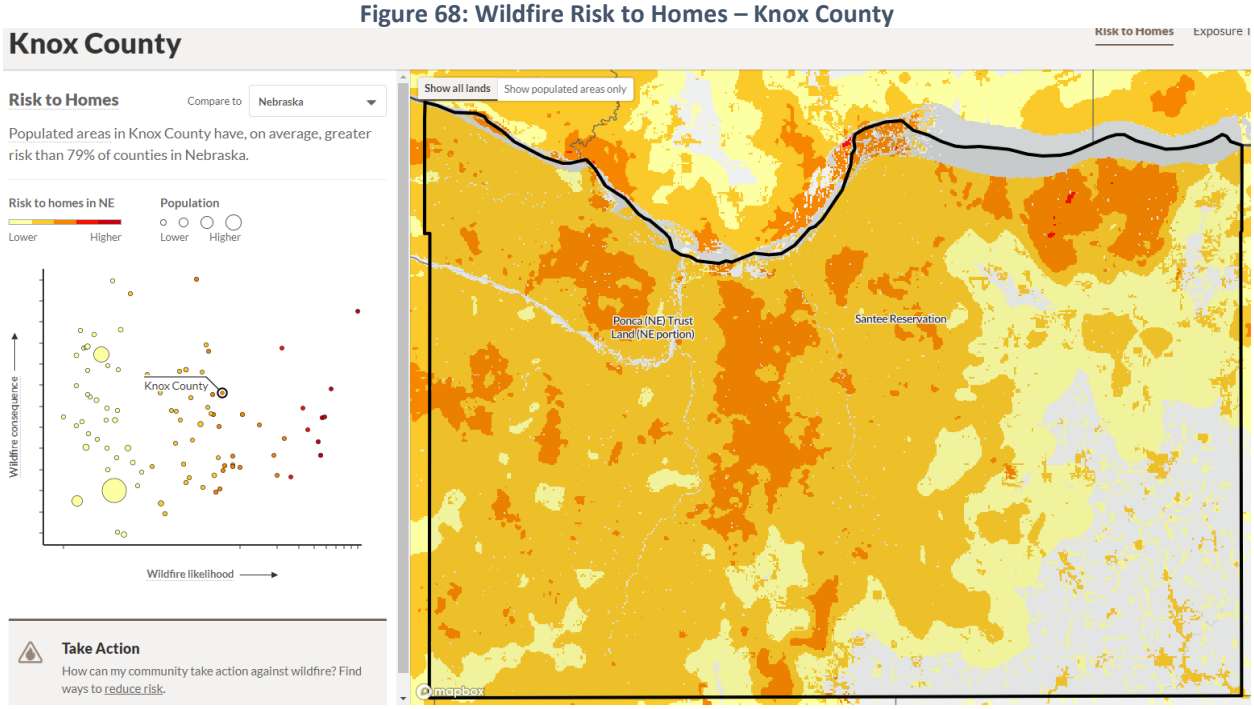
Source: Wildfire Risk to Communities

Figure 67: Nebraska Wildfire Risk Explorer – Holt County



Source: Wildfire Risk to Communities

Figure 68: Wildfire Risk to Homes – Knox County



Source: Wildfire Risk to Communities

The following tables describe other specific risks and vulnerabilities seen across the planning area.

Table 106: Wildfire Vulnerabilities by County

COUNTY	RISK TO HOMES (COMPARED TO NE COUNTIES)	EXPOSURE TYPE	WILDFIRE LIKELIHOOD (COMPARED TO NE COUNTIES)
Antelope	Greater risk than 59% of NE Counties	Directly Exposed (34%) Indirectly Exposed (44%) Not Exposed (22%)	Greater risk than 59% of NE Counties
Holt	Greater risk than 80% of NE Counties	Directly Exposed (40%) Indirectly Exposed (58%) Not Exposed (2%)	Greater risk than 79% of NE Counties
Knox	Greater risk than 24% of NE Counties	Directly Exposed (13%) Indirectly Exposed (3%) Not Exposed (84%)	Greater risk than 27% of NE Counties

Source: Wildfire Risk to Communities, 2020[114]

Table 107: Wildfire Vulnerable Populations by County

COUNTY	FAMILIES IN POVERTY	PEOPLE WITH DISABILITIES	PEOPLE OVER 65	DIFFICULTY WITH ENGLISH	HOUSEHOLDS WITH NO VEHICLE	MOBILE HOMES
Antelope	108 (6.5%)	876 (14%)	1,485 (23.5%	84 (1.4%)	87 (3.2%)	136 (5%)
Holt	114 (4.2%)	1,313 (13.2%)	2,215 (21.9%)	88 (0.9%)	164 (3.7%)	179 (4.1%)
Knox	134 (5.8%)	1,229 (14.9%)	2,091 (24.9%)	39 (0.5%)	163 (4.5%)	93 (2.6%)

Source: Wildfire Risk to Communities, 2020

Historical Occurrences

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. Wildfire count data was provided by the Nebraska Forest Service from January 2000 to November 2021. As the number of reported wildfires by county indicates, wildfire events can occur in any county within the planning area.

For the planning area, there were 1,205 wildfires reported by 22 different fire departments from 2000 to 2021, according to the NFS. The reported events burned 55,663 acres. While the RMA lists no damages from fire in the planning area, the NFS reported $215,112 in crop loss and $507,572 in property damages. There have been no presidential disaster declarations in the planning area which included wildfire events. Figure 70 shows the number of reported wildfires by year. Reported wildfires are most likely to be started by debris burning (29.9%) (Figure 71). Miscellaneous causes (26.5%) and equipment (21.5%) are the second and third leading causes of fires in the planning area. Wildfire events have ranged from less than one acre to 5,000 acres, with an average event burning 86 acres.

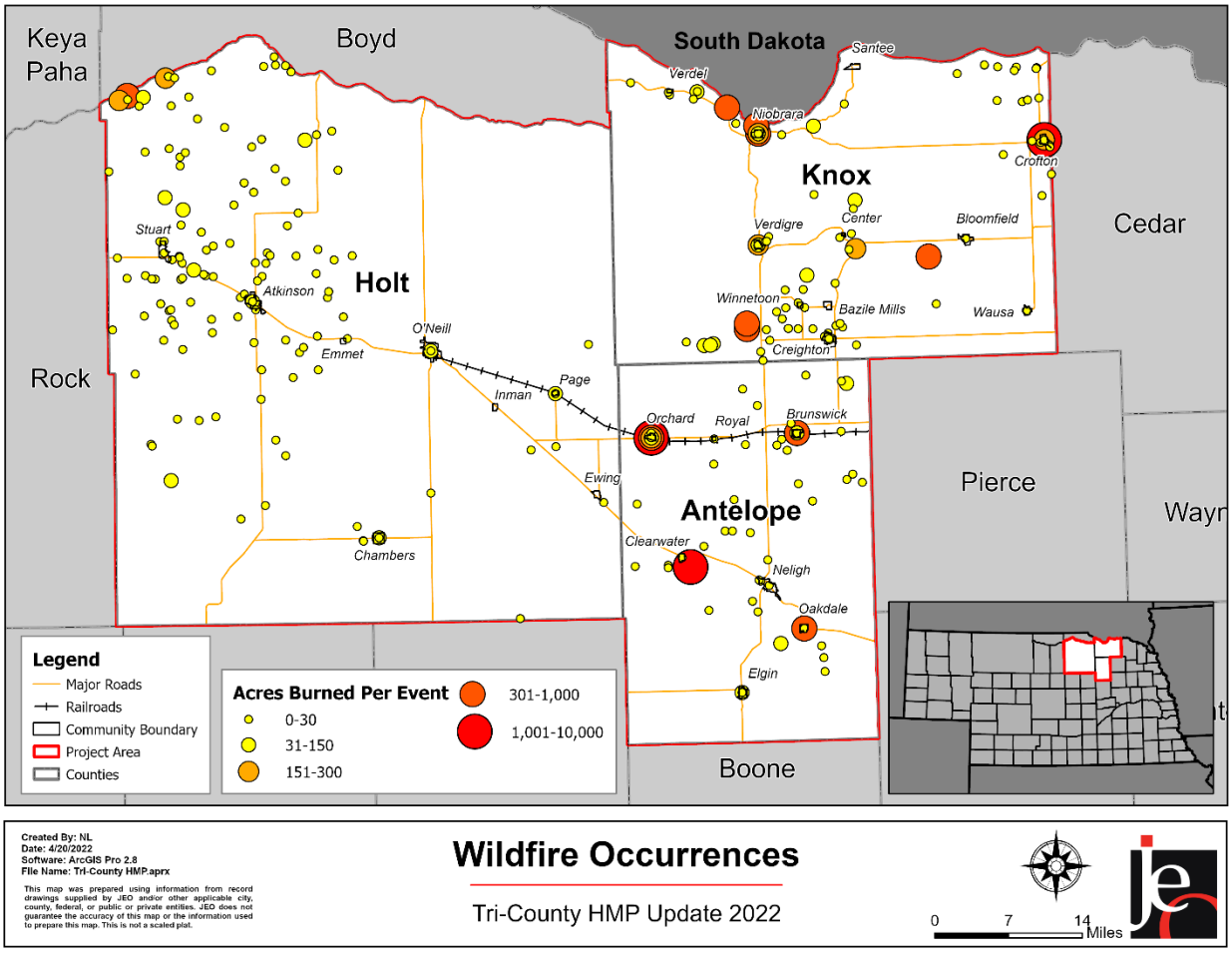
[114] United States Department of Agriculture, United States Forest Service. Accessed December 2022. "Wildfire Risk to Communities." https://wildfirerisk.org/.

Table 108: Reported Wildfires by County

COUNTY	REPORTED WILDFIRES	ACRES BURNED	OTHER IMPACTS
Antelope	644	38,956	6 injuries; 7 fatalities; 8 structures threatened; 3 structures destroyed
Holt	309	8,269	1 injury; 12 structures threatened; 1 structure destroyed
Knox	252	8,438	2 injuries; 31 structures threatened; 1 structure destroyed
Total	**1,205**	**55,663**	**9 injuries; 7 fatalities; 51 structures threatened; 5 structures destroyed**

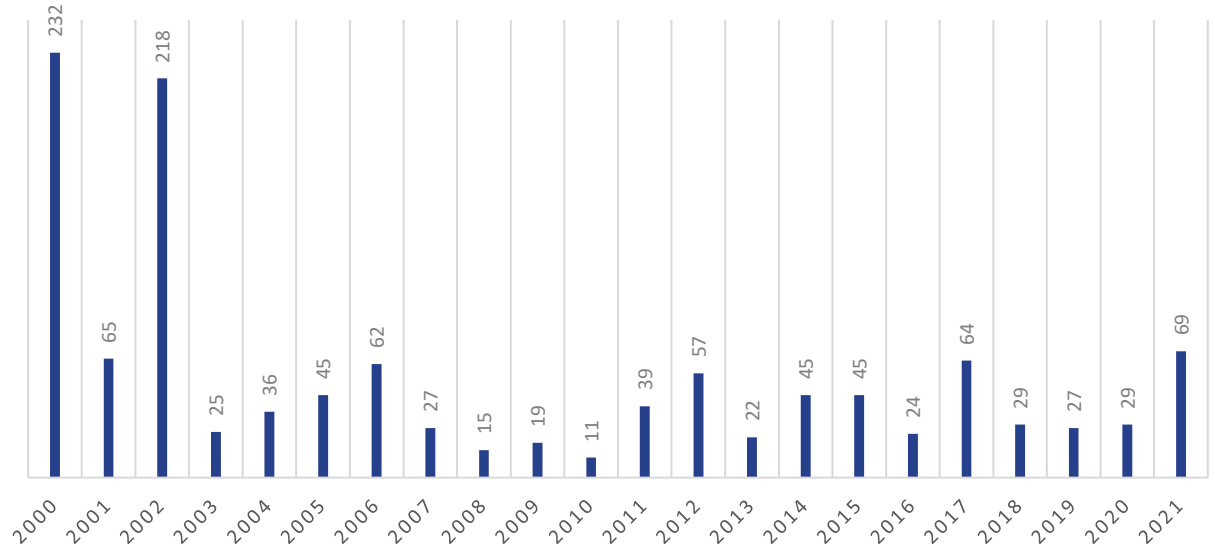
Source: NFS, 2000-2021[115]

Figure 69: Wildfire Occurrence in the Planning Area



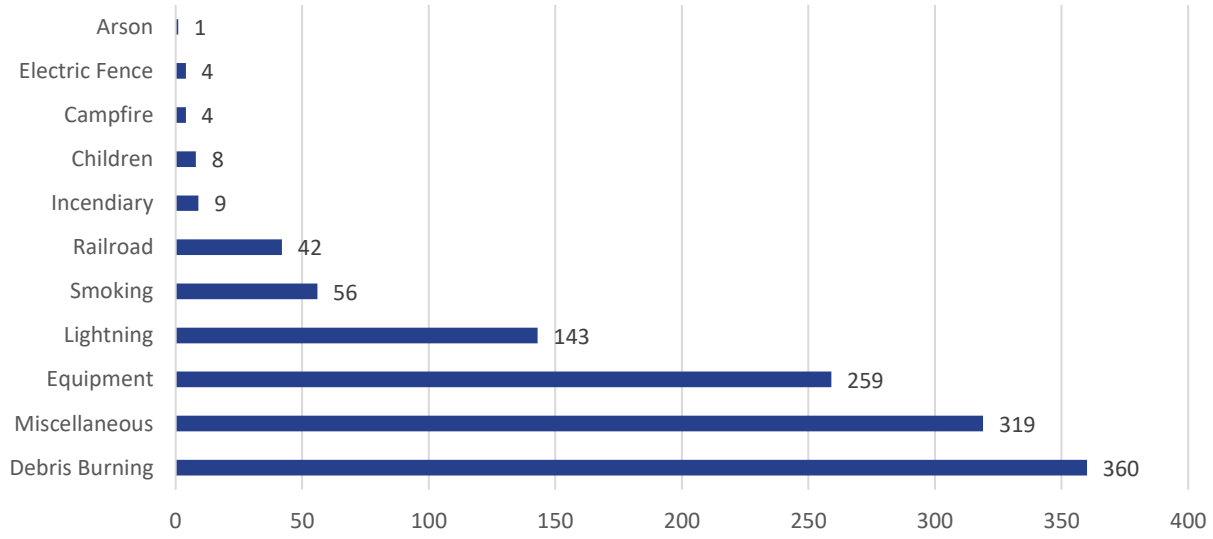
[115] Nebraska Forest Service. 2020. "Fire Incident Type Summary." Data Files 2000-2018 provided by NFS.

Figure 70: Wildfire Events by Year



Source: NFS, 2000-2021

Figure 71: Wildfires by Cause in Planning Area



Source: NFS, 2000-2021

Average Annual Losses

The average damage per event estimate was determined based upon records provided to the Nebraska Forest Service Wildfires Database from January 2000 to November 2021 and the number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. During this 21-year period, 1,205 wildfires burned 55,663 acres and caused $215,112 crop damage and $507,572 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 109: 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
Wildfire	1,205	54.7	86.2	$507,572	$23,071	$215,115	$9,778

Source: NFS, 2000-2021

Table 110: Wildfire Event Impacts and Threats

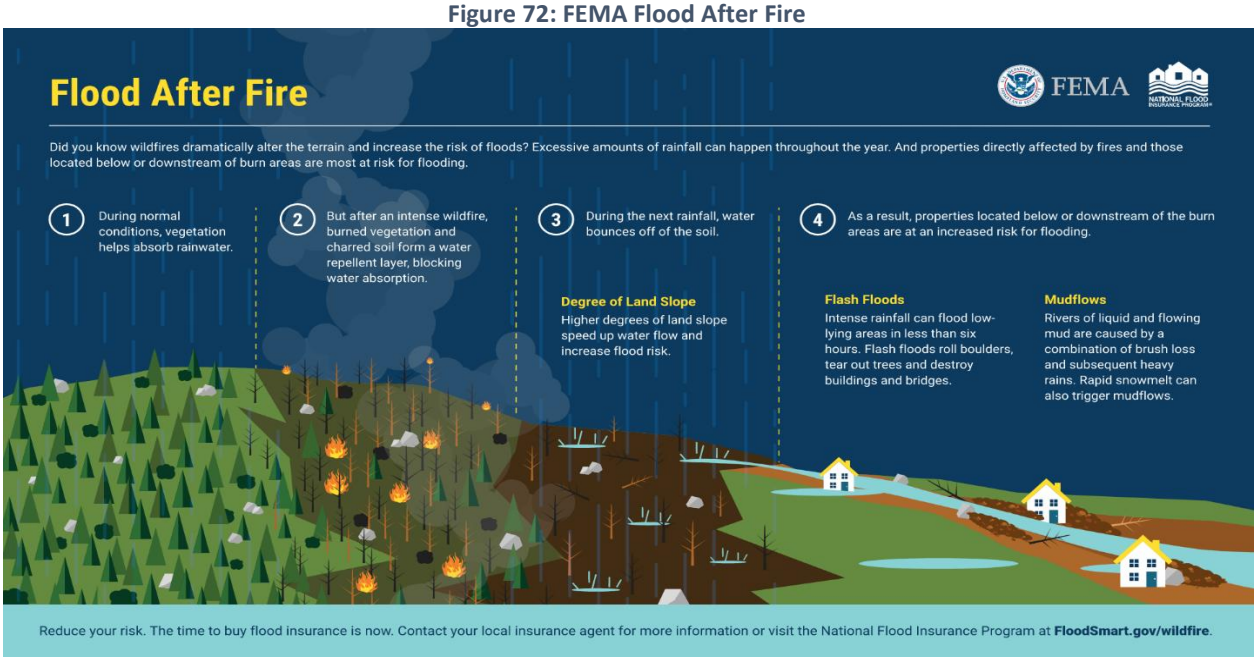
HAZARD TYPE	INJURIES	FATALITIES	HOMES THREATENED OR DESTROYED	OTHER STRUCTURES THREATENED OR DESTROYED
Wildfire	9	7	34	22

Extent

Overall, 1,205 wildfires were reported in the planning area and burned 55,663 acres in total. Of these, only two fires burned more than 100 acres, with the largest wildfire burning 5,000 acres in Holt County in June 2021. The average area burned per wildfire was less than 100 acres indicating while many fires may occur, they are typically small in nature and easily contained.

Wildfire also contributes to an increased risk from other hazard events, compounding damage and straining resources. FEMA has provided additional information in recent years detailing the relationship between wildfire and flooding (Figure 72). 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 72: FEMA Flood After Fire



Source: FEMA, 2020[116]

[116] FEMA and NFIP. 2020. "Flood After Fire." Accessed September 2020. https://www.fema.gov/media-library-data/1573670012259-3908ab0344ff8fbf5d537ee0c6fb531d/101844-019_FEMA_FAF_Infographic-ENG-web_v8_508.pdf.

Community Wildfire Protection Plans

In recent decades, as the population of the United States has decentralized and residents have moved farther away from the center of villages and cities, the area known as the wildland urban interface (WUI) has developed significantly, in both terms of population and building stock. The Nebraska Forest Service (NFS) develops Community Wildfire Protection Plans for regions across the state. Antelope County is located within the Middle Northeast Nebraska CWPP; Holt County is located within the North Central Nebraska CWPP; and Knox County is located within the Missouri River Northeast Region CWPP. [117] 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. The CWPPs which encompass the planning area define the WUI as the entirety of the counties. The expansion of the WUI increases the likelihood that wildfires will threaten people and homes, making it the focus of the majority of wildfire mitigation efforts.

The Middle Northeast Nebraska CWPP noted the following areas of concern for Antelope County.

> The WUI areas most at-risk from wildfire are the lands surrounding municipalities and recreational and residential areas along drainages where there are heavy fuels and limited access. Neligh Fire Department personnel stated that access to rural locations in rough terrain with wooded areas are of particular concern due to heavy fuels, topography, and lack of water within effective distance. They would like to establish a rural water supply. The Orchard fire chief indicated that the villages of Orchard and Royal are a top concern. He identified the Grove Lake WMA north of Royal as a concern due to multiple structures, difficult access, rough terrain, one way in/out, heavy fuels, and lack of water within effective distance. He also listed the Royal Hub CVA, east of Orchard, as a concern due to multiple structures, one way in/out, and lack of water within effective distance. Plainview Fire and Rescue named the Willow Creek bottom as of particular concern due to limited access, rough terrain, and wet ground.
>
> The Oakdale fire chief said that Cedar Creek, which runs through all of their district until it dumps into the Elkhorn River, is a hard area to get to with ground equipment. It has difficult access, rough terrain, one way in/out, heavy fuels, and lack of water within effective distance. The Tilden fire chief identified the Elkhorn River corridor as of particular concern due to difficult access, rough terrain, one way in/out, heavy fuels, and no established fuel breaks. He also named the area southwest of Tilden along Giles Creek as having difficult access, rough terrain, and one way in/out. He said the Tilden tree dump is problematic due to the presence of multiple houses and that heavy fuels and wooded areas surround the facility. The Brunswick VFD reported that canyons, trees, brush, and rough country make the Grove Lake area hard to get to. They also noted swampy locations with difficult access along Willow Creek near the south end of their district. Areas of concern in Antelope County were identified by steering committee members, fire chiefs, or in the statewide Priority Lands analysis.

[117] Nebraska Forest Service. 2022. "Community Wildfire Protection Plans." https://nfs.unl.edu/publications/community-wildfire-protection-plans.

Figure 73: Middle Northeast CWPP Priority Landscapes

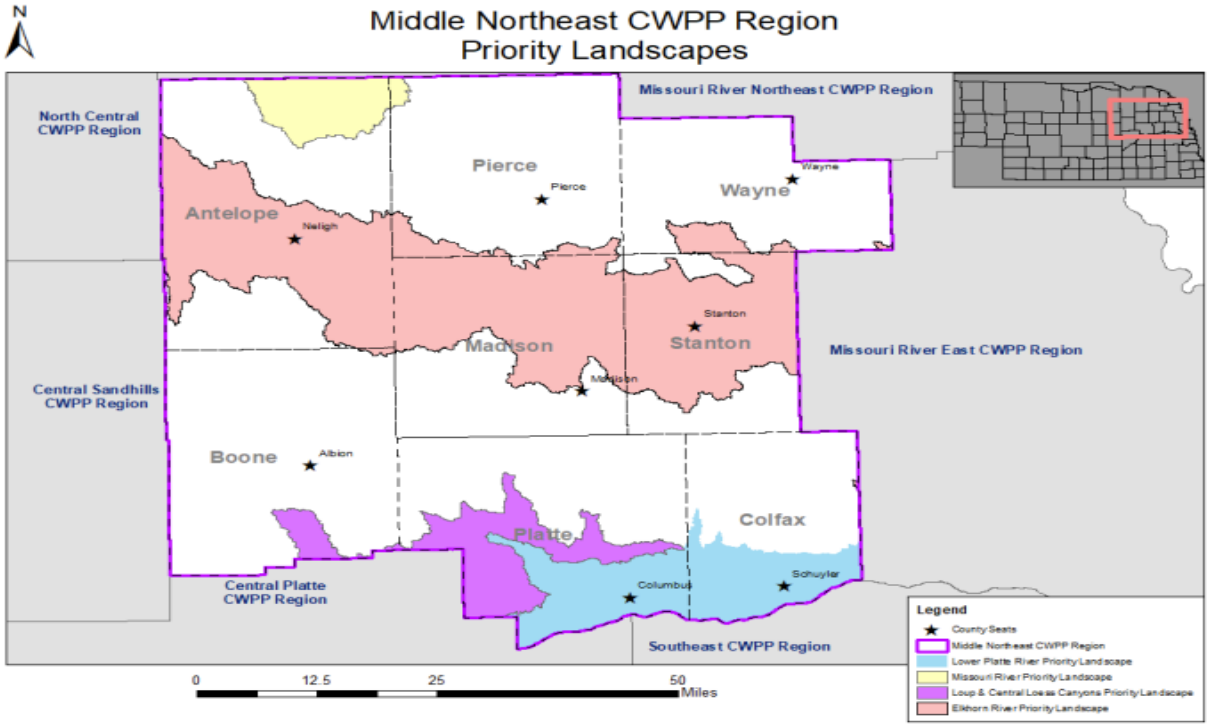
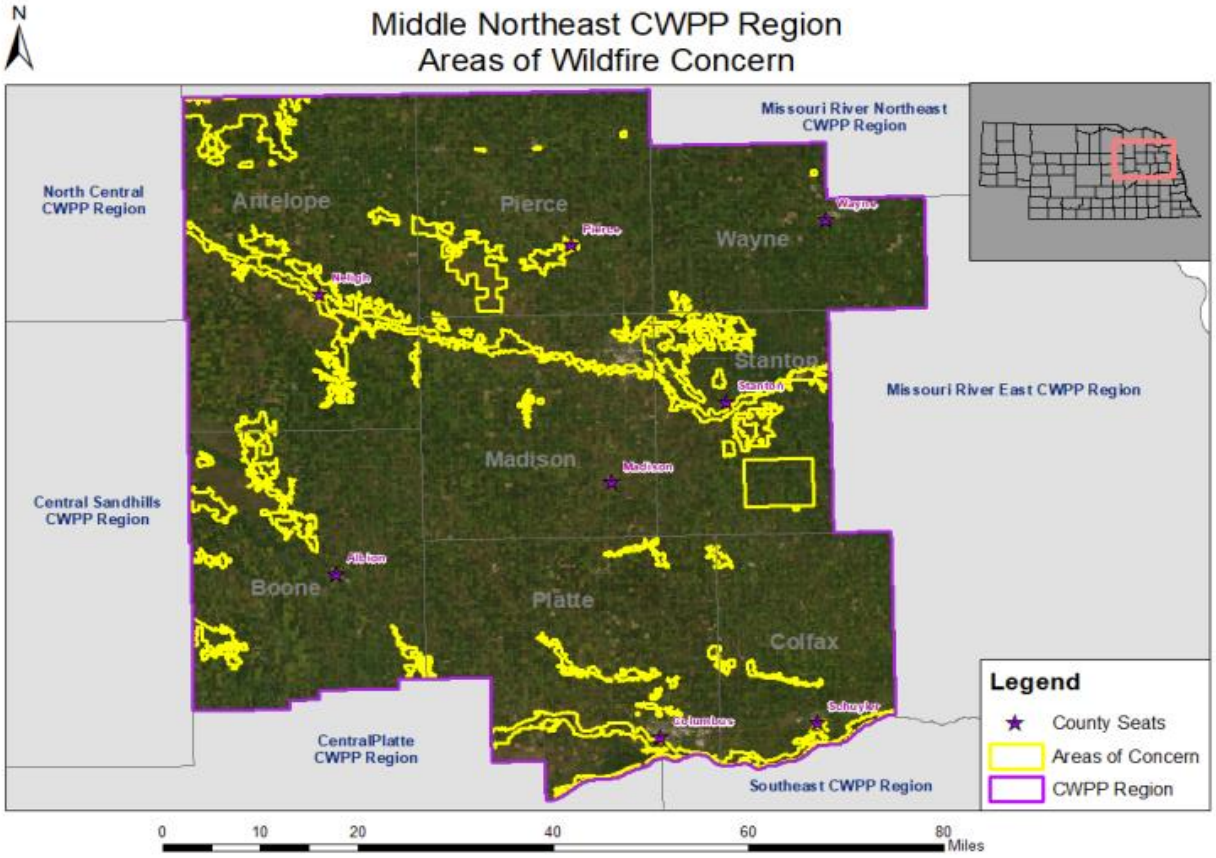


Figure 74: Middle Northeast CWPP Areas of Concern



The North Central Nebraska CWPP noted the following areas of concern for Holt County.

> Atkinson Fire and Rescue reported concerns about the Brush Creek and Sandy Creek areas approximately 20 miles north of Atkinson. Both are Niobrara River tributaries and have rough terrain, difficult access, and heavy fuel loads. The Clearwater VFD has concerns about areas in their district that have difficult access, rough terrain, one way in/out, and lack of water within effective distance. Ewing Fire and Rescue has concerns about the Ewing WUI and heavy fuels along the river. The Lynch VFD has concerns about areas in their district that have difficult access, rough terrain, and heavy fuels. The O'Neill Rural Fire District #7 named the oak and cedar-filled waterways of the Niobrara River tributaries of Eagle Creek Canyons, Redbird, and Blackbird as areas of concern due to difficult access, rough terrain, one way in/out, and heavy fuels. They also identified the Sandhills and the lowland meadows and swamps of the Elkhorn River meadows as areas with difficult access, rough terrain, one way in/out, and lack of water within effective distance. Orchard Fire & Rescue identified Grove Lake WMA and the CVA Royal Hub east of Orchard as areas of concern. Page Fire and Rescue has concerns about areas in their district that have multiple structures. The Stuart fire chief listed the northern parts of Cleveland and Dustin Townships, next to the Niobrara River as problematic, with multiple structures, difficult access, rough terrain, one way in/out, and heavy fuels; and areas in Holt Creek and Green Valley Townships with heavy grass fuels.

Figure 75: North Central Nebraska CWPP Priority Landscapes

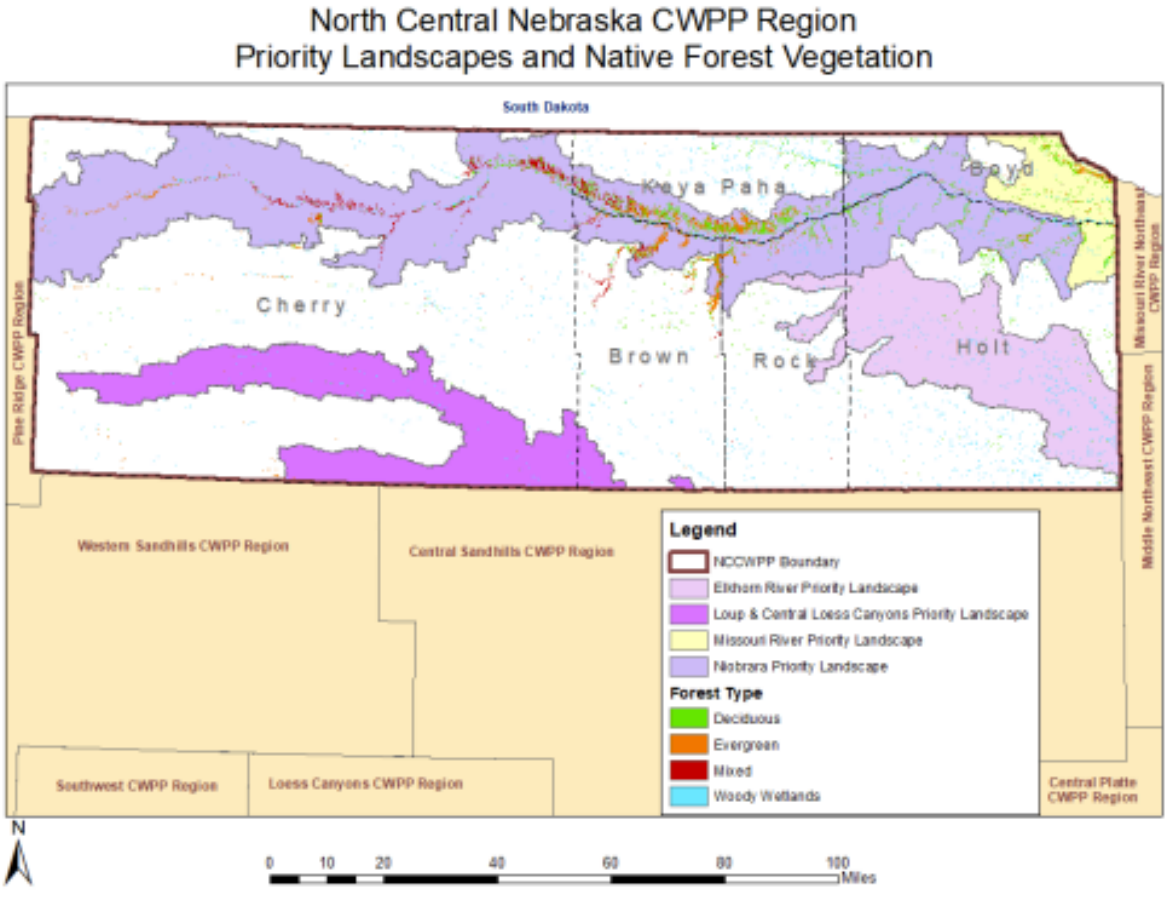
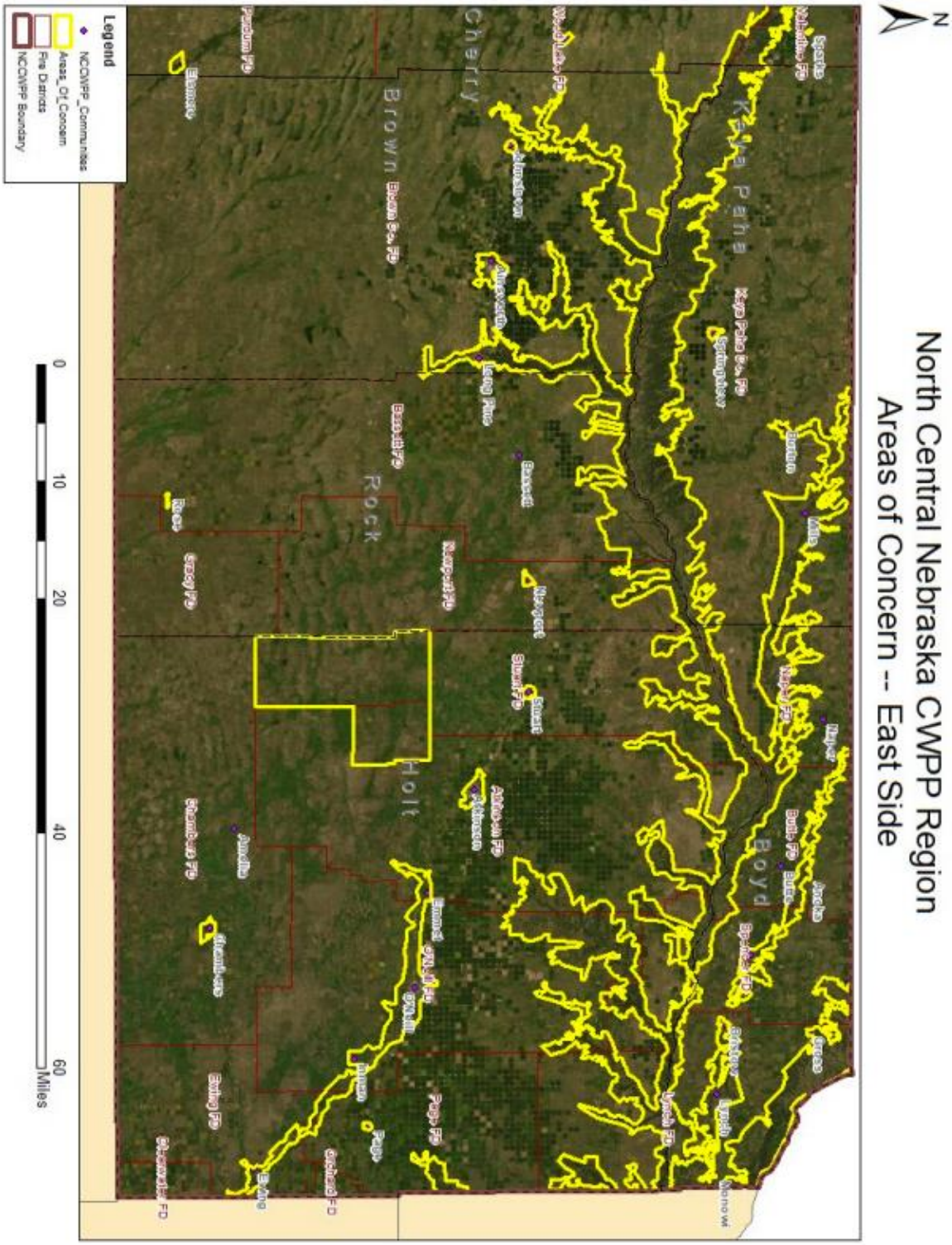


Figure 76: North Central Nebraska CWPP Areas of Concern (East)



The Missouri River Northeast Region CWPP noted the following areas of concern for Knox County.

> Locations of special concern identified by local fire districts and steering committee members include residential and recreational developments along the Missouri and Niobrara Rivers. The Creighton fire chief identified the areas north and west of Highway 59 as an issue because of difficult access, rough terrain, heavy fuels (ERC), and lack of water within effective distance. The Verdigre VFD identified the west hillside of the village as a concern. The Crofton fire chief named the Devils Nest subdivision and the Lewis and Clark Lake area as being of particular concern due to multiple structures, difficult access, rough terrain, one way in/out, heavy fuels (ERC), and lack of water within effective distance. The 2015 CWPP stated that in the Crofton district the forested area is concentrated along the Missouri River, with 91% of the wooded acres and 45% of the shrub acres north of Beaver Creek. The topography and the increasing presence of homes, both vacation and full-time residential, among the ERC-encroached riparian forest is a high concern. Egress and road width issues in these areas impact firefighter access and safety, as well as evacuation and wildland fire suppression.
>
> Part of the Yankton VFD is located in neighboring Cedar County. Their deputy chief listed both sides of the South Dakota/Nebraska border along Lewis & Clark Lake (which extends from Cedar County well into Knox County) and the Missouri River as having difficult access, rough terrain, one way in/out, and heavy fuels. He said that high home density, infrastructure, populated areas along and above Lewis and Clark Lake makes this an area of concern.
>
> The 2015 CWPP noted that portions of the Creighton district along Bazile Creek in the north, and Merriman Creek and branches of Verdigre/Cottonwood Creeks in the west, as well as parts of the Bloomfield district along Howe, Lost, Cook, Devils Nest, and Weigand Creeks, plus the west side of Little Bazile Creek would have the highest probability of large fire growth in the hilly mixed fuels. Limited water supply is a concern in the Verdel area. The Santee Sioux Nation CWPP4 identified 27,000 acres of their reservation as at-risk WUI areas. These include the communities of Santee and Lindy, two tribal housing areas, the casino, and the surrounding areas. These areas contain rural housing intermixed in the WUI and are a designated focus for the BIA fire management program. The Ponca Tribe of Nebraska, although it has no geographic reservation, has a service area for tribal members that includes Knox County. The tribe has identified Grass/Wildfires as a priority hazard. Due to high percentages of young and elderly people, they stated that fires could impact the public health of the Tribe by causing respiration issues in these vulnerable populations.

Figure 77: Missouri River Northeast CWPP Priority Landscapes

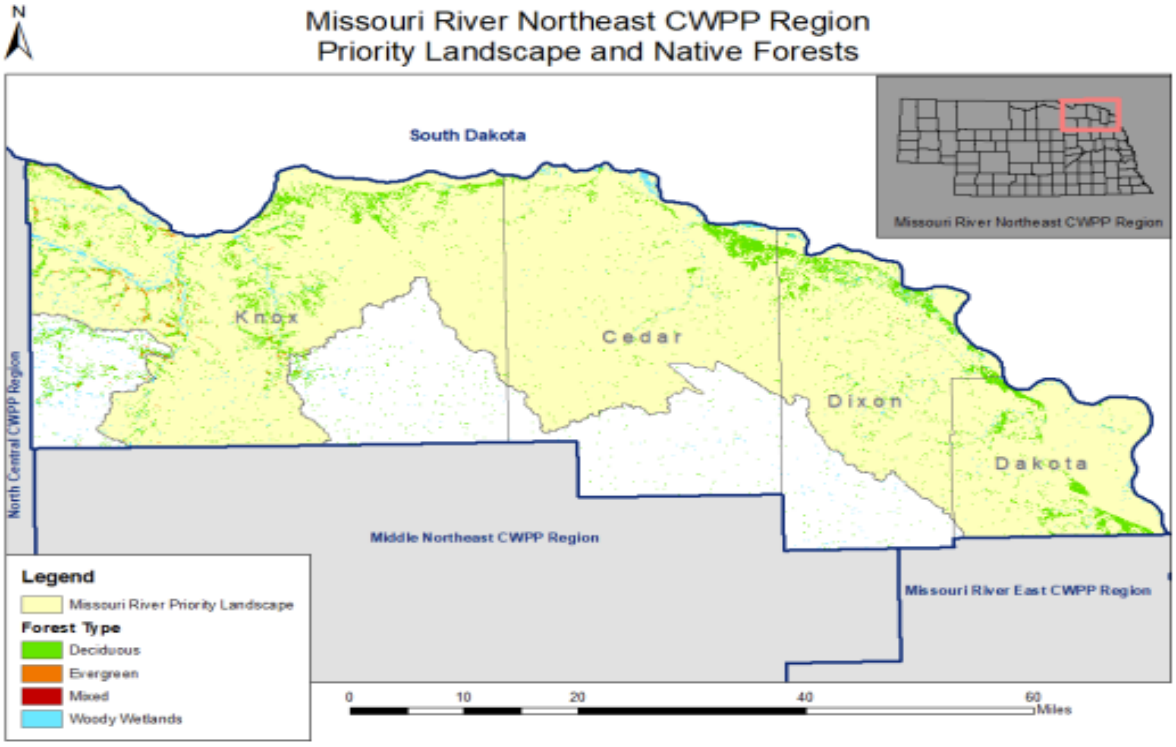
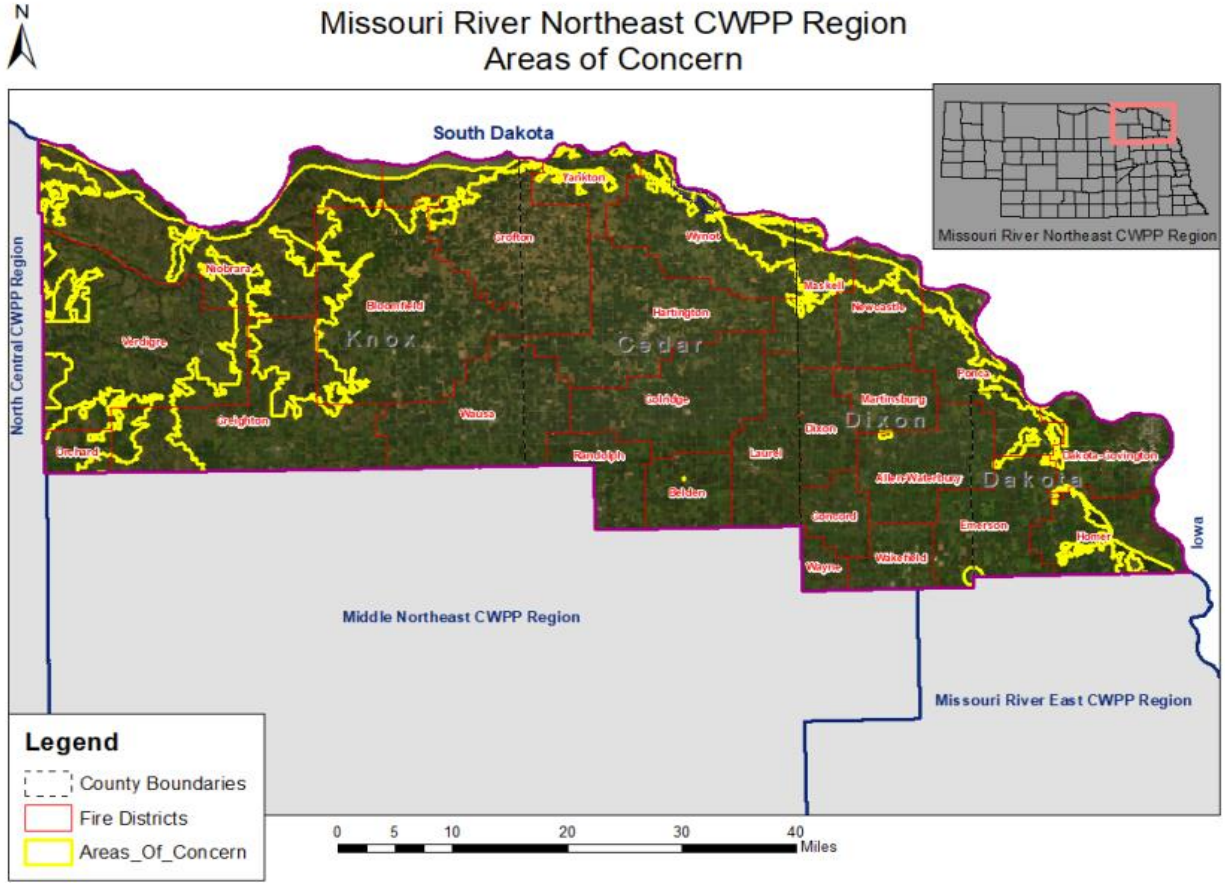


Figure 78: Middle Northeast CWPP Areas of Concern



The likely extent scale from this hazard is likely greatest for those communities located in or near areas of concern or priority landscapes including Niobrara, Neligh, Orchard, Verdigre, or Emmet.

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 wildfire event occurring at least once in each reported year (2000-2021) there is a 100 percent annual probability of wildfires occurring in the planning area in any given year.

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.

Climate Change Impacts

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.[118]

As mentioned in the drought section, climate change will likely contribute to the increase in the frequency and intensity of drought, especially during the summer months.[119] Periods of drought can occur throughout the year, while extreme heat conditions during summer months greatly increases the potential for and magnitude of wildland fires. Drought has a high probability of occurring in the planning area and the planning area sees, on average, three days above 100°F each year. 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 below shows the change in wildfire danger days in three-county region with different warming scenarios.

Table 111: 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 Avg. 4 days	7 to 13 Days per Year Avg. 8 days	7 to 13 Days per Year Avg. 11 days	14 to 29 Days per Year Avg. 18 days

Source: Probable Futures[120]

[118] 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/.

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

[120] Probable Futures. "Maps of Dryness". Accessed December 2022. https://probablefutures.org/ .

Community Top Hazard Status

The following jurisdictions identified Wildfire as a top hazard of concern:

- Antelope County
- Holt County
- Village of Orchard
- Village of Verdigre
- Brunswick Volunteer Fire District
- Creighton Volunteer Fire Department
- Elgin Volunteer Fire District
- Orchard Volunteer Fire District
- Verdigre Rural Fire District

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, including on tribal reservation lands. Wildfires can cause extensive damage to buildings and improvements, including community lifelines. Wildfires also impact agricultural producers who support the local economy. Damaged homes can reduce available housing stock for residents, causing them to leave the area. Additionally, fire events threaten the health and safety of residents and emergency response personnel. Recreation areas, timber and grazing land, wildlife habitat, and scenic views can also be threatened by wildfires.

Development across the planning area may be located within the WUI, particularly in communities with a large amount of intermix areas, where houses and wildland vegetation intermingle. Local officials can adopt codes and ordinances that can guide growth in ways that mitigate potential losses from wildfires. These may include more stringent building code standards, setback requirements, or zoning regulations. Other notable vulnerabilities exist for fire departments which service both urban and rural areas, as many fire districts lack adequate staff to respond to multi-fire complexes or multiple fire events occurring simultaneously in separate areas. The utilization and development of mutual aid agreements or memoranda of understanding are an important tool for districts to share resources and/or coverage.

The following tables provide information related to regional vulnerabilities and FEMA's National Risk Index values for Wildfire. For jurisdictional specific vulnerabilities, refer to *Section Seven: Community Profiles*.

Table 112: National Risk Index Wildfire Vulnerabilities

Risk Index Factor	Antelope County	Holt County	Knox County
Risk Index	Very Low (3.19)	Relatively Low (8.16)	Relatively Low (8.87)
Expected Annual Loss	Very Low (3.10)	Relatively Low (7.45)	Relatively Low (6.45)

Source: FEMA National Risk Index, 2022

Table 113: Regional Wildfire Vulnerabilities

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

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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 and impacts from the identified top hazards of concern per community. These action items should help reduce impacts on existing infrastructure and property in a cost effective and technically feasible manner. Mitigation strategy development is also based upon the established Goals and Objectives as determined by the Regional Planning Team at the Kick-off meeting.

At the Kick-off Meeting the Regional Planning Team reviewed the goals from the 2016 HMP and discussed recommended additions and modifications. The intent of each goal and set of objectives is to develop strategies to account for risks associated with hazards and identify ways to reduce or eliminate those risks. Each goal and set of objectives is followed by 'mitigation alternatives,' or actions. Participating jurisdictions were provided with a copy of the Goals and Objectives at meetings to review and provide comments. For the purposes of this plan, all jurisdictions used the same Goals and Objectives.

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 (NFIP), 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.*

Goals and Objectives

Below is the list of goals and objectives as determined by the Regional Planning Team and reviewed by participating jurisdictions. These goals and objectives provided specific direction to guide participants in reducing future hazard related losses and in their selection of mitigation actions.

Goal 1: Protect Health and Safety of Residents

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

Goal 2: Reduce Future Losses from Hazard Events

Objective 2.1 – Provide protection for existing structures, future development, critical facilities, vulnerable areas and populations, services, and utilities to the greatest extent possible.

Objective 2.2 – Develop hazard specific plans, conduct studies or assessments, and retrofit jurisdictions to mitigate for hazards and minimize their impacts.

Objective 2.3 – Minimize and control the impacts of hazard events through enacting or updating ordinances, permits, laws, or regulations.

Goal 3: Increase Public Awareness and Education on Vulnerability to Hazards

Objective 3.1 – 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 4: Improve Emergency Management Capabilities

Objective 4.1 – Develop or improve emergency response plan, procedures, and abilities.

Objective 4.2 – Develop or improve evacuation plan and procedures.

Goal 5: Pursue Multi-Objective Opportunities

Objective 5.1 – When possible, utilize existing resources, agencies, programs, and funding mechanisms to implement projects.

Objective 5.2 – When possible, implement projects that achieve several goals.

Mitigation Alternatives (Action Items)

Local planning teams evaluated mitigation actions with the guidance of established goals. These actions included both the mitigation actions identified by participating jurisdictions in the previous plan and new mitigation actions identified per hazard of top concern 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 and JEO provided recommendations or suggestions based on the risk assessment done in each community. 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. These suggestions helped participants determine which actions would best assist their respective jurisdiction in alleviating damage in the event of a disaster.

These projects are the core of a hazard mitigation plan. The local planning teams were instructed that each hazard of top concern must have an action that addresses it. Mitigation actions must be specific activities that are concise and can be implemented individually; however, other capability and resilience building activities may also be included in the plan even if they do not specifically address a mitigation need.

During the update of previous identified actions and the identification of new actions, each local planning team 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.

It is also 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. Participants have not committed to undertaking identified mitigation actions in the plan. The cost estimates, priority ranking, potential funding, and identified agencies are used to give communities an idea of what actions may be the most feasible over the next five years. This information will serve as a guide for the participants to assist in hazard mitigation for the future. Additionally, some jurisdictions may identify and pursue additional mitigation actions not identified in this HMP. Such actions should be discussed and noted in the HMP during the annual plan maintenance process.

Finally, not all mitigation actions may be eligible for funding through the Hazard Mitigation Assistance programs (HMGP, BRIC, or FMA). It is important to note that not all identified mitigation actions are solely for mitigation but may also address response or recovery activities. These mitigation actions are also a way for communities to address local vulnerabilities in response and recovery capabilities. Many of these types of projects are ineligible for HMA funding. Ineligibility for these grant programs should not preclude a community from identifying or pursuing a mitigation action. Numerous funding sources have been identified across the state and planning area to assist jurisdictions fund projects (see *Section Six)*. All mitigation strategies aimed at reducing risk to natural or human-caused hazards should be identified and discussed in the HMP.

Mitigation Action Descriptions

Mitigation actions identified by participants of the Tri-County HMP are found in the Mitigation Alternative Project Matrix below. Additional information about selected actions can be found in *Section Seven*. Each action includes the following information:

- Mitigation Action – general title of the action item
- Description – brief summary of what the action item(s) will accomplish
- Hazard(s) Addressed – which hazard(s) the mitigation action aims to address
- Estimated Cost – a general cost estimate for implementing the mitigation action for the appropriate jurisdiction
- Potential funding – a list of any potential local funding mechanisms or sources to fund the action
- Timeline – a general timeline as established by planning participants for project implementation
- Priority –a general description of the importance and workability in which an action may be implemented (high/medium/low); priority may vary between each community, mostly dependent on funding capabilities or limiting factors
- Lead agency – listing of agencies or departments which may lead or oversee the implementation of the action item
- Status (if a continued action) – 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. Establishment of a cost-benefit analysis is beyond the scope of this plan and could potentially be completed prior to submittal of a project grant application or as part of a five-year update. Completed, removed, and continuing or new mitigation alternatives for each participating jurisdiction can be found in *Section Seven: Community Profiles*.

Mitigation Action Matrix

Throughout this planning process, each jurisdiction was asked to review mitigation projects from the previous FEMA-approved Tri-County HMP and identify new potential mitigation alternatives to further reduce the effects of hazards. Selected projects varied amongst jurisdictions depending upon the significance of each hazard present and local priorities. The following tables are a compilation of new and continuing mitigation alternatives identified by participating jurisdictions. Completed and removed mitigation alternatives can be found in the respective community profile.

Table 114: Mitigation Actions Selected per Jurisdiction – Antelope and Holt Counties

MITIGATION ACTION	GOAL	ANTELOPE COUNTY	BRUNSWICK	CLEARWATER	ELGIN	NELIGH	OAKDALE	ORCHARD	ROYAL	HOLT COUNTY	ATKINSON	EWING	INMAN	O' NEILL	PAGE	STUART
		ANTELOPE COUNTY								HOLT COUNTY						
ALERT/WARNING SIRENS	3	X								X						
BACKUP GENERATORS	2	X	X					X		X		X	X			X
CIVIL SERVICE IMPROVEMENTS	1									X						X
DRAINAGE ASSESSMENT FOR BRIDGE AND CULVERT IMPROVEMENTS	2	X								X						
DROUGHT MANAGEMENT PLAN	4										X					
EMERGENCY COMMUNICATIONS	4									X						
EPA COPPER AND LEAD MITIGATION	1														X	
ESTABLISH QUARANTINE LOCATION	4										X					
FIRE SUPPRESSION UNITS	2	X														
FLOODPLAIN DEVELOPMENT ORDINANCE ENFORCEMENT	2	X														
FLOOD MAPPING AND PLANNING	2									X						
FLOOD-PRONE PROPERTY ACQUISITION	2									X						
HAZARDOUS FUELS REDUCTION										X						
HAZARDOUS TREE REMOVAL	1					X										

MITIGATION ACTION	GOAL	ANTELOPE COUNTY	BRUNSWICK	CLEARWATER	ELGIN	NELIGH	OAKDALE	ORCHARD	ROYAL	HOLT COUNTY	ATKINSON	EWING	INMAN	O' NEILL	PAGE	STUART
			ANTELOPE COUNTY							HOLT COUNTY						
HEAVY EQUIPMENT	4										X					
IMPROVE WATER DISTRIBUTION SUPPLY	1														X	
INCIDENT COMMAND CENTER	4	X														
JETTY REPAIR	2					X										
NEW WELL	1				X											
PUBLIC AWARENESS AND EDUCATION	3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
REPAVE ROADS	2			X												
RIP RAP REPAIR	2					X										
ROAD AND EMBANKMENT IMPROVEMENTS	2									X						
ROAD STABILIZATION	2	X														
SEWER TREATMENT PLANT	1				X											
SHELTER IDENTIFICATION SIGNAGE	3						X									
SNOW REMOVAL EQUIPMENT	1				X	X					X		X			
STORM SHELTER	1	X								X		X	X			X
STORMWATER SYSTEM AND DRAINAGE IMPROVEMENTS	1			X	X		X						X	X		X
STREAM BANK STABILIZATION	2									X						X
TRAINING	5	X														
TREE CITY USA	5											X				

MITIGATION ACTION	GOAL	ANTELOPE COUNTY	BRUNSWICK	CLEARWATER	ELGIN	NELIGH	OAKDALE	ORCHARD	ROYAL	HOLT COUNTY	ATKINSON	EWING	INMAN	O' NEILL	PAGE	STUART
			ANTELOPE COUNTY							HOLT COUNTY						
WARNING SYSTEMS										X						
WEATHER RADIOS	4	X														X

Table 115: Mitigation Actions Selected per Jurisdiction – Knox County

MITIGATION ACTION	GOAL	KNOX COUNTY	BLOOMFIELD	CENTER	CREIGHTON	CROFTON	NIOBRARA	VERDEL	VERDIGRE
		KNOX COUNTY							
ALERT/WARNING SIRENS	3	X	X			X			
BACKUP GENERATORS	2	X		X			X		
BRIDGE REPAIRS	2	X							
CIVIL SERVICE IMPROVEMENTS	1	X							
DRAINAGE ASSESSMENT FOR BRIDGE AND CULVERT IMPROVEMENTS	2	X		X	X				
EMERGENCY VEHICLES	1		X						
FIRE HALL	1		X						X
FLOODPLAIN DEVELOPMENT ORDINANCE ENFORCEMENT	2	X			X				
HAZARDOUS TREE REMOVAL	1								X
IMPROVE/CERTIFY DIKE	2	X							X
IMPROVE WATER DISTRIBUTION SUPPLY	1							X	
INCIDENT COMMAND CENTER	4						X		

MITIGATION ACTION	GOAL	KNOX COUNTY	BLOOMFIELD	CENTER	CREIGHTON	CROFTON	NIOBRARA	VERDEL	VERDIGRE
		KNOX COUNTY							
NEW LAGOON	2					X	X		
NEW WELL	1						X	X	
PUBLIC AWARENESS AND EDUCATION	3	X	X	X	X	X	X	X	X
ROAD AND EMBANKMENT IMPROVEMENTS	2	X							
SHELTER IDENTIFICATION SIGNAGE	3						X		
STORM SHELTER	1	X	X		X	X			
STORMWATER SYSTEM AND DRAINAGE IMPROVEMENTS	1			X				X	
STREAM BANK STABILIZATION	2	X		X	X				
WARNING SYSTEMS	3	X							
WEATHER RADIOS	4	X					X		

Table 116: Mitigation Actions Selected per Jurisdiction – School Districts

MITIGATION ACTION	GOAL	CHAMBERS PUBLIC SCHOOL	CROFTON COMMUNITY SCHOOLS	ELGIN PUBLIC SCHOOLS	NELIGH-OAKDALE PUBLIC SCHOOLS	NIOBRARA PUBLIC SCHOOLS	SANTEE COMMUNITY SCHOOLS	SUMMERLAND PUBLIC SCHOOL	VERDIGRE PUBLIC SCHOOL	WAUSA PUBLIC SCHOOLS
		SCHOOL DISTRICTS								
ASBESTOS ABATEMENT	1								X	
BACKUP GENERATORS	2	X		X						X
EARLY RELEASE PLAN	4		X							

MITIGATION ACTION	GOAL	CHAMBERS PUBLIC SCHOOL	CROFTON COMMUNITY SCHOOLS	ELGIN PUBLIC SCHOOLS	NELIGH-OAKDALE PUBLIC SCHOOLS	NIOBRARA PUBLIC SCHOOLS	SANTEE COMMUNITY SCHOOLS	SUMMERLAND PUBLIC SCHOOL	VERDIGRE PUBLIC SCHOOL	WAUSA PUBLIC SCHOOLS
		SCHOOL DISTRICTS								
HAZARDOUS TREE REMOVAL	1				X					
INCREASE STORAGE OF CRITICAL SUPPLIES	4					X				
LIGHTNING RODS	2									X
NEW HEATING/COOLING UNITS	2								X	
NEW ROOF	1				X					
PUBLIC AWARENESS AND EDUCATION	3	X	X	X		X	X	X	X	X
RETAINING WALL	1								X	
SECURITY SYSTEMS AND PLANS UPDATE	4				X					

Table 117: Mitigation Actions Selected per Jurisdiction - Fire Districts and Health Department

MITIGATION ACTION	GOAL	BRUNSWICK VOLUNTEER FIRE DEPARTMENT	CREIGHTON VOLUNTEER FIRE DEPARTMENT	ELGIN VOLUNTEER FIRE DEPARTMENT	ORCHARD VOLUNTEER FIRE AND RESCUE	VERDIGRE RURAL FIRE DISTRICT	NORTH CENTRAL DISTRICT HEALTH DEPARTMENT
		FIRE DISTRICTS					HEALTH DEPARTMENT
AIR QUALITY MONITORING EQUIPMENT	2						X
BACKUP GENERATORS	2		X				X
EQUIPMENT UPGRADES	4		X	X	X		
FIRE HALL	1			X		X	
PUBLIC AWARENESS AND EDUCATION	3	X	X	X	X	X	X
SATELLITE OFFICES	1						X
SHELTER IDENTIFICATION SIGNAGE	3			X			
TRAINING	5		X		X		
WATER SOURCES	1		X				

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SECTION SIX
IMPLEMENTATION AND MAINTENANCE

Introduction

Participants of the Tri-County HMP will be responsible for monitoring, evaluating, implementing, and updating the plan during its five-year lifespan. Hazard mitigation projects will be prioritized by each participant's governing body and/or local planning team with support and suggestions from the public, business owners, and stakeholders. Unless otherwise specified by each participant's governing body, local planning teams, and/or lead agencies identified in the mitigation action, the participant's governing body will be responsible for implementation of the recommended projects. The lead agency (or appropriate department/staff) identified on each mitigation action will report on the status of projects and include which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which strategies could be revised.

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.*

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 (https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/floodplain/resources/2022_SFHMP_Draft_Published04112022.pdf). 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/.

Incorporation into Existing Planning Mechanisms

The 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. According to FEMA's Local Mitigation Planning Policy Guide (2021) and the Local Mitigation Planning Policy Guide (2023), incorporation of planning mechanisms means to reference or include information from other existing sources to form the content of the mitigation plan. Local communities utilized FEMA's *Integrating the Local Natural Hazard Mitigation Plan into a Community's Comprehensive Plan*[121] guidance, FEMA's *2015 Plan Integration*[122] guide, as well as the *Comprehensive Economic Development Strategy and Hazard Mitigation Plan Alignment Guide*[123] to identify plans or documents in which plan integration could take place. During the planning process, specific questions which highlighted hazard mitigation principles from various types of planning mechanisms were discussed. This process offered an easy way for participants to notify the Planning Team of existing planning mechanisms, and if they interface with the Hazard Mitigation Plan.

Each participant referenced a variety of relevant existing planning mechanisms and provided information on how these did or did not address hazards and vulnerability as it pertained to their jurisdiction. Summaries of plan integration are found in each participant's individual profile. For these communities that lack existing planning mechanisms, especially smaller villages, the Hazard Mitigation Plan may be used as a guide for future activity and development in the community. Each local review team will be responsible for ensuring that the HMP's goals are incorporated into applicable revisions of each participant's relevant planning documents. The current HMP should be reviewed for including during any available document's next update period or development. It should be noted that only eight jurisdictions participated in the previous 2017 Tri-County Hazard Mitigation Plan; thus integration of the mitigation plan into other planning documents

The HMP will also consider any changes in planning documents and incorporate the information accordingly in its next update. To assist with monitoring of the plan, as identified mitigation actions or projects are completed, a detailed timeline of how that project was completed should be added to the HMP with either the plan sponsor or will be written and attached to the plan in a format selected by the governing body. Information that will be included will address project timelines, agencies involved, area(s) benefited, total funding (if complete), etc.

[121] Federal Emergency Management Agency. November 2013. "FEMA Region X Integrating the Local Natural Hazard Mitigation Plan into a Community's Comprehensive Plan." https://www.fema.gov/media-library-data/20130726-1908-25045-0016/integrating_hazmit.pdf.

[122] Federal Emergency Management Agency. July 2015. "Plan Integration: Linking Local Planning Efforts." https://www.fema.gov/media-librarydata/1440522008134-ddb097cc285bf741986b48fdcef31c6e/R3_Plan_Integration_0812_508.pdf.

[123] Federal Emergency Management Agency. September 2022. "Comprehensive Economic Development Strategy and Hazard Mitigation Plan Alignment Guide." https://www.fema.gov/sites/default/files/documents/fema_ceds-hmp-alignment-guide_2022.pdf.

Plan Update and Maintenance

FEMA requires a full update of this plan at least every five years, to prevent the risk of the HMP expiring. Updates may be incorporated more frequently, especially in the event of a major hazard. The Antelope, Holt, and Knox County point of contacts (Emergency Managers) will begin discussion of plan update at least 12 months prior to the deadline for completing the plan update. Some questions to consider when evaluating the plan for updates or when developing a scope for future plan updates may include:

- 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 there public engagement barriers identified to be addressed in future plan updates?
- Are current resources appropriate to implement the plan?
- Did the plan partners participate as originally planned?
- Are there other agencies or stakeholders which should be included in the revision process?

Worksheets in Appendix C may also be used to assist with plan updates.

Plan Amendments

If new, innovative mitigation strategies arise that could impact the planning area or elements of this plan, which are determined to be of importance, a plan amendment may be proposed and considered separate from the annual review and other proposed plan amendments. The applicable Tri-County Planning Team will compile a list of proposed amendments received annually and prepare a report for NEMA, who will file it with FEMA. Re-adoption of the plan would not be needed until the normal five-year update. Such amendments should include all applicable information for each proposed action, including description of changes, identified funding, responsible agencies, etc. For an amendment template, see Appendix C.

Continued Public Involvement

To ensure continued plan support and input from the public and business owners, public involvement will remain a top priority for each participant. Strategies identified by local participants to continue engaging the public in the plan update process included:

- Public spaces around the jurisdiction
- City/Village Halls
- Websites or social media sites
- Board/City council meetings
- Local radio stations
- Local newspapers
- Letters/mailings from project sponsors

SECTION SEVEN
COMMUNITY PROFILES

Purpose of Community Profiles

Community Profiles contain information specific to jurisdictions which have participated in the Tri-County planning effort. Community Profiles were developed with the intention of highlighting each jurisdiction's unique characteristics that affect its risk 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 communities was collected at public and one-on-one meetings and used to establish the plan. Community Profiles may include the following elements:

- Local Planning Team
- Location /Geography
- Climate (County Profiles only)
- Demographics
- Housing
- Employment and Economics
- Governance
- Local Capabilities and Social Vulnerabilities
- Plans and Studies Integration
- Future Development Trends
- Community Lifelines/Critical Facilities and Infrastructure
- Parcel Improvements and Valuation
- Hazard Prioritization and Mitigation Strategy
- Plan Maintenance Strategy

In addition, maps specific only to each jurisdiction are included such as: critical facilities as identified by the jurisdiction, flood prone areas (including those delineated through HAZUS), available flood drainage studies or other applicable reports, and future land use or zoning maps (when available).

The Hazard Prioritization information, as provided by individual participants, in *Section Seven: Community Profiles* 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 type area wide throughout the entire planning area. The 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 referred to in *Section Four: Risk Assessment.*

Community and county profiles are located in their respective county profile appendix. Special districts such as fire departments, school districts, and health departments are located in the *Special District Appendix*.

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SECTION EIGHT
FUNDING GUIDEBOOK

Overview

The following *Hazard Mitigation Project Funding Guidebook* is intended to provide initial guidance on hazard mitigation project funding opportunities and where to find more information on grants. The information included is consistent with established processes for hazard mitigation planning. However, it is important to note the following in terms of the context for this guidebook relative to the overall planning process.

Project identification includes identifying all possible options (or alternatives) to address planning objectives; at this stage, all options are viable. At times, the best option may be to work with other stakeholders in the community to design solutions that are in line with community values while reducing risk (e.g., a bike path or ball field that can double as a retention area, or the preservation of an animal habitat that also serves as a natural buffer). These types of solutions can often be funded in very innovative ways, including solutions which increase local industry and revenue (e.g., tapping into the entrepreneurial community). For information on the broad range of mitigation project types and how projects have been implemented in communities across the country, please refer to FEMA's Mitigation Best Practices webpage at https://www.fema.gov/mitigation-best-practices-portfolio.

It should be noted that the grant programs listed in this guidebook are not the only ones that could support hazard mitigation project implementation. Additionally, many of these programs are dependent on yearly funding allocations, resulting in fluctuations in their fund availability. However, at this point, it is more important to be aware of the potential for various avenues of support for a broad array of project types. As needs and potential hazard mitigation project options are identified, more information can begin to be gathered on the range of programs which might be utilized. It will be more efficient to start with project options and then follow up with the identification of potential matches, working with the full range of available programs and agencies as part of a comprehensive project evaluation process.

When the current FEMA hazard mitigation planning program was formulated in the late 1990s as part of the Disaster Mitigation Act of 2000, there was an assumption that federal funding would be provided on a substantial, on-going basis for implementing hazard mitigation projects. However, the level of funding has varied from year to year and future prospects are unclear. Additionally, some communities have not been successful in their pursuit of these grants and have not seen the value of their investment in mitigation planning. While participation in a hazard mitigation plan is required for a jurisdiction to be eligible for FEMA funds, those are not the only funding source available for mitigation actions. Depending on the type of mitigation project being pursued, FEMA funding is not always the best option either, so it is increasingly important to look for other opportunities.

Opportunities for funding and technical assistance exist in various federal, state, and local agencies. Non-governmental funding opportunities are available at the regional or local level with private sector businesses, private foundations, and other non-governmental organizations (NGOs). In order to fully map out the range of local and state options, it is necessary to undertake a detailed stakeholder analysis – something which has not been done at this time. The following contains an overview of key federal and state programs that may include opportunities for hazard mitigation project funding, as well as additional information on suggested alternative funding routes.

Federal Funding Resources

Information about federal hazard mitigation project funding opportunities is organized by agency. Under each agency heading, applicable grant programs are listed with a description of the grant and, when available, information on typical funds available, eligibility, examples of past projects funded, and any additional relevant information. Agencies covered in this guidebook include:

- FEMA
- US Forest Service
- US Army Corps of Engineers
- US Bureau of Reclamation – WaterSMART
- US Department of Agriculture
- US Department of Agriculture Rural Development Funding
- US Department of Energy
- US Department of Housing and Urban Development
- US Economic Development Administration
- US Environmental Protection Agency
- US Fish and Wildlife Service

Note: This is not a complete list of all federal funding opportunities. These grant programs have been chosen for their applicability to popular mitigation actions. The websites and reference materials used to provide this information are as current as possible; however, it is important to note that funding programs are dynamic and subject to frequent changes. While it is helpful to be familiar with the current information, it is equally as important to engage candidate federal and state agencies in a dialog as soon as possible.

FEMA

Building Resilient Infrastructure and Communities Program	
Description	This FEMA program aims to focus on research-supported, proactive investment in community resilience. Through BRIC, FEMA invests in a variety of mitigation activities with an added focus on infrastructure projects benefitting disadvantaged communities, nature-based solutions, climate resilience and adaption, and adopting hazard resistant building codes.
Funds Available	For Fiscal Year 2022, FEMA will distribute up to $2.295 billion through the BRIC program in the following manner.
Eligibility	Eligible states, territories and federally recognized tribal governments can submit applications on behalf of subapplicants for BRIC funding. Applicants may have their own priorities or requirements when screening their subapplications. Subapplicants cannot submit these directly to FEMA. Subapplicants must submit them to their applicant for review and submission. Subapplicants are local governments, including cities, townships, counties, special district governments, state agencies and federally recognized tribal governments and must submit subapplication to their state, territory, or tribal applicant agency.
Examples	The top five type of projects funded in Fiscal Year 2021 included Flood Control, Utility/Infrastructure Protection, Stabilization and Restoration, Mitigation Reconstruction, and Retrofits.
Additional Information	A cost share is required for all subapplications funded under BRIC. The non-federal cost share funding may consist of cash; donated or third-party in-kind services and materials; or any combination thereof. Generally, the cost share for this program is 75% federal cost share funding/25% non-federal cost share funding. Additional information can be found at https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities/before-apply#funding

Fire Management Assistance Grant (FMAG) Program	
Description	FMAG is available to states, local and tribal governments, for the mitigation, management, and control of fires on publicly or privately-owned forests or grasslands, which threaten such destruction as would constitute a major disaster.
Funds Available	The individual fire cost threshold is based on total eligible costs for the declared fire. The individual fire cost threshold for a state is the greater of $100,000 or 5 percent times the statewide per capita indicator, multiplied by the state population (the statewide per capita indicator is adjusted annually for inflation [e.g., the FY21 indicator is $1.55]).
Eligibility	Eligible applicants are entities legally responsible for the firefighting activities that reimbursement is being requested for, this includes states, local governments, and tribal governments.
Examples	Eligible firefighting costs may include expenses for field camps, repair and replacement tools, mobilization and demobilization activities, equipment use, materials and supplies.
Additional Information	https://www.fema.gov/assistance/public/fire-management-assistance

Flood Mitigation Assistance Program	
Description	FMA is a competitive program that provides funding for projects that reduce or eliminate the risk of repetitive flood damages to buildings insured by the National Flood Insurance Program. Projects must be cost effective, located in a participating NFIP community in good standing, align with the current hazard mitigation plan, and meet all environmental and historical preservation requirements.
Funds Available	Fiscal Year 2022 had $800 million available for distribution which was more than five times the amount available for Fiscal Year 2021.
Eligibility	States, territories, and federally recognized tribes are eligible. Local governments are considered sub-applicants and must apply to the State, territory, or tribe.
Examples	Projects include: project scoping, technical assistance, community flood mitigation projects, individual structure/property-level flood mitigation projects, and management costs.
Additional Information	Cost share is required for all subapplications funded by the Flood Mitigation Assistance program. Generally, the cost share for this program is 75% federal / 25% non-federal. Contributions of cash, third-party in-kind services, materials, or any combination thereof, may be accepted as part of the non-federal cost share. More information can be found at https://www.fema.gov/grants/mitigation/floods

HMGP-Post Fire	
Description	This program provides funding to help communities implement hazard mitigation measures focused on reducing the risk of harm from wildfire. Provides hazard mitigation grant funding to state, local, tribal, and territorial governments in areas receiving a Fire Management Assistance Grant (FMAG) declaration. The FMAG is the Disaster Declaration required and funding amounts are determined by FEMA based on an annual national aggregate calculation of the past 10 year's FMAG declarations.
Funds Available	Funds available each year are based on an average of historical Fire Management Assistance Grant declarations from the past 10 years. Total funding available for each FMAG declaration in Fiscal Year 2022 is $786,552 for applicants with a standard hazard mitigation plans and $1,048,736 for those with an enhanced hazard mitigation plan. Multiple event funding will be aggregated into one grant under the first declaration.
Eligibility	Eligible projects include defensible space initiatives, ignition-resistant construction, hazardous fuels reduction, erosion control measures, slope failure prevention measures and flash flooding prevention measures.
Examples	Defensible space, reducing hazardous fuels, removing standing burned trees, ignition-resistant construction, installing warning signs, strengthen or harden water systems that were burned and caused contamination, reseeding ground cover, planting grass to prevent noxious weeds, erosion barriers on slopes, modify/remove culverts, drainage dips and emergency spillways.
Additional Information	The application period opens with the state or territory's first FMAG declaration of the fiscal year and closes six months after the end of that fiscal year. Application extensions may be requested. https://www.fema.gov/grants/mitigation/post-fire

HMGP	
Description	FEMA's Hazard Mitigation Grant Program provides funding to state, local, tribal and territorial governments so they can develop hazard mitigation plans and rebuild in a way that reduces, or mitigates, future disaster losses in their communities. Funding is available when authorized under a Presidential major disaster declaration and in areas of the state requested by the Governor. Federally recognized tribes may also submit a request for a Presidential major disaster declaration within their impacted areas. All state, local, tribal and territorial governments must develop and adopt hazard mitigation plans to receive funding for their hazard mitigation projects.
Funds Available	Amount of funding is based on the estimated total or aggregate cost of disaster assistance: Up to 15% of the first $2 billion; Up to 10% for amounts between $2 billion and $10 billion; Up to 7.5% for amounts between $10 billion and $35.333 billion; States with enhanced mitigation plans: Up to 20%, not to exceed $35.333 billion.
Eligibility	Project eligibility under HMGP can be limited by the State as part of the HMGP Administrative Plan developed post-disaster. For example, funding may only be made available for projects that are related to the type of disaster, i.e., HMGP related to a significant flood disaster declaration may only be designated for flood mitigation projects like acquisitions of repetitively flooded properties.
Examples	Retrofitting existing buildings to make them less susceptible to damage from a variety of natural hazards. Purchasing hazard prone property to remove people and structures from harm's way. Drainage improvement projects to reduce potential for flood damage. Eligible project types do not have to coincide with the type of disaster declaration, as the state decides funding prioritization accordingly.
Additional Information	In this program, private homeowners and businesses cannot apply for a grant. However, a local community or other public entity may apply for funding on their behalf. Generally, the cost share is 75% federal and 25% non-federal funding. The 25% can come from any non-federal source, such as the state or local government, an individual, private contributions, Increased Cost of Compliance (ICC) funds from a flood insurance policy, or Small Business Administration loans. Additional information can be found at: https://www.fema.gov/grants/mitigation/hazard-mitigation/before-you-apply

Pre-Disaster Mitigation (PDM)	
Description	The Pre-Disaster Mitigation grant program makes federal funds available to state, local, tribal, and territorial governments to plan for and implement sustainable cost-effective measures. These mitigation efforts are designed to reduce the risk to individuals and property from future natural hazards, while also reducing reliance on federal funding from future disasters.
Funds Available	On March 1, 2023, FEMA published a Notice of Funding Opportunity (NOFO) for FY23 Pre-Disaster Mitigation grant program. The total amount of funds that are being made available to 100 congressionally directed projects will be $233,043,782. Applicants may request up to an additional 5% of project costs for management and administration of the program from a separate pool of funds.
Eligibility	Only states, territories, or federally recognized tribal governments identified by Congress in the Consolidated Appropriations Act and enumerated in the accompanying Joint Explanatory Statement for Division F are identified in this Notice of Funding Opportunity (NOFO) and are eligible to apply. All applicants and subapplicants must have a FEMA-approved Hazard Mitigation Plan by the application deadline
Examples	Storm Shelters, Wildfire Prevention Project, Bridge Rehabilitation, Drainage Improvements, Water Storage Tanks, Flood Mitigation Planning Projects, Evacuation Center, and more.
Additional Information	https://www.fema.gov/grants/mitigation/pre-disaster

Recovery and Resilience Resource Library	
Description	FEMA developed library to navigate the numerous programs available to the United States and its territories to help recover from a disaster. Tool helps users to find and research federal disaster recovery resources that would be beneficial to pre-disaster recovery planning or in the wake of a disaster.
Funds Available	Varies
Eligibility	Resources are intended for state, local, territorial, and tribal governments as well as non-profits, businesses, healthcare institutions, schools, individuals, and households.
Examples	Evidence-based or evidence-informed interventions to strengthen rural and urban communities.
Additional Information	https://www.fema.gov/emergency-managers/practitioners/recovery-resilience-resource-library

State and Local Cybersecurity Grant Program	
Description	Funding to help states, local governments, rural areas, and territories address cybersecurity risks and cybersecurity threats to information systems.
Funds Available	$183.5 million is available under the SLCGP, with varying funding amounts allocated over four years from the Infrastructure Investment and Jobs Act. The recipient contribution can be cash (hard match) or third-party in-kind (soft match).
Eligibility	All U.S. states and territories are eligible to apply. The designated State Administrative Agency (SAA) for each state and territory is the only entity eligible to apply for SLCGP funding.
Examples	Planning, equipment, exercises, management & administration, organization, and training.
Additional Information	This year, each state and territory will receive a funding allocation as determined by the statutory formula: • Allocations for states and territories include a base funding level as defined for each entity: 1% for each state, the District of Columbia, and Puerto Rico; and 0.25% for American Samoa, the Commonwealth of the Northern Mariana Islands, Guam, and the U.S. Virgin Islands. • State allocations include additional funds based on a combination of state population and rural population totals. • 80% of total state allocations must support local entities, while 25% of the total state allocations must support rural entities; these amounts may overlap.

Safeguarding Tomorrow through Ongoing Risk Mitigation Revolving Loan Fund (STORM-RLF)	
Description	FEMA is making $50 million available to fund capitalization grants that enable eligible entities to administer revolving loan funds and provide direct loans to local governments for projects and activities that mitigate the impacts of drought, intense heat, severe storms (including hurricanes, tornados, windstorms, cyclones, and severe winter storms), wildfires, floods, earthquakes, and other natural hazards. FEMA will work closely with participating entities and gather best practices on topics such as entity administrative burden and capacity, achieving resilience and equity goals, and common project and activity types for loans under this program. FEMA's goal is to increase entity participation with higher funding levels in future grant cycles.
Funds Available	FEMA intends to award $472 million of the funds available under the new program to address climate change and create a more equitable and resilient nation.
Eligibility	Eligible entities are States, Federally recognized tribes that received a major disaster declaration, Territories, and the District of Columbia. State entities must enroll in this program for it to be an option to local public entities.
Examples	This is an opportunity to prioritize low-impact development, wildland-urban interface management, conservation areas, reconnection of floodplain and open space projects. Funding can be utilized for building code adoption and enforcement. Allowable uses include: Mitigation Activities, Non-Federal Cost-Share, Local Government Technical Assistance, and Entity Administrative Costs.
Additional Information	Application period will be open starting February 1 - April 28, 2023. https://www.fema.gov/grants/mitigation/storm-rlf

U.S. Army Corps of Engineers

Planning Assistance to States	
Description	Provides assistance in the preparation of comprehensive plans for the development, utilization, and conservation of water and related land resources. Typical studies are only planning level of detail, not design for project construction. Program can encompass many types of studies dealing with water resource issues. PAS program has two types of efforts-comprehensive plans and technical assistance: Comprehensive Plans and Technical Assistance. Comprehensive Plan Assistance includes planning for the development, utilization, and conservation of the water and related resources of drainage basins, watersheds, or ecosystems located within the boundaries of that State, including plans to comprehensively address water resources challenges such as the state water plan. Comprehensive plans can extend across state boundaries provided both States agree. Technical Assistance provided through the PAS program includes support of planning efforts related to the management of state water resources, including the provision and integration of hydrologic, economic, or environmental data and analysis in support of the State's water resources management and related land resources development plans identified in the state water plan or other water resources management related state planning documents, such as state hazard mitigation, preparedness, response, and recovery plans and plans associated with changing hydrologic conditions, climate change, long-term sustainability, and resilience.
Funds Available	Comprehensive planning activities through the PAS program are cost shared (50 per cent) with the study partner, and voluntarily contributed funds in excess of cost share may be provided by the non-Federal partner. The non-Federal cost share for preparation of a state comprehensive water resources plan may be provided by funds or through the provision of services, materials, supplies, or other in-kind services. Technical assistance activities through the PAS program are cost shared (50 per cent) with the study partner, and voluntarily contributed funds in excess of cost share may be provided by the non-Federal partner. The cost-share for technical assistance must be provided by funds (not in-kind).
Eligibility	States, local governments, other non-Federal entities, and eligible Native American Indian tribes.
Examples	Types of studies in recent years include water supply/demand, water conservation, water quality, environmental/conservation, wetlands evaluation/restoration, dam safety/failure, flood damage reduction, coastal zone protection, and harbor planning.
Additional Information	https://www.nae.usace.army.mil/missions/public-services/planning-assistance-to-states/

U.S. Bureau of Reclamation – WaterSMART

Small Scale Water Efficiency Projects	
Description	Funding for small-scale on-the-ground water management projects that conserve, better manage, or otherwise increase efficient use of water supplies. Projects supported by an existing water management and conservation plan, System Optimization Review, or other planning effort led by the applicant are prioritized.
Funds Available	Applicants may request up to $100,000 in federal funding, with a non-federal cost-share of 50% or more of total project costs for projects with total project costs no more than $225,000.
Eligibility	Eligible applicants for all WaterSMART Grants funding opportunities include states; tribes; irrigation districts; water districts; state, regional, or local authorities, whose members include one or more organization with water or power delivery authority; other organizations with water or power delivery authority; and nonprofit conservation organizations that are acting in partnership with and with the agreement of an entity previously described. To be eligible, applicants must be located in the Western United States or U.S. Territories. Entities located in Alaska and Hawaii are also eligible to apply.
Examples	Example projects include Canal lining/piping, municipal metering, irrigation flow measurement, SCADA and automation, landscape irrigation measures, high-efficiency indoor appliances and fixtures, commercial cooling systems.
Additional Information	https://www.usbr.gov/watersmart/swep/index.html

Water Marketing Strategy Grants	
Description	Financial assistance for the development of water marketing strategies to facilitate water markets as a tool for helping willing buyers and sellers meet water demands efficiently in times of shortage and prevent water conflicts.
Funds Available	Program funding is allocated through a competitive process. Applicants may request federal funding up to $400,000 for projects to be completed within three years with a non-Federal cost share of 50% or more of the total project cost.
Eligibility	Eligible applicants for all WaterSMART Grants funding opportunities include states; tribes; irrigation districts; water districts; state, regional, or local authorities, whose members include one or more organization with water or power delivery authority; other organizations with water or power delivery authority; and nonprofit conservation organizations that are acting in partnership with and with the agreement of an entity previously described. To be eligible, applicants must be located in the Western United States or U.S. Territories. Entities located in Alaska and Hawaii are also eligible to apply.
Examples	Funding awarded under Water Marketing Strategy Grants can be used for outreach and partnership building, planning activities (e.g., hydrologic, economic, legal and other types of analysis), pilot activities, and the development of a “water marketing strategy” document.
Additional Information	https://www.usbr.gov/watersmart/watermarketing/index.html

Water and Energy Efficiency Grants	
Description	Focuses on projects that result in quantifiable and sustained water savings, including canal lining and piping projects, municipal metering projects, and Supervisory Control and Data Acquisition (SCADA) and automation projects.
Funds Available	Applicants may request federal funding: (I) up to $500,000 for projects to be completed within two years, (II) up to $2 million for projects to be completed within three years; and (III) up to $5 million for projects to be completed within three years, with a non-Federal cost share of 50% or more of the total project cost. No more than $5,000,000 in total WaterSMART Water and Energy Efficiency Grants funds will be awarded to any single applicant under this Funding Opportunity per fiscal year (i.e., an applicant may receive up to $5.0M in FY 2023 funds.
Eligibility	Eligible applicants for all WaterSMART Grants funding opportunities include states; tribes; irrigation districts; water districts; state, regional, or local authorities, whose members include one or more organization with water or power delivery authority; other organizations with water or power delivery authority; and nonprofit conservation organizations that are acting in partnership with and with the agreement of an entity previously described. To be eligible, applicants must be located in the Western United States or U.S. Territories. Entities located in Alaska and Hawaii are also eligible to apply.
Examples	Projects conserve and use water more efficiently; increase the production of hydropower; mitigate conflict risk in areas at a high risk of future water conflict; and accomplish other benefits that contribute to water supply reliability in the western United States.
Additional Information	https://www.usbr.gov/watersmart/weeg/faq.html

U.S. Department of Agriculture

Conservation Innovation Grants (CIG)	
Description	Competitive program that supports the development of new tools, approaches, practices, and technologies to further natural resource conservation on private lands. Through creative problem solving and innovation, CIG partners work to address our nation's water quality, air quality, soil health and wildlife habitat challenges, all while improving agricultural operations. Public and private grantees develop the tools, technologies, and strategies to support next-generation conservation efforts on working lands and develop market-based solutions to resource challenges.
Funds Available	Applications made a CIG funding notice is announced each year. Funds for single- or multi-year projects, not to exceed three years, are awarded through a nationwide competitive grants process. Grantees must match the CIG investment at least one to one.
Eligibility	The natural resource concerns eligible for funding through CIG are identified in the funding announcement and may change annually to focus on new and emerging, high-priority natural resource concerns. National and State CIG – all non-Federal entities and individuals are eligible to apply. All CIG projects must involve EQIP-eligible producers.
Examples	Projects may be watershed-based, regional, multi-state or nationwide in scope.
Additional Information	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/cig/

Emergency Watershed Protection Program	
Description	The EWP Program offers technical and financial assistance to help local communities relieve imminent threats to life and property caused by floods, fires, windstorms, and other natural disasters that impair a watershed. EWP does not require a disaster declaration by federal or state government officials for program assistance to begin.
Funds Available	NRCS may provide technical assistance as services and/or funds to plan, design, and contract the emergency measures, subject to an agreement between NRCS and the Sponsor. Installation/Construction costs are not to exceed 75% or 90% for limited resource areas. Engineering/Technical Assistance is not to exceed 100%. No funds are available for real property rights.
Eligibility	Project criteria requires the project to provide protection from flooding or soil erosion; reduce threats to life and property; restore the hydraulic capacity to the natural environment; and economically and environmentally defensible. Eligible local sponsors for recovery projects include cities, counties, towns, conservation districts, or any federally-recognized Native American tribe or tribal organization.
Examples	Removal of debris from stream channels, road culverts, and bridges; reshaping and protection of eroded streambanks; correction of damaged or destroyed drainage facilities; establishing vegetative cover on critically eroding lands; repair of levees and structures; repair of certain conservation practices; and purchase of floodplain easements.
Additional Information	https://www.nrcs.usda.gov/programs-initiatives/ewp-emergency-watershed-protection

Small Business Innovation Research	
Description	The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs at the U.S. Department of Agriculture (USDA) offer competitively awarded grants to qualified small businesses to support high quality research related to important scientific problems and opportunities in agriculture that could lead to significant public benefits. This program as two phases, Phase I is open to any small business concern that meets the SBIR/STTR eligibility requirements and Phase II is open only to previous Phase I awardees.
Funds Available	Funds are offered across 10 topic areas including: Forests and Related Resources, Plant Production and Protection-Biology, Animal Production and Protection, Conservation of Natural Resources, Food Science and Nutrition, Rural and Community Development, Aquaculture, Biofuels and Biobased Products, Small and Mid-size Farms, and Plant Production and Protection-Engineering
Eligibility	The SBIR/STTR programs do not make loans and do not award grants for the purpose of helping a business get established. The program seeks to stimulate technological innovation in the private sector, strengthen the role of small businesses in meeting federal research and development needs, increase private sector commercialization of innovations derived from USDA-supported research and development efforts, and foster and encourage participation by women-owned and socially and economically disadvantaged small business firms in technological innovations
Examples	Salary and wages for company employees, associated fringe benefits, materials and supplies, and a number of other direct costs needed to conduct the proposed R&D
Additional Information	https://www.nifa.usda.gov/grants/programs/small-business-innovation-research-technology-transfer-programs-sbirsttr

Watershed Rehabilitation Program	
Description	The Watershed Rehabilitation Program helps project sponsors rehabilitate aging dams that are reaching the end of their design life and/or no longer meet federal or state standards. NRCS provides technical and financial assistance to local project sponsors to rehabilitate aging dams that protect lives and property, and infrastructure.
Funds Available	Across the Nation, watershed REHAB projects provide over $2.2 billion in reduced flooding and erosion damage while improving wildlife habitat, recreation, water quality and supply for an estimated 47 million people. Costs associated with additional or new water supply storage purposes added to the rehabilitation project may be cost-shared with watershed rehabilitation funds. Eligible project costs are covered 65% Federal/35% Local of total eligible project cost, not to exceed 100% of actual construction cost. No more than 100% of the engineering/Technical Assistance will be covered.
Eligibility	Eligible projects are dams that were originally constructed through a NRCS Watershed Program, no longer meet current safety and performance standards, including dams past their evaluated life, and has current operation and maintenance.
Examples	*Information not available*
Additional Information	https://www.nrcs.usda.gov/programs-initiatives/watershed-rehabilitation

Watershed and Flood Prevention Operations Program	
Description	The WFPO program provides technical and financial assistance to help plan and implement authorized watershed projects for the purpose of flood prevention, watershed protection, public recreation, public fish and wildlife, agricultural water management, municipal and industrial water supply, water quality management, and watershed structure rehabilitation. The WFPO Program helps units of federal, state, local and tribal of government (project sponsors) protect and restore watersheds up to 250,000 acres. Nebraska Natural Resources Conservation Service (NRCS) has assisted public sponsors with construction of nearly 900 dams for the primary purposes of flood reduction and grade stabilization.
Funds Available	Nebraska has had over 60 approved WFPO plans providing over $80 million in average annual benefits. The percentage of a project that will be covered by the federal cost-sharing varies by project purpose. Engineering and Technical Assistance is covered 100% for most project, except for Municipal and Industrial Water Supply projects. The percentage of installation/construction costs that are covered are as follows: Flood prevention-100%, Watershed Protection - Variable, Public Fish and Wildlife or Public Recreational Development - No more than 50%, Agricultural Water Management - Up to 75%, Municipal and Industrial Water Supply - no more than 50%, Water Quality Management - To be determined, Rehabilitation - No more than 100%.
Eligibility	Project criteria requires public sponsorship, be a watershed project of 250,000 acres or less, and have agricultural benefits that, including rural communities, must be 20% or more of the total benefits for the project. Eligible project sponsors include States, local governments, and tribal organizations.
Examples	Watershed Plans, flood prevention projects, drainage, irrigation, reservoir structure, dams.
Additional Information	https://www.nrcs.usda.gov/conservation-basics/conservation-by-state/nebraska/nebraska-watershed-and-flood-prevention-program

U.S. Department of Agriculture Rural Development Funding

Community Facilities Loans and Grants	
Description	This program provides affordable funding to develop essential community facilities in rural areas, an essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial, or business undertakings.
Funds Available	*Information not available*
Eligibility	Eligible for areas 20,000 or less in population. Applicants are municipalities, non-profits, special purpose districts, and federally recognized Indian tribes. Eligible borrowers include public bodies, community based non-profit corporations, and federally recognized tribes.
Examples	Funds can be used to purchase, construct, and/or improve essential community facilities, purchase equipment, and pay related project expenses
Additional Information	https://www.rd.usda.gov/programs-services/community-facilities/community-facilities-direct-loan-grant-program/ne

Community Facility Rural Community Development Initiative Grants	
Description	RCDI grants are awarded to help non-profit housing and community development organizations, low-income rural communities and federally recognized tribes support housing, community facilities, and community and economic development projects in rural areas. Funds may be used to improve housing, community facilities, and community and economic development projects in rural areas.
Funds Available	Grants are awarded with a minimum amount of $50,000 and maximum of $250,000. Funds are limited and are awarded through a competitive process. Matching fund requirement equal to amount of grant but in-kind contributions cannot be used as matching funds. Partnerships with other federal, state, local, private, and nonprofit entities are encouraged.
Eligibility	Open to public bodies, non-profit organizations, and qualified private organizations. Rural and rural areas other than a city or town with a population of greater than 50,000 people and the urbanized area contiguous and adjacent to such city or town.
Examples	RCDI grants may be used for but are not limited to training sub-grantees and providing technical assistance to sub-grantees on strategic plan developments, accessing alternative funding sources, board training, developing successful child care facilities, creating training tools, and effective fundraising techniques.
Additional Information	https://www.rd.usda.gov/programs-services/community-facilities/rural-community-development-initiative-grants#overview

Community Facility Technical Assistance and Training Grant	
Description	Provide associations Technical Assistance and/or training with respect to essential community facilities programs. The Technical Assistance and/or training will help identify and plan for community facility needs that exist in the area. Once those needs have been identified, the Grantee can assist in identifying public and private resources to finance those identified community facility needs.
Funds Available	Maximum grant award of $150,000. Grant funds are limited and are awarded through a competitive process. Matching funds are not required, in-kind contributions cannot be used as matching funds, partnerships with other entities are encouraged.
Eligibility	Open to public bodies, non-profit organizations, and federally recognized tribes. Rural areas including cities, villages, townships, towns, and Federally Recognized Tribal Lands outside the boundaries of a city of 20,000 or more.
Examples	Webster County purchased a new ambulance and equipment with Rural Development funds (and other sources) and South Sioux City was able to build a new fire station with funding from USDA Rural Development (and other sources).
Additional Information	https://www.rd.usda.gov/programs-services/community-facilities/community-facilities-technical-assistance-and-training-grant#overview

Emergency Community Water Assistance Grants (ECWAG)	
Description	This program helps eligible communities prepare for, or recover from, an emergency that threatens the availability of safe, reliable drinking water. A federal disaster declaration is not required, and this grant covers events such as drought or flood, earthquake, tornado or hurricane, disease outbreak, chemical spill, leak, or seepage, or other disasters.
Funds Available	Up to $150,000 for water transmission line projects. Water Source grants up to $1,000,000.
Eligibility	Primarily for residential purposes and are eligible for 10,000 or less population areas. Applicants are municipalities, special purpose districts (RWS), non-profits, and Recognized Indian Tribes. Applications are accepted year-round online through the RD Apply or through local RD office
Examples	Construction of waterline extensions, repair breaks or leaks in existing water distribution lines, and address related maintenance necessary to replenish the water supply. Water Source Grants are to construct a water source, intake, or treatment facility.
Additional Information	https://www.rd.usda.gov/programs-services/water-environmental-programs/emergency-community-water-assistance-grants/ne

U.S. Department of Energy

Grid Innovation Program	
Description	This program provides support for projects that use innovative approaches to transmission, storage, and distribution infrastructure to enhance grid resilience and reliability. Projects selected under this program will include interregional transmission projects, investments that accelerate interconnection of clean energy generation, and utilization of distribution grid assets to provide backup power and reduce transmission requirements. Innovative approaches can range from use of advanced technologies to innovative partnerships to the deployment of projects identified by innovative planning processes.
Funds Available	The Grid Innovation Program will invest up to $5 billion ($1 billion/year for Fiscal Years 2022-2026) in innovation and new approaches to transmission, distribution, storage, and regional resilience. The first funding cycle will include both FY22 and FY23, up to $2 billion. Projects are subject to a 50% cost share minimum.
Eligibility	Eligible entities include a state, a combination of 2 or more states, an Indian Tribe, a unit of local government, or a public utility commission.
Examples	Transmission, storage, and distribution infrastructure to enhance grid resilience and reliability.
Additional Information	

Grid Resilience Utility and Industry Grants	
Description	Grants provide funding to support activities that will modernize the electric grid to reduce impacts from extreme weather and natural disasters. This grant program will fund comprehensive transformational transmission and distribution technology solutions that will mitigate weather hazards across a region or within a community that can cause a disruption to the power system. Grants awarded under the program will fund transmission and distribution technology projects that seek to address hazards within a region or a community that can disrupt the power system, such as wildfires, floods or hurricanes.
Funds Available	Funding of $2.5 Billion over five years from FY 22-26 with $500 million available per year. Funding is capped at the amount the eligible entity has spent in the previous three years on hardening efforts. There is a 100% cost match for this program. The program includes a small utility set aside for those entities selling no more than 4 million MWh of electricity per year.
Eligibility	This funding opportunity is available to electric grid operators, electricity storage operators, electricity generators, transmission owners or operators, distribution providers, and fuel suppliers.
Examples	Infrastructure upgrades to strengthen and modernize the power grid against natural disasters that are exacerbated by the climate crisis.
Additional Information	https://www.energy.gov/gdo/grid-resilience-utility-and-industry-grants

Smart Grid Grants	
Description	Smart Grid Grants is designed to increase the flexibility, efficiency, and reliability of the electric power system, with particular focus on: increasing capacity of the transmission system, preventing faults that may lead to wildfires or other system disturbances, integrating renewable energy at the transmission and distribution levels, and facilitating the integration of increasing electrified vehicles, buildings, and other grid-edge devices. Smart grid technologies funded and deployed at scale through this program must demonstrate a pathway to wider market adoption.
Funds Available	The Smart Grid Grant program will invest up to $3 billion ($600 million/year for Fiscal Years 2022-2026) in grid resilience technologies and solutions. The first funding cycle will include both FY22 and FY23, up to $1.2 billion. Recipients must provide a cost-share of at least 50% of the grant.
Eligibility	This program is open to domestic entities including institutions of higher education; for-profit entities; non-profit entities; and state and local governmental entities, and tribal nations.
Examples	Grid enhancing technologies such as dynamic line rating, flow control devices, advanced conductors, and network topology optimization, to improve system efficiency and reliability. Investments in optical ground wire, dark fiber, operational fiber, and wireless broadband communications networks.
Additional Information	https://www.energy.gov/gdo/grid-innovation-program

U.S. Department of Housing and Urban Development

Community Development Block Grants	
Description	Provides annual grants on a formula basis to states, cities, and counties to develop viable urban communities by providing decent housing and a suitable living environment, and by expanding economic opportunities, principally for low- and moderate-income persons.
Funds Available	HUD determines the amount of each entitlement grantee's annual funding allocation by a statutory dual formula which uses several objective measures of community needs, including the extent of poverty, population.
Eligibility	Eligible grantees include principal cities of Metropolitan Statistical Areas, Other metropolitan cities with populations of at least 50,000, qualified urban counties with populations of at least 200,000 (excluding the population of entitled cities), States and insular areas. Eligibility for participation as an entitlement community is based on population data provided by Census. Each activity must meet one of the following national objectives for the program: benefit low- and moderate-income persons, prevention or elimination of slums or blight, or address community development needs having a particular urgency because existing conditions pose a serious and immediate threat to the health or welfare of the community for which other funding is not available.
Examples	CDBG funds may be used for activities which include, but are not limited to: Acquisition of real property; Relocation and demolition; Rehabilitation of residential and non-residential structures; Construction of public facilities and improvements, such as water and sewer facilities, streets, neighborhood centers, and the conversion of school buildings for eligible purposes; Public services, within certain limits; Activities relating to energy conservation and renewable energy resources; Provision of assistance to profit-motivated businesses to carry out economic development and job creation/retention activities
Additional Information	HUD does not provide CDBG assistance directly to individuals, businesses, nonprofit or organizations or other non-governmental entities. https://www.hud.gov/program_offices/comm_planning/cdbg

CDBG Disaster Recovery Assistance	
Description	The Community Development Block Grant (CDBG) Program has Disaster Recovery grants to rebuild the affected areas and provide crucial seed money to start the recovery process. These flexible grants help cities, counties, and States recover from Presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations. Since CDBG Disaster Recovery (CDBG-DR) assistance may fund a broad range of recovery activities, HUD can help communities and neighborhoods that otherwise might not recover due to limited resources.
Funds Available	Varies according to the state plan outlined by the state department of economic development.
Eligibility	CDBG-DR funds are provided to the most impacted and distressed areas for Disaster Relief, Long-Term Recovery, Restoration of Infrastructure, Housing, and Economic Revitalization. HUD will notify eligible States, cities and counties if they are eligible to receive CDBG-DR grants. Those who receive grant money include state agencies, non-profit organizations, economic development agencies, citizens and businesses
Examples	Funding can be provided to cover unmet needs such as local cost share funding from public assistance projects or hazard mitigation grant projects.
Additional Information	https://www.hud.gov/program_offices/comm_planning/cdbg-dr

Neighborhood Stabilization Program	
Description	The Neighborhood Stabilization Program (NSP) was established for the purpose of providing emergency assistance to stabilize communities with high rates of abandoned and foreclosed homes, and to assist households whose annual incomes are up to 120 percent of the area median income (AMI). NSP funds were used for activities which included: Establish financing mechanisms for purchase and redevelopment of foreclosed homes and residential properties; Purchase and rehabilitate homes and residential properties abandoned or foreclosed; Establish land banks for foreclosed homes; Demolish blighted structures; Redevelop demolished or vacant properties.
Funds Available	$4 billion nationwide. Iowa receives $21.6 million in NSP funding while Nebraska receives $19.6 million.
Eligibility	States, certain local governments, and other organizations.
Examples	The NSP provides grants to every state, certain local communities, and other organizations to purchase foreclosed or abandoned homes and to rehabilitate, resell, or redevelop these homes in order to stabilize neighborhoods and stem the decline of house values of neighboring homes.
Additional Information	https://www.hud.gov/program_offices/comm_planning/nsp

U.S. Economic Development Administration

Public Works and Economic Adjustment Assistance (EAA)	
Description	The EAA provides funding to help plan, build, innovate, and put people into quality jobs in hundreds of communities across the nation. The Economic Adjustment Assistance program is EDA's most flexible program, and grants made under this program will help hundreds of communities across the nation plan, build, innovate, and put people back to work through construction or non-construction projects designed to meet local needs.
Funds Available	Total Program Funding of $500 Million with an award ceiling of $10 Million and a floor of $100,000.
Eligibility	A wide range of technical, planning, workforce development, entrepreneurship, and public works and infrastructure projects are eligible for funding under this program. Eligible applicants for EDA's Economic Adjustment Assistance program include a(n): District Organization of an EDA-designated Economic Development District; Indian Tribe or a consortium of Indian Tribes; State, county, city, or other political subdivision of a State, including a special purpose unit of a State or local government engaged in economic or infrastructure development activities, or a consortium of political subdivisions; Institution of higher education or a consortium of institutions of higher education; Public or private non-profit organization or association acting in cooperation with officials of a political subdivision of a State. Individuals or for-profit entities are not eligible.
Examples	Public infrastructure related to economic development.
Additional Information	As part of the $300 million Coal Communities Commitment, EDA will allocate at least $200 million of the Economic Adjustment Assistance funding to support coal communities.

U.S. Environmental Protection Agency

Clean Waters Act Section 319 Grants	
Description	Clean Water Act Section 319(h) funds are provided only to designated state and tribal agencies to implement their approved nonpoint source management programs. State and tribal nonpoint source programs include a variety of components, including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and regulatory programs.
Funds Available	Each year EPA awards Section 319(h) funds to states in accordance with a state-by-state allocation formula that EPA has developed in consultation with the states. Grant totals over the past 5 years have increased from $155.9 million in 2013 and $178 million in 2022.
Eligibility	*Information not available*
Examples	*Information not available*
Additional Information	https://www.epa.gov/sites/default/files/2015-09/documents/319-guidelines-fy14.pdf

Environmental Justice Collaborative Problem-Solving	
Description	This cooperative agreement program provides financial assistance to eligible organizations working on or planning to work on projects to address local environmental and/or public health issues in their communities. The program assists recipients in building collaborative partnerships with other stakeholders to develop solutions that will significantly address environmental and/or public health issue(s) at the local level. Selected applicants, or recipients, are required to use the EPA's Environmental Justice Collaborative Problem Solving Model as part of their projects.
Funds Available	The EJCPS Program anticipates awarding approximately $30,000,000 of Inflation Reduction Act funding through 83 cooperative agreements, organized in two tracks of funding. $25,000,000 for CBOs proposing projects for up to $500,000 each. Approximately 50 awards for up $500,000 each are anticipated under this track. $5,000,000 for qualifying small CBOs with 5 or fewer full-time employees proposing projects for up to $150,000 each. For more details about this opportunity, please review closely the "Small Community-based Nonprofit Set Aside". Approximately 33 awards for up to $150,000 each are anticipated under this track. Cooperative agreements will be funded for a three-year performance period.
Eligibility	Eligible entities include incorporated non-profit organizations, US Territories, Tribal government, either federally or state recognized, tribal organizations, and freely associated states.
Examples	In 2003 the Pacific Basin Development Council received this grant to build community resiliency.
Additional Information	https://www.epa.gov/environmentaljustice/environmental-justice-collaborative-problem-solving-cooperative-agreement-5

Urban Waters Small Grants	
Description	The mission of this program is to help local residents and their organizations, particularly those in underserved communities, restore their urban waters in ways that also benefit community and economic revitalization. The program recognizes that healthy and accessible urban waters can help grow local businesses and enhance educational, recreational, social, and employment opportunities in nearby communities. Projects should meet the following four objectives: address local water quality issues related to urban runoff pollution; provide additional community benefits; actively engage underserved communities; and foster partnership.
Funds Available	Urban Waters Small Grants are competed and awarded every two years with individual award amounts of up to $60,000.
Eligibility	Eligible applicants include States, local governments, Indian Tribes, public and private universities and colleges, public or private nonprofit institutions/organizations, intertribal consortia, and interstate agencies.
Examples	An example of a past grant awarded was to the University of Nebraska-Lincoln in 2015-2016 to provide technical assistance and training on stormwater and green infrastructure to small businesses and residents of under-served communities.
Additional Information	https://www.epa.gov/urbanwaterspartners/urban-waters-small-grants

Water Infrastructure Finance and Innovation Act of 2014 (WIFIA)	
Description	The WIFIA program provides long-term, low-cost supplemental loans for regionally and nationally significant water and wastewater infrastructure projects. Borrowers benefit from a single fixed interest rate that is equal to the US Treasury rate of a similar maturity, an interest rate that is not impacted by the borrower's credit or loan structure, custom long-term repayment schedules with options to defer payment for up to 5 years.
Funds Available	$20 million minimum project size for large communities, $5 million minimum for small communities of 25,000 or less. WIFIA can fund a maximum of 49% of eligible project costs.
Eligibility	Eligible borrowers are 1) local, state, tribal, and federal government entities; 2) Partnerships and joint ventures; 3) Corporations and trusts; 4) Clean Water and Drinking Water State Revolving Fund (SRF) programs.
Examples	Wastewater conveyance and treatment projects. Drinking water treatment and distribution projects. Enhanced energy efficiency projects at drinking water and wastewater facilities.
Additional Information	Total federal assistance may not exceed 80% of a project's eligible costs. https://www.epa.gov/wifia/what-wifia

U.S. Fish and Wildlife Services

North American Wetlands Conservation Standard and Small Grant	
Description	A competitive matching grants program that supports public-private partnerships carrying out projects in the United Stated that further the goals of the North American Wetlands Conservation Act. These projects must involve long-term protection, restoration, and/or enhancement of wetlands and associated uplands habitat for the benefit of all wetlands-associated migratory birds.
Funds Available	US Small Grants may not exceed $100,000 and require a 1-to-1 ratio match for awarded grant amount. The US Standard Grant is for grants larger than $100,000 and requires a 1-to-1 match ratio.
Eligibility	US Small Grants proposals are due in October or else will be considered an early submission for the next Fiscal Year. The US Standard Grant has a two deadline for proposals, one in February and one in July. Proposal submitted after July are considered ineligible unless clearly marked as an early submission for the next Fiscal Year.
Examples	Acquisition of land for the purposes of wetlands conservation, wetland restoration projects, wetland enhancement projects, wetland establishment, or other direct long-term wetland conservation work.
Additional Information	https://www.fws.gov/sites/default/files/documents/north-american-wetlands-conservation-act-us-eligibility-criteria_0.pdf

U.S. Forest Service

Forestry Legacy Program	
Description	Focuses on private forest land that is faced by threats of conversion to non-forest land by urbanization, residential development. Providing economic incentives to landowners to keep forests as forest encourages sustainable forest management and supports strong markets for forest products. Landowners participate in the FLP by either selling property outright or by retaining ownership and selling only a portion of the property's development rights; both are held by state agencies or another unit of government. Use of a conservation easement allows land to remain in private ownership while ensuring that its environmental values are retained. Program funded by Land and Water Conservation Fund, which invests a small percentage of federal offshore drilling fees towards the conservation of important land, water, and recreation areas for all Americans.
Funds Available	Previous year funds for Fiscal Year 2022 totaled $88,878,955 across 14 projects.
Eligibility	Private Lands
Examples	Funded projects from 2022 include the Montana Great Outdoors Conservation Project, Oregon's Spence Mountain Forest, Wyoming's Munger Mountain Corridor Initiative, and others.
Additional Information	https://www.fs.usda.gov/managing-land/private-land/forest-legacy/program

State of Nebraska Funding Resources

In addition to federal grants, there are a number of state agencies and programs with potential applicability to supporting funding and implementation of mitigation projects. Many federal hazard mitigation grant programs are administered at the state level by NEMA and NeDNR, as noted above. These agencies will also likely be important in earlier stages of the hazard mitigation planning process by providing current hazard and risk assessment data.

While this section of the funding guidebook attempts to list as many funding options as possible, it is by no means a complete list of programs in Nebraska that could have the potential to support hazard mitigation project implementation. Similar to federal grant programs, many of these programs are dependent on yearly funding allocations, which results in fluctuations in their availability. The websites and reference materials used to provide this information are as current as possible; however, it is important to note that funding programs are dynamic and subject to frequent changes. While it is helpful to be familiar with the current information, it is equally as important to engage candidate federal and state agencies in a dialog as soon as possible.

Nebraska Department of Natural Resources

Flood Mitigation Assistance	
Description	The Flood Mitigation Assistance Grant Program (FMA) is administered by NeDNR and provides financial assistance for either planning or projects that assist in decreasing long-term risk of flood damage to structures insured under the National Flood Insurance Program. The FMA program has priorities to mitigate structures that have suffered repeated flood claims and those with severe repetitive loss.
Funds Available	Approximately $800 million nationwide in 2022. Nebraska did not receive any FMA in 2022.
Eligibility	Municipalities
Examples	Project (structural or non-structural) to reduce or eliminate repetitive flood damage. This includes: Capability and capacity building activities, localized flood risk reduction projects, and individual flood mitigation projects.
Additional Information	http://dee.ne.gov/Publica.nsf/PubsForm.xsp?documentId=56E958FDC603A27A862588B50052EF8E&action=openDocument

Water Sustainability Fund	
Description	The Water Sustainability Fund (WSF) is a source of financial support to help local project sponsors achieve the goals set out in Neb. Rev. Stat. § 2-1506. The Nebraska Natural Resources Commission (NRC) oversees WSF operations including application review, scoring & ranking, and awarding funding to successful applicants.
Funds Available	Of the annual funding appropriated by the Nebraska Legislature, ten percent is designated by statute for projects separating storm and sewer water. The NRC also reserves ten percent for projects requesting $250,000 or less. A 40% local cost match is required of local project sponsors.
Eligibility	Political subdivisions
Examples	Projects that meet the goals and objectives of an approved integrated management plan or ground water management, projects that mitigate the threats to drinking water, improves water quality, contributes to water sustainability goals and water supply initiatives, reduces threats to property damage or critical infrastructure systems.
Additional Information	WSF applications are **filed electronically** between March 16th and 31st each year. The applications are typically reviewed during the second quarter with final determination made on each application during the third quarter. https://nrc.nebraska.gov/water-sustainability-fund-0

Nebraska Forest Service

Forest Fuels Reduction	
Description	Thinning of dense forests and removal of ladder fuels (ground vegetation that allows a fire to spread into the tree canopy).
Funds Available	Nebraska Forest Service reimburses landowners up to 75% of the costs for tree removal, piling and pile burning (if necessary); remainder paid by landowner.
Eligibility	Eligible locations include Pine Ridge, Niobrara Valley, and Wildcat Hills. State and private forest landowners are eligible to apply.
Examples	Thinning of dense forests and removal of hazardous "ladder fuels" from beneath trees.
Additional Information	https://nfs.unl.edu/fuels-assistance

Hazardous Fuels Reduction	
Description	Thinning of dense forests and removal of ladder fuels (ground vegetation that allows a fire to spread into the tree canopy) from private or state land adjacent to United States Forest Service (USFS) property.
Funds Available	NFS reimburses the landowner up to 100 percent of the costs for tree removal, piling and burning (if necessary). No landowner cost on eligible properties.
Eligibility	Eligible Locations must be adjacent to USFS property in the Pine Ridge. Eligible Applicants are State and private forest landowners
Examples	Thinning of dense forests and removal of hazardous "ladder fuels" from beneath trees.
Additional Information	https://nfs.unl.edu/fuels-assistance

The Nebraska Environmental Trust

NET Grants	
Description	The Nebraska Environmental Trust (NET) project will fund any project or portion of a project that achieves one or more of the trusts categories. These categories include habitat, surface and ground water, waste management, air quality, and soil management.
Funds Available	In 2023 the NET Board approved the NET Grants Committee's recommendation to fund 23 projects for a total of $11,347,203. Grants are funded through the proceeds of the Nebraska Lottery, which determines the amount available to applicants.
Eligibility	There are no restrictions on applicants or project sponsors as long as the project falls within the eligibility criteria. Individuals, private organizations, and public entities may apply. For-profit organizations must demonstrate that the project results in public benefit and does not pay for private benefits. See our eligibility criteria for more information.
Examples	Mobile Prescribed Burn Unit and Education Outreach, Increase Fire Capacity & Rangeland Impact - Sandhills, Early warning: Monitoring for agricultural pests and disease vectors in western Nebraska
Additional Information	The Nebraska Environmental Trust accepts grant applications annually. Applications open around July and are due on or before the first Tuesday after Labor Day in September. Applications need to be submitted through our online grant application portal located at the following address: https://environmentaltrustgrants.org/

Silver Jackets

The Silver Jackets	
Description	The Silver Jackets are collaborative state-led interagency teams, continuously working together to reduce flood risk at the state level. Through the Silver Jackets program, the U.S. Army Corps of Engineers, the Federal Emergency Management Agency, additional federal, state and sometimes local and Tribal agencies provide a unified approach to addressing a state's priorities. The Silver Jackets team is the forum where all relevant agencies come together with the state to collaboratively plan and implement that interagency solution. Through partnerships, Silver Jackets optimizes the multi-agency utilization of federal resources by leveraging state/ local/ Tribal resources, including data/information, talent and funding, and preventing duplication of effort.
Funds Available	Varies
Eligibility	Anyone impacted by flooding
Examples	Education and outreach, risk assessments, hydrologic studies
Additional Information	https://floods.nebraska.gov/index.html

Nebraska Department of Economic Development

CDBG Program	
Description	The Small Cities Community Development Block Grant (CDBG) Program, administered through the Nebraska Department of Economic Development, helps smaller local governments fund community projects that might not otherwise be financially feasible. Through funding from the United States Department of Housing and Urban Development, the program allows each community to determine which projects are most needed, with a focus on Housing, Neighborhood Revitalization, Commercial Revitalization and Economic Development
Funds Available	Annually, Nebraska receives $10.6± million for distribute to eligible applicants, plus prior year resources not obligated and program income. Congress may, at their discretion, appropriate supplemental CDBG funds in response to a natural disaster where a Presidential Declaration has been authorized.
Eligibility	Communities and counties whose residents are 51% or more low- to moderate-income, based on the American Community Survey Five-Year Estimate 2011-2015.
Examples	Flood control, drainage improvements, property buyout and relocation.
Additional Information	https://opportunity.nebraska.gov/programs/community/cdbg/

Nebraska Department of Environment and Energy

Clean Water State Revolving Fund Program	
Description	With the passage of the Amendments to the Clean Water Act (CWA) in 1987, Congress provided for the replacement of the federal Construction Grants program with the Clean Water State Revolving Fund (CWSRF) program and Drinking Water State Revolving Fund (DWSRF) Program. The program provides capitalization grants to state to be used as the basis (along with a required twenty percent state match), to create revolving loan funds which provide low-interest loans to publicly owned water and wastewater systems to finance water and wastewater infrastructure projects, and including, stormwater management.
Funds Available	$28.2± million for DWSRF Program, plus $28.35 million for Lead Service Line Replacement, and $7.56 million for Emerging Contaminants. $17.7± million for CWSRF Program.
Eligibility	Publicly-owned water and wastewater systems
Examples	Municipal water and wastewater systems, and stormwater management.
Additional Information	http://dee.ne.gov/Publica.nsf/PubsForm.xsp?documentId=56E958FDC603A27A862588B50052EF8E&action=openDocument

Alternative Funding Resources

In recent years, states and communities across the country have sought and developed innovative funding sources as alternatives to traditional government grant programs. These funding sources fall into three main categories: Local Funding Options, Public-Private Partnerships, and Private Foundations. These funding sources will be important for current and future hazard mitigation planning efforts for several reasons including:

- Decreases in funding for pre-disaster mitigation grant and assistance programs at the federal level and for state agencies - While technical assistance and other related support functions are still actively supported across federal and state agencies, and in some cases are increasing, allocations for "bricks and mortar" pre-disaster hazard mitigation projects will be competing with a broad range of government funding needs. These funds may not completely disappear, but the need will continue to outstrip the supply in the foreseeable future.

- Opportunities to fund projects that might not qualify or align with traditional grant and assistance programs. Funding programs seek solutions that reduce risk for a particular threshold (i.e., 1-percent flood) and meet absolute cost-benefit criteria that the agencies themselves must adhere to. Therefore, these programs, by their basic nature, are not able to support efforts that may help most of the time but don't meet these thresholds, e.g., a homeowner installed flood wall in a repetitive loss area that prevents annual floods, but not larger magnitude events that come along every few years. There is a related concept that can be referred to as "cumulative risk reduction". For example, a homeowner with limited resources (and no real access to grant funds) might be willing to spend a little time and money each year getting just a little bit safer.

Local Funding Options

Local funding options are just what they sound like, using local funds for local mitigation projects. Local funds are also needed as the non-federal share or "matching funds" for federal grant programs but can also be used independently to fund a range of project types. Local funding options include the following:

Capital Improvement Programs – Ongoing civic improvements can include prioritized hazard mitigation projects or mitigation can be included as one aspect of a larger project. For example, improving the hydraulic capacity of a culvert or bridge to prevent upstream flooding while undertaking periodic replacements for end of service considerations is one example. Replacing windows in a school with shatter resistant glass as part of an overall renovation is another example. Capital improvement programs are generally funded with local tax revenues and municipal bonds.

Permits, Fees, and Developer Contributions- Communities can establish fees, earmark a portion of existing permit and fee structures, and/or establish requirements for developer contributions for new developments in hazard prone areas that can then be used to fund local mitigation projects. The proceeds can be accumulated in what is often referred to as a Mitigation Trust Fund and the uses are typically tied to specific project types and/or relationships with projects already identified in specific plans or documents such as an HMP. These types of funds can also be used to create vouchers or other incentives for individual action.

Force Account / In-Kind Services – Although there is a cost associated with activities of public employees, there are a wide range of activities that can be undertaken by local government staff and officials as well as interested parties on their behalf that would yield significant benefits. Some of the obvious examples are public outreach and education for individual property owners, businesses, and institutions to reduce their risk through correspondingly inexpensive or essential activities. This would include tapping into available educations resources, promoting individual action, etc.

Property Owners – For a project that directly benefits one or more specific properties, the property owner can be asked to contribute. Through the HIRA process, property owners can become better aware of their risks and options. Owners that recognize they have a real flood problem may be willing to pay a portion of the cost. In recent years, property owners have voluntarily agreed to pay the non-federal share (up to 25 percent of the total project cost) for FEMA HMA grants in some states. In some cases, the owners have paid even higher percentages of the cost. In addition, after a flood, owners may have cash from insurance claims or disaster assistance that they will be using to repair their homes and properties. By including the right floodproofing and mitigation project components into the repairs, the resilience of the property to future flooding may be improved. Having property owners contribute to the project can help stretch available local funds and gives the property owner an enhanced stake in the outcome of the project and incentive to make sure the property is properly maintained.

Individual Participation – Although mitigation is ultimately intended to benefit individuals, HMPs often neglect to integrate participation of potential beneficiaries into the process. The participation by individuals, including small business owners, is important for making sure the resulting HMP reflects community needs and priorities, but it also allows for the planning team to identify measures and options that individuals can take to reduce their own risk at a cost they can afford.

Public-Private Partnerships

Developing a public-private partnership is a phrase used frequently in a wide range of government programs and for good reason, especially in the content of hazard mitigation. Participation of private sector organizations in solving their own hazard risk situations can be a low-cost and effective method. The phrase also encompasses finding opportunities for public and private sector partners to share costs equitably for larger projects that require substantial funds to implement. Private sector businesses and organizations have their own cost-benefit calculations to perform but joint efforts may make the balance sheets work for both sides.

Private Foundations

Cultivating relationships with local, regional, or even national foundations with interests or missions consistent with hazard mitigation, community sustainability, climate change adaptation, and other related topics can yield successful results in terms of funding and other means of support.

There are many local foundations around the State of Nebraska, many of which fund programs that can be utilized for components of hazard mitigation projects. Many of these foundations only support non-profit organizations, so the applicability of these funds to projects depends upon the partners involved.